SECTION 4: ALIGNMENT AND CALIBRATION

This section contains the instructions and information required to perform the routine reel control, tape tension, head alignment, audio channel calibration, bias and erase adjustments associated with normal maintenance of the MX-80.

When you are performing these procedures for the first few times, proceed slowly and carefully. Soon you will be familiar with them, but initially it is better to be cautious and avoid accidents.

4.1 TRANSPORT ALIGNMENT

The MX-80 transport should not require frequent adjustment of tape tension and wind speeds, but these procedures should be performed whenever track format or tape width is changed, or if any mechanical component in the tape path has been replaced.

4.1.1 Tools and Equipment Required

(1) DC voltmeter capable of 0.05 V resolution while measuring ± 5 V.

(2) Frequency counter capable of 50 Hz resolution while measuring 9.6 kHz.

(3) A general purpose dual-trace oscilloscope such as those made by Tektronics, Leader, Hitachi, Hewlett-Packard, etc. The oscilloscope is necessary for Tacho quadrature, and Capstan duty cycle adjustments.

(4) A Wow and Flutter meter capable of 0.01% resolution, DIN 45504 weighted.

(5) A reel of tape of the type normally used for sessions.

(6) A small non-magnetic alignment screwdriver with a blade small enough to fit the trimmers on the Reel and Transport Control PCBs.

(7) 1.5 mm, 2 mm, 2.5 mm, and 4 mm hex keys (allen wrenches).

(8) A calibrated, direct reading tape tension meter such as Tentelometer Model T2-H2O-2.

4.1.2 Opening the Transport and Removing the Deck Skin Panels

(1) Turn Off the Power to the machine and wait 30 seconds to allow the power supply capacitors to discharge, Remove any tape and/or empty reels from the transport.

(2) Open the upper rear panel to gain access to the Reel Control PCB by removing the uppermost two screws on each side of the panel, and folding it down to a horizontal position.

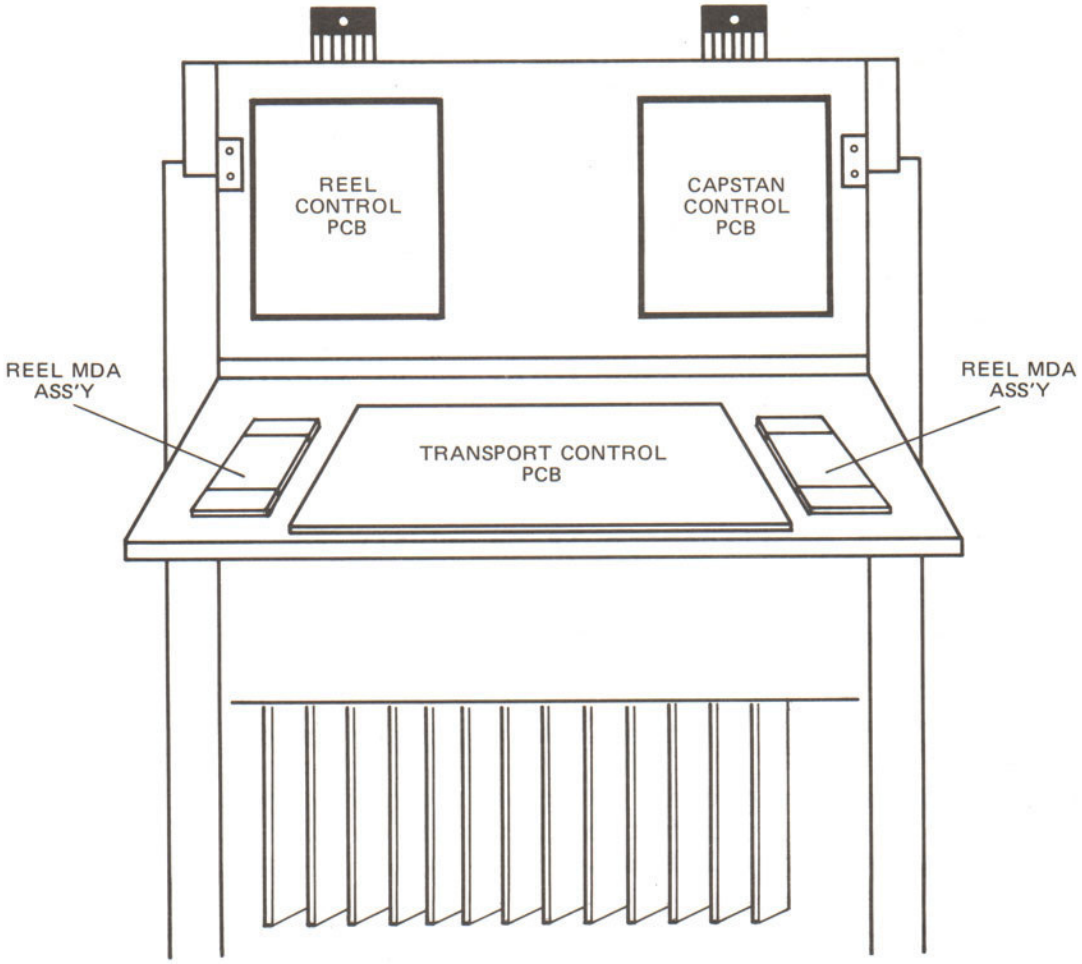


Figure 4-1 Location of Transport, Capstan, and Reel Control PCBs

(3) Open the VU Meter panel by removing the outer two screws from the top of the panel, and folding it down to a horizontal position.

