

The Harman Kardon Model CD491

Manual No. 66A

ULTRAWIDEBAND LINEAR PHASE CASSETTE DECK

Technical Manual



| | | |
|---------------|--------|------------------|
| LN | Maxell | UDXL-I |
| CR02 | TDK | SA ⁸⁺ |
| IV | TDK | MA |

harman/kardon
 240 CROSSWAYS PARK WEST, WOODBURY, N.Y. 11797
 1112-H15266A1 P-08836 250 PRINTED IN JAPAN

SPECIFICATIONS

Track Configuration 4-track 2 channel Stereo

Cassette Deck
Nominal Limit

●MECHANICAL SECTION

Record/Playback Tape Speed

Deviation 4.75cm/sec. 0.3% +1.0%
-0.5%
Drift 4.75cm/sec. 0.2% ≤ 0.5%

Wow and Flutter 0.025% (NAB) ≤ 0.038%
0.033% (CCIR) ≤ 0.1%

Take Up Torque 55gcm 35 ~ 70gcm
Back Tension 6gcm 4.5 ~ 8gcm
F.FWD Torque 120gcm 90 ~ 150gcm
REW. Torque 110gcm 90 ~ 150gcm

F.FWD/REW. Time for C-60 Cassette 72 sec. ≤ 85 sec.

Motor Direct Drive motor (Capstan)
2 Flat Torque DC motors (Reel & Assist)

●AMPLIFIRE SECTION

Bias Frequency 105kHz ± 5kHz

Record/Playback Sensitivity (Input 400Hz) 580mV ± 1dB

Signal-to-Noise Ratio at LINE input (Input 1kHz, 100mV)

| | | |
|------------------|------------------|-------------|
| Dolby NR OFF | LN | 50dB |
| | CrO ₂ | 53dB |
| | Metal | 52dB |
| Dolby NR B to ON | LN | 59dB |
| | CrO ₂ | 61dB ≥ 58dB |
| | Metal | 60dB ≥ 58dB |
| Dolby NR C to ON | LN | 69dB |
| | CrO ₂ | 71dB ≥ 66dB |
| | Metal | 70dB ≥ 66dB |

Signal-to-Noise Ratio

at MIC input (Input 1kHz, 1.5mV)
Dolby NR B to ON (LN) 50dB ≥ 46dB
Dolby NR C to ON (LN) 57dB

Channel Separation 43dB ≥ 35dB
Crosstalk 72dB ≥ 60dB

Record/Playback Distortion (Input 1kHz) LN 1.3% ≤ 1.6%
CrO₂ 1.0% ≤ 3.0%
Metal 1.0% ≤ 1.6%

MPX Filter Attenuation at 15kHz 0.3dB ≤ 1dB
at 19kHz 35dB ≥ 30dB

Erase Ratio (Input 80Hz) LN 70dB ≥ 60dB
Metal 65dB ≥ 60dB

Input Sensitivity (Input 1kHz) at MIC input 0.65mV 0.2(min) ~ 1.0(max)mV
at LINE input 33mV 25(min) ~ 50(max)mV

Input Impedance (Input 1kHz) at MIC input 1.3kΩ 1(min) ~ 2(max)kΩ
at LINE input 23kΩ 19(min) ~ 30(max)kΩ

Overload at MIC input (Input 1kHz) 90mV ≥ 20mV

●DIMENSIONS (WxHxD) 17-7/16"x4-13/16"x13-9/16"
(443 x 123 x 345mm)
15 lbs. 14 oz. (7.2 kg)

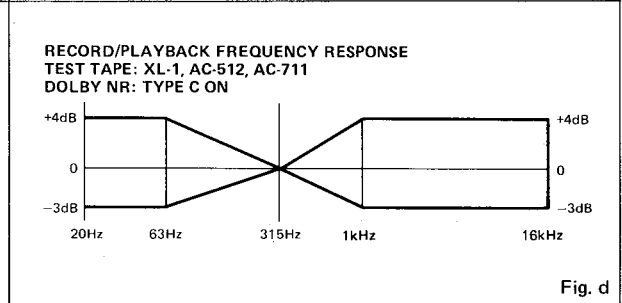
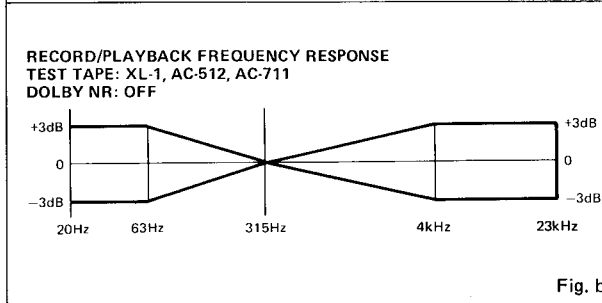
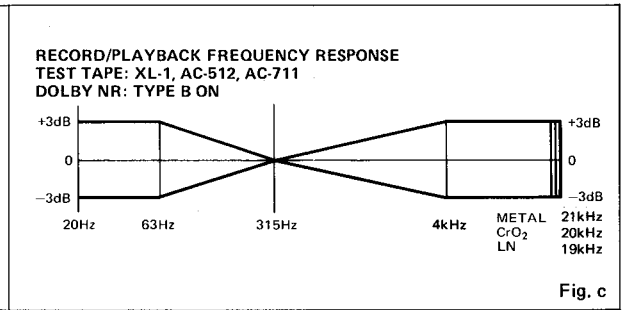
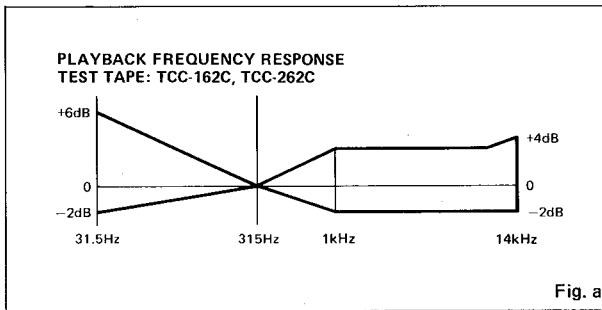
●WEIGHT

●POWER SUPPLY

U.S.A. & Canada models AC120V, 60Hz
General model AC100/120/220/240V, 50/60Hz

●POWER CONSUMPTION

U.S.A. & Canada models 55W
General model 60W



Specifications and components subject to change without notice. Overall performance will be maintained or improved.

This specification is the target of servicing. But, there is a case that the specification is not applicable to the measurement condition and instrument.

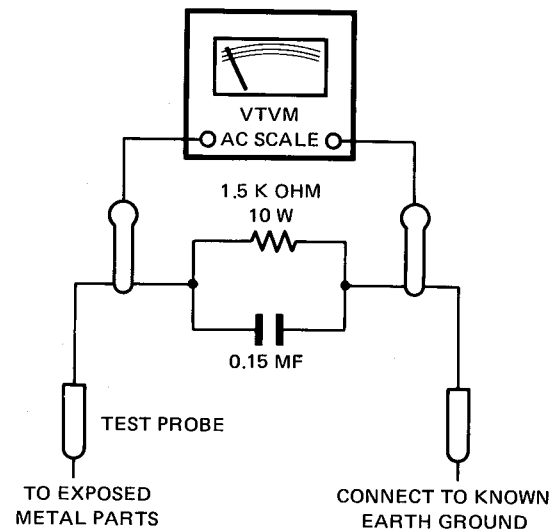
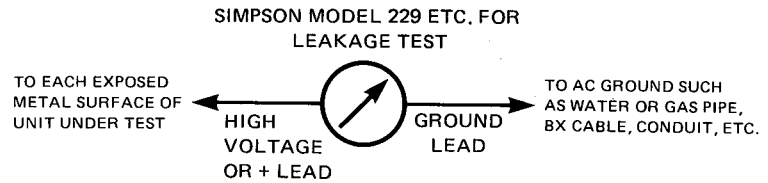
LEAKAGE TEST

Before returning the unit to the user, perform the following safety checks:

1. Inspect all lead dress to make certain that leads are not pinched or that hardware is not lodged between the chassis and other metal parts in the unit.
2. Be sure that any protective devices such as nonmetallic control knobs, insulating fishpapers, cabinet backs, adjustment and compartment covers or shields, isolation resistor-capacity networks, mechanical insulators, etc. which were removed for servicing are properly reinstalled.
3. Be sure that no shock hazard exists; check for leakage current using Simpson Model 229 Leakage Tester, standard equipment item No. 21641, RCA Model WT540A or use alternate method as follows:

Plug the AC line cord directly into a 120-volt AC receptacle (do not use an Isolation Transformer for this test). Using two clip leads, connect a 1500 ohm, 10-watt resistor paralleled by a 0.15mf capacitor, in series with all exposed metal cabinet parts and a known earth ground, such as a water pipe or conduit. Use a VTVM or VOM with 1000 ohms per volt, or higher, sensitivity to measure the AC voltage drop across the resistor. (See Diagram.) Move the resistor connection to each exposed metal part having a return path to the chassis (antenna, metal, cabinet, screw heads, knobs and control shafts, escutcheon, etc.) and measure the AC voltage drop across the resistor. (This test should be performed with the power switch in both the On and Off positions.)

A reading of 0.35 volt RMS or more is excessive and indicates a potential shock hazard which must be corrected before returning the unit to the owner.



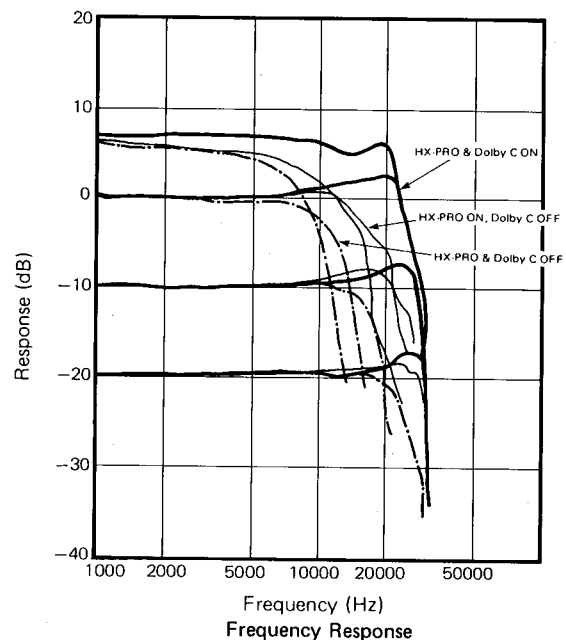
Dolby* HX-Professional Headroom Extension (HX-PRO) System

The CD491 is equipped with the Dolby HX-Professional Headroom Extension system (HX-PRO). It operates only during the record mode and does not require the user to "turn it on" or make adjustments. It is compatible with any low noise (standard), chromium dioxide (CrO₂), or metal audio cassette tape.

The effect of HX-PRO is that it extends the high frequency saturation (overload) level of the tape being recorded. Therefore, many of the high level, high frequency music signals that would be compressed or distorted with a conventional cassette deck will be recorded accurately by the CD491.

The advantages of HX-PRO are:

1. The performance of low noise and chromium dioxide tapes almost equals that of the more expensive metal tapes.
2. A major improvement is made in high frequency dynamic range.
3. The higher record levels result in an increased signal-to-noise ratio.
4. No decoding is necessary. The improved recording accuracy can be appreciated with any high quality tape player, including a portable or car stereo unit.
5. It can be used with or without Dolby B and C noise reduction circuitry.



*Noise reduction and headroom extension manufactured under license from Dolby Laboratories Licensing Corporation. HX Professional originated by Bang and Olufsen. "Dolby" and the double-D symbol are trademarks of Dolby Laboratories Licensing Corporation.

DISASSEMBLY PROCEDURES (REFER TO PAGES 17, 18, 19 AND 30)

- ① **CABINET TOP REMOVAL**
Remove 6 screws (A) and remove the cabinet top.
- ② **FRONT PANEL ASSEMBLY (103) REMOVAL**
 1. Remove the cabinet top. (Refer to step ①.)
 2. Pull off Master Fader, Output Level, Mic. Level and Rec. Level knobs (105 and 152).
 3. Remove 6 screws (B) and remove the front panel assembly (103).
- ③ **LOGIC CONTROL P.C. BOARD (PCB-2) REMOVAL**
 1. Remove the cabinet top. (Refer to step ①.)
 2. Disconnect J801, J802, J803, J808 and J809 from P801, P802, P803, P808 and P809 on the logic control P.C. board (PCB-2).
 3. Open the lid of connectors (P804, P805, P806 and P807) on the logic control P.C. board (PCB-2) and disconnect the lead wires.
 4. Unsolder the lead wires connected to the logic control P.C. board (PCB-2).
 5. Remove 4 screws (C) and remove the logic control P.C. board (PCB-2) with heat sink (301).
- ④ **PUSH SWITCHES P.C. BOARD (PCB-4) REMOVAL**
 1. Remove the cabinet top. (Refer to step ①.)
 2. Open the lid of connectors P451, J803, P804 and P401 on the main, logic control and VR P.C. boards (PCB-1, PCB-2 and PCB-3) and disconnect the lead wires.
 3. Remove 3 screws (D) and remove the push switches P.C. board (PCB-4) with rec. cal P.C. board (PCB-9). If necessary, unsolder the lead wires.
- ⑤ **MAIN P.C. BOARD (PCB-1) REMOVAL**
 1. Remove the front panel assembly, logic control P.C. board (PCB-2) and push switches P.C. board (PCB-4). (Refer to steps ② through ④.)
 2. Disconnect J501 and J503 from P501 and P503 on the main P.C. board (PCB-1).
 3. Open the lid of connectors (P201, P202, P251, P301, P502, P551 and P601) on the main P.C. board (PCB-1) and disconnect the lead wires.
 4. Unsolder lead wires connected to the main P.C. board (PCB-1).
 5. Remove 2 screws (E) and remove the tape monitor switch (SW406).
 6. Remove 8 screws (F) and remove the main P.C. board (PCB-1).
- ⑥ **VR P.C. BOARD (PCB-3) REMOVAL**
 1. Remove the front panel assembly. (Refer to step ②.)
 2. Remove 6 screws (G) and remove the cabinet bottom assembly (102).
 3. Remove 4 hexagon nuts (H) mounting the VR P.C. board (PCB-3) and remove it.
- ⑦ **CASSETTE TAPE RECORDER MECHANICAL ASSEMBLY (113) REMOVAL**
 1. Remove the front panel assembly and logic control P.C. board (PCB-2). (Refer to steps ② and ③.)
 2. Remove 4 screws (I) and remove the cassette tape recorder mechanical assembly (113) with plate assembly (104) backward.
- ⑧ **PLATE ASSEMBLY (104) REMOVAL**
 1. Remove the cassette tape recorder mechanical assembly. (Refer to step ⑦.)
 2. Remove 2 screws (J) and remove the plate assembly (104).
- ⑨ **DIRECT DRIVE MOTOR (506) REMOVAL**
 1. Remove the plate assembly. (Refer to step ⑧.)
 2. Remove 2 hexagon nuts (K) and remove the direct drive motor. If necessary, unsolder the lead wires.
- ⑩ **PAD ASSEMBLY (505) REMOVAL**
 1. Remove the plate assembly. (Refer to step ⑧.)
 2. Remove 2 screws (L) and remove PAD assembly. If necessary, unsolder the lead wires.
- ⑪ **IDLER MOTOR ASSEMBLY (503) REMOVAL**
 1. Remove the direct drive motor. (Refer to step ⑨.)
 2. Remove 2 lock washers (M) and remove supply and take-up reel spindle assembly (508 and 509). At this time, remove the belt (511) and spring (507).
 3. Remove 3 screws (N) and remove the idler motor assembly.
- ⑫ **HEAD BASE ASSEMBLY (502) REMOVAL**
 1. Remove the direct drive motor. (Refer to step ⑨.)
 2. Remove 2 E-stop rings (O) and remove supply and take-up pinch roller assembly (516 and 513).
 3. Remove the lamp holder assembly (519) and lamp holder mounting bracket.
 4. Remove 2 E-stop ring (P) and remove head base assembly with record/playback and erase heads.

