OTARI®

MX-5050
PROFESSIONAL RECORDER

MODELS MX-5050 2S, 4S, 2SD AND 4SD

MAINTENANCE MANUAL

MX-5050 SERIES PROFESSIONAL RECORDER

INTRODUCTION

This manual supplement provides detailed maintenance information, schematics, and parts lists for the Otari MX—5050 Series Models 2S, 4S, 2SD and 4SD Professional Recorder. For descriptive information, installation and operating instructions, preventive maintenance and routine adjustment procedures, refer to Otari Instruction Manual Catalog No. OIM—1005E.

MX—5050 2SD Recorder

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3. Date of purchase
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5. Power requirements (voltage and frequency)
6. Manual number which you are referring

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SECTION 1
GENERAL INFORMATION

SECTION 1
GENERAL INFORMATION

This manual is a maintenance supplement to the MX–5050 Series Models 2S, 4S, 2SD and 4SD Instruction Manual, Catalog No. OIM–1005E, and provides detailed maintenance information. This manual is intended for use by qualified maintenance or service personnel only. Prior to using this manual, it is suggested that the user become familiar with the information contained in the basic manual.

NOTE

AFTER MAINTENANCE OR COMPONENT REPLACEMENT, ALL SCREWS SHOULD BE LOCKED UP WITH FOLLOWING PAINT TO PREVENT POSSIBLE DAMAGE. USE ENAMEL PAINT FOR HEAD ALIGNMENT SCREWS (AZIMUTH, ZENITH, HEIGHT), AND USE LOCTITE–222 (VIOLET) FOR OTHER SCREWS.

1–1 TEST AND MAINTENANCE EQUIPMENT REQUIREMENTS

All maintenance, electronic, and mechanical test equipment required during maintenance, alignment, and adjustment of the recorder is listed in Table 1–1. In addition, recommended maintenance periods are shown by accumulative hours of usage and/or elapsed period of time, whichever occurs first. Equivalent equipment can be substituted for the equipment suggested in the table.

Table 1–1. Test and Maintenance Equipment

EQUIPMENT TYPE	SUGGESTED MODEL	USED FOR	PERIOD
Head cleaner	Ampex 087–007	Cleaning heads and guides	8 hours
Isopropyl or denatured alcohol	Any	Cleaning capstan pinch-roller	8 hours
Q tips	Any	Cleaning heads and guides	8 hours
Head demagnetizer	Ampex 4010820	Demagnetizing heads and guides	8 hours
Lubricating oil	Ampex 087–579 or Mobile DTE Medium	Oiling of capstan motor and pinch roller bearings	1,000 hours or 6 months
Spring scales 0–16 oz, 0–32 oz and 0–10 lbs	Any	Mechanical adjustments	1,000 hours or 6 months

Frequency Counter (Electronic Counter)	Hewlett-Packard 5300A + 5301A	Tape speed measurment	Same as above
Vacuum cleaner and brushes	Any	General cleaning	1 month
Standard alignment test tapes	Refer to Table 1–2 and 1–3.	Reproduce amplifier alignment	150 hours or 1 month
Audio oscillator	Hewlett Packard H20–200CD	Overall frequency response and signal-to-noise measurement	150 hours or 1 month
AC Voltmeter (VTVM)	Hewlett Packard 400L or 400 FL	Same as above	Same as above
Bandpass filter	See text	Same as above	Same as above
Flutter bridge	Data Measurement Corp. 8100	Flutter and wow measurement	Same as above
Wave analyzer	Hewlett Packard 3590A or 310A	Distortion and crosstalk measurement	Same as above
Test cables	See text		
Technicians tools			
Stroboscope	General Radio 1531–AB	Mechanical adjustments	1,000 hours or 6 months
Volt-ohm meter	20,000 ohms/volt any brank	Test and adjustments	–
Allen wrenches	Metric		
ASA Noise Filter	See text and Fig. 3–1.	Signal-to-noise ratio measurement	150 hours or 1 month

Table 1–2. Alignment Test Tape

SPEED (IN/S)	EQUALIZATION (TIME CONSTANTS)	STANDARD	TRACKS	AMPEX CATALOG NO.
3-3/4	90 μs & 3180 μs	NAB	Full	4690037-01
7-1/2	50 μs & 3180 μs	NAB	Full	01-31321-01
	50 μs & 3180 μs	NAB	1 & 3	01-31321-04
	70 μs & ∞	IEC	Full	4690014-01
15	50 μs & 3180 μs	NAB	Full	01-31311-01
	35 μs & ∞	IEC	Full	01-31313-01

1–2 ROUTINE MAINTENANCE

It is important that routine maintenance be performed at the recommended intervals. External cleaning and demagetization procedures should be performed after each eight hours of operation, and the interior of the transport should be cleaned once a month. The lubrication procedure should be performed after 1,000 hours of operation or after 6 months, whichever comes first.

1–2–(1) CLEANING

Oxide particles from the magnetic tape tend to collect on components in the tape path and degrade performance of the recorder. To clean the head assembly, proceed as follows:

1. Lift the head cover as shown in Fig. 1–1.

CAUTION

WHEN CLEANING THE HEADS, USE ONLY THE RECOMMENDED SOLVENT (HEAD CLEANER) TO AVOID DAMAGING THE HEADS. KEEP THE HEAD CLEANER OFF PLASTIC FINISHES AND THE CAPSTAN PINCH ROLLER. DO NOT USE METAL TOOLS THAT CAN SCRATCH THE HEADS.

2. Clean each head stack thoroughly with a cotton-tipped applicator (Q tip) dampened with head cleaner.
3. Use isopropyl alcohol to clean all tape-guiding components, the capstan shaft, and the capstan pinch roller.

CAUTION

DO NOT USE HEAD CLEANER ON THE CAPSTAN PINCH ROLLER AS DAMAGE WILL RESULT AND TAPE WILL SLIP.

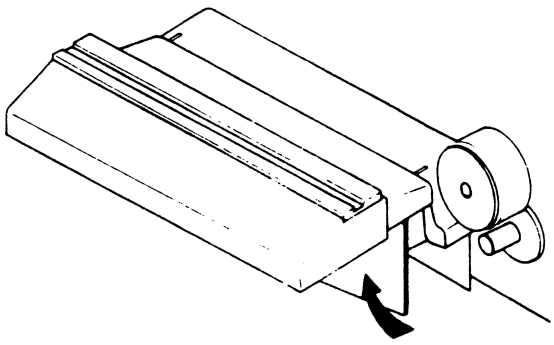

Fig. 1–1 Lifting Head Cover

4. Remove rear cover of recorder (4 screws).
5. Use a vacuum cleaner and a small brush to remove all dust or contamination from the interior of the transport. If necessary lightly moisten brush with isopropyl alcohol to clean parts.
6. Reinstall rear cover.

1–2–(2) DEMAGNETIZING

The heads and tape guiding components in the tape path should be demagnetized after each eight hours of operation. These components can acquire permanent magnetization that increases signal noise and distortion and partially erase high frequencies on recorded tape. Use a hand-held head demagnetizer to demagnetize all components in the tape path as follows:

1. Turn equipment power off and remove any recorded tape near the transport (tape could be partially erased by the demagnetizer).
2. Lift head cover as shown in Figure 1–1.
3. Cover the demagnetizer tips with adhesive tape to prevent scratching head stacks.
4. With the demagnetizer held away from the transport, connect demagnetizer to power source.
5. Move the demagnetizer tips slowly close to the head, lightly touch the demagnetizer tips to the face of one head stack and slowly move the tips up and down the stack several times. Then slowly withdraw the demagnetizer as shown in Fig. 1–2.
6. Repeat step 5 for each head stack.
7. Repeat the motions of step 5 for each guide and other metallic parts in the tape path.
8. Move the demagnetizer slowly away from the transport for at least three feet and then disconnect power from the demagnetizer.

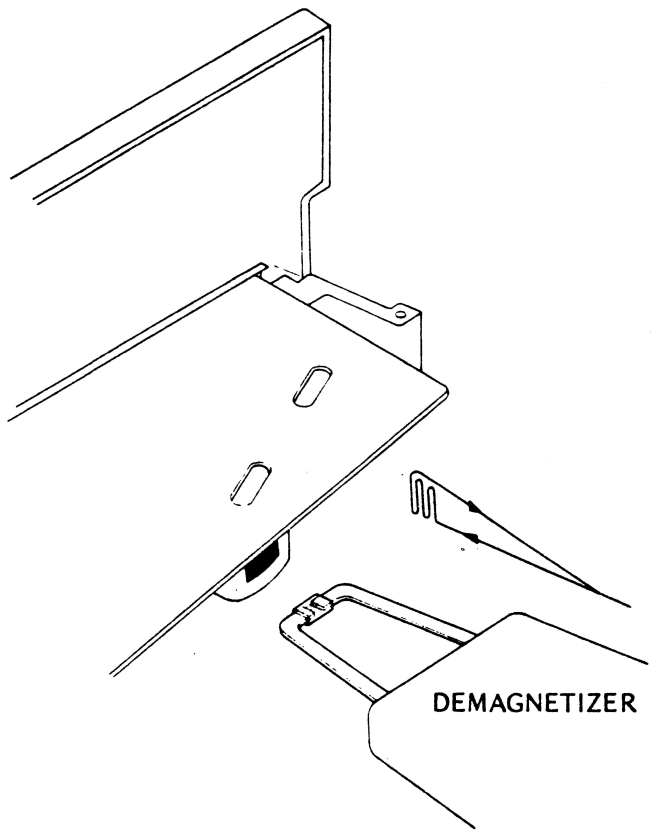

Fig. 1–2 Demagnetizing

1–2–(3) LUBRICATION

The only components requiring lubricaiton are the capstan sleeve bearing and the capstan pinch roller bearings. See Fig. 1–3 and proceed as follows:

CAUTION

BE CERTAIN TO CLEAN CAPSTAN SHAFT THOROUGHLY. THE LUBRICATING OIL CAN RUIN THE CAPSTAN PINCH ROLLER AND MAGNETIC TAPE. CLEAN THE CAPSTAN AND PINCH ROLLER WITH ISOPROYL ALCOHOL.

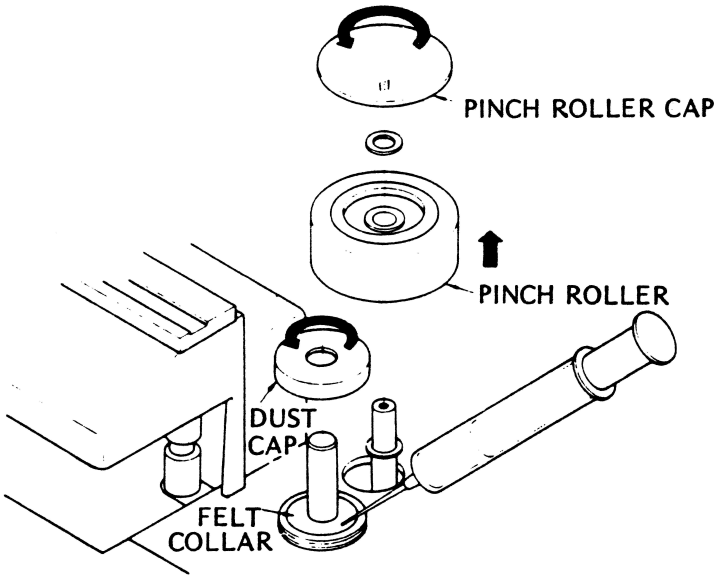

Fig. 1–3 Lubrication

1. Unscrew pinch roller cap.
2. Remove pinch roller from the pinch roller shaft.
3. Remove metal dust cap from the capstan shaft by turning counterclockwise.
4. Now the felt collar is visible. Apply 2 or 3 drops of oil onto this felt collar. Please do not over lubricate.
5. Apply a few drops of oil to the pinch roller bearings.
6. Wipe off any excess oil and reinstall the dust cap, pinch roller cap as they were.

SECTION 2
TAPE TRANSPORT MAINTENANCE

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TAPE TRANSPORT MAINTENANCE

Tape transport maintenance includes procedures for adjusting supply and takeup reel brakes, adjusting supply reel hold-back tension, and adjusting capstan pinch roller pressure.

2–1 TRANSPORT ACCESS

To gain access to recorder transport proceed as follows:

1. Remove power cord and place recorder in an upright position.
2. Use metric allen wrench and remove top panel, two side panels, and rear cover by removing four screws per panel (16 screws total).

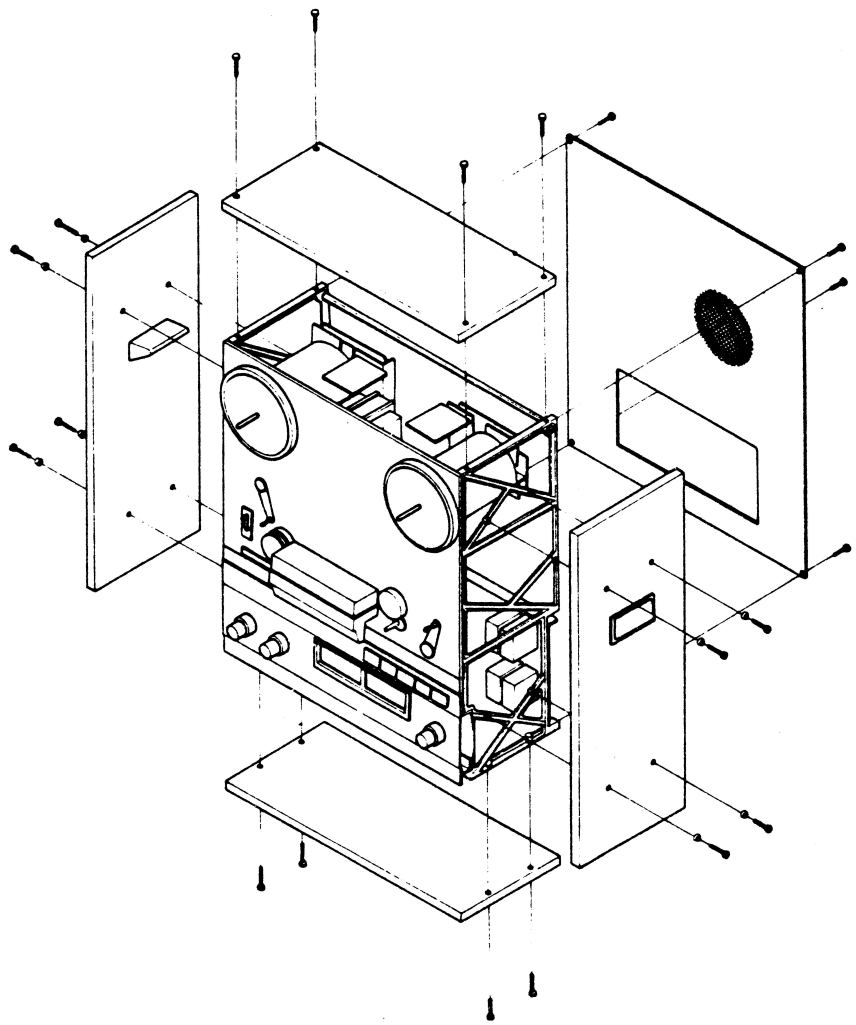


Fig. 2–1 Transport Access

2–2 BRAKE ADJUSTMENT

The brake system on each reel stops reel rotation when entering stop mode or when power is removed. The brakes are checked and adjusted with power removed. Since the brake force is different for each direction of rotation (brake differential), and there is a single adjustment, the force is checked and adjusted for the best compromise force in each direction.

In the following steps, an empty 10½ inch diameter NAB reel (4½ inch diameter hub) is used and a cord or twine is wrapped on the reel. A spring scale is attached to a small loop formed in the free end of the cord or twine.

If an 10½ inch diameter NAB reel (4½ inch diameter hub) is not available, a 7 inch diameter (2¼ inch diameter hub) may be used but all readings must be multiplied by a factor of 2. Proceed as follows: Refer to table 2–1 for the tension specifications on each Model.

1. Place an empty 10½ inch diameter NAB reel on the supply reel turntable. Secure with a holddown knob.
2. Wind a cord or twine a few turns counterclockwise on the hub. Tie a loop in the free end of the cord or twine.
3. Insert the hook of a 0–16 ounce or 0–32 ounce spring scale through the loop and hold the spring scale upright as shown in Fig. 2–2.
4. Pull on the scale slowly to make the reel rotate counterclockwise. While being sure the cord does not rub against either flange, note the scale reading. Reading should be "B" in Table 2–1.
5. Wind the cord or twin in a clockwise direction on the supply reel.
6. Repeat steps 3 and 4 to make the reel rotate clockwise. Reading should be "A" in Table 2–1.
7. If the readings were low in both directions, remove the brake spring (shown in Fig. 2–3) from the existing anchor hole on the brake lever and install spring in the next hole located farther away from the brake solenoid.
8. If the readings were high in both directions move the spring anchor point to a hole closer to the brake solenoid.
9. If the brake spring was moved, repeat steps 2 through 6 to check results.
10. Repeat the brake adjustment procedure on the takeup reel. Note that the high braking force is present when the takeup reel is rotated clockwise. The tension specifications are the same as for the supply reel.

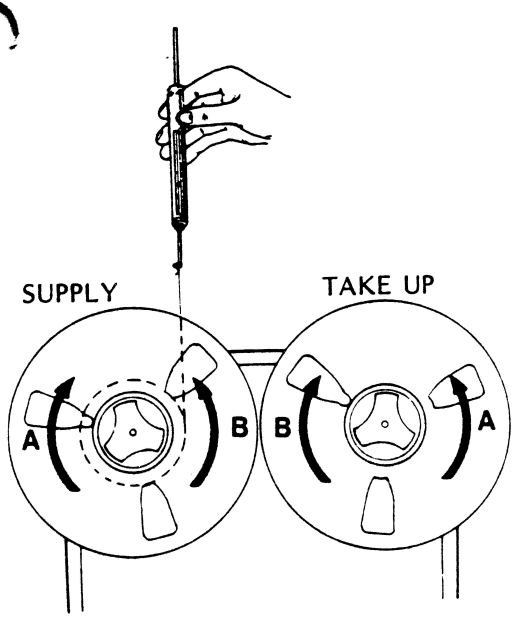


Fig. 2–2 Measurement

Table 2–1 Tension specifications

A	3.6~4.5oz (100~125g)
B	7.9~9.7oz (225~275g)

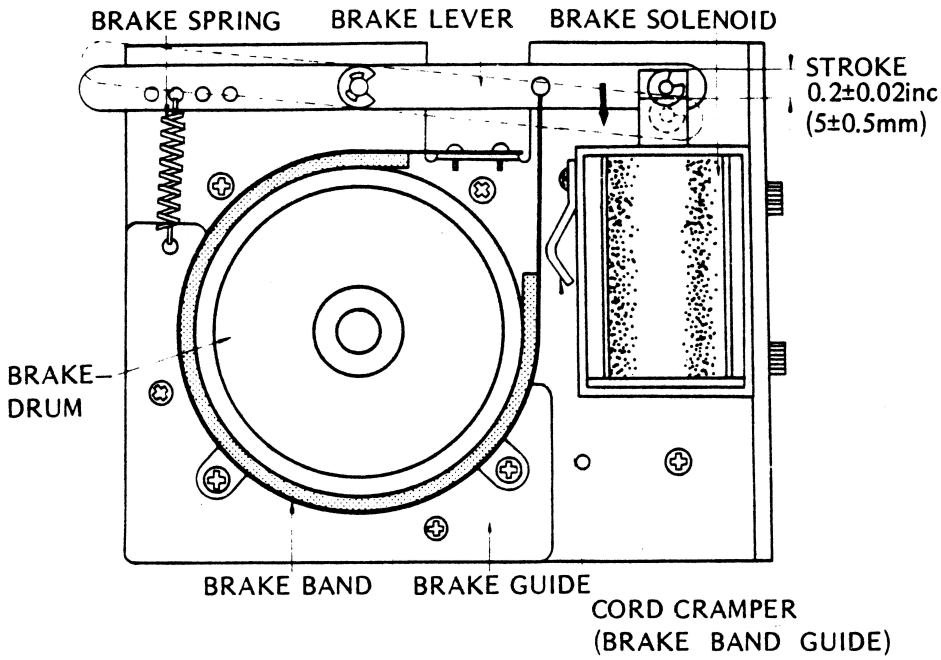


Fig. 2–3 Adjusting Parts Location

2–3 TAPE TENSION ADJUSTMENT

Tape tension is controlled by the amount of torque applied by the reel motors. Only the supply reel motor torque is adjustable. The tape tension is determined indirectly by measuring the supply motor holdback torque in play and fast forward modes. This tension is adjusted by positioning sliders on resistors located below the takeup motor (Fig. 2–4). When adjusting the sliders, loosen the contact screws just enough to slide the contact, then tighten the screw just enough to make good electrical contact.

WARNING

WHEN TRANSPORT POWER IS ON, LINE VOLTAGE IS PRESENT AT THE RESISTORS. TURN POWER OFF BEFORE MAKING AN ADJUSTMENT.

The supply reel tensions were adjusted at the factory with a local power line source. Since motor torque is affected by the source voltage, verify the source voltage is correct before making any adjustment.

In the following steps, an empty 10½ inch diameter NAB reel is used and a cord or twine is wrapped on the reel in the same direction as tape is pulled onto the reel. A spring scale is attached to a small loop formed in the free end of the cord or twine. If an 10½ diameter NAB reel (4½ inch diameter hub) is not available, a 7 inch diameter (2¼ inch diameter hub) may be used but all readings must be multiplied by a factor of 2. The spring scale is held stationary (Fig. 2–2) and with no slack in the cord. The scale indicates cord tension when in fast forward or play modes. Proceed as follows:

1. Use adhesive tape to hold the takeup-tension-arm safety switch in an upright position so that the safety switch is not activated.
2. Place an empty 10½ inch NAB reel on the supply turntable and secure reel with a hold-down knob.
3. Wind the cord or twine a few turns counterclockwise onto the reel hub. Fasten a spring scale to a loop formed on the free end of the cord or twine (Fig. 2–2).
4. Apply power to the recorder.
5. Press F.FWD pushbutton switch. The reading should be "C" in Table 2–2. If necessary adjust slider "C". (Moving slider towards front of transport increases tension.)
6. Set REEL switch to Large "out" position.
7. Hold the scale upright and press PLAY pushbutton switch. After an initial surge, the reading should be "A" in Table 2–2. If necessary adjust slider "A". (Moving slider towards front of transport increase tension.)
8. Set REEL switch to Small "in" position.
9. Press PLAY pushbutton. After an initial surge, the reading should be "B" in Table 2–2. If necessary adjust slider "B". (Moving slider towards front of transport increases tension.)

