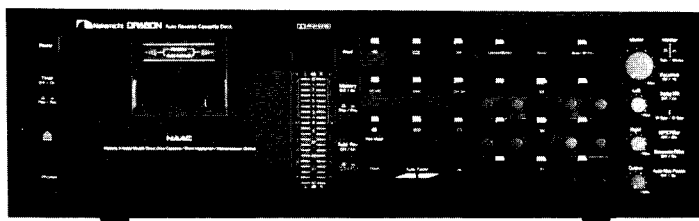




# Service Manual

# Nakamichi DRAGON

Auto Reverse Cassette Deck



# CONTENTS

1.	General	2
2.	Mechanical Adjustments	2
2. 1.	Mechanism Control Cam Adjustment	2
2. 2.	Reel Motor Speed Adjustment in Play Mode	2
2. 3.	Record Head and Playback Head Tilt Adjustment	2
2. 4.	Head Base Stroke Adjustment	3
2. 5.	Erase Head Stroke Adjustment and Tape Guide Height Check	4
2. 6.	Erase Head Height and Tilt Adjustment	4
2. 7.	Back Tension Adjustment	5
2. 8.	Playback Head and Record Head Height Adjustment and Azimuth Alignment	5
2. 9.	Record Head Stroke Adjustment	6
2. 10.	Tape Travelling Adjustment	7
2. 11.	Flywheel Ass'y Height Adjustment	7
2. 12.	Lubrication	7
3.	Parts Location for Electrical Adjustment	8
4.	Electrical Adjustments and Measurements	9
4. 1.	Adjustment and Measurement Instructions	9
4. 2.	Frequency Response Adjustment	12
4. 3.	Dolby NR Circuit Check	13
5.	Mechanism Ass'y and Parts List	14
5. 1.	Synthesis	14
5. 2.	Cassette Lid Ass'y (A01)	15
5. 3.	Chassis Ass'y (A02)	15
5. 4.	Rear Panel Ass'y (B01)	16
5. 5.	Mechanism Ass'y (B02)	17
5. 6.	Flywheel Holder Ass'y (C01)	17
5. 7.	Sub Mechanism Chassis Ass'y (C02)	18
5. 8.	Main Mechanism Chassis Ass'y (C03)	19
5. 9.	Head Mount Base Ass'y (D01)	20
5. 10.	Supply Pressure Roller Ass'y (D02)	20
5. 11.	Take-up Pressure Roller Ass'y (D03)	20
5. 12.	Head Base Ass'y (D04)	20
5. 13.	Cassette Case Holder L Ass'y (D05)	20
5. 14.	Cassette Case Holder R Ass'y (D06)	21
5. 15.	Auto Shut-off Ass'y (D07)	21
5. 16.	Pneumatic Damper Ass'y (D08)	21
5. 17.	PA-1L Playback Head Ass'y (E01)	21
5. 18.	R-8L Record Head Ass'y (E02)	21
6.	Mounting Diagrams and Parts List	22
6. 1.	Power Switch P.C.B. Ass'y	22
6. 2.	Fuse P.C.B. Ass'y	22
6. 3.	Shut-off P.C.B. Ass'y	22
6. 4.	Counter Pulse Generator P.C.B. Ass'y	22
6. 5.	Direction P.C.B. Ass'y	23
6. 6.	Timer Switch P.C.B. Ass'y	23
6. 7.	Tape Select P.C.B. Ass'y	23
6. 8.	Volume P.C.B. Ass'y	23
6. 9.	Counter P.C.B. Ass'y	23
6. 10.	Indicator P.C.B. Ass'y	24
6. 11.	Switch P.C.B. Ass'y	24
6. 12.	Control P.C.B. Ass'y	25
6. 13.	Motor Control P.C.B. Ass'y	25
6. 14.	Logic P.C.B. Ass'y	28
6. 15.	Auto Azimuth P.C.B. Ass'y	29
6. 16.	Main P.C.B. Ass'y	32
7.	Schematic Diagrams	33
7. 1.	Attention to Servicemen	33
7. 2.	IC Block Diagrams	34
7. 3.	Amplifier Section	36
7. 4.	Auto Azimuth Control Section	37
7. 5.	Mechanism Control Section	38
8.	Wiring Diagram	39
9.	Timing Chart and Eq. Amp. Frequency Response	39
10.	Block Diagrams	40
11.	Specifications	42



## 1. GENERAL

### 1.1. Voltage Selector

Voltage selector is installed on the rear panel for Other version of the Nakamichi DRAGON. This voltage selector can select either 120 V or 220-240 V at customer's disposal.

### 1.2. Parts List for Carton and Packing

Part No.	Description	Q'ty
0F03685B	Inner Carton	1
0F03686B	Outer Carton	1
0F03629B	Packing	2

## 2. MECHANICAL ADJUSTMENTS

### 2.1. Mechanism Control Cam Adjustment

Before adjustment, remove the Front Panel Ass'y and the Cover Plate.

#### (1) Offset Adjustment of Control Motor Driver

(a) Refer to Fig. 2.1.

Adjust VR604 and VR603 on the Logic P.C.B. Ass'y to locate approximately at the middle of the variable range. Then turn ON the Power switch.

VR604 (for Cam position stop)

VR603 (for Cam position play)

(b) Press the Stop button to set the cassette deck in Stop mode. Adjust VR604 (for stop) so that the "S" mark on the Cam corresponds to the pointer on the mechanism chassis.

(c) Press the Play button to set the cassette deck in Playback mode. (Cam will rotate, and the position marked with "PY" comes to the pointer.) Adjust VR603 (for play) so that the "PY" mark on the Cam corresponds to the pointer.

(d) Repeat above (b) and (c) 2 - 3 times so that the "S" and "PY" marks on the Cam correspond to the pointer accurately in Stop and Playback modes respectively. (This adjustment is required because the position adjusted by one volume will be slightly changed when the other volume is adjusted.)

(e) Set the cassette deck in F.F., Pause, or Cue mode by pressing each button. Check to insure that the pointer is in a range of "F", "PS", "CU" mark respectively.

(f) If out of the range, precise adjustment for each position according to "(2) Offset Fine Adjustment of Control Motor Driver" will be required.

#### (2) Offset Fine Adjustment of Control Motor Driver

Adjust only if a satisfactory result is not obtained in "(1) Offset Adjustment of Control Motor Driver". This adjustment is made by changing the value of the fixed resistors on the Logic P.C.B. Ass'y. Note: The value of voltage is typical value.

#### (a) Observation Point of Reference Voltage

Observe the each voltage at the sliding contact of the Cam Control Volume VR605 (10 kΩ) in Stop, Fast (F.F. or Rew.), Pause and Playback modes.

#### (b) Reference Voltage

Reference voltage at the sliding contact of VR605 (Cam Control Volume) in each mode is as follows:

Mode	Reference Voltage (Typical Value)
Stop	0 V
Fast (F.F./Rew.)	-2.0 V
Pause	-6.5 V
Play	-9.1 V

— 2.0 V ± 0.25 V

— 2.6 V ± 0.4 V

#### (c) Resistors for Adjustment

Mode	Ref. No.	Typical Value
Fast (F.F./Rew.)	R640	22 kΩ
Pause	R643	76.8 kΩ (F)
Play	R639	10 kΩ

#### (d) Adjustment Procedures

- Set the cassette deck in Stop mode, then check to insure that the voltage at the sliding contact of VR605 is 0 V (±0.3 V).
- Set the cassette deck in F.F. mode, then adjust the value of

R640 so that the voltage at the sliding contact of VR605 will become lower by 2.0 V (±0.25 V) than in Stop mode.

- Press the Pause button to set the cassette deck in Pause mode. Adjust the value of R643 to obtain -6.5 V (+0.4, -0.15 V) at the sliding contact of VR605.
- Set the cassette deck in Playback mode, then adjust the value of R639 so that the voltage at the sliding contact of VR605 will become lower by 2.6 V (±0.4 V) than in Pause mode.

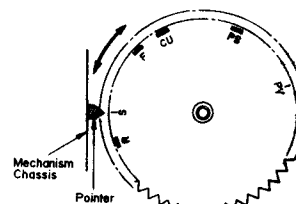


Fig. 2.1

### 2.2. Reel Motor Speed Adjustment in Play mode

- Connect a DC voltmeter to TP1 and GND on the Logic P.C.B. Ass'y.
- Without loading a cassette tape, set the cassette deck in Play mode.
- Adjust VR601 on the Logic P.C.B. Ass'y to obtain -4 V on the DC voltmeter.

### 2.3. Record Head and Playback Head Tilt Adjustment

Note: On items 2.3 - 2.9, refer to Fig. 2.2 flow chart. Refer to Figs. 2.3 and 2.4.

- Load a Tilt Check Gauge M-9039 (DA09039A) in the cassette deck.
- Clip the grounding terminal of the Tilt Check Gauge with one end of the cord with clip, and the chassis of the cassette deck with the other end.
- Remove both of the Height Gears.
- Set the cassette deck in Play mode. Check to insure whether the Beacons Playback Head "Upper" or "Lower" and Record Head "Upper" or "Lower" are illuminating. In order not to give damages onto the head surfaces, push both of slide knobs of the Gauge to the direction of arrow marks, then return them to the original place to be in contact with record head and playback head surfaces after Play mode is securely locked.
- Check to insure freedom from contact between the Gauge and pad lifter.
- Beacon Playback Head "Lower" will light on when height adjustment screw (P) turned clockwise but Playback Head "Upper" when counterclockwise. Adjust so that both "Upper" and "Lower" will light on even when you move the slide knob to the direction of an arrow mark and then return it to the original place.
- Same procedures will apply to the Beacons Record Head "Upper" and "Lower", except for the height adjustment screw (R).
- Set the cassette deck in Stop mode and fit both of the serrated Height Gears. Then set the cassette deck again in Play mode and insure all of the 4 Beacons are illuminating. If not, (3) through (7) will have to be repeated till satisfactory results are obtained.

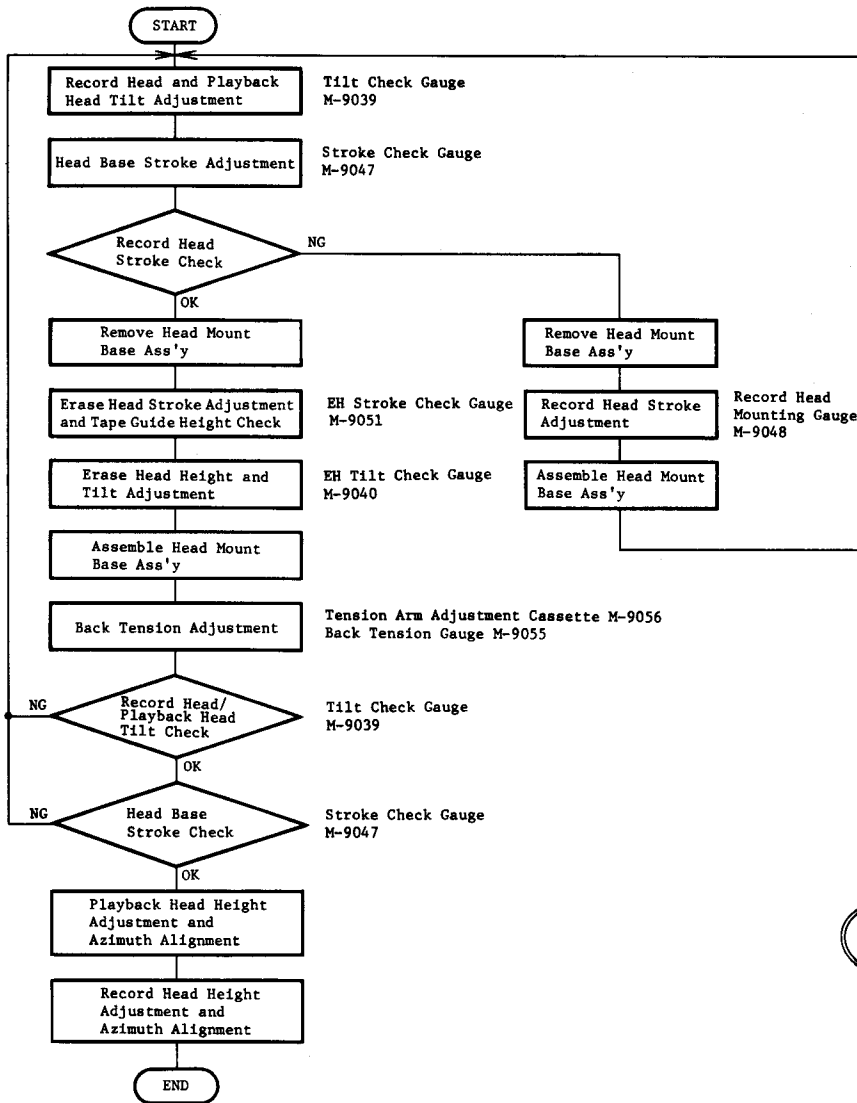


Fig. 2.2

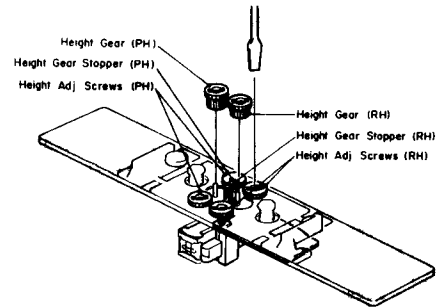


Fig. 2.3

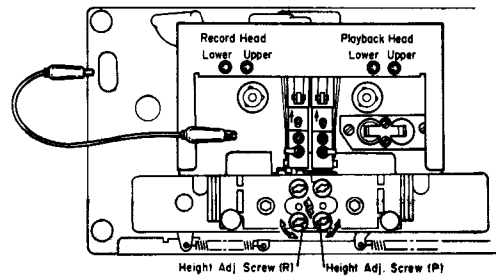


Fig. 2.4

**2.4. Head Base Stroke Adjustment**

Refer to Fig. 2.5.

Note: Before you conduct this adjustment, adjust with a "Tilt Check Gauge" to insure freedom from tilt on the playback head and record head.

**(1) Head Base Stroke Adjustment in Play Mode**

- (a) Load a Stroke Check Gauge M-9047 (DA09047B) in the cassette deck.
- (b) Move Record Head Indicator and Playback Head Indicator to the direction of arrow mark "A" with your finger tip and then set the cassette deck in Play mode. Then slowly release the Indicators and insure whether each of the Indicators is in contact with record and playback heads.
- (c) Check to insure whether the "P" pointer on the Playback Head Indicator locates between the 2 lines on the Indicator Plate.
- (d) If the playback head stroke is noted to be misaligned, adjustment can be made by moving the stroke adjuster assembled in the head base assembly (either forwardly or backwardly).
- (e) Check to insure whether the "P" pointer on the Playback Head Indicator locates between the 2 lines on the Record Head Indicator, thus check can be made on record head stroke.

- (f) If the record head stroke is noted to be misaligned, adjustment can be made with a Record Head Mounting Gauge M-9048 (DA09048A).

**(2) Head Base Stroke Adjustment in Cue Mode**

- (a) Load a Stroke Check Gauge M-9047 (DA09047B) in the cassette deck.
- (b) Move Record Head Indicator and Playback Head Indicator to the direction of arrow mark "A" with your finger tip and then set the cassette deck in Cue mode. Then slowly release the Indicators and insure whether each of the Indicators is in contact with record and playback heads.
- (c) Check to insure whether the "C" pointer on the Playback Head Indicator locates between the 2 lines on the Indicator Plate.
- (d) If the playback head stroke is noted to be misaligned, adjust VR602 on the Logic P.C.B. Ass'y till satisfactory results are obtained.
- (e) After completion of the Head Base Stroke Adjustment, check to insure accuracy of the Head Base Stroke Adjustment in Play mode. If the above are inaccurate, items (1) and (2) will have to be repeated till satisfactory results are obtained.

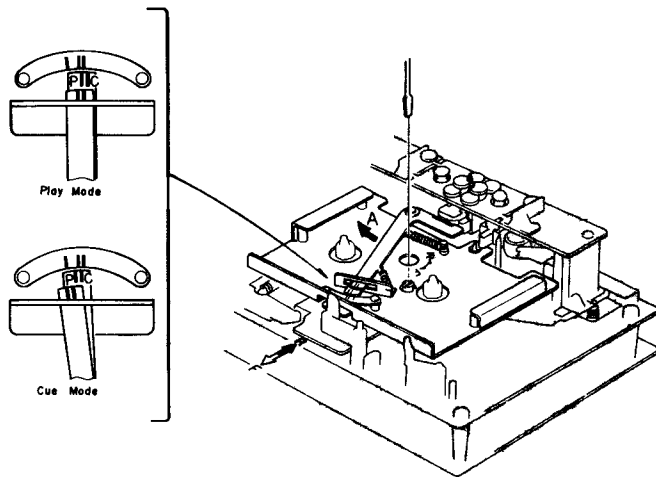


Fig. 2.5

**2.5. Erase Head Stroke Adjustment and Tape Guide Height Check**  
Remove the Head Mount Base Ass'y.  
Refer to Figs. 2.6 and 2.7.

- (1) Erase Head Stroke Adjustment
  - (a) Load an EH Stroke Check Gauge M-9051 (DA09051A) in the cassette deck.
  - (b) Set the cassette deck in Play mode, thus check can be made on erase head stroke through the EH Stroke Indicator.
  - (c) Check to insure whether the erase head surface is aligned with red line on the EH Stroke Indicator. If not, adjust the erase head stroke by loosening 2 screws A that assemble erase head and erase head plate.
  - (d) After completion of adjustment, 2 pcs. of screws shall be locked with lock tight paint.
- (2) Supply Tape Guide Height Check
  - (a) Load an EH Stroke Check Gauge M-9051 (DA09051A) in the cassette deck.
  - (b) Set the cassette deck in Play mode.
  - (c) Slide the Supply Tape Guide Check Bar down against the supply tape guide, and check to insure that the Supply Tape Guide Check Bar is accepted by the supply tape guide.
- (3) Take-up Tape Guide Height Check
  - (a) Load an EH Stroke Check Gauge M-9051 (DA09051A) in the cassette deck.
  - (b) Set the cassette deck in Play mode.
  - (c) Slide the Take-up Tape Guide Check Bar down against the take-up tape guide, and check to insure that the Take-up Tape Guide Check Bar is accepted by the take-up tape guide.

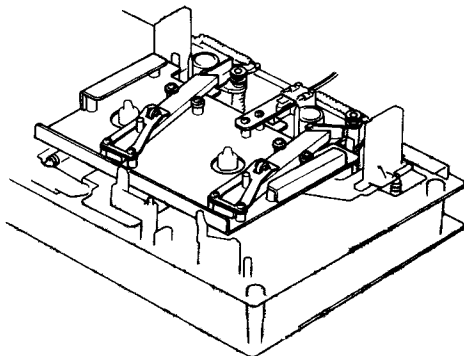


Fig. 2.6

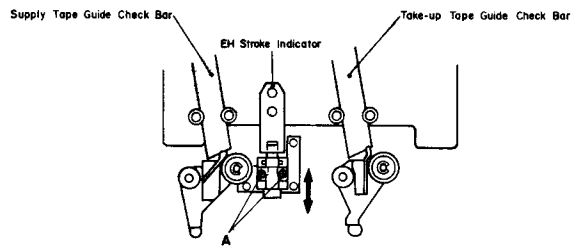


Fig. 2.7

**2.6. Erase Head Height and Tilt Adjustment**  
Refer to Figs. 2.8 and 2.9.

- (1) Remove Head Mount Base Ass'y.
- (2) Load an EH Tilt Check Gauge M-9040 (DA09040A) in the cassette deck.
- (3) Set the cassette deck in Stop mode.
- (4) Check to insure whether one of the 3 Beacons is illuminating. Look down the mirror as shown by an arrow mark and slowly turn the Screw "Height" counterclockwise (or clockwise) so that the two horizontal lines on the mirror will become superposed on the line (in different color) of the erase head, and check to insure whether Beacon "1" is illuminating.
- (5) Turn Screw "Tilt" counterclockwise (or clockwise) to light on Beacon "2". Excessive turning will cause the Beacon "1" to light off. Adjustments of Screw "Tilt" will therefore be conducted till both of the Beacons "1" and "2" illuminate.
- (6) Turn Screw "Azimuth" counterclockwise (or clockwise) to light on Beacon "3". Excessive turning will cause either Beacon "1" or "2" to light off, and therefore adjust Screw "Azimuth" until all of the 3 Beacons "1", "2" and "3" illuminate.
- (7) Check to insure whether the horizontal line on the mirror corresponds to that on the erase head. If not, (4) through (7) will have to be repeated till satisfactory results are obtained.
- (8) After completion of adjustment, 3 pcs. of screws shall be locked with lock tight paint.

Note: Before use of this gauge, check to insure freedom from dust or dirt, or overflow in the groove of the erase head surface.

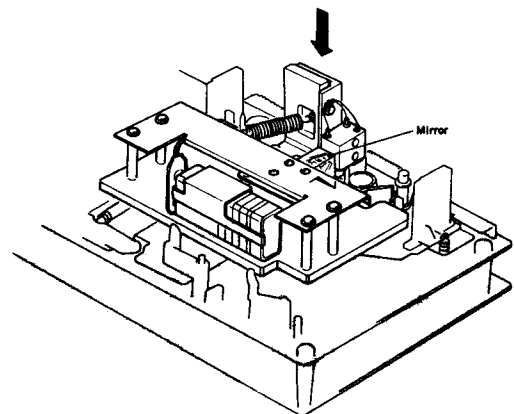


Fig. 2.8

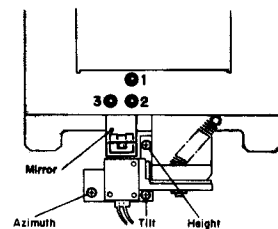


Fig. 2.9

## 2.7. Back Tension Adjustment

Refer to Figs. 2.10 — 2.13.

- (1) Load a Tension Arm Adjustment Cassette (DA09056A) in the cassette deck referring to Fig. 2.10.
- (2) Set the cassette deck in Play mode.
- (3) Bend the Back Tension Arm with pliers so that the gap between the Cassette Holding Spring assembled on the Head Base Ass'y and the Back Tension Arm becomes 0.5 mm as shown in Fig. 2.11. Do not bend the top of the Back Tension Arm.
- (4) Set the cassette deck in Stop mode, and remove the Tension Arm Adjustment Cassette (DA09056A), then set the cassette deck in Cue mode.

In Cue mode, check to insure that the gap is found between the Supply Reel Hub B Ass'y and the Felt of Back Tension Ass'y as shown in Fig. 2.12.

- (5) Load the Back Tension Gauge (DA09055A) in the cassette deck.
- (6) Set the cassette deck in Play mode and read the torque value of Back Tension Gauge.

If the value is in a range of 6 g-cm to 10 g-cm, adjustment is not necessary. If not, change the installation point of the Back Tension Spring as shown in Fig. 2.13, and obtain the torque of 7 g-cm to 9 g-cm range.

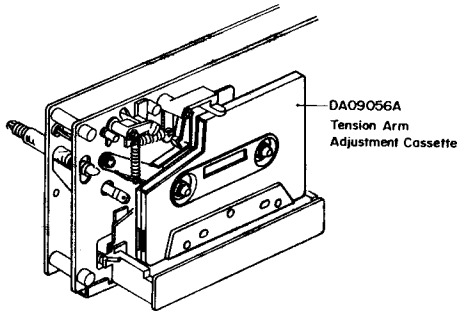


Fig. 2.10

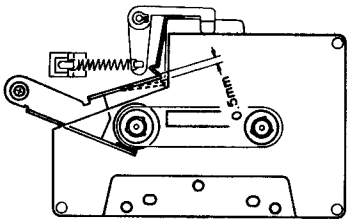


Fig. 2.11

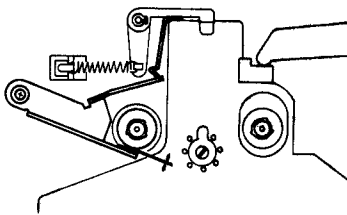


Fig. 2.12

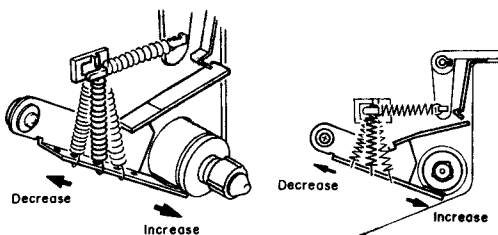


Fig. 2.13

## 2.8. Playback Head and Record Head Height Adjustment and Azimuth Alignment

Refer to Figs. 2.14 and 2.15. Perform the following adjustments successively.

### (1) Playback Head Height Adjustment

- (a) Set the Monitor switch to Tape, Tape Selector button to ZX and Eq. switch to 70  $\mu$ s.
- (b) Connect a VTVM to Output Jacks.
- (c) Load a 1 kHz Track Alignment Tape (DA09007B) and set the cassette deck in Forward-Play mode.
- (d) Turn the PH Height Gear until the outputs of both channels become minimum on the VTVM.

### (2) Azimuth Reference Position Adjustment

- (a) With the Cassette Holder open, press the Forward-Play button. Adjust VR824 on the Auto Azimuth P.C.B. Ass'y so that the Alignment Indicator coincides with the Pointer in the Azimuth Alignment Motor Ass'y. Refer to Fig. 2.15.
- (b) With the Cassette Holder open, press the Reverse-Play button. Adjust VR823 on the Auto Azimuth P.C.B. Ass'y so that the Alignment Indicator coincides with the Pointer in the Azimuth Alignment Motor Ass'y.

### (3) Playback Head Azimuth Alignment

- (a) Disconnect the Azimuth Motor by pulling out the connector CN-5 of the Auto Azimuth P.C.B. Ass'y.
- (b) Load a 15 kHz Azimuth Alignment Tape (DA09004B) and set the cassette deck in Forward-Play mode.
- (c) Turn the PH Azimuth Alignment screw until the outputs of both channels become maximum on the VTVM.

### (4) Phase Adjustment and Record Head Height Adjustment and Azimuth Alignment

- (a) Connect a DC millivoltmeter to pin 1 of CN-5 on the Auto Azimuth P.C.B. Ass'y (CN-5 is removed).
- (b) Load a 15 kHz Azimuth Alignment Tape (DA09004B) and set the cassette deck in Forward-Play mode. Adjust the VR701 on the Main P.C.B. Ass'y to obtain 0 V on the DC millivoltmeter. (Adjustment should be carried out within approx. 10 seconds.)
- (c) Turn the Azimuth Alignment Tape upside down and set the cassette deck in Reverse-Play mode. Adjust VR702 on the Main P.C.B. Ass'y to obtain 0 V on the DC millivoltmeter within approx. 10 seconds.
- (d) Load a Reference ZX Tape (DA09037B) and set the cassette deck in Rec./Forward-Play mode.
- (e) Press the Level Calibration button to oscillate 400 Hz (0 dB) and turn the RH Height Gear until the outputs of both channels become maximum on the VTVM.
- (f) Press the Bias Calibration button to oscillate 15 kHz (-20 dB) and turn the RH Azimuth Alignment Screw until the outputs of both channels become maximum on the VTVM.
- (g) Feed in 5 kHz (-20 dB) from an external generator. Set the cassette deck in Rec./Forward-Play mode and adjust VR822 on the Auto Azimuth P.C.B. Ass'y to obtain the closest value to 0 V on the DC millivoltmeter at pin 1 of CN-5. (Adjustment should be done within approx. 10 seconds.)
- (h) Mount CN-5 on the original place.
- (i) Load a 15 kHz Azimuth Alignment Tape (DA09004B) and set the cassette deck in Forward-Play mode. Note the Indicator swing from the Pointer. Turn the Azimuth Alignment Tape upside down, set the cassette deck in Reverse-Play mode and note the Indicator swing from the Pointer. (Indicator will move in the opposite direction as above.) Adjust the PH Azimuth Alignment Screw so that the Pointer swings evenly in Forward-Play and Reverse-Play modes.
- (j) Load a 15 kHz Azimuth Alignment Tape (DA09004B) and set the cassette deck in Forward-Play mode. Pull out CN-5 of the Auto Azimuth P.C.B. Ass'y after the Direction Indicator has been finished flashing.
- (k) Press the Bias Calibration button to oscillate 15 kHz (-20 dB) and turn the RH Azimuth Alignment Screw until the outputs of both channels become maximum on the VTVM.
- (l) Mount CN-5 on the original place.

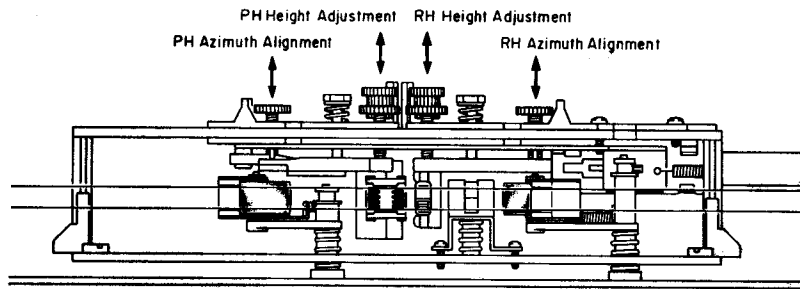


Fig. 2.14

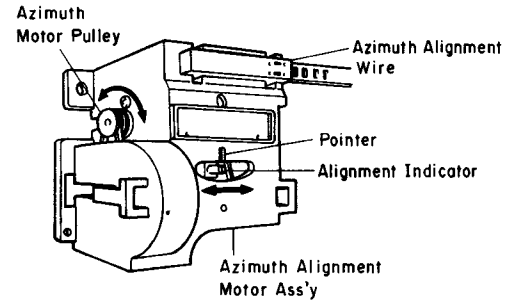


Fig. 2.15

### 2.9. Record Head Stroke Adjustment

Refer to Figs. 2.16 and 2.17.

Note: This adjustment will be required only to insure freedom from misalignment of the record head stroke in the record head stroke check mode.

- (1) Check the accuracy of the record head stroke.
- (2) Remove Head Mount Base Ass'y.
- (3) Remove the record head assembly.
- (4) Adjustment of Record Head Mounting Gauge M-9048 (DA0-9048A)
  - (a) Mount the Block B onto the Mounting Gauge Plate.
  - (b) Loosen the 2 screws fixing the Block A.
  - (c) As shown in Fig. 2.16, hold the Gauges (3.05 mm and 0.1 mm thickness) between the Block A and Block B, and fix the Block A with screws, pushing the Block A to the 2 guide pins.
- (5) Remove the Block B from the Mounting Gauge Plate.
- (6) As shown in Fig. 2.17, mount the R-8L record head assembly onto the Mounting Gauge Plate, then check the location of the R-8L record head surface. (If record head touches the Block C, loosen 2 pcs. of screws that assemble record head and record head plate, then place the R-8L record head assembly onto the Plate.)
- (7) Remove the R-8L record head assembly from the Mounting Gauge Plate.
- (8) Readjustment of Record Head Mounting Gauge M-9048 (DA09048A)
  - (a) Mount the Block B onto the Mounting Gauge Plate.
  - (b) Loosen the 2 screws fixing the Block A.
  - (c) As shown in Fig. 2.16, hold the Gauges (3.05 mm and either one of 0.05, 0.15, 0.2, 0.25, 0.3 or 0.35 mm thickness) between the Block A and Block B, and fix the Block A with screws, pushing the Block A to the 2 guide pins.
- (9) Remove the Block B from the Mounting Gauge Plate.
- (10) Mount the R-8L record head assembly onto the Mounting Gauge Plate.
- (11) As shown in Fig. 2.17, loosen 2 pcs. of screws that assemble record head and record head plate. As the location of the Block A is secured by the item (8)-(c), push the record head to the directions A and B, then tighten 2 pcs. of screws.
- (12) Check to insure freedom from gap between the Block C and record head surface, then tighten the 2 pcs. of screws on the record head assembly with lock tight paint.
- (13) Remove the R-8L record head assembly from the Mounting Gauge Plate.
- (14) Assemble the record head assembly to the head mount base assembly.
- (15) Assemble the head mount base assembly to the mechanism assembly.
- (16) Check the record head stroke. If the above are inaccurate, items (1) through (16) will have to be repeated till satisfactory results are obtained.

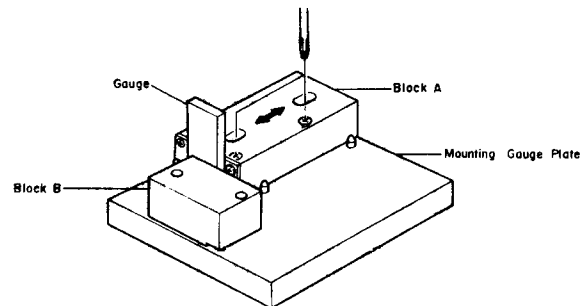
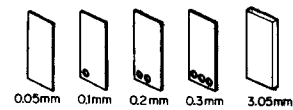


Fig. 2.16

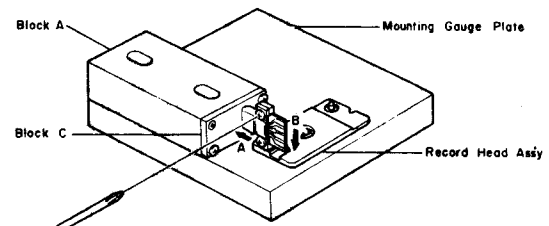


Fig. 2.17

### 2.10. Tape Travelling Adjustment

The adjustment shall be made with a modified version of the current type EXII C-90 as shown in Fig. 2.18 (error will be made if a current type Tape Travelling Cassette (DA09011A) should be used for this purpose).

While modifying an EXII C-90, the tape guides in the cassette housing shall be kept protected to avoid tilt.

Check shall be made in the following procedures.

- (1) An EXII C-90 tape thus modified shall be loaded onto the cassette deck.
- (2) Release the back-tension (rotate the Supply Reel and feed out some length of tape) and set the cassette deck in Play mode.
- (3) In this juncture, check to insure whether the tape is free from waving or slippage from the tape guide.
- (4) When the modified EXII C-90 is played back, check to insure whether the tape is freedom from waving from head surface or at pressure rollers.
- (5) If either of waving or slippage from the tape guide should be noted, adjustments of items 2.3 to 2.9, etc. will be required.

As a case may be, the said waving or slippage may have been caused from defective Supply Pressure Roller Ass'y or Take-up Pressure Roller Ass'y without parallel contact with capstans. If such are noted, the Pressure Roller Assemblies will have to be replaced.

Further, excessively weak take-up torque or strong take-up torque may cause defective tape travelling.

The cassette deck is intended to be an adjustment-free model, however if the similar matters as above should be noted, please replace the Reel Hub Ass'y to obtain appropriate take-up torque.

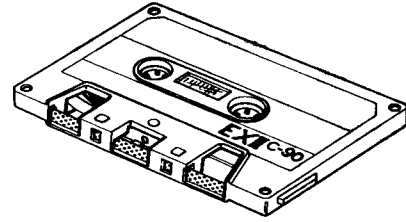


Fig. 2.18

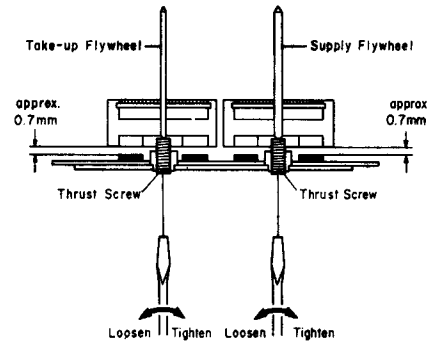


Fig. 2.19

### 2.11. Flywheel Ass'y Height Adjustment

Refer to Fig. 2.19.

- (1) Adjust both Thrust Screws so that the gaps between the Motor Coil Assemblies and the Flywheel Assemblies become approx. 0.7 mm.
- (2) Connect a synchroscope to CN501-1 (take-up side) and CN502-1 (supply side) on the Motor Control P.C.B. Ass'y. Set the synchroscope to AC input.
- (3) Check to insure that the peak-to-peak levels of both waveforms are greater than 20 mV.
- (4) Apply a quantity of lock tight paint to the Thrust Screws.

Note: Mount washers on the Flywheel Ass'y as follows if Flywheel Ass'y is replaced.

- (a) Turn the Thrust Screw so that the gap between the Motor Coil Ass'y and the Flywheel Ass'y becomes approx. 1 mm.
- (b) From the front side of the cassette deck, first insert a Washer 3.1 mm FT into the capstan shaft of supply side (Washer 2.6 mm FT for take-up side), then insert a Washer 3 mm (Washer 2.5 mm) into the shaft and press it until the Washer 3.1 mm FT (Washer 2.6 mm FT) contacts with the flange sufficiently. Refer to Fig. 5.5.
- (c) Perform the "Flywheel Ass'y Height Adjustment" in item 2.11.

### 2.12. Lubrication

This is a lubrication-free cassette deck except when parts are replaced. Apply the following lubricant for each replaced part:

- (1) LAUNA #100  
Capstan Shaft  
Pressure Roller Shaft  
Thrust Cap
- (2) FLOIL GB-TS-1  
Reel Hub Shaft  
Thrust portion on the Capstan Shaft  
FLOIL GB-TS-1, made by Kanto Chemicals Co., Ltd. in Japan.

We suggest that you use the above or equivalent type. If unavailable please contact Kanto Chemicals Co., Ltd., 2-7 Kanda Suda-cho Chiyoda-ku, Tokyo 101 Japan.

- (3) Silicon Oil #3000 CST  
Air Damper Piston

Note: Excessive lubrication may cause defective damper action as the 0.2 $\phi$  hole at the end of the cylinder may be filled with oil.

3. PARTS LOCATION FOR ELECTRICAL ADJUSTMENT

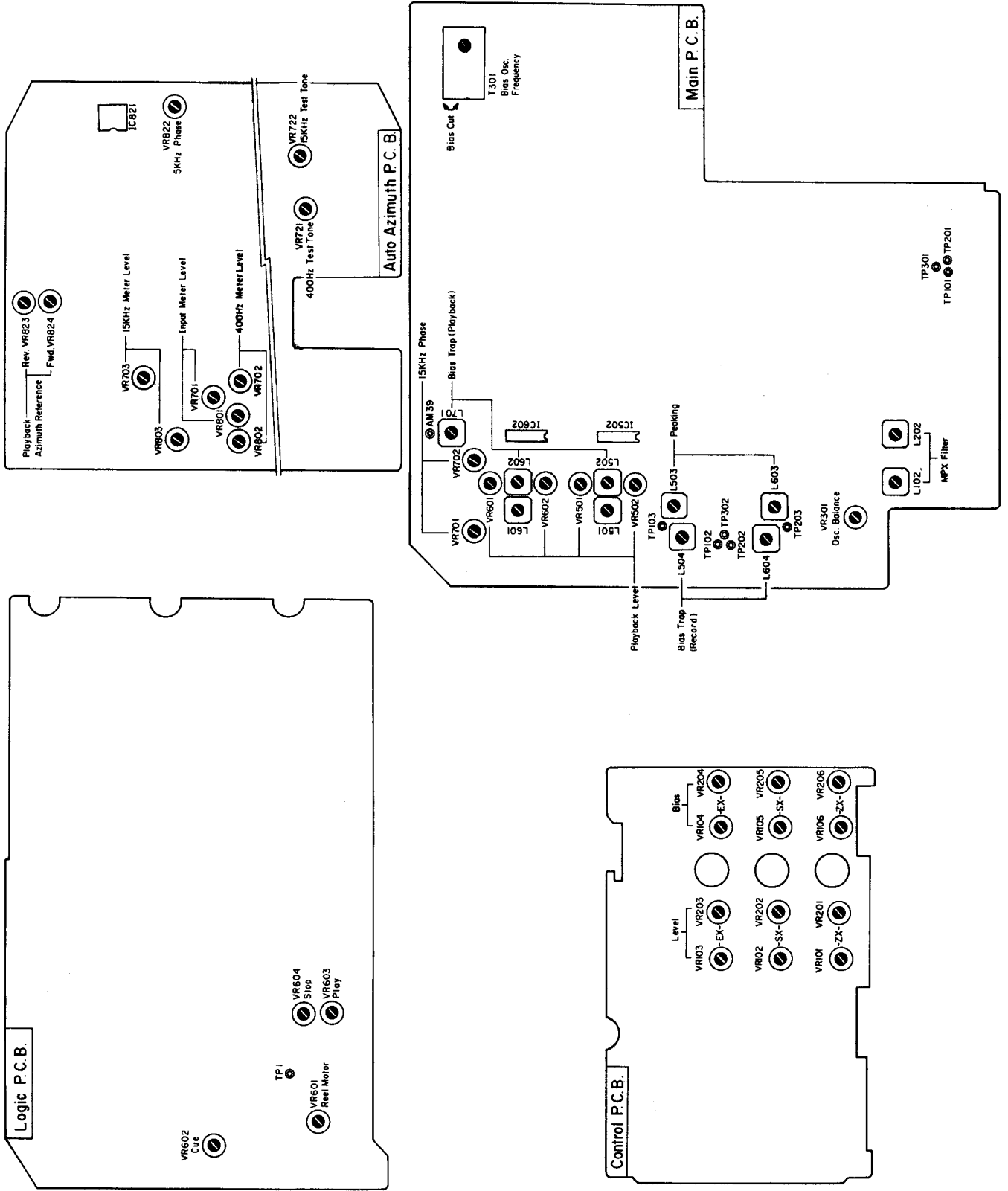


Fig. 3

#### 4. ELECTRICAL ADJUSTMENTS AND MEASUREMENTS

Note: Electrical adjustment should be performed after mechanical adjustment is completed.