CIRCUIT DESCRIPTION

● MPX/DOLBY NR CIRCUIT

The MPX filter circuit is turned on and off by the MPX filter switch. When it is off, the signals bypass the circuit. The dolby circuit is turned on and off by the dolby NR switch, and selected B and C types by the dolby NR type selector. When the circuit is on and type selector is B position, B-type dolby equalization is applied so that the signal is compressed during recording and expanded during playback.

● MUTING

1. PLAYBACK MODE

When the play button is pressed, the muting signal for the playback mode (which cuts the recording signal) is output from ① pin of the 4 bit micro computer IC851 and applied to Q701 (left channel) and Q702 (right channel). This turns on Q701 and Q702 to mute the recording signal.

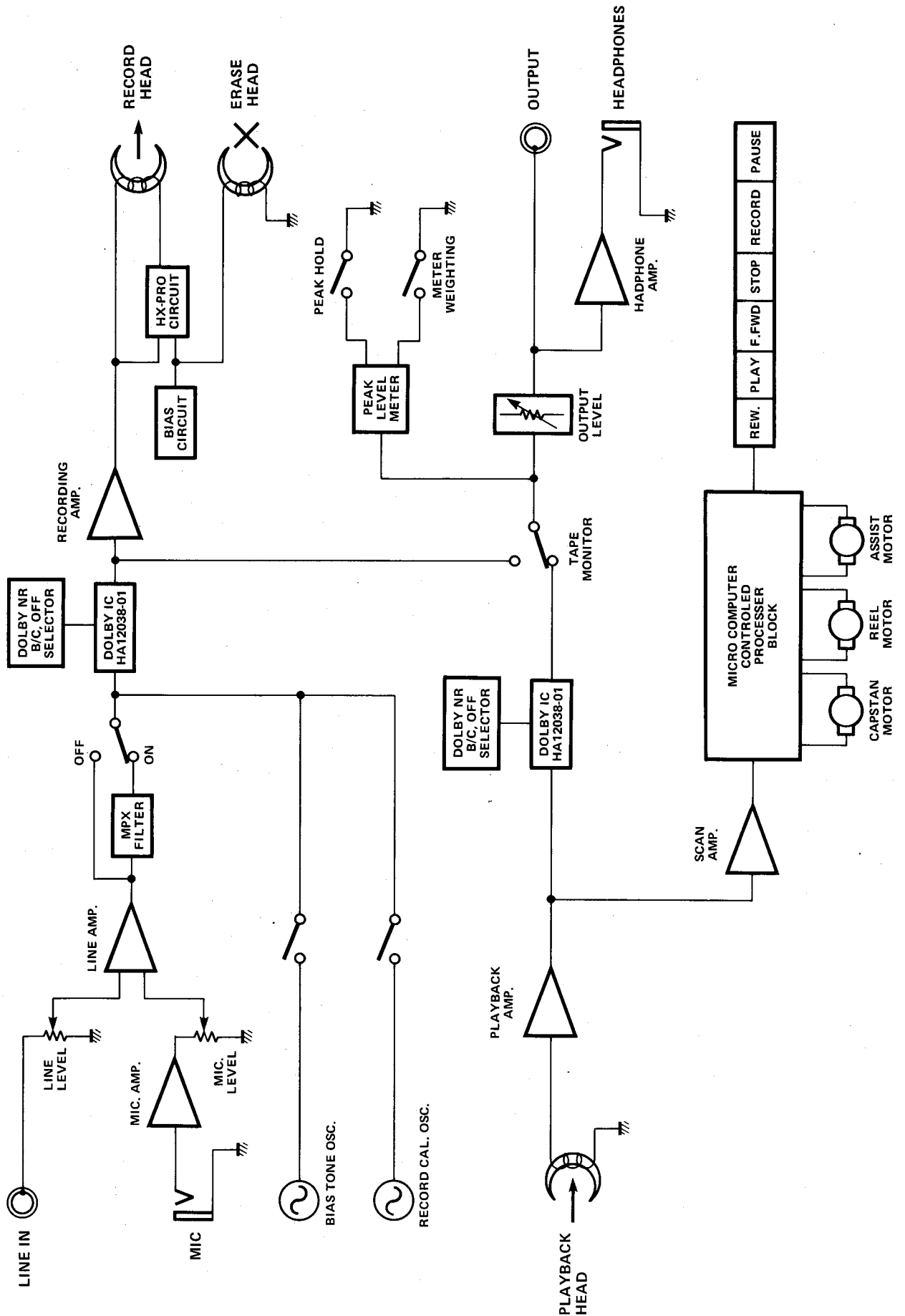
2. RECORDING MODE

When the record button is pressed, the muting signal for the record mode (which cuts the playback signal) is output from ③ pin of IC851 and applied to Q91 (left channel) and Q92 (right channel). This turns on Q91 and Q92 to mute the playback signal.

3. LINE MUTE (POWER SWITCH ON/OFF)

When the power is turned on, Q51 is turned on for a few seconds. At the same time Q93 and Q94 go on. ④ pin of the 4 bit micro computer IC851 becomes high level. The computer is reset. At the same time Q91 (left channel) and Q92 (right channel) are turned on. Thus, no shock noise is output to the OUTPUT terminals.

BLOCK DIAGRAM



Bias Fine Trim Feature

The optimal amount of recording bias varies from tape to tape. The bias fine trim feature is provided to enable precise adjustment for such variations.

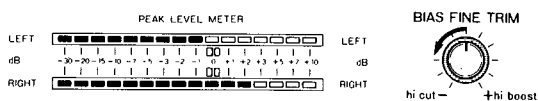
The high frequency range tends to be attenuated if the bias current is higher than the optimum value while it tends to be boosted if the bias current is less than the optimum value. Less than optimum bias also increases the amount of distortion in a recording.

This unit assists the user in determining the precise amount of bias, and therefore in obtaining the widest and flattest frequency response.

Operate as follows:

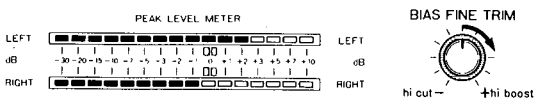
1. Insert a cassette tape in the CASSETTE COMPARTMENT and press the TAPE SELECTOR button corresponding to the type of tape being used.
2. Depress the TAPE MONITOR switch and make certain that the TAPE MONITOR indicator illuminates.
3. Press the RECORD and PLAY buttons together to start recording.
4. Hold the BIAS TONE button in. A 400Hz signal and a 12.5kHz signal are recorded in the left and right channels, respectively.
5. Compare the left and right channel PEAK LEVEL METER readings. If the amount of bias is optimum, the left and right channels will have the same reading. Turn the BIAS FINE TRIM knob counterclockwise (toward the direction marked as HI CUT) if the right channel reading exceeds the left channel reading or clockwise (toward the direction marked as HI BOOST) if the left channel reading exceeds the right channel reading.

If the right channel reading exceeds the left channel reading:



Turn the knob counterclockwise.

If the left channel reading exceeds the right channel reading:



Turn the knob clockwise.

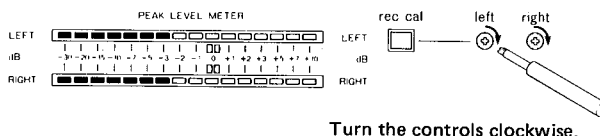
Record Calibration Feature

Each tape has different sensitivity. As a result, a tape that is recorded at a 0dB level may have a playback level that is either higher or lower than 0dB. The record calibration feature enables the user to precisely adjust the record/playback level so that both modes correlate. This is especially important when making Dolby NR encoded recordings.

Operate as follows:

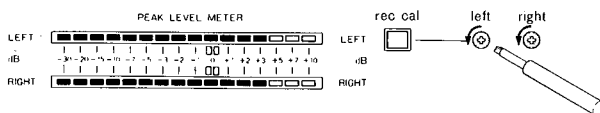
1. Insert the cassette tape to be recorded into the CASSETTE COMPARTMENT. Press the TAPE SELECTOR button according to the tape type.
2. Press the TAPE MONITOR switch and make certain that the TAPE MONITOR indicator illuminates.
3. Press the RECORD and PLAY button together to start recording.
4. Hold in the RECORD CALIBRATION button. A 400Hz signal is recorded on each channel.
5. If the PEAK LEVEL METERS show 0dB, no adjustment is required. If the indicated level is above or below 0dB, adjust the RECORD CALIBRATION control(s) of the left and right channels using a the screwdriver provided with your unit. If the indication of the PEAK LEVEL METER is below 0dB, turn the RECORD CALIBRATION control clockwise to adjust to 0dB. If the PEAK LEVEL METER reads above 0dB, turn the RECORD CALIBRATION control counterclockwise.

If the indication is below 0dB.



Turn the controls clockwise.

If the indication is above 0dB.



Turn the controls counterclockwise.

NOTE: Adjustment to 0dB may be impossible if the tape used is old or of poor quality.

ALIGNMENT PROCEDURES (REFER TO PAGES 29 AND 30)

ELECTRICAL ADJUSTMENT

1. Before adjustment

- After the power switch is pushed on, wait for 10 minutes before measuring to be sure of the most stable operation.
- Since head magnetization, dust accumulations, etc. are likely to introduce errors in the various characteristics, it is very important that the heads are properly demagnetized and cleaned before commencing any adjustment, particularly frequency response and head azimuth adjustment.

2. INSTRUMENTS REQUIRED

- Low frequency oscillator
- AC VTVM or dual channel AC VTVM
- Oscilloscope
- Wow/flutter meter
- Frequency counter

3. TEST TAPE

- Azimuth adjustment MTT-114
 - Tape speed adjustment MTT-111 or MTT-111D
 - Playback amp. level adjustment MTT-150 or TCC-130
 - Playback frequency characteristic confirmation TCC-162C and TCC-262C
 - Auto search adjustment MTT-150
 - Auto search confirmation MTT-250B
- Reference tapes
 LN XL-1
 CrO₂ AC-512
 Metal AC-711

Note:

C-90 differs with C-60 in the thickness and bias is unequal, so adjust with the tape whose bias is of specified value.

- General conditions (unless otherwise noted).

| CONTROLS AND SWITCHES | SETTINGS |
|-----------------------|----------|
| Dolby NR | off |
| MPX Filter | off |
| Tape Monitor | source |
| Bias Fine Trim | center |
| Timer | off |
| Output Level | max |
| Mic. Level | off |
| Rec. Level | max |
| Master Fader | max |

| STEP | ADJUSTMENT ITEM | INSTRUMENT REQUIRED | MODE | INPUT SIGNAL | POINT TO BE CONNECTED | ADJUST POINT | RATING | REMARKS | |
|------|--|---|-----------|---|-----------------------|-----------------------|--|--|---|
| 1 | Azimuth | VTVM Test tape (MTT-114) | PB | | TP501 or TP502 | Azimuth screw | Maximum output | Refer to "Azimuth adjustment" on page 12. | |
| 2 | Tape speed | Frequency counter Test tape (MTT-111 or MTT-111D) | PB | | TP501 or TP502 | VR built in motor | 3kHz +30 Hz -15 | | |
| 3 | Playback amp. level | VTVM Test tape (MTT-150 or TCC-130) | PB | | TP501 TP502 | VR101 VR102 | 580mV | | |
| 4 | Playback frequency characteristic confirmation | VTVM Test tape (TCC-162C and TCC-262C) | PB | | LINE OUTPUT | | Confirm that frequency response is within the range in Fig. a. | | |
| 5 | Auto search | VTVM Test tape (MTT-150) | PB | | TP751 | VR751 | 100mV | Set the auto search mode. Tape selector is CrO ₂ position. | |
| 6 | Auto search confirmation | Test tape (MTT-250B) | | | | | | Refer to "Auto search operation confirmation" on page 9. | |
| 7 | Step up trans. | VTVM | REC-PAUSE | | TP203 TP204 | L651 L203 L652 L204 | Maximum output | Tape selector is metal position. Set the bias fine trim to hi cut position. Set VR256 and VR257 all the way to counterclockwise. | |
| 8 | Bias trap | VTVM | REC-PAUSE | | TP201 TP202 | L205 L206 | Minimum output | Tape selector is metal position. Set the bias fine trim to hi cut position. Set VR256 and VR257 all the way to counterclockwise. | |
| 9 | Bias level (Pre-adjustment) | VTVM | REC-PAUSE | | TP203 TP204 | VR257 VR256 | 45mV | Tape selector is metal position. | |
| | | | | | TP203 TP204 | VR255 VR254 | 22mV | Tape selector is CrO ₂ position. | |
| | | | | | TP203 TP204 | VR253 VR252 | 13mV | Tape selector is LN position. | |
| 10 | Bias frequency confirmation | Frequency counter | REC-PAUSE | | TP251 | | 105kHz ± 5kHz | Tape selector is metal position. | |
| 11 | Record level (Pre-adjustment) | VTVM Blank tape (AC-512) | REC/PB | Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV in REC-PAUSE mode. | TP501 TP502 | VR201 VR202 | 580mV | Tape selector is CrO ₂ position. | |
| 12 | Peaking coil (Pre-adjustment) | VTVM | REC-PAUSE | Apply 27kHz signal to LINE INPUT. Set REC LEVEL knob so that TP101 and TP102 voltage is 580mV -25dB in REC-PAUSE mode. | TP201 TP202 | L201 L202 | Maximum output | Short the TP251 and TP252. Tape selector is metal position. | |
| 13 | Record/Playback equalizer frequency characteristic | VTVM Blank tapes metal AC-711 CrO ₂ AC-512 LN XL-1 | REC/PB | Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV -25dB in REC-PAUSE mode. Then adjust with a 20Hz to 30kHz sweep signal. | LINE OUTPUT | VR257 L201 VR256 L202 | | So that the record/playback frequency response is flat (at least within the range in Fig. b.) | Tape selector is metal position. |
| | | | | | LINE OUTPUT | VR255 L201 VR254 L202 | | So that the record/playback frequency response is flat (at least within the range in Fig. b.) | Tape selector is CrO ₂ position. |
| | | | | | LINE OUTPUT | VR253 VR252 | | So that the record/playback frequency response is flat (at least within the range in Fig. b.) | Tape selector is LN position. |

ALIGNMENT PROCEDURES (REFER TO PAGES 29 AND 30)

ELECTRICAL ADJUSTMENT

1. Before adjustment

- After the power switch is pushed on, wait for 10 minutes before measuring to be sure of the most stable operation.
- Since head magnetization, dust accumulations, etc. are likely to introduce errors in the various characteristics, it is very important that the heads are properly demagnetized and cleaned before commencing any adjustment, particularly frequency response and head azimuth adjustment.