(4) Remove the Splicing Block by removing the four socket head screws which attach it to the transport deck top.

(5) Loosen the Capstan Shaft Dust Cap by turning it counterclockwise.

(6) Remove the four socket head screws which attach the front Deck Skin Panel, and while holding the Tension Arm Rollers at their uppermost position, carefully remove the front Deck Skin Panel.

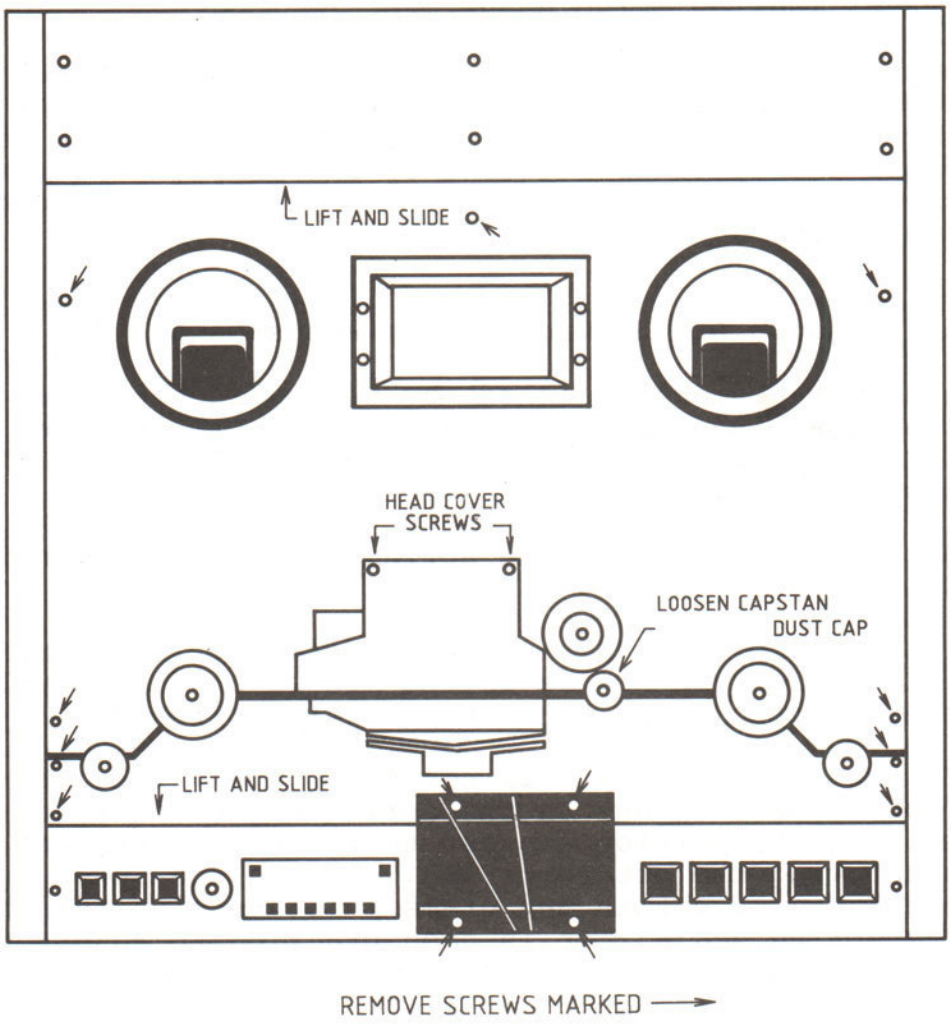


Figure 4-2 Deck Skin Panel removal

(7) Remove the Pinch Roller assembly from its shaft by removing the socket head screw in the center of the top of the Roller assembly and lifting the Pinch Roller assembly off its shaft.

(8) Remove the Head Assembly Cover by removing the two socket head cap screws which attach it to the Transport Deck, and lifting the Head Assembly Cover off the machine.

(9) Remove the rear Deck Skin Panel by first removing the five socket head screws from the perimeter of the rear Deck Skin. Then lift the rear of the Panel and carefully slide it toward the rear of the machine until it can be lifted off the machine.

4.1.3 Reel Tension Servo Adjustment

The constant tape tension system employed on the MX-80 utilizes Tension Arms in the tape path to provide feedback information to the Reel Control PCB. These circuits adjust the torque and speed of the Take-up and Supply reel motors to keep the tension on the tape constant regardless of operating mode, tape speed, and amount of tape on the reels.