##### 4.1. Adjustment and Measurement Instructions

STEP	ITEM	SIGNAL SOURCE	OUTPUT CONNECTION	MODE	ADJUSTMENT	REMARKS
1	Tone Level Calibration	Tone 400 Hz and 15 kHz	VTVM to TP101, TP201 on Main P.C.B. and Output Jacks	Tone — 400 Hz/15 kHz Monitor SW — Source	Auto Azimuth P.C.B. VR721 (400 Hz) VR722 (15 kHz) Main P.C.B. VR301 (400 Hz Balance)	<ol style="list-style-type: none"> <li>1. Press the Level Calibration button to oscillate 400 Hz.</li> <li>2. Adjust VR721 to obtain 350 mV on the VTVM at TP101 (L ch).</li> <li>3. Adjust VR301 to obtain the same level as L ch at TP201.</li> <li>4. Measure the reading on the VTVM at the Output Jacks.</li> <li>5. Press the Bias Calibration button to oscillate 15 kHz.</li> <li>6. Adjust VR722 to obtain 20 dB lower level than in 4 on the VTVM at the Output Jacks.</li> <li>7. Press the Calibration Reset button to stop the tone oscillation.</li> </ol>
2	Meter Level Calibration	400 Hz to Input Jacks and Tone 400 Hz and 15 kHz	VTVM to TP101, TP201 on Main P.C.B.	Tone — OFF/400 Hz/15 kHz Monitor SW — Source	Auto Azimuth P.C.B. VR701, VR801 VR702, VR802 VR703, VR803 VR721 (400 Hz) VR722 (15 kHz)	<ol style="list-style-type: none"> <li>1. Feed in 400 Hz, then adjust the Input level controls to obtain 350 mV —0.9 dB on the VTVM.</li> <li>2. Adjust VR701 (VR801) so that the 0 dB segment of the level meter starts illuminating.</li> <li>3. Press the Level Calibration button to oscillate 400 Hz, then adjust VR721 to obtain 350 mV —0.25 dB on the VTVM.</li> <li>4. Adjust VR702 (VR802) so that the 0 dB segment of the level meter starts illuminating.</li> <li>5. Press the Bias Calibration button to oscillate 15 kHz, then adjust VR722 to obtain 35 mV —0.25 dB on the VTVM.</li> <li>6. Adjust VR703 (VR803) so that the 0 dB segment of the level meter starts illuminating.</li> <li>7. Press the Calibration Reset button.</li> <li>8. Re-adjust the tone level according to step 1 "Tone Level Calibration".</li> </ol>
3	MPX Filter Adjustment	19 kHz ±100 Hz to Input Jacks	VTVM to Output Jacks	Monitor SW — Source Dolby NR SW — OFF MPX SW — ON	Main P.C.B. L102, L202	<ol style="list-style-type: none"> <li>1. Turn the Output level control fully clockwise (maximum position).</li> <li>2. Adjust the Input Level controls to obtain 1 V on the VTVM.</li> <li>3. Set the MPX Filter switch to ON, then adjust L102 (L202) to obtain the minimum reading on the VTVM (the minimum reading will be less than —30 dB).</li> </ol>
4	Playback Head and Record Head Height Adjustment and Azimuth Alignment	1 kHz Track Alignment Tape (DA09007B) 15 kHz Azimuth Tape (DA09004B) 5 kHz (—20 dB) to Input Jacks Tone 15 kHz	VTVM to Output Jacks and DC Millivoltmeter to pin 1 of CN-5 on Auto Azimuth P.C.B.	Playback (Fwd./Rev.) Record, Playback (Fwd.) Monitor SW — Tape Tape SW — ZX Eq. SW — 70 μs Dolby NR SW — OFF MPX SW — OFF	PH Height Gear PH Azimuth Alignment Screw RH Height Gear RH Azimuth Alignment Screw Auto Azimuth P.C.B. (Fwd. Azimuth Ref.) VR824 (Rev. Azimuth Ref.) VR823 (5 kHz Phase) VR822 Main P.C.B. (15 kHz Fwd. Phase) VR701 (15 kHz Rev. Phase) VR702	<p>Perform the following adjustments successively.</p> <ol style="list-style-type: none"> <li>1. Playback Head Height Adjustment <ol style="list-style-type: none"> <li>a. Load a 1 kHz track alignment tape (DA09007B) and forward-play it back.</li> <li>b. Adjust the PH Height Gear to obtain minimum readings of both channels on the VTVM.</li> </ol> </li> <li>2. Azimuth Reference Position Adjustment <ol style="list-style-type: none"> <li>a. With the Cassette Holder open, press the Forward-Play button. Adjust VR824 on the Auto Azimuth P.C.B. Ass'y so that the Alignment Indicator coincides with the Pointer in the Azimuth Alignment Motor Ass'y. Refer to Fig. 2.15.</li> <li>b. With the Cassette Holder open, press the Reverse-Play button. Adjust VR823 on the Auto Azimuth P.C.B. Ass'y so that the Alignment Indicator coincides with the Pointer in the Azimuth Alignment Motor Ass'y.</li> </ol> </li> <li>3. Playback Head Azimuth Alignment <ol style="list-style-type: none"> <li>a. Disconnect the Azimuth Motor by pulling out the connector CN-5 of the Auto Azimuth P.C.B. Ass'y.</li> <li>b. Load a 15 kHz azimuth tape (DA09004B) and forward-play it back.</li> <li>c. Adjust the PH Azimuth Alignment Screw to obtain maximum readings of both channels on the VTVM.</li> </ol> </li> <li>4. Phase Adjustment and Record Head Height Adjustment and Azimuth Alignment <ol style="list-style-type: none"> <li>a. Disconnect CN-5 of the Auto Azimuth P.C.B. Ass'y.</li> <li>b. Load a 15 kHz azimuth tape (DA09004B) and forward-play it back. Adjust VR701 on the Main P.C.B. Ass'y to obtain 0 V on the DC millivoltmeter. (Adjustment should be carried out within approx. 10 seconds.) (to be continued)</li> </ol> </li> </ol>



STEP	ITEM	SIGNAL SOURCE	OUTPUT CONNECTION	MODE	ADJUSTMENT	REMARKS
4	(continued)					<ul style="list-style-type: none"> <li>c. Turn the azimuth tape upside down and reverse-play it back. Adjust VR702 on the Main P.C.B. Ass'y to obtain 0 V on the DC millivoltmeter within approx. 10 seconds.</li> <li>d. Load a reference ZX tape (DA09037B) and record/forward-play it back.</li> <li>e. Press the Level Calibration button to oscillate 400 Hz (0 dB) and adjust the RH Height Gear to obtain maximum readings of both channels on the VTVM.</li> <li>f. Press the Bias Calibration button to oscillate 15 kHz (-20 dB) and adjust the RH Azimuth Alignment Screw to obtain maximum readings of both channels on the VTVM.</li> <li>g. Feed in 5 kHz (-20 dB) from an external generator and record/forward-play it back. Adjust VR822 on the Auto Azimuth P.C.B. Ass'y to obtain the closest value to 0 V on the DC millivoltmeter. (Adjustment should be done within approx. 10 seconds.)</li> <li>h. Mount CN-5 on the original place.</li> <li>i. Load a 15 kHz azimuth tape (DA09004B) and forward-play it back. Note the Indicator swing from the Pointer. Turn the azimuth tape upside down, reverse-play it back and note the Indicator swing from the Pointer. (Indicator will move in the opposite direction as above.) Adjust the PH Azimuth Alignment Screw so that the Pointer swings evenly in Forward-Play and Reverse-Play modes.</li> <li>j. Load a 15 kHz azimuth tape (DA09004B) and forward-play it back. Pull out CN-5 of the Auto Azimuth P.C.B. Ass'y after the Direction Indicator has been finished flashing.</li> <li>k. Press the Bias Calibration button to oscillate 15 kHz (-20 dB) and adjust the RH Azimuth Alignment Screw to obtain maximum readings of both channels on the VTVM.</li> <li>l. Mount CN-5 on the original place.</li> </ul>
5	Playback Level Calibration	400 Hz Level Tape (DA09005B)	VTVM to TP101, TP201 on Main P.C.B.	Playback (Fwd./Rev.) Monitor SW - Tape Eq. SW - 70 $\mu$ s Dolby NR SW - OFF MPX SW - OFF	Main P.C.B. VR501, VR601 (Fwd.) VR502, VR602 (Rev.)	<ol style="list-style-type: none"> <li>1. Load a 400 Hz level tape and forward-play it back.</li> <li>2. Adjust VR501 (VR601) to obtain 350 mV on the VTVM.</li> <li>3. Turn the tape upside down and reverse-play it back.</li> <li>4. Adjust VR502 (VR602) to obtain 350 mV on the VTVM.</li> </ol>
6	Playback Frequency Response Adjustment	400 Hz Level Tape (DA09005B) 10 kHz PB Frequency Response Tape (DA09003B) 15 kHz PB Frequency Response Tape (DA09002B) 20 kHz PB Frequency Response Tape (DA09001B)	VTVM to Output Jacks	Playback (Fwd./Rev.) Monitor SW - Tape Tape SW - SX Eq. SW - 70 $\mu$ s Dolby NR SW - OFF MPX SW - OFF	Main P.C.B. (Fwd.) R507, R607 R508, R608  (Rev.) R517, R617 R518, R618	<ol style="list-style-type: none"> <li>1. Load a 400 Hz level tape and forward-play it back. Adjust the Output level control to a certain level (0 dB for example).</li> <li>2. Load 10 kHz, 15 kHz and 20 kHz PB frequency response tapes and forward-play them back. Short R507 (R607) or R508 (R608) to obtain the following levels against the level for the 400 Hz level tape. 10 kHz: -20 dB -1 dB to +2 dB 15 kHz: -20 dB -1 dB to +3 dB 20 kHz: -20 dB -1 dB to +4 dB</li> <li>3. Turn the tape upside down and reverse-play them back. Short R517 (R617) or R518 (R618) to obtain the levels which suffice the range specified in above 2.</li> <li>4. Refer to the "Playback Frequency Response Adjustment" in item 4.2 for the detailed description.</li> </ol>
7	Bias Oscillation Frequency and Erase Current Adjustment		VTVM across the additional 0.1 $\Omega$ resistor and Frequency Counter to CN1-1 on Main P.C.B.	Record, Pause Monitor SW - Source Tape SW - ZX Eq. SW - 70 $\mu$ s Dolby NR SW - OFF MPX SW - OFF	Main P.C.B. T301 R313, R314	<ol style="list-style-type: none"> <li>1. Connect an additional 0.1 <math>\Omega</math> resistor in series to the Erase Head, then connect a VTVM across it.</li> <li>2. Adjust T301 to obtain 105 kHz on the frequency counter.</li> <li>3. Check the erase current by the VTVM. Erase current will be in a range of 310 mA to 400 mA (typically approx. 350 mA). If erase current is not sufficient, increase it by shorting R313 or R314.</li> <li>4. After completion of the erase current adjustment, re-check the bias oscillation frequency.</li> <li>5. Remove the additional 0.1 <math>\Omega</math> resistor.</li> </ol>

STEP	ITEM	SIGNAL SOURCE	OUTPUT CONNECTION	MODE	ADJUSTMENT	REMARKS
8	Record Amplifier Equalizer Adjustment	23 kHz (-20 dB) to Input Jacks	VTVM to TP102, TP202 on Main P.C.B.	Record, Pause Monitor SW - Source Tape SW - ZX Eq. SW - 70 $\mu$ s Dolby NR SW - OFF MPX SW - OFF	Main P.C.B. L503, L603	1. Remove the bias-cut jumper from the dip side of the Main P.C.B. Ass'y. 2. Adjust L503 (L603) to obtain approx. +16 dB at 23 kHz on the VTVM. 3. Re-solder the bias-cut jumper.
9	Bias Trap Adjustment (Record Amp.)	Remove input signals	VTVM to TP103, TP203 on Main P.C.B.	Same as above	Main P.C.B. L504, L604	Adjust L504 (L604) to obtain minimum reading on the VTVM.
10	Bias Trap Adjustment (Playback Amp.)	Remove input signals	VTVM to IC502-3, IC602-3 (Fwd. Playback Amp.), IC502-1, IC602-1 (Rev. Playback Amp.) and AM39 (Sub Playback Amp.)	Same as above	Main P.C.B. L501, L502 L601, L602 L701	1. Adjust L501 (L601) to obtain minimum reading on the VTVM at IC502-3 (IC602-3). 2. Adjust L502 (L602) to obtain minimum reading on the VTVM at IC502-1 (IC602-1). 3. Adjust L701 to obtain minimum reading on the VTVM at terminal AM39.
11	Record Level Calibration and Recording Bias Current Adjustment	Tone 400 Hz and 15 kHz and 10 kHz/20 kHz (-20 dB) to Input Jacks	VTVM and Distortion Meter to Output Jacks	Record, Playback (Fwd.) Tone - 400 Hz/ 15 kHz Monitor SW - Tape Tape SW - ZX/SX EX Eq. SW - 70 $\mu$ s (ZX/SX) 120 $\mu$ s (EX) Dolby NR SW - C-Type/B-Type/ OFF MPX SW - OFF	Control P.C.B. (Level) ZX: VR101, VR201 SX: VR102, VR202 EX: VR103, VR203  (Bias) ZX: VR106, VR206 SX: VR105, VR205 EX: VR104, VR204	Adjustment should be made in the order of ZX, SX and EX.  1. Set the Dolby NR switch to C-Type. 2. Load a reference ZX tape (DA09037B), reference SX tape (DA09025B) and reference EXII tape (DA09066B). 3. Adjust the Sensitivity controls VR101 (VR201) for ZX, VR102 (VR202) for SX and VR103 (VR203) for EXII to maximum position. 4. Adjust the Bias controls VR106 (VR206) for ZX, VR105 (VR205) for SX and VR104 (VR204) for EXII to maximum position. 5. Press the Record and Fwd. Play buttons, then press the Level Calibration button to oscillate 400 Hz. 6. Adjust the Sensitivity controls VR101 (VR201), VR102 (VR202) and VR103 (VR203) to obtain 0 dB on the level meters. 7. Press the Bias Calibration button to oscillate 15 kHz. 8. Adjust the Bias controls VR106 (VR206), VR105 (VR205) and VR104 (VR204) to obtain 0 dB on the level meters. 9. Repeat 5 to 8 as above two or three times to obtain optimum performance. 10. Set the Dolby NR switch to B-Type/OFF. 11. Feed in 10 kHz (-20 dB) and 20 kHz (-20 dB), then record and forward-play them back. Check to insure that the levels are within -20 dB $\pm$ 2 dB against the levels in Dolby NR C-Type. 12. Check to insure whether the total harmonic distortion is less than 0.8% for ZX tape and 1.0% for SX and EXII tapes.
12	Overall Frequency Response Adjustment	400 Hz (0 dB) and 20 Hz to 20 kHz (-20 dB) to Input Jacks	VTVM to Output Jacks	Record, Playback (Fwd.) Monitor SW - Source/ Tape Tape SW - ZX/SX/EX Eq. SW - 70 $\mu$ s (ZX/SX) 120 $\mu$ s (EX) Dolby NR SW - OFF MPX SW - OFF	Main P.C.B. L503, L603	1. Set the Monitor switch to Source. 2. Feed in 400 Hz (0 dB) and adjust the Input level controls to obtain 0 dB on the level meters. 3. Switch the Generator output level to -20 dB. 4. Set the Monitor switch to Tape, then record and forward-play it back. 5. Feed in 20 Hz to 20 kHz (-20 dB), and check to insure whether the output levels are within -20 dB $\pm$ 3 dB. 6. If above is not sufficient, adjust L503 (L603) to obtain approx. -20 dB on the VTVM at 20 kHz. 7. Conduct step 11 "Record Level Calibration and Recording Bias Current Adjustment". 8. If above is not sufficient further, precise re-adjustment of step 6 "Playback Frequency Response", replacement of Playback Head or Record Head, check on item 2.10 "Tape Travelling Adjustment" or frequency response adjustment according to item 4.2 will be required.
13	Crosstalk Measurement	1 kHz to Input Jacks	1 kHz Band Pass Filter and VTVM to Output Jacks	Record and Playback (Fwd.) Monitor SW - Tape Tape SW - ZX Eq. SW - 70 $\mu$ s Dolby NR SW - OFF		1. Erase a reference ZX tape with a bulk eraser. 2. Load the reference tape and adjust the Input level controls to obtain 0 dB on the level meters. 3. Record input signals on the tape with pressing the Record and Fwd. Play buttons. 4. Press the Stop button, then reverse-play it back with pressing Rev. Play button. 5. Measure the difference between 3 and 4. (to be continued)

STEP	ITEM	SIGNAL SOURCE	OUTPUT CONNECTION	MODE	ADJUSTMENT	REMARKS
13 (continued)						6. Record input signals on the tape but not on the portion used as above. 7. Turn the tape the other way round and forward-play it back. 8. Measure the output level difference between 6 and 7.
14	Channel Separation Measurement	1 kHz to Input Jacks	1 kHz Band Pass Filter and VTVM to Output Jacks	Record and Playback (Fwd.) Monitor SW — Tape Tape SW — ZX Eq. SW — 70 $\mu$ s Dolby NR SW — OFF		1. Erase a reference ZX tape with a bulk eraser. 2. Load the reference tape and adjust the L ch (R ch) Input level control to obtain 0 dB on the level meter. Close the R ch (L ch) Input level control. 3. Record and forward-play the input signals and measure the R ch (L ch) level on the VTVM. 4. Turn the tape the other way round and reverse-play it back. 5. Measure the R ch (L ch) level on the VTVM.
15	Signal to Noise Ratio Measurement	400 Hz to Input Jacks	VTVM and Distortion Meter to Output Jacks	Record and Playback (Fwd.) Monitor SW — Tape Tape SW — ZX Eq. SW — 70 $\mu$ s Dolby NR SW — B-Type/C-Type		1. Feed in 400 Hz and record and forward-play it back. 2. Adjust the Input level controls to obtain a 3% total harmonic distortion in Playback mode. 3. Close the Input level controls, then record again. After reword, forward-play back and check the output level difference between 3 and 4. Note: The filter of IHF-A curve shall be used in the measurements.
16	Total Harmonic Distortion Measurement	400 Hz to Input Jacks	Distortion Meter to Output Jacks	Record and Playback (Fwd.) Monitor SW — Tape Tape SW — ZX/SX/EX Eq. SW — 70 $\mu$ s (ZX/SX) 120 $\mu$ s (EX) Dolby NR SW — OFF		1. Adjust the Input level controls to obtain 0 dB on the level meters. 2. Record and forward-play it back. 3. Read the distortion meter and check to insure that the distortion is less than 0.8% for ZX tape and 1.0% for SX and EXII tapes.
17	Wow/Flutter & Speed Measurement	3 kHz Speed and Wow/Flutter Tape (DA09006C)	Wow/Flutter Meter to Output Jacks	Playback Monitor SW — Tape Eq. SW — 70 $\mu$ s		Forward-play back and read the wow/flutter meter.

#### 4.2. Frequency Response Adjustment

##### (1) Playback Frequency Response Adjustment

Refer to Figs. 4.2.1 and 4.2.2.

Peaking adjustment will be required if playback level is not sufficient when 20 kHz PB frequency response tape is played back as referred to step 6 in 4.1 "Adjustment and Measurement Instructions".

The adjustment will compensate the gap loss of the playback head.

Peaking level is varied by the short circuit of the following resistors in the playback amp. circuit of the Main P.C.B. Ass'y.

Forward Playback Amp.:

R507, R607 (220 ohms) or R508, R608 (470 ohms)

Reverse Playback Amp.:

R517, R617 (220 ohms) or R518, R618 (470 ohms)

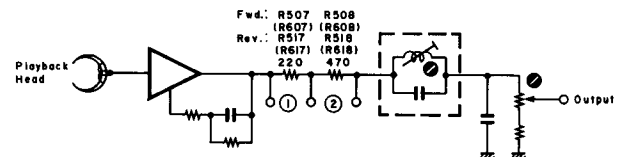


Fig. 4.2.1

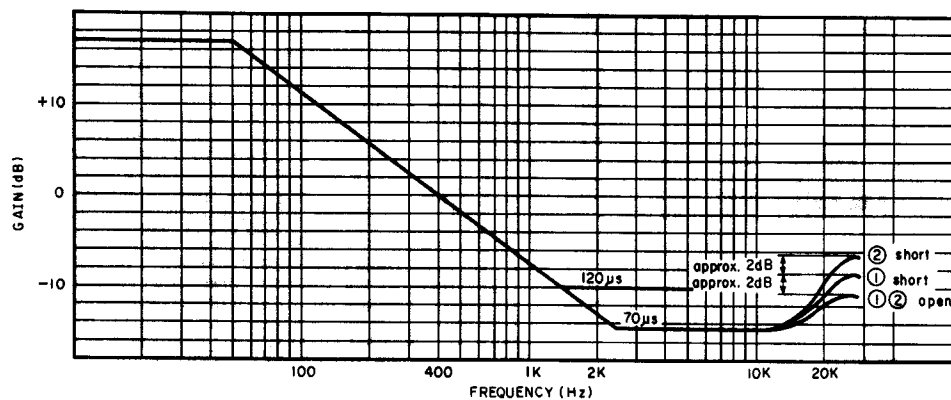


Fig. 4.2.2

**(2) Record Current Frequency Response Adjustment**

Record eq. peaking is adjusted for compensating the overall frequency response when playback frequency response is completed.

Normally however peaking frequency is pre-adjusted to approx. 23 kHz in Record mode. Refer to Fig. 4.2.3.

**(a) For ZX Tape**

- 1) Feed in 400 Hz (0 dB), then record and play it back. Adjust bias current by VR106 (VR206) on the Control P.C.B. Ass'y to obtain 0.8% distortion.
- 2) Feed in 10 kHz and 400 Hz (-20 dB), then record and play them back.

Check the difference of the levels between 10 kHz and 400 Hz, and mount an additional capacitor in parallel with C126 (C226) on the Main P.C.B. Ass'y from the dip side of the printed circuit board depending upon the difference of the levels against 400 Hz. Refer to Fig. 4.2.4.

Level Difference	Addition	Total
0 dB	0	820 pF
-1 dB	220 pF	1040 pF

- 3) Feed in 22 kHz (-20 dB), then record and play it back. Adjust record peaking coil L503 (L603) on the Main P.C.B. Ass'y to obtain flat overall frequency response.

**(b) For SX Tape**

- 1) Feed in 15 kHz and 400 Hz (-20 dB), then record and play them back. Adjust bias current by VR105 (VR205) on the Control P.C.B. Ass'y to obtain flat overall frequency response.
- 2) Feed in 20 kHz and 400 Hz (-20 dB), then record and play them back. And check to insure that the overall frequency response is flat.

**(c) For EXII Tape**

- 1) Feed in 15 kHz and 400 Hz (-20 dB), then record and play them back. Adjust bias current by VR104 (VR204) on the Control P.C.B. Ass'y to obtain flat overall frequency response.
- 2) Feed in 20 kHz and 400 Hz (-20 dB), then record and play them back. And check to insure that the overall frequency response is flat.

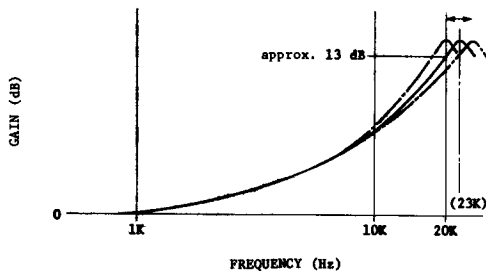


Fig. 4.2.3

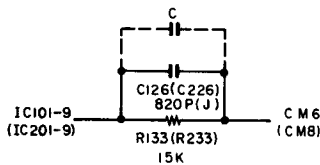


Fig. 4.2.4

**4.3. Dolby NR Circuit Check**

Dolby NR circuit incorporates Dolby NR ICs which have no adjustment point.

Perform the following checks and make sure that the IC operates accurately, i.e., accuracy of frequency response through IC.

**4.3.1. Dolby NR B-Type Circuit Check**

**(1) Playback Dolby NR Circuit**

Signal Source: 1.4 kHz to negative side of C131 (C231) on Main P.C.B.  
 Output Connection: VTVM to TP101 (TP201) on Main P.C.B.  
 Mode: Stop  
 Monitor SW - Tape  
 Dolby NR SW - B-Type/OFF

- (a) Connect a VTVM to TP101 (TP201) on the Main P.C.B. Ass'y.
- (b) Set the Dolby NR switch to B-Type. Feed in 1.4 kHz and adjust the generator output control to obtain 35 mV on the VTVM.
- (c) Set the Dolby NR switch to OFF. Check to insure that the reading is +3.2 dB ±1.5 dB on the VTVM.

**(2) Record Dolby NR Circuit**

Signal Source: 1.4 kHz to Input Jacks  
 Output Connection: VTVM to TP101 (TP201) and CM6 (CM8) on Main P.C.B.  
 Mode: Stop  
 Monitor SW - Source  
 Dolby NR SW - B-Type/OFF

- (a) Connect a VTVM to TP101 (TP201) on the Main P.C.B. Ass'y.
- (b) Feed in 1.4 kHz and adjust the Input Level controls to obtain 35 mV/11.1 mV on the VTVM.
- (c) Remove the VTVM from TP101 (TP201) and reconnect it to CM6 (CM8) on the Main P.C.B. Ass'y.
- (d) Check to insure that the reading at CM6 (CM8) corresponds to the following with Dolby NR switch OFF and B-Type.

Input Level at TP101, TP201	Level at CM6, CM8	
	Dolby NR OFF	Dolby NR B-Type
35 mV	0 dB	+3.2 dB ±1.5 dB
11.1 mV	0 dB	+8.2 dB ±1.5 dB

**4.3.2. Dolby NR C-Type Circuit Check**

**(1) Playback Dolby NR Circuit**

Signal Source: 1.4 kHz to negative side of C131 (C231) on Main P.C.B.  
 Output Connection: VTVM to TP101 (TP201) on Main P.C.B.  
 Mode: Stop  
 Monitor SW - Tape  
 Dolby NR SW - C-Type/OFF

- (a) Connect a VTVM to TP101 (TP201) on the Main P.C.B. Ass'y.
- (b) Set the Dolby NR switch to C-Type. Feed in 1.4 kHz and adjust the generator output control to obtain 35 mV on the VTVM.
- (c) Set the Dolby NR switch to OFF. Check to insure that the reading is +6.5 dB ±1.5 dB on the VTVM.

**(2) Record Dolby NR Circuit**

Signal Source: 1.4 kHz to Input Jacks  
 Output Connection: VTVM to TP101 (TP201) and CM6 (CM8) on Main P.C.B.  
 Mode: Stop  
 Monitor SW - Source  
 Dolby NR SW - C-Type/OFF

- (a) Connect a VTVM to TP101 (TP201) on the Main P.C.B. Ass'y.
- (b) Feed in 1.4 kHz and adjust the Input Level controls to obtain 35 mV/11.1 mV on the VTVM.
- (c) Remove the VTVM from TP101 (TP201) and reconnect it to CM6 (CM8) on the Main P.C.B. Ass'y.
- (d) Check to insure that the reading at CM6 (CM8) corresponds to the following with Dolby NR switch OFF and C-Type.

Input Level at TP101, TP201	Level at CM6, CM8	
	Dolby NR OFF	Dolby NR C-Type
35 mV	0 dB	+6.5 dB ±1.5 dB
11.1 mV	0 dB	+11.4 dB ±1.5 dB

## 5. MECHANISM ASS'Y AND PARTS LIST

### 5.1. Synthesis

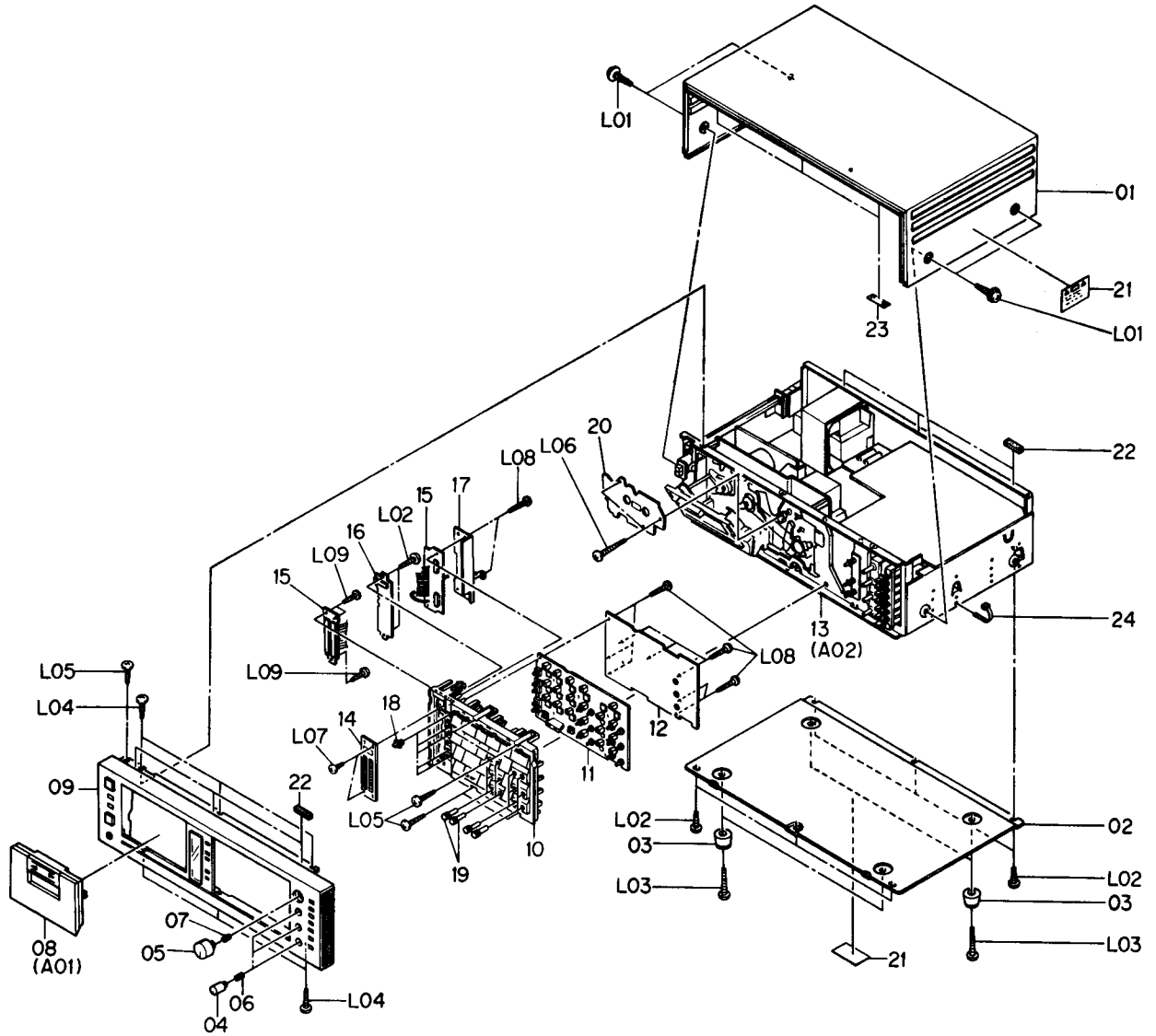


Fig. 5.1

Schematic Ref. No.	Part No.	Description	Q'ty	Schematic Ref. No.	Part No.	Description	Q'ty
	HA04393A	Synthesis (Japan)	1	14	0H04198A	Meter Cover	1
	HA04392A	Synthesis (U.S.A. & Canada)	1	15	BA04893A	Indicator P.C.B. Ass'y	1
	HA04396A	Synthesis (220V Class 2)	1	16	BA04894A	Counter P.C.B. Ass'y	1
	HA04391A	Synthesis (UK)	1	17	0J04698B	Shield Plate	1
	HA04395A	Synthesis (Australia)	1	18	0H04180A	Function Button	5
	HA04394A	Synthesis (Others)	1	19	0H04204A	Calibration Volume Knob	12
		Serial No.: A80101001 -		20	HA04422A	Cover Plate	1
01	0H04010A	Top Cover	1	21	0M04377A	Caution Label (U.S.A. & Canada)	2
02	0J04652A	Bottom Cover	1	22	0J04550A	Top Cover Cushion	6
03	0J03564A	Leg T-H	4	23	0J04080A	Top Cover Himelon	3
04	0H04203A	Volume Knob	3	L01	0E03032A	BT 4x8 @ Pan (Washer Faced)	4
05	0H04202A	Master Volume Knob	1	L02	0E00857A	BT 3x6 @ Binding	8
06	0H03737A	Volume Knob Base	3	L03	0E00865A	BT 3x10 @ Binding	4
07	0H03739A	Master Volume Knob Base	1	L04	0E00921A	BT 3x8 @ Binding (Black Chromate)	6
08	HA04401A	Cassette Lid Ass'y	1	L05	0E00868A	BT 3x8 @ Binding	3
09	HA04398A	Front Panel Ass'y	1	L06	0E00950A	BT 3x14 @ Pan (Black Chromate)	2
10	HA04399A	Front Panel Escutcheon Ass'y	1	L07	0E00869A	BT 2.6x4 @ Binding	2
11	BA04892A	Control P.C.B. Ass'y	1	L08	0E00954A	BT 2.6x8 @ Binding	10
12	0J04707A	Insulator	1	L09	0E00859A	BT 2.6x6 @ Binding	3
13	JA03971A	Chassis Ass'y (Japan)	1				
	JA03970A	Chassis Ass'y (U.S.A. & Canada)	1				
	JA03974A	Chassis Ass'y (220V Class 2)	1				
	JA03969A	Chassis Ass'y (UK)	1				
	JA03973A	Chassis Ass'y (Australia)	1				
	JA03972A	Chassis Ass'y (Others)	1				

5.2. Cassette Lid Ass'y (A01)

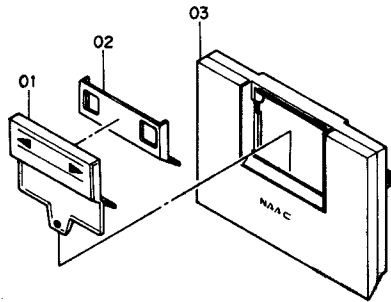


Fig. 5.2

5.3. Chassis Ass'y (A02)

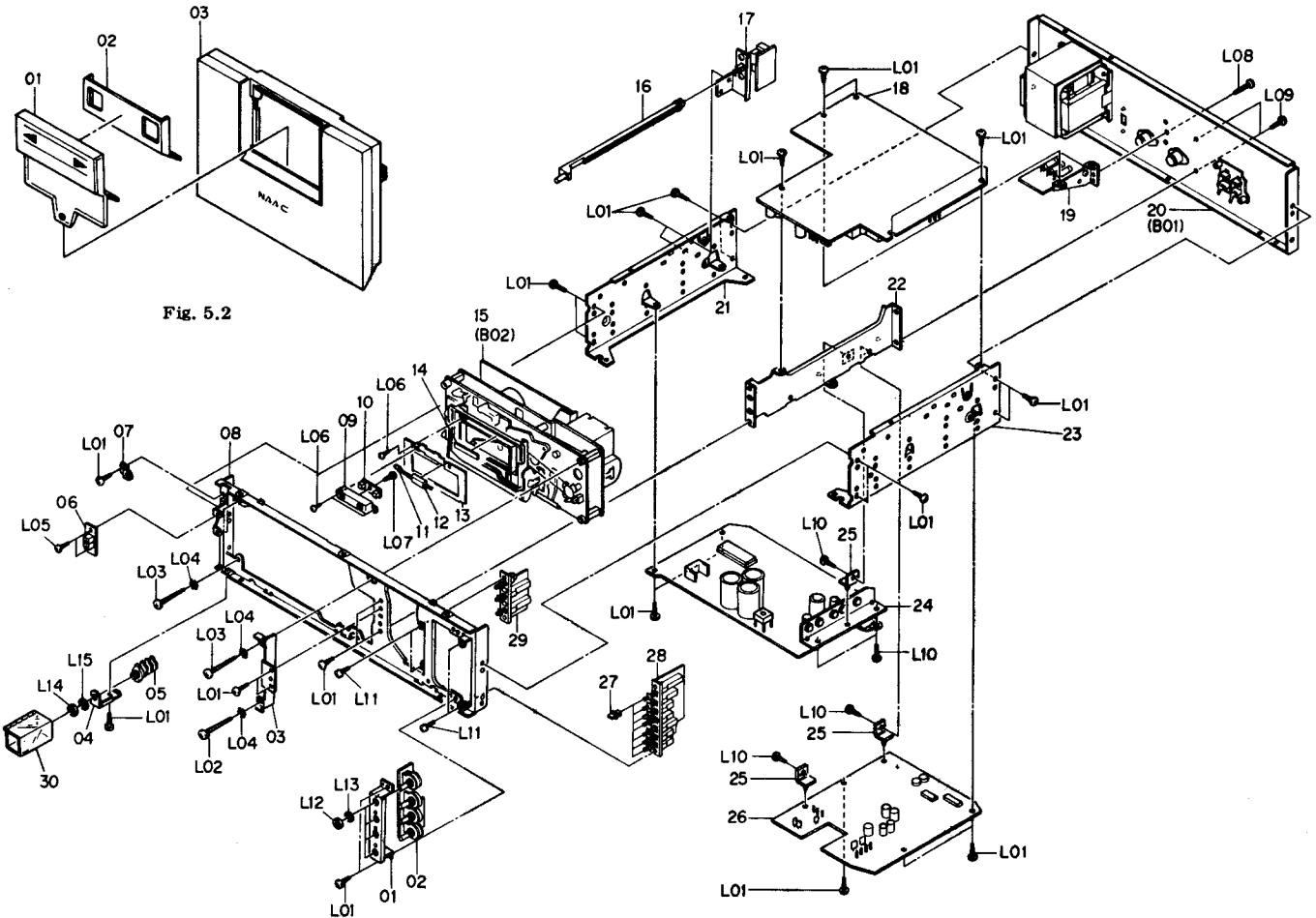


Fig. 5.3

Schematic Ref. No.	Part No.	Description	Q'ty	Schematic Ref. No.	Part No.	Description	Q'ty
A01	HA04401A	Cassette Lid Ass'y Serial No.: A80101001 -	1	18	BA04870A	Main P.C.B. Ass'y	1
01	OH04189A	Lid Cover	1	19	BA04899A	Fuse P.C.B. Ass'y (U.S.A., Canada & Others)	1
02	OH04187A	Indicator Reflector	1		BA04900A	Fuse P.C.B. Ass'y (UK, 220V Class 2 & Australia)	1
03	HA04414A	Cassette Lid Sub Ass'y	1		BA04898A	Fuse P.C.B. Ass'y (Japan)	1
A02	JA03969A	Chassis Ass'y (UK)	1		HA04403A	Rear Panel Ass'y (UK)	1
	JA03970A	Chassis Ass'y (U.S.A. & Canada)	1		HA04408A	Rear Panel Ass'y (U.S.A. & Canada)	1
	JA03971A	Chassis Ass'y (Japan)	1		HA04404A	Rear Panel Ass'y (Japan)	1
	JA03972A	Chassis Ass'y (Others)	1		HA04405A	Rear Panel Ass'y (Others)	1
	JA03973A	Chassis Ass'y (Australia)	1		HA04406A	Rear Panel Ass'y (Australia)	1
	JA03974A	Chassis Ass'y (220V Class 2) Serial No.: A80101001 -	1		HA04407A	Rear Panel Ass'y (220V Class 2)	1
01	OJ04643A	Volume Holder	1	21	OJ04650A	Side Chassis L	1
02	BA04890A	Volume P.C.B. Ass'y	1	22	OJ04649A	Center Chassis	1
03	OJ04135A	Mechanism Bracket	1	23	OJ04651A	Side Chassis R	1
04	OJ04644A	Headphone Jack Holder	1	24	BA04886A	Logic P.C.B. Ass'y	1
05	OB08511A	Headphone Jack	1	25	OB08771A	Hinge	1
06	BA04897A	Timer Switch P.C.B. Ass'y	1	26	BA04879A	Auto Azimuth P.C.B. Ass'y	1
07	OJ04645A	Power Switch Bar Holder	1	27	OH04179A	Function Button A	7
08	OJ04648A	Front Chassis	1	28	BA04889A	Switch P.C.B. Ass'y	1
09	OH04186A	Indicator Cover	1	29	BA04891A	Tape Select P.C.B. Ass'y	1
10	BA04895A	Direction P.C.B. Ass'y	1	30	OJ04516A	Headphone Jack Cover	1
11	OB02228B	Lamp 14V 50mA	1	L01	OE00857A	BT 3x6 ⊕ Binding (Chromate)	31
12	OJ04506C	Lamp Holder	1	L02	OE00924A	BT 4x16 ⊕ Binding (Chromate)	1
13	OJ04637A	Cassette Case Plate	1	L03	OE00944A	BT 4x15 ⊕ Binding (Black Chromate)	3
14	BA04896A	Connector P.C.B. Ass'y	1	L04	OE00078A	Washer 4mm Toothed Lock	4
15	CA08445A	Mechanism Ass'y	1	L05	OE03022A	BT 2x4 ⊕ Binding (Black Chromate)	2
16	OJ04604B	Power Switch Bar	1	L06	OE00869A	BT 2x4 ⊕ Binding (Chromate)	1
17	BA04947A	Power Switch P.C.B. Ass'y (U.S.A. & Canada)	1	L07	OE00873A	BT 2.6x5 ⊕ Binding (Chromate)	1
	BA04948A	Power Switch P.C.B. Ass'y (UK, 220V Class 2, Australia & Others)	1	L08	OE00921A	BT 3x8 ⊕ Binding (Black Chromate)	1
	BA04946A	Power Switch P.C.B. Ass'y (Japan)	1	L09	OE00860A	BT 3x6 ⊕ Binding (Black Chromate)	2
				L10	OE00612A	M3x6 ⊕ Pan	3

5.4. Rear Panel Ass'y (B01)

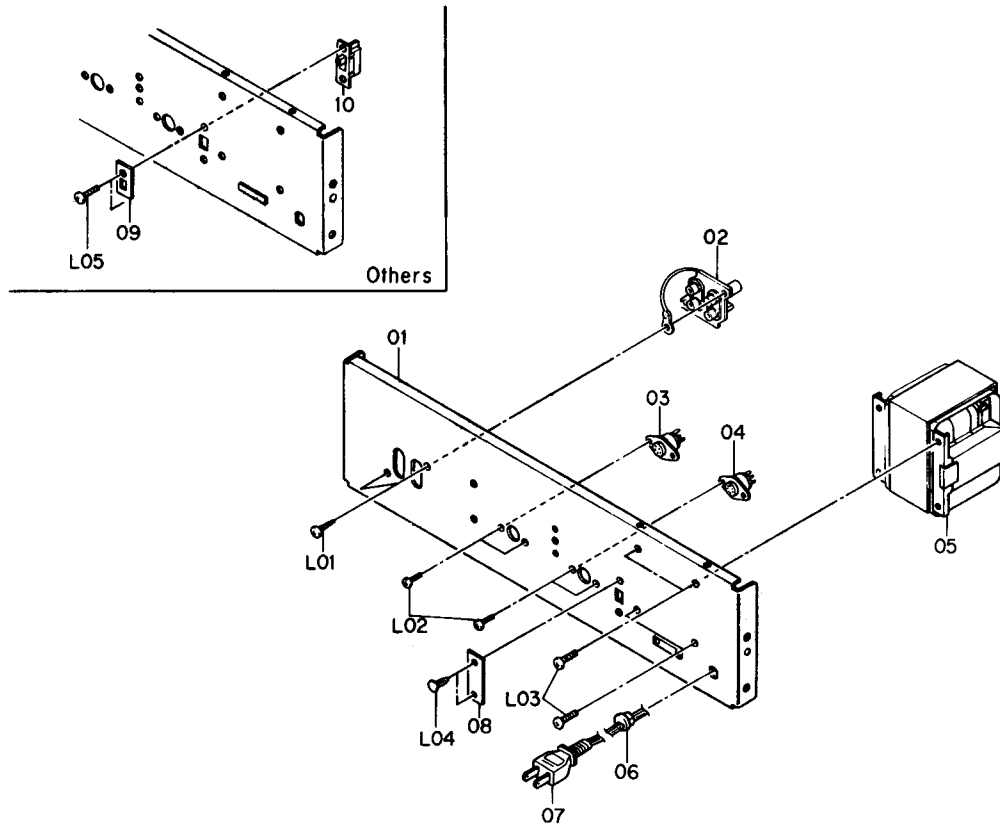


Fig. 5.4

Schematic Ref. No.	Part No.	Description	Q'ty	Schematic Ref. No.	Part No.	Description	Q'ty
B01	HA04408A	Rear Panel Ass'y (U.S.A. & Canada)	1	L03	0E00953A	M4x10 $\oplus$ Binding (Black Chromate)	4
	HA04404A	Rear Panel Ass'y (Japan)	1	L04	0B08583A	Plastic Rivet (U.S.A., Canada, Japan, 220V Class 2, UK & Australia)	2
	HA04405A	Rear Panel Ass'y (Others)	1	L05	0E00594A	M3x8 $\oplus$ Binding (Bronze) (Others)	2
	HA04403A	Rear Panel Ass'y (UK)	1				
	HA04407A	Rear Panel Ass'y (220V Class 2)	1				
	HA04406A	Rear Panel Ass'y (Australia)	1				
	Serial No.: A80101001 -						
01	OH04205A	Rear Panel	1				
02	BA04945A	Pin Jack P.C.B. Ass'y	1				
03	BA04944A	4P DIN Socket Ass'y	1				
04	BA04949A	8P DIN Socket Ass'y	1				
05	OB06639B	Power Transformer (U.S.A. & Canada)	1				
	OB06640B	Power Transformer (Japan)	1				
	OB06637B	Power Transformer (Others)	1				
	OB06638B	Power Transformer (UK, Australia & 220V Class 2)	1				
06	OB08037U	Cord Bushing C (U.S.A., Canada, Japan, 220V Class 2, Australia & Others)	1				
	OB08351A	Cord Bushing 4K-4 (UK)	1				
07	OB08533A	Power Cord (U.S.A. & Canada)	1				
	OB08219B	Power Cord (Japan)	1				
	OB08348A	Power Cord (UK)	1				
	OB08093U	Power Cord (220V Class 2)	1				
	OB05241A	Power Cord (Australia)	1				
08	OJ04601B	Switch Cover (U.S.A., Canada, Japan, 220V Class 2, UK & Australia)	1				
09	OM03946A	Voltage Selector Lock Plate C (Others)	1				
10	OB07092U	Voltage Selector (Others)	1				
L01	0E00921A	BT 3x8 $\oplus$ Binding (Black Chromate)	2				
L02	0E00714A	M2.6x6 $\oplus$ Binding (Bronze)	4				

5.5. Mechanism Ass'y (B02)

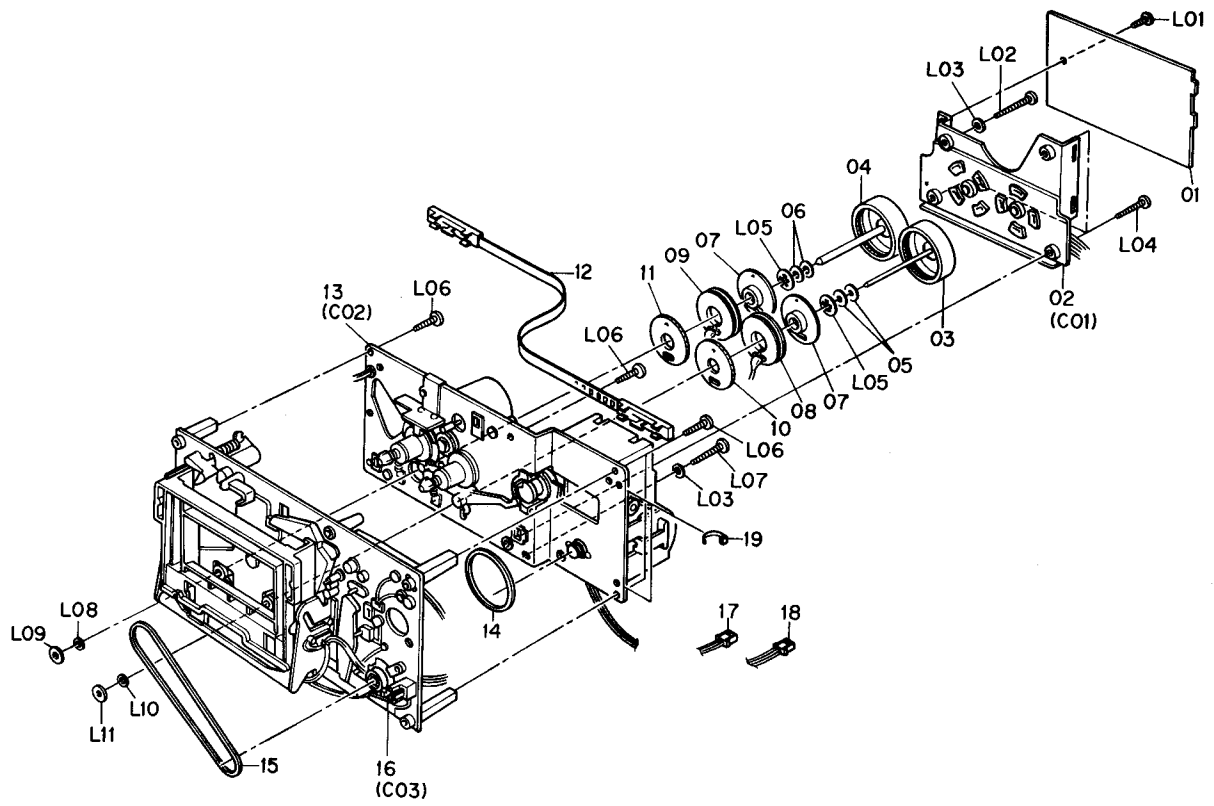


Fig. 5.5

5.6. Flywheel Holder Ass'y (C01)

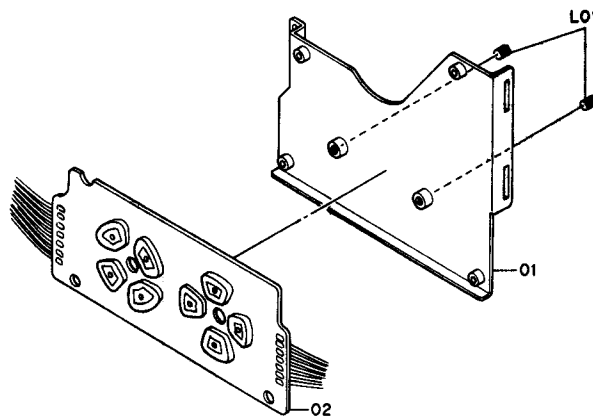


Fig. 5.6



5.7. Sub Mechanism Chassis Ass'y (C02)

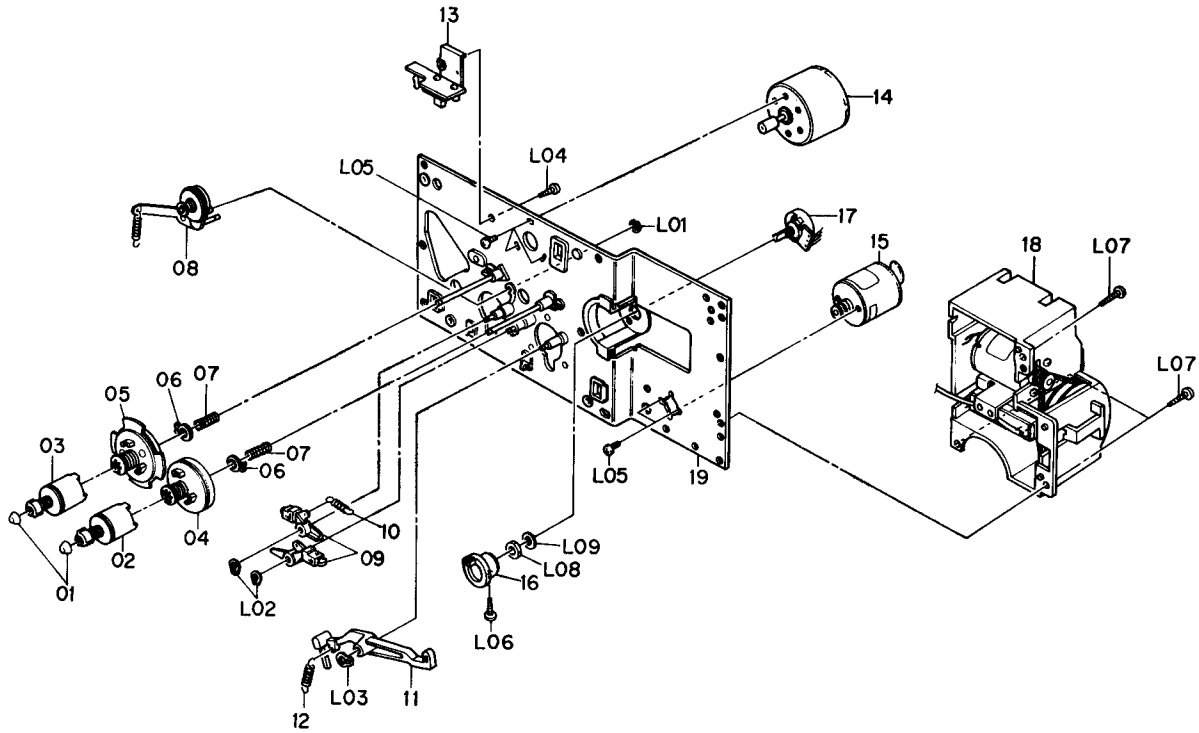


Fig. 5.7

Schematic Ref. No.	Part No.	Description	Q'ty	Schematic Ref. No.	Part No.	Description	Q'ty
<b>B02</b>	<b>CA08445A</b>	<b>Mechanism Ass'y</b> Serial No.: A80101001 -	<b>1</b>	<b>C02</b>	<b>CA08444A</b>	<b>Sub Mechanism Chassis Ass'y</b> Serial No.: A80101001 -	<b>1</b>
01	BA04941A	Motor Control P.C.B. Ass'y	1	01	OC08039B	Reel Hub Head	2
02	CA08422A	Flywheel Holder Ass'y	1	02	CA08038B	Reel Hub B Pulley Ass'y	1
03	CA08433A	Take-up Flywheel Sub Ass'y	1	03	CA08397A	Reel Hub S Pulley Ass'y	1
04	CA08434A	Supply Flywheel Sub Ass'y	1	04	CA08037A	Reel Hub Take-up Ass'y	1
05	OC08020B	Thrust Washer 2.6mm	2	05	CA08452A	Reel Hub Supply Ass'y	1
06	OC08021B	Thrust Washer 3.1mm	2	06	CA08039A	Back Tension Ass'y	2
07	OC08333A	Sensor Plate	2	07	OC08269A	Back Tension Spring C	2
08	CA08391A	Sensor Coil Take-up Sub Ass'y	1	08	CA08193A	Idler Ass'y	1
09	CA08454A	Sensor Coil Supply Sub Ass'y	1	09	CA08042A	Brake Ass'y	2
10	CA08483A	Sensor Gear Take-up Ass'y	1	10	OC08129B	Brake Arm Spring	1
11	CA08485A	Sensor Gear Supply Ass'y	1	11	OC08030C	Brake Drive Arm	1
12	OC08237A	Azimuth Wire	1	12	OC08128A	Brake Drive Arm Spring	1
13	CA08444A	Sub Mechanism Chassis Ass'y	1	13	BA04943A	Counter Pulse Generator P.C.B. Ass'y	1
14	OC08099B	Cam Motor Belt	1	14	CA08242A	Reel Motor Ass'y	1
15	OC08098B	Counter Belt B	1	15	CA08034A	Control Motor Ass'y	1
16	CA08443A	Main Mechanism Chassis Ass'y	1	16	OC08053B	Volume Coupler	1
17	OB02333B	3P-H Connector (Blue with Shield)	1	17	OB07240A	Volume Control 10K (B)	1
18	OB08672A	3P-H Connector	1	18	CA08453A	Playback Head Azimuth Alignment Motor Ass'y	1
19	OB08515A	Insu-Lock	1	19	CA08194A	Sub Chassis Ass'y B	1
L01	OE00857A	BT 3x6 Pan	1	L01	OE00698A	E-Ring 2.5mm	1
L02	OE00834A	BT 3x30 Pan	1	L02	OE00837A	Stopper Ring 3mm	2
L03	OE00178A	Washer 3.3x8x0.5	2	L03	OE00838A	Stopper Ring 4mm	1
L04	OE00833A	BT 3x20 Pan	3	L04	OE00859A	BT 2.6x6 Pan Binding	1
L05	OE03023A	Stopper Ring 8mm	2	L05	OE00226A	M2.6x4 Pan	5
L06	OE00883A	BT 3x18 Pan	5	L06	OE00792A	BT 2.6x6 Pan	1
L07	OE00835A	BT 3x25 Pan	1	L07	OE00846A	BT 3x8 Pan	3
L08	OC08347A	Washer 3.1mm FT	1	L08	-	Volume Nut	(1)
L09	OC08345A	Capstan Washer 3mm	1	L09	-	Volume Washer	(1)
L10	OC08348A	Washer 2.6mm FT	1				
L11	OC08346A	Capstan Washer 2.5mm	1				
<b>C01</b>	<b>CA08422A</b>	<b>Flywheel Holder Ass'y</b> Serial No.: A80101001 -	<b>1</b>				
01	CA08382B	Flywheel Holder Sub Ass'y	1				
02	BA04942A	Motor P.C.B. Ass'y	1				
L01	OC08068C	Thrust Screw	2				