2. INSTRUMENTS REQUIRED

- Low frequency oscillator
- AC VTVM or dual channel AC VTVM
- Oscilloscope
- Wow/flutter meter
- Frequency counter

3. TEST TAPE

- Azimuth adjustment MTT-114
 - Tape speed adjustment MTT-111 or MTT-111D
 - Playback amp. level adjustment MTT-150 or TCC-130
 - Playback frequency characteristic confirmation TCC-162C and TCC-262C
 - Auto search adjustment MTT-150
 - Auto search confirmation MTT-250B
- Reference tapes
- LN XL-1
 - CrO₂ AC-512
 - Metal AC-711

Note:

C-90 differs with C-60 in the thickness and bias is unequal, so adjust with the tape whose bias is of specified value.

| STEP | ADJUSTMENT ITEM | INSTRUMENT REQUIRED | MODE | INPUT SIGNAL | POINT TO BE CONNECTED |
|------|--|---|-----------|---|-----------------------|
| 1 | Azimuth | VTVM Test tape (MTT-114) | PB | | TP501 or TP502 |
| 2 | Tape speed | Frequency counter Test tape (MTT-111 or MTT-111D) | PB | | TP501 or TP502 |
| 3 | Playback amp. level | VTVM Test tape (MTT-150 or TCC-130) | PB | | TP501 TP502 |
| 4 | Playback frequency characteristic confirmation | VTVM Test tape (TCC-162C and TCC-262C) | PB | | LINE OUTPUT |
| 5 | Auto search | VTVM Test tape (MTT-150) | PB | | TP751 |
| 6 | Auto search confirmation | Test tape (MTT-250B) | | | |
| 7 | Step up trans. | VTVM | REC-PAUSE | | TP203 TP204 |
| 8 | Bias trap | VTVM | REC-PAUSE | | TP201 TP202 |
| 9 | Bias level (Pre-adjustment) | VTVM | REC-PAUSE | | TP203 TP204 |
| | | | | | TP203 TP204 |
| | | | | | TP203 TP204 |
| 10 | Bias frequency confirmation | Frequency counter | REC-PAUSE | | TP251 |
| 11 | Record level (Pre-adjustment) | VTVM Blank tape (AC-512) | REC/PB | Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV in REC-PAUSE mode. | TP501 TP502 |
| 12 | Peaking coil (Pre-adjustment) | VTVM | REC-PAUSE | Apply 27kHz signal to LINE INPUT. Set REC LEVEL knob so that TP101 and TP102 voltage is 580mV -25dB in REC-PAUSE mode. | TP201 TP202 |
| 13 | Record/Playback equalizer frequency characteristic | VTVM Blank tapes metal AC-711 CrO ₂ AC-512 LN XL-1 | REC/PB | Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV -25dB in REC-PAUSE mode. Then adjust with a 20Hz to 30kHz sweep signal. | LINE OUTPUT |
| | | | | | LINE OUTPUT |
| | | | | | LINE OUTPUT |
| | | | | | LINE OUTPUT |
| | | | | | LINE OUTPUT |

• General conditions (unless otherwise noted).

| CONTROLS AND SWITCHES | SETTINGS |
|-----------------------|----------|
| Dolby NR | off |
| MPX Filter | off |
| Tape Monitor | source |
| Bias Fine Trim | center |
| Timer | off |
| Output Level | max |
| Mic. Level | off |
| Rec. Level | max |
| Master Fader | max |

| TO BE TESTED | ADJUST POINT | RATING | REMARKS |
|--------------|------------------------------|---|--|
| r | Azimuth screw | Maximum output | Refer to "Azimuth adjustment" on page 12. |
| r | VR built in motor | 3kHz \pm 30 Hz -15 Hz | |
| | VR101 VR102 | 580mV | |
| TPUT | | Confirm that frequency response is within the range in Fig. a. | |
| | VR751 | 100mV | Set the auto search mode. Tape selector is CrO ₂ position. |
| | | | Refer to "Auto search operation confirmation" on page 9. |
| | L651 L203 L652 L204 | Maximum output | Tape selector is metal position. Set the bias fine trim to hi cut position. Set VR256 and VR257 all the way to counterclockwise. |
| | L205 L206 | Minimum output | Tape selector is metal position. Set the bias fine trim to hi cut position. Set VR256 and VR257 all the way to counterclockwise. |
| | VR257 VR256 | 45mV | Tape selector is metal position. |
| | VR255 VR254 | 22mV | Tape selector is CrO ₂ position. |
| | VR253 VR252 | 13mV | Tape selector is LN position. |
| | | 105kHz \pm 5kHz | Tape selector is metal position. |
| | VR201 VR202 | 580mV | Tape selector is CrO ₂ position. |
| | L201 L202 | Maximum output | Short the TP251 and TP252. Tape selector is metal position. |
| TPUT | VR257 L201 | So that the record/playback frequency response is flat (at least within the range in Fig. b.) | Tape selector is metal position. |
| | VR256 L202 | | |
| TPUT | VR255 L201 | So that the record/playback frequency response is flat (at least within the range in Fig. b.) | Tape selector is CrO ₂ position. |
| | VR254 L202 | | |
| TPUT | VR253 VR252 | So that the record/playback frequency response is flat (at least within the range in Fig. b.) | Tape selector is LN position. |

| STEP | ADJUSTMENT ITEM | INSTRUMENT REQUIRED | MODE | INPUT SIGNAL | POINT TO BE CONNECTED | A/P |
|------|--|---|-----------|--|-----------------------|----------|
| 14 | Record level | VTVM Blank tape (AC-512) | REC/PB | Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV in REC-PAUSE mode. Then adjust with a 20Hz to 30kHz sweep signal. | TP501 TP502 | VF VF |
| 15 | Record level confirmation | VTVM Blank tapes metal AC-711 LN XL-1 | REC/PB | Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV in REC-PAUSE mode. Then adjust with a 20Hz to 30kHz sweep signal. | TP501 TP502 | |
| 16 | Playback trap | VTVM Blank tape (XL-1) | REC/PB | Apply 250Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 25dB below 580mV in REC-PAUSE mode. | TP501 TP502 | L1 L1 |
| 17 | Record/playback equalizer frequency characteristic confirmation | VTVM Blank tapes metal AC-711 CrO ₂ AC-512 LN XL-1 | REC/PB | Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 25dB below 580mV in REC-PAUSE mode. Then adjust with a 20Hz to 30kHz sweep signal. | LINE OUTPUT | |
| 18 | Meter level | VTVM | REC-PAUSE | Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 0.5dB below 580mV in REC-PAUSE mode. | | VR VR |
| 19 | Record calibration tone level | VTVM | REC-PAUSE | | TP561 TP562 | VR |
| 20 | Bias tone | VTVM | REC-PAUSE | | TP561 TP562 | VR VR |
| 21 | LED display lighting level of record calibration tone confirmation | | REC-PAUSE | | | |
| 22 | LED display lighting level of bias tone confirmation | | REC-PAUSE | | | |
| 23 | MPX filter characteristic confirmation | | REC-PAUSE | Apply 15kHz and 19kHz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV in REC-PAUSE mode. | LINE OUTPUT | |
| 24 | Attenuation level confirmation | VTVM | REC-PAUSE | Apply 19.9kHz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 25dB below 580mV in REC-PAUSE mode. | TP201 TP202 | |
| 25 | Boost level confirmation | VTVM | PB | Apply 19.9kHz signal to LINE INPUT. Set REC LEVEL knob so that TP501 and TP502 voltage is 25dB below 580mV. | TP501 TP502 | |

| POINT TO BE CONNECTED | ADJUST POINT | RATING | REMARKS |
|-----------------------|----------------|---|---|
| P501 P502 | VR201 VR202 | 580mV | Tape selector is CrO2 position. |
| P501 P502 | | 580mV ± 0.5dB | This confirmation should be done at each tape selector position. |
| P501 P502 | L101 L102 | Minimum output | Tape selector is LN position. Dolby NR C is on. |
| NE OUTPUT | | Confirm that record/playback frequency response is within the range in Fig. c and Fig. d. If it is not within the specification, redo the adjustment and confirmation on steps 13, 15 and 16. | This confirmation should be done at each tape selector position under each of the following conditions, Dolby B and Dolby C on. |
| | VR401 VR402 | Adjust to the point where the 0VU LED of the LED display lights. | |
| P561 P562 | VR453 | 580mV | Keep pressing the REC CAL button. Adjust balance if there is a difference in output between the R and L channels. |
| P561 P562 | VR451 VR452 | 580mV -20dB | Keep pressing the BIAS TONE button. |
| | | | Refer to "LED display light level confirmation" on page 9. |
| | | | Same as above. |
| NE OUTPUT | | Confirm that attenuation of 15kHz and 19kHz is within the specification. | |
| P201 P202 | | Maximum output | Dolby NR C is on. |
| P501 P502 | | Maximum output | Dolby NR C is on. |

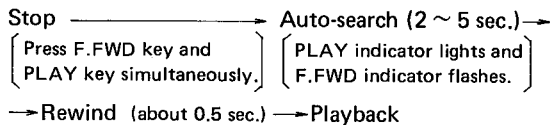
| STEP | ADJUSTMENT ITEM | INSTRUMENT REQUIRED | MODE | INPUT SIGNAL | POINT TO BE CONNECTED | ADJUST POINT | RATING | REMARKS |
|------|--|---|-----------|--|-----------------------|----------------|---|---|
| 14 | Record level | VTVM Blank tape (AC-512) | REC/PB | Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV in REC-PAUSE mode. Then adjust with a 20Hz to 30kHz sweep signal. | TP501 TP502 | VR201 VR202 | 580mV | Tape selector is CrO2 position. |
| 15 | Record level confirmation | VTVM Blank tapes metal AC-711 LN XL-1 | REC/PB | Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV in REC-PAUSE mode. Then adjust with a 20Hz to 30kHz sweep signal. | TP501 TP502 | | 580mV ± 0.5dB | This confirmation should be done at each tape selector position. |
| 16 | Playback trap | VTVM Blank tape (XL-1) | REC/PB | Apply 250Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 25dB below 580mV in REC-PAUSE mode. | TP501 TP502 | L101 L102 | Minimum output | Tape selector is LN position. Dolby NR C is on. |
| 17 | Record/playback equalizer frequency characteristic confirmation | VTVM Blank tapes metal AC-711 CrO2 AC-512 LN XL-1 | REC/PB | Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 25dB below 580mV in REC-PAUSE mode. Then adjust with a 20Hz to 30kHz sweep signal. | LINE OUTPUT | | Confirm that record/playback frequency response is within the range in Fig. c and Fig. d. If it is not within the specification, redo the adjustment and confirmation on steps 13, 15 and 16. | This confirmation should be done at each tape selector position under each of the following conditions, Dolby B and Dolby C on. |
| 18 | Meter level | VTVM | REC-PAUSE | Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 0.5dB below 580mV in REC-PAUSE mode. | | VR401 VR402 | Adjust to the point where the OVU LED of the LED display lights. | |
| 19 | Record calibration tone level | VTVM | REC-PAUSE | | TP561 TP562 | VR453 | 580mV | Keep pressing the REC CAL button. Adjust balance if there is a difference in output between the R and L channels. |
| 20 | Bias tone | VTVM | REC-PAUSE | | TP561 TP562 | VR451 VR452 | 580mV -20dB | Keep pressing the BIAS TONE button. |
| 21 | LED display lighting level of record calibration tone confirmation | | REC-PAUSE | | | | | Refer to "LED display light level confirmation" on page 9. |
| 22 | LED display lighting level of bias tone confirmation | | REC-PAUSE | | | | | Same as above. |
| 23 | MPX filter characteristic confirmation | | REC-PAUSE | Apply 15kHz and 19kHz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV in REC-PAUSE mode. | LINE OUTPUT | | Confirm that attenuation of 15kHz and 19kHz is within the specification. | |
| 24 | Attenuation level confirmation | VTVM | REC-PAUSE | Apply 19.9kHz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 25dB below 580mV in REC-PAUSE mode. | TP201 TP202 | | Maximum output | Dolby NR C is on. |
| 25 | Boost level confirmation | VTVM | PB | Apply 19.9kHz signal to LINE INPUT. Set REC LEVEL knob so that TP501 and TP502 voltage is 25dB below 580mV. | TP501 TP502 | | Maximum output | Dolby NR C is on. |

■ **AUTO-SEARCH OPERATION CONFIRMATION**

● **Conditions**

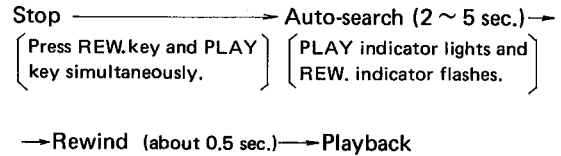
Test tape MTT-250B
 Tape Selector CrO₂
 Dolby NR off

1. Wind the test tape to its end and reset the counter to "0000".
2. Press the REW key to rewind the tape until the counter indicates around "9500".
3. Check for the following operation by pressing the F.FWD key and the PLAY key simultaneously.



4. Repeat the same check as in step 3 a few times by pressing the F.FWD key and the PLAY key simultaneously.

5. With the test tape rewound fully, reset the counter to "0000".
6. Wind the tape on quickly until the counter indicates around "0050" by pressing the F.FWD key.
7. Check for the following operation by pressing the REW. key and the PLAY key simultaneously.