4.1.3.1 Tension Arm Spring Tension Adjustment

The running tape tension is set by the balance of Reel Motor torque against the tension of the Tension Arm springs. Therefore it is important that the Tension Arm Spring Tension be set accurately.

(1) Attach the 0 - 2000 gram spring scale to the Tension Arm Roller with a loop of string.

(2) Pull the spring scale toward the rear of the machine until the Tension Arm is in the middle of its travel, and measure the spring tension. Refer to Figure 4-3.

(3) If the spring tension is not 500 grams ± 10%, then loosen the lock nut on the Spring Adjusting Screw by holding the portion closest to the Anchor Bracket and unscrewing the outer portion. Adjust the inner nut as necessary to obtain 500 grams ± 10% tension reading on the spring scale. It is good practice to adjust both Supply and Take Up Tension Arms to the same tension within ± 10 grams.

(4) Tighten the outer portion of the double nut to lock the adjusting screw in place.

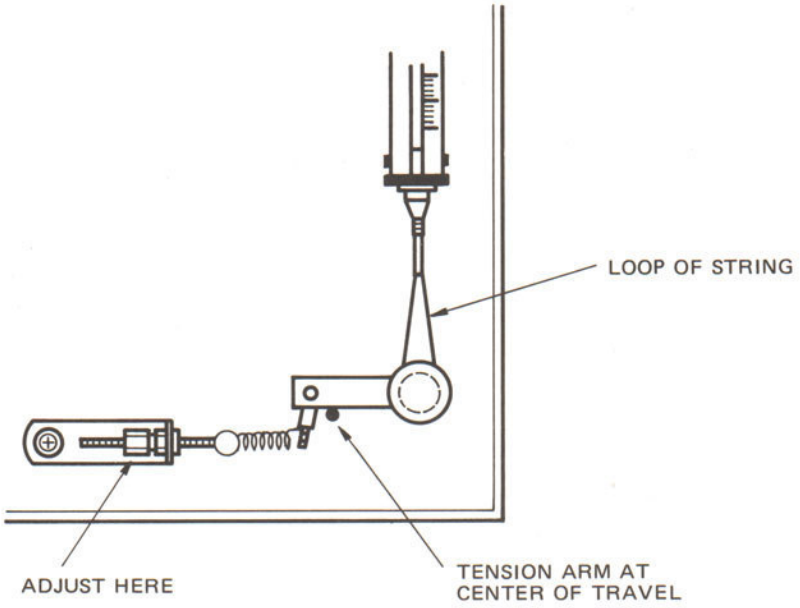


Figure 4-3 Tension Arm Spring Tension Measurement

4.1.3.2 Tachometer Quadrature/Phase Adjustment

(1) Connect CH1 of the dual channel oscilloscope to TP2 on the Transport Control PCB.

(2) Connect CH2 of the oscilloscope to TP3. Use TP1 for Ground for the oscilloscope.

(3) Connect the Tach Roller to the Capstan Shaft with a rubber band, so that the Tach Roller turns when the Capstan Shaft turns.

(4) Secure both Tension Arms at the top of their travel.

(5) Adjust the position of the Tacho I PCB (the PCB with two sensors) so that the waveform at TP3 leads the waveform at TP2 by 90 degrees.

NOTE: The waveforms do not have 50% duty cycle. Refer to Figure 4-5. Remove the rubber band when adjustment is completed.