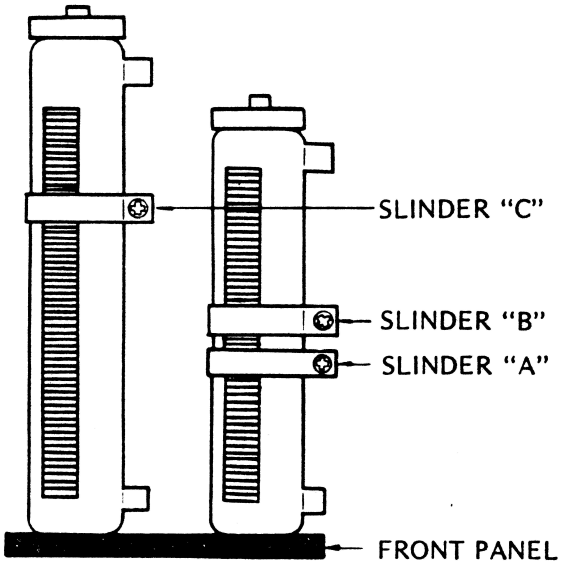


Fig. 2–4 Tape Tension Adjustment Resistors

Table 2–2 Tape Tension Specifications

SLIDER	MODE	Specification
A	PLAY LARGE	2.2~2.7 oz (63~77 gram)
B	PLAY SMALL	1.4~1.8 oz (40~50 gram)
C	F.FWD.	1.4~1.8 oz (40~50 gram)

2–4 CAPSTAN PINCH ROLLER PRESSURE ADJUSTMENT

The capstan pinch roller pressure against the capstan is determined by the capstan solenoid spring. This force is adjusted by means of nut shown in Fig. 2–6. This force is adjusted by means of nut shown in Fig. 2–6. The nut is adjusted to obtain a force of 6.4~7.0 pounds. The resistance of the solenoid coil rises with temperature and causes the solenoid force to decrease. Therefore, do not adjust the pinch roller pressure until the recorder has been operated in play mode for at least 30 minutes prior to performing the following procedure.

1. Use adhesive tape to hold the takeup-tension-arm safety switch in an upright position so that the safety switch is not activated.
2. Tie a cord or twine together for form a continuous loop. Place one end of the loop around the capstan pinch roller shaft.
3. Press the PLAY pushbutton. The pinch roller will move to contact the capstan and both will rotate.
4. Hook a 0 to 10 pound spring scale to the other end of the cord and pull the cord taut straight to center of capstan as shown in Fig. 2–5. Do not let the cord contact the rotating pinch roller.
5. Pull on the scale and note the scale reading when the pinch roller just loses contact with the capstan (the pinch roller stops rotating). The scale reading should be 6.4~7.0 pounds.
6. If the proper scale reading was not obtained in step 5, loosen the locknut and adjust the pressure nut as required. (Turning the pressure nut towards the spring increases pinch roller pressure.) Tighten locknut.
7. After adjustment is completed, check that the solenoid bottoms within the solenoid coil (pinch roller can easily be pushed away from the capstan). If the solenoid does not bottom, loosen locknut and turn pressure nut away from spring until solenoid bottoms. Recheck pressure adjustment and tighten locknut.

After the proceeding adjustments are completed, reinstall top panel, two side panels, and rear cover (16 screws total). For transport component replacement procedures, refer to Section 4 of this manual.

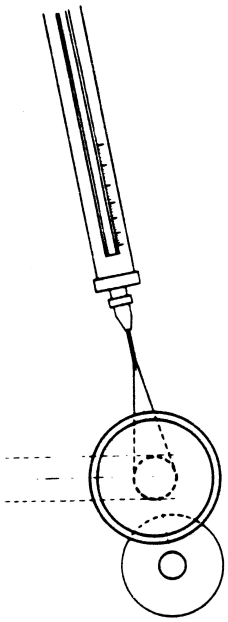


Fig. 2–5 Measurement

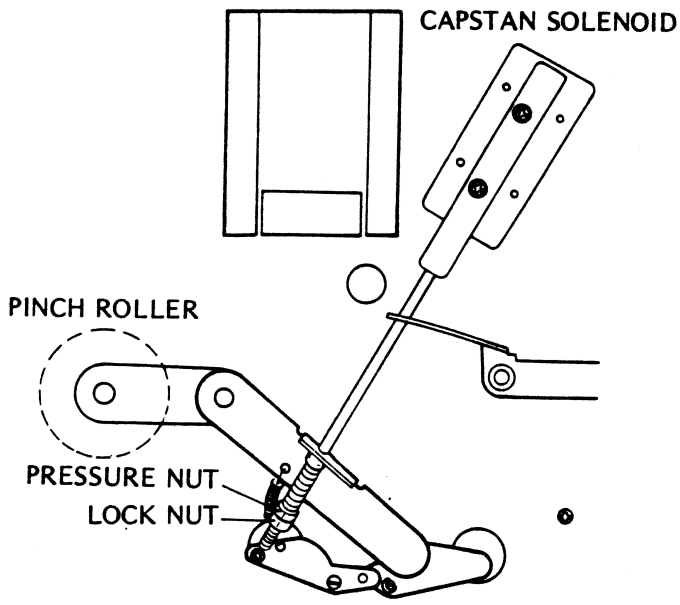
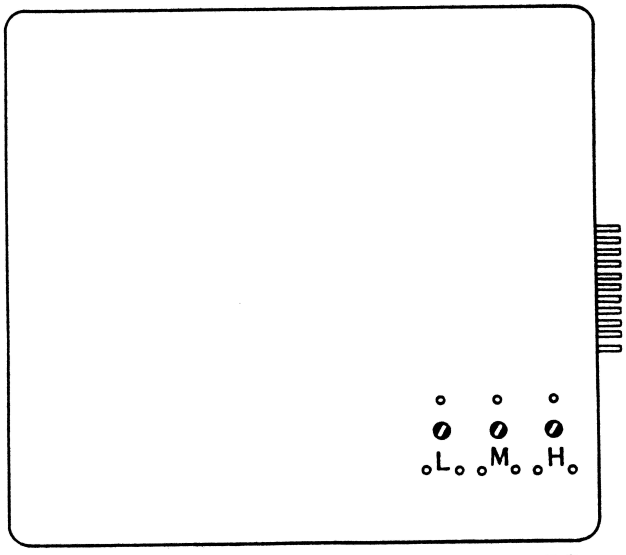


Fig. 2–6 Adjusting Parts Location

2–5 CAPSTAN SPEED ADJUSTMENT (D Type Only)

Capstan speed can be adjusted by speed control on servo control printed circuit board.
This adjustment follows tape speed measurement in Section 3 and adjust the speed control as shown in Fig. 2–7 as necessary.



CAPSTAN SERVO CONTROL P.C. BOARD

Fig. 2–7 Adjusting Parts Location

SECTION 3
PERFORMANCE TESTS
AND ELECTRONIC ALIGNMENT

SECTION 3
PERFORMANCE TESTS
AND ELECTRONIC ALIGNMENT

Performance tests should be performed at regularly scheduled intervals (every 150 hours or 1 month periods) to ensure the recorder is performing within specifications. These tests should also be performed whenever the recorder appears to be malfunctioning and following repairs to the equipment that may affect performance. If the performance test is not successful, proceed to the applicable electronic alignment procedure. It is important that clean and demagnetize the head and tape guiding components before performing the following steps.

3–1 TEST EQUIPMENT

The test equipment listed in Table 1–1 is required for completion of the performance and alignment procedures.

3–2 TEST TAPES

The test tapes are precisely recorded under controlled conditions and must be correctly handled and stored to retain their accuracy. The following requirements should be followed:

1. Clean and demagnetize the heads and tape guiding components before installing the test tape.
2. Never store test tapes in areas where there are temperature or humidity extremes.
3. Remove test tapes from equipment only after a normal play run (never after a fast-winding mode). This is further explained below.

During the alignment procedure, the rewind and fast forward modes should not be used. After alignment, wind the tape completely on the takeup reel, interchange reels, thread the tape, and place the equipment in the play mode to wind the tape back on its original reel.

All tones on an Ampex 15 in/s standard alignment tape are recorded at operating level. On slower speed tapes, all tones are recorded 10 dB below operating level except for the last tone. After extensive use, high frequency tones may drop as much as 2 dB. In addition, flutter indications may rise even though actual flutter remains unchanged. Flutter increase is caused by : demagnetization of the recorded signal from repeated plays; tape deformation due to tape tension, changes in temperature and humidity; and increased dropouts resulting from tape wear.

3–3 TEST CONDITIONS

The test conditions specified in the following steps are to be used prior to performing the tests. After these test conditions are set up, continue with the procedures that follow for checking overall signal-to-noise, overall distortion, crosstalk, and flutter.

1. Clean and demagnetize the heads.
2. Use high quality low-noise tape such as Ampex 406, 407, 456 or Scotch 206, 207, 250, or equivalent. Bulk erase the blank tape.
3. Turn power on and allow unit to warm up for 20 minutes.
4. Be sure head cover is installed for all tests.

3–4 PERFORMANCE TESTS

Before making performance test, SRL check, reproduce frequency response check, record level check, monitor level check, overall frequency response check, and SEL/REP level check are necessary. Refer to 3–5 ELECTRONIC ALIGNMENT in this section for checking procedures.
For performance tests, preliminary proceed as follows.
Demagnetize and clean heads and guiding compornents.

1. Set REEL switch to appropriate position, and set EDIT switch to "out" non edit position.
2. Set LINE OUT switch to H, set each RECORD switch to "in" record position, set each SEL/REP switch to "out" position, and set each MONITOR switch to "out" SOURCE position.
3. Thread a reel of bulk-erased tape onto the transport, set SRL switch to SRL position, and push PITCH CONTROL knob to place fix position.

3–4–(1) OVERALL SIGNAL-TO-NOISE

The overall signal-to-noise test requires an ASA "A" weighted filter to attenuate noise outside of the audible frequency band. The filter is shown in Fig. 3–1 and may be built into a small alumimum box as shown in Fig. 3–1.

Signal-to-noise depends on SRL calibration, reproduce equalization, bias calibration, and record equalization. Proceed as follows:

1. Connect filter to CH–1 LINE OUT and connect VTVM to the output of filter.
2. Hold TEST OSC pushbutton depressed and adjust CH–1 INPUT LINE control for 0 VU indication on the VU meter.
   (On model MX–5050 $2SD_2$, set reproduce head selector switch at the rear of the head assembly to 2T position.)
   Note VTVM indication, VTVM does not read +4 dBm due to insertion loss of filter.
3. Depress CH–1 MONITOR switch to "in" TAPE position, set CH–1 INPUT LINE and CH–1 INPUT MIC controls to full counterclockwise position. Reset TAPE TIMER to "0000".
4. Start record mode and record for one minute. Rewind the tape to "0000" indication on the timer.
5. Reproduce the recorded portion and read noise level on VTVM.
6. Signal-to-noise retio is determined by calculating the difference in readings obtained in step 2 and step 5 plus 9 dB (peak recording level–520 nWb/m–is 9 dB above SRL–185 nWb/m)
7. Repeat step 1 through 6 for the other channels as required, change tape speed to other and check signal-to-noise retio.

Table 3–1. Signal-to-noise specifications (ASA weighted)

Models	2S or 2SD	4S or 4SD
15 or 7½	68dB	65dB
3¾	67dB	64dB

If signal-to-noise specifications are not obtained, check and adjust following items.

1. SRL caliblation is incorrect.
2. BIAS/CAL adjustment is incorrect.
3. Reproduce equalization is incorrect.
4. Record equalization is incorrect.
5. Bias buffer adjustment is incorrect.
6. Record and/or reproduce electronics is defective.
7. Head is magnetized
8. Affected with magnetic flux of a motor, a soldering iron or a transformer near the recorder.

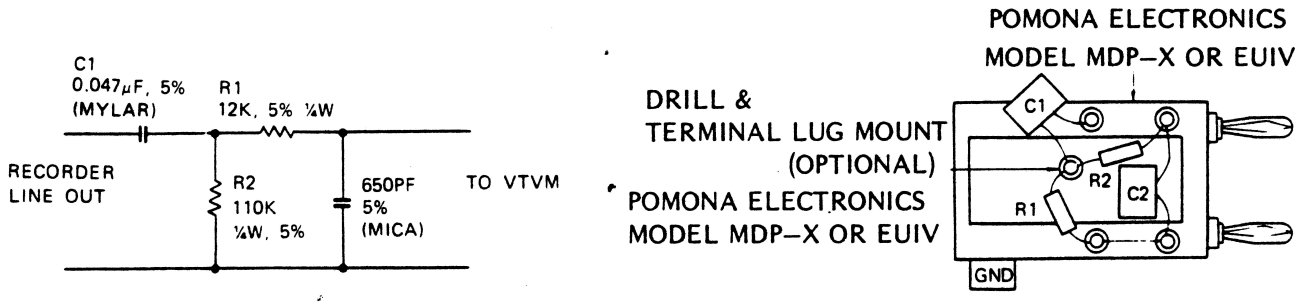


Fig. 3–1 ASA "A" Weighted Filter

3–4–(2) OVERALL DISTORTION TEST

For accurately checking distortion it is necessary to use an audio oscillator with less than 0.1% distortion and a wave analyzer with an adjustable bandwidth capability. A wave analyzer with too narrow a bandwidth may make it difficult to measure harmonics due to flutter components within the transport. Instruments that measure total harmonic distortion will be affected by tape and modulation noise in addition to harmonic distortion. To measure overall harmonic distortion proceed as follows:

1. Connect wave analyzer to CH–1 LINE OUTPUT and connect audio oscillator to CH–1 LINE INPUT.
2. Set MONITOR switches to "in" TAPE position, set audio oscillator frequency to 1000 Hz.
3. Set wave analyzer frequency to 1000 Hz, bandwidth to 100 Hz, and mode selector switch to AFC.
4. Start Record mode and adjust CH–1 INPUT LINE control for O VU on the VU meter.
5. Adjust fine tuning control on the wave analyzer and adjust analyzer input level control for full scale reading of 100%.
6. Change wave analyzer tuning control to 2000 Hz and measure second harmonic content. The second harmonic content should not exceed 0.5%.
7. Change wave analyzer tuning control to 3000 Hz and measure third harmonic content. The third harmonic distortion is dependent upon the type of tape used, accuracy of the BIAS/CAL setting. Typical reading for low noise high output tape is 0.5%. Typical reading for standard output professional grade tape is 0.8%.
8. Repeat step 1 through 7 for channel 2.

If distortion specification is not obtained, check and adjust the following items.

1. SRL caliblation is incorrect.
2. BIAS/CAL adjustment is incorrect.
3. Head is magnetized.
4. Record and/or reproduce electronics is defective.

3–4–(3) CROSSTALK TEST

It is important that blank bulk-erased tape is used for crosstalk test. To measure crosstalk between channels proceed as follows:

1. Follow the procedure for Overall Distortion Test, steps 1 through 5.
2. Connect wave analyzer from the output of CH–1 to CH–2 LINE OUTPUT.
3. Measure the crosstalk in dB.
   Crosstalk should not exceed Table 3–2. If crosstalk specification is not obtained, record and/or reproduce head alignment (height and tape contact) is incorrect or record or reproduce head is detective.

Table 3–2. Crosstalk specifications (Between adjacent channels)

2S or 2SD	4S or 4SD
60 dB	55 dB

3–4–(4) ERASURE TEST

It is important that blank bulk-erased tape is used in erasure test. To measure erasing effect proceed as follows.

1. Follow the procedure for Overall Distortion Test step 1 through 5. A 1000 Hz signal is being recorded at SRL.
2. Set SRL switch to off position and adjust OUTPUT control for –10 VU on VU meter.
3. Adjust INPUT LINE control for O VU on VU meter and 1000 Hz signal is being recorded at 10 dB above SRL. Continue recording for a few minutes.
4. Remove the audio oscillator.
5. Rewind and reproduce the recorded position.
   VU meter reading should be O VU.
   Check wave analyzer and readjust as necessary.
6. Press RECORD pushbutton to place recorder in record mode.
   As the tape is being erased, adjust the percent scale on the wave analyzer to read the residual 1000 Hz tone.
7. Repeat the same procedure for other channels.
8. Erasure effect should be more than 65 dB.

If erasure specification is not obtained, check and adjust following items.

1. Erase and/or record head alignment is incorrect. (height, tape contact)
2. Erase head is worn.
3. Erase head surface is dirty.
4. Bias oscillator is detective.

3–4–(5) TAPE SPEED MEASUREMENT

A flutter test tape is used for measuring tape speed.
Since tape tension affects the tape speed, it is important for accurate measurement that flutter test tape is used to be attached to end of full winded blank tape as Fig. 3–2 and is used with REEL pushbutton to appropriate reel size to be used.
Proceed as follows:

1. Place PITCH CONTROL to fix position and set all RECORD switch to off "out" position.
2. Connect frequency counter to LINE OUT and set MONITOR switch to TAPE position.
3. Set SPEED switch to HI and use test tape to appropriate tape speed.
4. Attach test tape to 10½ inch NAB reel as Fig. 3–2, place test tape onto supply reel table, thread the tape, and set REEL switch to L position.
5. Place recorder in play mode and note reading on frequency counter.
   Reading should be 2994 ~ 3006 Hz (3000Hz ± 0.2%).
6. Repeat procedure for at a point towards the end of the reel, for at 7 inch EIA reel and for at low tape speed.

If speed accuracy is not within ± 0.2%, check and adjust following items.

1. Capstan servo control is incorrect (on 2SD or 4SD).
   Capstan belt is dirty or worn (on 2S or 4S).
2. Capstan motor is defective.
3. Pinch roller tire is worn, or has insufficient pressure.
4. Brakeshoe is contacting brake drum.
5. Tape tensions are incorrect.
6. Power requirement is incorrect.

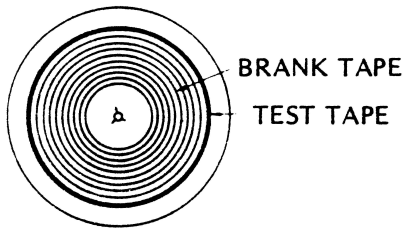


Fig. 3–2 Using Test Tape

3–4–(6) FLUTTER AND WOW TEST

It is recommended that these checks be made with standard flutter test tapes (See Table 1–2) which are recorded on pricise equipment to produce less than 0.03% rms flutter. If flutter tapes are not available it is possible to record a 3000 Hz or 3150 Hz signal to be used for a flutter measurement. After recording a section of tape, rewind to the begining and start the tape in the reproduce mode. Since it is possible for the record mode flutter to either add or subtract from the reproduce mode flutter depending upon the phase relationship, it is necessary to make several passes over the recorded section of tape and average the flutter meter readings.
Flutter meters are sensitive to amplitude modulation that results from poor head-to-tape contact or from signal dropouts. Therefore, clean the heads before making flutter tests.

Test tape method is as follows:
It is important that flutter test tape is used to be attached to end of full winded blank tape as Fig. 3–2, and is used with REEL pushbutton to appropriate reel size to be used.

1. Set all RECORD switch to off "out" position, and on 2SD or 4SD, place PITCH CONTROL to fix psition.
2. Connect flutter meter to LINE OUT of CH–2 and set the channel MONITOR switch to TAPE position.
3. Set selector switch of flutter meter to NAB weighted position, set SPEED switch to HI and use test tape of appropriate tape speeds.
4. Attach test tape to 10½ inch NAB reel as Fig. 3–2, place test tape onto supply reel table, thread the tape, and set REEL switch to L position.
5. Place recorder in play mode and note reading on flutter meter. Reading should be Table 3–3.
6. Repeat procedure for at a point towards the end of the reel, for at 7 inch EIA reel and for at low tape speed.

Record-playback method is as follows:

1. Connect oscillator signal output of the flutter meter to CH–2 LINE INPUT of the recorder.
2. Connect the LINE OUTPUT of the recorder to the signal input of the flutter meter
3. Set SPEED switch to HI, set SRL switch to SRL position set MONITOR switch to TAPE position, start record mode, and adjust appropriate INPUT LINE control

4. Rewind and reproduce recorded portion, note the flutter and wow on the flutter meter.
5. Check flutter and wow at low tape speed and check at a point towards the end of the reel.

Table 3–3 Flutter and wow specifications

Tape speed	Flutter and wow
15 ips	0.05 %
7.5 ips	0.06 %
3¾ ips	0.15 %

Flutter and wow can be caused by any element in the tape path. Excessive flutter and wow may be traced by observing the flutter component on an oscilloscope screen connected to the demodulator output of the flutter meter. If the fluctuation rate observed on the oscilloscope coincides with the rotation elements, such as the supply or takeup reel, capstan or pinch roller, the problem source may be easily traced. Other sources of excessive flutter and wow are:

1. Capstan servo control is defective(on D type).
2. Capstan motor is damaged.
3. Capstan needs lubrication (dry bearing).
4. Tape tensions are incorrect.
5. Brakeshoe is contacting brake drum.
6. Tape reels or tape is defective.
7. Pinch roller tire is worn, has insufficient pressure, or pinch roller solenoid is not bottomed.
8. Pinch roller and capstan are dirty.

3–5 ELECTRONIC ALIGNMENT

If the previous performance tests were not successful, perform the following applicable reproduce and record alignment procedure.

Access to electromic assembly is as follows:
The record/reproduce electronic circuitry is contained on three printed circuit board assemblies (PCB).
Access to these PCB may be obtained by removing the base of the cabinet (four screws). Fig. 3–4 shows the location of the various circuits contained on the PCBs.

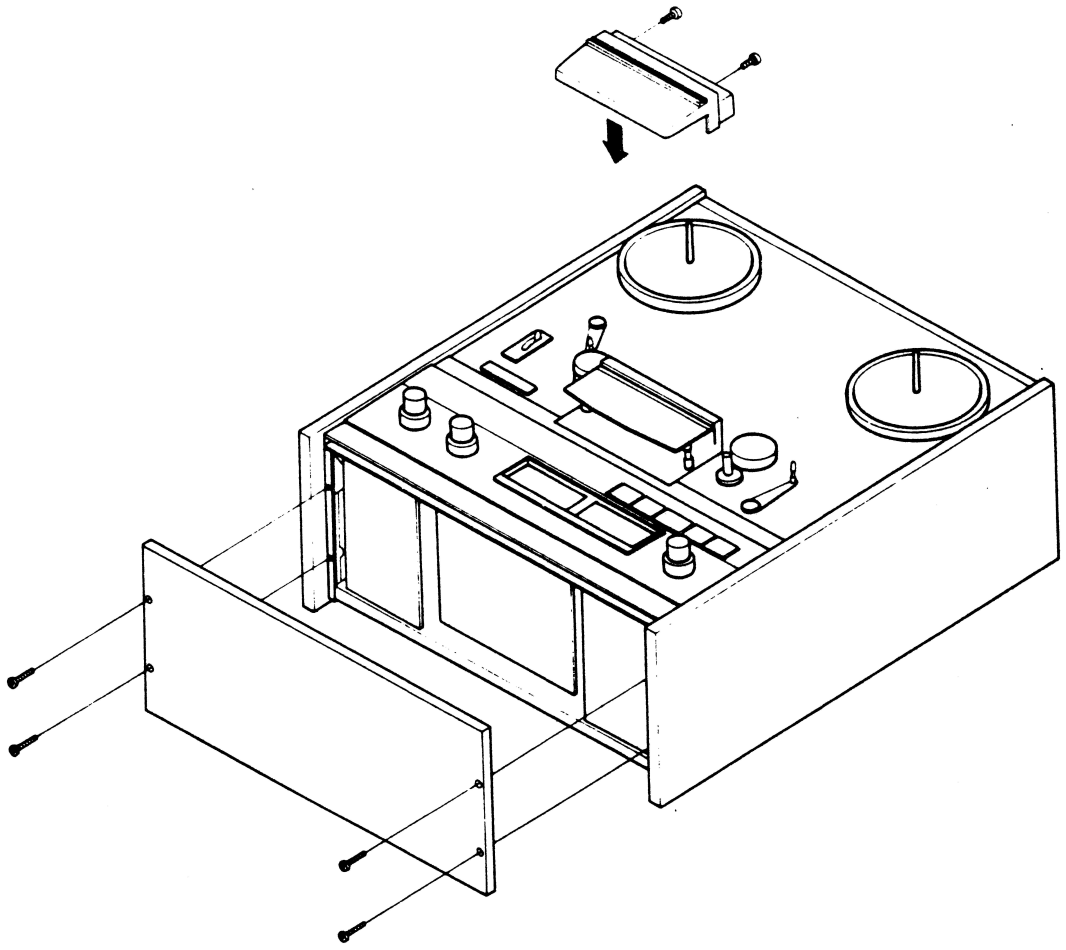


Fig. 3–3 Access to Electronic Assembly

3–5–(1) REPRODUCE ALIGNMENT

Reproduce adjustment consists of reproduce head azimuth adjustment, reproduce equalization adjustment, maximum reproduce level caliblation (MRL), and standard reference level (SRL) calibration. Location of each calibration potentiometer control is shown in Fig. 3–4. To adjust the reproduce system, proceed as follows:

1. Lift head cover and demagnetize and clean heads and guides.
2. Set LINE OUT switch to HIGH, set SRL switch to "off" variable position. Set REEL switch to appropriate position, and set EDIT switch to "out" (non edit) position.
   Set reproduce head selector switch to 2T position for models 2S or 2SD, to 4T position for mosels 4S or 4SD.
3. Set each RECORD switch to "out" (non record) position, set SEL/REP switches to "out" position, and set MONITOR switches to "out" SOURCE position.
4. Connect VTVM to LINE OUT.