5.8. Main Mechanism Chassis Ass'y (C03)

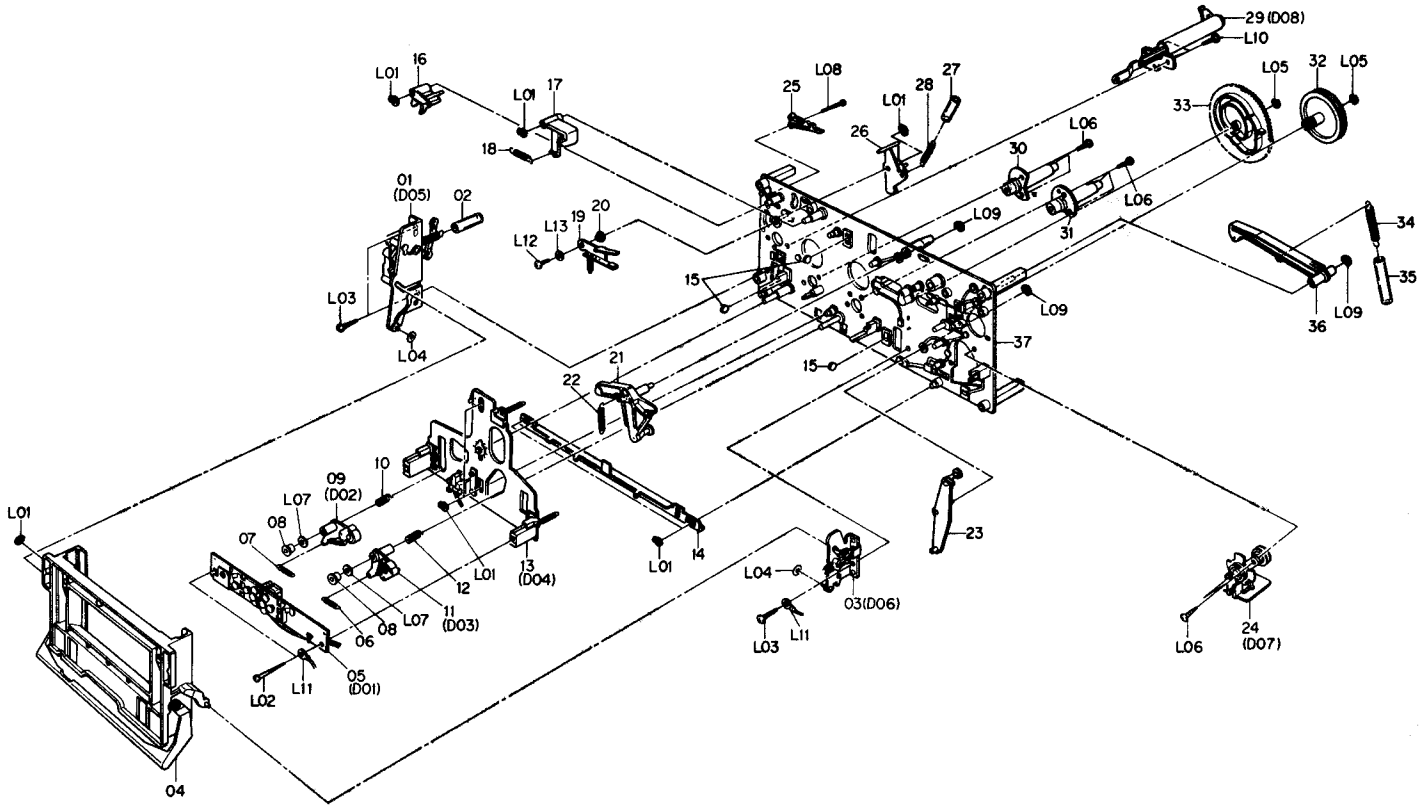


Fig. 5.8

Schematic Ref. No.	Part No.	Description	Q'ty	Schematic Ref. No.	Part No.	Description	Q'ty
C03	CA08443A	Main Mechanism Chassis Ass'y Serial No.: A80101001 -	1	36	CA08028A	Counter-Load Arm	1
				37	CA08347A	Main Chassis Ass'y	1
01	CA08350A	Cassette Case Holder L Ass'y	1	L01	0E00837A	Stopper Ring 3mm	9
02	0C08152A	Lid Arm Spring Tube	1	L02	0E00834A	BT 3x30 ⊕ Pan	2
03	CA08455A	Cassette Case Holder R Ass'y	1	L03	0E00831A	BT 3x10 ⊕ Pan	3
04	CA08451A	Cassette Case Ass'y	1	L04	0E00254A	Washer 3.1mm	2
05	CA08438A	Head Mount Base Ass'y	1	L05	0E00222A	E-Ring 2mm	2
06	0C08250A	Take-up Roller Arm Spring	1	L06	0E00876A	BT 2.6x8 ⊕ Pan	8
07	0C08121A	Supply Roller Arm Spring	1	L07	0E00178A	Washer 3mm	2
08	0C08313A	Pressure Roller Arm Bushing	2	L08	0E00879A	BT 2x15 ⊕ Pan	1
09	CA08437A	Supply Pressure Roller Arm Ass'y	1	L09	0E00838A	Stopper Ring 4mm	3
10	0C08122C	Supply Pressure Roller Thrust Spring	1	L10	0E00846A	BT 3x8 ⊕ Pan	3
				L11	0E00895A	Earth Lug 3mm	2
11	CA08436A	Take-up Pressure Roller Arm Ass'y	1	L12	0E00859A	BT 2.6x6 ⊕ Binding	1
12	0C08183B	Take-up Pressure Roller Thrust Spring	1	L13	0C08255A	Washer 2.6mm	1
13	CA08339A	Head Base Ass'y	1				
14	0C08368A	Pressure Roller Drive Bar D	1				
15	0C08086B	Head Base Roller	3				
16	0C08050B	Record Sensor Arm	1				
17	0C08051E	Cassette Hold Arm	1				
18	0C08120A	Cassette Hold Arm Spring	1				
19	0C08371A	Back Tension Arm Ass'y	1				
20	0C08254A	Back Tension Arm Collar	1				
21	0C08027A	Head Base Drive Arm Ass'y	1				
22	0C08143C	Head Base Drive Arm Spring	1				
23	CA08026A	Pressure Roller Drive Arm Ass'y	1				
24	CA08441A	Auto Shut-off Ass'y	1				
25	0C08119A	Record Protector	1				
26	0C08194C	Damper Lock Arm	1				
27	0C08153A	Damper Lock Arm Spring Tube	1				
28	0C08116A	Record Arm Spring	1				
29	CA08030A	Pneumatic Damper Ass'y	1				
30	CA08404B	Supply DD Flange Ass'y	1				
31	CA08457A	Take-up DD Flange Ass'y	1				
32	CA08186A	Cam Drive Gear	1				
33	0C08029H	Control Cam	1				
34	0C08117A	Counter-Load Arm Spring	1				
35	0C08152A	Counter-Load Arm Spring Tube	1				

5.9. Head Mount Base Ass'y (D01)

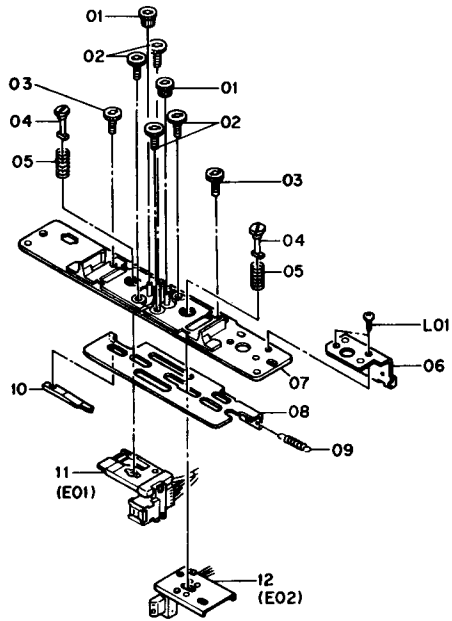


Fig. 5.9

5.10. Supply Pressure Roller Ass'y (D02)

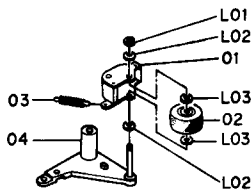


Fig. 5.10

5.11. Take-up Pressure Roller Ass'y (D03)

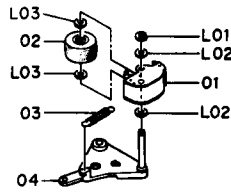


Fig. 5.11

5.12. Head Base Ass'y (D04)

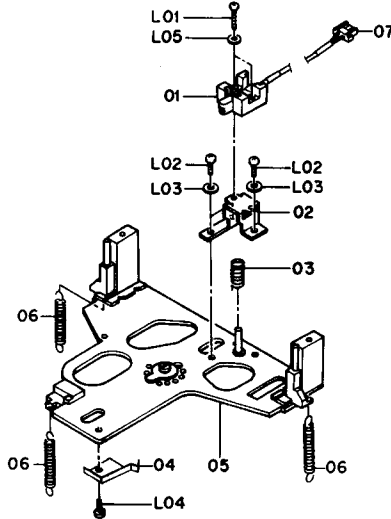


Fig. 5.12

5.13. Cassette Case Holder L Ass'y (D05)

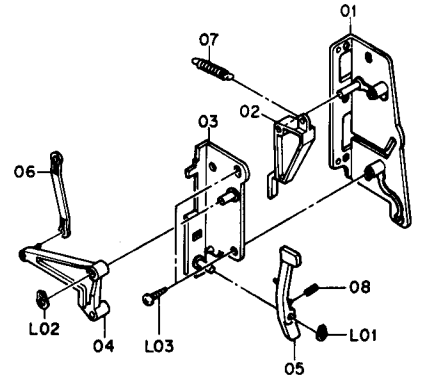


Fig. 5.13

Schematic Ref. No.	Part No.	Description	Q'ty	Schematic Ref. No.	Part No.	Description	Q'ty
<b>D01</b>	<b>CA08438A</b>	<b>Head Mount Base Ass'y</b> Serial No.: A80101001 -	<b>1</b>	L01	0E00042A	E-Ring 1.5mm	1
01	OC08028C	Head Height Adjustment Screw	2	L02	0C08024A	Washer 2mm 0.25T	2
02	OC08027F	Head Height Adjustment Gear	4	L03	0C08365A	Washer 2mm 0.13T	2
03	OC08026D	Azimuth Alignment Screw	2	<b>D04</b>	<b>CA08339A</b>	<b>Head Base Ass'y</b> Serial No.: A80101001 -	<b>1</b>
04	OC08161B	Spring Stopper	2	01	GA02103A	EOK Erase Head	1
05	OC08187B	Head Plate Spring	2	02	OC08158D	Erase Head Hold Plate	1
06	OC08315A	Azimuth Alignment Wire Hold Plate	1	03	OC08166A	Erase Head Hold Plate Spring	1
07	CA08083D	Head Mount Base Sub Ass'y	1	04	OC08174D	Cassette Hold Spring	1
08	OC08352A	AP Drive Plate	1	05	CA08003R	Head Base Ass'y	1
09	OC08362A	TG Spring	1	06	OC08175A	Head Base L Spring	3
10	OC08351A	PH Azimuth Plate	1	07	0B08944A	2P-H Connector	1
11	CA08439A	PA-1L Playback Head Ass'y	1	L01	0E00951A	M1.7x7 @ Pan (Black Chromate)	2
12	CA08440A	R-8L Record Head Ass'y	1	L02	0E00909A	M2x6 @ Pan	3
L01	0E00917A	BT 2.6x5 @ Pan	2	L03	0E00117A	Washer 2mm	3
				L04	0E00853A	BT 2x3 @ Pan	1
				L05	0E00952A	Washer 1.7mm	2
<b>D02</b>	<b>CA08437A</b>	<b>Supply Pressure Roller Arm Ass'y</b> Serial No.: A80101001 -	<b>1</b>	<b>D05</b>	<b>CA08350A</b>	<b>Cassette Case Holder L Ass'y</b> Serial No.: A80101001 -	<b>1</b>
01	CA08403A	Supply Tape Guide	1	01	CA08326B	Cassette Case Holder L Sub Ass'y	1
02	OC08357A	Pressure Roller	1	02	OC08073C	Lid Arm A	1
03	OC08495A	Supply Guide Spring	1	03	OC08306A	Eject Arm Holder	1
04	CA08401A	Supply Roller Arm Ass'y	1	04	OC08307A	Eject Arm A	1
L01	0E00042A	E-Ring 1.5mm	1	05	OC08197C	Eject Arm B	1
L02	OC08024A	Washer 2mm 0.25T	2	06	OC08199B	Eject Arm Joint	1
L03	OC08365A	Washer 2mm 0.13T	2	07	OC08114A	Lid Arm Spring	1
<b>D03</b>	<b>CA08436A</b>	<b>Take-up Pressure Roller Arm Ass'y</b> Serial No.: A80101001 -	<b>1</b>	08	OC08211C	Eject Arm Spring	1
01	CA08402A	Take-up Tape Guide	1	L01	0E00837A	Stopper Ring 3mm	1
02	OC08357A	Pressure Roller	1	L02	0E00838A	Stopper Ring 4mm	1
03	OC08362A	Take-up Guide Spring	1	L03	0E00865A	BT 3x10 @ Binding	2
04	CA08400A	Take-up Roller Arm Sub Ass'y	1				

5.14. Cassette Case Holder R Ass'y (D06)

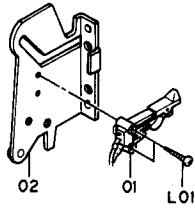


Fig. 5.14

5.15. Auto Shut-off Ass'y (D07)

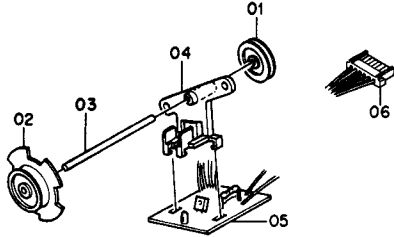


Fig. 5.15

5.16. Pneumatic Damper Ass'y (D08)

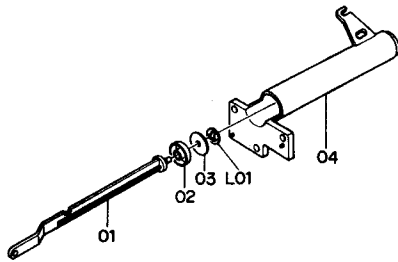


Fig. 5.16

5.17. PA-1L Playback Head Ass'y (E01)

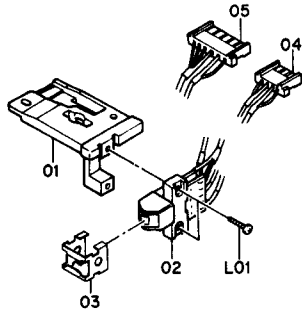


Fig. 5.17

5.18. R-8L Record Head Ass'y (E02)

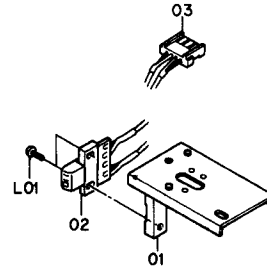


Fig. 5.18

Schematic Ref. No.	Part No.	Description	Q'ty
D06	CA08455A	Cassette Case Holder R Ass'y Serial No.: A80101001 -	1
01	OC08133A	Eject Sensor	1
02	CA08427A	Cassette Case Holder R Sub Ass'y	1
L01	0E00840A	BT 2x8 @ Pan	1
D07	CA08441A	Auto Shut-off Ass'y Serial No.: A80101001 -	1
01	OC08047A	Shut-off Pulley A	1
02	OC08309B	Shut-off Pulley B	1
03	OC08088B	Shut-off Pulley Shaft	1
04	OC08207B	Shut-off Pulley Holder	1
05	BA04852A	Shut-off P.C.B. Ass'y	1
06	0B02339B	6P-H Connector	1
D08	CA08030A	Pneumatic Damper Ass'y Serial No.: A80101001 -	1
01	OC08058C	Damper Piston	1
02	OC08102C	Damper Ring	1
03	OC08010C	Damper Plate	1
04	OC08059D	Cylinder	1
L01	0E00874A	Stopper Ring CS 2mm	1
E01	CA08439A	PA-1L Playback Head Ass'y Serial No.: A80101001 -	1
01	OC08350B	Playback Head Plate	1
02	GA02162A	PA-1L Playback Head	1
03	OC08349C	Tape Protector	1
04	0B02341B	4P-H Connector	1
05	0B02342B	6P-H Connector	1
L01	0E00886A	M1.7x6.5 @ Pan	1
E02	CA08440A	R-8L Record Head Ass'y Serial No.: A80101001 -	1
01	CA08308A	Record Head	1
02	GA01050A	R-8L Record Head	1
03	0B02340B	4P-H Connector	1
L01	0E00887A	M1.7x4 @ Pan	2

## 6. MOUNTING DIAGRAMS AND PARTS LIST

Notes: 1. Mounting diagram shows a dip side view of the printed circuit board.

2. Diode is 1SS53, 1S1555, or 1SS176 unless otherwise specified.

3. Following transistors are interchangeable with each other,

- a. 2SA733, 2SA608SP, 2SA1048, 2SA1175
- b. 2SC945, 2SC536SP, 2SC2458, 2SC2785

4. Abbreviation for part name:

TR — Transistor, SiD — Silicon Diode, GD — Germanium Diode, ZD — Zener Diode

RK — Carbon Resistor, RM — Metal Film Resistor, RF — Fail Safe Type Resistor, RC — Cement Resistor,

RW — Wire Wound Resistor

CE — Electrolytic Capacitor, CM — Mylar Capacitor, CC — Ceramic Capacitor, CP — PP Capacitor,

CT — Tantalum Capacitor, CF — Film Capacitor, C — Mica Capacitor

### 6.1. Power Switch P.C.B. Ass'y

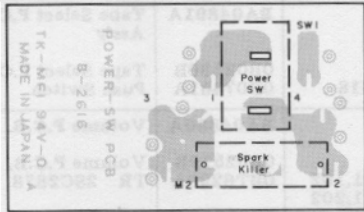


Fig. 6.1

### 6.2. Fuse P.C.B. Ass'y

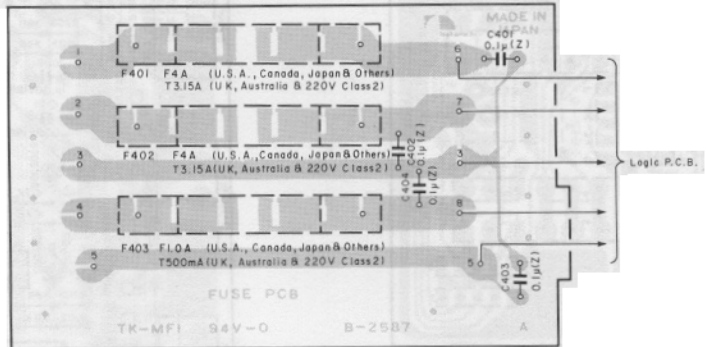


Fig. 6.2

### 6.3. Shut-off P.C.B. Ass'y

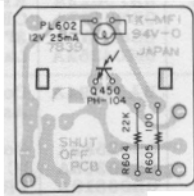


Fig. 6.3

### 6.4. Counter Pulse Generator P.C.B. Ass'y

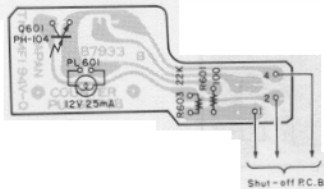


Fig. 6.4

Schematic Ref. No.	Part No.	Description	Schematic Ref. No.	Part No.	Description	Schematic Ref. No.	Part No.	Description
	BA04947A	Power Switch P.C.B. Ass'y (U.S.A. & Canada)		BA04899A	Fuse P.C.B. Ass'y (U.S.A., Canada & Others)		OM04432A	Fuse Label 4A 125V x 2 (U.S.A., Canada & Others) (1)
	BA04946A	Power Switch P.C.B. Ass'y (Japan)		BA04898A	Fuse P.C.B. Ass'y (Japan)		OM04441A	Fuse Label 4A 250V x 2 (Japan) (1)
	BA04948A	Power Switch P.C.B. Ass'y (UK, Australia, 220V Class 2 & Others)		BA04900A	Fuse P.C.B. Ass'y (UK, Australia & 220V Class 2)		OM03936B	Fuse Label T3.15A 250V (UK, Australia & 220V Class 2) (1)
SW1	OB02616A	Power Switch P.C.B.	C401,402	OB02587A	Fuse P.C.B.		OB08349A	Fuse Clip (UK, Australia & 220V Class 2) (6)
SW1	OB07407A	Power Switch (U.S.A. & Canada)	403,404	OBT9292A	CC 0.1μ 50V Z			
SW1	OB07406A	Power Switch (Japan)	F401,402	OB90002A	Fuse F4A 125V (U.S.A., Canada & Others)		BA04852A	Shut-off P.C.B. Ass'y
SW1	OB07408A	Power Switch (UK, Australia, 220V Class 2 & Others)	F401,402	OB90001A	Fuse F4A 250V (Japan)	Q450 R604 R605 PL602	OB07839B	Shut-off P.C.B.
M2	OB08342A	Spark Killer (U.S.A. & Canada)	F401,402	OB08281A	Fuse T3.15A 250V (UK, Australia & 220V Class 2)		OB06228A	Photo TR PH104
M2	OB08363A	Spark Killer (Japan)	F403	OB08374A	Fuse F1A 250V (U.S.A., Canada & Others)		OB05615A	RF 100 1/4W J
M2	OB08955A	Spark Killer (UK, Australia, 220V Class 2 & Others)	F403	OB08686A	Fuse F1A 250V (Japan)		OB09215A	RF 100 1/4W J
	OE00622A	M3x5 ⊕ Pan (2A) (2)	F403	OB08457A	Fuse T500mA 250V (UK, Australia & 220V Class 2)		OB08552A	Lamp 12V 25mA
	OE00752A	Eyelet 2x3 (2)		OM04190A	Fuse Label 1A 250V (U.S.A., Canada & Japan) (1)	Q601 R601 R603 PL601	BA04943A	Counter Pulse Generator P.C.B. Ass'y
	OJ04646A	Power Switch Holder (1)		OM04096C	Fuse Label T500mA (UK, Australia & 220V Class 2) (1)		OB07933B	Counter Pulse Generator P.C.B.
							OB06228A	Photo TR PH104
							OB09215A	RF 100 1/4W J
							OB05661A	RF 100 1/4W J
							OB08552A	Lamp 12V 25mA
							OC08281B	P.C.B. Holder (1)
							OE00792A	BT 2.6x6 ⊕ Pan (Chromate) (2)

6.5. Direction P.C.B. Ass'y

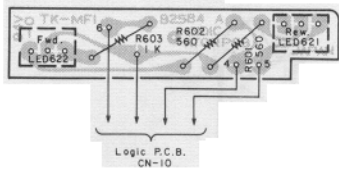


Fig. 6.5

6.6. Timer Switch P.C.B. Ass'y

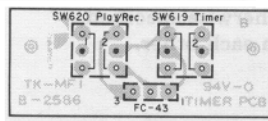


Fig. 6.6

6.7. Tape Select P.C.B. Ass'y

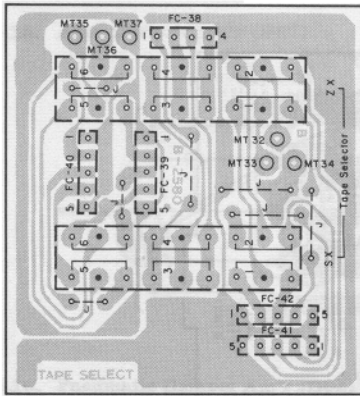


Fig. 6.7

6.8. Volume P.C.B. Ass'y

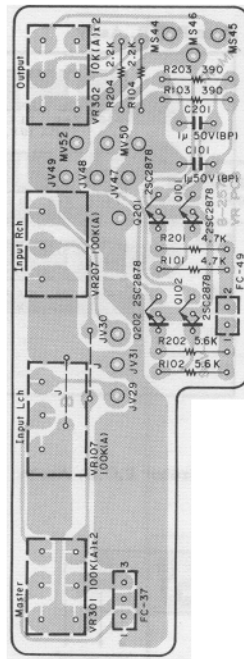


Fig. 6.8

6.9. Counter P.C.B. Ass'y

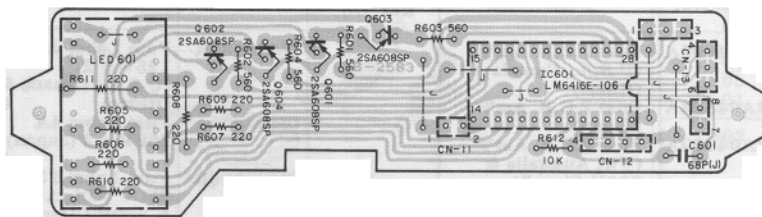


Fig. 6.9

Schematic Ref. No.	Part No.	Description
	BA04895A	Direction P.C.B. Ass'y
LED621 622	OB02584A OB06448A	Direction P.C.B. LED (RED + GRN)
R601,602 R603	OB05575A OB01857A	RK 560 1/4W J RK 1K 1/4W J
	BA04897A	Timer Switch P.C.B. Ass'y
SW619,620	OB02586B OB07464A	Timer Switch P.C.B. Push Switch
	BA04891A	Tape Select P.C.B. Ass'y
SW618	OB02580B OB07461A	Tape Select P.C.B. Push Switch
	BA04890A	Volume P.C.B. Ass'y
Q101,102 201,202	OB02579B OBT6299A	Volume P.C.B. TR 2SC2878
VR107,207 VR301 VR302	OB07202A OB07203A OB07204A	VR 100K (A) VR 100K (A)x2 VR 10K (A)x2
R101,201 R102,202 R103,203 R104,204	OBT1846A OBT1887A OBT5691A OBT5622A	RK 4.7K 1/4W J RK 5.6K 1/4W J RK 390 1/4W J RK 2.2K 1/4W J
C101,201 FC37	OBT9187A OB82037A OM04252A	CE 1μ 50V (BP) 3P Flat Cable Label CN-37 (1)
	BA04894A	Counter P.C.B. Ass'y
IC601 Q601,602 603,604 LED601 R601,602 603,604 R605,606 607,609 610 R608,611 R612 C601 CN11 CN12 CN13	OB02583A OB06368A OB06319A OB06442A OBT9671A OBT9661A OBT1933A OBT9701A OBT9393A OB02344A OB02345B OB02346A	Counter P.C.B. IC LM6416E-106 TR 2SA608SP Counter LED RK 560 1/6W J RK 220 1/6W J RK 220 1/4W J RK 10K 1/6W J CC 68P 50V J 2P-H Connector 4P-H Connector 8P-H Connector
	BA04893A	Indicator P.C.B. Ass'y
IC301,302 LED303 D101,201 D102,202 R101,201 R102,202 R103,104 203,204 R301-320 R321,326 R322 R323 R324 R325 C301 FC34 FC35 FC44,45	OB02582B OB06369A OB06401A OB06441A OBT6398A OB06109A OBT9725A OBT9709A OBT9719A OBT9681A OBT9701A OBT9695A OBT1857A OBT9655A OBT9677A OBT9282A OB05360B OB05352B OB05374C OM04250A OM04251A OE00130A	Indicator P.C.B. IC TA7612AP TR 2SC536SP Indicator LED SiD 1SS176 SiD GP08B RK 100K 1/6W J RK 22K 1/6W J RK 56K 1/6W J RK 1.5K 1/6W J RK 10K 1/6W J RK 5.6K 1/6W J RK 1K 1/4W J RK 120 1/6W J RK 1K 1/6W J CC 100P 50V K 4P Flat Cable 3P Flat Cable 11P Flat Cable Label CN-34 (1) Label CN-35 (1) Earth Lug 2.6mm (1)

6.10. Indicator P.C.B. Ass'y

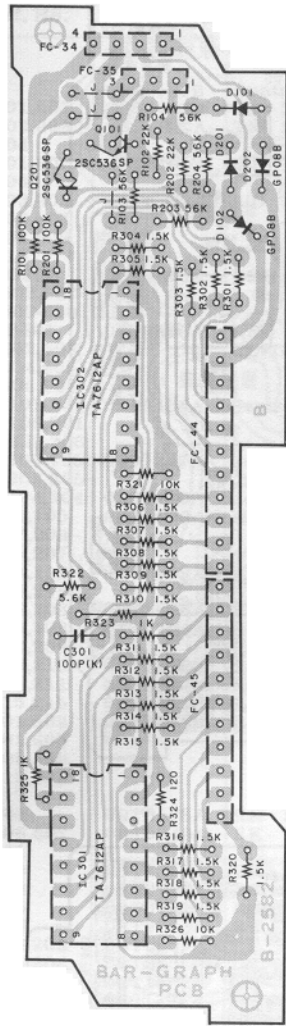


Fig. 6.10

6.11. Switch P.C.B. Ass'y

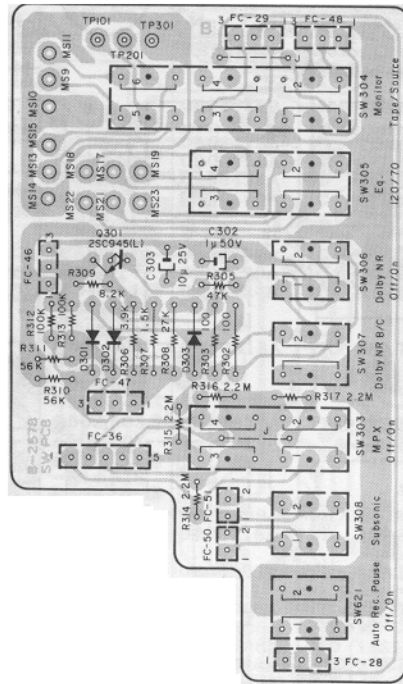


Fig. 6.11

Schematic Ref. No.	Part No.	Description
	BA04889A	Switch P.C.B. Ass'y
	0B02578B	Switch P.C.B.
Q301	0BT1872A	TR 2SC945L (P,Q)
D301,302,303	0BT6181A	SiD 1SS53
R302,303	0BT9653A	RK 100 1/6W J
R305	0BT9717A	RK 47K 1/6W J
R306	0BT5675A	RK 3.9K 1/4W J
R307	0BT5505A	RK 1.5K 1/4W J
R308	0BT5743A	RK 27K 1/4W J
R309	0BT9699A	RK 8.2K 1/6W J
R310,311	0BT9719A	RK 56K 1/6W J
R312,313	0BT9725A	RK 100K 1/6W J
R314,315,316,317	0BT5671A	RK 2.2M 1/4W J
C302	0BT1405A	CE 1 $\mu$ 50V
C303	0BT1674A	CE 10 $\mu$ 25V
FC28	0B82035A	3P Flat Cable
FC29	0B82034A	3P Flat Cable
FC36	0B82036A	5P Flat Cable
FC50	0B05331B	2P Flat Cable
FC51	0B82001B	2P Flat Cable
	0B07460A	Push Switch
	0M04240A	Label CN-28
	0M04438A	Label CN-29
	0M04440A	Label CN-36



6.12. Control P.C.B. Ass'y

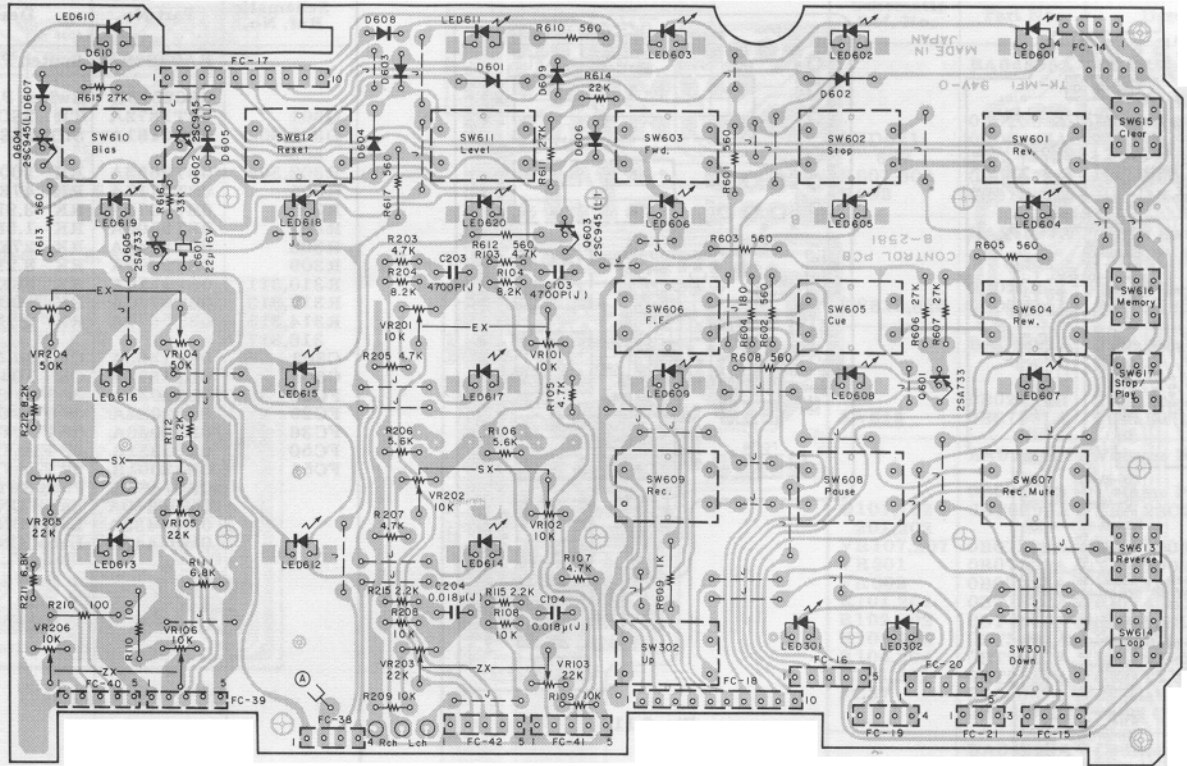


Fig. 6.12

6.13. Motor Control P.C.B. Ass'y

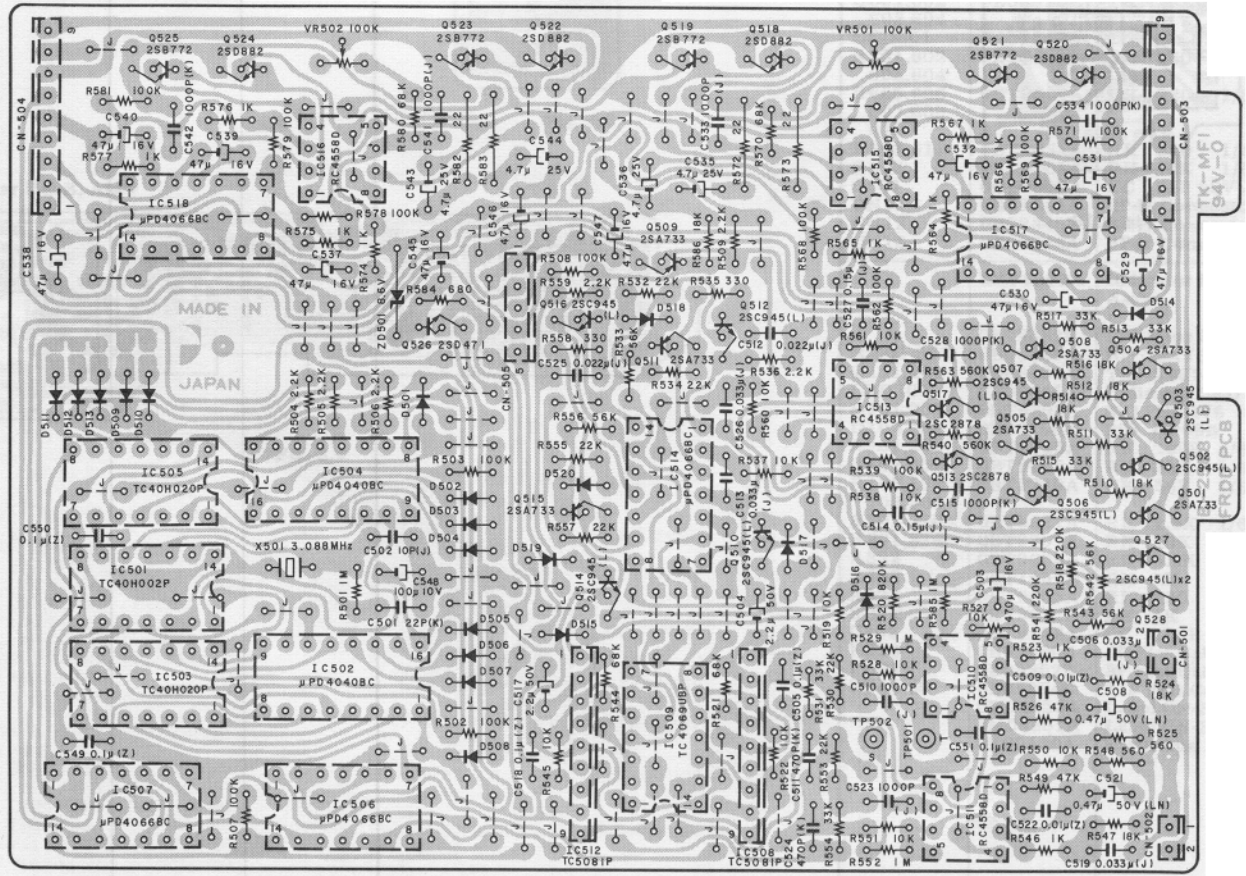


Fig. 6.13



Schematic Ref. No.	Part No.	Description	Schematic Ref. No.	Part No.	Description	Schematic Ref. No.	Part No.	Description
	BA04892A	Control P.C.B. Ass'y		BA04941A	Motor Control P.C.B. Ass'y	C508,521	OBT9222A	CE 0.47μ 50V (LN)
Q601,605	OB02581B	Control P.C.B.				C509,522	OBT9290A	CC 0.01μ 50V Z
Q602,603	OBT6013A	TR 2SA733 (P,Q)		OB02588B	Motor Control P.C.B.	C510,523	OBT9844A	CF 1000P 50V J
604	OBT1872A	TR 2SC945L (P,Q)	IC501	OB06423A	IC TC40H002P	533,541		
D601,602	OBT6181A	SiD 1SS53	IC502,504	OB06223A	IC μPD4040BC	C511,524	OBT9286A	CC 470P 50V K
604			IC503,505	OB06424A	IC TC40H020P	C512,525	OBT9848A	CF 0.022μ 50V J
D603,605	OBT6398A	SiD 1SS176	IC506,507	OB06144A	IC μPD4066BC	C514,527	OBT5914A	CM 0.15μ 50V J
606,607			514,517			C515,528	OBT9288A	CC 1000P 50V K
608,609			518			534,542		
610			IC508,512	OB06297A	IC TC5081P	C529,530	OBT1403A	CE 47μ 16V
LED301	OB06445A	LED ORN TLO-123 (15)	IC509	OB06270A	IC TC4069UBP	531,532		
302,607			IC510,511	OB06124B	IC RC4558D	537,538		
609-620			513,515			539,540		
LED601	OB06446A	LED GRN TLPG-163	516	OBT6013A	TR 2SA733 (P,Q)	545,546		
602,603			Q501,504			547	OBT1402A	CE 4.7μ 25V
604,605			505,508			C535,536		
606,608	OB07404A	Semi-fixed VR 10K	509,511			543,544	OBT5885A	CE 100μ 10V
VR101,102			515	OBT1872A	TR 2SC945L (P,Q)	C548	OB02280A	2P-T Post
106,201	OB07277A	Semi-fixed VR 22K	Q502,503			CN501	OB08656A	2P-T Post
202,206			506,507			CN502	OB08645A	9P-T Post
VR103,105	OB07260A	Semi-fixed VR 50K	510,512			CN503,504	OB08724A	5P-T Post
203,205	OBT9693A	RK 4.7K 1/6W J	514,516			CN505	OE00507A	Nut Hex. M3 (8) (Chromate)
VR104,204			527,528	OBT6299A	TR 2SC2878		OE00521A	M3x8 ⊕ Pan (8) (Chromate)
R103,105	OBT9699A	RK 8.2K 1/6W J	Q513,517	OB06316A	TR 2SD882 (P,Q)		OJ04485A	Heat Sink B (4)
107,203			Q518,520					
205,207	OBT9695A	RK 5.6K 1/6W J	522,524					
R104,112	OBT9701A	RK 10K 1/6W J	Q519,521	OB06303A	TR 2SB772 (P,Q)			
204,212			523,525					
R106,206	OBT1679A	RK 100 1/4W J	Q526	OB06066A	TR 2SD471 (L,M)			
R108,109	OBT9697A	RK 6.8K 1/6W J	ZD501	OBT6426A	ZD 8.6V XZ086			
208,209	OBT9685A	RK 2.2K 1/6W J	D501-520	OBT6398A	SiD 1SS176			
R110,210	OBT5575A	RK 560 1/4W J	X501	OB02324A	Xtal 3.088MHz			
R111,211			VR501,502	OB09060A	Semi-fixed VR 100K			
R115,215			R501,529	OBT9749A	RK 1M 1/6W J			
R601,602			552,585					
603,605			R502,503	OBT9725A	RK 100K 1/6W J			
608,610			507,508					
612,613			539,562					
617			568,569					
R604	OBT5578A	RK 180 1/4W J	571,578					
R606,607	OBT5743A	RK 27K 1/4W J	579,581					
611			R504,505	OBT9685A	RK 2.2K 1/6W J			
R609	OBT1857A	RK 1K 1/4W J	506,509					
R614	OBT9709A	RK 22K 1/6W J	536,559	OBT9707A	RK 18K 1/6W J			
R615	OBT9711A	RK 27K 1/6W J	R510,512					
R616	OBT9713A	RK 33K 1/6W J	514,516					
C103,203	OBT9852A	CF 4700P 50V J	524,547					
C104,204	OBT9854A	CF 6800P 50V J	586					
C601	OBT1862A	CE 22μ 16V	R511,513	OBT9713A	RK 33K 1/6W J			
SW301,302	OB07396A	Double Action Switch	515,517					
			531,554	OBT9733A	RK 220K 1/6W J			
SW601-612	OB07459A	Switch	R518,541	OBT9701A	RK 10K 1/6W J			
SW613,614	OB07462A	Push Switch	R519,522					
616,617			527,528					
SW615	OB07463A	Push Switch	537,538					
FC14,15	OB05361B	4P Flat Cable	545,550					
FC16	OB05371B	5P Flat Cable	551,560					
FC17	OB05372B	10P Flat Cable	561					
FC18	OB82038A	10P Flat Cable	R520	OBT9747A	RK 820K 1/6W J			
FC19	OB05360B	4P Flat Cable	R521,544	OBT9721A	RK 68K 1/6W J			
FC20	OB05370B	5P Flat Cable	570,580					
FC21	OB05346B	3P Flat Cable	R523,546	OBT9677A	RK 1K 1/6W J			
FC38	OB05354B	4P Flat Cable	564,565					
FC39,40	OB05365B	5P Flat Cable	566,567					
FC41,42	OB05368B	5P Flat Cable	574,575					
	OE00857A	BT 3x6 ⊕ Binding (Chromate) (1)	576,577					
	OJ04653A	Lens House (20)	R525,548	OBT9671A	RK 560 1/6W J			
	OJ04654A	Fader House (1)	R526,549	OBT9717A	RK 47K 1/6W J			
	OM04231A	Label CN-14 (1)	R530,532	OBT9709A	RK 22K 1/6W J			
	OM04222A	Label CN-15 (1)	534,553					
	OM04223A	Label CN-16 (1)	555,557					
	OM04224A	Label CN-17 (1)	R533,542	OBT9719A	RK 56K 1/6W J			
	OM04330A	Label CN-18 (1)	543,556					
	OM04225A	Label CN-19 (1)	R535,558	OBT9665A	RK 330 1/6W J			
	OM04226A	Label CN-20 (1)	R540,563	OBT9743A	RK 560K 1/6W J			
	OM04232A	Label CN-21 (1)	R572,573	OB09049A	RF 22 1/4W J			
			582,583					
			R584	OBT9673A	RK 680 1/6W J			
			C501	OBT9279A	CC 22P 50V K			
			C502	OBT9277A	CC 10P 50V J			
			C503	OBT1392A	CE 470μ 16V			
			C504,517	OBT9372A	CE 2.2μ 50V			
			C505,518	OBT9292A	CC 0.1μ 50V Z			
			549,550					
			551					
			C506,513	OBT5583A	CM 0.033μ 50V J			
			519,526					