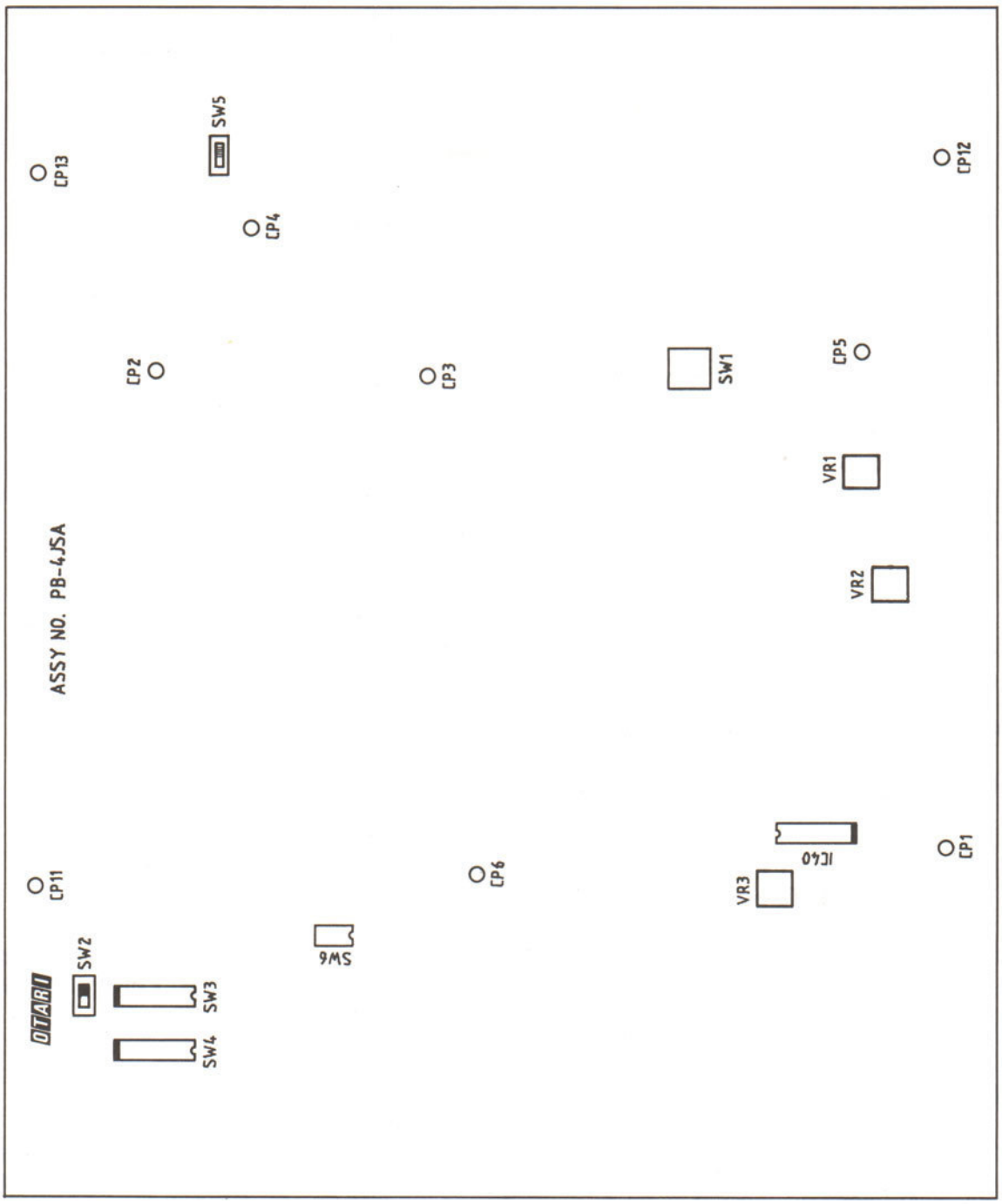


Figure 4-4 Location of Trimmers and Check Points on Transport Control PCB

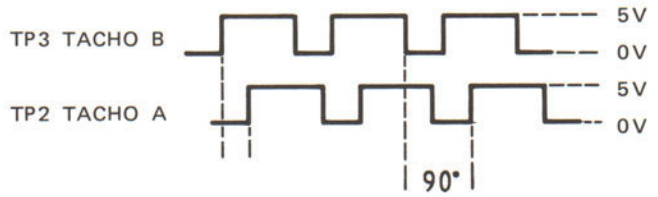


Figure 4-5 Tach Waveforms

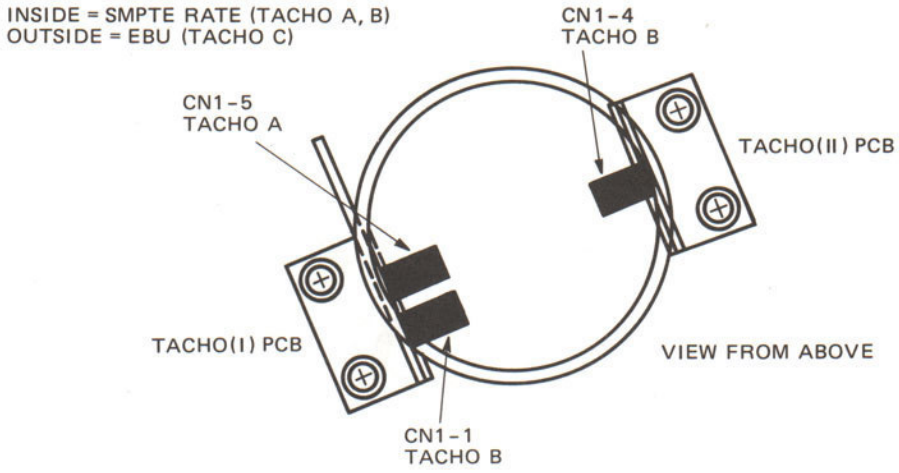


Figure 4-6 Location of Tacho I and Tacho II PCBs

4.1.3.3 Fast Wind Speed Reference Voltage Adjustment

(1) Adjust VR2 for 0.0 V at TP5 on the Transport Control PCB in Unload mode.

(2) Secure both Tension Arms at the top of their travel.

(3) Adjust VR1 for 7.0 V at TP5 on the Transport Control PCB in Fast Forward mode.

4.1.3.4 Tension Sensor Position

(1) Remove Tape and Reels from the Transport, and raise the Transport to its open position (Refer to Section 4.1.6). Turn On the Power to the machine.