8. Repeat the same check as in step 7 a few times by pressing the REW. key and the PLAY key simultaneously.

■ **LED DISPLAY LIGHTING LEVEL CONFIRMATION**

● **Conditions (unless otherwise noted)**

Output Level Center
 Mic. Level Off
 Bias Fine Trim Center
 Dolby NR Off
 MPX Filter Off
 Tape Monitor Monitor
 Connect a 10kΩ load resistors to LINE OUTPUT.

● **Test tape** MTT-150
 ● **Reference tapes**
 LN XL-1
 CrO₂ AC-512
 Metal AC-711

1. **Dolby NR light level confirmation**

Play back the test tape (MTT-150) and confirm that the LED display lights to 0VU with the tape selector at both the LN position and the CrO₂ position. If the display does not operate as described above, make a readjustment by repeating steps 3 and 18 of Electrical Adjustment.

2. **REC. CAL. TONE and BIAS TONE light level confirmation**

- 1) With the tape monitor switch set to source and the tape selector at the CrO₂ position, set the unit in the REC-PAUSE state. Then confirm that the LED display lights to 0VU when the REC CAL button is pressed.
 If the display does not operate as described above, make a readjustment by repeating step 19 of Electrical Adjustment.

- 2) Check to ensure that the LED display lights to 0VU when the BIAS TONE button is pressed.

If the display does not operate as described above, make a readjustment by repeating step 20 of Electrical Adjustment.

- 3) With the tape selector at the LN and then the Metal position, check to ensure that the LED display reading does not change when the buttons are pressed as in steps 1) and 2).

3. Playback level and playback frequency response confirmation of REC. CAL. TONE and BIAS TONE

1) With the tape selector set at the LN position, record the REC. CAL. TONE for more than 1 count indication of the counter. During playback, check to ensure that one of -1VU, 0VU and +1VU on the Lch of the LED display lights. If the display does not operate as described above, make a readjustment by repeating step 14 of Electrical Adjustment.

Repeat the same check with the tape selector set to the CrO₂ position and then the Metal position. The level difference with the Rch must be within 1VU.

2) As in step 1), record the BIAS TONE by pressing the BIAS TONE button and play it back. During playback, keep the BIAS TONE button depressed and check to ensure that one of -1VU, 0VU and +1VU on the Lch of the LED display lights. If the display does not operate as described above, make a readjustment by repeating step 14 of Electrical Adjustment.

The level difference with the Rch must be within 1VU.

4. Recording/playback frequency response correction confirmation by means of BIAS FINE TRIM

1) With the 2ch VTVM connected to the LINE OUTPUT terminals and the tape selector set to the CrO₂ position, record the BIAS TONE by pressing the BIAS TONE button and play it back. Note the output level of Lch and Rch when playing back and suppose it as 0dB.

2) Turn the BIAS FINE TRIM all the way to the BOOST side and confirm that the output level changes more than +2dB. Then turn it all the way to the CUT side and confirm that the output level changes less than -2dB.

3) Repeat the same confirmation procedure as in steps 1) and 2) with the tape selector set to the LN position and the Metal position respectively. The amount of the output level change should be more than +2dB on the BOOST side and less than -2dB on the CUT side.

5. MEMORY, AUTO REWIND, AUTO REPLAY operation confirmation

1) With the AUTO REWIND and AUTO REPLAY switches in the OFF state, load the tape and wind it up to the end by pressing the F.FWD key. Then confirm that the AUTO STOP operation. The unit must stop automatically about 2 seconds after the tape was wound fully and the reel stopped.

2) With the AUTO REWIND switch ON, rewind the tape (for any length) by pressing the REW key and then play it back to the end. Then confirm that the AUTO STOP operates about 2 seconds after the tape was fully wound up and the reel stopped and at the same time the REWIND operates automatically.

3) With the MEMORY switch ON, wind the tape approximately half way, press the RESET switch to make the counter indication "0000" and wind the tape quickly by pressing the F.FWD key (for any length). Then press the REW. key to rewind the tape and confirm that the tape automatically stops somewhere between "0000" and "9999" on the counter.

4) With the AUTO REPLAY switch ON, press the F.FWD key to wind the tape quickly (for any length). Then press the REW. key to rewind the tape and confirm that the tape stops automatically somewhere between "0000" and "9999" on the counter and at the same time the REPLAY operates.

5) Furthermore, press the REW. key to rewind to the end of the tape and confirm that about 2 seconds after the tape was fully rewound and the tape stopped, the AUTO STOP operates and at the same time the REPLAY operates.

■ CASSETTE MECHANISM ADJUSTMENT AND CONFIRMATION

1. Pinch roller contact timing

- 1) Run the capstans by placing the POWER switch in the ON position.
- 2) Lift the head base slowly until the take-up pinch roller starts rotating. Then confirm that there is a clearance of 0.05~0.5mm between the supply pinch roller and the capstan.

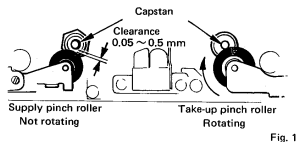


Fig. 1

- 3) If the pinch roller contact timing is simultaneous or reverse, advance the pinch roller contact timing of the take-up pinch roller by bending the A section in the below Fig. 2 in the arrow direction or replace the supply pinch roller assembly.

Note: If the contact timing has been adjusted by bending the A section of the head base, be sure to confirm after the adjustment that the capstan and the take-up pinch roller are not in contact while the deck is in the PAUSE mode.

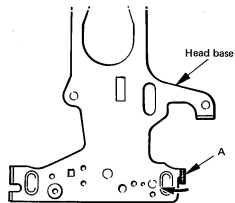


Fig. 2

2. Pinch roller parallelism confirmation

- 1) Push up the head base until right before the capstan and pinch roller contact and visually confirm for parallelism of each capstan and the pinch roller.

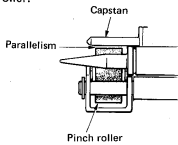


Fig. 3

- 2) If out of parallelism, check the pinch arm spindle for bend and if not bent, replace the pinch roller assembly.

3. Specification confirmation

- Check for the following specifications.
- 1) Back tension 6gcm (4.5~8gcm)
 - 2) Pinch roller pressure Tape-up 360g ± 40g
Supply 260g ± 40g

4. Head height adjustment

- 1) Install the M-300 head gauge plate.
- 2) With the unit in the PLAY state, apply the adjustment chip to the head gauge plate and make an adjustment with the adjusting screws A and B in the below Fig. 4 so that the chip doesn't contact the tape guide.

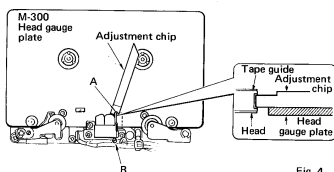


Fig. 4

5. Head penetration adjustment

- 1) Install the M-300 head gauge plate.
- 2) Apply the adjustment chip to the head and check for the chip to head clearance. If there is a clearance, make an adjustment with the adjusting screw C so that no clearance remains.

Note: 1. There should be no clearance at either record or playback head.
2. If there is a clearance at either record or playback head, adjust so that the clearance will be at the lower side as shown in the Fig. 5.
3. After the flapping adjustment, re-check the head height.

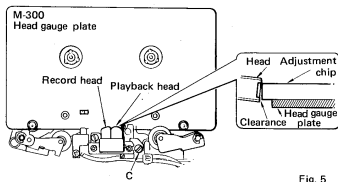


Fig. 5

6. Supply pinch roller height adjustment

- 1) Install the M-300 head gauge plate.
- 2) Set the unit in the PLAY state. With the adjustment chip applied to the tape guide of the supply pinch roller, check the tape guide to chip clearance. Make an adjustment with the adjusting screw D in the below Fig. 6 so that the upper and lower clearances become equal.
- 3) After the adjustment, repeat STOP-PLAY and re-check the height.

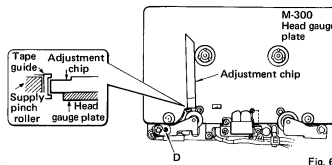


Fig. 6

7. Erase head flapping confirmation

As in step 5, visually check the erase head flapping. If the clearance is large, make an adjustment by inserting a spacer or replace the erase head.

8. Azimuth adjustment

When the maximum level point of R channel does not equal that of L channel, connect the oscilloscope as shown in Fig. 7 and proceed with azimuth adjustment so that L and R channels are in phase.

- 1) Connect L channel tape out to "X(or V)" and R channel to "Y(or H)". Observe the lissajous waveform.
- 2) Set L and R channels to monaural. Adjust vertical and horizontal gain so that the waveform becomes 45 degree.
- 3) Adjust azimuth so that the measurement of "a" becomes maximum and the measurement of "b" becomes minimum against 45 degree line.

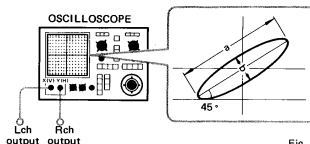


Fig. 7

9. Tape pass confirmation

- 1) With the mirror cassette (MC-109C without pad) in the PLAY state, check the tape for snaking or curling at the side.
- 2) Confirm by repeating PLAY-STOP more than twice.

● Contact or curling at the tape guide
Curling must be corrected but contact is acceptable.

● Watch carefully between the tape guide of the pinch roller and the erase head as flapping tends to occur there.

● If flapping exists, perform checking as described in the following 3) and on.

- 3) When the tape transport is unstable;
 - a. Re-adjust the supply pinch roller height as in step 6. Then perform the azimuth adjustment as in step 10 and check the tape transit. If the tape transit is satisfactory, check to ensure that the erase head height is proper.
 - b. If the pinch roller height adjustment can not correct the unstable tape transport, check each part for parallelism.

① Check the capstan spindle for tilt. If it has a tilt, try tilting the record and playback heads in the same direction.

② If the tape flapping exists right before the erase head, eliminate it by tilting the erase head with a spacer inserted A or B between the erase head and erase head base as shown in the Fig. 8.

③ Check for parallelism of the tape guide of the supply pinch roller and the capstan. If they are not parallel, replace the supply pinch roller assembly.

④ Check for parallelism of the take-up pinch roller and the capstan. If they are not parallel, replace the take-up pinch roller assembly.

Note: Make sure to perform the azimuth adjustment after each adjustment and then check the head height and flapping.

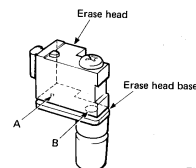


Fig. 8

■ CASSETTE MECHANISM ADJUSTMENT AND CONFIRMATION

6.

1. Pinch roller contact timing

- 1) Run the capstans by placing the POWER switch in the ON position.
- 2) Lift the head base slowly until the take-up pinch roller starts rotating. Then confirm that there is a clearance of 0.05 ~ 0.5mm between the supply pinch roller and the capstan.

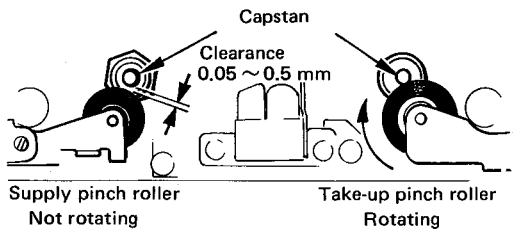


Fig. 1

- 3) If the pinch roller contact timing is simultaneous or reverse, advance the pinch roller contact timing of the take-up pinch roller by bending the A section in the below Fig. 2 in the arrow direction or replace the supply pinch roller assembly.

Note: If the contact timing has been adjusted by bending the A section of the head base, be sure to confirm after the adjustment that the capstan and the take-up pinch roller are not in contact while the deck is in the PAUSE mode.

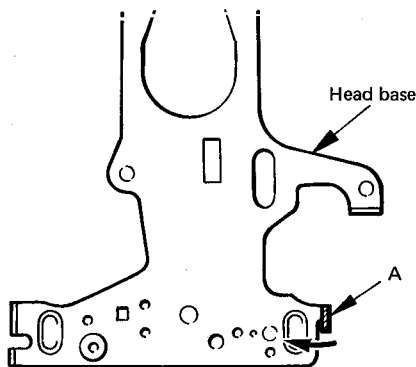


Fig. 2

2. Pinch roller parallelism confirmation

- 1) Push up the head base until right before the capstan and pinch roller contact and visually confirm for parallelism of each capstan and the pinch roller.

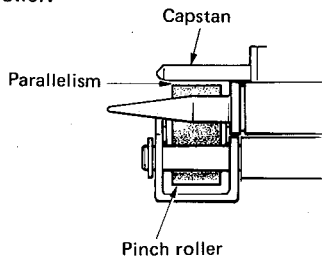


Fig. 3

- 2) If out of parallelism, check the pinch arm spindle for bend and if not bent, replace the pinch roller assembly.

3. Specification confirmation

Check for the following specifications.

- 1) Back tension 6gcm (4.5 ~ 8gcm)
- 2) Pinch roller pressure Tape-up 360g ± 40g
Supply 260g ± 40g

4. Head height adjustment

- 1) Install the M-300 head gauge plate.
- 2) With the unit in the PLAY state, apply the adjustment chip to the head gauge plate and make an adjustment with the adjusting screws A and B in the below Fig. 4 so that the chip doesn't contact the tape guide.

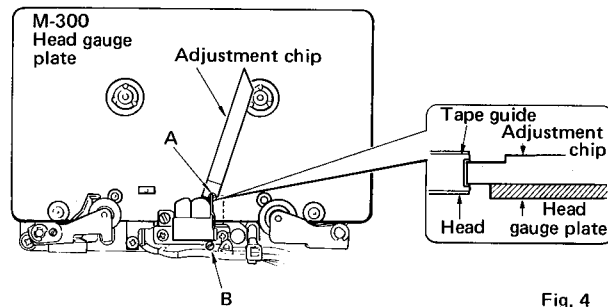


Fig. 4

Tape guide
Supply pinch roller

7.

5. Head penetration adjustment

- 1) Install the M-300 head gauge plate.
- 2) Apply the adjustment chip to the head and check for the chip to head clearance. If there is a clearance, make an adjustment with the adjusting screw C so that no clearance remains.

- Note:**
1. There should be no clearance at either record or playback head.
 2. If there is a clearance at either record or playback head, adjust so that the clearance will be at the lower side as shown in the Fig. 5.
 3. After the flapping adjustment, re-check the head height.