Schematic Ref. No.	Part No.	Description	Schematic Ref. No.	Part No.	Description	Schematic Ref. No.	Part No.	Description
	BA04886A	Logic P.C.B. Ass'y	D602-611	OBT6398A	SID 1SS176 (27)	R706	OBT9711A	RK 27K 1/6W J
	-- DC Supply --		614-619			R712,713	OBT5509A	RK 33K 1/4W J
IC401	OB06124B	IC JRC4558D	623,624			R717	OBT1683A	RK 15K 1/4W J
Q403,404	OBT1872A	TR 2SC945L (P,Q)	626-633			R731	OB09217A	RF 5.6 1/4W J
409,414			640	OB08908A	Xtal KBR400BT	C601,602	OBT9283A	CC 220P 50V K
415			X601	OB02307A	Xtal KBR800H	C603,604	OBT1405A	CE 1μ 50V
Q407,408	OBT6013A	TR 2SA733 (P,Q)	X602	OB07258A	Semi-fixed VR 220K	630		
411			VR601	OB07257A	Semi-fixed VR 100K	C606,615	OBT1402A	CE 4.7μ 25V
Q410,412	OBT6322A	TR 2SC2002 (K,L)	VR602	OB07329A	Semi-fixed VR 2K	618		
Q416	OBT1426A	TR 2SA562 (O,Y)	VR603	OB07256A	Semi-fixed VR 10K	C607	OBT9852A	CF 4700P 50V J
ZD401	OBT6058A	ZD 5.1V YZ051	VR604	OBT9725A	RK 100K 1/6W J	C608,609	OBT9282A	CC 100P 50V K
ZD402	OBT6384A	ZD 5.5V XZ055	R601,607			C612,613	OBT1412A	CE 10μ 16V
D401	OB06283A	Diode Bridge DBA30	608,611			C614	OBT9276A	CC 5P 50V J
D402,403	OB06109A	SID GP08B	612,613			C616	OBT1502A	CE 330μ 16V
D404	OB06282A	Diode Bridge DBA10	614,615			C617	OBT9327A	CE 0.33μ 50V (LN)
D405,406	OBT6398A	SID 1SS176	627,632			C619	OBT9865A	CF 0.056μ 50V J
D407	OBT6181A	SID 1SS53	649,667			C620	OBT9370A	CC 33P 50V J
R401,426	OBT1857A	RK 1K 1/4W J	672,693	OBT5622A	RK 2.2K 1/4W J	CN7	OB02347A	3P-T Post BLU
R402	OBT1679A	RK 100 1/4W J	694,696	OBT9749A	RK 1M 1/6W J	CN8	OB08653A	3P-T Post
R403	OBT1846A	RK 4.7K 1/4W J	703,704			CN9	OB02286A	6P-T Post BLU
R404	OBT1888A	RK 10K 1/4W J	709,710			CN10	OB08642A	6P-T Post
R405,415	OBT5671A	RK 2.2M 1/4W J	720,721			CN11	OB08656A	2P-T Post
R406	OBT9528A	RM 13.7K 1/4W F	722,726			CN12	OB08654A	4P-T Post
R407	OBT9203A	RM 10K 1/4W F	727,734			CN13	OB08644A	8P-T Post
R408	OBT1887A	RK 5.6K 1/4W J	R603,651	OBT9701A	RK 10K 1/6W J		OB08964A	TR Mica TO-126(2)
R409	OBT5794A	RK 680 1/4W J	R604,609				0E00507A	Nut Hex. M3 (2)
R410,417	OBT9504A	RM 11K 1/4W F	610,708				0E00510A	M3x8 ⊕ Pan (2A)
R411	OBT9677A	RK 1K 1/6W J	736					(2)
R412	OBT9653A	RK 100 1/6W J	R605,616				0J04485A	Heat Sink B (1)
R413,431	OBT9693A	RK 4.7K 1/6W J	617,629					
R414	OBT9701A	RK 10K 1/6W J	639,659					
R416,420	OBT9695A	RK 5.6K 1/6W J	661,662					
421			676,681					
R418,425	OBT9725A	RK 100K 1/6W J	682,683					
427			689,695					
R419	OBT9707A	RK 18K 1/6W J	699,711			Q401,402	OB02577B	Logic P.C.B.
R422	OBT9667A	RK 390 1/6W J	729,730			413	OB06255A	TR 2SD880 (Y)
R423,434	OBT9737A	RK 330K 1/6W J	733,735			Q405,406		
R424	OBT9729A	RK 150K 1/6W J	738	OBT1888A	RK 10K 1/4W J			
R428	OBT9713A	RK 33K 1/6W J	R606,634					
R429	OBT9719A	RK 56K 1/6W J	673,690					
R430	OBT5622A	RK 2.2K 1/4W J	724,728					
R432,433	OB09243A	RF 4.7 1/2W J	R618,697	OBT9707A	RK 18K 1/6W J			
C401	OB40037A	CE 10000μ 25V	698	OBT9713A	RK 33K 1/6W J			
C402	OB09374A	CE 6800μ 25V	R619,637					
C403,407	OBT1272A	CE 100μ 25V	638,642					
C404,408	OBT9276A	CC 5P 50V J	666,671					
C405	OB09798A	CE 6800μ 16V	691					
C406	OB09799A	CE 4700μ 25V	R620	OBT9717A	RK 47K 1/6W J			
C409,411	OB01397A	CE 1000μ 16V	R621	OBT9712A	RK 30K 1/6W J			
C410	OBT9218A	CE 47μ 16V (LN)	R622	OBT9716A	RK 43K 1/6W J			
C412	OB01406A	CE 2200μ 16V	R623,644	OBT9703A	RK 12K 1/6W J			
C413	OBT1405A	CE 1μ 50V	R624,645	OBT9723A	RK 82K 1/6W J			
C414	OBT9873A	CF 0.27μ 50V J	R625,668	OBT9727A	RK 120K 1/6W J			
	-- Logic --		R626,628	OBT9737A	RK 330K 1/6W J			
IC601	OB06324A	IC LM6402A-052	633,652					
IC602	OB06392A	IC LM6416E-149	665,670					
IC603	OB06124B	IC JRC4558D	674,678					
IC604	OB06317A	IC μPD4030BC	679,680					
IC605	OB06214A	IC μPD4071BC	718,719					
Q601,606	OBT6013A	TR 2SA733 (P,Q)	725,732	OBT5620A	RK 270K 1/4W J			
607,611			R630	OBT5627A	RK 330K 1/4W J			
612,613			R631	OBT9699A	RK 8.2K 1/6W J			
614,621			R635	OBT9689A	RK 3.3K 1/6W J			
626,627			R636,732	OBT9709A	RK 22K 1/6W J			
629,630			R640,653	OBT9731A	RK 180K 1/6W J			
631,633			R641	OB22444Y	RM 76.8K 1/4W F			
635			R643	OB22457Y	RM 100K 1/4W F			
Q602,603	OBT1872A	TR 2SC945L (P,Q)	R646	OBT9305A	RM 100K 1/4W F			
604,605			R647	OBT5671A	RK 2.2M 1/4W J			
608,617			R648,654					
618,619			737					
622,623			R650	OBT9472A	RM 220K 1/4W F			
628,632			R655,656	OBT9315A	RM 332K 1/4W F			
634,636			R657	OB22420A	RM 47.5K 1/4W F			
Q609	OB06316A	TR 2SD882 (P,Q)	R658	OB22475Y	RM 150K 1/4W F			
Q610	OB06303A	TR 2SB772 (P,Q)	R663	OBT5621A	RK 120K 1/4W J			
Q615	OB06066A	TR 2SD471 (L,M)	R664	OBT5626A	RK 150K 1/4W J			
Q616	OB06069A	TR 2SB564 (L,M)	R669	OBT9729A	RK 150K 1/6W J			
Q624,625	OBT6372A	TR 2SA953 (K,L)	R677,684	OBT1889A	RK 100K 1/4W J			
D601,612	OBT6181A	SID 1SS53	685,686					
613,620			688,705					
621,622			714,715					
625			716,723					
			R687	OBT9695A	RK 5.6K 1/6W J			
			R692	OBT9677A	RK 1K 1/6W J			
			R700	OBT9733A	RK 220K 1/6W J			
			R701,702	OBT9719A	RK 56K 1/6W J			
			707					

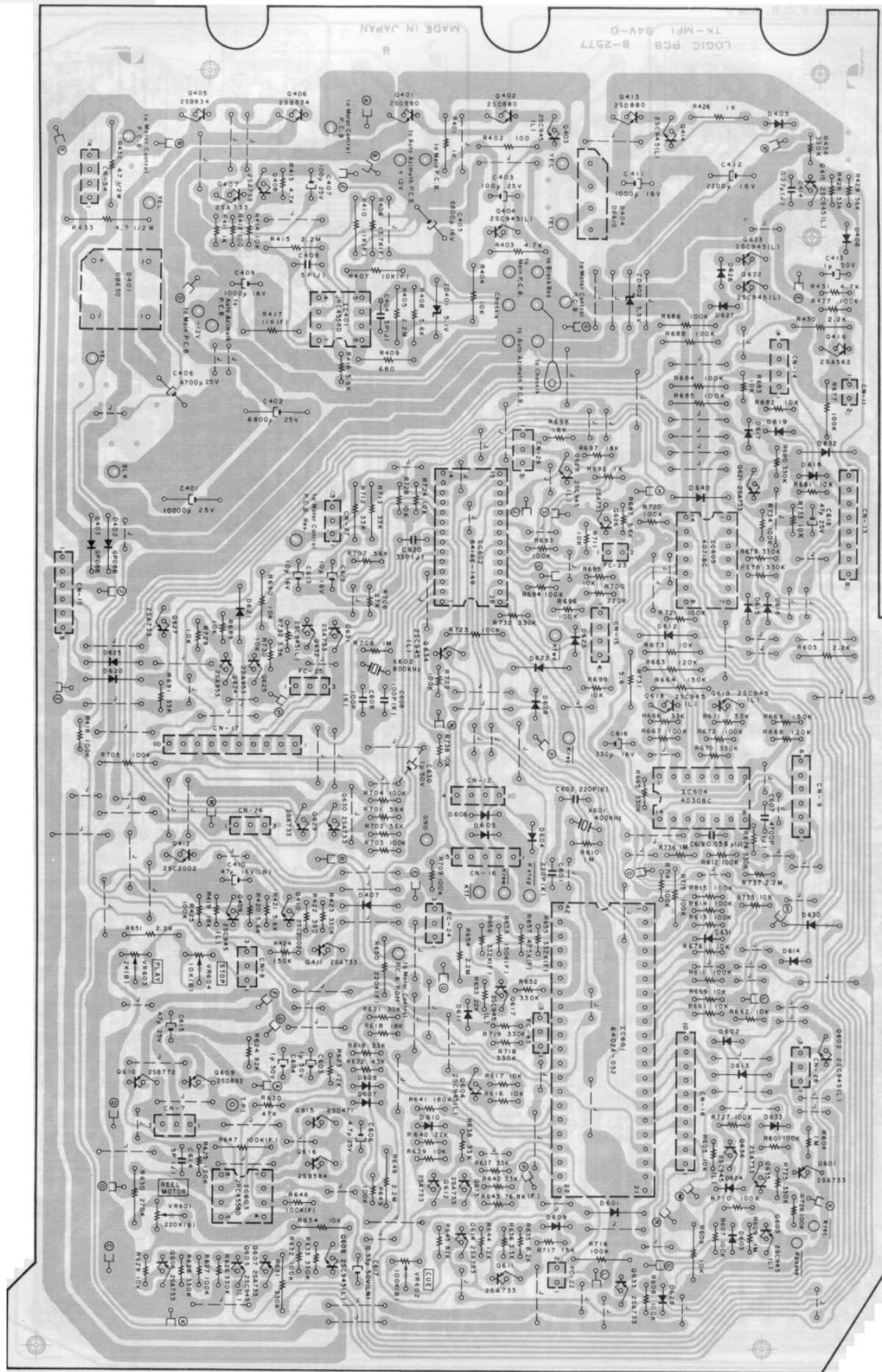


Fig. 6.14.1 Serial No.: A80102201 -

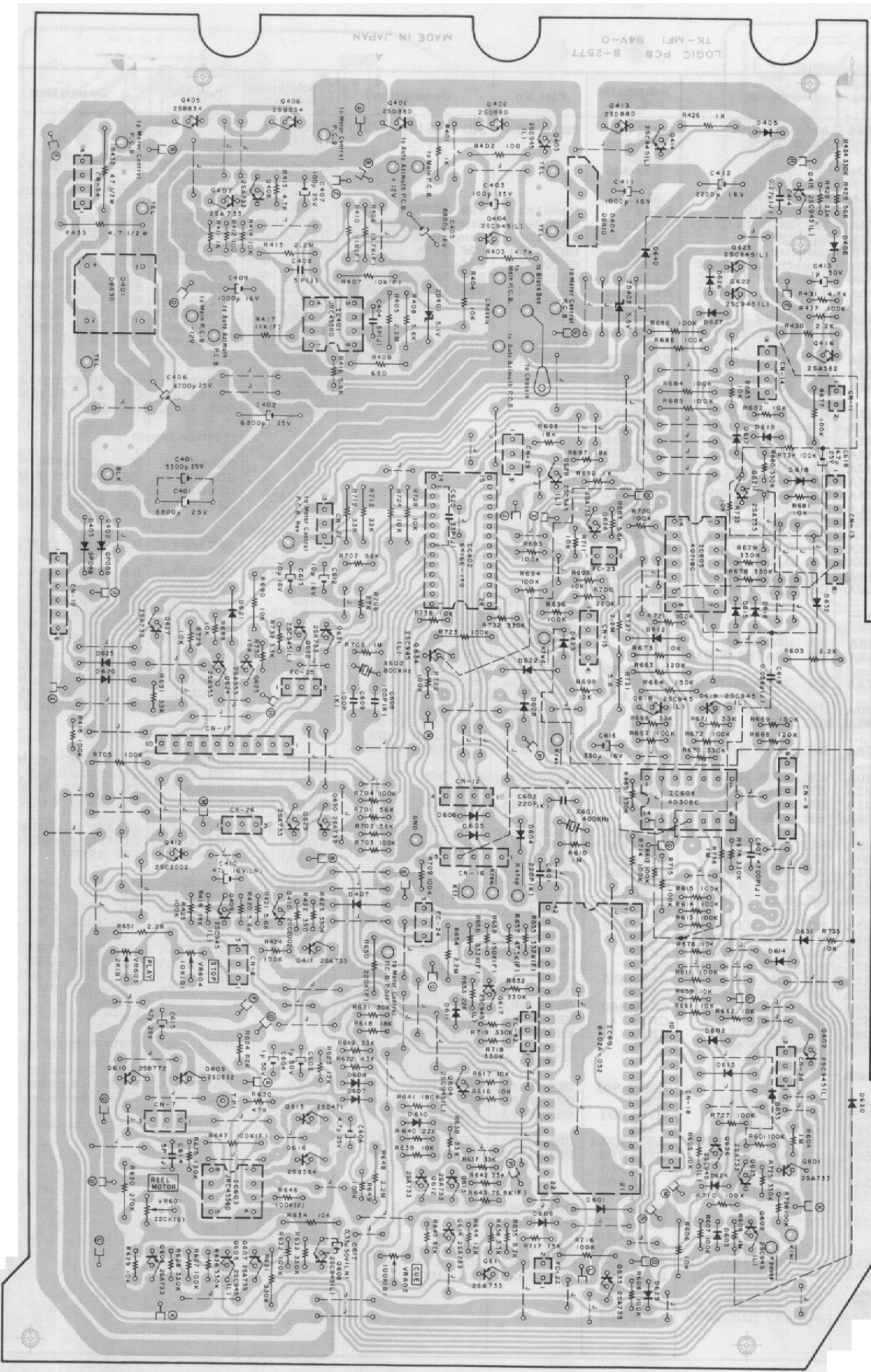


Fig. 6.14.2 Serial Nos.: A80101001 - A80102200

Schematic Ref. No.	Part No.	Description	Schematic Ref. No.	Part No.	Description	Schematic Ref. No.	Part No.	Description
	BA04879A	Auto Azimuth P.C.B. Assy	D821-827	OBT6398A	SiD 1SS176 (21)	R805,807		
	— Tone Osc. —		832-835			903,904		
IC721	OBT6181A	SiD 1SS53	840			905	OBT5615A	RK 22K 1/4W J
IC722	OB06127A	IC RC4559D	842-846			R706,806		
Q721	OB06219A	IC μPD4081BC	848,849			901		
D721,722	OBT1872A	TR 2SC945L (P,Q)	850,851			R708,711	OBT1857A	RK 1K 1/4W J
L721	OB03919B	Inductor 36mH	D841	OBT07269A	SiD 1SS53	808,811	OBT1682A	RK 6.8K 1/4W J
VR721	OB07269A	Semi-fixed VR 50K	VR822	OB07256A	Semi-fixed VR 10K	R709,809	OBT5625A	RK 220K 1/4W J
VR722	OB07270A	Semi-fixed VR 20K	VR823,824	OB22512Y	RM 316K 1/4W F	R710,810	OBT9432A	RM 8.25K 1/4W F
R721,722	OBT9315A	RM 332K 1/4W F	R821	OB22265Y	RM 2.2K 1/4W F	R712,812	OBT5627A	RK 330K 1/4W J
723			R822,830	OB22457Y	RM 100K 1/4W F	R713,714		
R724	OBT9583A	RM 97.6K 1/4W F	R823,831	OB22256Y	RM 1.8K 1/4W F	813,814	OBT9510A	RM 66.5K 1/4W F
R725,726	OBT1889A	RK 100K 1/4W J	R824,832	OBT9701A	RK 10K 1/6W J	R715,815	OBT9305A	RM 100K 1/4W F
732			R825,828			R716,816	OBT5577A	RK 330 1/4W J
R727	OBT5615A	RK 22K 1/4W J	833,836			R718,818	OBT9709A	RK 22K 1/6W J
R728	OBT5627A	RK 330K 1/4W J	847,848	OB22507Y	RM 287K 1/4W F	R902	OBT1405A	CE 1μ 50V
R729,730	OBT5508A	RK 56K 1/4W J	R829	OBT9725A	RK 100K 1/6W J	C701,703		
731			R838,839			704,801		
R733	OBT9527A	RK 130K 1/4W J	843,844			803,804		
R734	OBT5676A	RK 390K 1/4W J	862,863			C702,802	OBT9844A	CF 1000P 50V J
R735	OBT1682A	RK 6.8K 1/4W J	871,872			C705,805	OBT9218A	CE 47μ 16V (LN)
R736	OBT5622A	RK 2.2K 1/4W J	877,881			C901	OBT1862A	CE 22μ 16V
C721,722	OBT1400A	CE 100μ 16V	882,883					
C723	OBT9836A	CP 360P 100V J	884,898					
C724	OBT9538A	CP 0.018μ 100V G	899,920					
C725	OBT9861A	CF 0.027μ 50V J	922,928					
C726	OBT9865A	CF 0.056μ 50V J	930,931	OBT9749A	RK 1M 1/6W J	IC771	OBT6216A	IC μPC4556C
C727	OB09302A	CF 100P 100V J	R840,842			Q771	OBT6013A	TR 2SA733 (P,Q)
C728	OBT9868A	CF 0.1μ 50V J	854,856			D771-775	OBT6181A	SiD 1SS53
C729	OBT9860A	CF 0.022μ 50V J	894,921			R771,772	OBT5625A	RK 220K 1/4W J
C730	OBT9848A	CF 2200P 50V J	894,921			775,777		
C731	OBT9322A	CP 330P 100V J	924,925			778,779		
			R841	OBT9707A	RK 18K 1/6W J	R773,774	OBT1888A	RK 10K 1/4W J
			R845,846	OBT9733A	RK 220K 1/6W J	784,786		
			849,852			R776,781		
			890,928	OBT9677A	RK 1K 1/6W J	R780	OBT5675A	RK 3.9K 1/4W J
	— Fader —		R850,855	OBT9681A	RK 1.5K 1/6W J	R782	OBT9380A	RK 1.5M 1/4W J
IC741	OB06216A	IC μPC4556C	R853	OBT9687A	RK 2.7K 1/6W J	R783,785	OBT5509A	RK 33K 1/4W J
Q741,744	OB06013A	TR 2SA733 (P,Q)	R869	OBT9697A	RK 6.8K 1/6W J	R787	OBT1889A	RK 100K 1/4W J
745,747			R873	OBT1889A	RK 100K 1/4W J	C771	OBT5776A	RK 1M 1/4W J
Q742,743	OBT1872A	TR 2SC945L (P,Q)	R874	OBT9709A	RK 22K 1/6W J	C772,774	OBT9854A	CF 6800P 50V J
746			R875,929	OBT5627A	RK 330K 1/4W J	C773,775	OBT9282A	CC 100P 50V K
ZD741	OBT6290A	ZD 5.6V RD5.6EB2	R876,878	OBT5671A	RK 2.2M 1/4W J	C776	OBT9222A	CE 0.47μ 50V (LN)
D741,742	OBT6181A	SiD 1SS53	R879	OBT9653A	RK 100 1/6W J	C777	OBT9148A	CE 10μ 25V (LN)
743,744			R880	OBT9671A	RK 560 1/6W J	C778	OBT9223A	CE 1μ 50V (LN)
R741,743	OBT5676A	RK 390K 1/4W J	R891	OBT9743A	RK 560K 1/6W J		OBT9856A	CF 0.01μ 50V J
746			R892,923	OBT9737A	RK 330K 1/6W J			
R742,744	OBT5640A	RK 180K 1/4W J	927			Q911	— Black Box Control —	
R745,763	OBT5692A	RK 68K 1/4W J	R926	OBT9719A	RK 56K 1/6W J	Q912,915	OB06066A	TR 2SD471 (L,M)
R747	OBT5641A	RK 47K 1/4W J	R932	OB01857A	RK 1K 1/4W J	Q913	OBT1872A	TR 2SC945L (P,Q)
R748,751	OBT1888A	RK 10K 1/4W J	R935	OBT9705A	RK 15K 1/6W J	Q914,916	OB06069A	TR 2SB564 (L,M)
754,765			R936	OBT9685A	RK 2.2K 1/6W J	917	OBT6013A	TR 2SA733 (P,Q)
R749,750	OBT5668A	RK 82K 1/4W J	C821,826	OB09302A	C 100P 100V J	ZD911,912	OBT6231A	ZD 11V RD11EB2
R752	OBT1889A	RK 100K 1/4W J	C823,828	OBT9489A	CP 5600P 100V G	ZD913	OBT6268A	ZD 5.6V RD5.6EB3
R753	OBT5621A	RK 120K 1/4W J	C824,829	OBT9868A	CF 0.1μ 50V J	D911,912	OBT6181A	SiD 1SS53
R755	OBT5743A	RK 27K 1/4W J	C831,856	OBT9370A	CC 33P 50V J	913		
R756,764	OBT5622A	RK 2.2K 1/4W J	C832	OBT9849A	CF 2700P 50V J	R911,913	OB09215A	RF 100 1/4W J
767			C833,834	OBT9223A	CE 1μ 50V (LN)	R912,914	OB09321A	RF 4.7 1/4W J
R757	OBT1857A	RK 1K 1/4W J	C835,858	OBT9332A	CE 2.2μ 50V (LN)	R915,916	OBT5743A	RK 27K 1/4W J
R758	OBT5691A	RK 390 1/4W J	C841,842	OBT9148A	CE 10μ 25V (LN)	R917,918	OBT1889A	RK 100K 1/4W J
R759	OBT5576A	RK 470 1/4W J	C845	OBT9848A	CF 2200P 50V J	920,922		
R760,766	OBT1887A	RK 5.6K 1/4W J	C846	OBT9147A	CE 3.3μ 50V (LN)	R919	OBT5627A	RK 330K 1/4W J
R761	OBT1681A	RK 3.3K 1/4W J	C853	OBT9163A	CE 10μ 16V (BP)	R921	OBT5615A	RK 22K 1/4W J
R762	OBT5627A	RK 330K 1/4W J	C854,855	OBT9137A	CE 22μ 25V (LN)	R923	OBT1857A	RK 1K 1/4W J
C741	OBT1674A	CE 10μ 25V	C857	OBT9288A	CC 1000P 50V K	C911,912	OBT1392A	CE 470μ 16V
C742	OBT9844A	CF 1000P 50V J	C859,860	OBT9490A	CP 0.015μ 100V G			
C743	OBT1409A	CE 47μ 25V	CN5	OB08656A	2P-T Post		— Miscellaneous —	
C744	OBT9852A	CF 4700P 50V J	CN6	OB08653A	3P-T Post	OB02576B	Auto Azimuth P.C.B.	
						OB02349A	4P-JP Connector	
IC821	OB06443A	IC NJM082D	IC701,801	OB06144A	IC μPD4066BC	OB02350A	5P-JP Connector	
IC822	OB06387A	IC NJM2043DD	IC901	OB06216A	IC μPC4556C	OB02336A	2P-JP Connector	
IC823	OB06216A	IC μPC4556C	Q701,801	OBT1872A	TR 2SC945L (P,Q)			
IC824	OB06178A	IC μPD4011BC	901					
IC825	OB06358A	IC μPD4013BC	ZD701,801	OBT6058A	ZD 5.1V YZ051		OB02348A	3P-JP Connector
IC826	OB06144A	IC μPD4066BC	D701,702	OBT6181A	SiD 1SS53			
IC827	OB06124B	IC RC4558D	703,801					
Q821,822	OBT6013A	TR 2SA733 (P,Q)	802,803					
825,831			901					
Q823,824	OBT1872A	TR 2SC945L (P,Q)	D902	OBT6398A	SiD 1SS176			
828,829			VR701,703	OB07256A	Semi-fixed VR 10K			
830,843			801,803					
Q832	OB06066A	TR 2SD471 (L,M)	VR702,802	OB07405A	Semi-fixed VR 200K			
Q833	OB06069A	TR 2SB564 (L,M)	R701,801	OBT1846A	RK 4.7K 1/4W J			
Q840	OBT6299A	TR 2SC2878	R702,703	OBT1889A	RK 100K 1/4W J			
ZD821	OBT6230A	ZD 5.1V RD5.1EB2	704,705					
ZD822	OBT6353A	ZD 6.2V RD6.2EB2	707,802					
			803,804					



6.15. Auto Azimuth P.C.B. Ass'y

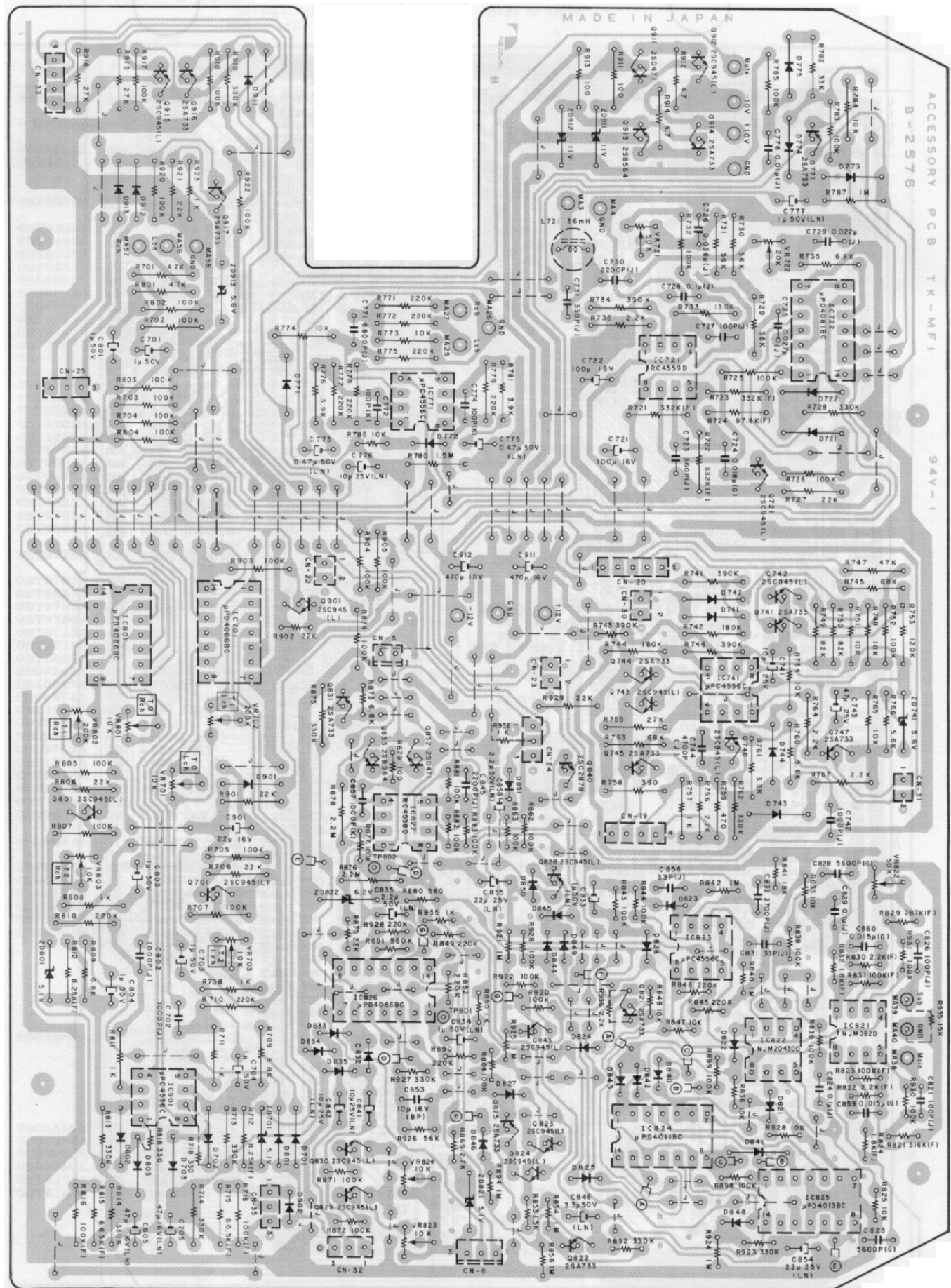


Fig. 6.15.1 Serial No.: A80102201

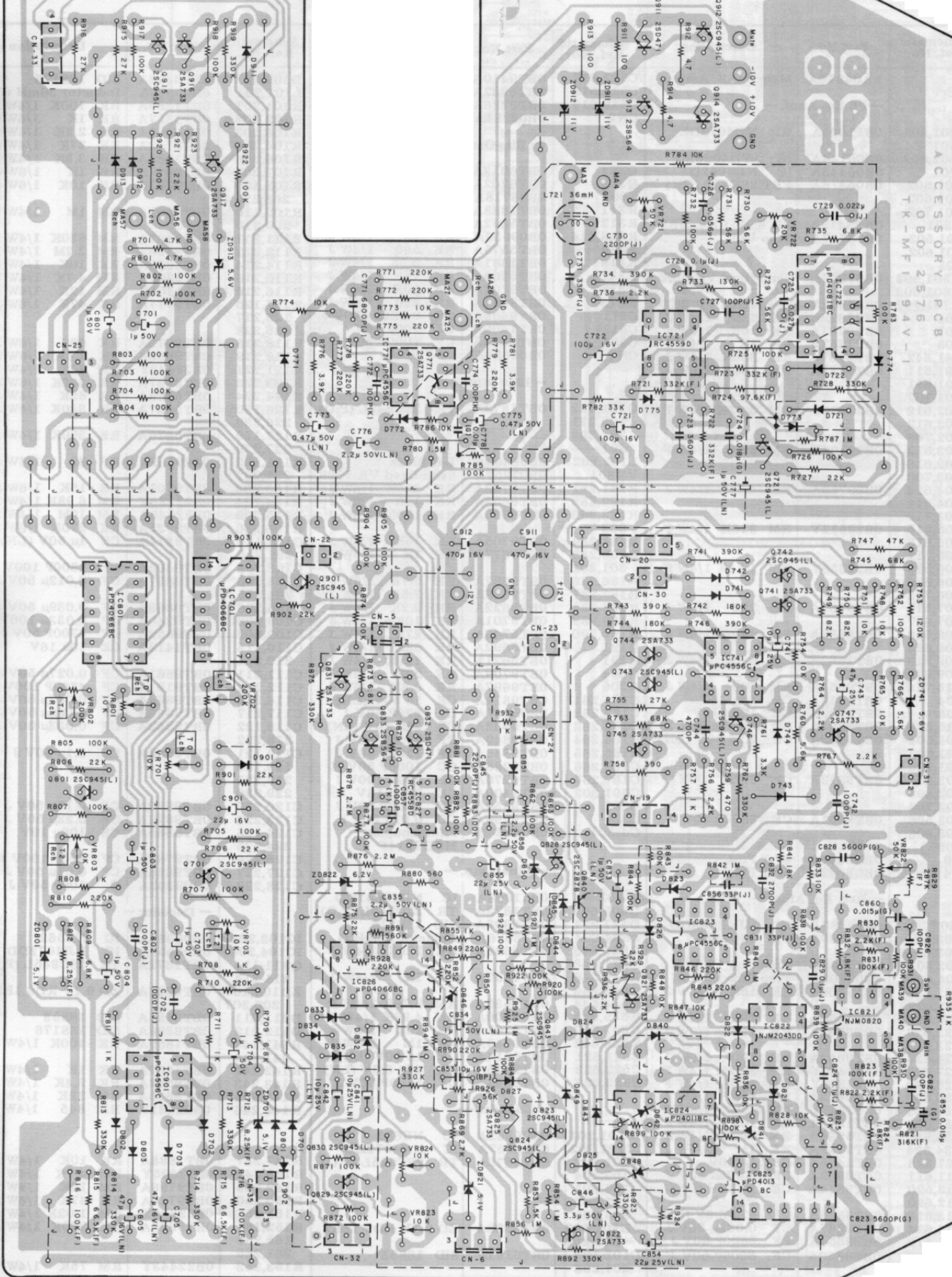


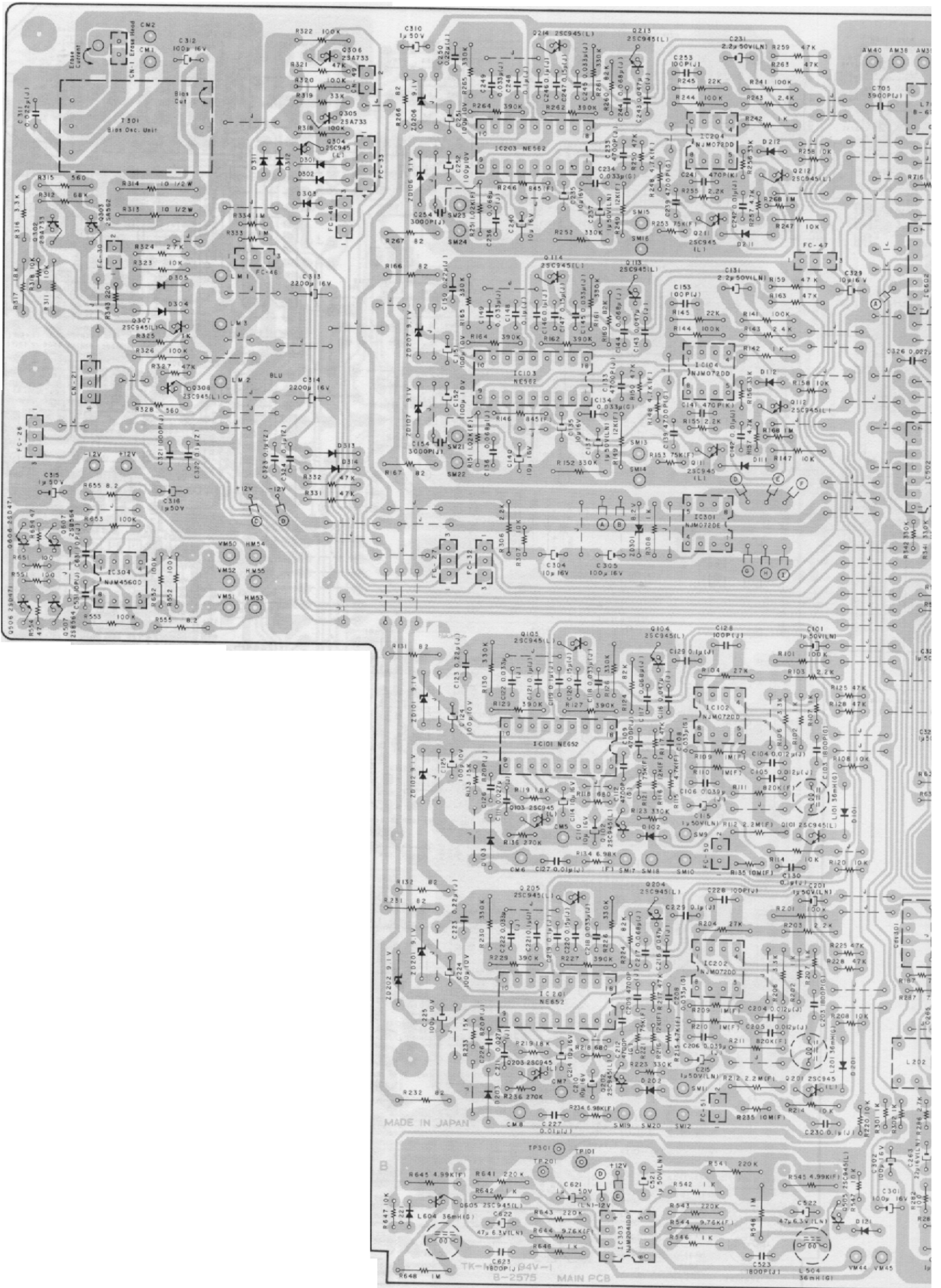
Fig. 6.15.2 Serial Nos.: A80101001 - A80102200

Schematic Ref. No.	Part No.	Description	Schematic Ref. No.	Part No.	Description	Schematic Ref. No.	Part No.	Description
	BA04870A	Main P.C.B. Ass'y	C517,617	OBT9410A	CP 2200P 100V G	D102,202	OBT6398A	SiD 1SS176
	- PB Eq. Amp. -		C518,618	OBT9322A	CP 330P 100V J	L101,201	OB06676A	Inductor 36mH G
			C519,619	OBT9286A	CC 470P 50V K	R101,201	OBT1889A	RK 100K 1/4W J
			CN2	OB02281A	4P-T Post	R102,202	OBT1857A	RK 1K 1/4W J
IC301,501	OB11005A	IC NJM072DE				R103,203	OBT5622A	RK 2.2K 1/4W J
601						R104,204	OBT5743A	RK 27K 1/4W J
IC502,602	OB06144A	IC $\mu$ PD4066BC	Q302	OBT6013A	TR 2SA733 (P,Q)	R106,206	OBT1681A	RK 3.3K 1/4W J
IC701	OB06443A	IC NJM082D	Q303	OBT6202A	TR 2SA562TM (Y)	R107,207	OBT9677A	RK 1K 1/6W J
Q501,502	OB06376A	FET 2SK170 (GR)	T301	OB06718A	Bias Osc. Unit	R108,120	OBT9701A	RK 10K 1/6W J
601,602			R311	OBT1888A		208,220		
701,702			R312	OBT5692A	RK 68K 1/4W J	R109,110	OBT9502A	RM 1M 1/4W F
ZD301	OBT6418A	ZD 8.2V RD8.2JB2	R313,314	OB09936A	RF 10 1/2W J	R111,211	OBT9197A	RM 820K 1/4W F
L501,502	OB06717A	Trap Unit	R315	OBT5575A	RK 560 1/4W J	R112,212	OBT9766A	RM 2.2M 1/4W F
601,602			R316	OBT1681A	RK 3.3K 1/4W J	R114,214	OBT1888A	RK 10K 1/4W J
VR501,502	OB07256A	Semi-fixed VR 10K	R317	OBT5560A	RK 18K 1/4W J	R115,215	OB22305Y	RM 4.7K 1/4W F
601,602			R318	OBT9701A	RK 10K 1/6W J	R116,216	OB22351Y	RM 12K 1/4W F
VR701,702	OB32002A	Semi-fixed VR 2K	R343	OBT9661A	RK 220 1/6W J	R117,125	OBT9717A	RK 47K 1/6W J
R306	OBT5622A	RK 2.2K 1/4W J	C311	OBT9405A	CP 0.022 $\mu$ 100V J	128,217		
R307	OBT9701A	RK 10K 1/6W J	C312	OBT1400A	CE 100 $\mu$ 16V	225,228		
R308	OBT1857A	RK 1K 1/4W J	C321	OBT9844A	CF 1000P 50V J	R118,218	OBT9673A	RK 680 1/6W J
R341,342	OBT9737A	RK 330K 1/6W J	CN1	OB08656A	2P-T Post	R119,219	OBT9683A	RK 1.8K 1/6W J
R501,511	OBT9725A	RK 100K 1/6W J				R121,221	OB22443Y	RM 75K 1/4W F
601,611						R123,223	OBT9737A	RK 330K 1/6W J
701,707						R124,224	OBT5668A	RK 82K 1/4W J
R502,512	OB22296Y	RM 3.92K 1/4W F	Q121,122	OBT1872A	TR 2SC945L (P,Q)	R126,130	OBT5627A	RK 330K 1/4W J
602,612			123,221			226,230		
702,708			222,223			R127,129	OBT5676A	RK 390K 1/4W J
R503,513	OB22104Y	RM 80.6 1/4W F	301			227,229		
603,613			L102,202	OB06690A	L-C Block	R131,132	OB09162A	RF 82 1/4W J
703,709			VR301	OB07257A	Semi-fixed VR 100K	231,232		
R504,514	OB09785A	RK 4.7M 1/4W J	R181,281	OBT9733A	RK 220K 1/6W J	R133,233	OBT9705A	RK 15K 1/6W J
604,614			R182,282	OBT9653A	RK 100 1/6W J	R134,234	OB22326Y	RM 6.98K 1/4W F
704,710			R183,283	OBT9725A	RK 100K 1/6W J	R135,235	OB22545A	RM 10M 1/4W F
R505,515	OB22512Y	RM 316K 1/4W F	303			R136,236	OBT9735A	RK 270K 1/6W J
605,615			R184,284	OBT9705A	RK 15K 1/6W J	C101,115	OBT9814A	CE 1 $\mu$ 50V (LN)
705,711			R185,285	OBT9677A	RK 1K 1/6W J	201,215		
R506,516	OB22353Y	RM 12.4K 1/4W F	301,302			C103,203	OBT9409A	CF 1800P 100V G
606,616			R186,286	OBT9687A	RK 2.7K 1/6W J	C104,105	OBT9857A	CF 0.012 $\mu$ 50V J
706,712			R187,287	OBT9698A	RK 7.5K 1/6W J	204,205		
R507,517	OBT9661A	RK 220 1/6W J	R188,288	OBT5622A	RK 2.2K 1/4W J	C106,206	OBT9863A	CF 0.039 $\mu$ 50V J
607,617			R189,289	OBT9701A	RK 10K 1/6W J	C108,208	OBT9240A	CF 0.033 $\mu$ 100V G
R508,518	OBT9669A	RK 470 1/6W J	R190,290	OBT5743A	RK 27K 1/4W J	C109,209	OBT9852A	CF 4700P 50V J
608,618			R191	OBT5692A	RK 68K 1/4W J	C110,114	OBT1412A	CE 10 $\mu$ 16V
R509,519	OBT1682A	RK 6.8K 1/4W J	R291	OBT5621A	RK 120K 1/4W J	210,214		
609,619			R304	OBT9709A	RK 22K 1/6W J	C111,211	OBT9861A	CF 0.027 $\mu$ 50V J
R715,716	OBT9653A	RK 100 1/6W J	R305	OBT9697A	RK 6.8K 1/6W J	C112,212	OBT9191A	CF 4700P 100V G
C304	OBT1412A	CE 10 $\mu$ 16V	C161,261	OBT9814A	CE 1 $\mu$ 50V (LN)	C116,216	OBT9864A	CF 0.047 $\mu$ 50V J
C305	OBT1400A	CE 100 $\mu$ 16V	C162,262	OB09247A	C 220P 50V J	C117,217	OBT9866A	CF 0.068 $\mu$ 50V J
C325,326	OBT9291A	CC 0.022 $\mu$ 50V Z	C163,263	OBT9932A	CE 22 $\mu$ 16V (LN)	C118,122	OBT9862A	CF 0.033 $\mu$ 50V J
C501,504	OBT9933A	CE 2.2 $\mu$ 50V (LN)	C164,264	OBT9849A	CF 2700P 50V J	218,222		
601,604			C165,265	OBT9845A	CF 1200P 50V J	C119,121	OBT9868A	CF 0.1 $\mu$ 50V J
701,703			C166,266	OBT9288A	CC 1000P 50V K	129,130		
C502,505	OBT9312A	CP 0.01 $\mu$ 100V G	C167,267	OBT9270A	CP 470P 100V J	219,221		
602,605			C301,302	OBT1400A	CE 100 $\mu$ 16V	229,230		
702,704			C303	OBT9850A	CF 3300P 50V J	C120,220	OBT9870A	CF 0.15 $\mu$ 50V J
C503,506	OBT9851A	CF 3900P 50V J	C320	OBT9290A	CC 0.01 $\mu$ 50V Z	C123,223	OBT9872A	CF 0.22 $\mu$ 50V J
603,606			Cds301	OB06325B	Photocoupler MCD7214F	C124,125	OBT5885A	CE 100 $\mu$ 10V
705						224,225		
CN3	OBL8654A	4P-T Post				C126,226	OBT9783A	CF 820P 100V J
CN4	OBL8642A	6P-T Post				C127,227	OBT9856A	CF 0.01 $\mu$ 50V J
	- Rec. Eq. Amp. -					C128,228	OB09302A	C 100P 50V J
IC302	OB06387A	IC NJM2043DD	IC303	OB11004A	IC NJM2041DD		- Decoder -	
Q503,504	OBT6299A	TR 2SC2878	Q505,605	OBT1872A	TR 2SC945L (P,Q)		OB06382A	IC NE562
603,604			D121,221	OBT6398A	SiD 1SS176		OB06457A	IC NJM072DD
L503,603	OB00068A	Trap Coil 10.5mH	L504,604	OB06676A	Inductor 36mH G	IC103,203	OBT1872A	TR 2SC945L (P,Q)
L504,604	OB06705A	Trap Coil 1.05mH	R541,543	OBT5625A	RK 220K 1/4W J	IC104,204		
R521,529	OBT9705A	RK 15K 1/6W J	641,643			Q111-114		
621,629			R542,546	OBT1857A	RK 1K 1/4W J	211-214		
R522,622	OBT5560A	RK 18K 1/4W J	642,646			ZD106,107	OBT6232A	ZD 9.1V RD9.1EB2
R523,526	OBT9731A	RK 180K 1/6W J	R544,644	OBT9535A	RM 9.76K 1/4W F	206,207		
623,626			R545,645	OBT9900A	RM 4.99K 1/4W F	D111,211	OBT6181A	SiD 1SS53
R524,624	OBT9653A	RK 100 1/6W J	R547,647	OBT9701A	RK 10K 1/6W J	D112,212	OBT6398A	SiD 1SS176
R527,627	OB22410Y	RM 39.2K 1/4W F	R548,648	OBT9749A	RK 1M 1/6W J	R141,144	OBT1889A	RK 100K 1/4W J
R528,628	OB22296Y	RM 3.92K 1/4W F	C521,621	OBT9814A	CE 1 $\mu$ 50V (LN)	241,244		
R530,630	OBT9673A	RK 680 1/6W J	C522,622	OBT9815A	CE 4 $\mu$ 6.3V (LN)	R142,242	OBT1857A	RK 1K 1/4W J
R531,631	OB22247Y	RM 1.5K 1/4W F	C523,623	OBT9847A	CF 1800P 50V J	R143,243	OBT9588A	RK 2.4K 1/4W J
R532,632	OBT1888A	RK 10K 1/4W J				R145,245	OBT5615A	RK 22K 1/4W J
R533,633	OBT5936A	RK 10 1/4W J	IC101,201	OB06382A	IC NE652	R146,246	OB22221Y	RM 845 1/4W F
R534,634	OBT9749A	RK 1M 1/4W J	IC102,202	OB06457A	IC NJM072DD			
C327,328	OBT1405A	CE 1 $\mu$ 50V	Q101,102	OBT1872A	TR 2SC945L (P,Q)	R147,247	OBT1888A	RK 10K 1/4W J
C511,611	OBT9862A	CF 0.033 $\mu$ 50V J	103,104			R148,248	OB22305Y	RM 4.7K 1/4W F
C512,520	OBT9814A	CE 1 $\mu$ 50V (LN)	105,201			R149,249	OBT9796A	RM 12K 1/4W F
612,620			202,203			R150,250	OBT9717A	RK 47K 1/6W J
C513,613	OBT9815A	CE 47 $\mu$ 6.3V (LN)	204,205			R151,251	OB22230Y	RM 1.02K 1/4W F
C514,614	OBT9867A	CF 0.082 $\mu$ 50V J	ZD101,102	OBT6232A	ZD 9.1V RD9.1EB2	R152,161	OBT5627A	RK 330K 1/4W J
C515,615	OBT9854A	CF 6800P 50V J	201,202			165,252		
C516,616	OBT9850A	CF 3300P 50V J	D101,103	OBT6181A	SiD 1SS53	261,265		
			201,203			R153,253	OB22443Y	RM 75K 1/4W F