(2) With the Supply Tension Arm at the bottom of its travel, adjust the position of the Safety Sensor so that its centerline is aligned with the center of the Tension Arm Shaft.

(3) With the Supply Tension Arm at the bottom of its travel, adjust the position of the Sensor Vane, by loosening the two screws which attach the Vane to the mounting collar, so that the edge of the vane lines up with the edge of the Safety Sensor. Tighten the Vane mounting screws.

(4) Adjust the position of the Supply Tension Sensor so that its centerline is aligned with the center of the "C" screw. Tighten its mounting screw securely.

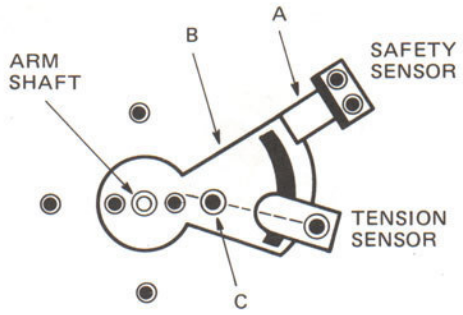


Figure 4-7 Location of Tension Sensor Adjustments

(5) Connect the DC Voltmeter to CP1 (Supply) and CP11 (Ground) on the Reel Control PCB.

(6) Slowly move the Supply Tension Arm from the bottom to the top of its travel while observing the voltage on the DC Voltmeter. The voltage will decrease as the Tension Arm is raised. If the voltage reaches its minimum before the Tension Arm reaches its upper limit, then the Tension Sensor position must be adjusted.
Repeat the observation and adjustment until the Sensor Voltage is linear with Tension Arm travel. Refer to Figure 4-9.