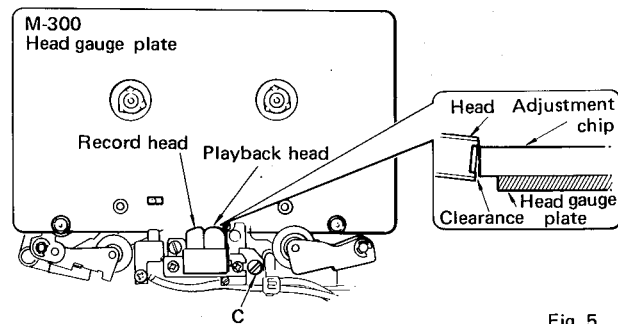


Fig. 5

1
ou

6. Supply pinch roller height adjustment

- 1) Install the M-300 head gauge plate.
- 2) Set the unit in the PLAY state. With the adjustment chip applied to the tape guide of the supply pinch roller, check the tape guide to chip clearance. Make an adjustment with the adjusting screw D in the below Fig. 6 so that the upper and lower clearances become equal.
- 3) After the adjustment, repeat STOP-PLAY and re-check the height.

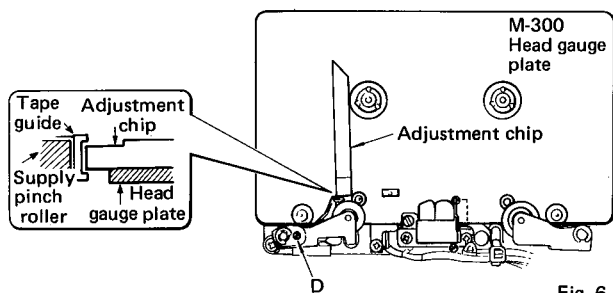


Fig. 6

7. Erase head flapping confirmation

As in step 5, visually check the erase head flapping. If the clearance is large, make an adjustment by inserting a spacer or replace the erase head.

8. Azimuth adjustment

When the maximum level point of R channel does not equal that of L channel, connect the oscilloscope as shown in Fig. 7 and proceed with azimuth adjustment so that L and R channels are in phase.

- a) Connect L channel tape out to "X(or V)" and R channel to "Y(or H)". Observe the lissajous waveform.
- b) Set L and R channels to monaural. Adjust vertical and horizontal gain so that the waveform becomes 45 degree.
- c) Adjust azimuth so that the measurement of "a" becomes maximum and the measurement of "b" becomes minimum against 45 degree line.

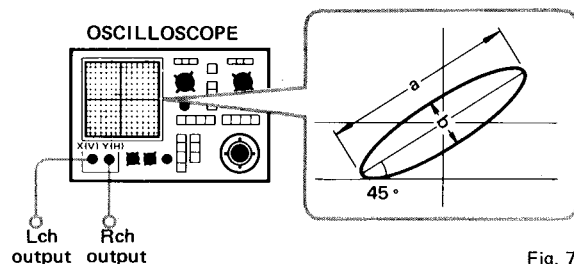


Fig. 7

9. Tape pass confirmation

- 1) With the mirror cassette (MC-109C without pad) in the PLAY state, check the tape for snaking or curling at the side.
- 2) Confirm by repeating PLAY-STOP more than twice.
 - Contact or curling at the tape guide
 - Curling must be corrected but contact is acceptable.
 - Watch carefully between the tape guide of the pinch roller and the erase head as flapping tends to occur there.
 - If flapping exists, perform checking as described in the following 3) and on.
- 3) When the tape transport is unstable;
 - a. Re-adjust the supply pinch roller height as in step 6. Then perform the azimuth adjustment as in step 10 and check the tape transit. If the tape transit is satisfactory, check to ensure that the erase head height is proper.
 - b. If the pinch roller height adjustment can not correct the unstable tape transport, check each part for parallelism.

- ① Check the capstan spindle for tilt. If it has a tilt, try tilting the record and playback heads in the same direction.
- ② If the tape flapping exists right before the erase head, eliminate it by tilting the erase head with a spacer inserted A or B between the erase head and erase head base as shown in the Fig. 8.
- ③ Check for parallelism of the tape guide of the supply pinch roller and the capstan. If they are not parallel, replace the supply pinch roller assembly.
- ④ Check for parallelism of the take-up pinch roller and the capstan. If they are not parallel, replace the take-up pinch roller assembly.

Note: Make sure to perform the azimuth adjustment after each adjustment and then check the head height and flapping.

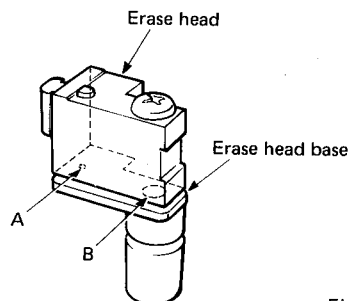
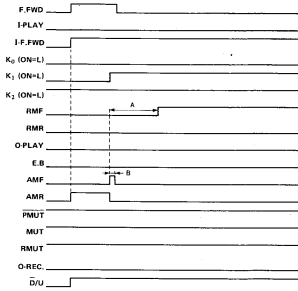


Fig. 8

TIMING CHART

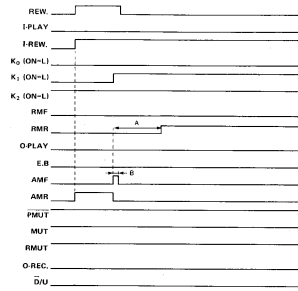
A = 130 msec.
B = 30 msec.

1. STOP → F.FWD



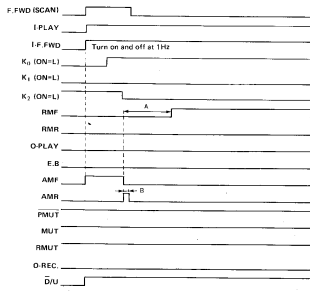
Cautions: 1. After AMR rises, the computer performs puls check and auto stop processing at F.FWD.
2. It performs auto stop and auto playback processing.

2. STOP → REW.



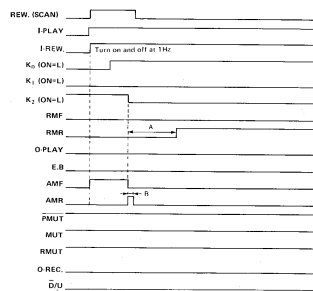
Cautions: 1. After AMR rises, the computer performs puls check and auto stop processing at REW.
2. It performs auto stop and auto playback processing.

3. STOP → SCAN F.FWD



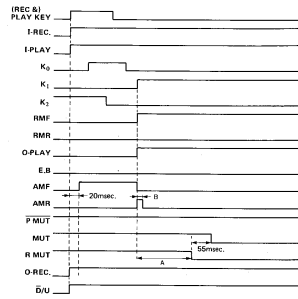
Cautions: 1. After AMR rises, the computer performs puls check and auto stop processing at F.FWD.
2. After AMR rises, if the set is in scan F.FWD, the computer checks scan signal and performs queing processing.

4. STOP → SCAN REW.



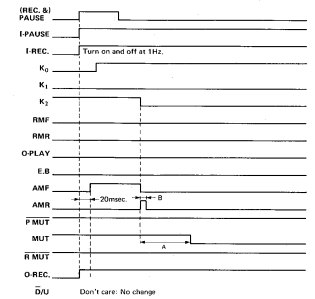
Cautions: 1. After AMR rises, the computer performs puls check and auto stop processing at F.FWD.
2. After AMR rises, if the set is in scan REW., the computer checks scan signal and performs queing processing.

5. STOP → RECORD & PLAYBACK



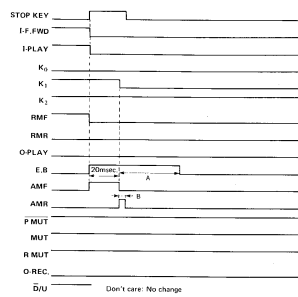
Cautions: 1. After RMF rises, the computer performs puls signal check, auto stop and auto rewind processing.
2. At timer play mode or immediately after attaching the cassette half, it performs correcting the slack of a tape.

6. STOP → RECORD-PAUSE

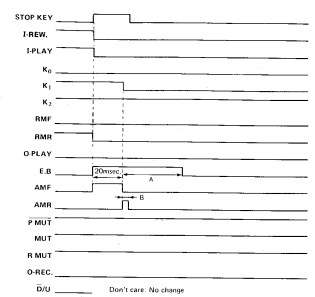


Cautions: 1. At recording pause, when play or pause key are depressed, the set switches over to recording mode.
2. Immediately after attaching a cassette half, when pause key performs correcting the slack of a tape.

7. F.FWD → STOP



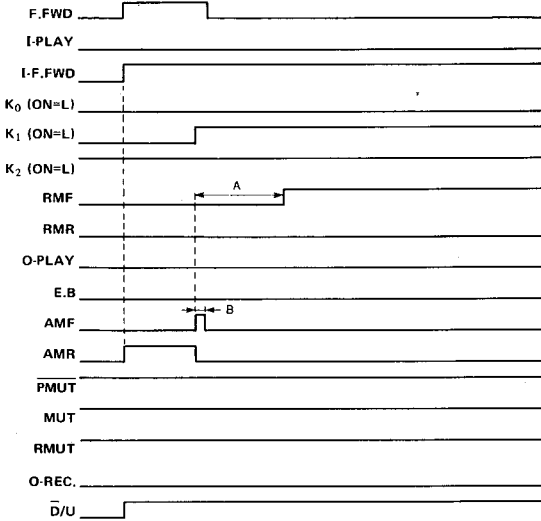
8. REW. → STOP



TIMING CHART

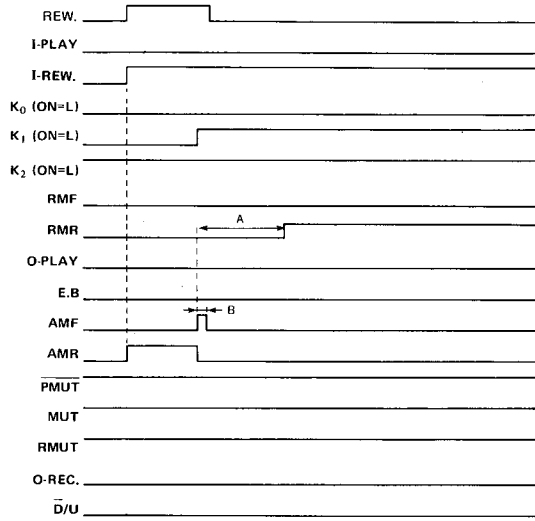
A = 130 msec.
B = 30 msec.

1. STOP → F.FWD



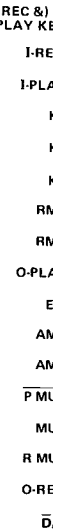
- Cautions:**
1. After AMR rises, the computer performs puls check and auto stop processing at F.FWD.
 2. It performs auto stop and auto playback processing.

2. STOP → REW.



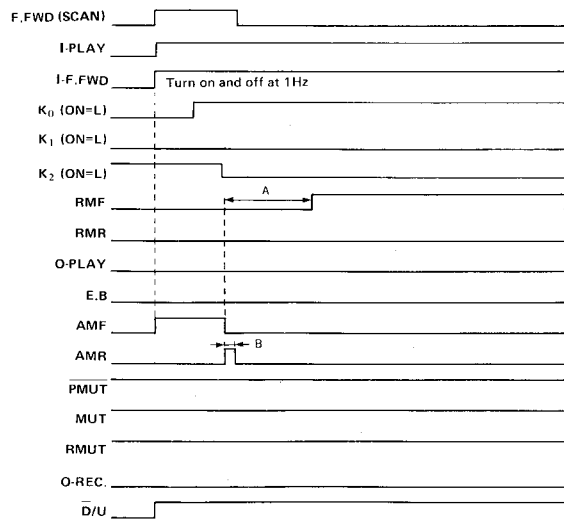
- Cautions:**
1. After AMR rises, the computer performs puls check and auto stop processing at REW.
 2. It performs auto stop and auto playback processing.

5. ST



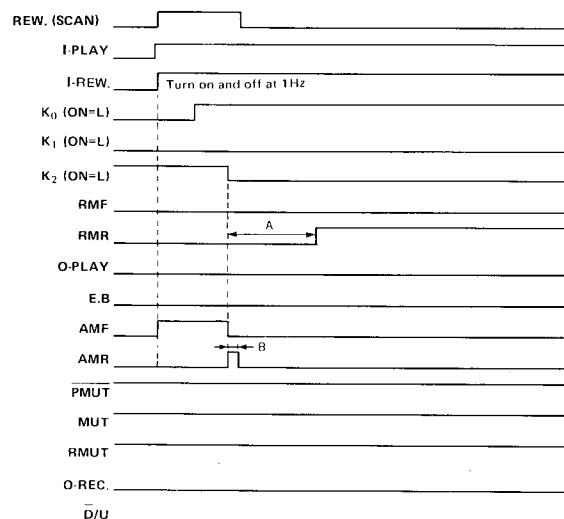
Cautio

3. STOP → SCAN F.FWD



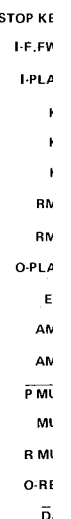
- Cautions:**
1. After AMR rises, the computer performs puls check and auto stop processing at F.FWD.
 2. After AMR rises, if the set is in scan F.FWD, the computer checks scan signal and performs queing processing.

4. STOP → SCAN REW.

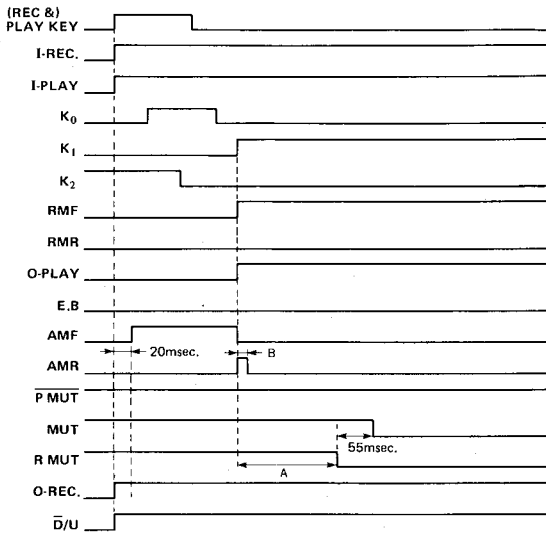


- Cautions:**
1. After AMR rises, the computer performs puls check and auto stop processing at F.FWD.
 2. After AMR rises, if the set is in scan REW., the computer checks scan signal and performs queing processing.