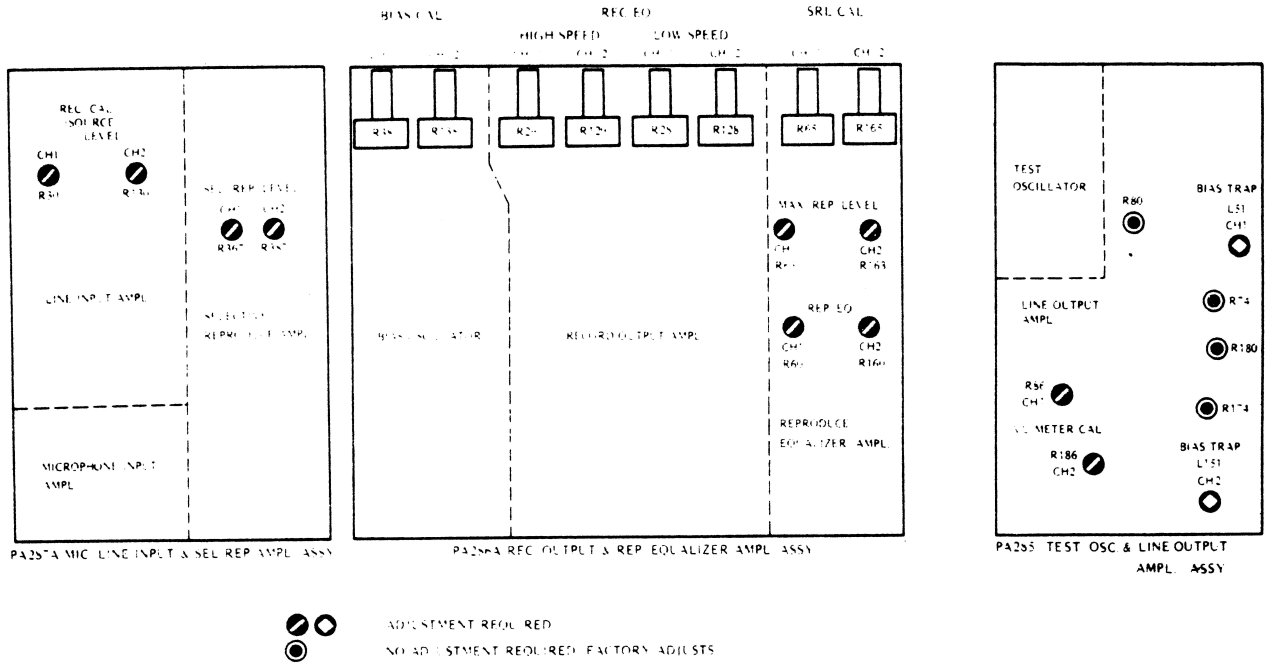


Fig. 3–4 Adjusting Parts Location

3–5–(2) VU METER CALIBLATION

1. Depress TEST OSC switch and adjust INPUT LINE CONTROL to obtain +4dBm reading on VTVM.
2. Adjust R86 (CH–1) and R186 (CH–2) to obtain OVU reading on VU meter.

3–5–(3) REPRODUCE HEAD AZIMUTH ADJUSTMENT

It is recommended that reproduce head azimuth adjustment is made at 7½ ips tape speed.

1. Set SPEED switch to appropriate position for 7½ ips and set MONITOR switches to "in" TAPE position.
2. Thread 7½ alignment test tape on the equipment.
3. Place equipment in play mode, first tone on test tape is refference level of 700 Hz. Adjust OUTPUT level control to obtain O dBm on the VTVM. Next tone is for azimuth adjustment (15 kHz).
4. Adjust the head azimuth screw (appropriate screw "A" in Fig.4–6) to obtain a maximum reading on the VTVM.

CAUTION

DO NOT ADJUST ANY OTHER SCREWS EXCEPT AZIMUTH ADJUSTMENT SCREW (LABELED "A" IN FIG. 4–6).

If a maximum reading cannot be achieved within one full turn of the azimuth screw, or a maximum reading on the VTVM is way below O dBm, a full head alignment may be required. Refer to section 4 of this manual.

3–5–(4) REPRODUCE EQUALIZATION ADJUSTMENT

This adjustment is performed at 7½ ips tape speed for both High speed models and Low speed models.

1. Reproduce the 10 kHz tone and adjust REP EQ potentiometer R60 (CH–1) and R161 (CH–2) so that VTVM indicate O dBm. If adjustment was required, recheck the 15 kHz tone and note if reading is O dBm ±2 dB.
2. Check response for the other tones on the alignment tape. Frequency response should be O dBm ± 2 dB.

3. Check frequency response for the other tape speed.
   Frequency response should be O dBm ±2 dB.
   It is unnecessary to readjust equalization for 15 ips or 3¾ ips, since adjustment has been done at the same time of 7½ ips.

NOTE

Many test tapes are recorded full track. When reproduced by a half-track or multi--track head, the fringing effect produces invalid response at frequencies below 700 Hz. This effect, which results in high indications in the lower frequencies, does not occur when tapes are recorded and reproduced with heads of the same configuration. Do not adjust the low frequency reproduce equalizers for flat response from a full track standard tape.

3–5–(5) MAXIMUM REPRODUCE LEVEL (MRL) CALIBLATION

This adjustment is performed at 7½ ips tape speed.

1. Set both OUTPUT controls to full clockwise position.
2. Reproduce a 7½ ips alignment test tape. When the first 700Hz tone is reached, adjust maximum reproduce level caliblation potentiometers R63 (CH–1) and R163 (CH–2) so that each VU meter indicates O VU.

NOTE

The first tone is a reference level which is recorded at 10 dB below operating level (185nWb/m).

3–5–(6) SRL ADJUSTMENT

This adjustment is made with the operating level 700 Hz signal of the standard alignment tape. It is important that this adjustment is accurate since it affects signal to noise ratio, distortion, and tape saturation level. On Ampex standard alignment tapes this level is 185 nWb/m and is the first tone for 15 ips the last tone for 7½ ips and 3¾ ips tapes. It is suggested that SRL be set at the speed at which the equipment will usually run. If used equally, set at 15 ips for high speed models, 7½ ips for low speed models.

Set SRL switch to SRL position. Reproduce the operating level tone and adjust SRL/CAL potentiometers R65 (CH–1) and R165 (CH–2) so that each VU meter indicates O VU or a +4 dBm or –10 dBm reading on the VTVM depending upon the LINE OUTPUT LEVEL selector.

NOTE

If high output extended dynamic range tapes are to be used exclusively such as Scotch 206, 207 or 250 or Ampex 406, 407 or 456 (or equivalent), the SRL/CAL and SEL/REP levels may be set lower than O VU. Consult Otari representative. Nominal setting for these tapes is −3 VU.

3–6 RECORD AND BIAS SYSTEM ADJUSTMENT

Record and bias system adjustment consists of bias calibration, record level calibration, record head azimuth adjustment, record equalization adjustment, and SEL/REP LEVEL adjustment.

The record and bias system adjustment should be made after reproduce system adjustments are completed.

1. Connect VTVM to LINE OUT, connect audio oscillator to LINE IN, and thread blank bulk-erased tape onto the transport.
2. Push POWER switch to on, set SPEED switch to HI position, and set MONITOR switch to TAPE position, set LINE OUT LEVEL switch to HIGH position, and SRL switch to SRL position.

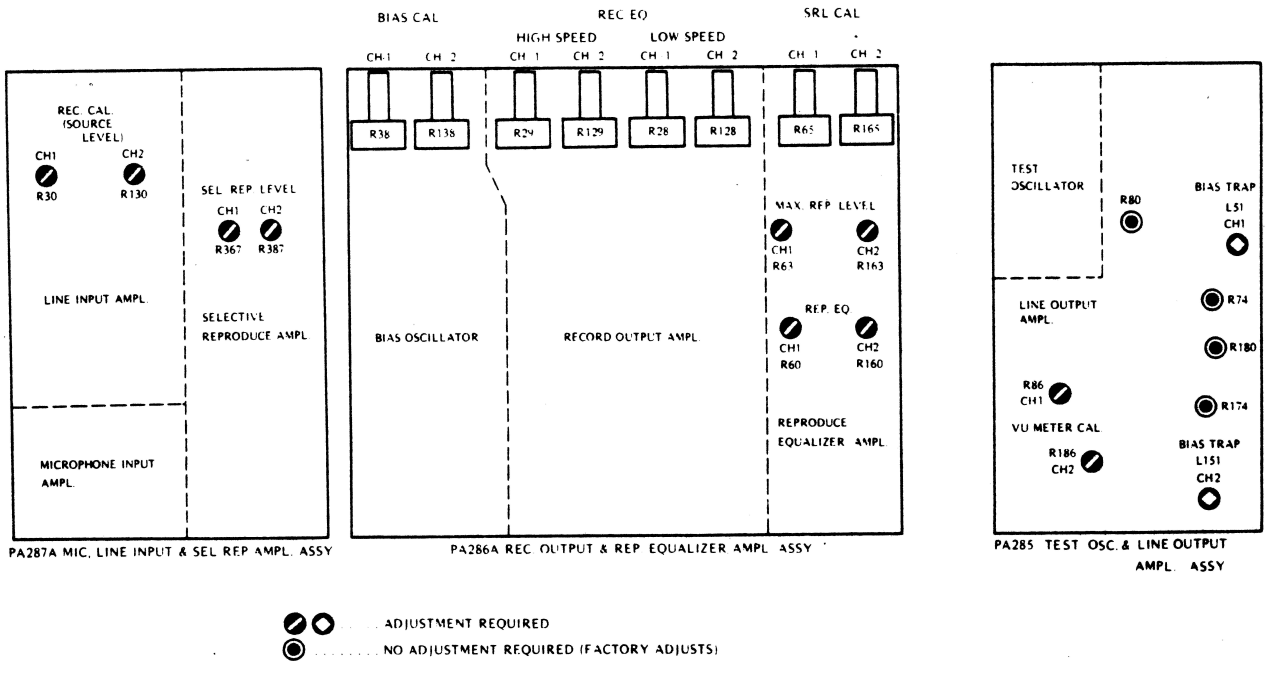


Fig. 3–4 Adjusting Parts Location

3–6–(1) BIAS CALIBRATION

Bias adjustment should be made at 15 ips for high speed models and 7½ ips for low speed models. Record bias current affect signal-to-noise ratio, frequency response, distortion, and recording level. Then it is important to adjust bias current for the using tape in order to make perfect recording.

1. Connect 1 kHz tone of audio oscillator to LINE INPUT. (Built in TEST oscillator is also available.) Set MONITOR switch to TAPE position.
2. Start Record mode and adjust INPUT LINE control for O VU on the VU meter.
3. Adjust the BIAS/CAL potentiometers R38(CH–1) and R138(CH–2) so that each VU meter indicates maximum record output.

3–6–(2) RECORD HEAD AZIMUTH ADJUSTMENT

This adjustment should be made at 7½ ips tape speed and at least 10 dB below SRL.

1. Set audio oscillator frequency to 15 kHz.
2. Start record mode and adjust INPUT LINE control for –10 dBm on VTVM (14 dB below SRL).
3. Adjust record head azimuth adjustment screw (labeled "A" in Fig. 4–6)for maximum reading on VTVM.
4. If a peak reading cannot be achieved within one full turn of the azimuth screw, a full head alizument may be required. Refer to Section 4 of this manual.

3–6–(3) RECORD LEVEL CALIBLATION

This adjustment should be made at 15 ips for high speed models and 7½ ips for low speed models.

1. Set audio oscillator frequency to 1 kHz, set SRL switch to SRL position, and set MONITOR switches to TAPE position.
2. Start record mode and adjust input LINE controls so that each VU meter indicates O VU.
3. Set MONITOR switches to SOURCE position and adjust REC. CAL. potentiometers R30 (CH–1) and R130 (CH–2) so that each VU meter indicates 0 VU.

3–6–(4) RECORD EQUALIZATION ADJUSTMENT

This adjustment should be performed at SRL position for 15 ips tape speed and at least 10 dB below SRL for 7½ ips or 3 ¾ ips tape speed.
Since overall frequency response is affected with bias current, bias calibration may be performed before making this adjustment.

ADJUSTMENT FOR 15 ips

1. Set SRL switch to SRL position, and set MONITOR switches to TAPE position.
2. Place recorder in record mode, set audio oscillator frequency to 1 kHz and adjust INPUT LINE controls for 0 VU on VU meters.
3. Change frequency to 18 kHz and adjust REC/EQ potentiometers R29 (CH–1) and R129 (CH–2) so that each VU meter indicates 0 VU.
4. Sweep oscillator frequency from 35 to 22 kHz.
   Check that the overall frequency response is within ±2 dB.
   Readjust REC/EQ potentiometers R29 (CH–1) and R129 (CH–2) as necessary.

ADJUSTMENT FOR 7½ ips

1. Set SRL switch to "off" or "variable" position and set OUTPUT controls to full clockwise position.
2. Place recorder in record mode. Set audio oscillator frequency to 1 kHz and adjust INPU LINE controls for 0 VU on VU meters (recording is made at 10 dB below SRL).
3. Change frequency to 15 kHz and adjust REC/EQ potentiometers R28 (CH–1) and R128 (CH–2) on high speed models or R29 (CH–1) and R129 (CH–2) on low speed models, so that each VU meter indicates 0 VU.
4. Sweep oscillator frequency from 30 to 18 kHz and check that the over all frequency response is within ±2 dB.
   Readjust appropriate REC/EQ potentiometer as necessary.

ADJUSTMENT FOR 3 ¾ ips

1. Set SRL switch to "off" or "variable" position and set OUTPUT controls to full clockwise position.
2. Place recorder in record mode. Set audio oscillator frequency to 1 kHz and adjust INPUT LINE controls for 0 VU on VU meter (recording is made at 10 dB below SRL).
3. Change frequency to 10 kHz and adjust REC/EQ potentiometers R28 (CH–1) and R128 (CH–2) so that each VU meter indicates 0 VU.

4. Sweep oscillator frequency from 30 to 12 kHz and check that the over all frequency responce is within ±2 dB.
   Readjust appropriate REC/EQ potentiometer as necessary.

3–6–(5) SEL/REP LEVEL ADJUSTMENT

1. Record 1 kHz signal at SRL for about one minute for both channels.
2. Rewind and reproduce the recorded position in the step, and check both VU meters should indicate 0 VU.
3. Depress SEL/REP switch and adjust SEL. REP LEVEL potentiometers R367 (CH–1) and R387 (CH–2) so that each VU meter indicates 0 VU.

NOTE

If this adjustment is made by using standard alignment test tapes which are full track recorded, there will be a little error on acount of fringing effect.

SECTION 4
MAJOR COMPONENT REPLACEMENT PROCEDURES

SECTION 4
MAJOR COMPONENT REPLACEMENT PROCEDURES

4–1 TAPE TRANSPORT

In order to gain access to the tape transport components, place the recorder in an upright position and remove rear cover, two side panels, and top panel (16 screws total).
Refer to Section 6 for parts lists and exploded views of the transport assembly to aid in the identification of the various components.

4–1–(1) REEL TABLE REPLACEMENT AND HEIGHT ADJUSTMENT

The reel table may be removed by removing three cross head screws accessible from the front of the transport. To adjust the reel table height, loosen two hexagonal socket head screws shown in Fig. 4–1, adjust height and retighten screws.

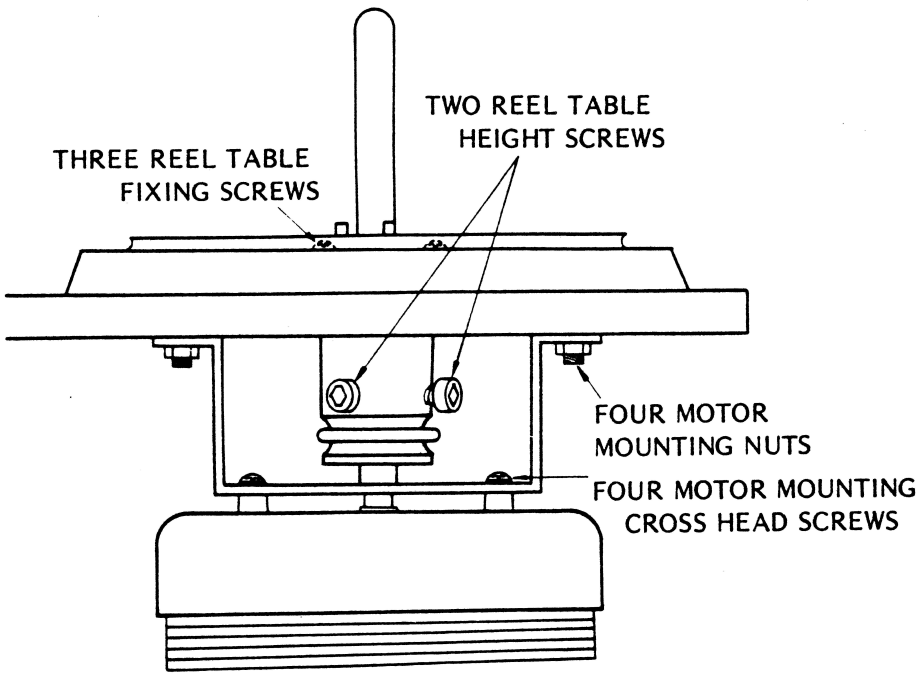


Fig. 4–1 Reel Table and Motor

4–1–(2) SUPPLY OR TAKEUP REEL MOTOR REPLACEMENT

To replace the supply or takeup motor proceed as follows:

1. Loosen two hexagonal socket head screws on the reel shaft holder (Fig. 4–1) and remove reel table and holder.
2. Tag and unsolder motor leads from the attached printed circuit board.
3. Remove four motor mounting M4 nuts.
4. Remove four motor mounting crosshead screws.
5. Install new motor in the reverse order of removal and adjust reel table height.

4–1–(3) POWER TRANSFORMER REPLACEMENT

To replace the power transformer (refer to EXPLODED VIEW 2), proceed as follows:

1. Tag and unsolder all transformer leads from the terminal.
2. Remove four M4 nuts that secures the transformer to the transport. (Ref. No. 2–18)
3. Install new transformer in the reverse order of removal and resolder leads to the terminal of the transformer.

4–1–(4) CAPSTAN MOTOR REPLACEMENT

On models 2S or 4S (Hysteresis synchronous motor machines).

To place the capstan motor (Fig. 4–1 and refer to Exploded View 4), proceed as follows:

1. Tag and unsolder all motor leads from the printed circuit board.
2. Remove entire motor assembly and mounting bracket by removing four cross head screws accessible from the rear of the transport.
3. Remove motor pully from motor shaft by loosening an allen head screw.
4. Remove motor from mounting bracket and replace with new motor.
5. Reinstll motor assembly and mounting bracket in the reverse order of removal. Adjust bracket position to tighten drive belt before cross head mounting screws are tightened.

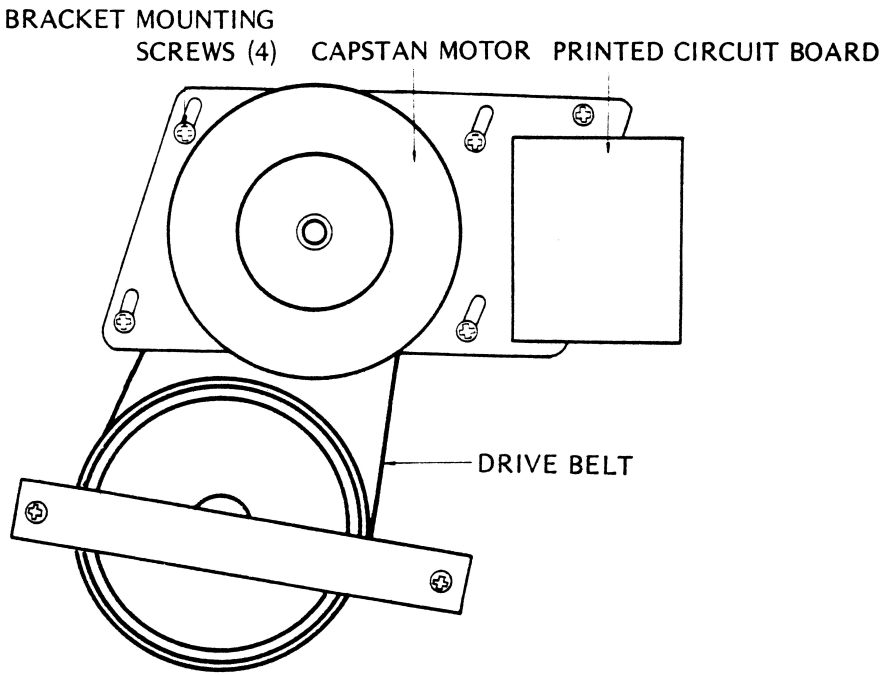


Fig. 4–2 Capstar Motor Location (2S or 4S)

On models 2SD or 4SD (DC servo controlled motor machines)

The capstan motor should be replaced with servo control printed circuit board assembly, to replace the capstan motor proceed as follows: (Refer to EXPLODED VIEW 4–2)

1. Remove connector on servo control printed circuit board assembly located above capstan.
2. Remove servo control printed circuit board assembly with mounting plate by turning four M3 crosshead screws "B" on mounting plate.
3. Remove capstan dust cap from face of transport. (Ref. No. 4–102)
4. Remove capstan mounting plate with capstan motor by removing four M4 crosshead screws "A" on the mounting plate.
5. Remove the capstan motor by removing three M4 crosshead screws "C" on the mounting plate and install new capstan assembly in the reverse order.