Schematic Ref. No.	Part No.	Description
R155,255	OBT9685A	RK 2.2K 1/6W J
R156,256	OBT9713A	RK 33K 1/6W J
R157,257	OBT9693A	RK 4.7K 1/6W J
R158,258	OBT9701A	RK 10K 1/6W J
R159,163	OBT5641A	RK 47K 1/4W J
259,263		
R160,260	OBT5668A	RK 82K 1/4W J
R162,164	OBT5676A	RK 390K 1/4W J
262,264		
R166,167	OB09162A	RF 82 1/4W J
266,267		
R168,268	OBT9749A	RK 1M 1/6W J
C131,231	OBT9933A	CE 2.2μ 50V (LN)
C133,233	OBT9852A	CF 4700P 50V J
C134,234	OBT9240A	CP 0.033μ 100V G
C135,140	OBT1412A	CE 10μ 16V
235,240		
329		
C136,144	OBT9866A	CF 0.068μ 50V J
236,244		
C137,237	OBT9814A	CE 1μ 50V (LN)
C139,239	OB09191A	CP 4700P 100V G
C141,241	OBT9286A	CC 470P 50V K
C142,242	OBT9856A	CF 0.01μ 50V J
C143,243	OBT9864A	CF 0.047μ 50V J
C145,149	OBT9862A	CF 0.033μ 50V J
245,249		
C146,148	OBT9868A	CF 0.1μ 50V J
246,248		
C147,247	OBT9870A	CF 0.15μ 50V J
C150,250	OBT9872A	CF 0.22μ 50V J
C151,152	OBT5885A	CE 100μ 10V
251,252		
C153,253	OB09302A	C 100P 50V J
C154,254	OBT9262A	CP 3000P 100V J
C310	OBT1405A	CE 1μ 50V
-- Logic Interface --		
Q304,307	OBT1872A	TR 2SC945L (P,Q)
308		
Q305,306	OBT6013A	TR 2SA 733 (P,Q)
D301,302	OBT6181A	SID 1SS53
304,305		
313,314		
D303,311	OBT6398A	SID 1SS176
312		
R318,320	OBT1889A	RK 100K 1/4W J
322,326		
R319	OBT5509A	RK 33K 1/4W J
R321,331	OBT5641A	RK 47K 1/4W J
332		
R323	OBT1888A	RK 10K 1/4W J
R324	OBT5743A	RK 27K 1/4W J
R325	OBT1857A	RK 1K 1/4W J
R327	OBT9717A	RK 47K 1/6W J
R328	OBT5675A	RK 560 1/4W J
R333,334	OBT9749A	RK 1M 1/6W J
C313,314	OB01406A	CE 2200μ 16V
C322,323	OBT9292A	CC 0.1μ 50V Z
324		
-- Headphone Amp. --		
IC304	OB06217A	IC NJM4560D
Q506,606	OB06066A	TR 2SD471 (L,M)
Q507,607	OB06069A	TR 2SB564 (L,M)
R551,651	OBT9653A	RK 100 1/6W J
R552,553	OBT1889A	RK 100K 1/4W J
652,653		
R554,654	OBT9645A	RK 47 1/6W J
R555,655	OB09331A	RF 8.2 1/4W J
C531,631	OBT9277A	CC 10P 50V J
C315,316	OBT1405A	CE 1μ 50V
-- Miscellaneous --		
CN21,37	OB02575B	Main P.C.B.
CN36	OB02348A	3P-JP Connector
FC21	OB02350A	5P-JP Connector
FC30	OB05343B	3P Flat Cable
FC31	OB05334B	2P Flat Cable
FC32,47	OB82032A	2P Flat Cable
FC33	OB05342B	3P Flat Cable
FC37	OB05356B	4P Flat Cable
FC46	OB05341B	3P Flat Cable
FC48	OB05344B	3P Flat Cable
FC49	OB05347B	3P Flat Cable
	OB05335B	2P Flat Cable
	OB08515A	Insu-Lock (5)

Schematic Ref. No.	Part No.	Description
	OB08676B	Heat Sink A304 (1)
	OM04238A	Label CN-26 (1)
	OM04239A	Label CN-27 (1)
	OM04439A	Label CN-30 (1)
	OM04247A	Label CN-31 (1)
	OM04248A	Label CN-32 (1)
	OM04249A	Label CN-33 (1)
	OE00612A	M3x6 ⊕ Pan (2A) (2)
	OE00857A	BT 3x6 ⊕ Binding (Chromate) (2)
	OJ03834C	Fuse P.C.B. Holder (1)



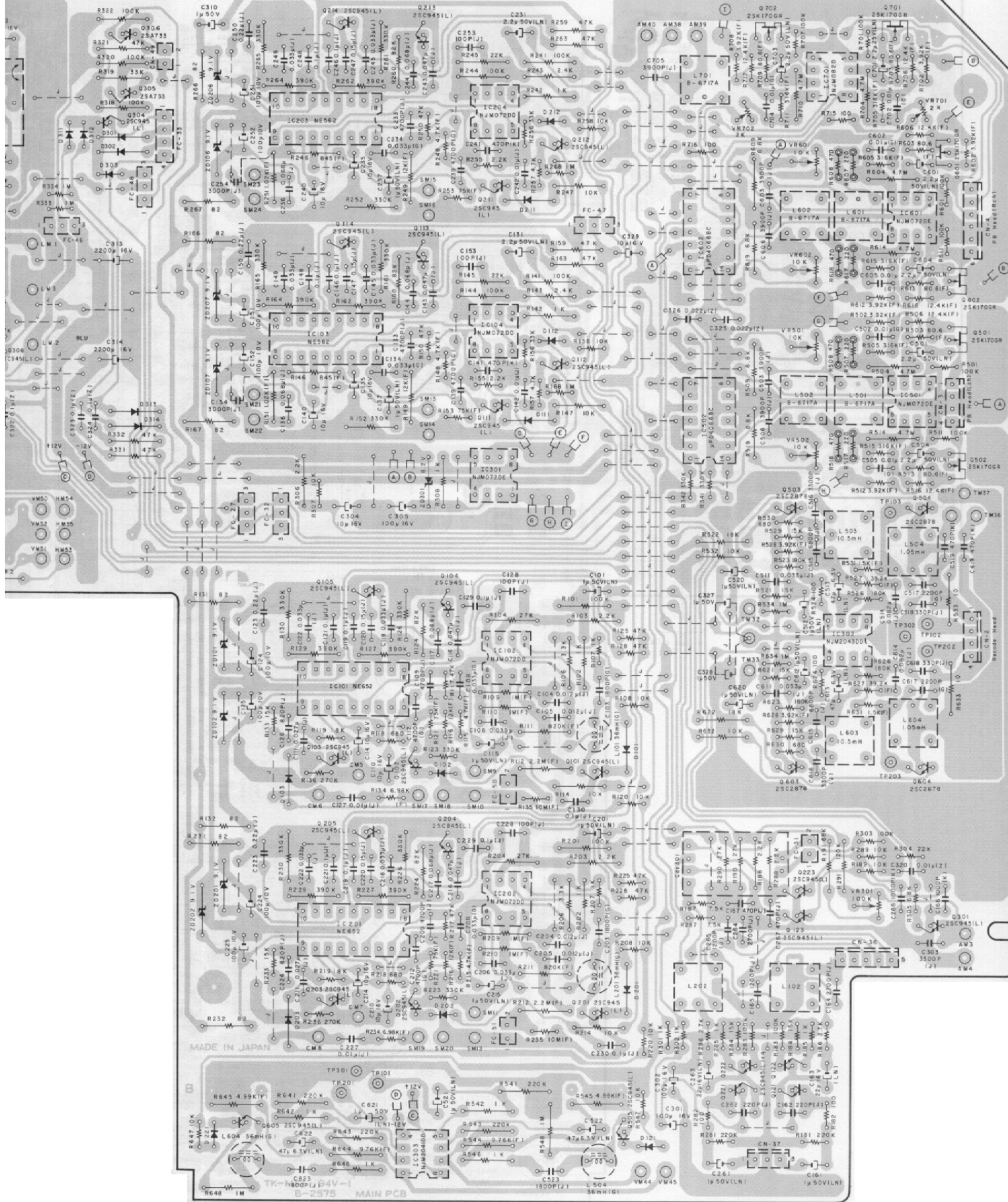


Fig. 16.1 Serial No.: A80102201 -



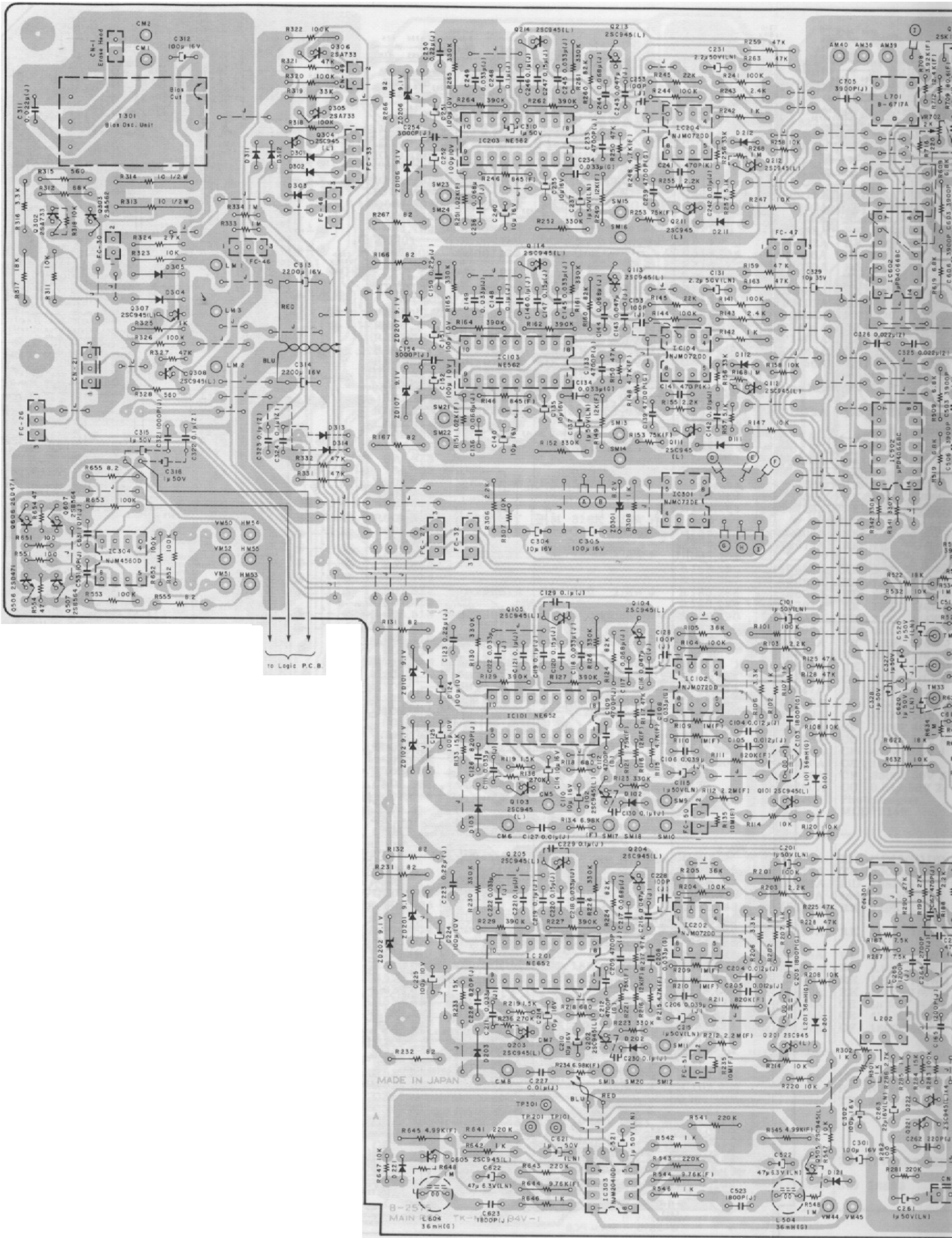
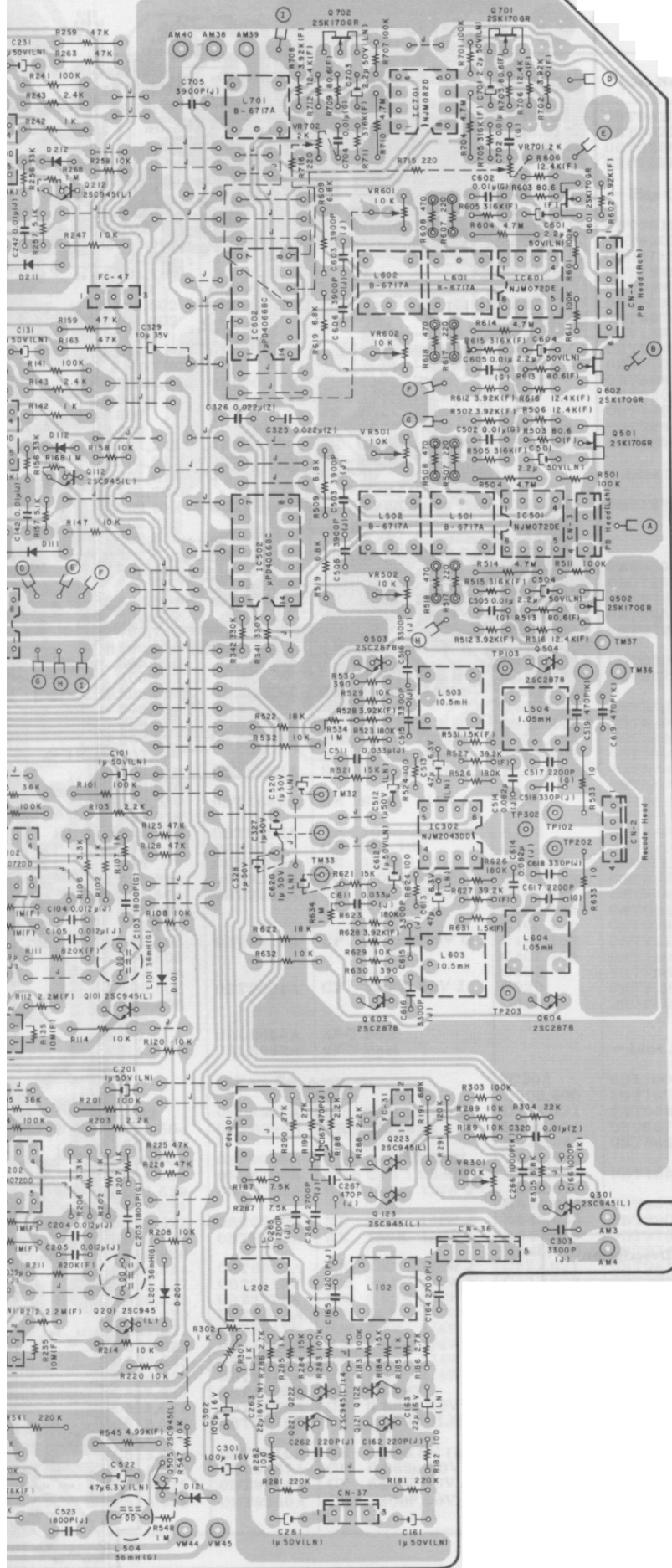


Fig. 6.16.2 Serial Nos.: A80101001 - A80102200



**7.1. Attention to Servicemen**

**(1) Parts Replacement**

Following parts shall be replaced with the specified ones. Refer to the parts list.

**(a) Power Supply Circuit**

Power Cord  
Power Transformer: T1

**(b) Power Switch P.C.B. Ass'y**

Power Switch: SW1  
Spark Killer: M2

**(c) Fuse P.C.B. Ass'y**

Fuses: F01, 02, 03

**(d) Logic P.C.B. Ass'y**

Power Transistors: Q401, 402, 405, 406, 410, 412, 413, 416, 609, 610, 615, 616  
Diode Bridges: D401, 404  
Fail Safe Type Resistors: R432, 433, 731

**(e) Main P.C.B. Ass'y**

Power Transistors: Q303, 506, 606  
Fail Safe Type Resistors: R131, 132, 166, 167, 231, 232, 266, 267, 313, 314, 555, 655

**(f) Auto Azimuth P.C.B. Ass'y**

Power Transistors: Q832, 833, 911, 913  
Fail Safe Type Resistors: R911, 912, 913, 914

**(g) Motor Control P.C.B. Ass'y**

Power Transistors: Q518, 519, 520, 521, 522, 523, 524, 525, 526  
Fail Safe Type Resistors: R572, 573, 582, 583

**(h) Shut-off P.C.B. Ass'y**

Fail Safe Type Resistor: R605  
Lamp: PL602

**(i) Counter Pulse Generator P.C.B. Ass'y**

Fail Safe Type Resistor: R601  
Lamp: PL601

**(2) Insulation Check**

Before returning the repaired Nakamichi DRAGON to a customer, check to insure that the exposed parts are accurately insulated from the AC line by measuring the leakage current or the insulation resistance between them.

2. IC Block Diagrams

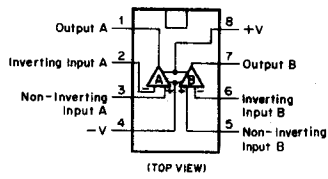


Fig. 7.2.1 Operational Amp. IC 4558D, 4559D, 4560D, 4556C, 2041DD, 2043DD, 082D, 072D

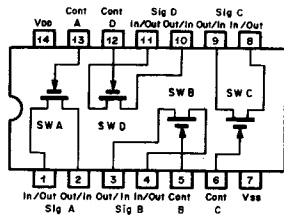


Fig. 7.2.2 Bilateral Switch C-MOS IC μPD4066BC

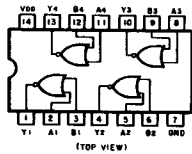


Fig. 7.2.3 NOR Gate C²-MOS IC TC40H002P

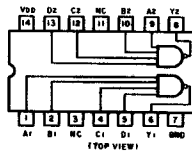


Fig. 7.2.4 NAND Gate C²-MOS IC TC40H020P

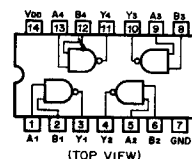


Fig. 7.2.5 NAND Gate C-MOS IC μPD4011BC

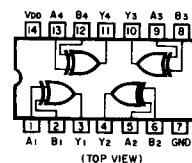


Fig. 7.2.6 Exclusive OR Gate C-MOD IC μPD4030BC

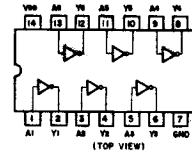


Fig. 7.2.7 Inverter C-MOS IC TC4069UBP

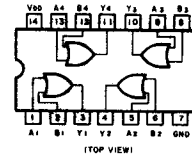


Fig. 7.2.8 OR Gate C-MOS IC μPD4071BC

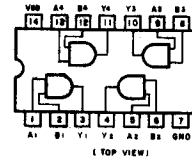


Fig. 7.2.9 AND Gate C-MOS IC μPD4081BC

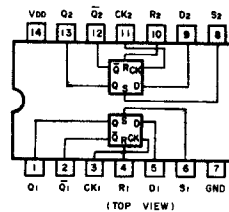


Fig. 7.2.10 D-Type Flip-Flop C-MOS IC μPD4013BC

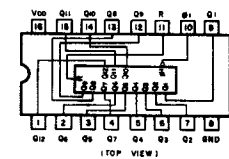


Fig. 7.2.11 Decoder C-MOS IC μPD4040BC

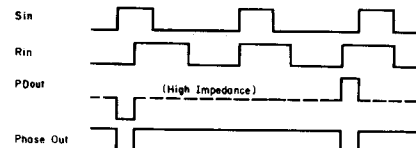
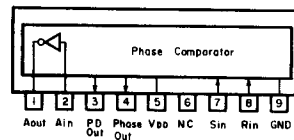


Fig. 7.2.12 Phase Comparator TC5081P

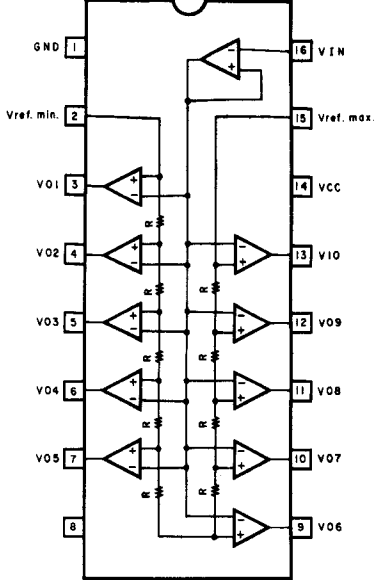


Fig. 7.2.13 Level Meter Driver TA7612AP

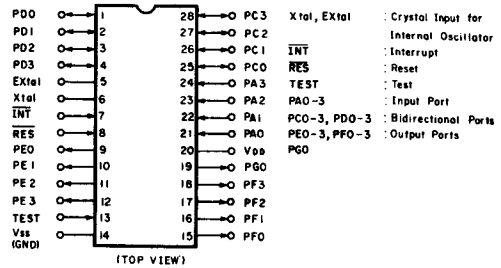
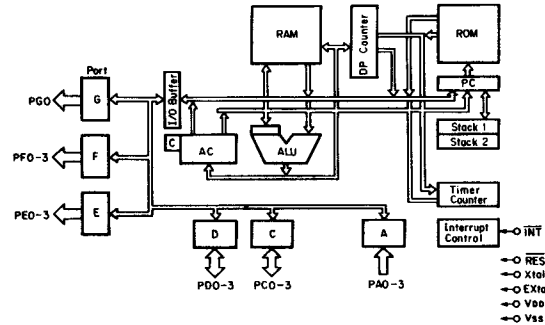


Fig. 7.2.15 4-Bit Micro-processor LM6416E

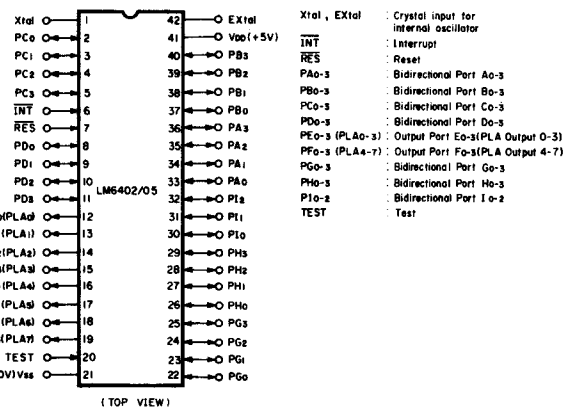
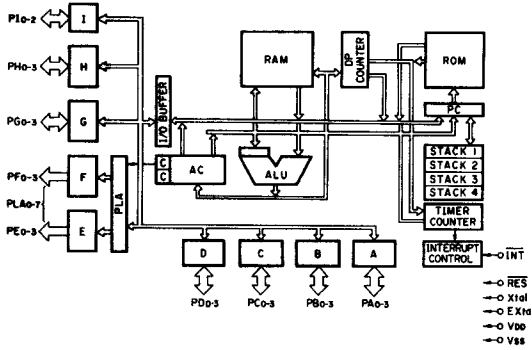
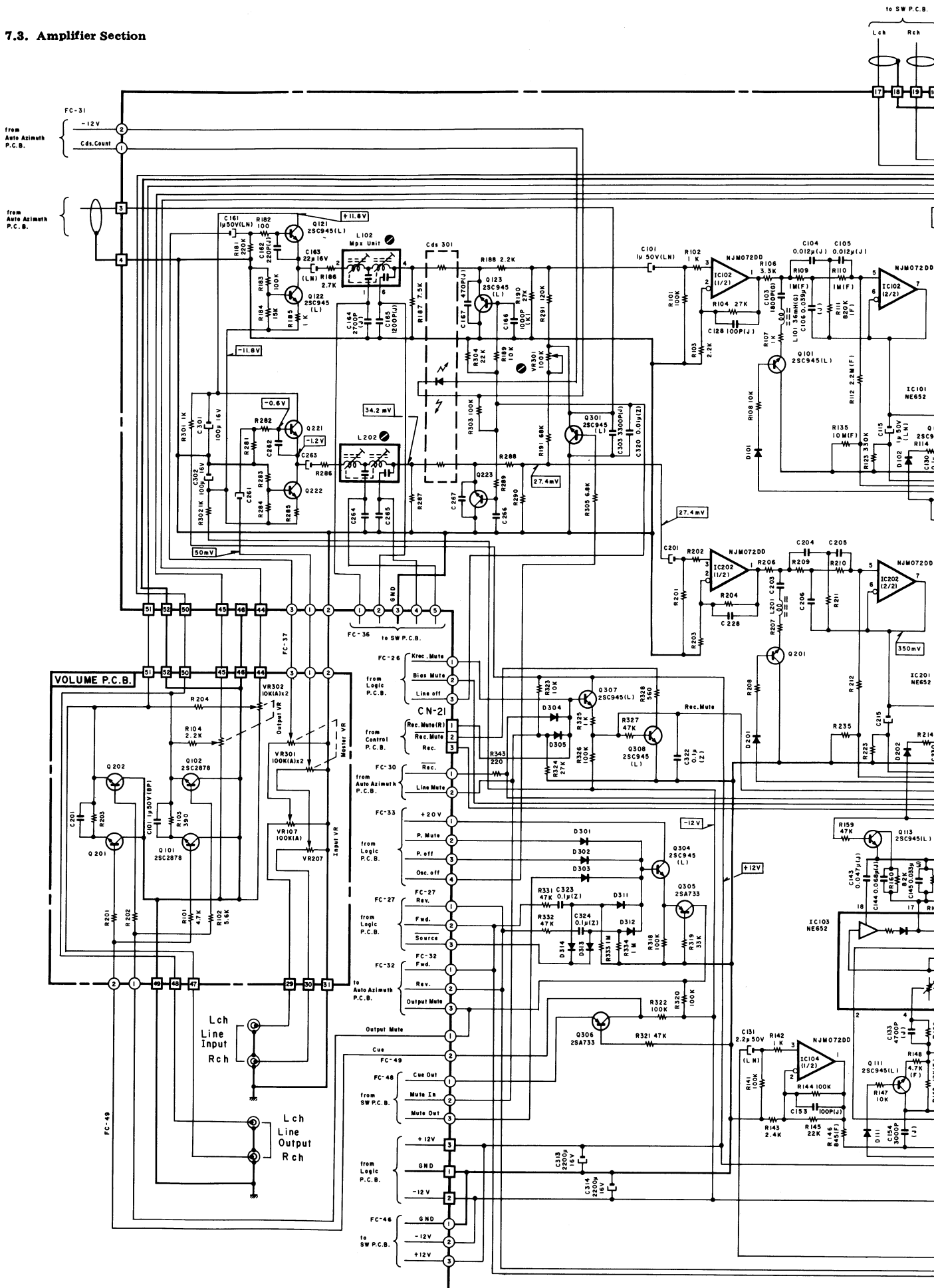


Fig. 7.2.14 4-Bit Micro-processor LM6402A

### 7.3. Amplifier Section

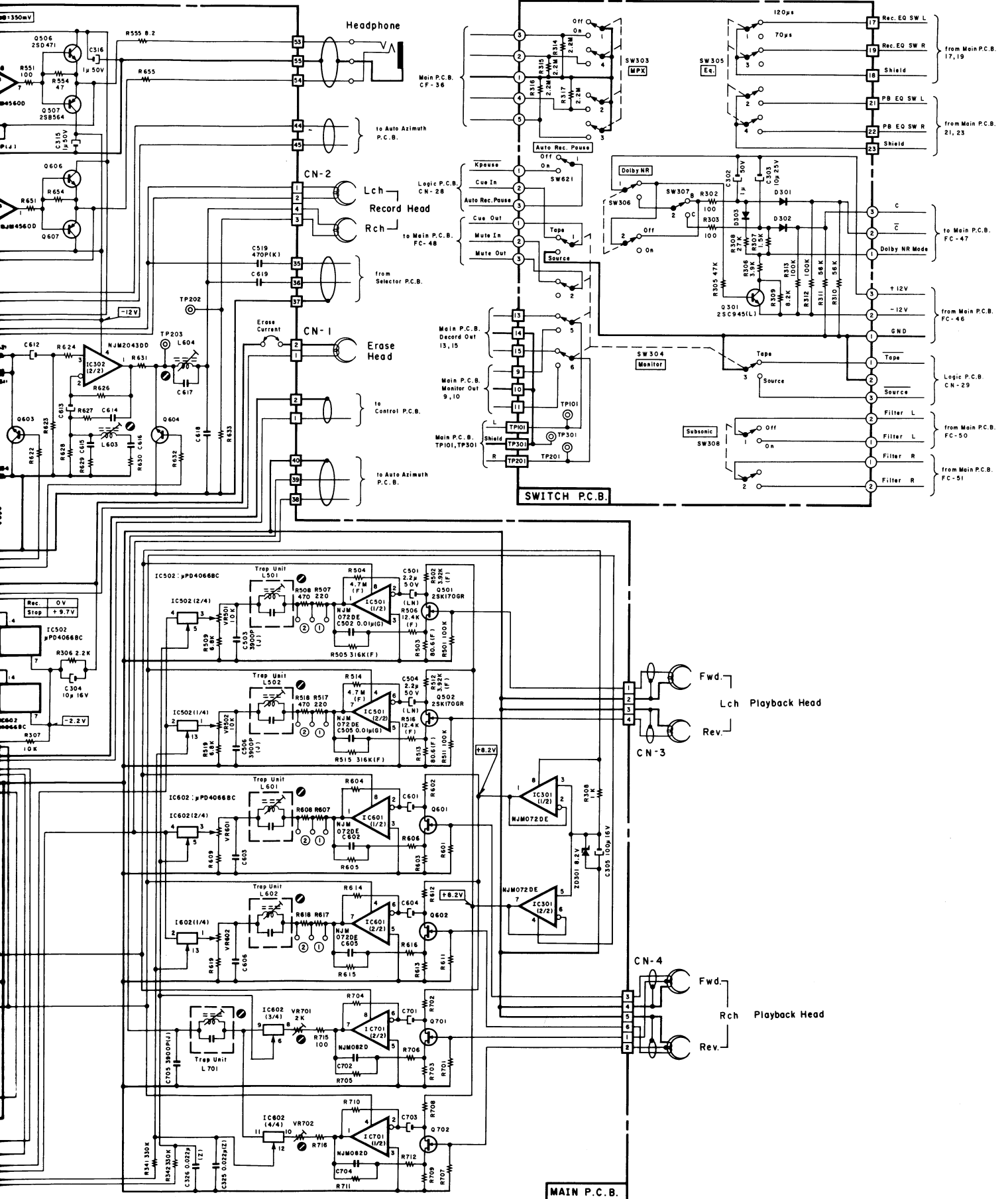




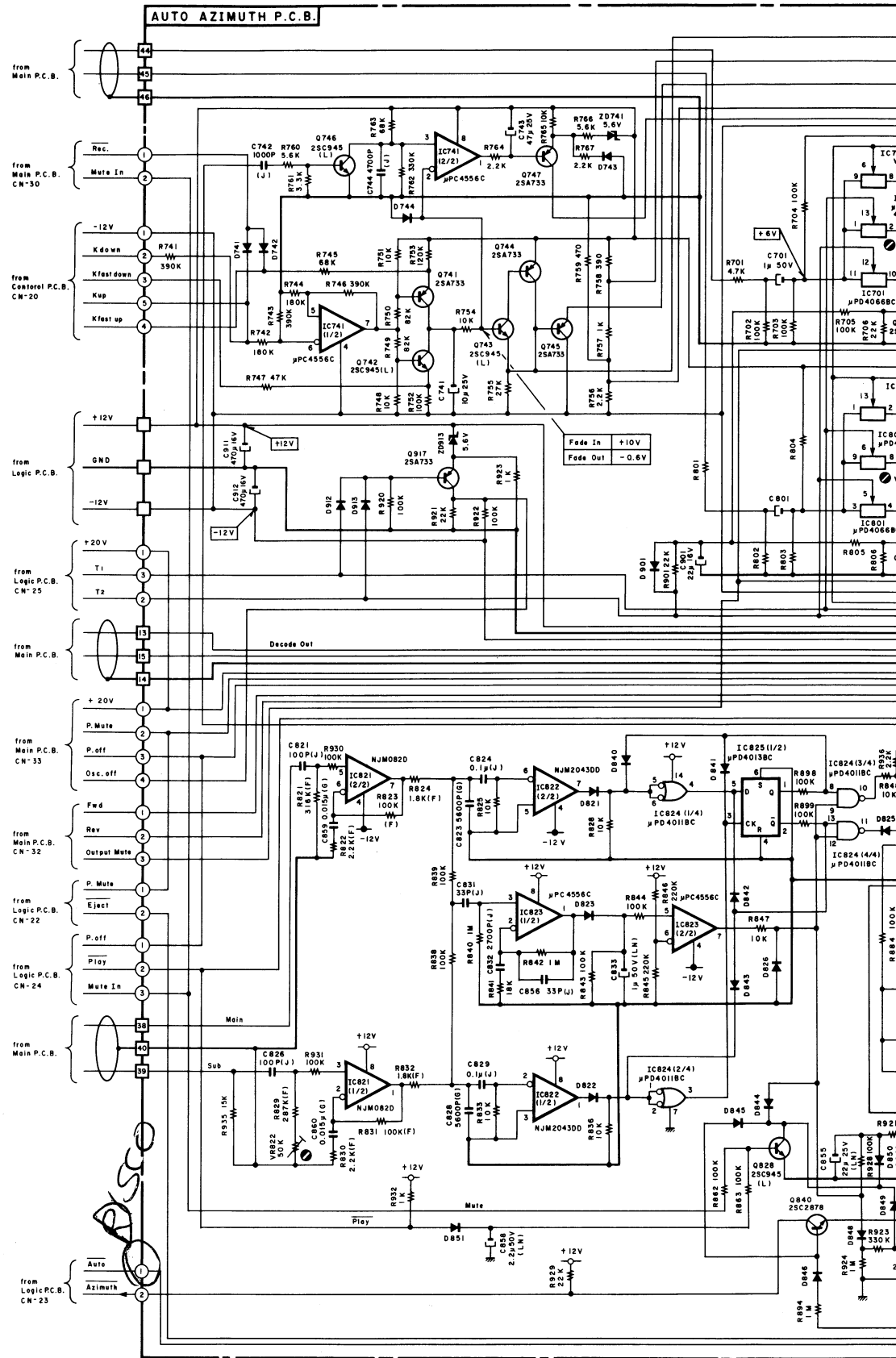


- Notes: 1. Diode is 1SS53, 1S1555, or 1SS176 unless otherwise specified.  
 2. Resistor and capacitor marked with \* show typical value.

- Notes: 1. 2SA733, 2SA608SP, 2SA1048 and 2SA1175 are interchangeable with each other.  
 2. 2SC945, 2SC536SP, 2SC2458 and 2SC2785 are interchangeable with each other.



7.4. Auto Azimuth Control Section



- Notes: 1. 2SA733, 2SA6085P, 2SA1048 and 2SA1175 are interchangeable  
 2. 2SC945, 2SC5365P, 2SC2458 and 2SC2785 are interchangeable

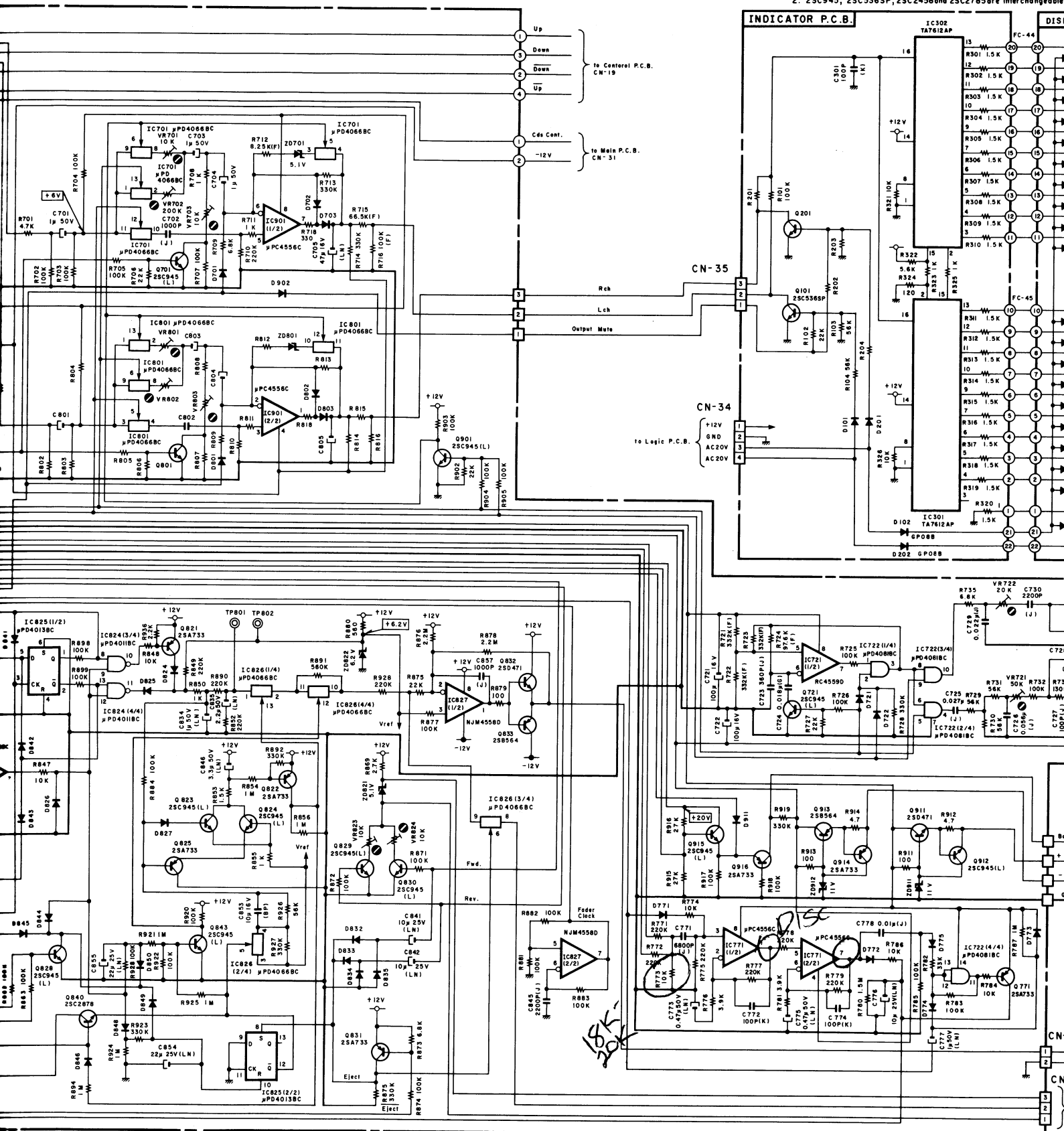
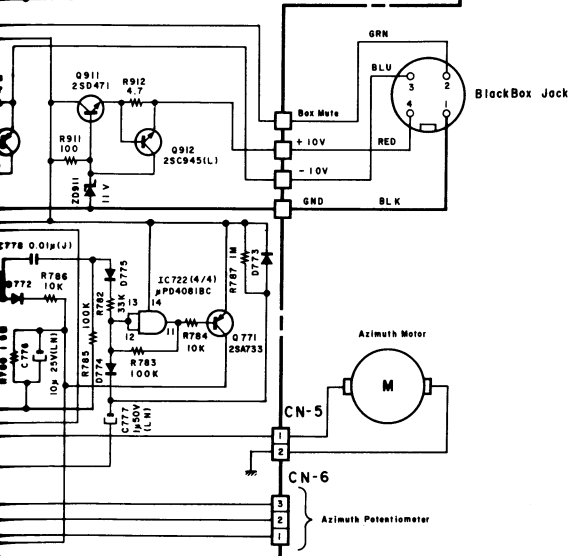
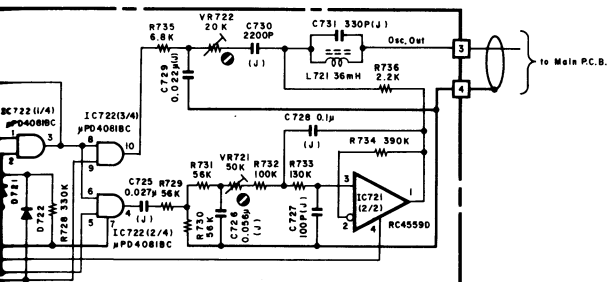
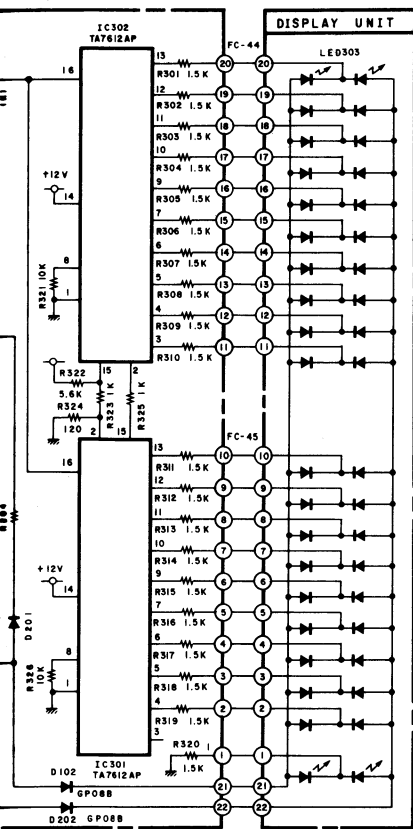


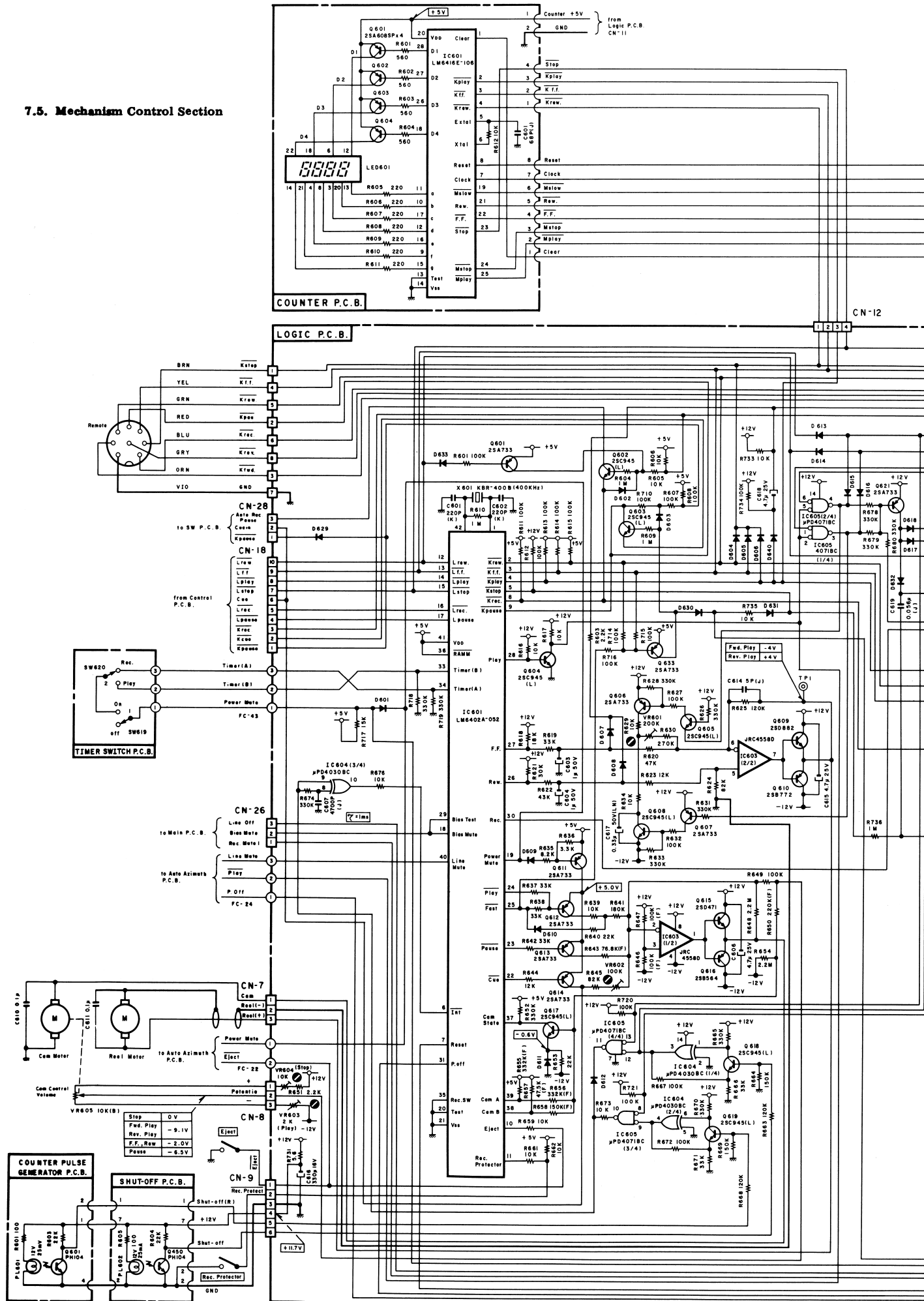
Fig. 7.4

005P, 25A1048 and 25A1175 are interchangeable with each other.  
 3365P, 25C2458 and 25C2785 are interchangeable with each other.