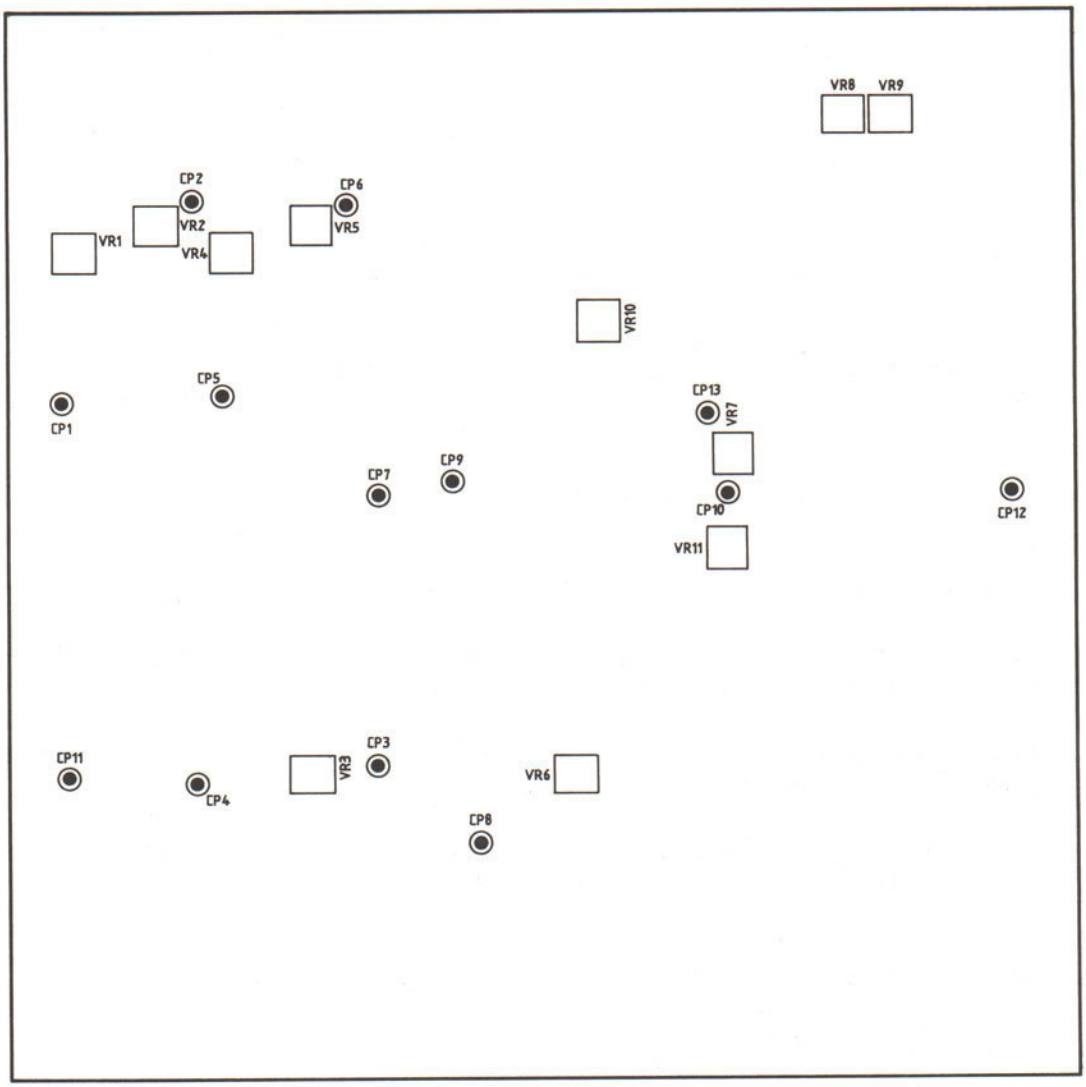


Figure 4-8 Location of Trimmers and Check Points on Reel Control PCB

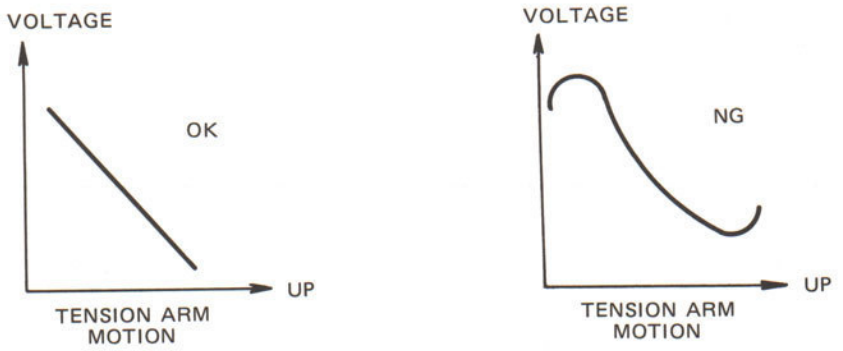


Figure 4-9 Tension Sensor Voltage Adjustment

(7) Repeat Steps 1 through 6 for the Take Up Tension Arm Sensor assembly using CP 5 on the Reel Control PCB.

4.1.3.5 Tension Arm Sensor Gain Adjustment

(1) Hold the Take Up Tension Arm at the top of its travel and adjust VR4 on the Reel Control PCB for 0.0 V at CP6.

(2) Let the Take Up Tension Arm return to the bottom of its travel and adjust VR5 for 10.0 V at CP6.

(3) Hold the Supply Tension Arm at the top of its travel and adjust VR1 for 0.0 V at CP2.

(4) Let the Supply Tension Arm return to the bottom of its travel and adjust VR2 for 10.0 V at CP2.

4.1.3.6 Play Acceleration Preliminary Adjustment

(1) Hold both Tension Arms at the top of their travel.

(2) Adjust VR11 of the Reel Control PCB for 7.0 V at CP10 in Play mode.

NOTE: Adjust VR11 within the first two seconds after pressing the PLAY button because the voltage will decrease rapidly after a short time.

4.1.3.7 Fast Forward and Rewind Torque Adjustment

(1) Remove Tape and Reels from the Transport and secure both Tension Arms at the top of their travel.

(2) Connect the DC Voltmeter to the top of R27 (or IC4 Pin 1) on the Reel Control PCB, and place the MX-80 in Rewind mode.

(3) After about 10 seconds (after the voltage has stabilized), adjust VR8 to obtain a reading of -8.0 V +0.5/-0.25 V on the DC Voltmeter. Press the STOP button.

(4) Connect the DC Voltmeter to the top of R71 (or IC10 Pin 1), and place the MX-80 in Fast Forward mode.

(5) After about 10 seconds (after the voltage has stabilized), adjust VR9 to obtain a reading of -8.0 V +0.5/-0.25 V on the DC Voltmeter. Press the STOP button.

4.1.3.8 Reel Motor Torque Adjustment

(1) Secure both Tension Arms at the top of their travel.

(2) Connect the DC Voltmeter to CP4 on the Reel Control PCB.

(3) Hold the Supply reel firmly by hand to prevent it from turning, and place the MX-80 in Rewind.

(4) After about 10 seconds (after the voltage has stabilized), adjust VR 3 to obtain a reading of + 7.5 V ± 0.5 V on the DC Voltmeter. Press the STOP button.

(5) Connect the DC Voltmeter to CP8.

(6) Hold the Take Up reel firmly by hand to prevent it from turning, and place the MX-80 in Fast Forward.

(7) After about 10 seconds (after the voltage has stabilized), adjust VR 6 to obtain a reading of + 7.5 V ± 0.5 V on the DC Voltmeter. Press the STOP button.

4.1.3.9 Tension Arm Position Adjustment

(1) Thread the machine with tape and wind until there is an equal amount of tape on each reel.

(2) Adjust VR4 on the Reel Control PCB until the front edge of the Take Up Tension Arm is even with the drill mark in the deck plate, while in Load mode. Refer to Figure 4-10.

(3) Place the machine in Play briefly to confirm the position of the Tension Arm.