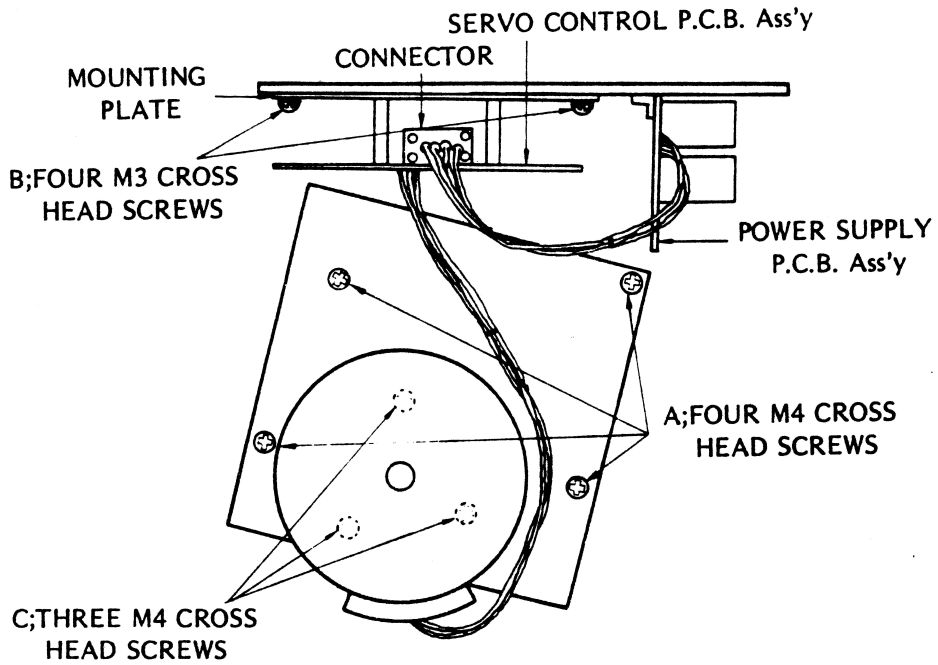


Fig. 4–3 Capstar Motor Location (2SD or 4SD)

4–1–(5) BRAKE BAND OR BRAKE SOLENOID REPLACEMENT

When a new brake band or new brake solenoid is installed (Fig. 2–2), it is necessary to position the brake guide and/or brake solenoid to ensure that there is uniform brake band clearance around the brake drum when the solenoid is energized. Also the brake solenoid plunger must bottom in the solenoid housing when the solenoid is energized. When the solenoid is deenergized, the brake band should uniformally contact the drum surface. After installation, perform the Brake Adjustment procedure given in Section 2 of this manual. After completion of the adjustments place the recorder in play mode for 30 minutes. Then press STOPand PLAY pushbuttons to ensure that the solenoid bottoms when it is hot.

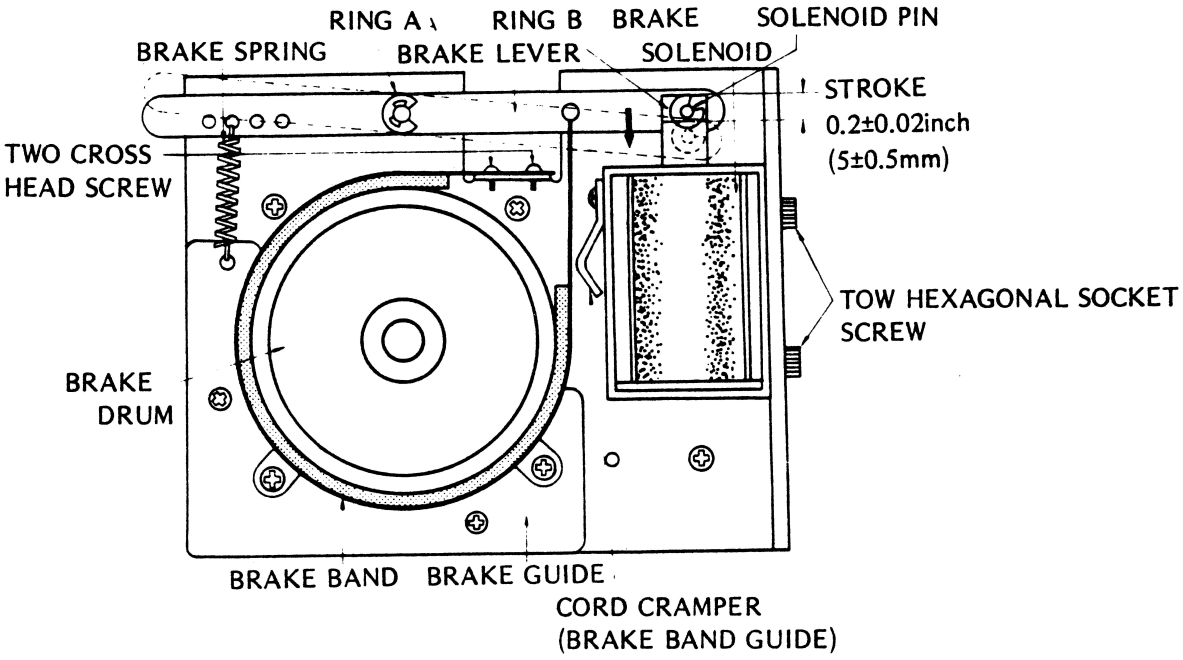


Fig. 4–4 Brake Assembly Location

To replace the brake band or brake solenoid, proceed as follows:

1. Remove brake spring and retaining ring "A".
2. Remove retaining ring "B" of solenoid pin. and remove solenoid pin.
3. Remove solenoid housing with plunger by removing two hexagonal socket head screws.
4. Install new solenioid housing with plunger and set solenoid housing so that plunger stroke is 0.2 ± 0.02 inch (5 ± 0.5 mm).
5. Remove spring pin of brake lever and remove brake band by removing two cross head screws.
6. Install new brake band in the reverse order.

4–1–(6) PINCH ROLLER REPLACEMENT

To replace the pinch roller assembly proceed as follows:

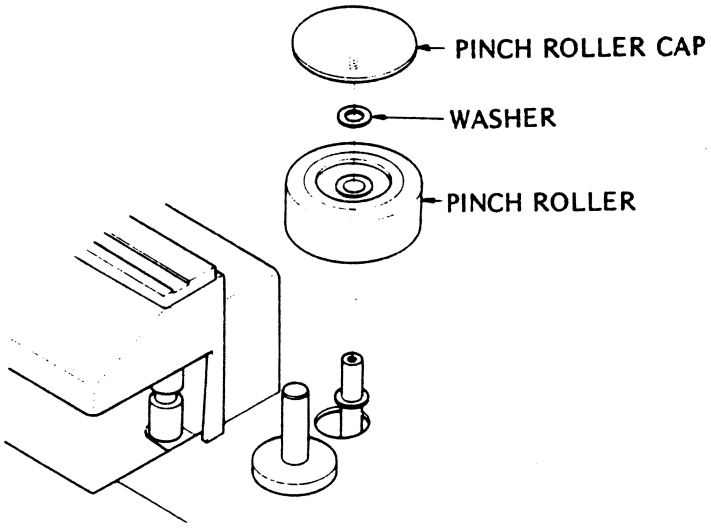


Fig. 4–5 Pinch Roller Removal

1. Remove pinch roller cap by turning counterclock wise.
2. Install new pinch roller.
3. Reinstall nylon washer and pinch roller cap in the reverse order.

4–2 HEAD ASSEMBLY REPLACEMENT

This section provide a description of the head assembly, procedures for changing head stacks and adjustment procedures for adjusting head azimuth (tilt), head height, head zenith (perpendicularity) and tape wrap (racking). These adjustments are required whenever a head stack is replaced.

NOTE

AFTER HEAD ALIGNMENT, ALIGNMENT SCREWS (AZIMUTH, ZENITH, HEIGHT) SHOULD BE LOCKED UP WITH ENAMEL PAINT.

DESCRIPTION

The head assembly is mounted on three tape-guide posts and secured in place by three screws labled "M" in Fig. 4–6.

The insulating shield for the head assembly printed circuit board is secured by screws labled "S". Each head stack is secured to a bracket by screws labled "W" with a spacer between the bracket and head stack. Each bracket is suspended from the head base by three spring-loaded screws labled "H", "A", and "Z". Screws labeled "W" are used to adjust tape wrap. Screws labeled "H", "A", and "Z" are used to adjust height, azimuth, and zenith.

A head stack may be removed and re-lapped (face resurfaced) if the amount of wear is small and only an indication of poor head-to-tape contact is evident. Poor contact is a result of improper adjustment and is evidenced by loss of high frequency response of the record or reproduce head stack, difficulty in achieving bias peak (record stack), or insufficient erase stack erasure.

HEAD STACK REPLACEMENT

To change a head stack, proceed as follows:

1. Lift head cover, remove AC power cord.
2. Remove three screws labeled "M" and pull out the head assembly from head connector.
3. Tag and unsolder (use low wattage pencil type iron to prevent damage) leads at rear terminal of the head stack.
4. Remove head stack by removing two screws labeled "W".
5. Install new head stack and resolder leads.
6. As a preliminary adjustment, measure the distance between the head base and the bracket at a point near spring-loaded screws "A", "Z", and "H". If necessary adjust screws for equal spacing.
7. Lay a piece of ¼-inch tape over the spacers and head stacks as shown in Fig. 4–7. Note if the leading and trailing wrap angle around the head stack is equal. If not equal, correct by loosening screw "W", adjusting head stack, and retightening screws.
   Remove the three screws and spacers installed in step 7.
8. Remount the head assembly. Perform the appropriate head alignment procedure given below.

Following adjustment are necessary whenever head is replaced.

1. In case of reproduce head replacement.
   A. Reproduce Equalization Adjustment (See 3–5–(ᴗ))
   B. SRL Calibration (See 3–5–(6))
2. In case of record head replacement.
   A. Bias Calibration (See 3–6–(1))
   B. Record Level Calibration (See 3–6–(3))
   C. Record Equalization Adjustment (See 3–6–(4))
   D. SEL/REP Level Adjustment (See 3–6–(5))
3. In case of erase head replacement
   A. Bias Calibration (See 3–6–(1))

RECORD OR REPRODUCE HEAD ADJUSTEMNT

Follow the procedure for Reproduce Amplifier Alignment given in Section 3 of this manual. For the final adjustment of a record stack, the height and azimuth adjustment may be accomplished in the same manner as for a reproduce head stack by playing back an alignment tape with the recorder in the selective reproduction mode (SEL/REP switches "in"). Use the 10 kHz tone for azimuth adjustment.

ERASE HEAD ALIGNMENT

Erase head azimuth is not critical, however wrap angle and head height relative to the record head is important to achieve maximum efficiency. Poor erasure is often caused by misalignment of the erase head. Before making any attempt to adjust the erase head stack, an entire electronic alignment procedure (reproduce, record, and bias amplifier alignment) should be performed so that the record and reproduce head heights are correct, SRL/CAL setting is correct, and bias and record levels are properly calibrated. If should be also noted that in some cases, high coercivity tape can be the cause of poor erasure.

An approximate erase head adjustment can be accomplished using headset or a speaker/amplifier. However, for precise alignment, a wave analyzer should be used. Proceed as follows:

1. Follow the procedure for Erasure Test steps 1 through 6 given in Section 3 of this manual.
2. Observe reading on wave analyzer and turn screw "H" (Fig.4–5) ¼ turn clockwise. If the reading decreased, turn screw "A" and "Z" ¼ turn clockwise. If the reading increased when "H" was turned ¼ turn clockwise, turn "H" counterclockwise past the original setting to ¼ turn counterclockwise. If the reading decreased, turn screw "A" and "Z" counterclockwise by the same amount.
3. Repeat step 2 in small increments to achieve a minimum reading on the wave analyzer. Typical amount of erasure should be 65 dB or better.
   Note: After "H" is turned, be sure to turn "A" and "Z" the same amount.
4. If the adjustment of erase head height alone cannot achieve satisfactory erasure, set screw "H", "A", and "Z" for minimum reading on the wave analyzer.
   Note that there are two vertical gaps on the face of the erase head. The trailing gap has the most effect on erasure and must be in good contact with the tape. Loosen screws "W" slightly and rotate the erase head stack for a minimum reading on the wave analyzer. Tighten screws "W".

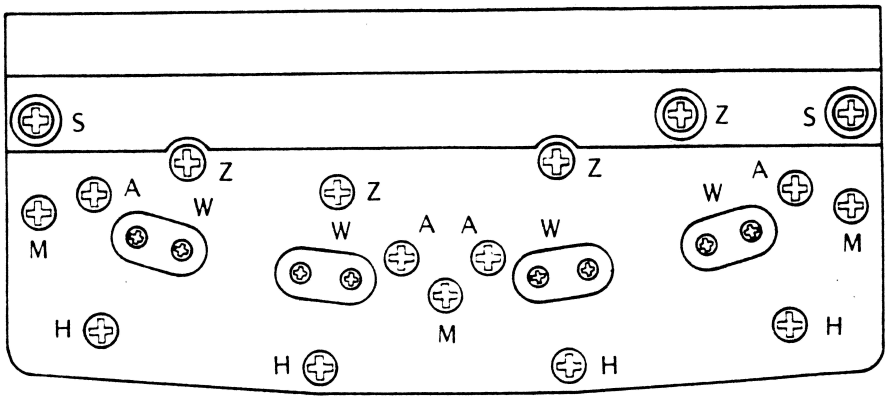


Fig. 4–6 Top View of Head Assembly

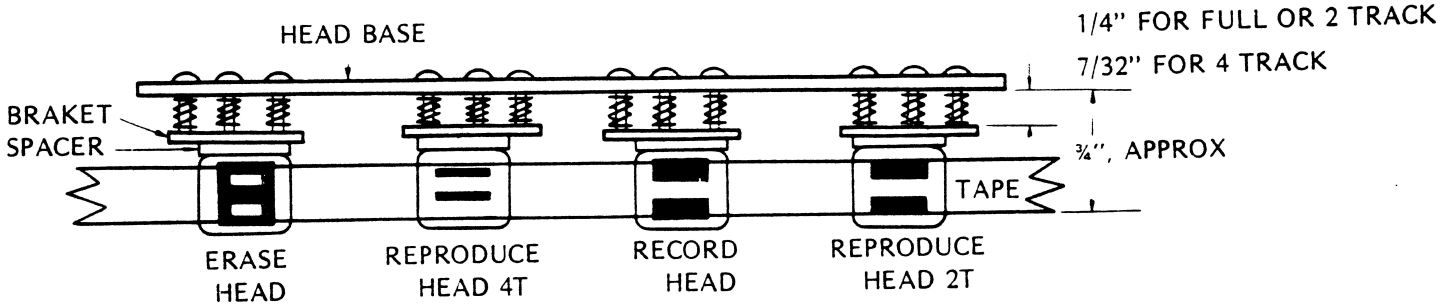


Fig. 4–7 Front View of Head Assembly

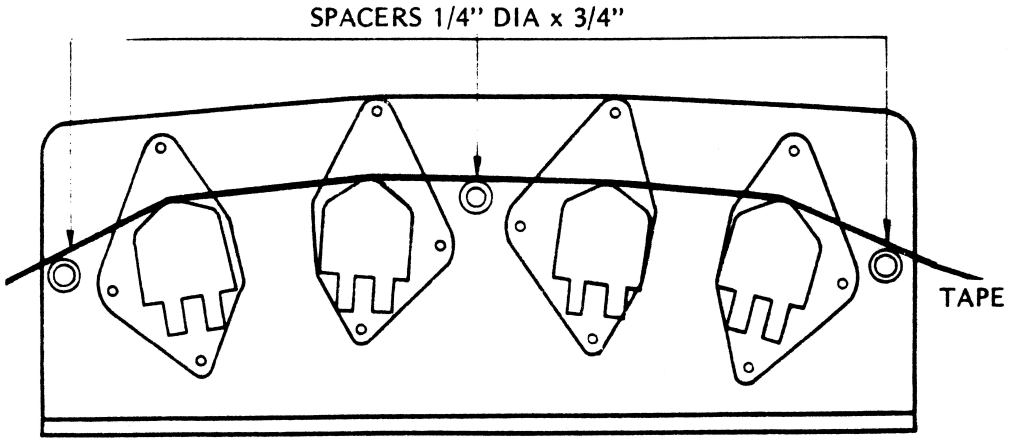


Fig. 4–8 Bottom View of Head Assembly

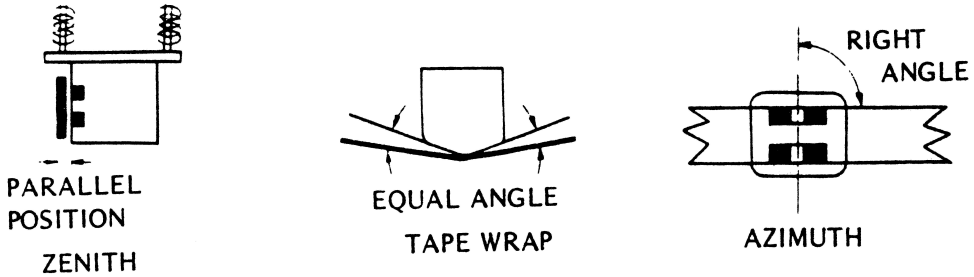


Fig. 4–9 Head Alignment

4–3 INSTALLATION OF OPTIONAL TRANSFORMER

4–3–(1) INSTRUCTION OF INPUT TRANSFORMER

Follow the instruction to install the input transformer.

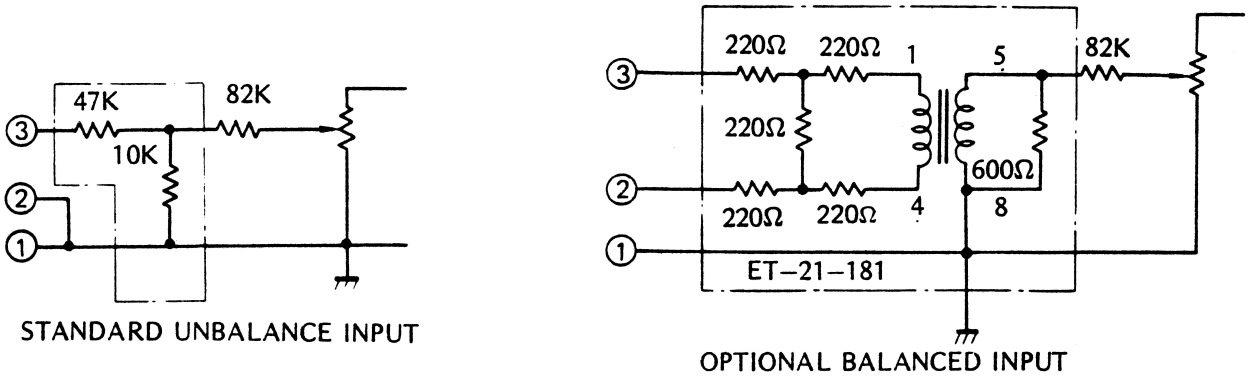
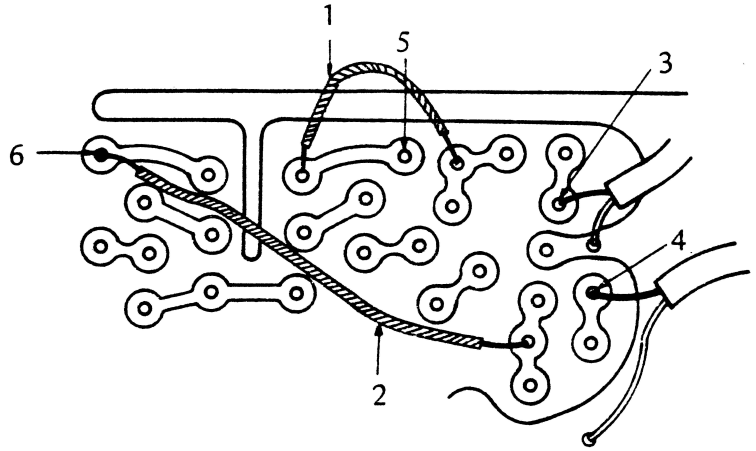


Fig. 4–10 Input Circuity

Input transformer has terminals as shown above surrounded by broken line.

1. Take out case rear board as shown in Fig. 2–1, and out Rear Panel. Then mount the transformer with two screws. (See Fig. 4–12)
2. Remove wires from XLR connector. Solder Hot Line (Orange) to transformer output side number 5, Solder Cold Line & Shied to terminal number 8.
3. Solder Hot Line (Orange) premounted on the transformer to XLR connector number 3, Cold Line (White) to XLR connector number 2, and Shield to XLR connector I. (See Fig. 4–13)
4. Take out the bottom board and re-wire the PCB as shown below.



A Take out jumpers 1 and 2.
B UM-solder 3 and solder to 5.
C UM-solder 4 and solder to 6.

Fig. 4–11 P.C. Board Wiring.

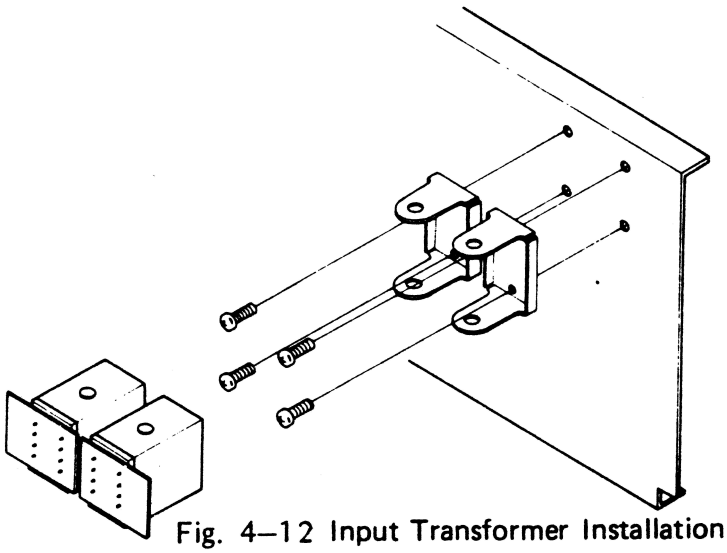


Fig. 4–12 Input Transformer Installation

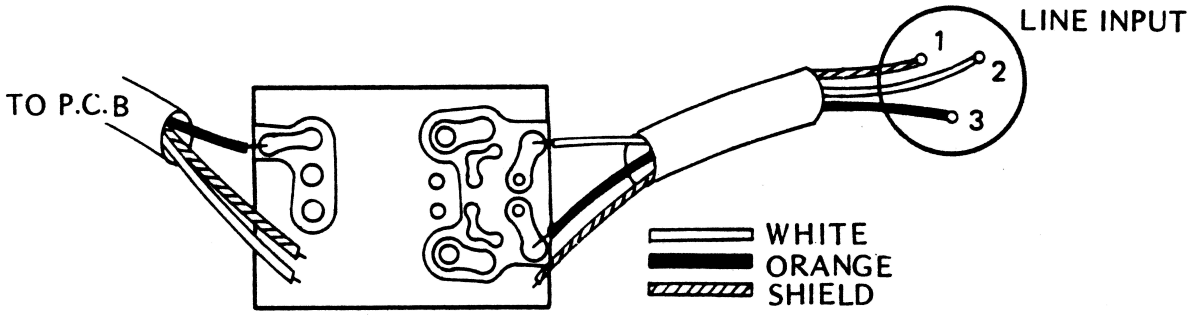


Fig. 4–13 Input Transformer Wiring

5. After all of above modification, please test record.

4–3–(2) INSTALLATION OF OUTPUT TRANSFORMER

Fig. 4–15 shows circuity of unbalanced output and balanced output. To install input transformer, proceed as follows:

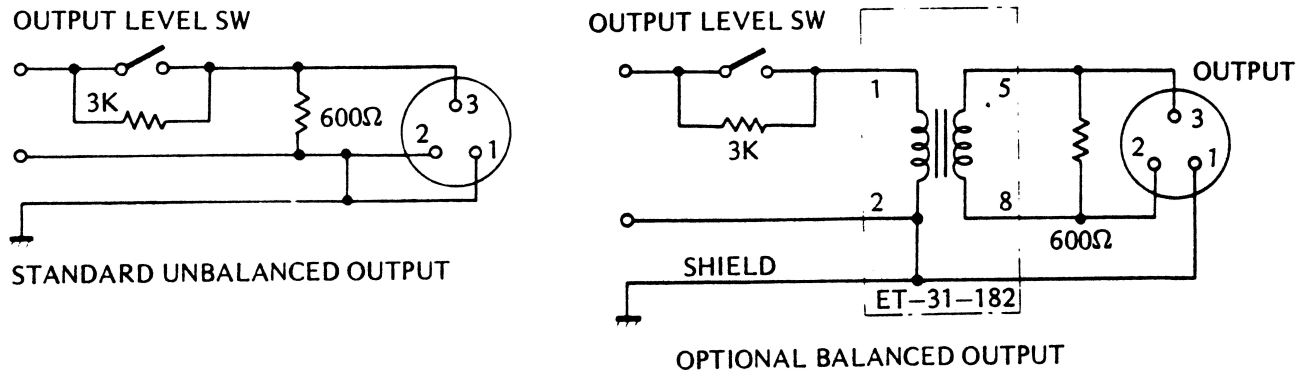


Fig. 4–14 Output Circuity

Transformer has terminals as shown above surrounded by broken line.