7. F.I

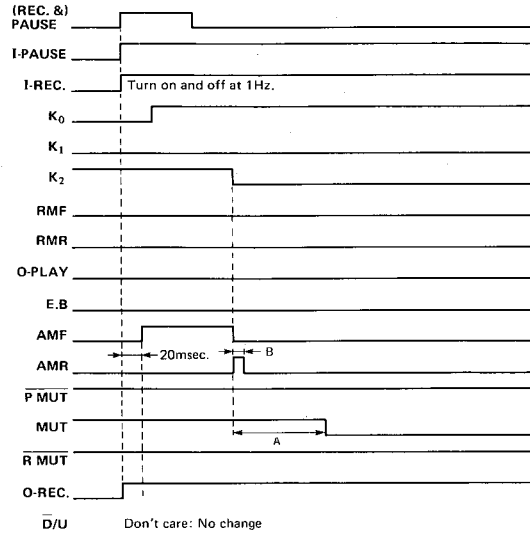


5. STOP → RECORD & PLAYBACK



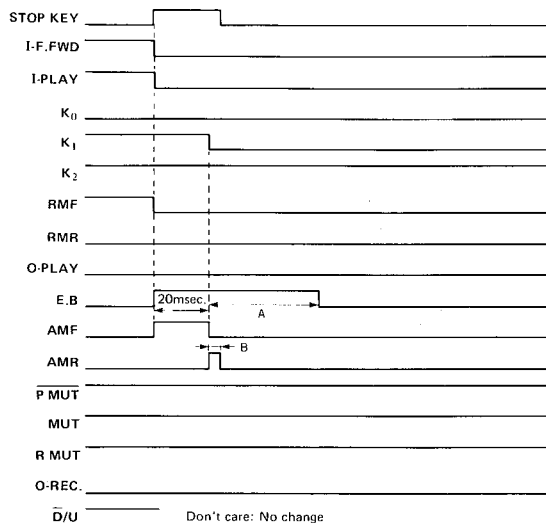
- Cautions:**
1. After RMF rises, the computer performs puls signal check, auto stop and auto rewind processing.
 2. At timer play mode or immediately after attaching the cassette half, it performs correcting the slack of a tape.

6. STOP → RECORD-PAUSE

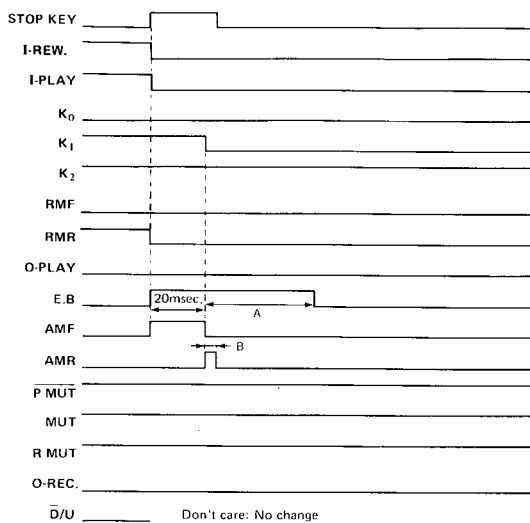


- Cautions:**
1. At recording pause, when play or pause key are depressed, the set switches over to recording mode.
 2. Immediately after attaching a cassette half, when pause key performs correcting the slack of a tape.

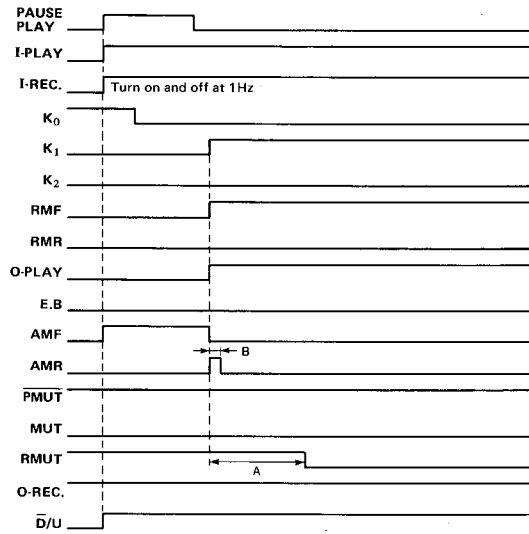
7. F.FWD → STOP



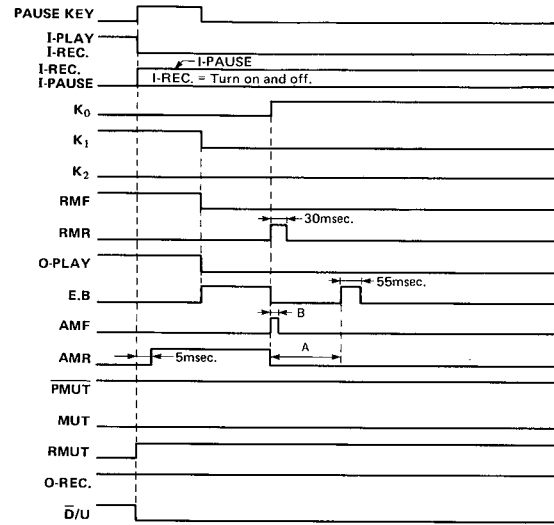
8. REW. → STOP



13. RECORD-PAUSE → RECORD



14. RECORD → RECORD-PAUSE



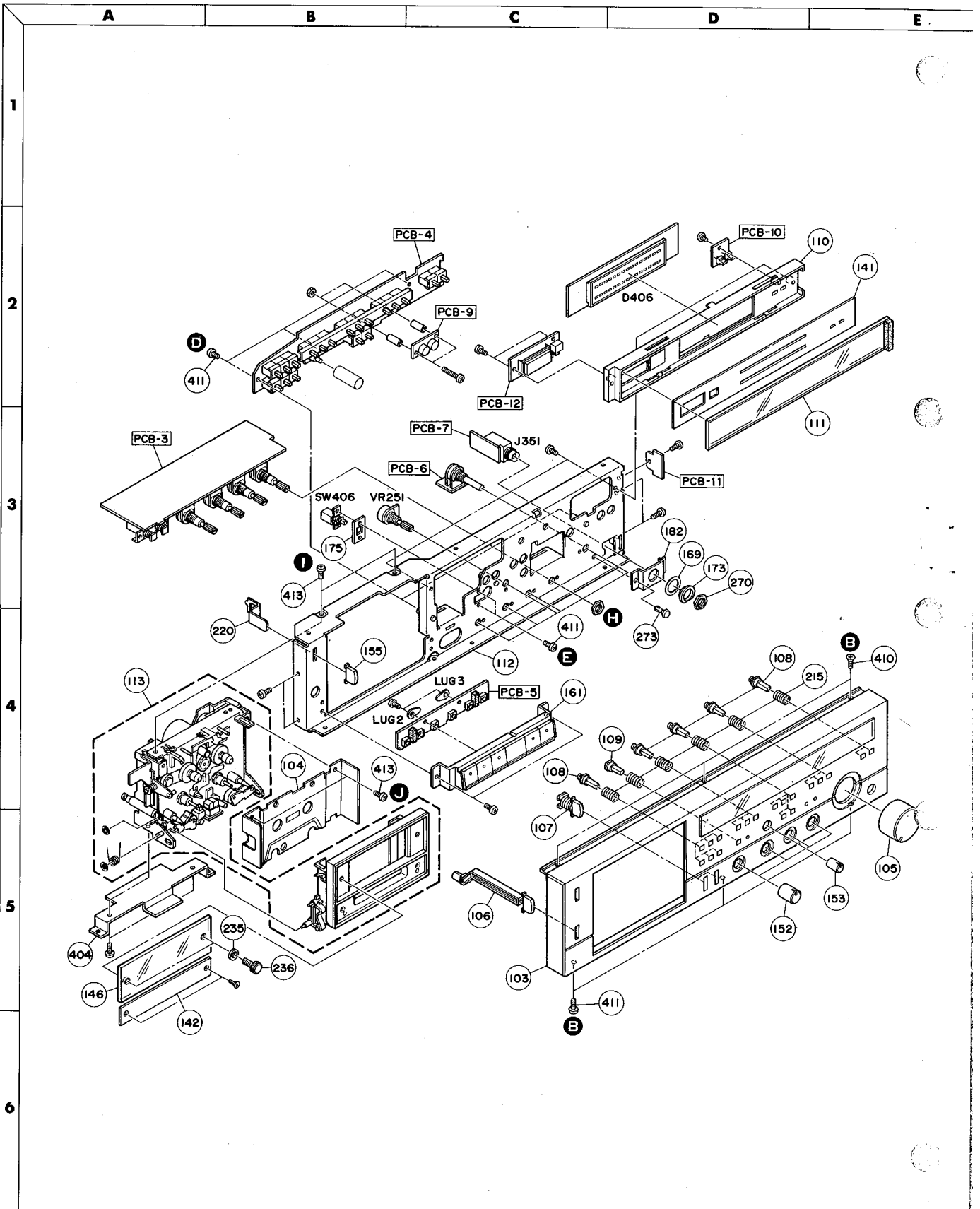
Caution: After RMF rises, the computer performs puls check, auto stop and auto rewind processing.

- All sorts of operating mode and conditions of output signals (steady states)

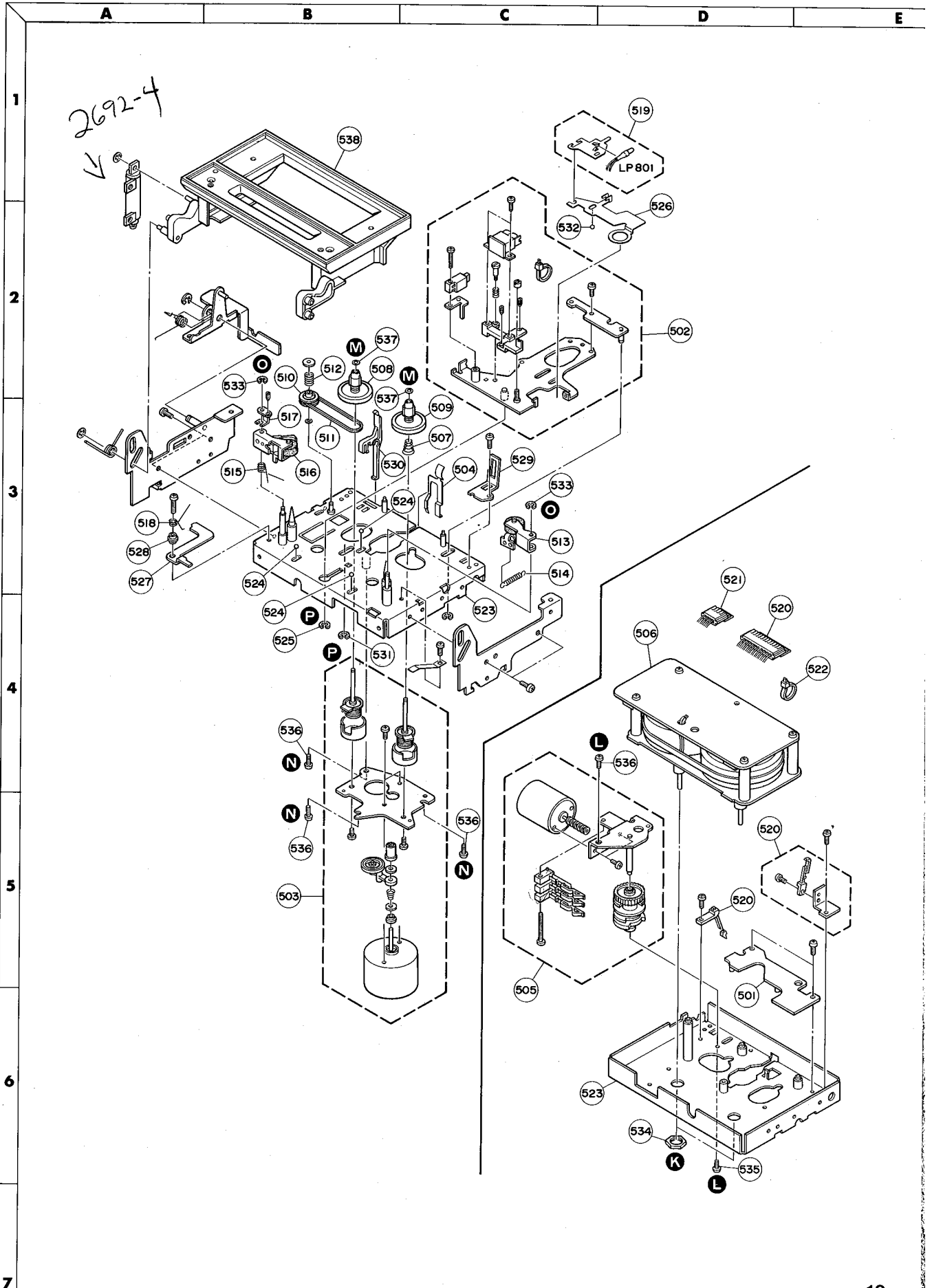
| OUTPUT MODE | I-REW. | I-PLAY | I-F.FWD | I-REC | I-PAUSE | RMF | RMR | O-PLAY | MUT | R MUT | O-REC. | D/U |
|--------------|--------|--------|---------|-------|---------|-----|-----|--------|-----|-------|--------|-----|
| REWIND | H | L | L | L | L | L | H | L | H | H | L | L |
| PLAYBACK | L | H | L | L | L | H | L | H | L | H | L | H |
| F.FWD | L | L | H | L | L | H | L | L | H | H | L | H |
| STOP | L | L | L | L | L | L | L | L | H | H | L | - |
| PAUSE | L | L | L | L | H | L | L | L | H | H | L | - |
| RECORD | L | L | L | H | L | H | L | H | L | L | H | H |
| RECORD PAUSE | L | L | L | H/L | H | L | L | L | L | H | H | - |
| SCAN (F.FWD) | L | H | H/L | L | L | H | L | L | H | H | L | H |
| SCAN (REW.) | H/L | H | L | L | L | L | H | L | H | H | L | L |
| AUTO SPACE | L | H/L | L | H | L | H | L | H | L | H | H | H |

H; high level output transistor on
 L; low level output transistor off
 H/L; on/off at 1Hz 50% duty

- When it turns on and off from L, it starts from H.
- When it turns on and off from H, it starts from L.
- ; Holds the before state.