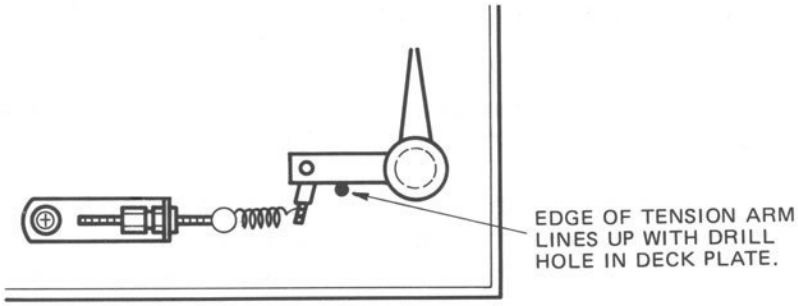


Figure 4-10 Tension Arm Position Adjustment

(4) Adjust VR1 until the front edge of the Supply Tension Arm is even with the drill mark in the deck plate, while in Load mode.

(5) Place the machine in Play briefly to confirm the position of the Tension Arm.

4.1.3.10 Fast Wind and Spooling Wind Speed Adjustment

(1) Connect the Frequency Counter to CP13 on the Reel Control PCB.

(2) Thread the machine with tape and wind until there is an equal amount of tape on each reel.

(3) Place the machine in Fast Forward mode.

(4) After the frequency has reached its maximum (about 10 seconds), adjust VR 10 to obtain a frequency reading of 3000 Hz ± 30 Hz.

(5) Rewind the tape until there is an equal amount on each reel.

(6) Place the machine in Forward Spooling Wind mode (by pressing 2nd FUNCTION and F.FWD buttons).

(7) Readjust VR7 to obtain a frequency reading of 1000 Hz ± 10 Hz.

(8) Place the machine in Fast Forward mode and note the frequency reading.

(9) Place the machine in Rewind and note the frequency reading. If the Fast Forward and Rewind readings are not within 60 Hz of each other adjust VR3 and VR6 until they are.

4.1.3.11 Tape Tension Check

Thread the machine with tape and wind until there is an equal amount of tape on each reel. With the MX-80 in Stop mode, measure the tape tension between the Take Up Tension Arm Roller and the Take Up Reel, using a calibrated Tentelometer (or equivalent). The tape tension should be 420 grams ± 20 grams. If the tape tension is not correct, check the tension of the Tension Arm springs (Section 4.1.3.1), and check the setting of the Tension Arm position trimmers VR1(Supply) and VR4 (Take Up). Refer to Section 4.1.3.9.

4.1.4 Capstan Servo Adjustment

Refer to Figure 4-1 for the location of the Capstan Control PCB. If you have just completed adjustments to the Reel Control PCB, the necessary panels will already be open, and you may disregard any instruction relating to opening the panels to gain access to the PCBs. These procedures should be performed in the order presented here because the correct adjustment of one parameter may depend upon the previous correct adjustment of another parameter.

4.1.4.1 Preliminary Adjustment

(1) Turn Off the Power to the machine and wait 30 seconds to allow the power supply capacitors to discharge. Remove any tape and/or empty reels from the transport.

(2) Open the upper rear panel to gain access to the Capstan Control PCB by removing the uppermost two screws on each side of the panel, and folding it down to a horizontal position.