1. Take out case rear board in the Fig. 11–1, and then take off rear panel. Mount the transtormer with two screws.
2. Remove wires from XLR connectors. Solder Hot Line (Orange) to transformer terminal 1, and Solder Cold Line (White) and Shield to terminal 2.
3. Solder Orange Wire coming out of terminal 5 to XLR connector number 3, Solder White Wires coming out of terminal 8 to XLR connector number 2, Solder Shield Wire to XLR connector number 1.
4. After above wiring, put test tape and adjust reproduce level.

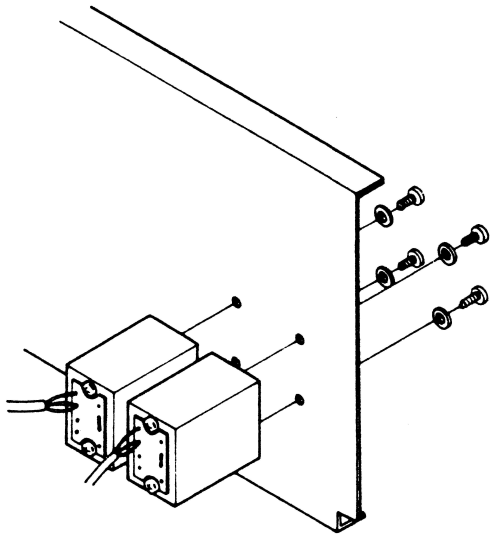


Fig. 4—15 Output Transformer Installation

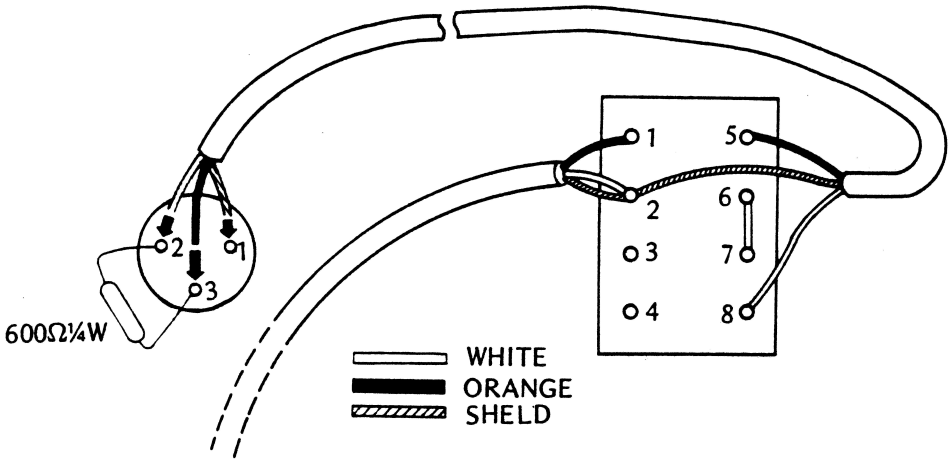


Fig. 4—16 Output Transformer Wiring

SECTION 5
TROUBLESHOOTING

SECTION 5
TROUBLESHOOTING

5–1 PRELIMINARY PROCEDURES

If a problem should occur with the recorder, check that the following items are correct before proceeding with troubleshooting procedures. As an aid in troubleshooting, refer to the schematic diagram and parts lists included in this manual.

1. Head stacks are cleaned and demagnetized.
2. Head azimuth and height are correct.
3. Record bias has been adjusted properly.
4. Recommended tape has been used.
5. Input and/or output connectors are correctly wired.
6. Ac line voltage is within ± 10% of indicated power requirement.
7. All operational switches have been correctly set.
8. Adjustment procedures have been correctly made using accurate test equipment.

5–2 TROUBLESHOOTING HINTS

Some of the more common problems and possible causes are listed in Table 5–1.

Table 5–1 Troubleshooting Hints

SYMPTOM	POSSIBLE CAUSE
Power switch is on but meters do not illuminate and transport does not function.	Fuse is blown, ac power cord is defective, or power switch is defective.
Transport function and meters illuminate but no recording and reproducing	Power source for amplifier (+29Vdc) is defective.
Transport does not function.	Power source for control (+24Vdc) is defective.

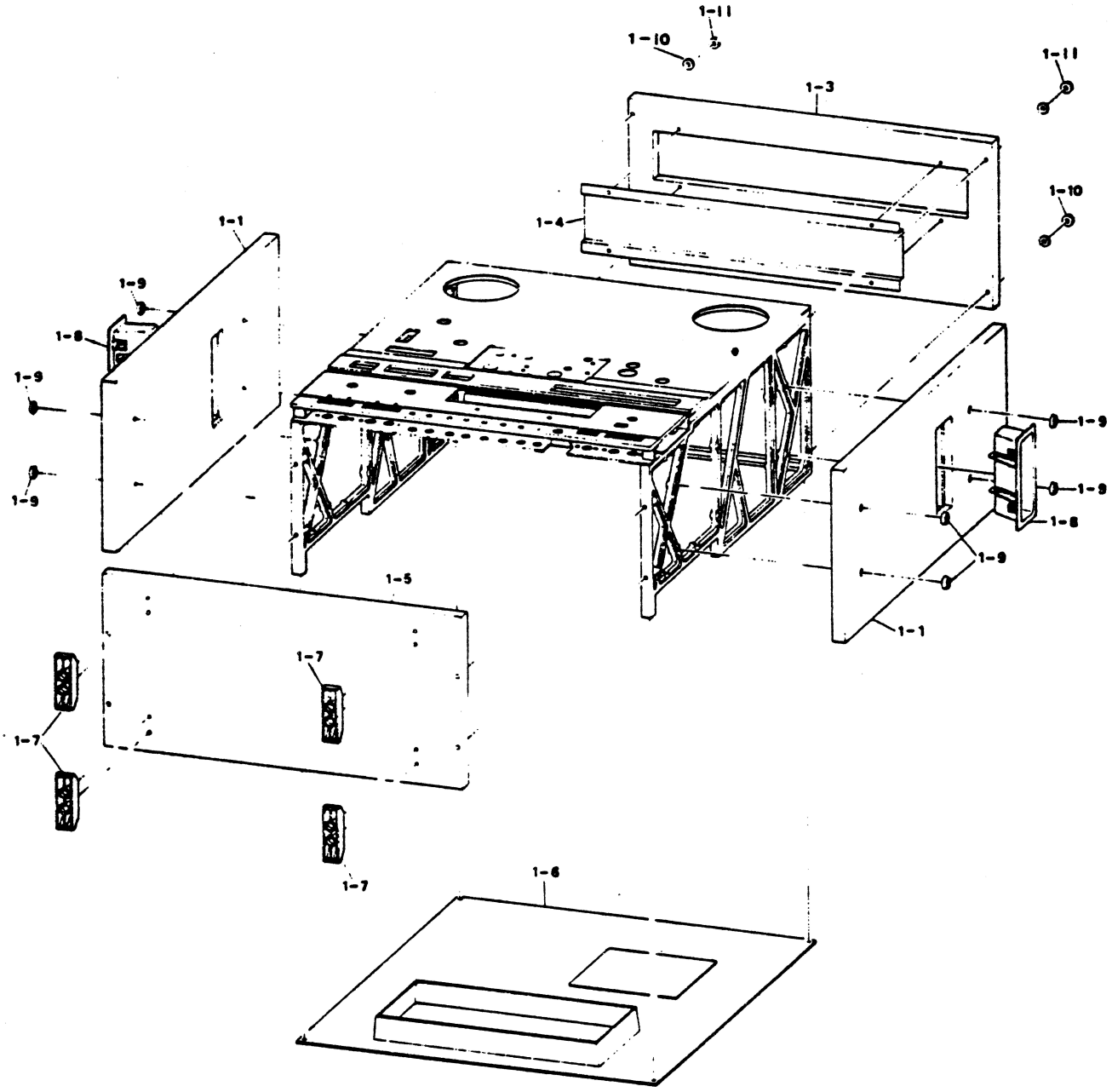
Capstan shaft does not rotate	Tension arm safety switch is defective. On models 2S or 4S, capstan motor is defective or capstan belt come off. On Models 2SD or 4SD, power source for capstan motor (+24Vdc or +5Vdc) is defective, or fuse of the power supply is blown.
No PLAY mode function	Control circuit (PA–284) is defective (Tr8,9,SCR2,3)), or pinch roller solenoid is defective.
No FAST FORWARD mode function	Control circuit (PA–284) is defective (Tr 3,4, SCR 1).
No REWIND mode function	Control circuit (PA–284) is defective (Tr2).
Record lamp of transport does not illuminate and no RECORD mode function	Control circuit (PA–284) is defective (Tr10, SCR4)
Brake solenoide does not move.	Control circuit (PA–284) is defective (Tr5), or brake solenoi--lenoide is defective, or brake adjustment is incorrect (strok).
Tape speed is incorrect	Pinch roller adjustment is incorrect (not bottomed), or dirty pinch roller, dirty capstan shaft. On models 2S or 4S, loose or dirty capstan belt slips, or capstan motor is defective. On models 2SD or 4SD, capstan servo control circuit is defective, or adjusted incorrectly. Pitch control nob is at wrong position.
Output level is wrong	Reproduce head switch is at wrong position, or output level switch is wrong position.

SECTION 6
PARTS LISTS AND SCHEMATICS

PARTS LIST 1

Ref. No.	Description	Parts No. (old)	New No.
1-1	Left Side Board	CS-245-004	K100603
1-1	Right Side Board	CS-245-004	K100603
1-3	Case Top Board	CS-245-002	K100601
1-4	Cooling Cover	CS-232-007	K100602
1-5	Case Bottom Board	CS-245-007	K100604
1-6	Case Rear Board	CS-245-009	K1006-D
1-7	Rubber Pad	NB-91-032	CY4006
1-8	Catcher	CS-245-005	CY1004
1-9	Display Washer	TY-800-014	KZ6C016
1-10	Sheet	TY-800-017	K6C011
1-11	Display Washer	TY-800-021	KZ6C010

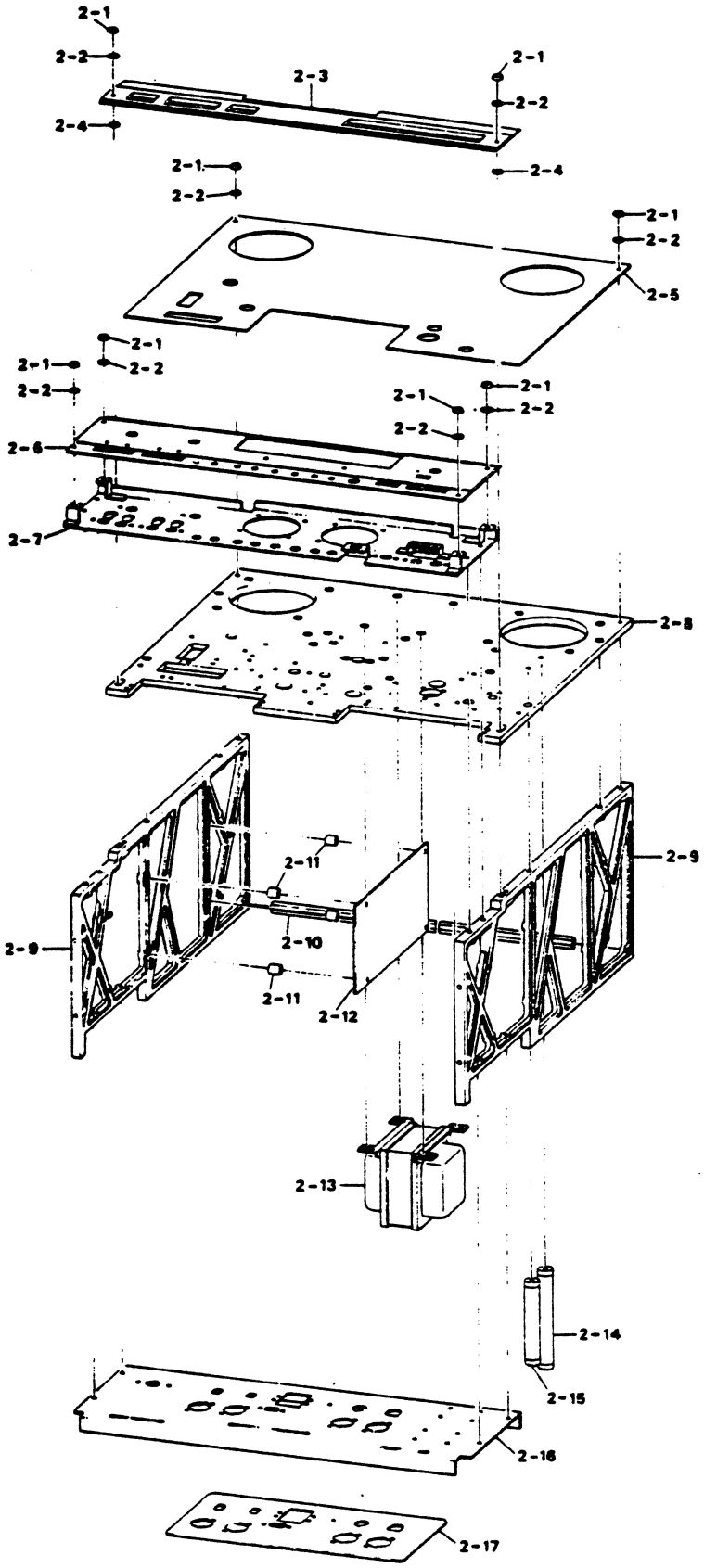
EXPLODED VIEW 1



PARTS LIST 2

Ref. No.	Description	Parts No. (old)	New No.
2-1	Display washer	TY-800-021	KZ6C010
2-2	Sheet	TY-800-017	KZ6C011
2-3	Control Display Panel	TD-5050-004	T505003
2-4	Plain Washer	TY-800-024	KZ6C009
2-5	Display Panel	TD-5050D-001(2SD,4SD)	T506006
		TD-5050-001(2S,4S)	T505002
2-6	Amplifier Display Panel	AF-230-003	A101601
2-7	Amplifier Mounting Base	AF-230-004	A101602
2-8	Mounting Base	TD-5010-001	T505001
2-9	Frame	TD-5010-006	T505004
2-10	Frame Stud	TD-5010-008	KZ7B202
2-11	Stud	ST-107	KZ7A217
2-12	Control PCB Assembly	PA-284	PB-41D
2-13	Power Transfomer	ET-11-194	TF11012
2-14	W-W Resistor	RS-39-40HAAC-600ohm	RV5J6011
2-15	W-W Resistor	RS-39-30HAAC-200ohm	R55J2011
2-16	Rear Panel	AF-230-007	A101609
2-17	Rear Name Plate	AF-230-009	A101610

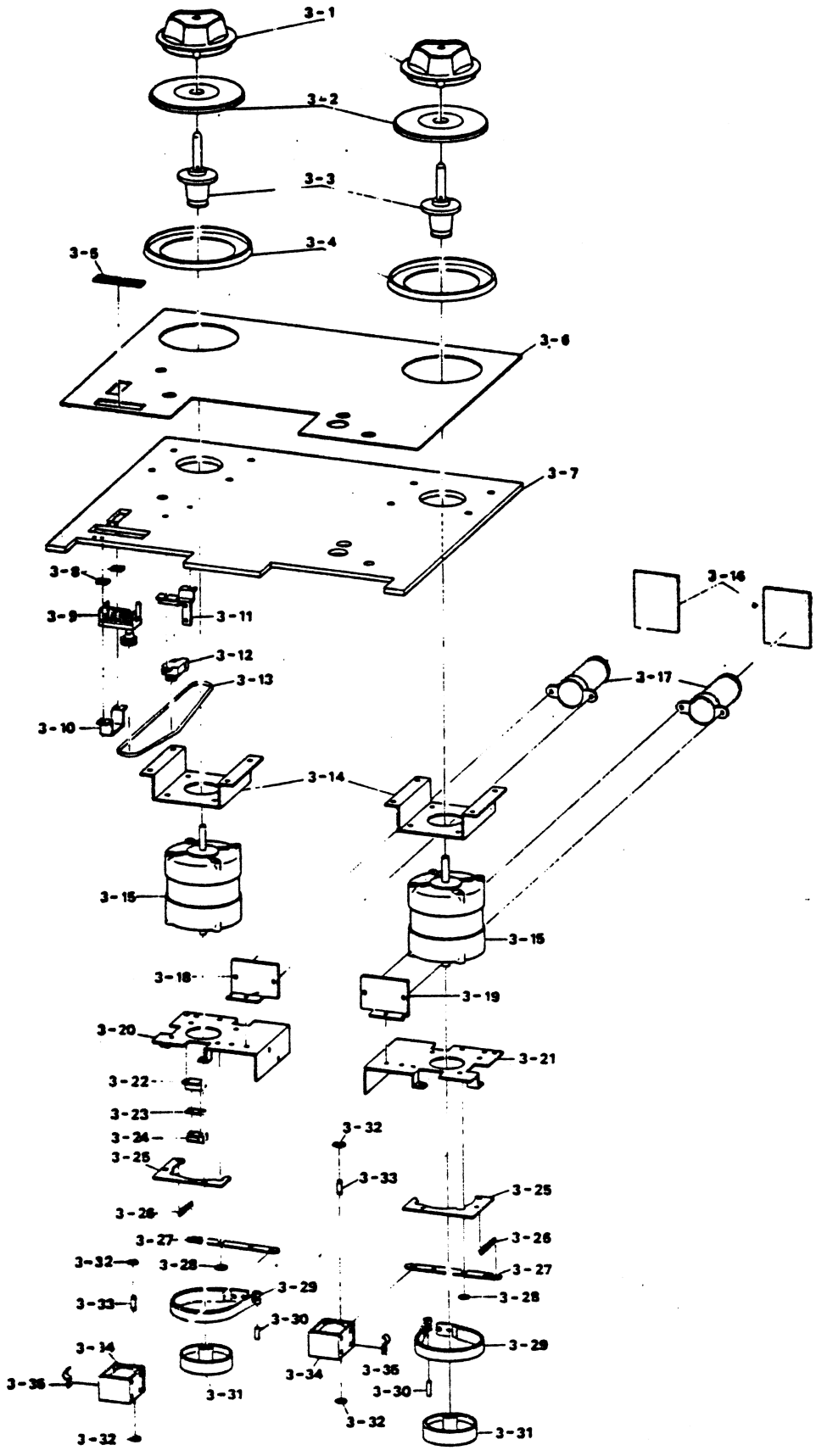
EXPLODED VIEW 2



PARTS LIST 3

Ref. NO.	Description	Parts No. (old)	New No.
3-1	Reel Clamper	TW-661	TW-670
3-2	Reel Table	TW-424-001/KW4J002	Assy.#
3-3	Reel Shaft Holder	TW-424-002/KWOB017S	KW4J001
3-4	Reel Protector	TW-424-009	KWOH007
3-5	Counter Grille	TD-5500-005	SR8B003
3-6	Display Panel	TD-5050D-001(2sD,4SD)	T505006
		TD-5050-001(2S,4S)	T505003
3-7	Mounting Base	TD-5010-001	T505001
3-8	Spacer	TZ-131-001	SR8B002
3-9	Tape Counter	CT-09-T4A SPEC	SR-8B
3-10	Counter Supporter	TZ-126-001	SR8B001
3-11	Switch Bracket	PA-282-003	T505005
3-12	Rotary Switch(With Pulley)	SW-99-HZR0036-01-010	/WH91005
3-13	Endless Belt	TB-5147-20	BE1B147
3-14	Reel Motor Supporter	TW-421-018	KWOG016
3-15	Reel Motor	EW-506-019	MR1C005
3-16	Relaying PCB	PM-678	PB9A027
3-17	Electrolytic Capacitor	CD-99-MPL-5.5μ	CZ10014W
3-18	Capacitor Holder	TW-421-017L	KW4B003
3-19	Capacitor Holder	TW-421-017R	KW4B004
3-20	Brake Base	TW-421-009	KWOG013
3-21	Brake Base	TW-421-007	KWOG012
3-22	Switch Supporter	TW-421-006	KW4B002
3-23	Spacer	TW-421-019	KW4B005
3-24	Micro Switch	SW-59-SS5GL	WH51002
3-25	Brake Guide	TW-421-004	KW4B001
3-26	Spring	SG-100-052	GS1024
3-27	Brake Arm	TW-424-008	KWOD014
3-28	Retaining Ring	EZ-09-E-15	F74TE15
3-29	Brake Band Assembly(With	Sheet).....	KW-4E-A
3-30	Pin	EZ-09-316	F63316
3-31	Brake Drum	TH-424-007	KWOA012
3-32	Retaning Ring	EZ-09-E-9	F74TE09
3-33	Solenoid Pin	TY-400-015	MR5A003
3-34	Solenoid	SO-334 DC24V	GP1F01
3-35	Cord Clamper	.....	KZ3A047