CASSETTE MECHANISM EXPLODED VIEW



GENERAL UNIT PARTS LIST

| Ref. No. | Part No. | Description |
|----------|--------------|---|
| 101 | A414-CD491A | Cabinet Top Assembly |
| 102 | A424-CD491A | Cabinet Bottom Assembly (U.S.A. & Canada models) |
| " | A424-CD491B | Cabinet Bottom Assembly (General model) |
| " | A424-CD491C | Cabinet Bottom Assembly (General model Black Face version) |
| 103 | A443-CD491A | Front Panel Assembly (U.S.A., Canada & General models) |
| " | A443-CD491C | Front Panel Assembly (General model Black Face version) |
| 104 | A514-CD491A | Plate Assembly |
| 105 | A630-CD491A | Knob Assembly, Master Fader (U.S.A., Canada & General models) |
| " | A630-CD491B | Knob Assembly, Master Fader (General model Black Face version) |
| 106 | A662-CD491A | Push Button Assembly, Power |
| 107 | A662-CD491B | Push Button Assembly, Rec. Mute, Auto Space |
| 108 | A662-CD491C | Push Button Assembly, Reset, Time, Count, Memory, Auto rewind/replay, Dolby NR, NR Type, MPX Filter, Bias/Equalization (METAL, CrO ₂ , LN), Bias Tone, Rec. Cal, Timer (Play, Off, Rec.), Peak Hold, Meter Weighting |
| 109 | A662-CD491D | Push Button Assembly, Tape Monitor |
| 110 | A731-CD491A | Indicator Holder Assembly |
| 111 | A443-CD491B | Indicator Panel Assembly |
| 112 | B211-CD491A | Chassis Assembly, Front |
| 113 | C112-CD491A | Cassette Tape Recorder Mechanical Assembly (U.S.A., Canada & General models) |
| " | C112-CD491B | Cassette Tape Recorder Mechanical Assembly (General model Black Face version) |
| 131 | 1319-0139 | Foot |
| 136 | 1424-09301 | Cabinet Back (U.S.A. & Canada models) |
| " | 1424-09302 | Cabinet Back (General model & General model Black Face version) |
| 141 | 1513-04801 | Plate |
| 142 | 1513-05101 | Dressing Plate (U.S.A., Canada & General models) |
| " | 1513-05102 | Dressing Plate (General model Black Face version) |
| 146 | 1531-05601 | Cassette Compartment Cover |
| 152 | 1630-01901 | Knob, Output Level, Mic. Level, Rec. Level (U.S.A., Canada & General models) |
| " | A634-CD491A | Knob Assembly, Output Level, Mic. Level, Rec. Level (General model Black Face version) |
| 153 | 1634-02701 | Knob, Bias Fine Trim (U.S.A., Canada & General models) |
| " | 1634-02702 | Knob, Bias Fine Trim (General model Black Face version) |
| 155 | 1662-05501VN | Push Button, Eject |
| 161 | 3351-015 | Push Button Assembly, Cassette Mechanism Control |
| 169 | 2111-1356 | Felt |
| 172 | 2114-415027 | Bushing |
| 173 | 2114-72167 | Bushing |
| 175 | 2132-7115 | Spacer |
| 180 | 2114-71254 | Bushing |
| 181 | 2219-7093 | Bracket |
| 182 | 2219-7809 | Bracket |
| 191 | 2224-7061 | Insulator (Except General model & General model Black Face version) |
| 192 | 2240-7118 | Holder (Except General model & General model Black Face version) |
| 198 | 2240-7120 | Holder |
| 215 | 2651-2101705 | Spring |
| 220 | 2674-7013 | Slider |
| 235 | 2114-01224 | Bushing |
| 236 | 2310-7025 | Special Screw |
| 270 | 2440-61 | Special Nut |
| 273 | 2459-3003511 | Rivet |
| 301 | 2222-7147 | Heat Sink |
| 302 | 2222-7151 | Heat Sink |
| 303 | 2222-7067 | Heat Sink |
| 305 | 2114-71278 | Bushing |
| 306 | 2652-00309 | Leaf Spring |
| 307 | 2440-7017 | Special Nut (Except U.S.A. & Canada models) |
| 401 | 2211-7238 | Chassis, Left (U.S.A. & Canada models) |
| " | 2211-7245 | Chassis, Left (General model & General model Black Face version) |
| 402 | 2219-7811 | Bracket, SW1 |
| 403 | 2219-7909 | Bracket, Microphone Jack |
| 404 | 2219-7910 | Bracket, Cassette Mechanism Bottom |
| 405 | 2219-7911 | Bracket, Right |

| Ref. No. | Part No. | Description |
|----------|-------------|---|
| 406 | 2219-7924 | Bracket, PCB-1 Mounting |
| 407 | 2219-7937 | Bracket, T1 |
| " | 2219-7963 | Bracket, T1 (for General model) |
| 408 | 2347-400647 | Bind Head Tapping Screw |
| 409 | 2347-300647 | Bind Head Tapping Screw |
| 410 | 2343-300627 | Self-Tapping Screw |
| 411 | 2347-300627 | Bind Head Tapping Screw |
| 412 | 2347-300827 | Bind Head Tapping Screw |
| 413 | 2347-260547 | Bind Head Tapping Screw |
| 414 | 2347-300841 | Bind Head Tapping Screw |
| | 1111-J30147 | Owner Guide (U.S.A. model) |
| | 1111-J30148 | Owner Guide (Canada, General models & General model Black Face version) |
| | 1221-897130 | Packing Box |
| | 1222-7184 | Packing Cushion (2 Used) |
| | 4474-29 | AC Adaptor (General model & General model Black Face version) |
| | 1192-1 | Screw Driver, Rec. Cal. Tone Level ADJ. |

CASSETTE MECHANISM PARTS LIST

| Ref. No. | Part No. | Description |
|----------|-------------|---|
| 501 | SIE08008-07 | Rotation Sensor P.C. board |
| 502 | SIE02016-09 | Head Base Assembly |
| 503 | SID05001-08 | Idler Motor Assembly |
| 504 | SIE25017-01 | Cassette Hold Spring |
| 505 | SIE09048-03 | PAD Assembly |
| 506 | 30A2NLB-51 | Direct Drive Motor |
| 507 | SIE24010-03 | Spindle Spring, Take-up Reel |
| 508 | SIE04006-02 | Supply Reel Spindle Assembly |
| 509 | SIE04018-03 | Take-up Reel Spindle Assembly |
| 510 | SIE14004-01 | Pulley |
| 511 | SIE18001-07 | Belt |
| 512 | SIE24034-01 | Spring |
| 513 | SIE99017-02 | Take-up Pinch Roller Assembly |
| 514 | SIE24017-01 | Spring |
| 515 | SIE24068-02 | Spring |
| 516 | SIE99018-02 | Supply Pinch Roller Assembly |
| 517 | SIE12004-01 | Adjustment Bracket, Supply Pinch Roller |
| 518 | SIE24007-01 | Spring |
| 519 | SIE09025-01 | Lamp Holder Assembly |
| 520 | SIE09129-01 | Switch & Connector Assembly |
| 521 | SIE67065-01 | Connector with Lead Wires, 6 Pos. |
| 522 | SIE33014-01 | Holder, Lead Wires |
| 523 | SID01007-14 | Chassis Assembly |
| 524 | SIE36002-01 | Steel Ball |
| 525 | SIE36001-02 | E-Stop Ring |
| 526 | SIE25010-01 | Bracket, Head Base Hold |
| 527 | SIE21018-02 | Lock Lever |
| 528 | SIE23004-01 | Collar |
| 529 | SIE21015-02 | Bracket, Cassette Detect Switch |
| 530 | SIE20006-01 | Lever, Mis-Erase Protect Switch |
| 531 | SIE36001-01 | E-Stop Ring |
| 532 | SIE36002-03 | Steel Ball |
| 533 | 22145 | E-Stop Ring |
| 534 | SIE36014-01 | Hexagon Nut |
| 535 | SEE30545-01 | Pan Head Screw |
| 536 | SEE30535-01 | Pan Head Screw |
| 537 | SEE10228-02 | Washer |
| 538 | A614-CD491A | Cassette Compartment Slot Assembly (U.S.A., Canada & General model) |
| " | A614-CD491B | Cassette Compartment Slot Assembly (General model Black Face version) |

ELECTRICAL PARTS LIST

| Ref. No. | Part No. | Description |
|---|---------------|---|
| CHASSIS MISCELLANEOUS | | |
| P1 | 4161-0487 | Power Cord |
| " | 4161-7256 | Power Cord (for General model) |
| T1 | 5584-703434 | Power Transformer |
| " | 5584-702434 | Power Transformer (for General model) |
| VR251 | 5113-2028221 | Control, 2k Ω B, Bias Fine Trim |
| D406 | 5623-LT1107 | L.E.D. Display, Peak Level Meter |
| SW2 | 4411-104736 | Rotary Switch, Voltage Selector (for General model) |
| F1 | 5732-402031 | Fuse, 4A, 125V (Except General model) |
| LUG1 | 4211-4 | Lug Terminal |
| LUG2, 3 | 4211-6 | Lug Terminal |
| | 4472-0125 | Fuse Holder (Except General model) |
| PCB-1 MAIN P.C. BOARD | | |
| RESISTORS | | |
| R101, 102, 531, 532, 591, 592 | 5174-563381 | 56k Ω , \pm 1%, 1/4W, Metal |
| R113, 114, 117, 118 | 5174-622381 | 6.2k Ω , \pm 1%, 1/4W, Metal |
| R115, 116 | 5174-123381 | 12k Ω , \pm 1%, 1/4W, Metal |
| R137, 138 | 5102-4704715 | 47 Ω , \pm 2%, 1/4W, Fuse |
| R273, 274 | 5102-6804715 | 68 Ω , \pm 2%, 1/4W, Fuse |
| R365, 366, 367, 368, 465, 466, 671, 672 | 5102-1004715 | 10 Ω , \pm 2%, 1/4W, Fuse |
| R505, 506, 565, 566 | 5174-512381 | 5.1k Ω , \pm 1%, 1/4W, Metal |
| R507, 508, 567, 568 | 5174-153381 | 15k Ω , \pm 1%, 1/4W, Metal |
| R557, 610 | 5102-1204715 | 12 Ω , \pm 2%, 1/4W, Fuse |
| R651, 652 | 5174-104381 | 100k Ω , \pm 1%, 1/4W, Metal |
| R667, 668 | 5102-5604713 | 56 Ω , \pm 2%, 1/4W, Fuse |
| R761 | 5102-1014715 | 100 Ω , \pm 2%, 1/4W, Fuse |
| CONTROLS | | |
| VR101, 102, 254, 255, 256, 257 | 5101-20371920 | 20k Ω B |
| VR252, 253 | 5101-50271920 | 5k Ω B |
| VR451, 452, 751 | 5101-50371920 | 50k Ω B |
| VR453 | 5101-50171920 | 500 Ω B |
| CAPACITORS | | |
| C81 | 5352-224571 | 0.22 μ F, \pm 5%, 63V, Metalized Polyester |
| C101, 102 | 5353-270534 | 27pF, \pm 5%, 500V, Mica |
| C103, 104 | 5345-226C0226 | 22 μ F, \pm 20%, 16V, Electrolytic |
| C105, 106 | 5345-337A0952 | 330 μ F, \pm 20%, 6.3V, Electrolytic |
| C107, 108, 109, 110 | 5359-3927851 | 3900pF, \pm 2%, 100V, Polypropylene |
| C111, 112 | 5345-106C0226 | 10 μ F, \pm 20%, 16V, Electrolytic |
| C115, 116, 219, 220 | 5345-107C041 | 100 μ F, \pm 20%, 16V, Electrolytic |
| C151, 152, 155, 156 | 5345-106C0952 | 10 μ F, \pm 20%, 16V, Electrolytic |
| C153, 154, 251, 457, 458, 667, 668, 757, 758, 759 | 5345-476C041 | 47 μ F, \pm 20%, 16V, Electrolytic |
| C207, 208 | 5345-105F0951 | 1 μ F, \pm 20%, 50V, Electrolytic |
| C209, 210 | 5345-226C0952 | 22 μ F, \pm 20%, 16V, Electrolytic |
| C211, 212 | 5352-154571 | 0.15 μ F, \pm 5%, 63V, Metalized Polyester |
| C215, 216 | 5342-106C0951 | 10 μ F, \pm 20%, 16V, Electrolytic |
| C252 | 5342-476C0951 | 47 μ F, \pm 20%, 16V, Electrolytic |
| C351, 352, 353, 354, 551, 552, 611, 612 | 5345-226C041 | 22 μ F, \pm 20%, 16V, Electrolytic |
| C455, 456 | 5345-105F041 | 1 μ F, \pm 20%, 50V, Electrolytic |
| C501, 502, 527, 528, 561, 562, 587, 588, 615, 616 | 5345-106C0951 | 10 μ F, \pm 20%, 16V, Electrolytic |
| C503, 504, 563, 564 | 5345-107C0952 | 100 μ F, \pm 20%, 16V, Electrolytic |
| C505, 506, 553, 565, 566, 613, 614 | 5345-477C041 | 470 μ F, \pm 20%, 16V, Electrolytic |
| C507, 508, 509, 510, 567, 568, 569, 570 | 5359-153771 | 0.015 μ F, \pm 2%, 50V, Polypropylene |
| C511, 512, 539, 540, 571, 572, 599, 600 | 5345-L106M16 | 10 μ F, \pm 20%, 16V, Electrolytic |
| C517, 518, 543, 544, 577, 578, 603, 604 | 5345-L475M25 | 4.7 μ F, \pm 20%, 25V, Electrolytic |