Notes: 1. Diode is 1SS53, 1S1555, or 1SS176 unless otherwise specified.  
 2. Resistor and capacitor marked with \* show typical value.



### 7.5. Mechanism Control Section



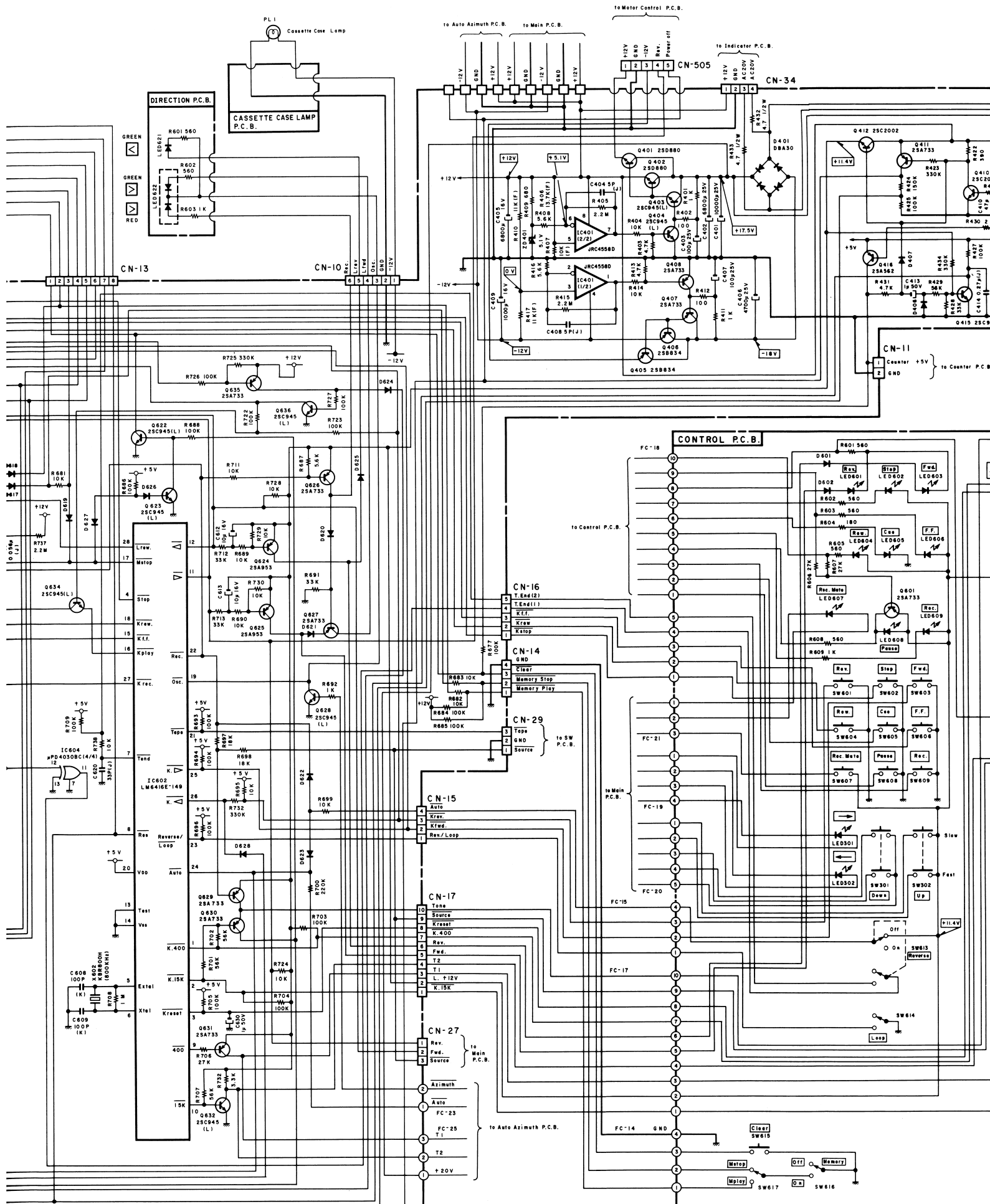
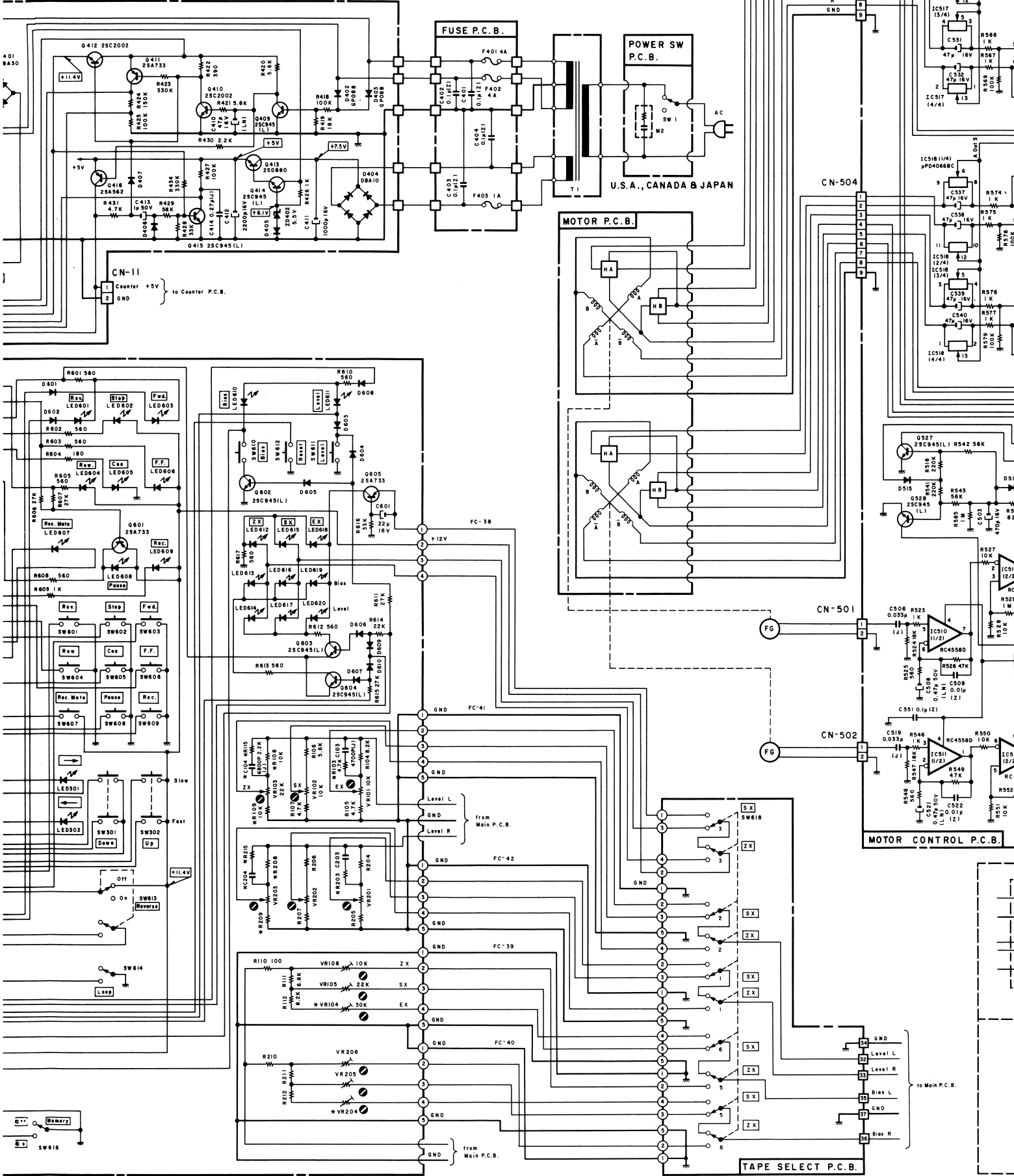


Fig. 7.5

Notes: 1. Diode is 1SS53, 1S1555, or 1SS176 unless otherwise specified.  
 2. Resistor and capacitor marked with \* show typical value.

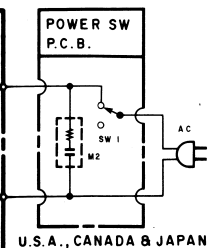
Notes: 1. 2SA733, 2SA608SP, 2SA1048 and 2SA1175 are interchangeable with each other.  
 2. 2SC945, 2SC536SP, 2SC2458 and 2SC2785 are interchangeable with each other.



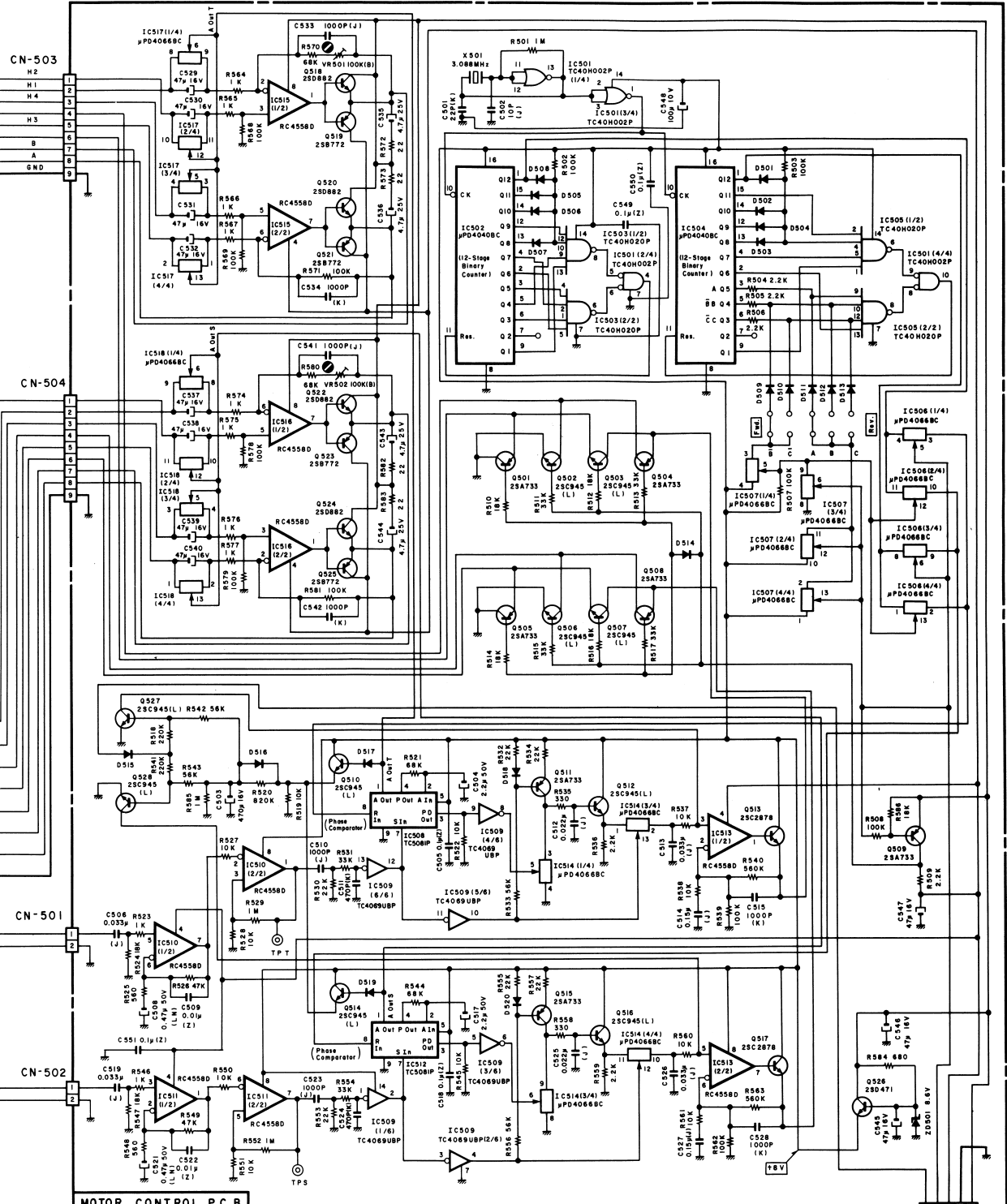
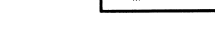
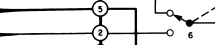
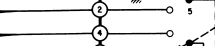
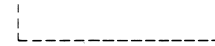
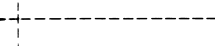
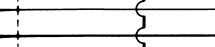
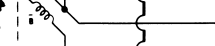
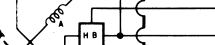
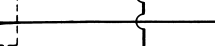
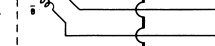
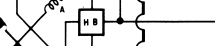
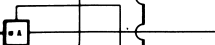


otherwise specified.  
nominal value.

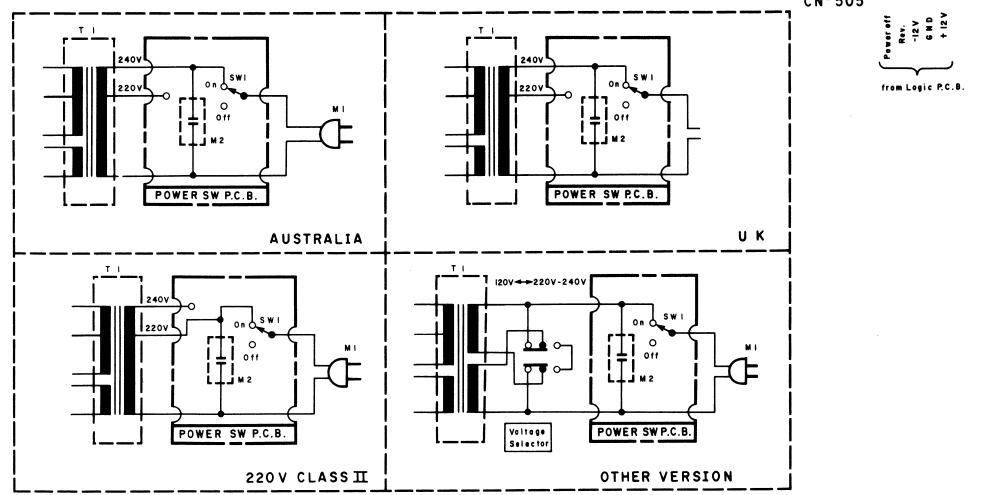
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U.S.A., CANADA & JAPAN



MOTOR CONTROL P.C.B.

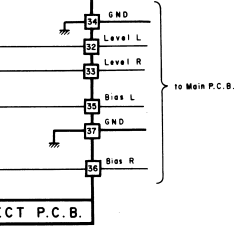


AUSTRALIA

U K

220 V CLASS II

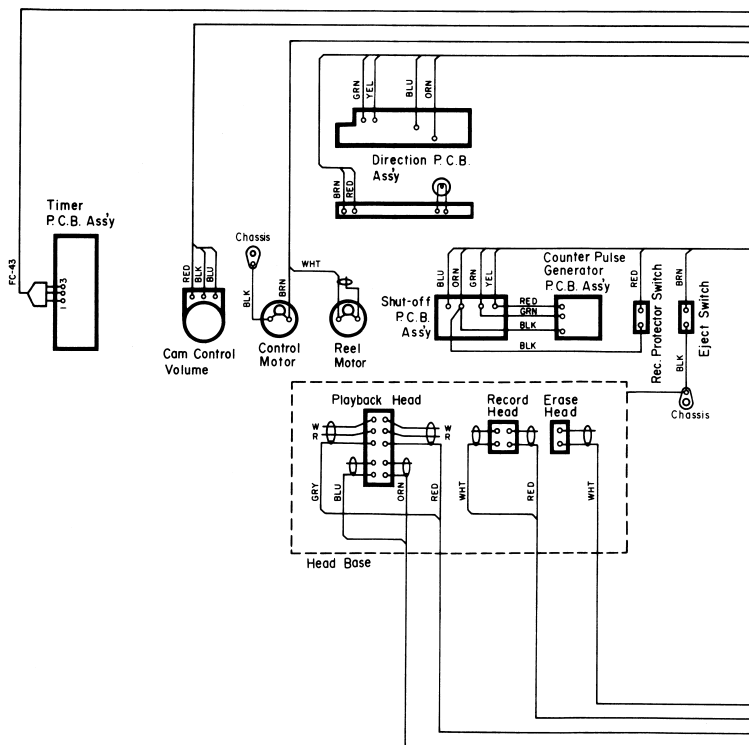
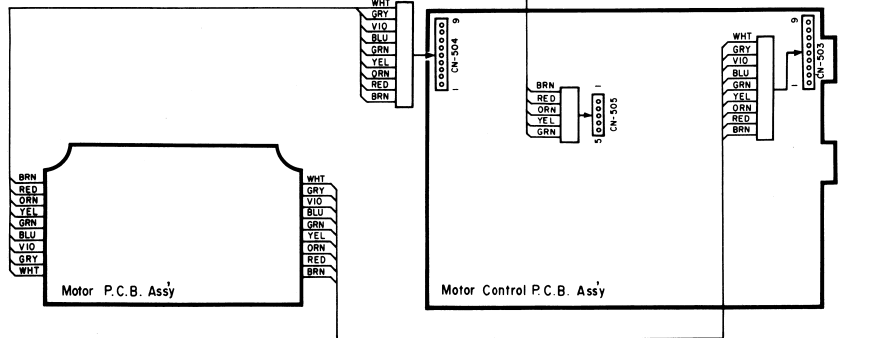
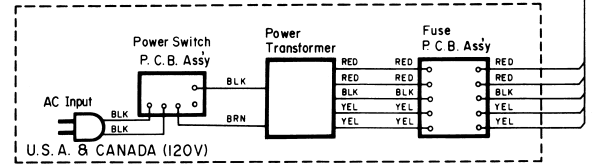
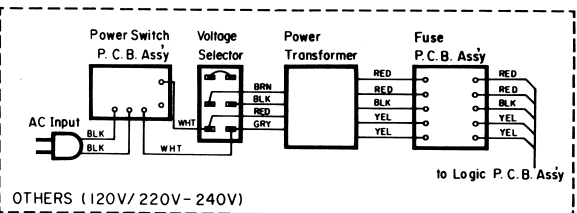
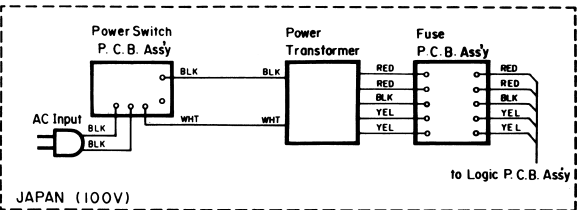
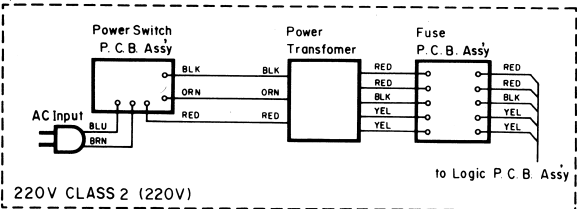
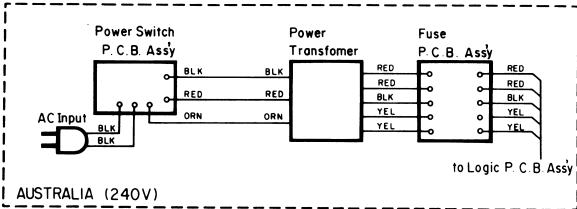
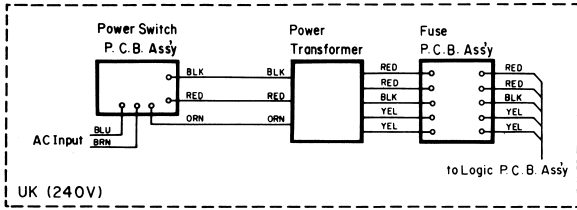
OTHER VERSION



TAPE SELECT P.C.B.

to Main P.C.B.

## 8. WIRING DIAGRAM



### Notes: 1. Table of wire colors

BRN — Brown  
 RED — Red  
 ORN — Orange  
 YEL — Yellow  
 GRN — Green  
 BLU — Blue  
 VIO — Violet  
 GRY — Gray  
 WHT — White  
 BLK — Black

2. Dip side view of the P.C.B. is illustrated.
3. Wire tube color is shown in ( ).

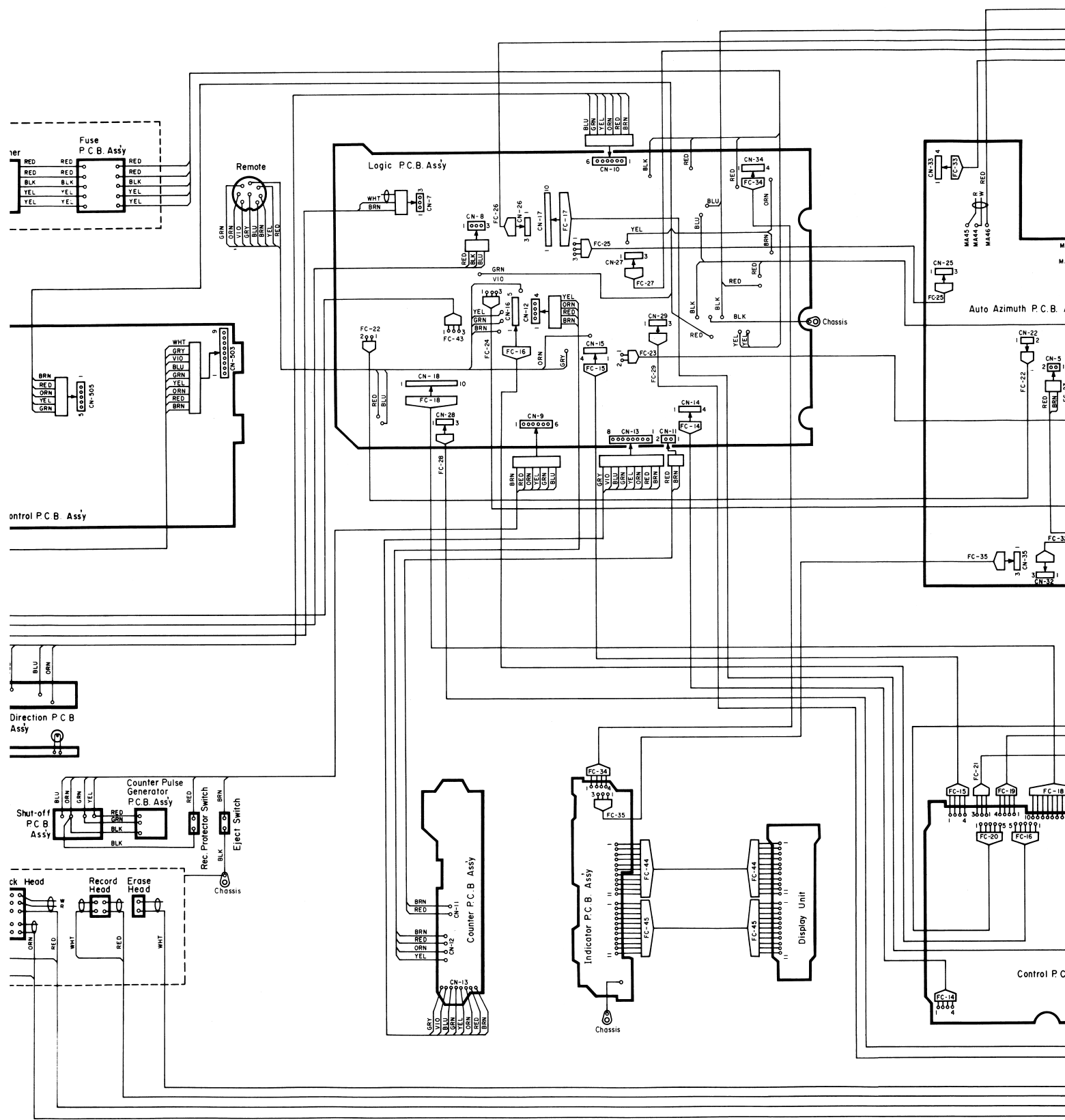


Fig. 8



## 9. TIMING CHART AND EQ. AMP. FREQUENCY RESPONSE

### 9.1. Overall Timing Chart

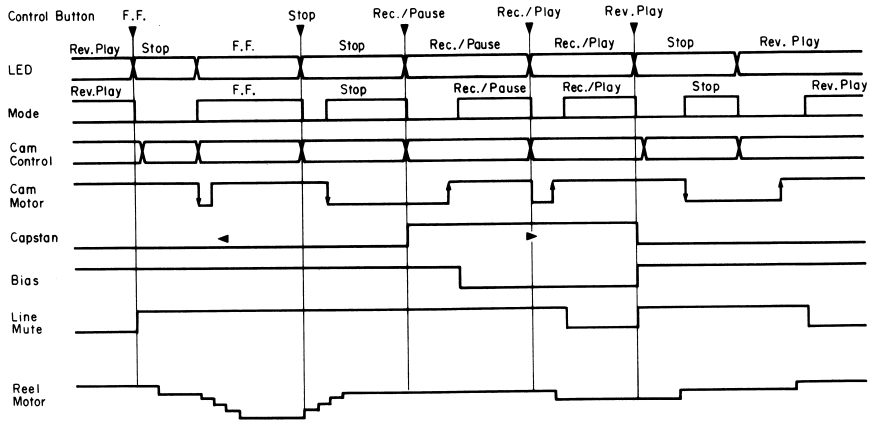


Fig. 9.1

### 9.2. Eq. Amp. Frequency Response

(1) Playback Frequency Response

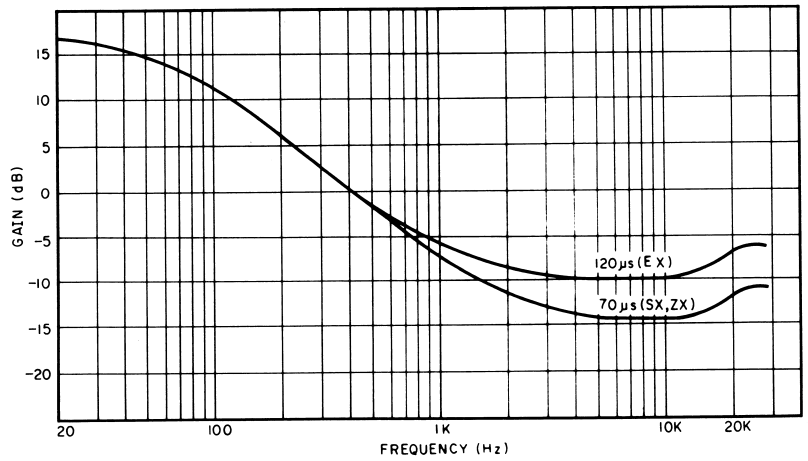


Fig. 9.2.1

(2) Record Current Frequency Response

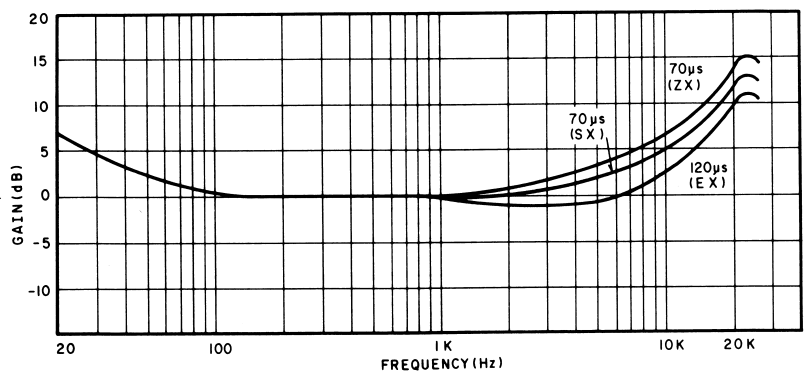
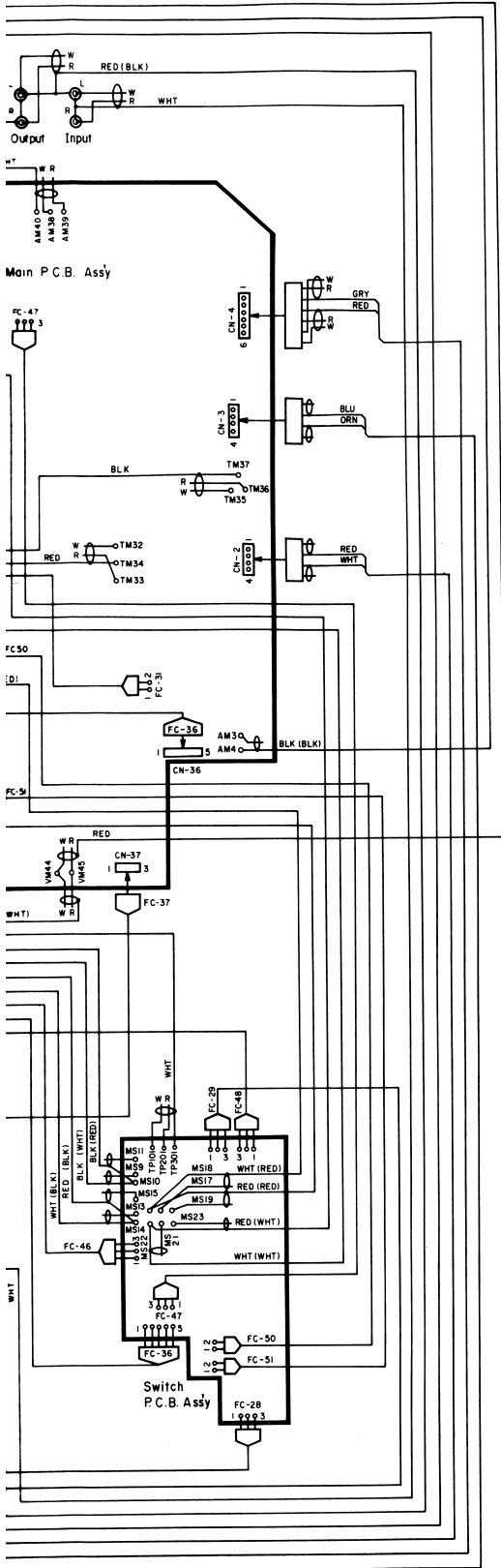


Fig. 9.2.2



# 10. BLOCK DIAGRAMS

## 10.1. Amplifier Section

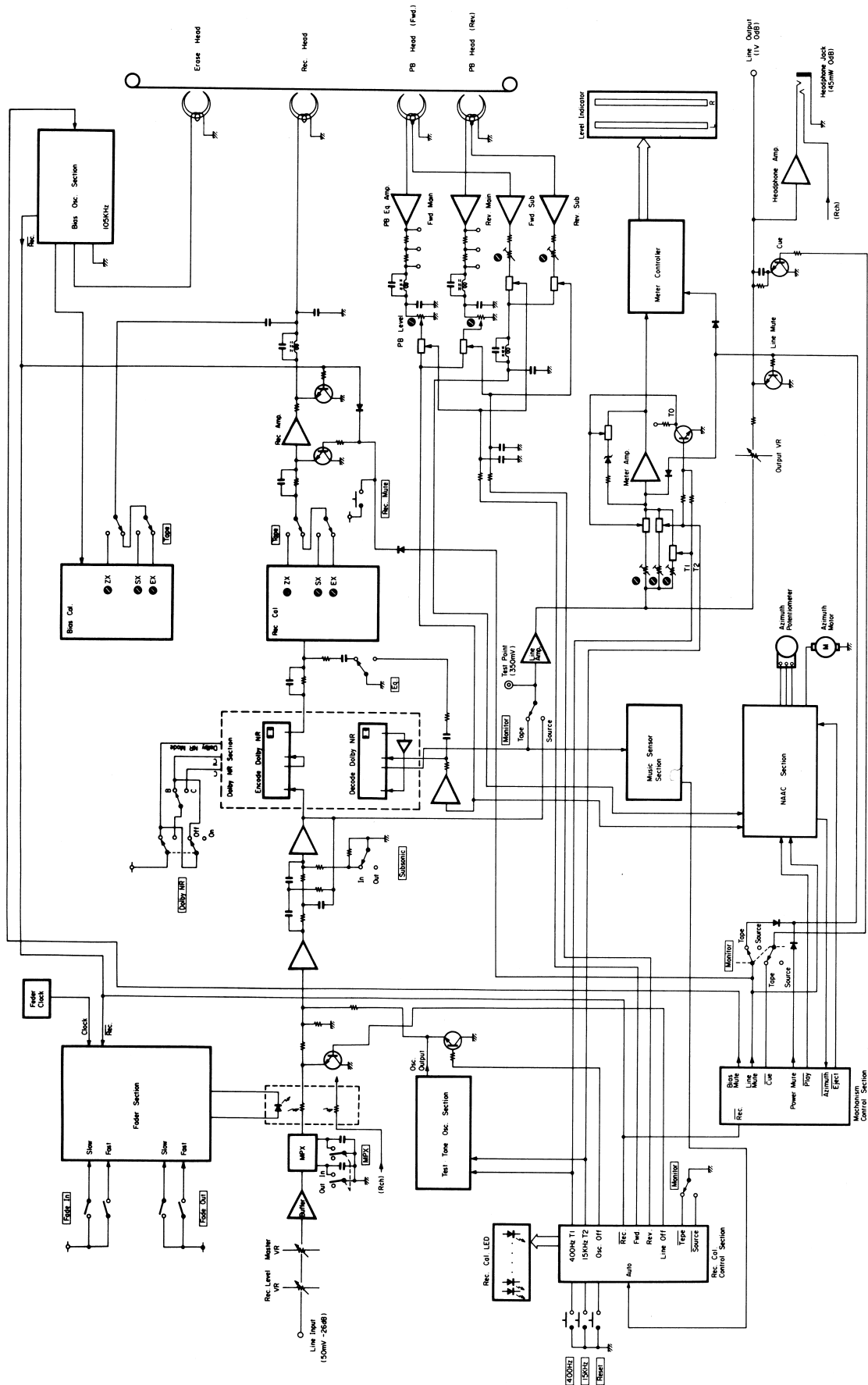


Fig. 10.1

10.2. Mechanism Control Section

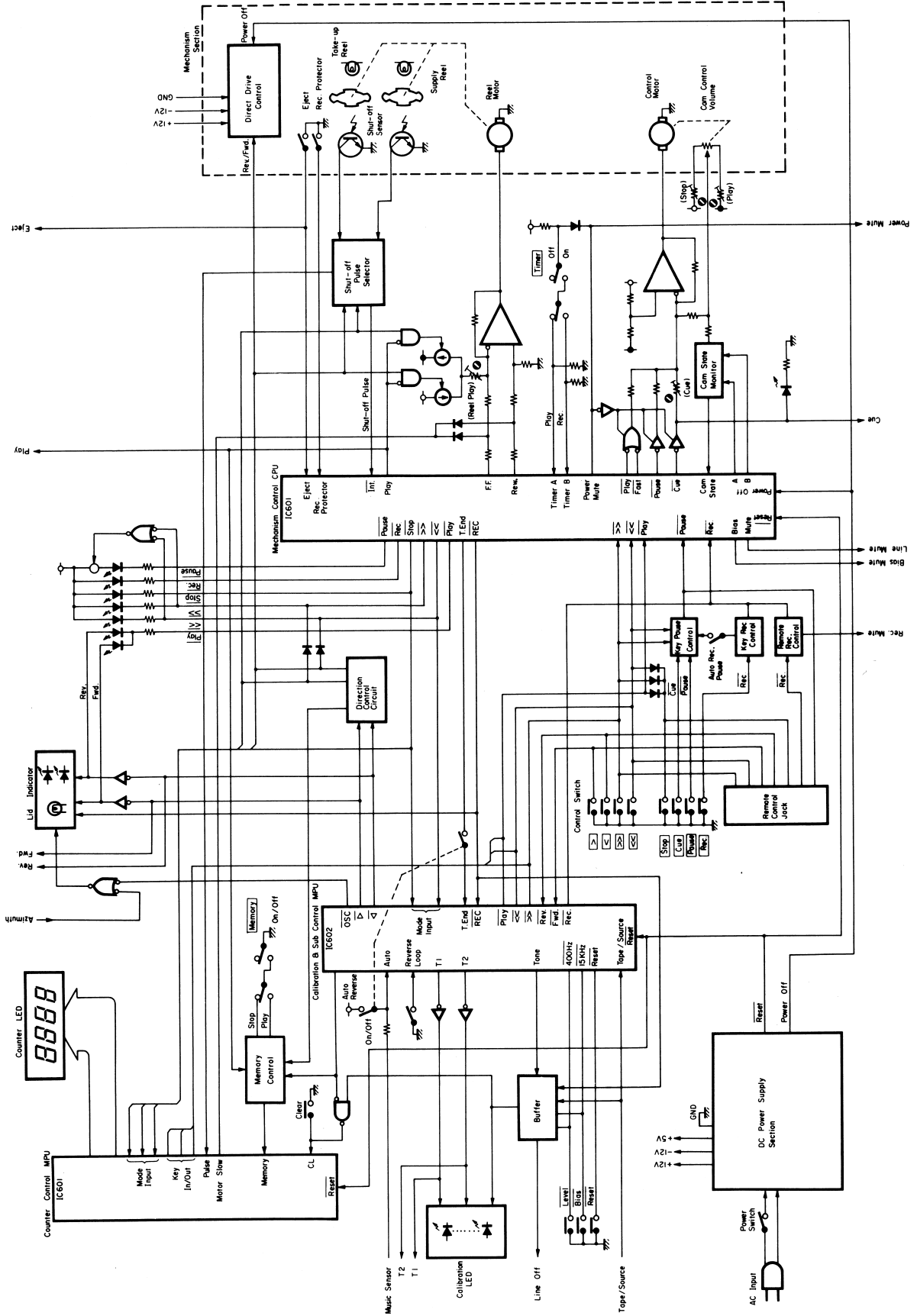


Fig. 10.2

## 11. SPECIFICATIONS

Track Configuration . . . . .	4 Tracks/2-Channel Stereo (Playback auto reverse)
Heads . . . . .	3 (Erase Head x 1, Record Head x 1, 4-Track, 4-Channel Playback Head x 1)
Motors . . . . .	<ul style="list-style-type: none"> <li>● TRANSPORT</li> <li>Quartz PLL DC, Brushless, Slotless, Coreless, Super Linear Torque D.D. Motor (Capstan Drive) x 2</li> <li>DC Motor (Reel Drive x 1)</li> <li>● AUTO AZIMUTH CORRECTION</li> <li>DC Motor x 1</li> <li>● MECHANISM</li> <li>DC Motor x 1</li> </ul>
Power Source . . . . .	100, 120, 120/220-240, 220 or 240 V AC; 50/60 Hz (According to country of sale)
Power Consumption . . . . .	45 W max.
Tape Speed . . . . .	1-7/8 ips (4.8 cm/sec.)
Wow and Flutter . . . . .	Less than 0.019% Wtd rms Less than 0.04% Wtd peak
Frequency Response . . . . .	20 Hz—22,000 Hz $\pm 3$ dB (recording level -20 dB, ZX Tape) 20 Hz—21,000 Hz $\pm 3$ dB (recording level -20 dB, SX, EXII Tape)
Signal to Noise Ratio . . . . .	<ul style="list-style-type: none"> <li>Dolby C-Type NR on <math>&lt;70 \mu s</math>, ZX Tape</li> <li>Better than 72 dB (400 Hz, 3% THD, IHF A-Wtd rms)</li> <li>Dolby B-Type NR on <math>&lt;70 \mu s</math>, ZX Tape</li> <li>Better than 66 dB (400 Hz, 3% THD, IHF A-Wtd rms)</li> </ul>
Total Harmonic Distortion . . . . .	Less than 0.8% (400 Hz, 0 dB, ZX Tape) Less than 1% (400 Hz, 0 dB, SX, EXII Tape)
Erasure . . . . .	Better than 60 dB (100 Hz, 0 dB)
Separation . . . . .	Better than 37 dB (1 kHz, 0 dB)
Crosstalk . . . . .	Better than 60 dB (1 kHz, 0 dB)
Bias Frequency . . . . .	105 kHz
Input (Line) . . . . .	50 mV, 50 k ohms
Output (Line) . . . . .	1 V (400 Hz, 0 dB, Output Level Control at max.) 2.2 k ohms
(Headphones) . . . . .	45 mV (400 Hz, 0 dB, output level control at max.) 8 ohms
BlackBox Series DC Output . . . . .	$\pm 10$ V, 125 mA max.
Dimensions . . . . .	450 (W) x 135 (H) x 300 (D) millimeters 17-3/4 (W) x 5-5/16 (H) x 11-13/16 (D) inches
Approximate Weight . . . . .	9.5 kg 21 lb.

- Specifications and appearance design are subject to change for further improvement without notice.
- Dolby NR under license from Dolby Laboratories Licensing Corporation.
- The word "DOLBY" and the Double-D-Symbol are trademarks of Dolby Laboratories Licensing Corporation.



# Service Manual

# Nakamichi DRAGON

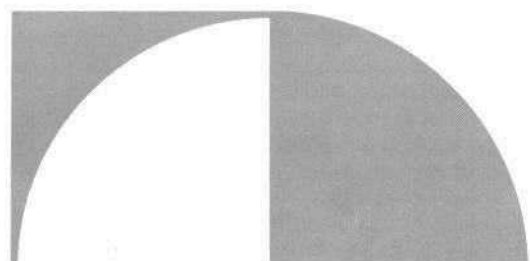
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Phone: (0423) 42-1111  
Telex: 2832610 (NAKAM J)  
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Phone: (516) 333-5440



# Nakamichi DRAGON

Auto Reverse Cassette Deck

Owner's Manual

Congratulations!

You have chosen a truly unique cassette deck. The Nakamichi DRAGON is a direct-drive, auto-reverse cassette deck incorporating the epoch-making "NAAC" system for automatic azimuth correction of the playback head.

Thanks to the NAAC system, sound quality differences between forward and reverse are completely eliminated, and perfect playback is possible under all conditions. Furthermore, manual calibration facilities for record sensitivity and bias permit high-precision adjustment to suit the requirements of every tape.


Please take the time to read this manual in its entirety to fully acquaint yourself with the various features of this cassette deck.

Thank you.


Nakamichi Corporation.


## CONTENTS

Safety Instructions.....	2
On Cassette Tapes.....	3
Precautions.....	3
Controls and Features.....	4
Connections.....	6
Special Features.....	6
Playback.....	8
Before Recording.....	9
Recording.....	12
Tips on Setting Record Levels.....	13
Dolby Noise Reduction System.....	13
Maintenance.....	14
Troubleshooting.....	15
Specifications.....	16




**CAUTION**  
RISK OF ELECTRIC  
SHOCK. DO NOT OPEN!





The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user of the presence of uninsulated "dangerous voltage" within the product's enclosure; that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user of the presence of important operating and maintenance (servicing) instructions, in the literature accompanying the appliance.

**CAUTION**

TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE COVER (OR BACK). NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

## WARNING

TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

Please record the Model Designation and Serial Number in the space provided below and retain these numbers.

Model Designation and Serial Number are located on the rear panel of the unit.

Model Designation: Nakamichi DRAGON

Serial Number: \_\_\_\_\_

## Safety Instructions

The following safety instructions have been included in compliance with safety standard regulations. Please read them carefully.

1. Read Instructions — All the safety and operating instructions should be read before the appliance is operated.
2. Retain instructions — The safety and operating instructions should be retained for future reference.
3. Heed Warnings — All warnings on the appliance and in the operating instructions should be adhered to.
4. Follow Instructions — All operating and use instructions should be followed.
5. Water and Moisture — The appliance should not be used near water — for example, near a bathtub, washbowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool, etc.
6. Carts and Stands — The appliance should be used only with a cart or stand that is recommended by the manufacturer.
7. Wall or Ceiling Mounting — The appliance should be mounted to a wall or ceiling only as recommended by the manufacturer.
8. Ventilation — The appliance should be situated so that its location or position does not interfere with its proper ventilation. For example, the appliance should not be situated on a bed, sofa, rug or similar surface that may block the ventilation openings; or placed in a built-in installation, such as a bookcase or cabinet that may impede the flow of air through the ventilation openings.
9. Heat — The appliance should be situated away from heat sources such as radiators, heat registers, stoves, or other appliances (including amplifiers) which produce heat.
10. Power Sources — The appliance should be connected to a power supply only of the type described in the operating instructions or as marked on the appliance.
11. Grounding or Polarization — Precautions should be taken so that the grounding or polarization means of an appliance is not defeated.
12. Power-Cord Protection — Power-supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon or against them, paying particular attention to cords at plugs, convenience receptacles, and the point where they exit from the appliance.
13. Cleaning — The appliance should be cleaned only as recommended by the manufacturer.
14. Nonuse Periods — The power cord of the appliance should be unplugged from the outlet when left unused for a long period of time.
15. Object and Liquid Entry — Care should be taken so that objects do not fall and liquids are not spilled into the enclosure through openings.
16. Damage Requiring Service — The appliance should be serviced by qualified service personnel when:
  - A. The power-supply cord or the plug has been damaged; or,
  - B. Objects have fallen, or liquid has been spilled into the appliance; or,
  - C. The appliance has been exposed to rain; or,
  - D. The appliance does not appear to operate normally or exhibits a marked change in performance; or,
  - E. The appliance has been dropped, or the enclosure damaged.
17. Servicing — The user should not attempt to service the appliance beyond that described in the operating instruction. All other servicing should be referred to qualified service personnel.

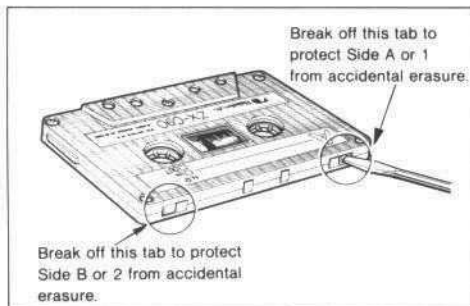
# On Cassette Tapes

## Precautions

1. C-120 cassettes (playing time one hour per side) contain extremely thin tape which breaks or snarls easily, is sometimes subject to stretching and also is of low sensitivity. Therefore, C-120 cassettes are not recommended for high-fidelity recording.
2. Do not pull out the tape from the cassette housing.
3. Be careful not to turn the cassette tape reels with the fingers, causing tape slackening.
4. Store cassette tapes away from heat, high humidity, dust and magnetic fields such as caused by speakers, TV sets etc.

## Cassette Tabs

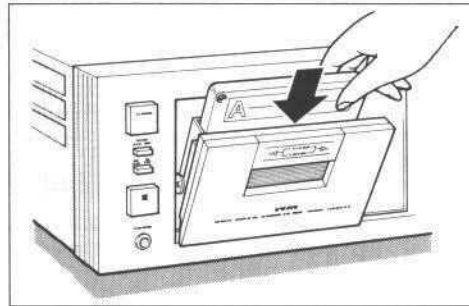
You can protect valuable recordings from accidental erasure and re-recording by completely removing the appropriate tab on the top edge of the cassette. The tab for each side is located on the top left-hand corner as you face the side. Use a small screwdriver, and push the tab down to break it off. Do not leave the broken tab in the recess. If you wish at a later date to record over a side for which the tab has been removed, cover the tab opening with a piece of adhesive tape.



## Insertion and Removal

### (1) Insertion of a Cassette

1. Push the eject button to open the cassette holder.
2. Load the cassette into the holder from the top. Make sure that the exposed tape is facing downward.
3. Close the cassette holder gently by pushing the holder back into the panel.