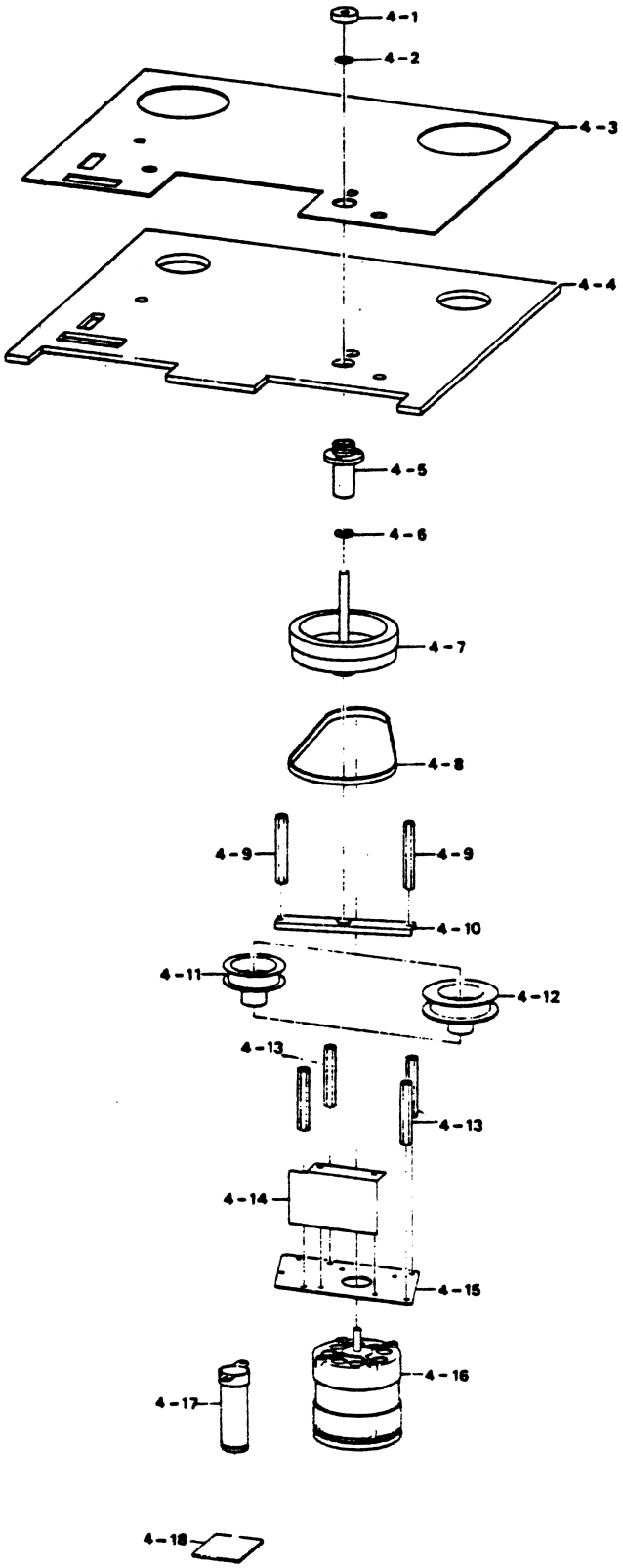
EXPLODED VIEW 3



PARTS LIST 4-1

Ref. No.	Description	Parts No. (old)	New No.
4-1	Dust Cap	TC-423-007	KCOB008
4-2	Felt Collar	TC-419-004	PZ1B007
4-3	Display Panel	TD-5050-001	T505002
4-4	Mounting Base	TD-5010-001	T505001
4-5	Metal Holder Assembly	TC-423-004	KC4B001
4-6	Slide Washer	TY-800-026C	KZ6C014
4-7	Capstan-Flywheel	TC-423-001	KCOA020
4-8	Endless Belt	TB-9140-10-High speed	BE2M140
		TB-9137-10-Low speed	BE2M137
4-9	Stud	ST-076	KZ9I755A
4-10	Flywheel Holder	TC-419-007	KC4B004
4-11	Motor Pulley A	TC-423-008A 50HZ High	KCOD010
		TC-426-001A 50HZ Low	KCOD016
4-12	Motor Pulley B	TC-423-008B 60HZ High	KCOD011
		TC-426-001B 60HZ Low	KCOD017
4-13	Motor Stud	ST-054	KZ9I570A
4-14	Shielding Plate	TC-419-012	KC4B006
4-15	Motor Suppoter	TC-423-009	KC4B005
4-16	Motor	EM-408-011	MR2F010
4-17	Electrolytic Capacitor	CD-99-MPL-2.0+0.5	CZ10011W
4-18	Relaying PCB	PM-669	PB9A026

EXPLODED VIEW 4-1 (For Models 2S and 4S)

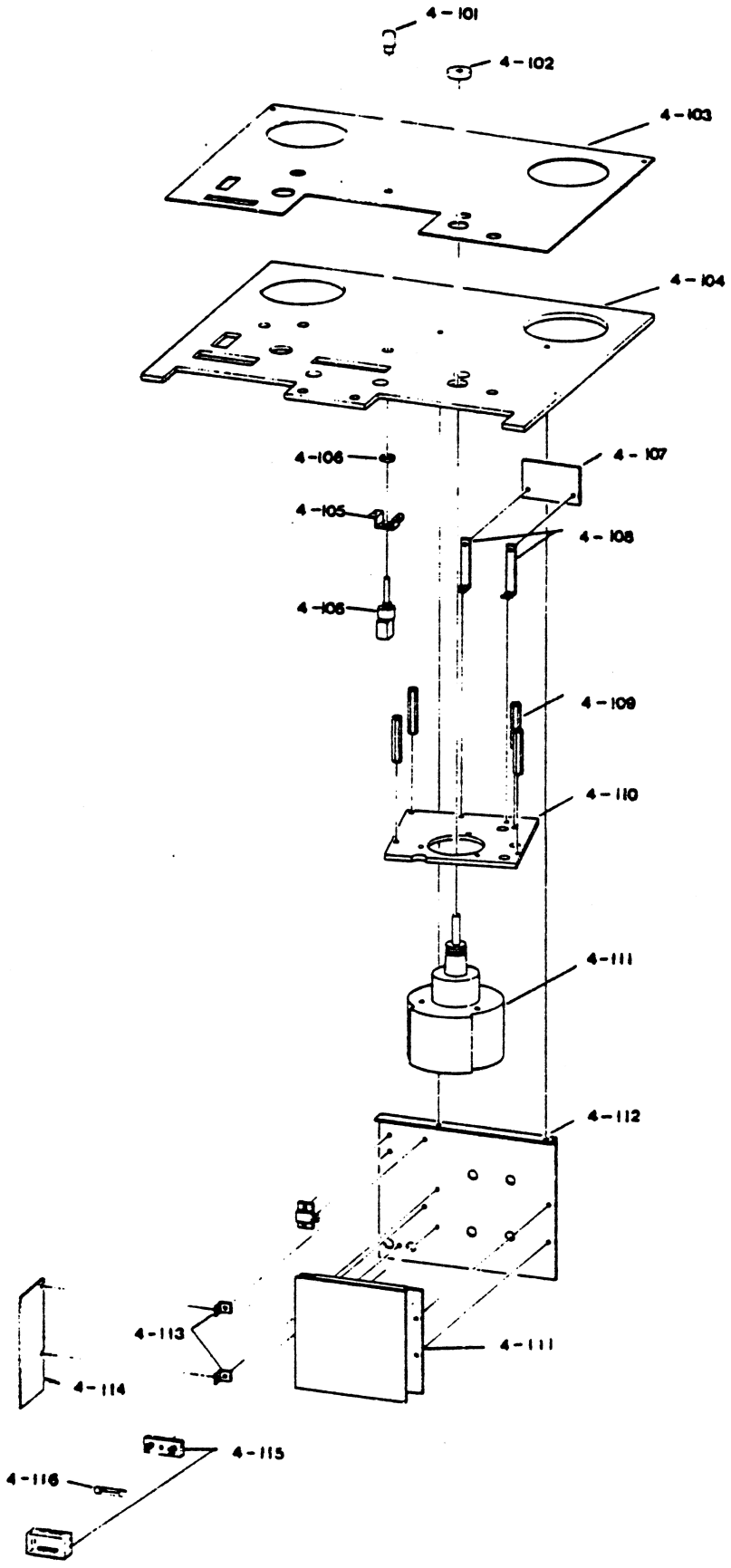


PARTS LIST 4-2

Ref. No.	Description	Parts No. (old)	New No.
4-101	Knob	NB-31-037	KN1013
4-102	Dust Cap	TC-423-007	KCOB008
4-103	Display Panel	TD-5050D-001	T505006
4-104	Mounting Base	TD-5010-001	T505001
4-105	Variable Resistor Supporter	TC-427-003	KZ2A030
4-106	Variable Resistor	VR-29-EVH-Y03R25B52	RV252009
4-107	+5Volt Dc Power Supply PCB Assembly	PA-426	PB-61D
4-108	PCB Supporter	TY-200-082	KZ3A027
4-109	Stud	ST-086	KZ7B220
4-110	Motor Supporter	TC-212-001	KC2B001
4-111	Capstan Drive Motor	EM-710-007A	MR5A001
4-112	Radiator	TC-212-002	KZ1A012
4-113	PCB Supporter	TC-427-004	KZ3A028
4-114	Power Supply PCB Assembly	PA-377	PB-61E
4-115	Fuse Holder	FS-89-F-3294	FH1-022
4-116	Fuse	FS-19-2A	FH7A020

THERE ARE VERY FEW OF THIS VERSION IN THE U.S. PLEASE CONFIRM THESE PART NUMBERS WITH THE CUSTOMER OF THEY ARE ORDERED.

EXPLODED VIEW 4-2 (For Models 2SD and 4SD)

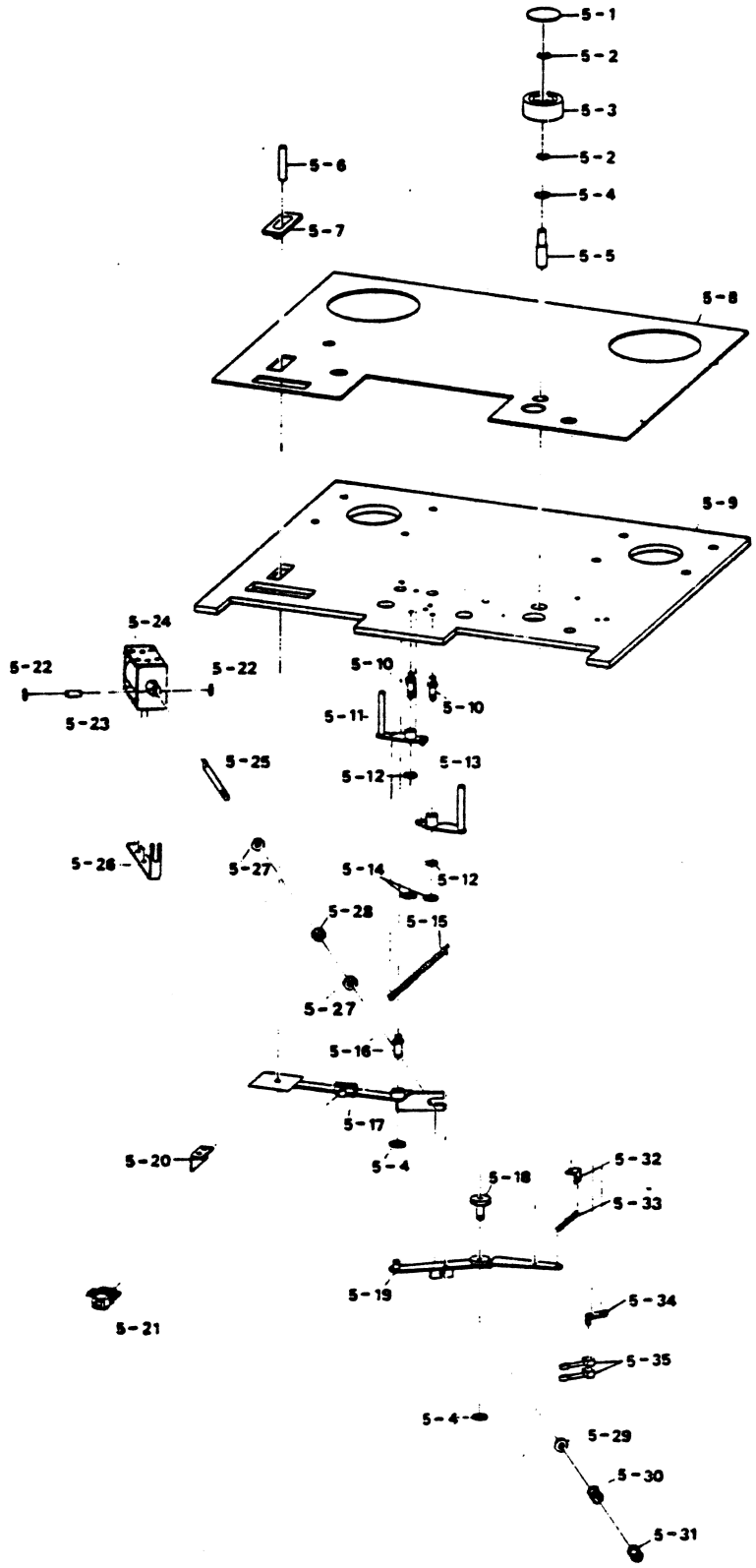


PARTS LIST 5

Ref. No.	Description	Parts No. (old)	New No.
5-1	Pinch Roller Cap	TP-416-001	KPOC005
5-2	Polyslider Washer	EZ-09-5TW-FT-6 0.25	6x0.25 polyslide washer
5-3	Pinch Roller	TP-416-001	KPOA007
5-4	Retaining Ring	EZ-09-E-20	F74TE20
5-5	Pinch Roller Shaft	TP-416-002	KPOB010
5-6	Cue Lever	TR-416-001	KPOC005
*5-7	CUE Lever Escutcheon	TR-416-002	KR4B006
5-8	Display Panel	TD-5050D-001(2SD,4SD)	T505006
		TD-5050-001(2S,4S)	T505002
5-9	Mounting Base	TD-5010-001	T505001
5-10	Arm Shaft	TR-413-002	KR4B001
5-11	Shifter Arm A	TR-413-003	KROB005
5-12	Polyslider Washer	EZ-09-STW-FT-4 0.25	4x0.25 polyslide washer
5-13	Shifter Arm B	TR-413-007	KROB006
5-14	Retaining Ring	EZ-09-E-15	F74TE15
5-15	Spring	SG-100-050	GS1028-A
5-16	Arm Shaft	TR-414-003	KR4B007
5-17	Cue Arm	TR-416-003	KR4B008
5-18	Arm Shaft	TE-416-002	KR4B006
5-19	Pinch Roller Arm	TP-420-002	KR4E001
5-20	Arm Guide	TR-414-007	KR4B011
5-21	Roller Catch	EZ-09-C-51-2	CY3001
5-22	Retaining Ring	EZ-09-E-9	F74TE09
5-23	Solenoid Pin	TY-400-015	KZ5A003
5-24	Solenoid	SO-317	GP1B02
5-25	Adjusting Rod	TP-416-009	KZ6A022
5-26	Stopper	TY-200-013	KZ2A015
5-27	Plain Washer	EZ-09-M4	M4 Washer
5-28	Retaining Ring	EZ-09-E-15	F74TE15
5-29	Spherical Washer	TP-401-007	KPOG004
5-30	Pressure Spring	SG-500-031	GS2003
5-31	Double Nuts	EZ-09-M4	M4 Double Nut
5-32	Spring Holder	TY-900-019	KZ3A023
5-33	Spring	SG-100-048	GS1011
5-34	Switch Braket	TD-500-095	KZ3A026
5-35	Leaf Spring Switch	SW-09-PU-3024	WH91004

* Old Part Number is incorrect, new number is correct.

EXPLODED VIEW 5



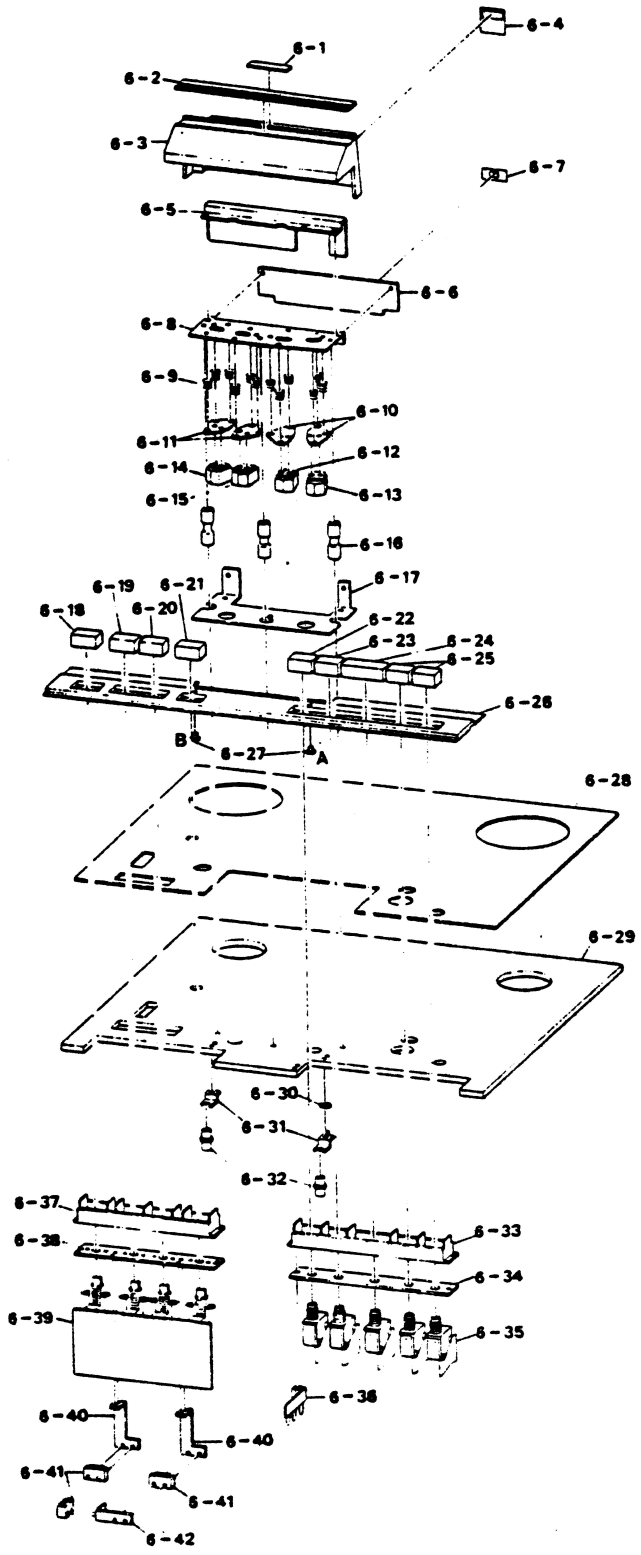
PARTS LIST 6.

Ref. No.	Description	Parts No. (old)	New No.
6-1	Name Plate	TH-446-005	PT1004
6-2	Splicing Block	TH-446-004	KH4C003
6-3	Head Housing Assy	TH-446-00B	KH-4C-A
6-4	Switch Name Plate	TH-446-006	PT4124
6-5	Protector Sheet	TH-438-009	KH4C002
6-6	Head Cord PCB Assembly	PA-274	PB-71B
6-7	Blind	TY-900-009	PZ1B010
6-8	Head Base	TH-446-001	KHOC011
6-9	Head Adjusting Spring	SG-500-063	GS2007
6-10	Head Supporter B	TH-422-002	KHOD005
6-11	Head Supporter A	TH-422-001	KHOD004
6-12	Record Head(2T 2C)	SH-6202-11-001 (2s)	GH4R005
	Record Head(4T 2C)	SH-6204-11-001 (4s)	GH4R003
6-13	Reproduce Head(2T 2C)	SH-7202-11-001 (2s)	GH4P006
	Reproduce Head(4T 2C)	SH-7204-11-002 (4s)	GH4P069
6-14	Erase Head(2T 2C)	SH-5202-11-001 (2s)	GH4E004
	Erase Head(4T 2C)	SH-5204-11-001 (4s)	GH4E009
6-15	Reproduce Head(4T 2C)	SH-7204-11-001 (2s)	GH4P069
	Reproduce Head(2S 2C)	SH-7204-11-001 (4s)	GH4P006
6-16	Tape Guide	TH-438-004	KG4C002
6-17	Housing Base	TH-438-005	KH4C001
6-18	Push Button A	CR-824-001A	KN2020
6-19	Push Button C	CR-824-001C	KN2022
6-20	Push Button B	CR-824-001B	KN2021
6-21	Push Button E	CR-824-001E	KN2024
6-22	Push Button C	CR-823-001C	KN2018
6-23	Push Button B	CR-823-001B	KN2017
6-24	Push Button D	CR-823-001D	KN2019
6-25	Push Button A	CR-823-001A	KN2016
6-26	Control Display Panel	TD-5050-004	T505003
* 6-27	Lamp Cover	TY-900-024 A:Red	LU9002
6-28	Display Panel	TD-5050D-001(2SD,4SD)	T505006
		TD-5050-001(2S,4S)	T505002
6-29	Mounting Base	TD-5010-001	T505001
6-30	Plain Washer	EZ-09-M4	M4 Washer
6-31	Lamp Supporter	TY-900-025	KZ2A029
6-32	Lamp Assembly	PL-19-005	LU2003
6-33	Guide	CR-823-010	CB20602
6-34	Switch Base	CR-823-008	CB20601
6-35	Micro Switch	SW-59-V-1A	WH11007
6-36	2P Terminal	LP-09-1L2P	CN902002
6-37	Guide	CR-824-006	CB20701
6-38	Switch Base	CR-824-005	PB41E01
6-39	POwer Switch PCB Assembly	PA-288	PB-41E
6-40	Micro Switch Supporter	CR-824-007R	PB41E02
6-41	Micro Switch	SW-59-SS5GL	WH51002
6-42	Switch Supporter	CR-824-008	PB41E04