| Ref. No. | Part No. | Description |
|--|---------------|--|
| C519, 520, 521, 522, 545, 546, 579, 580, 581, 582, 605, 606 | 5345-L154M50 | 0.15 μ F, \pm 20%, 50V, Electrolytic |
| C523, 524, 525, 526, 547, 548, 583, 584, 585, 586, 607, 608 | 5345-L474M50 | 0.47 μ F, \pm 20%, 50V, Electrolytic |
| C535, 536, 595, 596 | 5359-3327851 | 3300pF, \pm 2%, 100V, Polypropylene |
| C537, 538, 597, 598 | 5359-3927851 | 3900pF, \pm 2%, 100V, Polypropylene |
| C651, 652 | 5359-1515851 | 150pF, \pm 5%, 100V, Polypropylene |
| C661, 662 | 5359-3915851 | 390pF, \pm 5%, 100V, Polypropylene |
| C665, 666 | 5353-101534 | 100pF, \pm 5%, 500V, Mica |
| C756 | 5345-224F0952 | 0.22 μ F, \pm 20%, 50V, Electrolytic |
| INTEGRATED CIRCUITS | | |
| IC151 | 5652-M5218L | M5218L |
| IC201 | 5652-M5220P | M5220P |
| IC451, 653, 751 | 5652-M5218P | M5218P |
| IC501, 502, 561, 562 | 5652-12038-01 | HA12038-01 |
| IC651, 652 | 5652-HA17082P | HA17082PS |
| IC752 | 5652-BA335 | BA335 |
| TRANSISTORS | | |
| Q83,84, 109, 110, 201, 202, 203, 204, 205, 206, 251, 252, 253, 254, 455, 456, 457, 701, 702 | 5613-2603(F) | 2SC2603(F) or 2SC2603(E) |
| Q101, 102 | 5613-2855(E) | 2SC2855(E) or 2SC2855(D) |
| Q103, 104 | 5611-1190(E) | 2SA1190(E) or 2SA1190(D) |
| Q105, 106 | 5613-2320L(F) | 2SC2320L(F) |
| Q107, 108 | 5611-999L(F) | 2SA999L(F) |
| Q111, 355, 356, 501, 561 | 5611-966(Y) | 2SA966(Y) |
| Q112, 357, 358 | 5613-2236(Y) | 2SC2236(Y) |
| Q255 | 5611-1115(F) | 2SA1115(F) or 2SA1115(E) |
| Q351, 352 | 5613-2320(F) | 2SC2320(F) |
| Q353, 354 | 5611-999(F) | 2SA999(F) |
| Q451, 452, 453, 454 | 5616-246(GR) | F.E.T., 2SK246(GR) |
| Q458, 459 | 5613-2878(B) | 2SC2878(B) |
| Q651, 652 | 5613-3246(H) | 2SC3246(H) |
| DIODES | | |
| D101, 102, 501, 561 | 5635-HZ11B2L | Zener, HZ11B2L |
| D251, 254, 455, 456, 457, 651, 652, 653, 654 | 5631-1S2473 | 1S2473 |
| D252, 253 | 5636-MC921 | MC921 |
| D451, 452, 453, 454 | 5635-RD5R1EB2 | Zener, RD5.1EB2 |
| D562, 563 | 5635-RD5R6EB2 | Zener, RD5.6EB2 |
| D751 | 5635-RD10EB2 | Zener, RD10EB2 |
| COILS | | |
| L101, 102, 203, 204 | 5932-70116 | |
| L201, 202 | 5932-70323 | 2.7mH |
| L205, 206 | 5932-70115 | |
| L501, 502, 561, 562 | 5932-70215 | |
| L651, 652 | 5933-70123 | |
| MISCELLANEOUS | | |
| OS101 | 6171-0103 | Complex, Record Bias Osc. |
| SW406 | 4422-70111 | Remote Switch, Tape Monitor |
| J1/2/3/4 | 4484-24 | 4-Pin Jack, Line Input, Line Output |
| J151, 152 | 4452-0110 | Jack, Microphones |
| P201 | 4443-040185 | Connector, 4 Pos. |
| P202, 251, 301, 502, 551, 601 | 4443-030185 | Connector, 3 Pos. |
| P451 | 4443-100185 | Connector, 10 Pos. |
| P501, 503 | 4443-034116 | Connector, 3 Pos. |
| J809 | 4163-071002 | Connector with Lead Wire, 7 Pos. |
| | 2132-5049 | Spacer, D501, 561 |

| Ref. No. | Part No. | Description |
|--|----------------|---------------------------------------|
| PCB-2 LOGIC CONTROL P.C. BOARD | | |
| RESISTORS | | |
| R20, 27 | 5102-4R74713 | 4.7Ω, ±2%, 1/4W, Fuse |
| CAPACITORS | | |
| C3 | 5345-478D0962 | 4700μF, ±20%, 25V, Electrolytic |
| C4 | 5345-228D041 | 2200μF, ±20%, 25V, Electrolytic |
| C5, 6, 11, 13, 51 | 5345-477C041 | 470μF, ±20%, 16V, Electrolytic |
| C7 | 5341-109D0958 | 10000μF, ±20%, 25V, Electrolytic |
| C8, 9 | 5352-684571 | 0.68μF, ±5%, 63V, Metalized Polyester |
| C14 | 5345-107C041 | 100μF, ±20%, 16V, Electrolytic |
| C52 | 5345-476D041 | 47μF, ±20%, 25V, Electrolytic |
| C53 | 5345-475D041 | 4.7μF, ±20%, 25V, Electrolytic |
| C54 | 5345-106D041 | 10μF, ±20%, 25V, Electrolytic |
| C802 | 5342-475D0951 | 4.7μF, ±20%, 25V, Electrolytic |
| C901 | 5345-474F041 | 0.47μF, ±20%, 50V, Electrolytic |
| INTEGRATED CIRCUITS | | |
| IC1 | 5653-T78012AP | TA78012AP |
| IC801 | 5653-BA6109 | BA6109 |
| IC851 | 5654-58846-41 | M58846-641SP |
| IC852 | 5654-TD62503P | TD62503P |
| IC901 | 5654-TC4001BP | TC4001BP |
| TRANSISTORS | | |
| Q1, 9 | 5611-1217(Y) | 2SA1217(Y) |
| Q2, 11 | 5613-2877(Y) | 2SC2877(Y) |
| Q3 | 5616-2SK381(D) | F.E.T., 2SK381(D) |
| Q4, 10, 807, 851, 852, 853, 854, 855, 856, 903, 905 | 5611-1115(F) | 2SA1115(F) or 2SA1115(E) |
| Q5, 801, 802, 803, 808, 809 | 5613-3246(H) | 2SC3246(H) |
| Q6, 812, 813 | 5611-1286(H) | 2SA1286(H) |
| Q7, 8, 12, 13, 804, 805, 806, 810, 811, 857, 901, 904 | 5613-2603(F) | 2SC2603(F) or 2SC2603(E) |
| Q51, 91, 94 | 5611-1115(E) | 2SA1115(E) or 2SA1115(F) |
| Q52, 92, 93 | 5613-2603(E) | 2SC2603(E) or 2SC2603(F) |
| Q902 | 5611-1305(Y) | 2SA1305(Y) |
| DIODES | | |
| D1, 2 | 5632-1SR35-10 | 1SR35-10 |
| D3 | 5685-1F | Bridge Silicon, S1RBA |
| D4, 5 | 5635-RD9R1EB2 | Zener, RD9.1EB2 |
| D6 | 5635-RD8R2EB1 | Zener, RD8.2EB1 |
| D8, 9 | 5641-KB265 | Varistor, KB265 or MV-12 |
| D10 | 5635-RD12EB1 | Zener, RD12EB1 |
| D51, 55, 56, 57, 58, 59, 90, 91, 92, 93, 95, 96, 97, 98, 801, 802, 805, 806, 808, 809, 810, 856, 859, 860, 861, 862, 863, 864, 865, 866, 873, 902, 903, 904 | 5631-1S2473 | 1S2473 |
| D52 | 5635-RD13EB2 | Zener, RD13EB2 |
| D53, 54 | 5631-1S2471 | 1S2471 |
| D803 | 5635-RD8R2EB3 | Zener, RD8.2EB3 |
| D804 | 5635-RD6R2EB2 | Zener, RD6.2EB2 |
| D807 | 5635-RD4R7EB2 | Zener, RD4.7EB2 |

| Ref. No. | Part No. | Description |
|--|---------------|---|
| MISCELLANEOUS | | |
| X851 | 5693-CSB457 | Crystal, Osc. |
| F2, 3 | 5732-402031 | Fuse, 4A, 125V |
| " | 5732-40202 | Fuse, 4A, 250V (for General model) |
| P801 | 4443-067114 | Connector, 6 Pos. |
| P802 | 4443-107114 | Connector, 10 Pos. |
| P803 | 4443-097114 | Connector, 9 Pos. |
| P804 | 4443-030185 | Connector, 3 Pos. |
| P805 | 4443-080185 | Connector, 8 Pos. |
| P806 | 4443-050185 | Connector, 5 Pos. |
| P807 | 4443-060185 | Connector, 6 Pos. |
| P808 | 4443-104116 | Connector, 10 Pos. |
| P809 | 4443-074116 | Connector, 7 Pos. |
| | 4472-414 | Fuse Holder (x4) |
| | 2132-7048 | Spacer, R13, 810, 811, 832, 835, D1, 2, 6 |
| | 2132-7049 | Spacer, R20, 27, 836, 837 |
| | 2132-5049 | Spacer, R833, 834 |
| PCB-3 VR P.C. BOARD | | |
| RESISTORS | | |
| R191, 192 | 5102-1814715 | 180 Ω , \pm 2%, 1/4W, Fuse |
| R428 | 5173-270571 | 27 Ω , \pm 5%, 2W, Metal |
| CONTROLS | | |
| VR151/152 | 5113-20371140 | 20k Ω A, Mic Level |
| VR161, 162 | 5113-2038321 | 20k Ω A, Rec Level Left/Right |
| VR301/302 | 5113-5027F40 | 5k Ω A, Output Level |
| VR401, 402 | 5101-20371920 | 20k Ω B |
| CAPACITORS | | |
| C161, 162 | 5345-106C0952 | 10 μ F, \pm 20%, 16V, Electrolytic |
| C163, 164 | 5359-2215851 | 220pF, \pm 5%, 100V, Polypropylene |
| C165, 166 | 5345-106C0951 | 10 μ F, \pm 20%, 16V, Electrolytic |
| C167, 168 | 5359-1015851 | 100pF, \pm 5%, 100V, Polypropylene |
| C169, 170 | 5345-226C0951 | 22 μ F, \pm 20%, 16V, Electrolytic |
| C171, 172 | 5359-1025851 | 1000pF, \pm 5%, 100V, Polypropylene |
| C177, 178, 413, 414 | 5345-476C041 | 47 μ F, \pm 20%, 16V, Electrolytic |
| C403, 404 | 5345-475D041 | 4.7 μ F, \pm 20%, 25V, Electrolytic |
| C405, 406 | 5345-335F041 | 3.3 μ F, \pm 20%, 50V, Electrolytic |
| C411, 412 | 5345-226C041 | 22 μ F, \pm 20%, 16V, Electrolytic |
| C415 | 5345-227C041 | 220 μ F, \pm 20%, 16V, Electrolytic |
| INTEGRATED CIRCUIT | | |
| IC401 | 5652-M5218P | M5218P |
| TRANSISTORS | | |
| Q81, 82 | 5613-2878(B) | 2SC2878(B) |
| Q161, 162, 165, 166 | 5613-2320L(F) | 2SC2320L(F) |
| Q163, 164 | 5611-999L(F) | 2SA999L(F) |
| Q167, 168, 169, 170, 401, 402, 403, 404, 405, 406 | 5613-2603(F) | 2SC2603(F) |
| Q407 | 5613-2236(Y) | 2SC2236(Y) |
| DIODES | | |
| D161, 162 | 5635-RD10EB2 | Zener, RD10EB2 |
| D401, 402, 403, 404 | 5631-1K34A | 1K34A |
| D405 | 5635-RD7R5EB2 | Zener, RD7.5EB2 |
| D701 | 5631-1S2473 | 1S2473 |
| MISCELLANEOUS | | |
| LC161, 162 | 5214-51 | LC Components |
| SW301/302 | 4431-02047364 | Push Switch, Rec Mute, Auto Space |
| P401 | 4443-070185 | Connector, 7 Pos. |
| J402 | 4163-072002 | Connector with Lead Wire, 7 Pos. |
| J501 | 4163-70296 | Connector with Lead Wire, 3 Pos. |
| J503 | 4163-70396 | Connector with Lead Wire, 3 Pos. |
| | 2132-5049 | Spacer, R425 |

| Ref. No. | Part No. | Description |
|---|---|--|
| PCB-4 PUSH SWITCHES P.C. BOARD | | |
| DIODES | | |
| D201, 202, 203, 204, 205, 206, 411, 867, 868, 869, 870, 872 | 5631-1S2473 | 1S2473 |
| D409 | 5637-GL5HD22 | L.E.D., GL5HD22, Red, Tape Monitor |
| MISCELLANEOUS | | |
| SW201, 202, 203, 401, 402, 403, 801, 802, 803 | 4431-0918716 | Push Switch, Bias/Equalization, Dolby NR/Type, MPX Filter, Timer |
| SW204, 205, 901, 902, 903 | 4431-A027136 | Push Switch, Peak Hold, Meter Weighting, Memory, Auto Rewind/Replay |
| SW404, 405, 904, 905, 906 J803 | 4431-A027236 4163-094502 2132-01401 | Push Switch, Bias Tone, Rec. Cal, Reset, Time, Count Connector with Lead Wire, 9 Pos. Spacer, D409 |
| PCB-5 KEY SWITCHES P.C. BOARD | | |
| DIODES | | |
| D851 | 5637-SY406TK | L.E.D., SY406TK, Yellow, Pause |
| D852 | 5637-TLR122 | L.E.D., TLR122, Red, Record |
| D853, 854, 855 | 5637-TLG121 | L.E.D., TLG121, Green, F.FWD, Play, Rew. |
| D857, 858 | 5631-1S2473 | 1S2473 |
| MISCELLANEOUS | | |
| SW101, 102, 103, 104, 105, 106 | 4431-A017140 | Push Switch, Rew, Play, F.FWD, Stop, Record, Pause |
| PCB-6 MASTER FADER P.C. BOARD | | |
| VR163/164 | 5113-10371141 | Control, 10k Ω , Master Fader |
| PCB-7 HEADPHONES JACK P.C. BOARD | | |
| J351 | 4451-00141 | Jack, Headphones |
| PCB-8 POWER SWITCH P.C. BOARD | | |
| C1 | 5361-1030419 | Capacitor, 0.01 μ F, +100% -0%, AC125V, Ceramic |
| " | 5352-1030958 | Capacitor, 0.01 μ F, \pm 20%, AC250V, Metalized Polyester (for General model) |
| SW1 | 4431-A01056 | Push Switch, Power |
| PCB-9 REC. CAL P.C. BOARD | | |
| VR201, 202 | 5101-2228074 | Control, 2.2k Ω , Rec. Cal Left/Right |
| PCB-10 DOLBY NR INDICATORS P.C. BOARD | | |
| D407 | 5637-GL9PG19 | L.E.D., GL9PG10, Green, Dolby B |
| D408 | 5637-GL9HY9 | L.E.D., GL9HY9, Yellow, Dolby C |
| PCB-11 LAMP P.C. BOARD | | |
| LP802 | 5731-0807445 | Lamp, Illumination |
| PCB-12 TAPE COUNTER P.C. BOARD | | |
| Q906 | 5613-2603(E) | Transistor, 2SC2603(E) or 2SC2603(F) |
| D905 | 5637-LT9002D | L.E.D., LT9002D, Red, Wait |
| DSP901 | 5623-SLK2452 | LED Display |
| J808 | 4163-101802 | Connector with Lead Wire, 10 Pos. |

Index KGE 015360A
Direct Drive belt SEE 21549-01