### (2) Removal of a Cassette

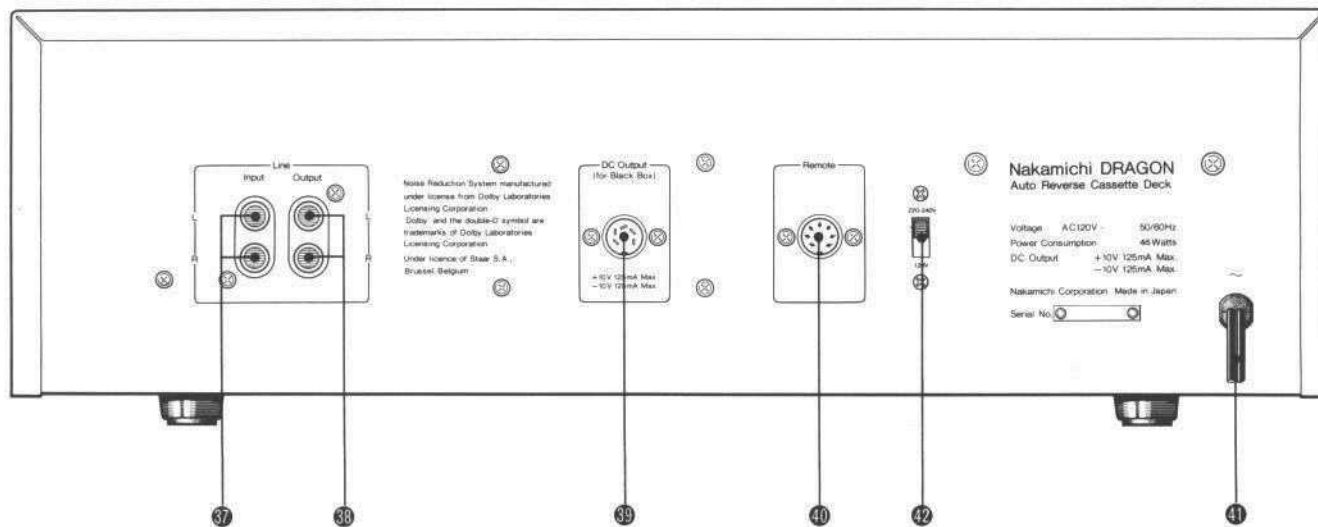
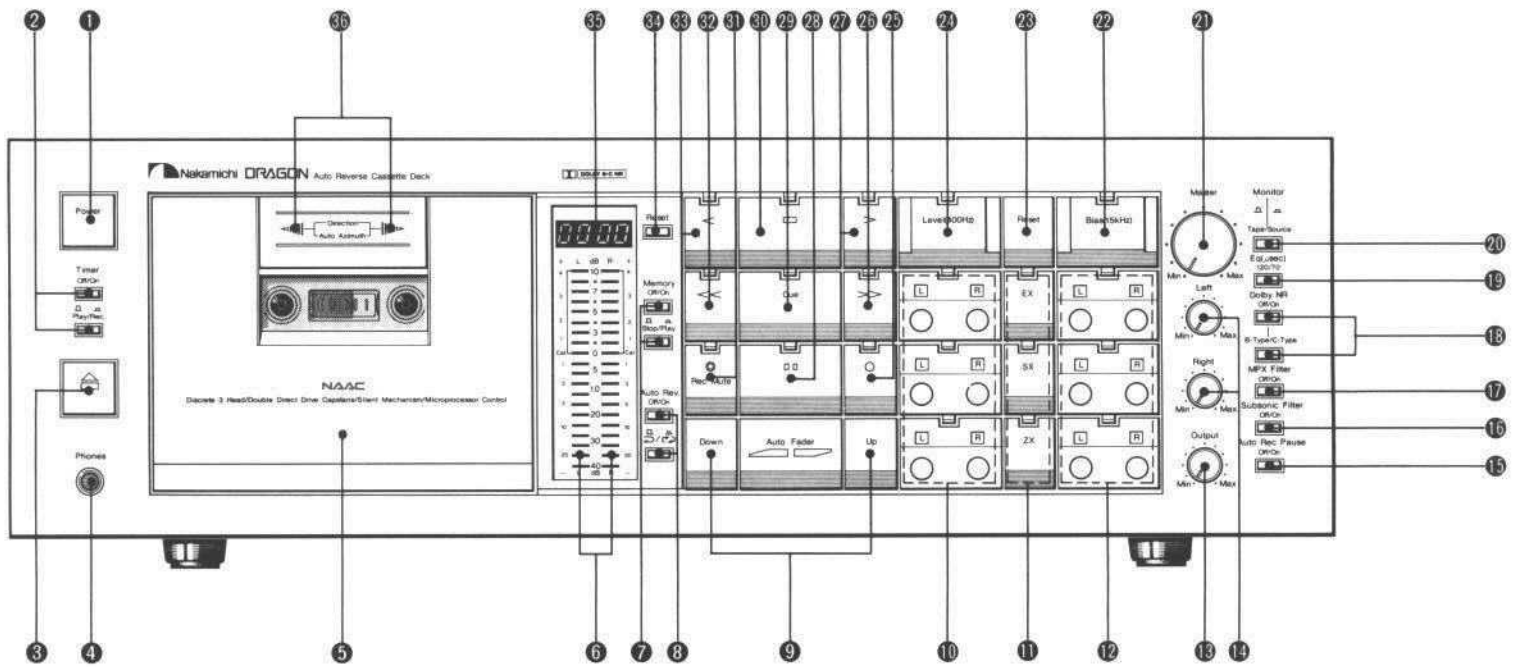
1. Push the stop button.
2. Push the eject button to open the cassette holder.
3. Remove the cassette.

---

## Precautions

1. Make sure that the timer switch is set to "Off" when the self-start feature is not desired.
2. This deck incorporates a special circuit designed to take up any loose tape inside the cassette. When a cassette tape is inserted, the right-hand spindle will make a few rotations. The right-hand spindle will also rotate and the tape counter will advance by a few digits if the cassette holder is closed without a cassette or the power to the deck is switched on. This behavior is normal and not a fault with the deck.
3. This deck incorporates a muting circuit to prevent the generation of transient noise when switching on the power. While the muting circuit is active, the stop button indicator flashes and the tape transport buttons are inoperative. When the timer function for recording or playback is used, the respective mode is entered after the muting interval (when the stop button indicator has stopped flashing).

# Controls and Features



## (1) Power Switch

Pressing this button activates the deck. Pressing it once more switches the power off. When the power is switched on, the stop button indicator etc. light up to indicate readiness for operation.

## (2) Timer Switches

In conjunction with an ordinary audio timer, timer recording or timer playback is possible. When the self-start feature is not to be used, the on/off switch must be set to "Off".

## (3) Eject Button

Depressing this button opens the cassette holder for insertion and removal of a cassette.

## (4) Headphone Jack

Accepts a standard stereophone plug. Headphones with an impedance of 8~150 ohms should be used.

## (5) Cassette Holder

The cover can be easily removed for routine cleaning of heads, etc. (→p. 14)

## (6) Peak Level Meters

Provide exact indication of peak levels in the range of -40 dB to +10 dB.

## (7) Memory Switches

When the on/off switch is set to "On" (  ) and the stop/play switch to "Stop" (  ), the tape is stopped at the tape counter indication "0000"

during fast-forward or fast-reverse. When the stop/play switch is set to "Play" (  ), playback starts from the "0000" indication during fast-forward or fast-reverse.

## (8) Auto Reverse Switches

With the auto reverse on/off switch and the reverse mode switch  /  , the desired operation mode for playback of one or both sides of a cassette is selected.

## (9) Auto Fader

By means of these controls, fade-in or fade-out during recording can be performed easily at the touch of a button. There is also a choice between two fading speeds. (→p. 6)



**(10) Sensitivity Controls**

Used to adjust the record sensitivity (record/playback level) for each tape selector position and for left and right channels separately. (→p. 10)

**(11) Tape Selector Buttons**

Used to select the EX, SX or ZX position. For Nakamichi EX and EX II tapes and other high-density LH tapes, push the "EX" button. For Nakamichi SX and SX II tapes and other chrome-position tapes, push the "SX" button. For Nakamichi ZX and other metal tapes, push the "ZX" button. The respective indicator lights up. (→p. 12)

**(12) Bias Controls**

Used to adjust the bias current for each tape selector position and for left and right channels separately. (→p. 10)

**(13) Output Level Control**

Controls the output level and the headphones listening level.

**(14) Input Level Controls (Left, Right)**

Used to adjust the input (record) level to the deck for left and right channel, as well as the left/right channel balance. Fade-in or fade-out can be performed with the auto fader. (→p. 6)

**(15) Auto Rec Pause Switch**

When this switch is set to "On", a blank space (no-signal condition) of more than 10 seconds during recording causes the deck to automatically enter the record/pause (recording stand-by) mode.

**(16) Subsonic Filter Switch**

Used to cut off harmful low-frequency noise such as turntable rumble etc. during recording from phonograph records. (→p. 8)

**(17) MPX Filter Switch**

Used to cut off the 19-kHz multiplex carrier signal from FM broadcasts, which could otherwise interfere with correct operation of the Dolby NR system. When not recording from FM broadcasts, this switch should be set to "Off". (→p. 8)

**(18) Dolby NR Switches**

Used to activate the Dolby NR system and select either the Dolby B-Type NR for a 10-dB improvement in mid/high-frequency S/N ratio, or the Dolby C-Type NR for a 20-dB improvement.

**(19) Eq Switch**

Used to select the proper equalization for each tape in recording and playback. Refer to the list on page 12.

**(20) Monitor Switch**

For playback of a tape, for off-the-tape monitoring during recording and for any calibration, set this switch to the "Tape" position. For record level setting etc., set the switch to the "Source" position.

**(21) Master Input Level Control**

Turn up the master input level control to a certain degree and adjust the left/right channel balance with the left and right input level controls. Then use the master input level controls for the final record level setting. Fade-in or fade-out can be performed with the auto fader. (→p. 6)

**(22) Bias Calibration Button**

Used when performing bias current calibration. (→p. 10)

**(23) Calibration Reset Button**

Used to release the calibration mode after calibration of record sensitivity and bias current is completed. (→p. 10)

**(24) Level Calibration Button**

Used when performing calibration of record sensitivity (record/playback level). (→p. 10)

**(25) Record Button**

Used for recording. During recording, the indicator above the button lights up.

**(26) Fast-Forward Button**

Press the button for rapid tape winding in the forward direction. During operation, the indicator above the button lights up.

**(27) Forward Play Button**

Used to start playback in the forward direction or recording. During operation, the indicator above the button lights up.

**(28) Pause Button**

Used for short-term interruption of the tape transport in recording or playback and also to initiate the recording or playback stand-by mode. During operation, the indicator above the button lights up.

**(29) Cueing Button**

Used for tape cueing to easily find a desired spot on the tape. During operation, the indicator above the button lights up. (→p. 7)

**(30) Stop Button**

Used to completely stop the tape transport from any mode. During operation, the indicator above the button lights up.

**(31) Rec Mute Button**

By depressing this button during recording, the input signal can be temporarily cut off. During operation, the indicator above the button lights up.

**(32) Fast-Reverse Button**

For rapid tape winding in the reverse direction. During operation, the indicator above the button lights up.

**(33) Reverse Play Button**

Used to start playback in the reverse direction.

**(34) Tape Counter Reset Button**

Pressing this button returns the tape counter indication to "0000".

**(35) Tape Counter**

Indicates the relative tape position at any given time and can be used to index the tape, etc. The indicators count from "0000" to "9999" in the record, forward playback and fast-forward modes ("plus count") and to "-999" in the reverse playback and fast-reverse modes ("-minus count").

**(36) Direction Indicators**

Show the direction of normal-speed tape travel. In reverse or forward playback the left or right indicator lights up in green color, and in recording (forward direction only) the right indicator lights up in red. During automatic correction of playback head azimuth, the indicator is flashing.

**(37) Line Input Jacks (Left and Right Channel)****(38) Output Jacks (Left and Right Channel)****(39) DC Output Jack (For Nakamichi BlackBox Series Only)**

Provides a DC voltage to power optional components from Nakamichi's BlackBox series (such as the MX-100 Microphone Mixer, etc.). The maximum capacity of this outlet is 125 mA. Make sure that components connected to this jack do not exceed 125 mA in total current consumption.

**(40) Remote Control Jack**

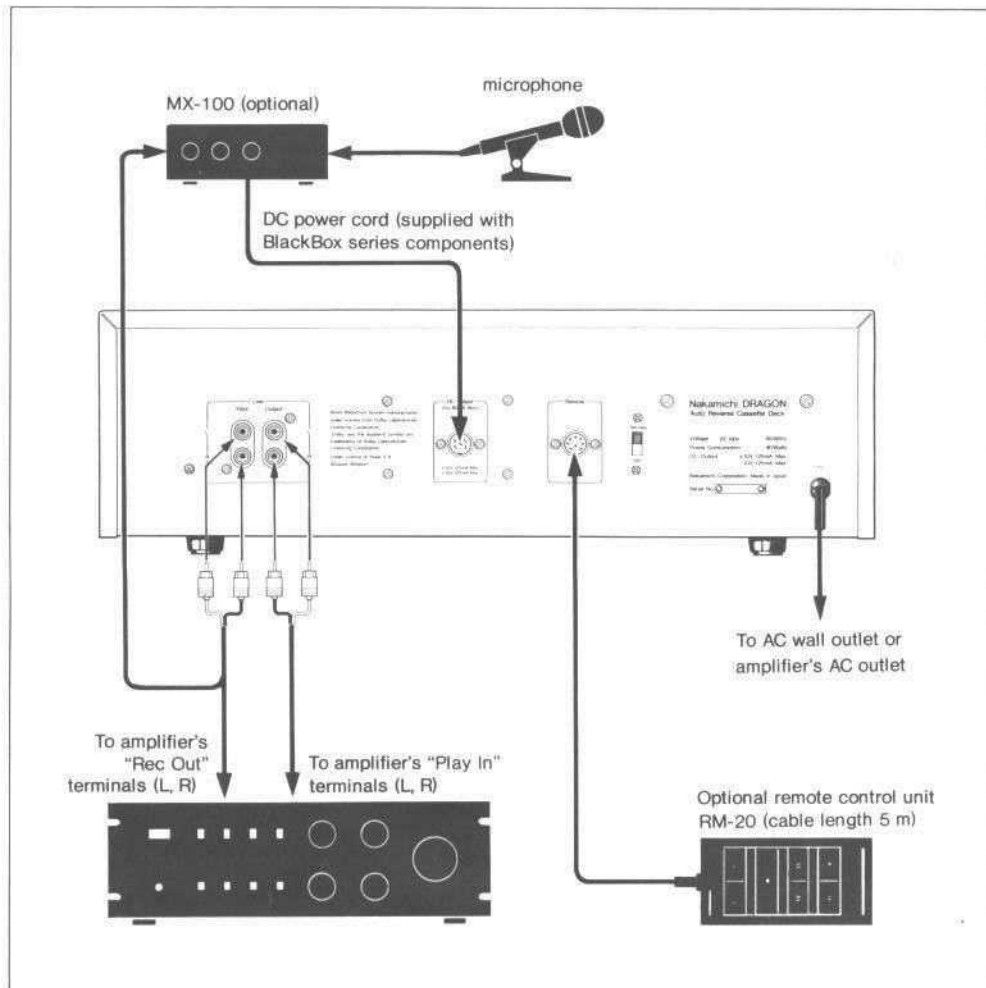
Accepts the respective plug of the optional remote control unit to control tape operation from a distance.

**(41) Power Cord****(42) Voltage Selector**

AC voltage is factory set for the country in which you purchased your cassette deck. The voltage selector permits re-setting of mains voltage in case the deck is to be used in a different country.

**Note:** Safety regulations in certain countries prohibit inclusion of a voltage selector. This feature, therefore, may be absent from your deck.

# Connections



### Amplifier Connection

After checking the instructions for your amplifier or receiver, use the shielded cables with RCA plugs (provided with the deck) to make secure connections as shown in the chart. Be careful not to mix up left and right channels. While making connections, the power to the deck and to the amplifier should be switched off.

### Remote Control

The optional remote control unit RM-20 permits operation of the deck's tape transport functions from any convenient location.

### Microphones

As this deck possesses only line input facilities, direct connection of microphones is not possible. When microphones are to be used, a separate microphone amplifier, such as the optionally available MX-100 Microphone Mixer from Nakamichi's BlackBox series, is required. The MX-100 is a simple and easy-to-use microphone mixer providing three inputs (left, right and center "blend") which can be mixed freely.

As this deck provides a DC output jack on the rear panel to power components from the BlackBox series, the power supply unit (PS-100) is not required.

- The DC output jack is designed for use with components from Nakamichi's BlackBox series only. Do not connect any other units to this jack. As the maximum capacity of this outlet is 125 mA, be careful that the total rated current consumption of components connected to this jack does not exceed 125 mA. If you wish to operate multiple BlackBox components which exceed 125 mA in total current consumption, a PS-100 Power Supply unit (rated capacity 200 mA) must be used.

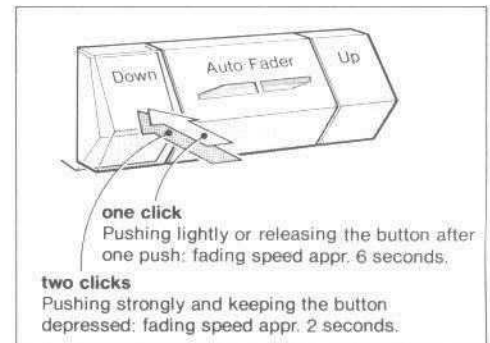
Power Consumption of BlackBox Components

BlackBox Component	Current Rating
MX-100 Microphone Mixer	50 mA
EC-100 Electronic Crossover	100 mA

# Special Features

## 1. Auto Fader Control

This feature permits smooth and easy fades during recording simply by pressing a button. Fade-in is performed by pressing the "Up" button, and fade-out by pressing the "Down" button. You can choose between two fading speeds: Depressing the button strongly (two clicking sounds of the switch) and keeping it depressed causes the fading process to be performed in about 2 seconds. Depressing the button lightly (one clicking sound of the switch) or releasing the button after one push causes the fading process to be performed in about 6 seconds.



The respective fading mode is indicated by the relative brightness of the auto fader indicators. In ordinary music recording, slow-speed fading may be more desirable, while high-speed fading can be used effectively for example to eliminate noise when the cartridge is lowered onto a record, etc.

### Note:

- The operation of the auto fader can be changed from "Up" to "Down" or from "Down" to "Up", but it cannot be stopped midway.
- The auto fader is operative only in the record and record stand-by modes. In other modes, the setting is automatically "Up".

## 2. Auto Rec Pause

If the auto rec pause switch is set to "On", this feature causes the deck to automatically enter the record/pause (record stand-by) mode, thereby stopping the tape motion, when during recording a no-signal condition of more than 10 seconds is encountered.

This feature is useful for example when dubbing an LP record onto one side of a C-90 cassette. After one side of the LP is fully played, the deck automatically enters the record/pause mode. The need to constantly supervise the recording or otherwise to rewind the tape and search for the precise and location is eliminated. To re-start the recording, press the forward play button.

## 3. Rec Mute

This feature is used to temporarily cut off the input signal during recording. When the rec



mute button is depressed, the input signal is muted for as long as the button is kept depressed, and a blank portion is recorded on the tape. During this operation, the indicator above the button lights up. If the rec mute operation is performed with the auto rec pause switch set to "On", the deck automatically goes into the record/pause mode after appr. 10 seconds. However, this does not apply if the rec mute function is activated via the remote control unit RM-20.

When the monitor switch is set to "Source", the line and headphone output is not muted. This deck's rec mute indicator is set to display the condition when the recording signal current is cut off. Therefore the indicator lights up not only during rec mute operation, but also for example in the record/pause mode.

When entering the record mode from the stop mode, the rec mute indicator lights up for an instant, because the muting is activated until the heads touch the tape.

#### 4. Cueing

Monitoring the high-pitched sounds from the tape while it is being fast-wound is called cueing. This can be used to locate the beginning of a musical selection, etc.

##### ■ Operation

When the cueing button is depressed in the fast-forward or fast-reverse mode (respective indicator lit), the head assembly is moved closer to the tape and winding speed is reduced to one-third, letting you hear the recorded signals from the tape. When you approach the desired spot on the tape, you can further reduce winding speed to approximately one-sixth by pressing and holding the fast-forward or fast-reverse button. If you have

moved the tape too far in one direction, you can change the direction of tape travel while remaining in the cueing mode simply by pressing the opposite fast-winding button. Pressing both fast-winding buttons simultaneously will stop the tape with the deck remaining in the cueing mode. (At this time, the pause button indicator lights up.) If you release both buttons simultaneously, the deck goes into the pause mode, and playback can be started easily from this point by pressing the desired play button. The cueing mode can be released by pressing the stop button.

- Cueing can be performed only for the direction shown by the direction indicators.

#### 5. Punch-In Recording

This feature serves to directly enter the record mode from the forward playback mode without stopping the tape. It can be used to immediately start a recording from playback or later insert another recording source on silent passages left in previous recording, etc. Also, with this deck the record/pause mode can be entered directly from the pause mode without using the stop button.

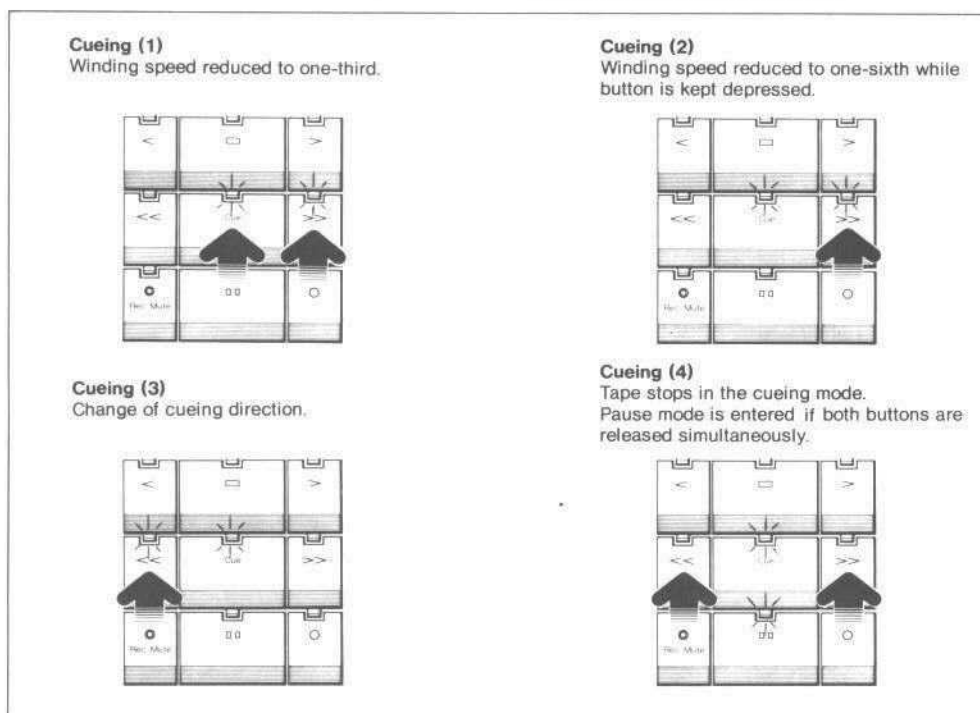
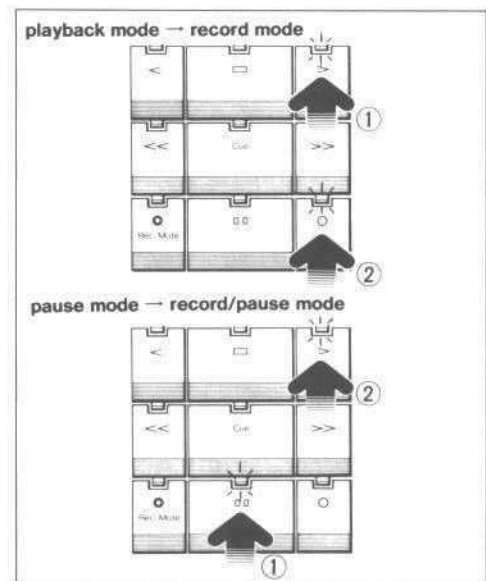
##### ■ Operation

In the forward play mode, while depressing the forward play button, press the record button. In addition to the forward play button indicator, the record button indicator lights up and recording starts without the tape motion being interrupted.

To enter the record/pause mode from the pause mode, press the record button while keeping the pause button depressed. The record button indicator flashes for about 2 seconds and then lights up continuously to indicate the record/pause mode.

#### Note:

- If the tabs on the rear of the cassette are removed, it is not possible to enter the record mode.
- For punch-in recording, always press the forward play button or the pause button before you press the record button. If the record button is pressed first, the operation cannot be performed.
- If during reverse playback the record button is pressed while keeping the reverse play button depressed, the tape motion stops.

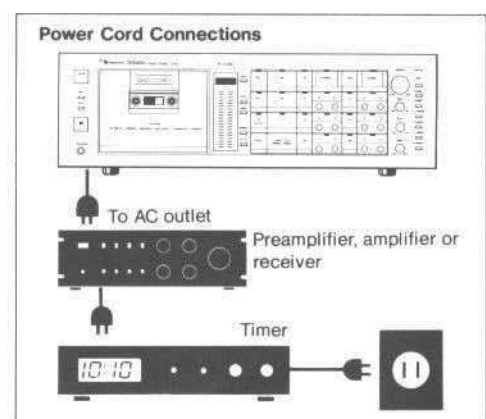


#### 6. Timer Recording or Playback

This deck incorporates a self-start feature which enables you to make unattended recordings or start playback at a pre-selected time with the use of a timer. Recording is possible in the forward direction only, and playback can be set to forward direction only or auto-reverse playback, starting with the forward direction.

##### ■ Operation

- (1) Make connections as shown in the chart.



# Playback

- (2) Insert the tape for recording or playback and turn on the power to all components.
- (3) For timer recording, set the recording level to suit the expected input signal. For timer playback, set the output control to the desired level and confirm that the auto reverse switches are set to the desired position. Check if all components are set up properly.
- (4) Set the timer switches as follows:

	Timer On/Off	Auto Play/Rec
for timer playback		
for timer recording		

- (5) Adjust the timer to the desired starting time.
- (6) At the pre-selected time, the timer will supply power to the components, and the deck will start recording or playing.
  - When the timer recording or playback feature is not to be used, be sure to set the timer on/off switch (upper switch) to the "Off" position.

## 7. Subsonic Filter and MPX Filter

### (1) Subsonic Filter

If subsonic noise produced by turntable rumble, tonearm resonances etc. when playing phonograph records is recorded on the tape deck, the playback signal may become modulated, which will be heard as sound fluctuations similar to flutter effects. The subsonic filter serves to cut off these harmful noise elements in the subsonic frequency range. If necessary, set the subsonic filter switch to "On" when recording from phonograph records.

### (2) MPX Filter

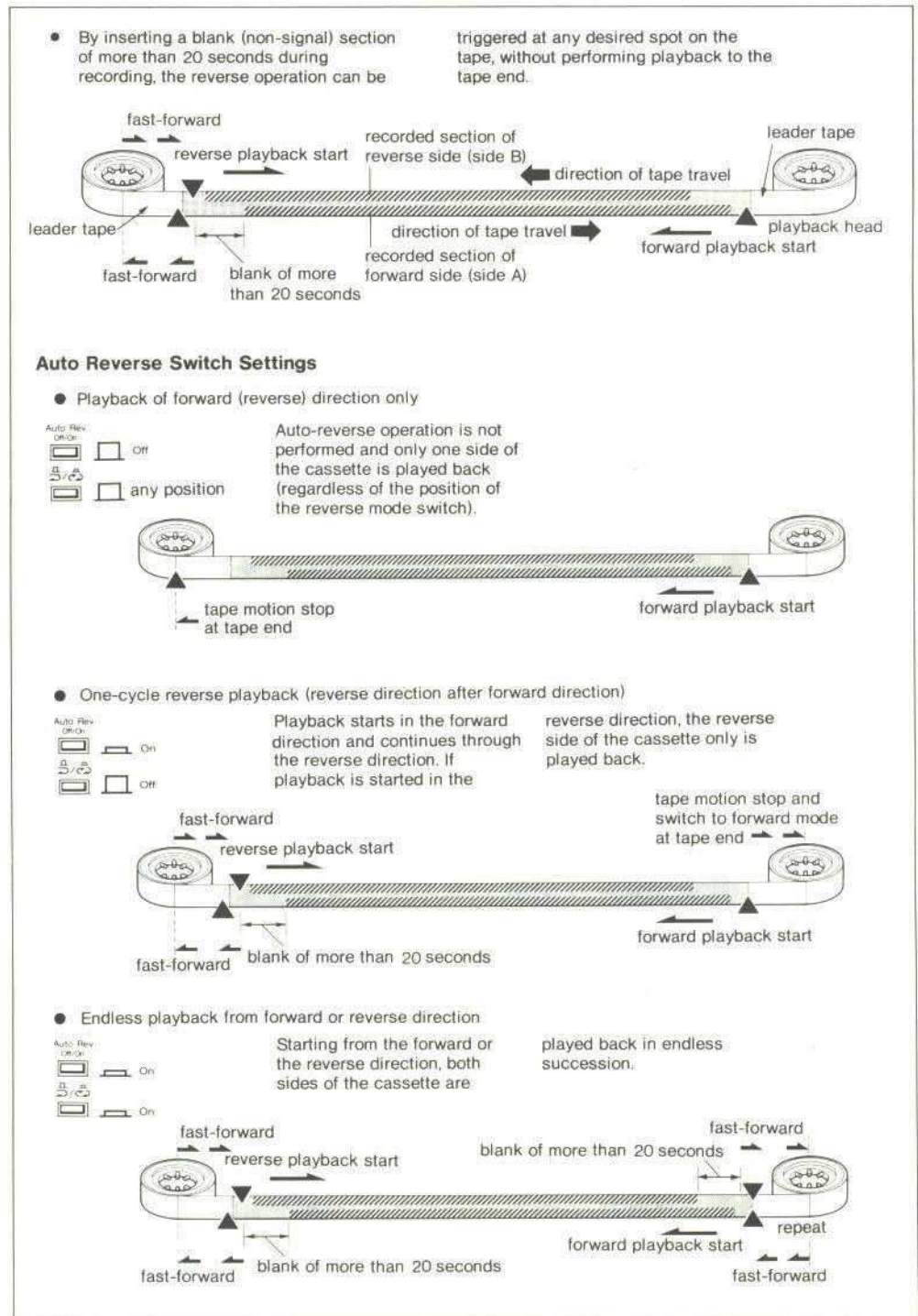
The 19-kHz multiplex carrier signal can cause erroneous operation of the Dolby NR circuits when recording from FM broadcasts. The MPX filter serves to cut off any remains of this carrier signal. Setting the MPX filter switch to "On" activates the filter. When recording from other program sources except FM broadcasts, the switch should be set to "Off".

## The Playback Auto-Reverse System

This cassette deck incorporates a playback auto-reverse system which permits automatic playback direction reversal from side A to side B or vice versa, simply by setting the auto reverse switches to the desired position. The need to remove the cassette and turn it over at the end of one side is completely eliminated. Automatic playback of side B after side A, and also endless playback of both sides is possible. The unique reverse system of this cassette deck operates as follows: If during playback of

side A (B), a blank section (recorded level below  $-30$  dB) of more than 20 seconds is detected, the tape is automatically fast-forwarded to the end of the side, there directions are reversed and the tape is again fast-forwarded for the presumed interval of the leader tape section. Playback then starts at the beginning of the magnetic tape section of side B (A).

- If a low-level recorded section of less than  $-30$  dB continues for more than 20 seconds, the reverse operation will be triggered even during playback of a musical selection.



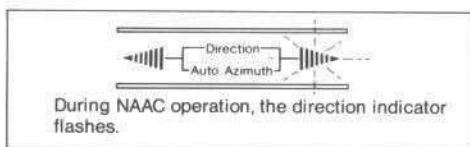


## NAAC (Nakamichi Auto Azimuth Correction) System

In order to ensure perfect performance of the auto-reverse feature, this deck incorporates a revolutionary system called NAAC for automatic correction of the playback head azimuth. When playing back a tape, slight differences in tape travel characteristics between sides A and B would lead to azimuth losses (due to misalignment of the head vs. the tape). The NAAC system automatically corrects azimuth misalignment and maintains proper playback head azimuth at all times. Thereby the difference in sound quality between playback of side A and side B, which tended to be a problem in auto-reverse systems, has been completely eliminated.

Playback head azimuth is constantly controlled in the forward and reverse playback modes as well as in the forward recording mode. When automatic correction is being performed, the respective direction indicator flashes as a visual indication.

- The NAAC system operates with musical signals above 3 kHz recorded on the tape. If a tape with music containing only little energy in this range is used, the direction indicator may sometimes flash and the adjustment will require more time.
- After a cassette tape was ejected or after reversal of playback direction, the playback head is set to the standard azimuth position (ordinary azimuth angle). If a tape with little azimuth misalignment is used in this condition, the NAAC system may not be activated.



### Playback Operation

- (1) Confirm that the timer switch is set to "Off", then turn on the power to the deck by depressing the power switch.
- (2) Open the cassette holder by depressing the eject button.
- (3) Insert the cassette into the holder. Push the cassette holder back until it locks into the panel.
- (4) Set the monitor switch to "Tape".
- (5) Set the Eq switch to 120  $\mu$ s or 70  $\mu$ s, according to the tape used. (→p.12)
- (6) For playback of a tape which was recorded with the Dolby NR system, set the Dolby NR on/off switch to "On" and select the required system with the B-Type/C-Type switch.  
For playback of a tape which was recorded without the Dolby NR system, set the Dolby NR on/off switch to "Off".

	Dolby NR OFF/On	B-Type/C-Type
Playback with Dolby B-Type NR		
Playback with Dolby C-Type NR		
Playback without Dolby NR		any position

- (7) Select the desired auto-reverse operation with the auto reverse switches. (Refer to "The Playback Auto-Reverse System".)
- (8) To start playback from side A of the tape, press the forward play button. To start playback from side B, press the reverse play button.
- (9) Adjust the output level control to the desired level.

## Before Recording

Be sure to read this paragraph and perform the respective adjustments before starting to record.

There are many brands of cassette tapes, which can be generally classified into three types: chrome-equivalent tapes, normal tapes (ferric-oxide formulations) and metal tapes. Tapes from the list on page 12 can be used with this deck simply by setting the tape selector buttons and the Eq switch to the appropriate positions. However, even with tapes of the same general type, there are certain individual differences. In order to perfectly match the deck to the tape and extract full performance, this deck provides manual adjustment facilities for record sensitivity (record/play level) and bias current. The manual adjustment process is aided by a microprocessor, which makes for swift and simple operation.

### Order and Procedure of Calibration

#### 1. Order of Calibration

The manual calibration is to be performed in the following order:

##### (1) Record/Play Level Calibration

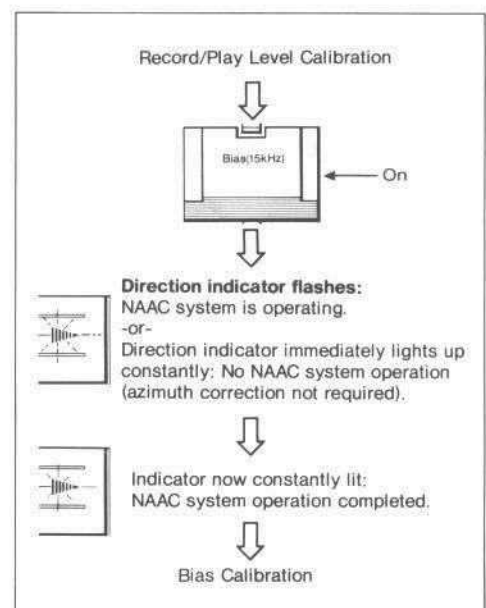


##### (2) Bias Calibration

For the bias calibration, correct playback head azimuth is of great importance. Therefore, if an azimuth correction is required, the NAAC system automatically goes into operation

- (10) For short-term interruption of playback, press the pause button. To resume playback, press the respective play button again.
  - With this deck, you can change from any transport mode into any other, i.e. from forward playback to reverse playback, from forward or reverse playback to fast-forward, etc. without having to use the stop button.
  - While the tape is in motion or in the pause mode, the eject button is inoperative and the cassette holder does not open even if the button is pressed. While the cassette holder is open, all tape control buttons are inoperative.
  - During playback, this deck's peak level meters display the level recorded on the tape. Readings are not affected by turning the output level control.

immediately after the bias calibration button is pushed. During the adjustment process of the playback head azimuth, the direction indicator flashes. Start the bias calibration only after the indicator has stopped flashing and is lit constantly. If no azimuth correction is required, the direction indicator is lit constantly from the beginning.



## Manual Calibration Procedure

- (1) Confirm that the timer switch is set to "Off", then turn on the power to the deck by depressing the power switch.
- (2) Insert the cassette to be used for recording.
- (3) Set the Dolby NR switch to "Off" and select the appropriate positions of the tape selector buttons and the Eq switch for the tape in use.
- (4) While keeping the record button depressed, push the pause button to put the deck into the record stand-by (record/pause) mode.
- (5) Set the monitor switch to "Tape".
- (6) Press the level calibration button. The indicator above the button lights up and the deck automatically goes from record stand-by into the record mode. Simultaneously, the tape counter is automatically reset to "0000".

After the tape motion has started, the indicator of the sensitivity controls corresponding to the selected tape position lights up, and the peak level meters display the record/playback level of the 400 Hz (0 dB) test tone.

- (7) If the meter indication is higher than the "Cal." point on the outer scale of the peak level meters, turn the corresponding sensitivity control counterclockwise, and if meter indication is lower, turn it clockwise until the meter reading is at the "Cal." marking for both left and right channels.
- (8) Next, bias calibration is to be performed. After completion of level calibration as described in the preceding paragraph, but with the tape still running in the record mode, press the bias calibration button. The indicator above the button and the indicator

### 1. Level Calibration

This calibration corrects different levels in recording and playback which are due to sensitivity differences of various tapes. If level differences remain uncorrected, they can cause malfunction of the noise reduction system and degrade sound quality. Therefore this calibration should be performed when changing to a cassette of another brand even if it is to be used at the same tape selector position (for example changing from the normal-position Nakamichi EX to EX II, etc.). If exactly the same brand of cassette is used continuously, repeated calibration is not imperative, but a quick check is recommended. The calibration is performed using the built-in test tone of 400 Hz (0 dB).

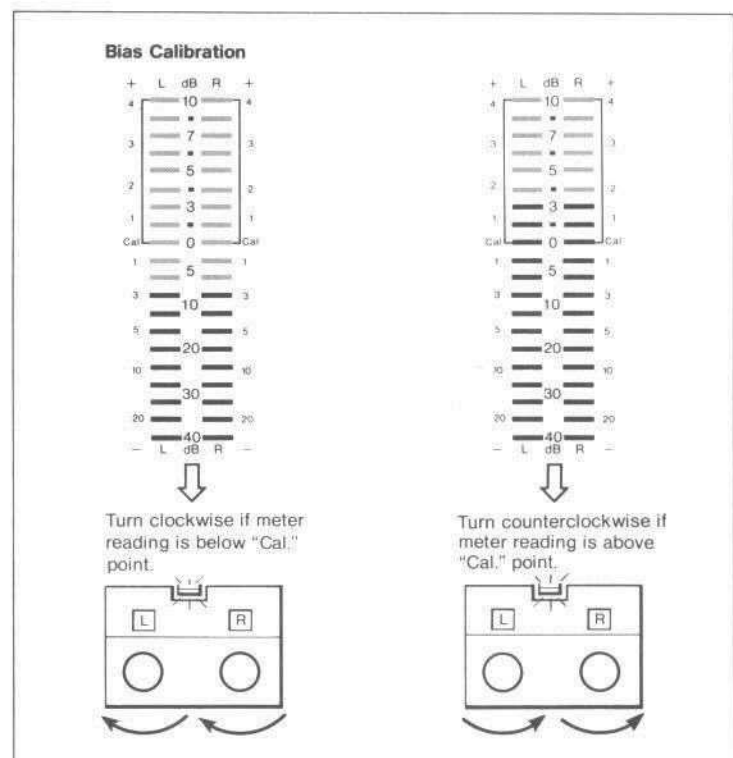
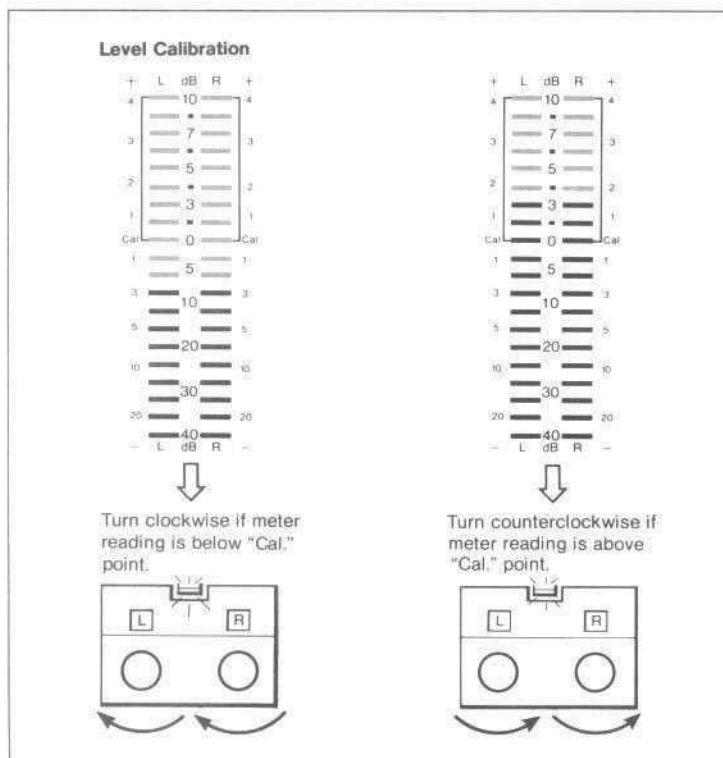
of the bias controls corresponding to the selected tape position light up. The peak level meters display the record/play level of the 15 kHz (-20 dB) test tone with increased sensitivity.

- If correction of playback head azimuth by the NAAC system is being performed, the direction indicator flashes. Confirm that the indicator has stopped flashing and is constantly lit before proceeding to the next step. If no azimuth correction is required, the NAAC system does not operate and the direction indicator is lit constantly from the beginning.

### 2. Bias Calibration

Bias is an inaudible high-frequency current used in the recording process. When bias is increased, distortion decreases but high-frequency response declines. On the opposite, when bias is decreased, distortion rises but high-frequency response improves. By means of the tape selector buttons, the appropriate bias range for normal, chrome-equivalent or metal tapes is chosen, and the bias controls permit fine adjustment. As the bias requirements differ for various brands of cassettes and even tapes of the same brand may have slightly different bias requirements, a bias check and adjustment should be performed every time a new cassette is used for recording. The calibration is performed using the built-in test tone of 15 kHz (-20 dB).

- (9) If the meter indication is higher than the "Cal." point on the outer scale of the peak level meters, turn the corresponding bias control counterclockwise, and if meter indication is lower, turn it clockwise until the meter reading is at the "Cal." marking for both left and right channels.
- (10) Press the calibration reset button to terminate the calibration process. The record mode is released, the tape stops and then is automatically rewound to the starting point of calibration (tape counter indication "0000"). The manual calibration procedure is now completed.



### ■ Ordinary Calibration Cannot Be Performed

If for some reason the settings of the bias and sensitivity controls were greatly disturbed, correct bias adjustment may not be possible. This is due to the fact that the recorded test tone level is too low, which prevents the NAAC system from properly adjusting the azimuth. In such a case, first perform a rough adjustment of level and bias before proceeding to the ordinary manual calibration.

### ■ Rough Adjustment

- (1) Confirm that the correct tape selector button for the tape in use is pushed.
- (2) Turn the bias controls corresponding to the selected tape position fully counterclockwise (maximum bias).
- (3) Turn the sensitivity controls corresponding to the selected tape position fully clockwise.
- (4) Press the level calibration button and adjust the sensitivity controls for a peak level meter reading of  $-1$  to  $0$  dB for both channels.
- (5) Press the bias calibration button. If the NAAC system is operating, wait until the direction indicator has stopped flashing and is lit constantly. Then adjust the bias controls so that the peak level meter indication is at the "Cal." point for both channels.

This completes the rough level and bias adjustment. Now perform the regular manual calibration.

### Use of the Test Tone

The built-in test tone can be used not only for record/playback level and bias calibration, but also for level calibration with other audio components, etc.

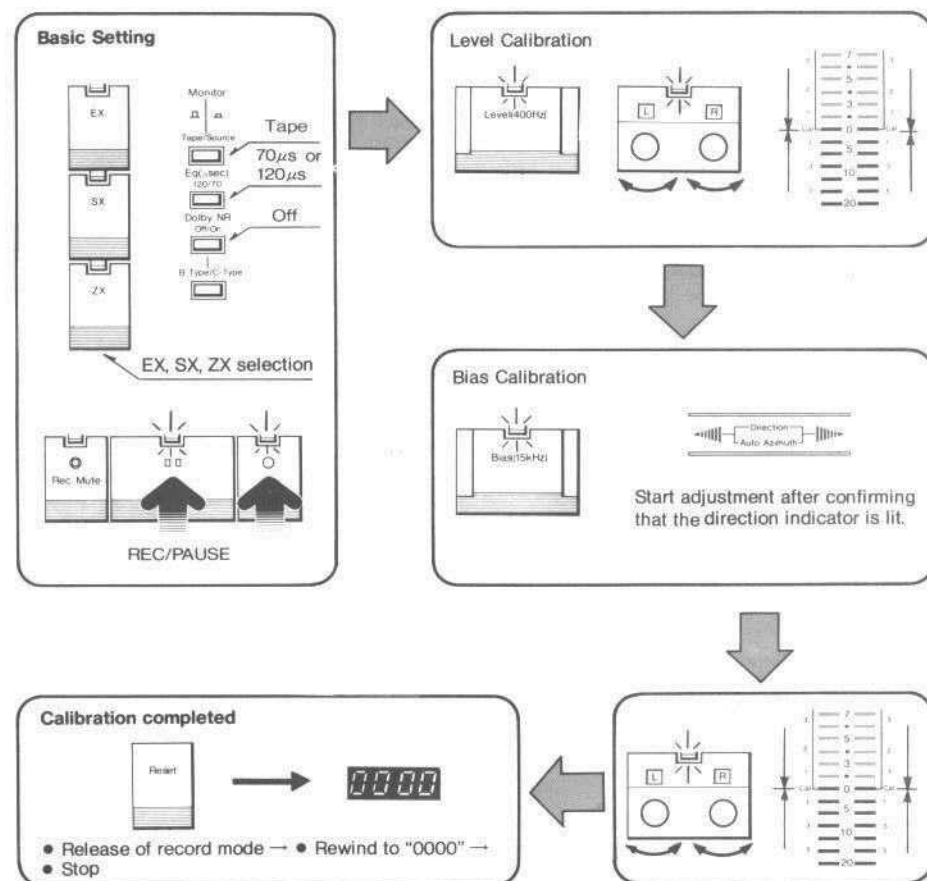
### ■ Operation

- Turn the output level control to maximum and set the monitor switch to "Source".
  - For use of the 400 Hz (0 dB) test tone, press the level calibration button. For use of the 15 kHz ( $-20$  dB) test tone, press the level calibration button and then the bias calibration button. The respective test tone is now fed out from the output jacks and is also displayed on the deck's peak level meters. (The 15 kHz test tone is produced and fed out at  $-20$  dB, but it is displayed on the meters with increased sensitivity.)
- To switch off the test tone, press the calibration reset button.