* B:Green

LU9003

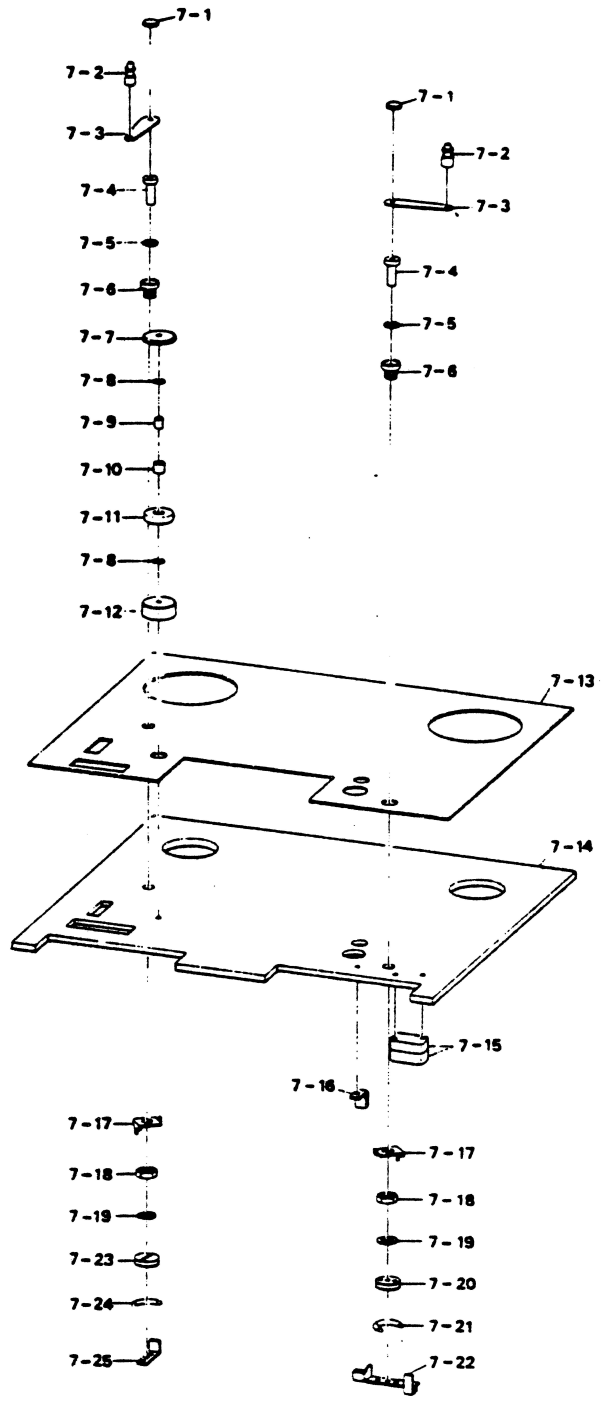
EXPLODED VIEW 6



PARTS LIST 7

Ref. No.	Description	Parts No. (old)	New No.
7-1	Display Screw	TA-420-005	KAOC002
7-2	Tape Guide	TA-420-004	KG4D006
7-3	Tension Arm	TA-420003	KAOA005
7-4	Arm Shaft	TA-429-001	KAOA004
7-5	Polyslider Washer	EZ-09-STW-FT-5 0.5t	5x.5t polyslide washer
7-6	Arm Holder	TA-420-002	KAOB003
7-7	Roller Cap	TG-424-01	GROA005
7-8	Polyslider Washer	EZ-09-STW-FT-8 0.25t	8x.25t polyslide washer
7-9	Roller Shaft	TG-424-02	GR4H001
7-10	Sleeve	TG-424-03	Assy. #
7-11	Roller	TG-424-04	GR4H002
7-12	Roller Base	TG-424-05	GR4B004
7-13	Display Panel	TD-5050D-001(2SD, 4SD)	T505006
		TD-5050-001(2S,4S)	T505002
7-14	Mounting Base	TD-5010-001	T505001
7-15	Micro Switch	SW-59-1V-3H-2A	WH51004
7-16	Magnetic Supporter	TY-900-023	KZ3A025
7-17	Spring Holder	TY-900-020	KZ3A024
7-18	Nut	TA-420-007	KZ6D004
7-19	Polyslider Washer	EZ-09-STW-FT-5 0.5t	5x.5t polyslide washer
7-20	Arm Boss B	TA-427-001	KAOE005
7-21	Spring	SG-100-047B	GS1027
7-22	Switch Arm	TA-423-002	KA4B001
7-23	Arm Boss A	TA-429-002	KAOE004
7-24	Spring	SG-100-046	GS1025
7-25	Stopper Arm	TA-420-010	KAOH004

EXPLODED VIEW 7

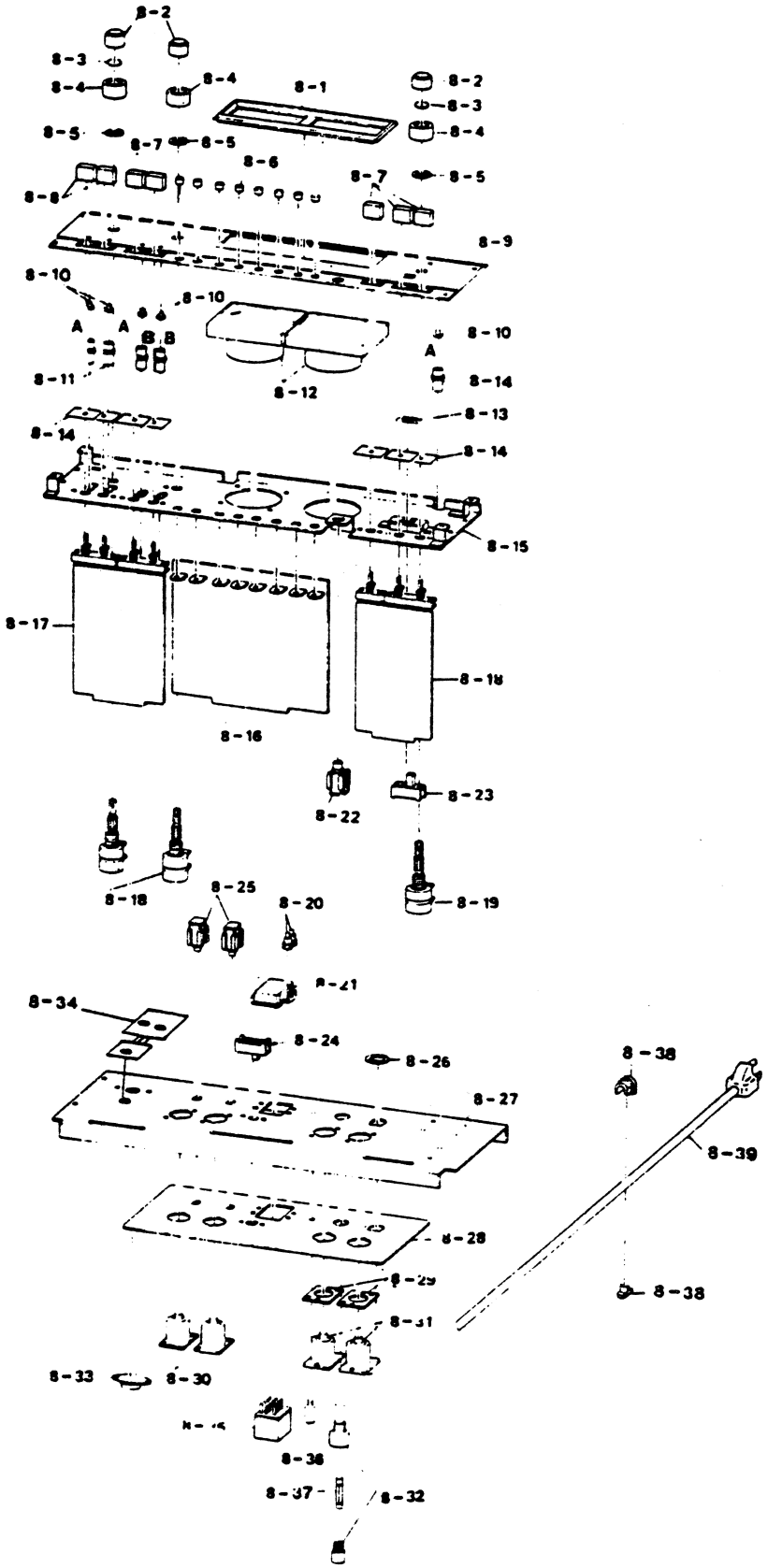


PARTS LIST 8

Ref. No.	Description	Parts No. (old)	New No.
8-1	Meter Grille	AF-207-005	PZ4A007
8-2	Knob B	NB-31-014	KN1012
8-3	Spacer	TY-100-038	PZ1B011
8-4	Knob A	NB-31-013	KN1011
8-5	Spacer	TY-100-013	KZ6C015
8-6	Variable Resistor Escutcheon	TY-100-010	PZ4A006
8-7	Push Button B	NB-19-4094B	KN2026
8-8	Push Button A	NB-19-4094A	KN2025
8-9	Amplifier Display Panel	AF-230-003	A101601
* 8-10	Lamp Cover	TY-900-024 A:Red	LU9002
8-11	Lamp Assembly	PL-19-005	LU2003
8-12	VU Meter	MT-11-023	ME11003
8-14	Blind	TY-900-029	PZ1B010
8-15	Blind	TY-900-031	PZ1B012
8-16	Amplifier Mounting Base	AF-230-004	A101602
8-17	Record out & Playback Equalizer Amplifier Assembly	PA-286A	PB-11O
8-18	MIC Amplifier Assembly	PA-287A	PB-11P
	Test Oscillator & Line out Amplifier Assembly	PA-285	PB-11N
8-19	Variable Resistor	VR-19-EWF-AOAM25A24	RV224001
8-20	Terminal	LP-09-STT-1L5NR	CN901011
8-21	Remort Connector	CN-09-OSAB12F N/N	CN212050
8-22	Stereo Jack	CN-09-LJ-109	CN603009
8-23	Slide Switch C	SW-39-SL242B4	WH340013
8-24	Slide Switch A	SW-39-SL242B4	WH340011
8-25	Stereo Jack	CN-09-LJ-110-1-2	CN602010
8-26	Spacer	TO-230-009	KZ6C023
8-27	Rear Panel	AF-230-007	A101609
8-28	Rear Hame Plate	AF-230-009	A101610
8-29	Connector Supporter	AF-204-11	A101610
8-30	Connector	CN-09-XLR-3-31	CN103046
8-31	Connector	CN-09-XLR-3-32	CN103045
8-32	Fuse Holder	FS-89-SN-2052	FH1-022
8-33	IC Power Supply	IC-09-SI-3250E	ISI3240E
8-34	SUB Power Supply PCB Assembly	PA-307	PB-61C
8-35	Dummy Plug	CN-01-QS-SP12M N/N	CN212049
8-36	Earth Terminal	LP-09-T-10	CN901040
8-37	Fuse	FS-19-2A	FH7A020
8-38	Cord Stopper	RB-19-BU-3270	PZ1G002
8-39	Power Cord	TY-559	PZ9D017

* B:Green LU9003

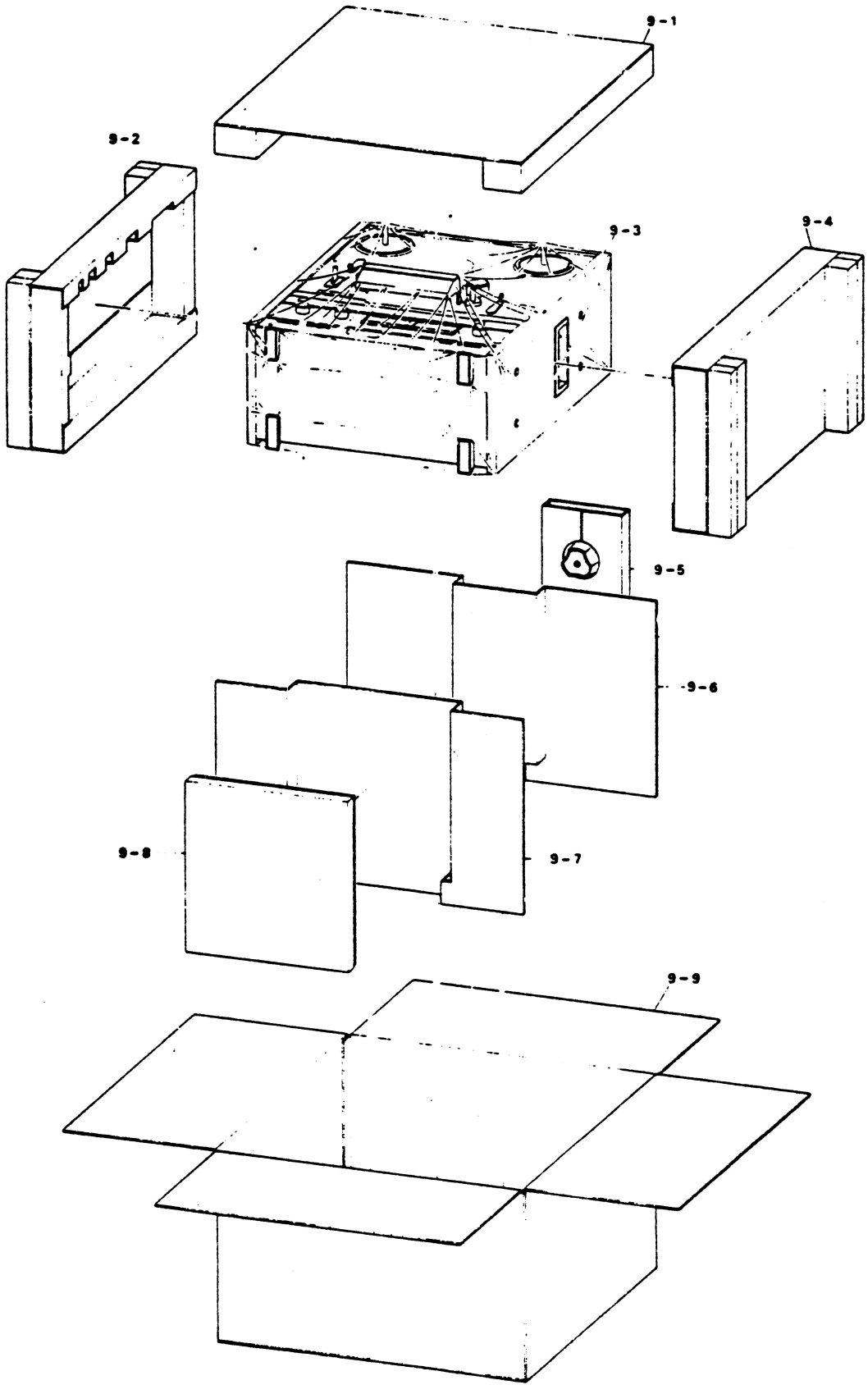
EXPLODED VIEW 8



PARTS LIST 9

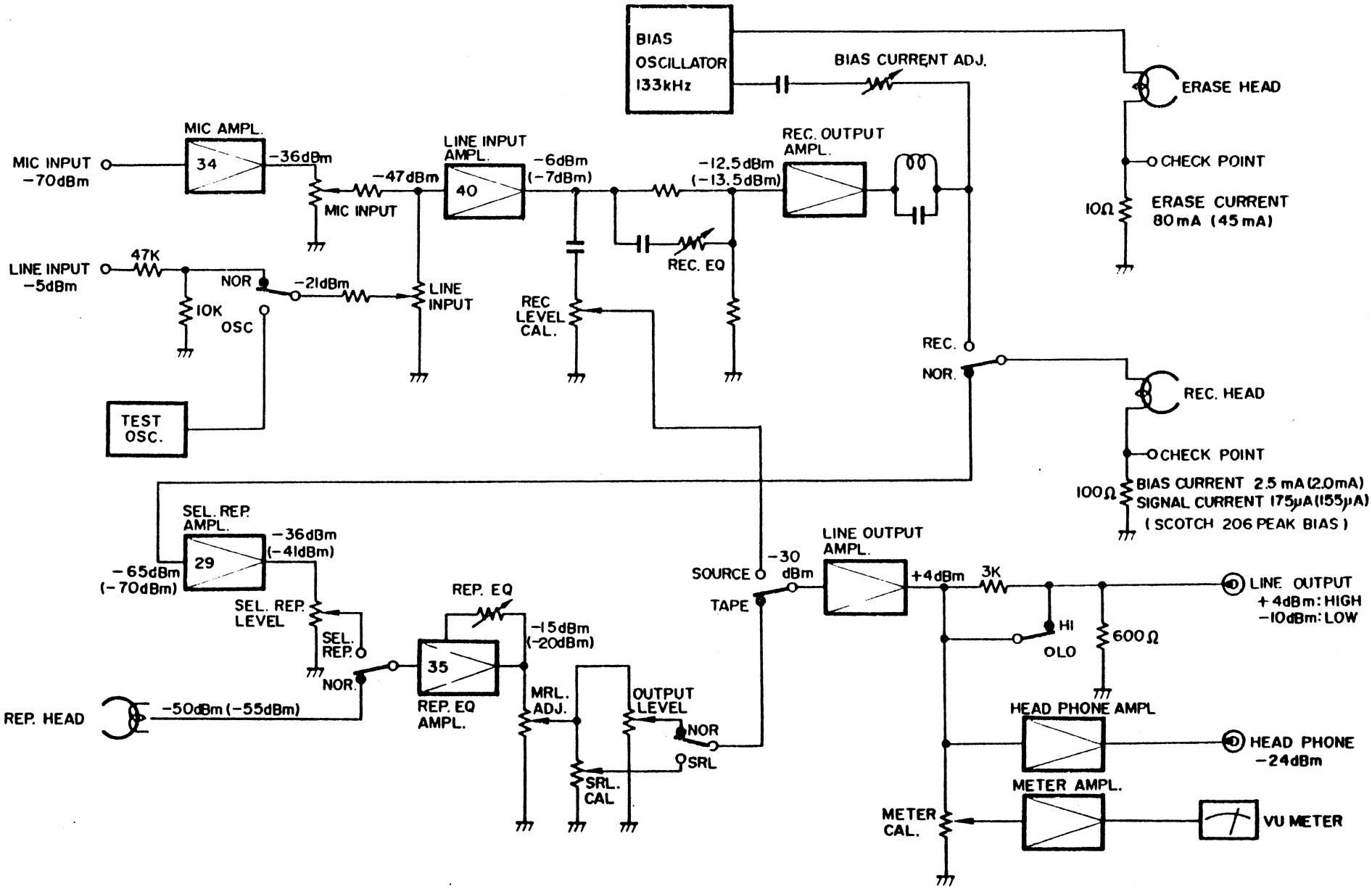
Ref. No.	Description	Parts No. (old)	New No.
9-1	Top Packing	PC-133-002	K700502
9-2	Left Side Packing	PC-133-007	K7005-A
9-3	MX-5050 Profetional Assembly-------		
9-4	Right Side Packing	PC-133-008	K7005-B
9-5	Reel Clamper Packing Assembly-------		
9-6	Packing B	PC-133-003	K700503
9-7	Packing C	PC-133-004	K700504
9-8	Open Reel Box	----------	
9-9	Packing Box	PC-133-001	K700501

EXPLODED VIEW 9



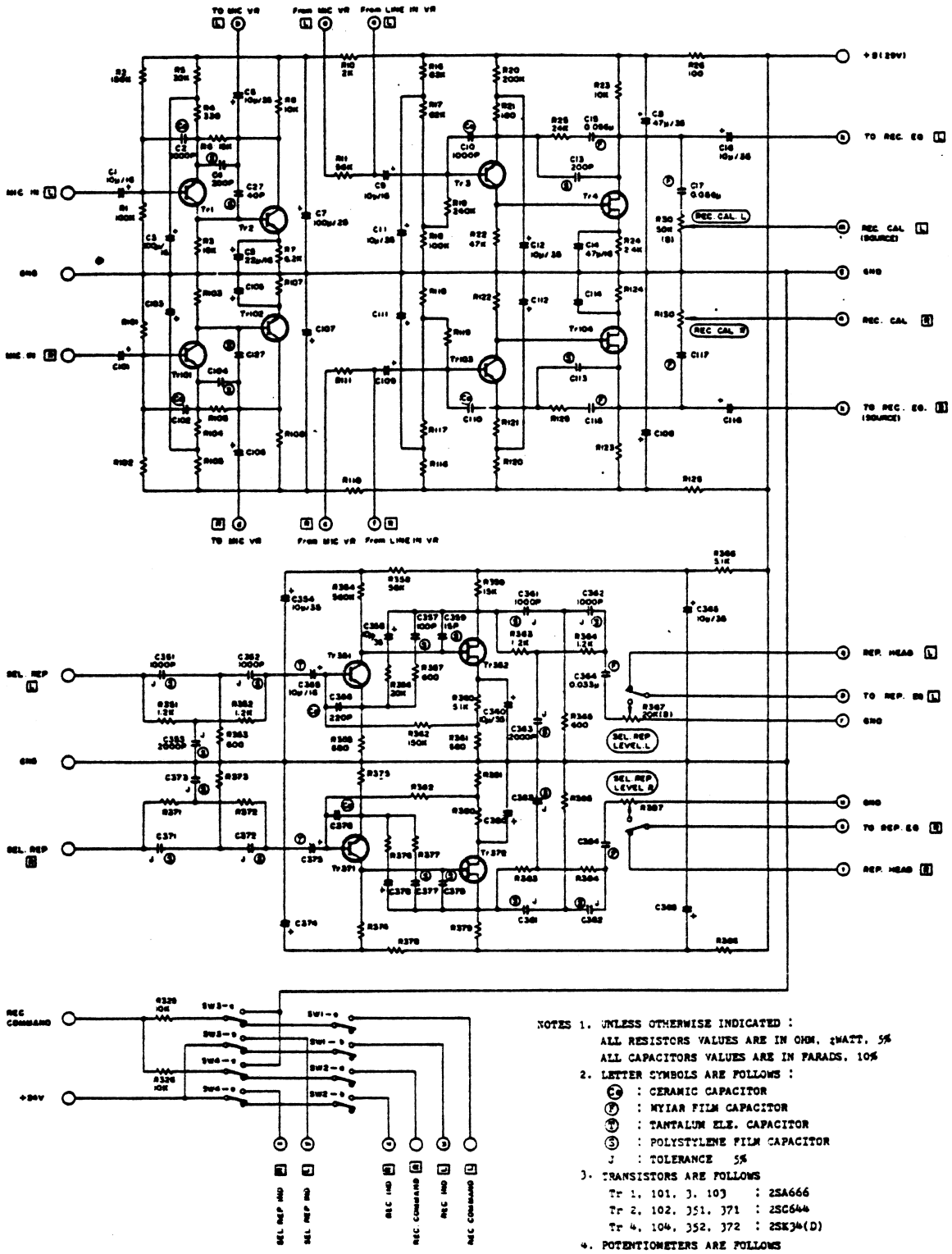
SIMPLIFIED DIAGRAM for Models 2S and 4S (at 1kHz)

Values in the parentheses is on models 4S(D)



old # new #

MIC. LINE INPUT & SEL. REP. AMPLIFIER P.C. BOARD ASSY (PA-287A) PB-11P



NOTES 1. UNLESS OTHERWISE INDICATED :
ALL RESISTORS VALUES ARE IN OHM, ¼WATT, 5%
ALL CAPACITORS VALUES ARE IN FARADS, 10%

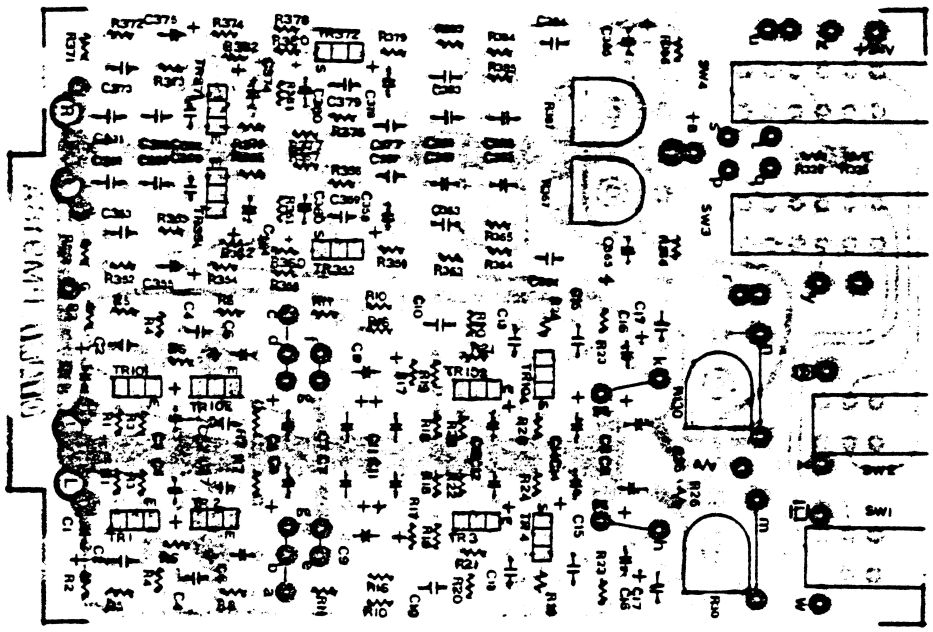
2. LETTER SYMBOLS ARE FOLLOWS :
(C) : CERAMIC CAPACITOR
(F) : MYIAR FILM CAPACITOR
(T) : TANTALUM ELE. CAPACITOR
(S) : POLYSTYLENE FILM CAPACITOR
J : TOLERANCE 5%

3. TRANSISTORS ARE FOLLOWS
Tr 1, 101, 3, 103 : 2SA666
Tr 2, 102, 351, 371 : 2SC644
Tr 4, 104, 352, 372 : 2SK34(D)

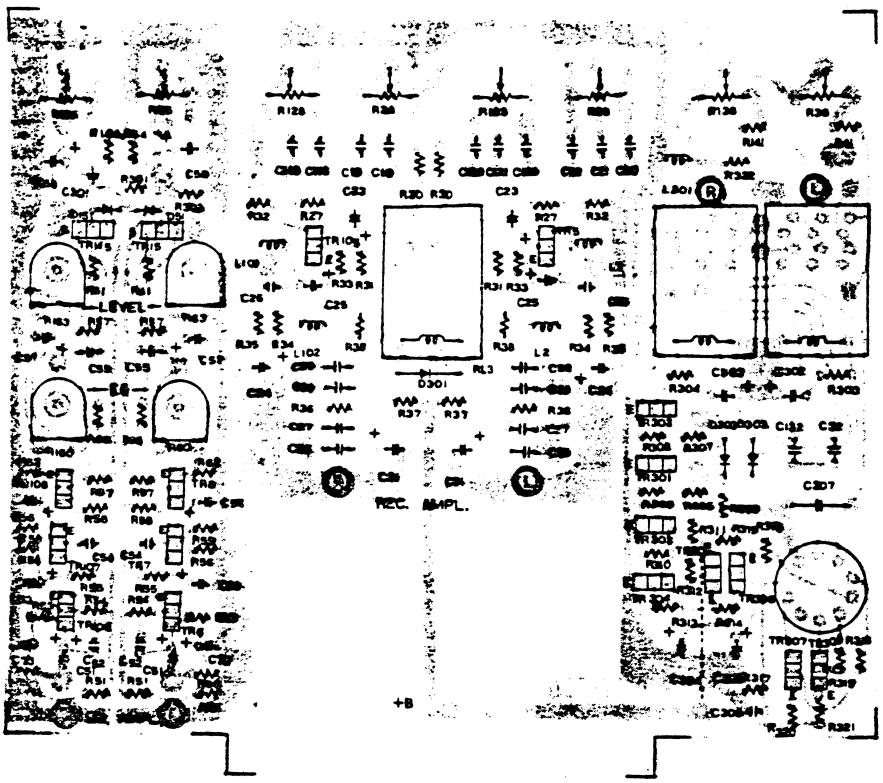
4. POTENTIOMETERS ARE FOLLOWS
R30,130 : RECORD LEVEL CAL.
R367,387: SEL/REP LEVEL ADJ.

5. SWITCHES ARE FOLLOWS
SW 1, 2 : RECORD SW
SW 3, 4 : SEL. REP. SW.

MIC,LINE INPUT & SEL.REP AMPLIFIER P.C.BOARD ASSY PA287A(PM918A)

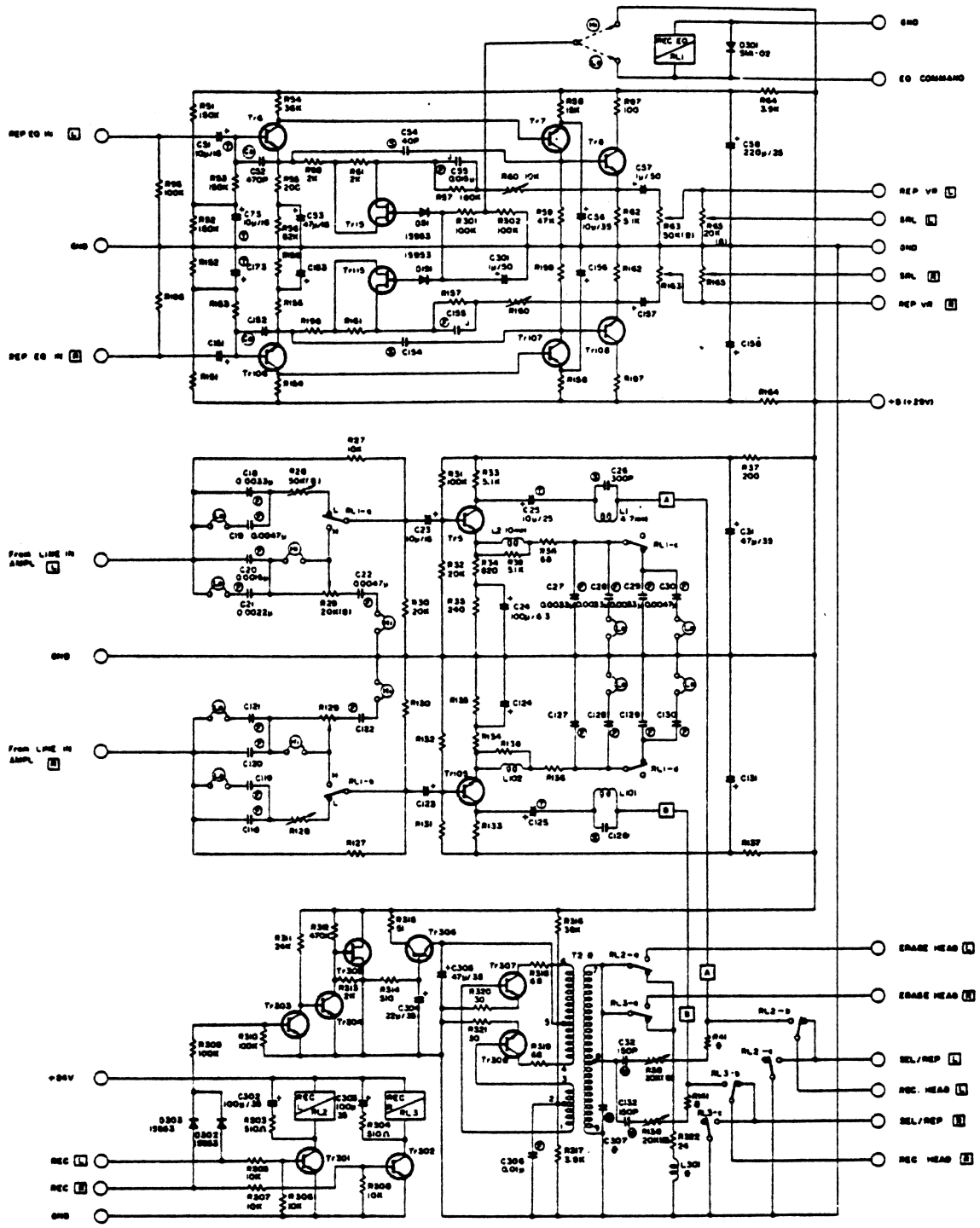


REC OUTPUT & REP.EQUALIZER AMPLIFIER P.C.BOARD ASSY PA286A(PM917A)



old# new #

REC. OUTPUT & REP. EQUALIZER AMPLIFIER P.C. BOARD ASSY (PA-286A) PB-110



NOTES 1. UNLESS OTHERWISE INDICATED :
ALL RESISTORS VALUES ARE IN OHM, ¼WATT, 5%
ALL CAPACITORS VALUES ARE IN FARADS, 10%

2. LETTER SYMBOLS ARE FOLLOWS :
(M) : MICA FILM CAPACITOR
(T) : TANTALUM ELE. CAPACITOR
(S) : POLYSTYLENE CAPACITOR
(P) : MYLAR FILM CAPACITOR
(Ce) : CERAMIC CAPACITOR
J : TOLELANCE 5%
(H) : Jumped on High Speed Models
(L) : Jumped on Low Speed Models

3. TRANSISTORS ARE FOLLOWS

Tr 307, 308	: 2SC1211
Tr 6, 106, 8, 108	: 2SC644
Tr 7, 107	: 2SA666
Tr 306	: 2SC1384
Tr 301, 302	: 2SC373
Tr 303, 304, 5, 105	: 2SC828A
Tr 305	: 2SK34(C)
Tr 15, 115	: 2SK34(D)

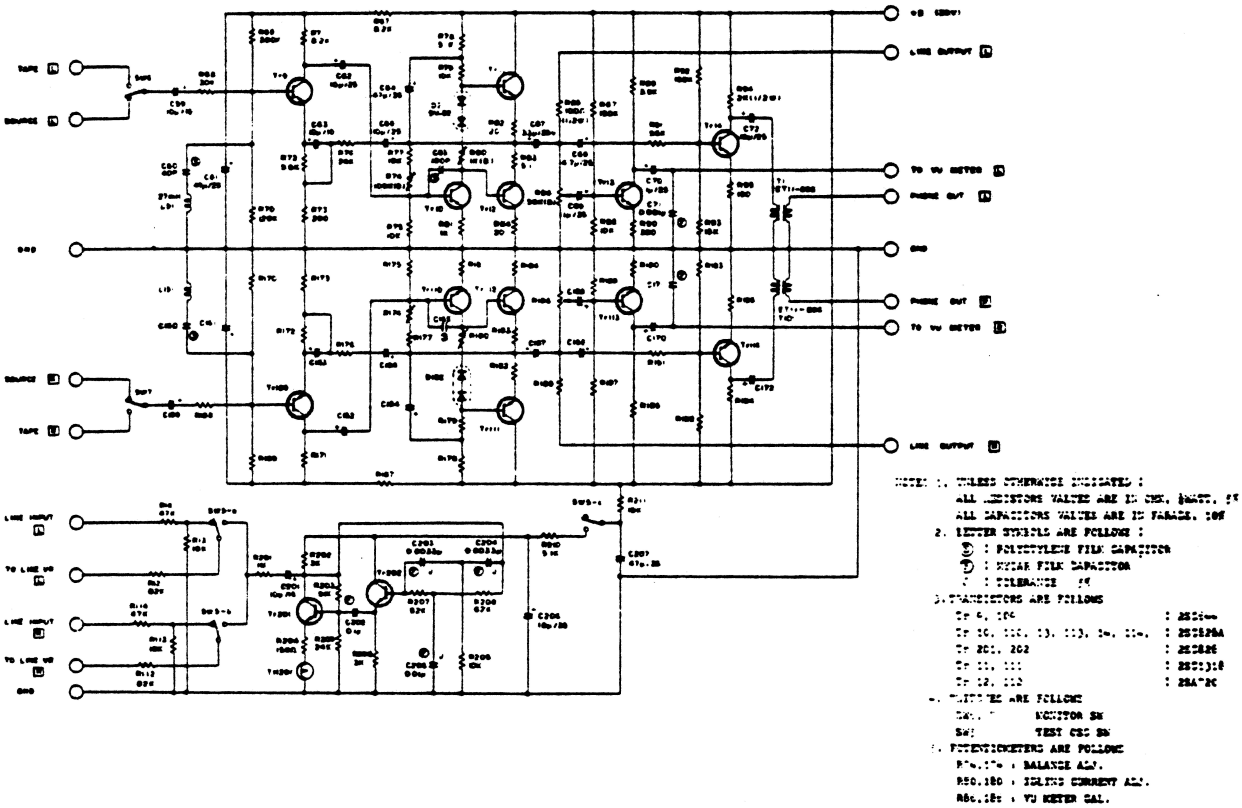
4. POTENTIOMETERS ARE FOLLOWS
R60, 160 : REP. EQ. ADJ.
R63, 163 : MAX. REP. LEVEL ADJ.
R65, 165 : SRL ADJ.
R28, 128 : REC. EQ. (Low speed) ADJ.
R29, 129 : REC. EQ. (High speed) ADJ.
R38, 138 : REC BIAS CURRENT ADJ.

5. DIFFERENCE ON BOTH MODELS

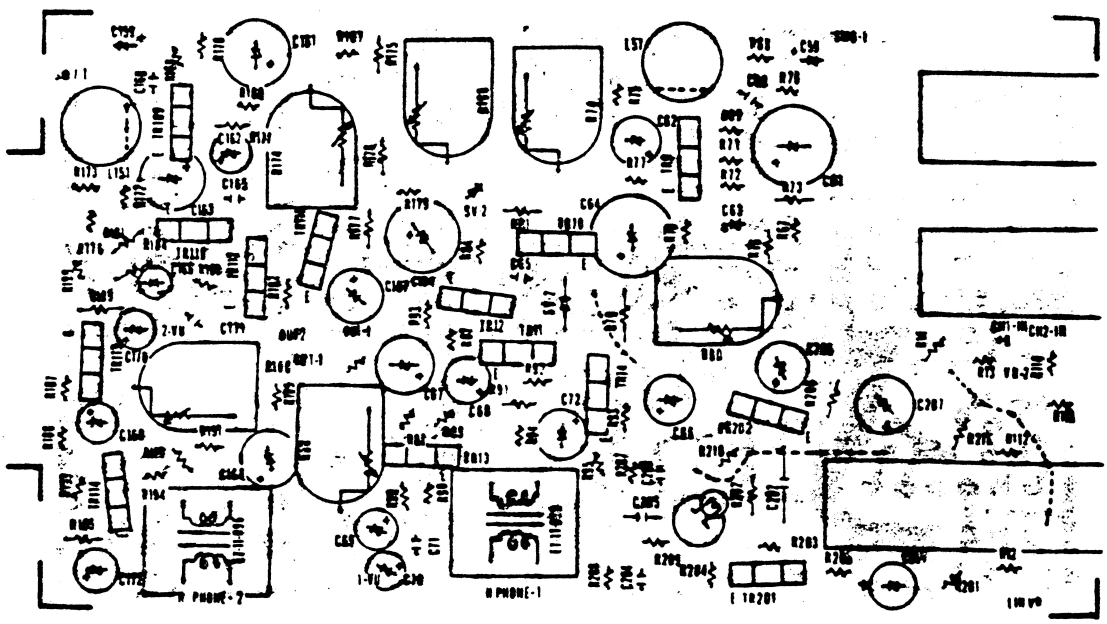
#	2S, 2SD	4S, 4SD
T2	ET-51-177	ET-51-112
C307	0.01μ/500	0.003μ/500
L301	0.58mH	1.8mH
R41,141	00(short)	10kΩ

old # new #

TEST OSC. & LINE OUTPUT AMPLIFIER P.C. BOARD ASSY (PA-285) PB-11N



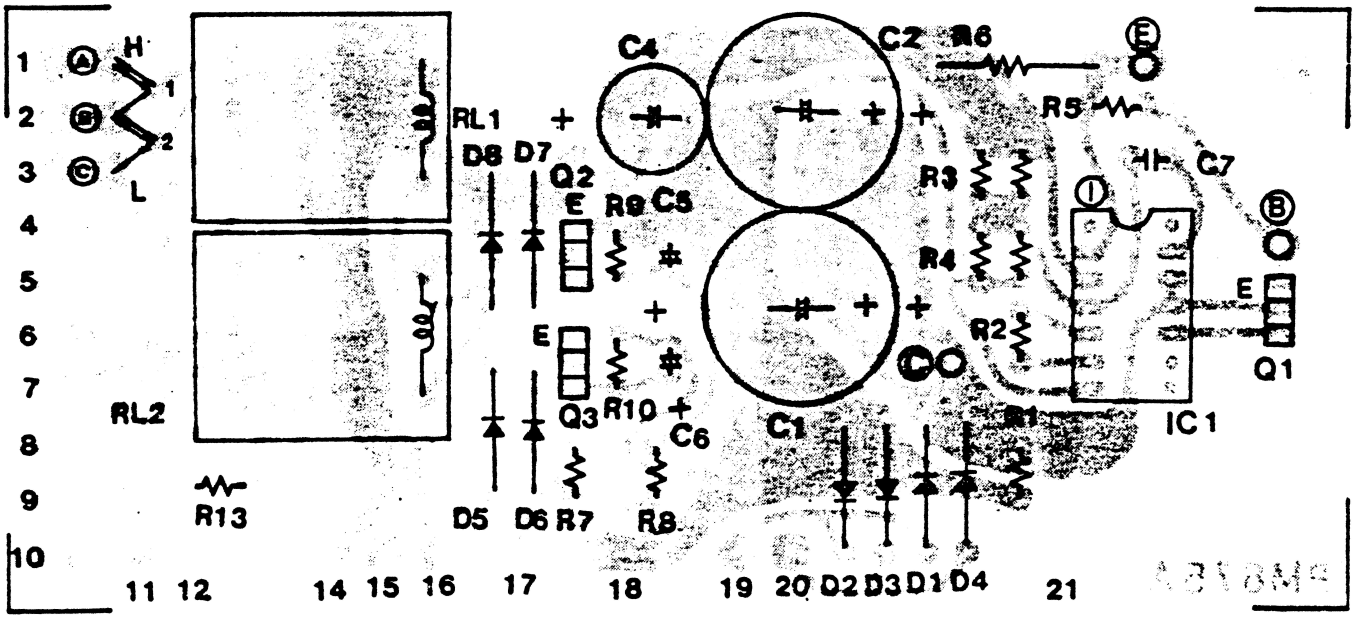
TEST OSC & LINE OUTPUT AMPLIFIER P.C.BOARD ASSY PA285(PM680-1)



old # new #

CAPSTAN SERVO MOTER POWER SUPPLY P.C. BOARD ASSY PA-377 (PM-875A) PB-61E

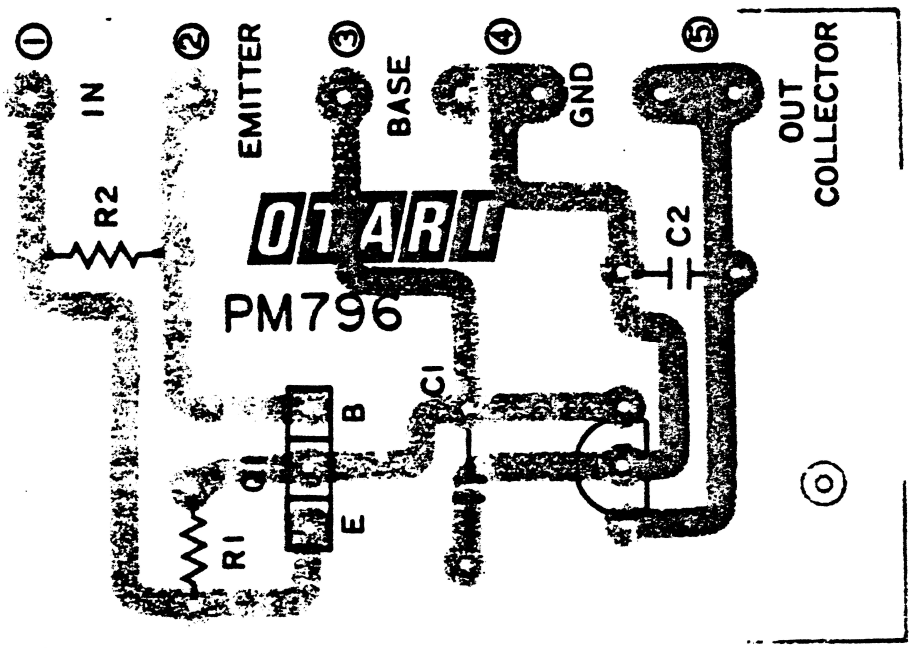
Refer to TAPE TRANSPORT ELECTRONICS(TD5050DA) WIRING DIAGRAM



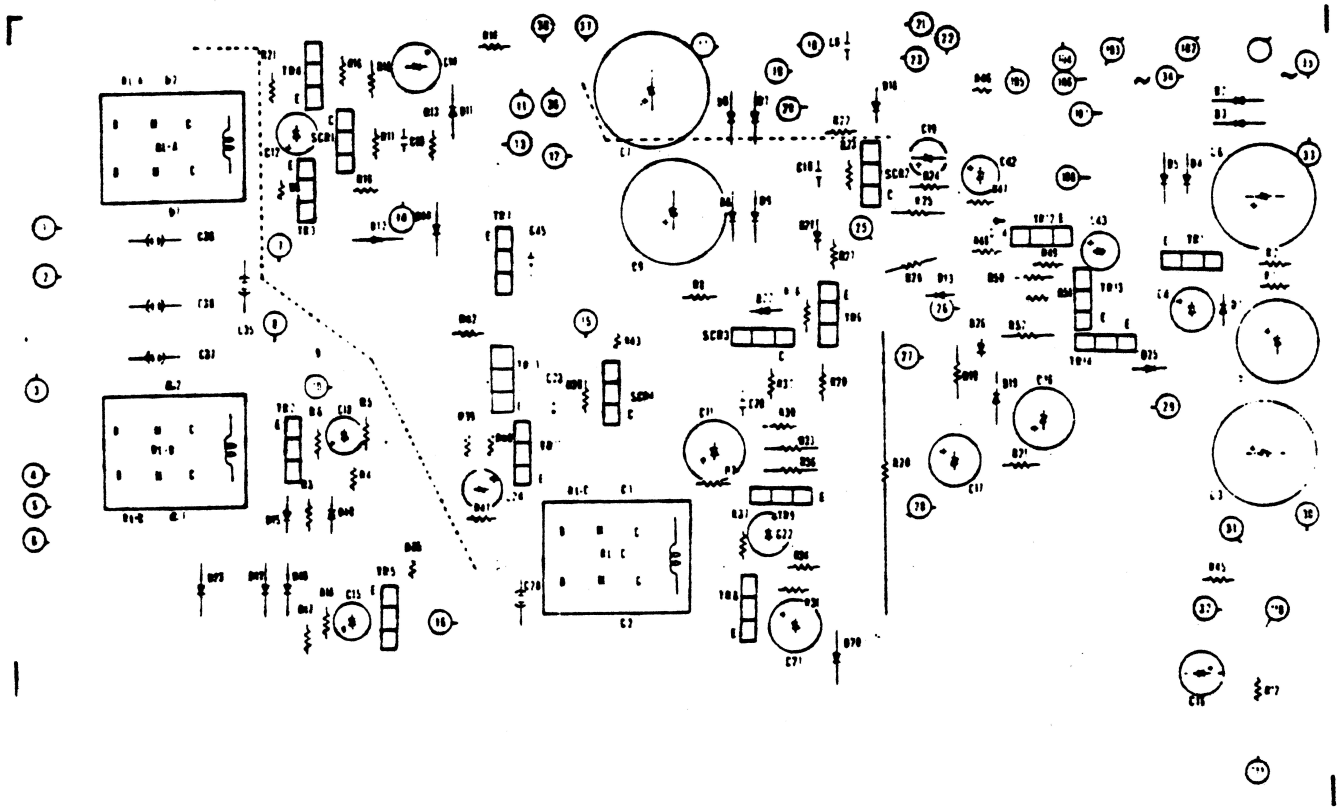
old# new #

+5 VOLT DC POWER SUPPLY P.C.BOARD ASSY PA426(PM796) PB-61D

Refer to TAPE TRANSPORT ELECTRONICS(TD5050DA) WIRING DIAGRAM



old # new #

CONTROL P.C.BOARD ASSY PA284(PM679-2) PB-41D

Refer to TAPE TRANSPORT ELECTRONICS WIRING DIAGRAM