### Some Precautions on Calibration

1. Bias calibration and level calibration are performed with the test tone being recorded and the results being displayed on the peak level meters in the "Tape" position of the monitor switch. If the switch is set to "Source" or in other modes (playback), the test tone is not displayed.
2. If a low-quality tape is used, the high-frequency output may not increase even if the bias current is decreased (the bias controls are turned clockwise). Rather, in such a case, distortion only will increase. Therefore it is highly recommended that you use tapes from the list on page 12.
3. During use of the test tone, you should turn down the volume control on your amplifier, because excessive high-frequency levels can cause damage to your speakers.
4. During calibration or use of the test tone, the line input is automatically cut off.
5. Due to temperature influences, the level of the built-in test tone (400 Hz, 15 kHz) may vary slightly at times. To perform very exact bias and level calibration, set the monitor switch to "Source" while the test tone is being displayed and check the actual indication. Then return the monitor switch to "Tape" and perform calibration in such a way that the meter readings in the "Tape" position are the same as in the "Source" position.

### ■ Manual Calibration Flow Chart



# Recording

This deck permits forward and reverse playback, but recording can only be carried out in the forward direction.

- (1) Confirm that the timer switch is set to "Off", then turn on the power to the deck by depressing the power switch.
- (2) Open the cassette holder by depressing the eject button.
- (3) Insert the cassette into the holder with the side you want to record facing outwards. Push the cassette holder back until it locks into the panel.
- (4) Select the required positions of the tape selector buttons and the Eq switch for the tape in use. (See chart)
- (5) Has record/play level calibration and bias calibration been performed for the tape in use? If not, refer to the paragraph "Before Recording" on page 9, and perform manual calibration.
- (6) If the Dolby NR system is to be used for recording, set the Dolby NR on/off switch to "On" and select the desired system with the B-Type/C-Type switch. If the Dolby NR system is not to be used, set the on/off switch to "Off".

	Dolby NR On/Off	B-Type/C-Type
Playback with Dolby B-Type NR		
Playback with Dolby C-Type NR		
Playback without Dolby NR		any position

- (7) When recording from FM broadcasts, set the MPX filter switch to "On". When recording from phonograph records, set the subsonic filter switch to "On", if required.
- (8) Press the tape counter reset button to return the counter indication to "0000". When the memory on/off switch is set to "On" and the stop/play switch to "Stop", the tape will stop at the "0000" point in rewind. If the stop/play switch is set to "Play", playback starts automatically at the "0000" point.
- (9) Set the monitor switch to "Source" and adjust the record level. First turn up the master input level control to a certain degree. Then, while watching the indication of the peak level meters, gradually turn up the left and right input level controls to achieve the proper recording level and left/right channel balance. For final adjustments of the overall recording level, the master input level control can again be used. (→p.13)

## Tape Selector Button and Eq Switch Settings (Recommended Tapes)

### EX/120 $\mu$ s Position

Tape Selector Buttons, Eq Switch	Brand Name
	<b>Nakamichi</b> EX, EXII <b>TDK</b> AD, AD-X <b>Maxell</b> UD, UD-XLI, XL-IS <b>Fuji</b> FR-I <b>AMPEX</b> GM-I

### SX/70 $\mu$ s Position

Tape Selector Buttons, Eq Switch	Brand Name
	<b>Nakamichi</b> SX, SXII <b>TDK</b> SA-X <b>Maxell</b> UD-XLII, XL-IIS <b>Fuji</b> FR-II <b>AMPEX</b> GM-II

### ZX/70 $\mu$ s Position

Tape Selector Buttons, Eq Switch	Brand Name
	<b>Nakamichi</b> ZX <b>TDK</b> MA, MA-R <b>Maxell</b> MX <b>Fuji</b> FR-Metal <b>AMPEX</b> MPT

• This deck is not suited for use with ferri-chrome cassettes.

• Press the tape selector buttons firmly and make sure that the appropriate indicator is lit.

- (10) While keeping the record button depressed, push the pause button to put the deck into the record stand-by (record/pause) mode. The orange record button indicator and the green pause button indicator light up.
  - ★ If you want to start the recording with a fade-in, press the "Down" button of the auto fader to set the fader to minimum.
- (11) Press the forward play button to start recording.
  - ★ To perform fade-in, now press the "Up" button of the auto fader. The recording level is automatically raised to the level determined in step (9).
- (12) To check the quality of the recording in progress, you can instantly monitor the playback signal by setting the monitor switch to "Tape". In the "Source" position, the input signal before recording is heard. For short-term interruption of recording, press the pause button. To resume recording, press the forward play button again.

- (13) By pressing the stop button, the recording mode is released and the tape transport comes to a full stop.
  - ★ If you want to end the recording with a fade-out, press the "Down" button of the auto fader to return the fader level to minimum, and then press the stop button. After the stop button was pushed, the auto fader control is automatically released and the level setting returns to the "Up" value.

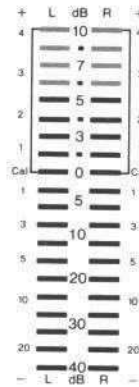


## Tips on Setting Recording Levels

The LED level meters of this cassette deck are free of "overshoot" problems and display peak levels with a high degree of accuracy. For good recordings, it is essential to maintain a high signal-to-noise ratio. This is achieved by putting as much signal on the tape as is possible without producing distortion. Setting record levels too low will result in noisy recordings, while too high recording levels cause distortion. Finding the proper level between these two extremes is what good recording is all about. The task is facilitated by this deck's level meters which cover a wide 50 dB range and accurately display even very short signal peaks. Refer to the chart as a guideline to set recording levels.

**"Normal" (LH) position tape formulations, "Chrome" position tape formulations:**  
The meters should be allowed to read as high as +5 dB on short program peaks.

**"Metal" position tape formulations:**  
The meters should be allowed to read as high as +8 dB on short program peaks.

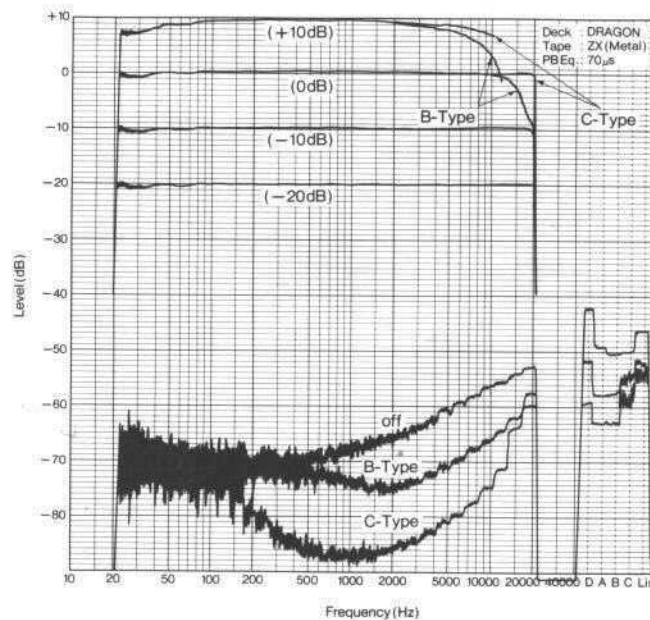


As different tape formulations have slightly different overload (headroom) characteristics, the requirements may vary to a certain degree when using different tapes.

## Dolby Noise Reduction System

This cassette deck provides a choice between the Dolby B-Type NR system and the Dolby C-Type NR system. The Dolby B-Type system reduces noise in the high frequency range by about 10 dB. The Dolby C-Type system achieves a noise reduction of about 20 dB in the range from 2 kHz to 8 kHz, where tape hiss etc. is most objectionable to human hearing. For playback of tapes from your collection which were recorded with Dolby B-Type noise reduction, set the B-Type/C-Type selector to "B-Type". For playback of tapes recorded with Dolby C-Type noise reduction, set the selector to "C-Type".

- The Dolby NR system does not reduce any noise already contained in the incoming input signal. You should therefore use recording sources which are as noise-free as possible.



Record/Play Frequency Response and Noise Spectrum Analysis of the DRAGON



# Maintenance

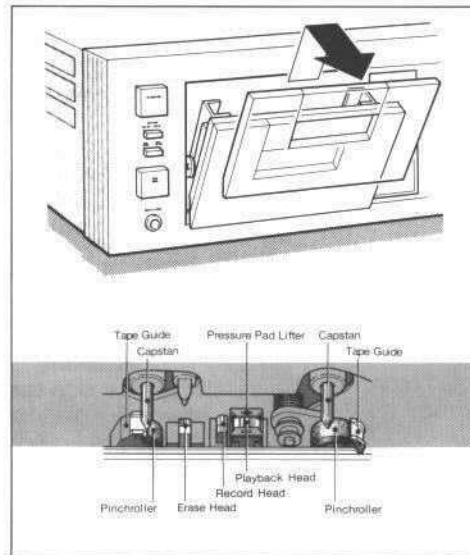
## Head and Transport Cleaning

It is very important to regularly clean the surfaces of the record head, playback head and erase head as well as the capstans, pinchrollers and all other parts which come in contact with the tape. Tiny particles shedded from the tape onto these parts, as well as dust accumulations etc. become the cause of drop-outs, and severely degrade frequency response and wow-and-flutter characteristics. With some low-quality tapes, head contamination is especially severe. Avoid the use of such tapes whenever possible and be sure to keep all parts spotlessly clean.

## Cleaning Procedure

Remove the cover of the cassette holder. Use commercially available cotton-tipped sticks or the like and—with very light pressure—clean the parts indicated in white on the illustration. In case of severe contamination, dip the cotton tip in cleaning fluid. By closing the cassette holder with the cover removed and pressing the pause button, the head assembly can be raised for easy access. To clean the right pinchroller, press the reverse play button. To clean the left pinchroller, press the forward play button. Hold the cotton tip to the revolving pinchroller on the side turning away from the capstan. Be careful that the cotton tip does not get caught between the pinchroller and the capstan. After cleaning the pinchrollers, press the pause button again and clean the capstans.

- Be careful not to apply too much force in cleaning, as the respective parts are critically aligned. Take special care not to damage the tape guides.
- Do not use an excessive amount of cleaning fluid, and give the cleaned surfaces a minute or two to dry off completely before playing a tape.
- If you have used cotton-tipped sticks, be sure not to leave any cotton strands on the cleaned parts.



## Demagnetizing

After a longer period of use, there can be a build-up of residual magnetism in the heads and capstans. Such residual magnetism can induce noise and partially erase the high frequencies of a tape being played. To prevent this, you should demagnetize these parts about once every 50 hours of use with the Nakamichi DM-10 Demagnetizer (optional) or any other properly designed demagnetizer.

- Always switch off the power to the deck before starting the demagnetizing procedure.

## Cleaning the Faceplate

Clean the faceplate only by wiping it with a soft, dry cloth. Never use alcohol, solvents, ammonia or abrasive cleaning agents.

## Lubrication

All important moving parts of this deck are fitted with long-life, oil-less bearings. Periodic lubrication is therefore not necessary.

# Troubleshooting

Condition	Probable Cause	Remedy
Tape does not run.	<ol style="list-style-type: none"> <li>1. In order to protect the main drive motor, the power supply to the motor is cut off. (If for example during the cleaning process the revolving capstan is stopped by external force for 10 seconds or more, the protective circuit becomes active and the capstan motor stops.</li> <li>2. Power cord is unplugged.</li> <li>3. Cassette holder not firmly closed.</li> </ol>	<ol style="list-style-type: none"> <li>1. Set the power switch to "off", wait for appr. 30 seconds, and set it to "on" again. While performing head and capstan cleaning, be careful that the cleaning stick etc. does not get caught in the revolving parts.</li> <li>2. Plug in cord firmly.</li> <li>3. Press eject button and then close cassette holder firmly.</li> </ol>
Record mode cannot be entered.	<ol style="list-style-type: none"> <li>4. No cassette inserted.</li> <li>5. Cassette tabs have been removed.</li> </ol>	<ol style="list-style-type: none"> <li>4. Insert the cassette tape.</li> <li>5. Place adhesive tape over tab opening or use new cassette.</li> </ol>
Excessive playback hiss.	<ol style="list-style-type: none"> <li>6. Head is magnetized.</li> </ol>	<ol style="list-style-type: none"> <li>6. Demagnetize head.</li> </ol>
Uneven sound levels, drop-outs, excessive wow/flutter.	<ol style="list-style-type: none"> <li>7. Heads and/or capstans and pressure rollers dirty.</li> <li>8. Faulty cassette.</li> </ol>	<ol style="list-style-type: none"> <li>7. Clean these parts.</li> <li>8. Replace cassette.</li> </ol>
Incomplete erasure.	<ol style="list-style-type: none"> <li>9. Erase head dirty.</li> </ol>	<ol style="list-style-type: none"> <li>9. Clean head and pressure roller.</li> </ol>
Distorted record/playback sound.	<ol style="list-style-type: none"> <li>10. Program material itself is distorted.</li> <li>11. Recording levels are too high.</li> <li>12. Excessive FM carrier leak.</li> <li>13. Wrong tape selector button pushed.</li> </ol>	<ol style="list-style-type: none"> <li>10. Check program material.</li> <li>11. Wide dynamic range permits some short-term overload, but excessive recording levels will cause distortion. Adjust recording levels.</li> <li>12. Set the MPX filter switch to "On" when the Dolby system is used.</li> <li>13. Push the correct button for the tape in use.</li> </ol>
Record mode is entered, but cannot record.	<ol style="list-style-type: none"> <li>14. Input disconnected.</li> <li>15. Head dirty.</li> </ol>	<ol style="list-style-type: none"> <li>14. Check connections.</li> <li>15. Clean head.</li> </ol>
Cannot playback.	<ol style="list-style-type: none"> <li>16. Output disconnected.</li> <li>17. Head dirty.</li> </ol>	<ol style="list-style-type: none"> <li>16. Check connections.</li> <li>17. Clean head.</li> </ol>
Dull high frequencies.	<ol style="list-style-type: none"> <li>18. Heads dirty.</li> <li>19. Tape selector buttons and/or equalizer switch not set correctly.</li> <li>20. Bias amount does not fit tape in use.</li> </ol>	<ol style="list-style-type: none"> <li>18. Clean heads.</li> <li>19. Select correct positions for tape in use.</li> <li>20. Perform bias adjustment.</li> </ol>
Hum heard during recording or playback.	<ol style="list-style-type: none"> <li>21. Strong induction fields near deck.</li> <li>22. Signal cable or connector grounding faulty.</li> </ol>	<ol style="list-style-type: none"> <li>21. Keep deck away from amplifier, transformers, fluorescent lamps, etc.</li> <li>22. Replace signal cables.</li> </ol>

# Specifications

## Specifications

Track Configuration.....	4 tracks/2-channel stereo (playback auto reverse )
Heads.....	3 (erase head x 1, record head x 1, 4-track, 4-channel playback head x 1)
Motors.....	<ul style="list-style-type: none"> <li>• <b>TRANSPORT</b></li> <li>Quartz PLL DC, brushless, slotless, coreless, Super Linear Torque D.D. motor (capstan drive) x 2</li> <li>DC motor (reel drive x 1)</li> <li>• <b>AUTO AZIMUTH CORRECTION</b></li> <li>DC motor x 1</li> <li>• <b>MECHANISM</b></li> <li>DC motor x 1</li> </ul>
Power Source.....	100, 120, 120/220-240, 220 or 240V AC; 50/60Hz (According to country of sale)
Power Consumption.....	45 W max.
Tape Speed.....	1-7/8 ips. (4.8 cm/sec.)
Wow-and-Flutter.....	Less than 0.019% WTD RMS Less than 0.04% WTD Peak
Frequency Response .....	20 Hz~22,000 Hz $\pm 3$ dB (recording level -20dB, ZX tape) 20 Hz~21,000 Hz $\pm 3$ dB (recording level -20 dB, SX, EX II tape)
Signal-to-Noise Ratio.....	<b>Dolby C-Type NR on</b> <70 $\mu$ s, ZX tape> Better than 72 dB (400 Hz, 3% THD, IHF A-WTD RMS) <b>Dolby B-Type NR on</b> <70 $\mu$ s, ZX tape> Better than 66 dB (400 Hz, 3% THD, IHF A-WTD RMS)
Total Harmonic Distortion.....	Less than 0.8% (400 Hz, 0 dB, ZX tape) Less than 1% (400 Hz, 0 dB, SX, EX II tape)
Erasure.....	Better than 60 dB (100 Hz, 0 dB)
Separation.....	Better than 37 dB (1 kHz, 0 dB)
Crosstalk.....	Better than 60 dB (1 kHz, 0 dB)
Bias Frequency.....	105 kHz
Input (Line).....	50 mV, 50 k $\Omega$
Output (Line).....	1V (400 Hz, 0 dB, output level control at max.) 2.2 k $\Omega$
(Headphones).....	45 mW (400 Hz, 0 dB, output level control at max.) 8 $\Omega$
BlackBox Series DC Output .....	$\pm 10$ V, 125 mA max.
Dimensions .....	450(W) x 135(H) x 300(D) mm 17-3/4(W) x 5-5/16(H) x 11-13/16(D) inches
Weight.....	Appr. 9.5 kg 21 lb

- Specifications and appearance design are subject to change for further improvement without notice.
- Dolby NR under license from Dolby Laboratories Licensing Corporation.
- The word "DOLBY" and the Double-D-Symbol are trademarks of Dolby Laboratories Licensing Corporation.

## Nakamichi Corporation

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Shinjuku Daiichi Seimei Bldg.  
2-7-1 Nishishinjuku, Shinjuku-ku, Tokyo  
Phone : (03) 342-4461  
Telex : 2324721 (NAKAM J)

## Nakamichi U.S.A. Corporation

1101 Colorado Avenue  
Santa Monica, Calif. 90401  
Phone : (213) 451-5901  
Telex : 652429 (NAKREI SNM )

## Optional Accessories

ZX Metalloy Cassette Tape  
C-60, C-90  
SX-II Super Ferricobalt Cassette Tape  
C-60, C-90  
SX Ferricobalt Cassette Tape  
C-60, C-90  
EX II Ferricrystal Cassette Tape  
C-60, C-90  
EX Ferrioxide Cassette Tape  
C-60, C-90



## RM-20 Remote Control Unit



## DM-10 Head Demagnetizer



## SP-7 Stereo Headphones



## Nakamichi U.S.A. Corporation

220 Westbury Avenue  
Carle Place, N. Y. 11514  
Phone : (516) 333-5440



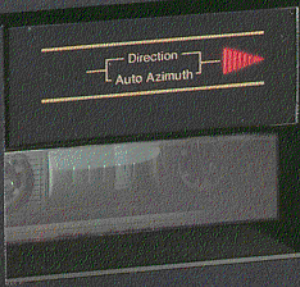


# Nakamichi

## DRAGON

Auto Reverse Cassette Deck

Nakamichi **DRAGON** Auto Reverse Cassette Deck



**NAAC**

Discrete 3 Head/Double Direct Drive Capstan/Silent Mechanism/Microprocessor Control

**DOLBY B-C NR**



Reset  
Memory Off / On  
Stop / Play  
Auto Rev Off / On

Control panel with buttons and knobs:

- Level (400Hz)
- Recall
- Blank Detect
- Cue
- EX
- Rec Mute
- Auto Fader
- Up
- Down

Volume and output controls:

- Mute
- Left
- Right
- Output



# —DRAGON— The Most Incredible Creature Of The Decade !

Only once or twice a decade does a truly remarkable "breakthrough" occur in cassette-recording technology — not a mere refinement of past technique but a dramatic advance in engineering knowledge that solves a basic technological problem and opens the door to the future. One such "breakthrough" was the development of Dolby-B noise-reduction — the first viable consumer NR system — the one that suppressed tape hiss without introducing audible coloration. With Dolby-B NR, high-fidelity cassette reproduction became a possibility. Another "breakthrough" occurred when Nakamichi created the Model 1000 — the world's first three-head cassette deck — the one that made high-fidelity cassette reproduction a *reality!*





Steady progress has been made "refining" these "breakthroughs." Dolby-B NR led to the C-type system, and hiss was banished to the point of inaudibility. With new tapes, it became possible to extend response beyond 20 kHz, and we developed the advanced magnetic heads and electronics to do so. We refined the dual-capstan drive and ultimately created the Asymmetrical Diffused-Resonance transport that eliminated common-mode resonance and controlled tape tension so precisely that it required no pressure pad. Mechanical "logic" gave way to "IC logic" and then to full microprocessor control. Finally, we developed the SLT motor that eliminated "belt wow" without introducing "direct-drive flutter."

It seemed as if cassette recording had advanced to its limit, but one problem remained — a basic one that limits cassette interchangeability and precludes "reverse playback" with full fidelity — play-head azimuth misalignment! True, we had developed a system to ensure proper *recording* azimuth, but it cannot correct a tape that has *already* been recorded improperly or one that tracks slightly askew in reverse. Such correction must occur *on playback*, and that was considered impossible! No longer! In DRAGON, we introduce NAAC — Nakamichi Auto Azimuth Correction — the most revolutionary "breakthrough" of the decade — an automatic *playback* azimuth-correction system that brings forth the full spectrum recorded on cassette!





## NAAC Reveals The Hidden Highs Of Each Cassette

Azimuth misalignment between record and play-head gaps severely restricts high-frequency response. As Figure 1 shows, a disagreement between the angle at which a tape was recorded and the angle at which it is played has an effect very similar to that of widening the playback gap. When this happens, the play head is unable to "resolve" short wavelengths and high-frequency response drops precipitously as shown in Figure 2. The music sounds dull and lacks the crispness and clarity that give it life *even though the tape may contain the full range of frequencies that originally were recorded!*

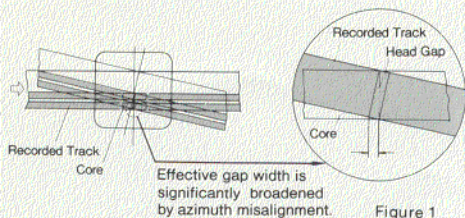


Figure 1

Azimuth disagreement can happen for several reasons, the most obvious being physically misaligned heads. But even heads that were properly aligned at the factory will not guarantee perfect reproduction. Tape-width and cassette-shell tolerances, together with differences in tape tension from deck to deck, cause the tape to track along a slightly different path in each cassette and in each machine. Thus, a tape recorded on one deck will not necessarily reveal its full response when played on another, and, when a tape is recorded in one direction and reproduced in the opposite direction — as, for example, on an auto-reverse deck — there is almost bound to be considerable azimuth disagreement.

Even the slightest misalignment — one measured not in "degrees," but in "minutes" of arc (sixtieth parts of a degree!) — causes a very audible loss in treble response. To make matters worse, noise-reduction systems increase whatever loss exists in the basic record/play response. Without doubt, azimuth misalignment is the prime reason why, in the past, cassettes have usually sounded best when played on the deck that recorded them.

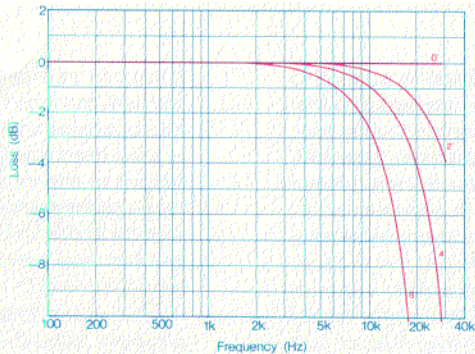


Figure 2 Frequency Response Loss Due To Azimuth Misalignment

NAAC (Nakamichi Auto Azimuth Correction) is the first system capable of extracting every bit of information stored on cassette. Obviously, it cannot reproduce what had never been recorded, but, if there is treble energy on the tape, NAAC will bring it to you with full fidelity and clarity *even if the tape has been recorded with improper azimuth!* NAAC automatically determines the *actual* recorded azimuth on the tape, aligns the *playback* head to it, and continues to track it throughout the program. NAAC works on tape — commercially recorded tapes, tapes borrowed from a friend, or those you made yourself. It works in *both* directions, requires no test tones, no setup, no action on your part at all!

NAAC utilizes the "phase-comparison" method of azimuth alignment, but, unlike systems that record test tones and adjust the *recording* head for in-phase left and right signals, NAAC determines the actual azimuth of the *recording* and aligns the playback head to it! It does not compare the phase in the left and right channels for, in stereo, the two contain different information. It works *within the same channel* by utilizing a unique playback head that splits the track in half and derives two signals from it. (Figures 3 and 4) The signals — "a" and "b" — are processed to extract the phase difference. This "error" drives a servo motor that realigns the playback head to the track. (Figure 5) The improvement in sound quality is nothing less than amazing!

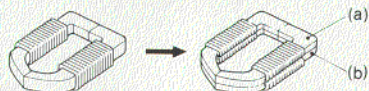


Figure 3 Standard core construction for one stereo channel.

Figure 4 Dual core construction for channel to be used for azimuth measurement.

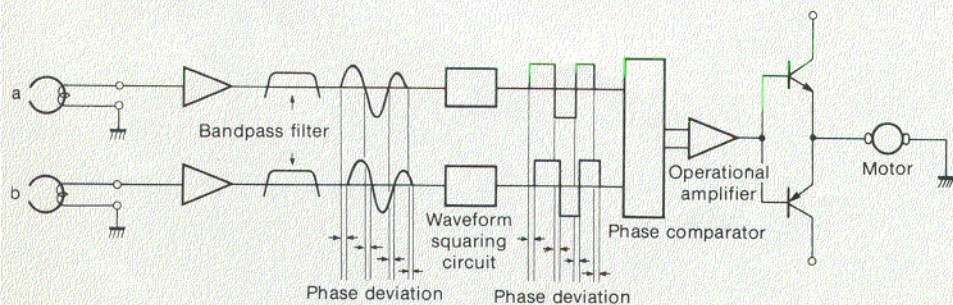


Figure 5 Automatic Playback Head Azimuth Correction System Block Diagram

## Double-Direct-Drive Auto-Reverse

DRAGON is the world's first Dual-Capstan, Double-Direct-Drive, Auto-Reverse cassette deck! Now you can have the convenience of auto-reverse playback *without* sacrificing treble response — thanks to NAAC — or speed stability — thanks to the Nakamichi Super-Linear-Torque motor. Actually, *two* SLT motors are used, one directly driving each capstan. Both are active in each direction so flutter and modulation noise are eliminated in *both* forward and reverse.

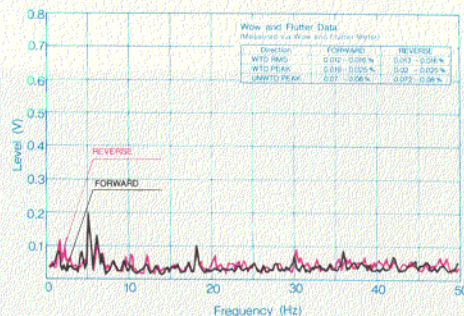


Figure 6 Flutter Spectral Analysis (UNWTD Peak)

Frequency : 3kHz Test Tape  
Wow/Flutter Meter: Meguro MK-615  
Spectrum Analyzer: HP-3582A





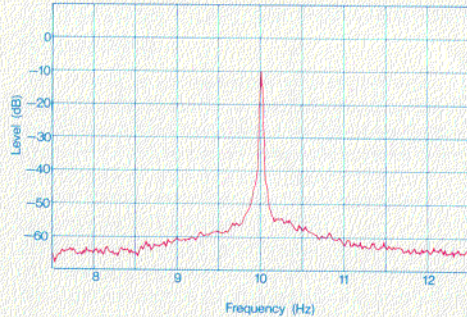


Figure 7 Modulation Noise Analysis  
 Freq.:10kHz/ Tape:ZX (Metal)/ Eq:70 $\mu$ s

With its unusual star-shaped rotor magnetization, the SLT motor generates "cog-free" uniform torque. It eliminates "belt-drive wow" without introducing "direct-drive flutter." In a Double-Direct configuration like DRAGON, it produces less than 0.019% wow and flutter and virtual freedom from modulation noise! Figures 6 and 7 depict DRAGON's flutter spectrum and modulation noise. Note the peak-free flutter spectrum and the absence of side-bands about the 10-kHz tone. These characteristics, ignored by standard specifications, are responsible for DRAGON's remarkable tonal purity — the quality known as "Nakamichi Sound!"

DRAGON's SLT motors are locked to quartz reference in such a way that, in either direction, the supply capstan rotates 0.2% slower than the takeup capstan to provide precise control over tape tension and eliminate the need for a pressure pad. The capstans are "asymmetrical" to avoid resonance, and, since DRAGON is auto-reversing, an unusual mechanism ensures that the "supply" guide is automatically engaged and the "takeup" guide retracted.

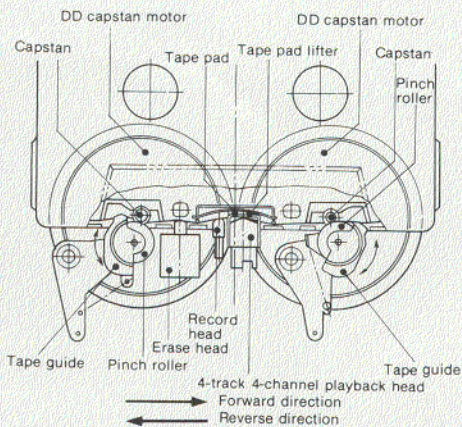


Figure 8 Auto-Reverse Dual-Capstan Double-Direct-Drive System Construction

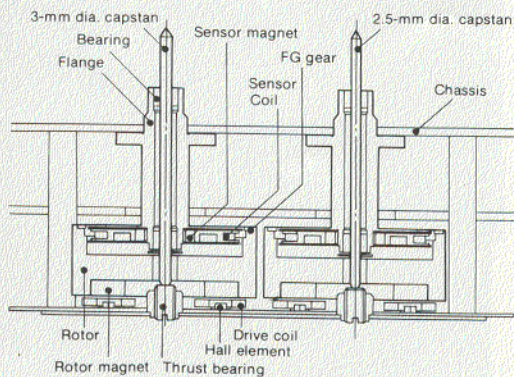
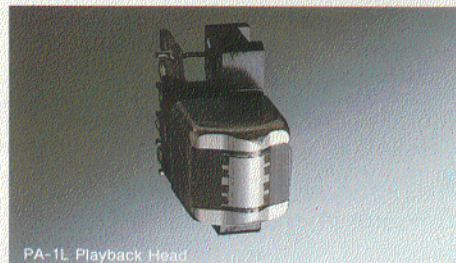
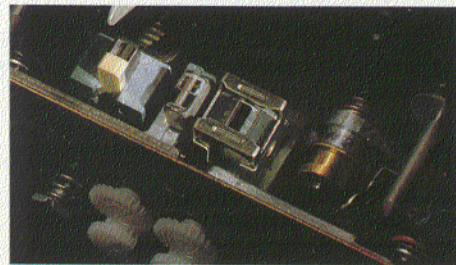


Figure 9 Auto-Reverse Dual-Capstan Double-Direct-Drive System Cross Section

## Discrete 3-Head Playback In An Auto-Reverse Deck!

DRAGON also is the world's first Discrete 3-Head Auto-Reverse cassette deck! Now you can have the sound quality available *only* with this Nakamichi creation *and* the convenience of auto-reverse playback.



NAAC made high-fidelity reproduction possible in the auto-reverse format. But what made NAAC possible? The PA-1L 4-track/2-channel-stereo Crystalloy playback head — a unique creation of Nakamichi technology! Each stereo track is a mere 0.6 mm (24 *thousandths* of an inch) wide. Most engineers thought that it was impossible to divide the track into two parts and read separate signals from each, but this is exactly what Nakamichi creativity and expertise in magnetic technology has accomplished!

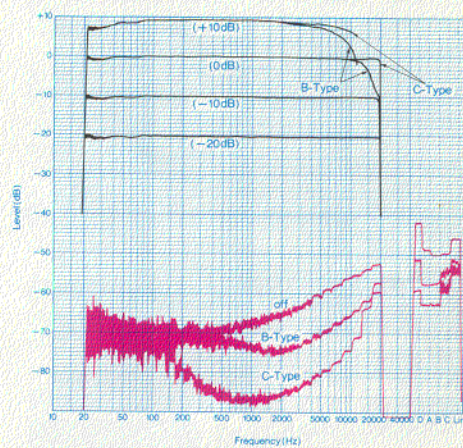


Figure 10 Frequency Response/Noise Analysis

Deck :Nakamichi DRAGON  
 Tape :ZX (Metal)  
 PB Eq :70 $\mu$ s  
 Dolby NR :Off

With its 2-track/2-channel Crystalloy recording head and dual-gap Ferrite/Sendust erase head, DRAGON records the *full* frequency spectrum — from 20 Hz to 22 kHz — in the forward direction and reproduces it in *either* direction with remarkable uniformity. Nakamichi's special poletip geometry suppresses low-frequency "head bumps" completely, and thanks to a special surface treatment, our heads have a useful life of more than 10,000 hours!



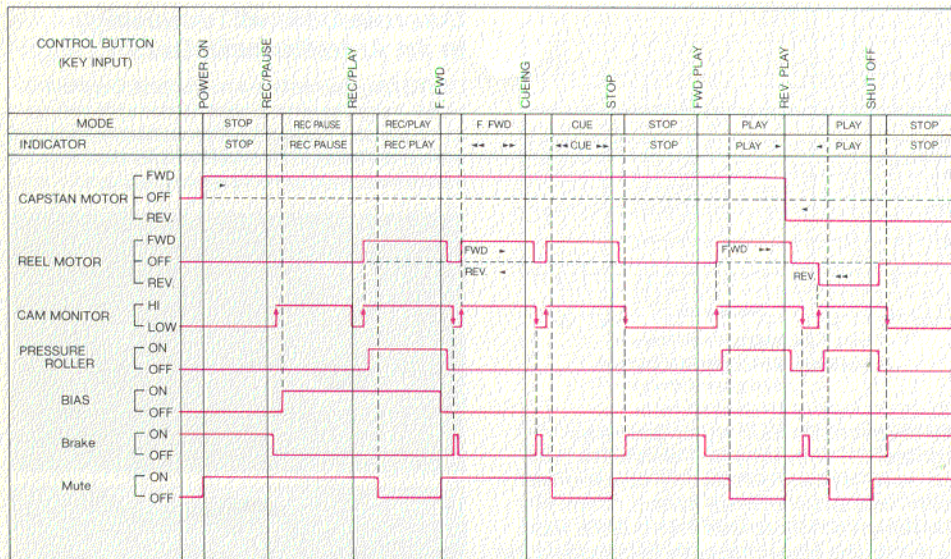


Figure 11 Transport Control Timing Chart

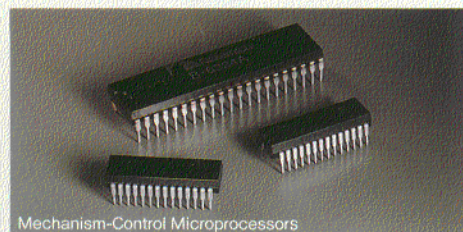
## Precision And Convenience Through Microprocessor Control

DRAGON is intelligent! Three microprocessors monitor the control panel and key points in the operating system. The microprocessors instantly issue commands to a special motor-control mechanism that positions the heads, engages and disengages reel brakes and pinch rollers, and performs the mechanical functions normally assigned to solenoids. Figure 11 shows the system timing diagram and DRAGON's intricately interwoven operational modes.

The motor-control mechanism performs each change of function rapidly and much more precisely than is possible with solenoid actuation because the microprocessors monitor the control motor and thus place it inside a digital servo loop. Operation is remarkably smooth, quiet, and free of the jarring mechanical shock typical of solenoid operation.

Delicate mechanical adjustments are not disturbed and very little heat is generated. Thus mechanical and electrical reliability are greatly improved.

The chassis is fabricated from an aluminum alloy that is specially treated to absorb vibration before it can affect tape motion. This greatly improves speed stability, reduces flutter and modulation noise, and contributes to the unique purity of "Nakamichi Sound."



Mechanism-Control Microprocessors

The microprocessors determine drive motor speed and direction to provide flawless auto-reverse operation. With this "intelligence" in control of DRAGON's mechanism and circuitry, several unusual features are possible: Auto Record Pause, Easy Cueing, Punch-In Recording, and Memory Stop/Play.

## Auto Record Pause

When you are dubbing a record onto tape, it is bothersome to constantly watch over the recording process in order to catch the end of the program. If your attention wanders or you're called away, it is easy to miss the end of the side; the tape continues to run, and you're left with a long length of blank tape. You must rewind to find the end of the last program and "splice" in the next.

Now, DRAGON's "intelligent" electronics can do the monitoring for you! Simply switch on Auto Rec Pause, and DRAGON checks the incoming program. If it finds a silence of more than 30 seconds, DRAGON automatically goes into Rec Pause. The tape stops, and you're ready to resume recording at the touch of a button!

## Easy Cueing

Thanks to the "continuous" action of DRAGON's motor-driven control system and the "intelligence" of its microprocessors, cueing is exceptionally versatile. Pressing Cue during fast-forward or rewind reduces transport speed by one-third and brings the playback head close to the tape so you can hear the program. Pressing either fast-wind button again now drops tape speed to one-sixth normal for as long as the button is held. You can zero in on the start of a program very precisely!

Easy Cueing also is possible via the optional RM-20 Remote Control Unit. The RM-20's Pause button duplicates the action of the on-board Cue button whenever the deck is in either fast-wind mode.

## Punch-In Recording

You can enter Record directly from Forward-Play by pressing Play and Record simultaneously so you can "splice" a new program into an old one very accurately. Punch-In Recording is possible either from the DRAGON control panel or via the RM-20 Remote Control Unit.

## Memory Stop/Play

With Memory on, DRAGON automatically stops at a counter reading of "0000" in either fast mode. Depending upon whether "Stop" or "Play" had been selected, the tape either remains stationary or immediately begins playback.





## Dual-Speed Auto Fader

DRAGON's dual-speed Auto Fader allows you to create professional-like level fades at the press of a button. Once you have adjusted recording balance and level with the independent left and right level controls, a quick tap on UP or DOWN produces a smooth 6-second fade up to or down from the preset level. If you hold either button down, the fade occurs just as smoothly but more rapidly — in 2 seconds.



## Record Mute

You can prevent recording of the source signal entirely via the Rec Mute button. For as long as this button is pressed, the record amplifiers are muted, and a bland section of tape is recorded. This allows you to clearly delineate between recordings and to eliminate commercials.

The Record Mute function also is accessible by remote control. Once you are in the recording mode, pressing the RM-20's record button a second time activates the mute.

## Calibration Controls For Optimum Recording

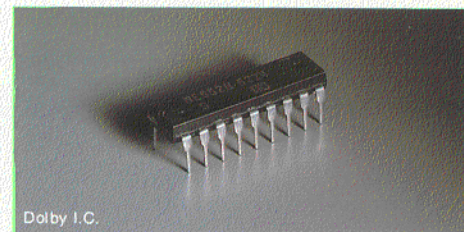
With NAAC's unique ability to reproduce every subtle nuance recorded on cassette, it is all the more important that each tape be created as perfectly as possible to take full advantage of this extraordinary system. DRAGON accommodates the three major tape types — "standard" ferric, chrome/ferricobalt, and metal. What's more, you can individually calibrate the system for best performance on the particular brand of tape you are using.

Separate sets of bias and record-level (sensitivity) controls are provided for each channel and tape type. Self-contained test oscillators generate a 400-Hz signal for setting record level and a 15-kHz tone for adjusting bias. In the calibration mode, DRAGON's recording indicators automatically become 20 dB more sensitive to improve the precision of adjustment.

It takes only a moment to calibrate DRAGON for peak performance, and it is a moment well spent! Tapes *do* differ in bias requirement and sensitivity. These differences are most apparent from brand to brand, but slight differences exist even between batches of the same brand! These can audibly affect high-frequency response and throw off Dolby tracking. Especially when using the more sophisticated Dolby-C system, perfect *basic* response is the key to total system fidelity.

## Advanced Dolby Processing

DRAGON contains a highly sophisticated single-chip Dolby B-C processor. By employing this device rather than conventional cascaded Dolby-B chips, tolerances are eliminated, and a very wide dynamic range becomes possible.



## High-Performance Electronics

DRAGON's electronic circuitry is of a quality rarely found in cassette decks. Distortion is kept under 0.005% — no small feat when you consider the complexity of tape-recording electronics! DRAGON actually has six separate preamp/equalizers in its playback chain to accommodate the NAAC system and provide for bi-directional playback.

Side-A/Side-B switching is entirely electronic — no clumsy unreliable head-rotation devices — and the switching is performed after preamplification to avoid noise. Each unit is hand calibrated at the factory to ensure perfect level matching and optimum performance.

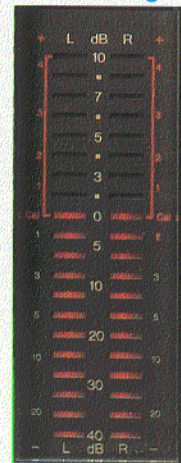
## MPX And Subsonic Filters

With DRAGON's broad frequency response — 20 Hz to 22,000 Hz — it may sometimes be desirable to eliminate unwanted signals in the recording amplifier. When taping an FM-stereo broadcast, for example, 19-kHz pilot from a misadjusted tuner could upset Dolby tracking. DRAGON's MPX filter prevents that from occurring!

At the other end of the spectrum, infrasonic signals generated when playing a warped record — especially with a tonearm/cartridge system whose resonance is poorly placed — can intermodulate with the music and produce an effect similar to wow. DRAGON's subsonic filter can then be called upon to eliminate the condition.

DRAGON's filters are independently switchable and so can be called into play only as needed.

## Wide-Range Peak-Level Meters



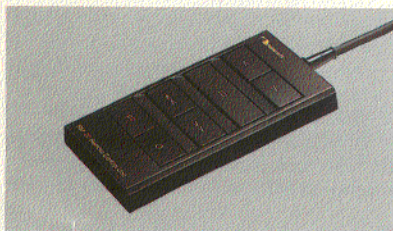
DRAGON's peak-reading electronic meters span a full 50-dB range — from -40 dB to +10 dB — with 20 LED segments per channel. They are fast responding but hold the peak reading momentarily so they are easier to read. Being completely electronic, they are free of "pointer lag" and "overshoot." These precision instruments automatically increase sensitivity by 20 dB in the calibration mode to improve the precision of the adjustments.





### DRAGON Features

- NAAC (Nakamichi Auto Azimuth Correction) System Automatically Adjusts Playback-Head Azimuth To Agree With Each Cassette
- Auto-Reverse, Asymmetrical, Dual-Capstan, Double-Direct-Drive Transport On Non-Resonant Chassis
- Dual Super-Liner-Torque DD Capstan Motors Phase Locked To Quartz Crystal
- Motor-Driven Control System Under Supervision Of Three Microprocessors
- Auto-Retracting Slot Guides And Tape-Pad Lifter
- Discrete Three-Head Technology Employing Unique Quadruple Split-Track Playback Head With 20—22,000 Hz  $\pm 3$  dB Response
- Laminated Crystalloy Record And Playback Heads For Reduced Distortion
- Dual-Gap Ferrite/Sendust Erase Head For Low-Noise Erasure Of Metal Tape
- Individual Bias And Record-Level Calibration Controls For Each Channel And Tape Type With Two-Tone Test Oscillator
- Auto Rewind After Calibration Via Calibration-Reset Button
- Separate Tape And Equalization Switches For ZX, SX, and EX Tapes
- Double Dolby-B And Dolby-C Noise Reduction Employing One-Chip Processors
- Defeatable MPX Filters For FM-Stereo Recording
- Defeatable Subsonic Filters For Phono-Disc Recording
- Master Input Level Control With Individual Left And Right Controls To Establish Balance
- Full Off-Tape Monitoring
- Two-Speed Auto-Fader For Professional Fades Plus Record Mute
- Auto Record Pause
- Punch-In Recording In Forward Direction
- 50-dB Peak-Responding Electronic LED Metering
- Six Discrete Equalizer/Amplifiers
- Direct-Coupled Record And Playback Amplifiers
- Two-Speed Easy Cue
- Output Level Control
- High-Output Headphone Jack Plus DC Power For BlackBox Series
- 4-Digit LED Electronic Counter (-999 to 9999) With Memory Stop And Memory Repeat
- Unattended Operation In Record Or Playback Via Accessory Timer
- Remote Control Capability Via RM-20 Option



RM-20 Remote Control



SP-7 Stereo Headphones



### Tapes

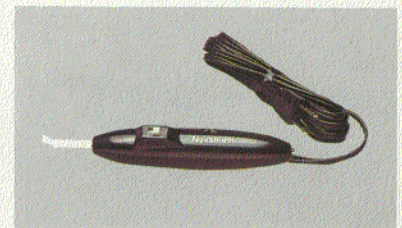
ZX Metalloy Cassette Tape  
(70 $\mu$ s, metal bias)  
ZX C-60 ZX C-90

SX Ferricobalt Cassette Tape  
(70 $\mu$ s, CrO<sub>2</sub> bias)  
SX C-60 SX C-90

EX Ferrioxide Cassette Tape  
(120 $\mu$ s, normal bias)  
EX C-60 EX C-90

SX II Super Ferricobalt Tape  
(70 $\mu$ s, CrO<sub>2</sub> bias)  
SX II C-60 SX II C-90

EX II Ferricrystal Cassette Tape  
(120 $\mu$ s, normal bias)  
EX II C-60 EX II C-90



DM-10 Head Demagnetizer

### DRAGON Specifications

Track Configuration.....	4 tracks/2-channel stereo (Playback Auto Reverse)
Heads.....	3 (erase head $\times$ 1, record head $\times$ 1, 4-track, 4-channel playback head $\times$ 1)
Motors .....	• <b>TRANSPORT</b> Quartz PLL DC, brushless, slotless, coreless Super Linear Torque D.D. Motor (capstan drive) $\times$ 2, DC Motor (reel drive) $\times$ 1
	• <b>AUTO AZIMUTH CORRECTION</b> DC Motor $\times$ 1
	• <b>MECHANISM</b> DC Motor $\times$ 1
Power Source .....	100, 120, 120/220-240, 220 or 240V AC; 50/60Hz (According to country of sale)
Power Consumption .....	45 W max.
Tape Speed.....	1-7/8 ips. (4.8 cm/sec.)
Wow-and-Flutter.....	Less than 0.019% WTD RMS Less than $\pm 0.04\%$ WTD Peak
Frequency Response .....	20 Hz—22,000 Hz $\pm 3$ dB (recording level -20dB, ZX tape) 20 Hz—21,000 Hz $\pm 3$ dB (recording level -20dB, SX, EX II tape)
Signal-to-Noise Ratio .....	<b>Dolby C-Type NR on</b> <70 $\mu$ s, ZX tape> Better than 72 dB (400 Hz, 3% THD, IHF A-WTD RMS) <b>Dolby B-Type NR on</b> <70 $\mu$ s, ZX tape Better than 66 dB (400 Hz, 3% THD, IHF A-WTD RMS)
Total Harmonic Distortion .....	Less than 0.8% (400 Hz, 0 dB, ZX tape) Less than 1% (400 Hz, 0 dB, SX, EX II tape)
Erase .....	Better than 60 dB (100 Hz, 0 dB)
Separation.....	Better than 37 dB(1 kHz, 0 dB)
Crosstalk .....	Better than 60 dB (1 kHz, 0 dB)
Bias Frequency.....	105 kHz
Input (Line) .....	50 mV, 50 k $\Omega$
Output (Line).....	1 V (400 Hz, 0 dB, output level control at max.) 2.2k $\Omega$
	(Headphone)..... 45 mW (400 Hz, 0 dB, output level control at max.) 8 $\Omega$
BlackBox Series DC Output .....	$\pm 10$ V, 125mA max.
Dimensions .....	450(W) $\times$ 135(H) $\times$ 300(D) mm 17-3/4(W) $\times$ 5-5/16(H) $\times$ 11-13/16(D) inches
Weight .....	Appr. 9.5 kg 21 lb

- Specifications and appearance subject to change for further improvement without notice.
- Dolby NR under license from Dolby Laboratories Licensing Corporation.
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