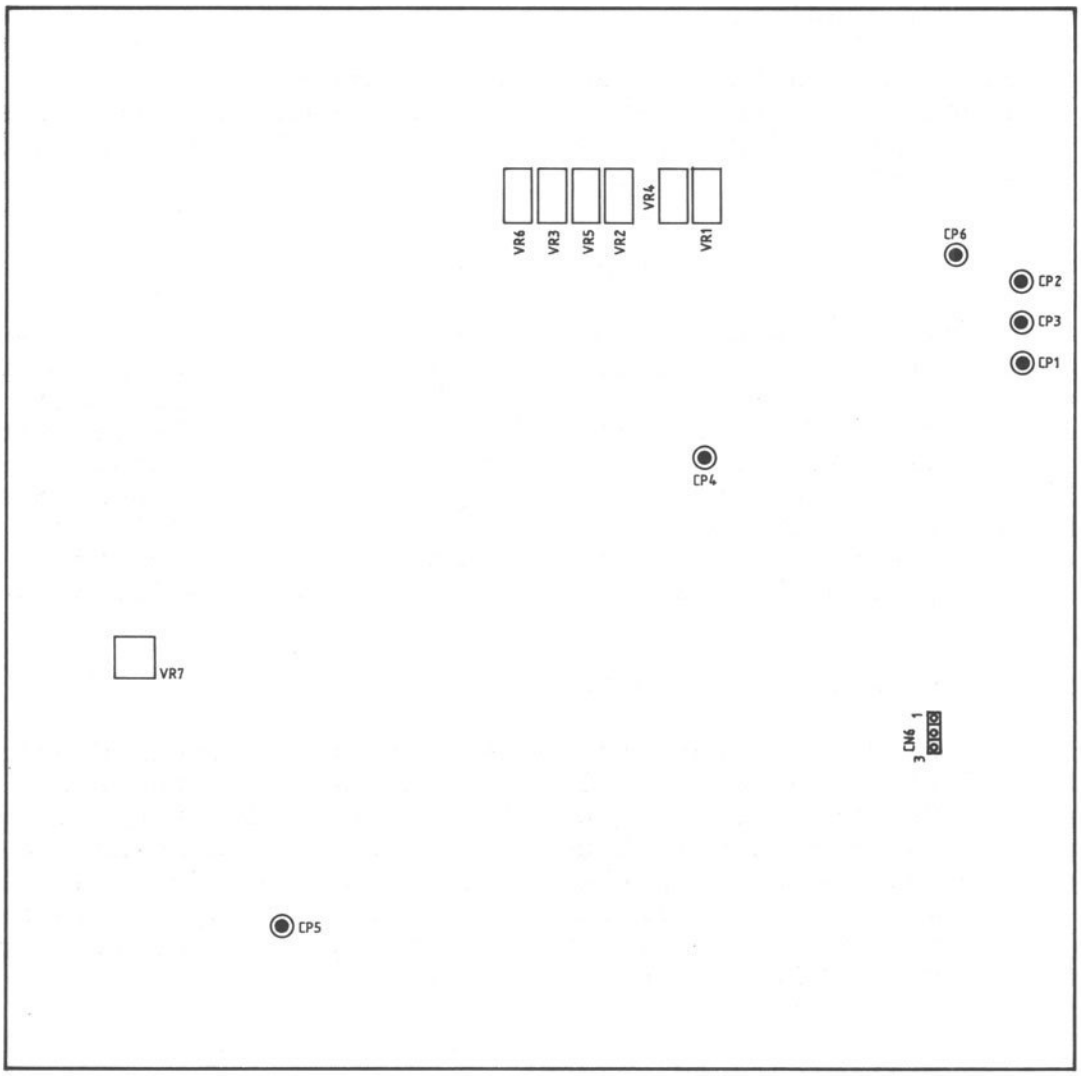


Figure 4-11 Location of Trimmers and Test Points on Capstan Control PCB

(3) On the Capstan Control PCB, turn VR1, VR2, VR3, VR4, VR5, and VR6 fully counterclockwise until the trimpot clicks on each revolution (NOTE: These are 30-turn trimpots), then turn each trimmer clockwise 15 full revolutions.

(4) Set VR7 on the Capstan Control PCB to the center of its rotation.

4.1.4.2 Phase Locked Loop Duty Cycle Adjustment

(1) Connect an oscilloscope to CP3 and Ground on the Capstan Control PCB.

(2) Set the SPEED switch on the Transport Control Panel to the H position. Set SW2 on the Transport Control PCB (the H/L Speed Pair switch) to the H position. Set the SPEED MODE switch on the Remote Control unit to the Fix position.

(3) Secure both Tension Arms at the top of their travel.

(4) Turn On the Power to the MX-80.

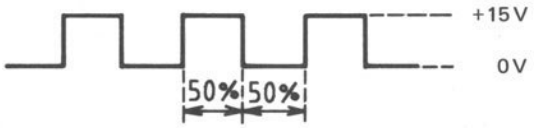


Figure 4-12 Capstan Waveforms

(5) Adjust VR7 so that the waveform displayed on the oscilloscope has a duty cycle of approximately 50%.

4.1.4.3 Gain Adjustment

(1) With the oscilloscope still connected to CP3 on the Capstan Control PCB and the SPEED switch still set for 30 ips, adjust VR4 (30 ips Gain) so that the waveform displayed on the oscilloscope has a duty cycle of exactly 50%.

(2) Set the SPEED switch on the Transport Control Panel to the L position (15 ips).

(3) Adjust VR5 (15 ips Gain) so that the waveform displayed on the oscilloscope has a duty cycle of exactly 50%.

(4) Set SW2 on the Transport Control PCB (the H/L Speed Pair switch) to the L position.

(5) Adjust VR6 (7.5 ips Gain) so that the waveform displayed on the oscilloscope has a duty cycle of exactly 50%.

4.1.4.4 Capstan Servo Damping Adjustment

NOTE: If a Wow and Flutter meter is not available, do not change the setting of VR1, VR2, or VR3 (Capstan Damping trimmers).

(1) Thread the MX-80 with tape and wind until there is less than 1/2" (1.25 cm) of tape pack remaining on the Supply Reel.

(2) Connect the (3150 Hz) output of the Wow and Flutter meter to the TEST SIGNAL input on the Audio Control PCB.

(3) Connect the input of the Wow and Flutter meter to the CH8 rear panel Line Output connector.

(4) Set SW2 on the Transport Control PCB (the H/L Speed Pair switch) to the H position. Set the SPEED switch on the Transport Control Panel to the H position (30 ips).

(5) Set the CH8 READY/SAFE switch on the Remote Control unit to the Ready position. Set the ALL SAFE switch to the Ready position.

(6) Press the ALL REPRO button on the Remote Control unit, and press the RECORD and PLAY buttons to place the machine in Record mode.

(7) Adjust VR1 a small amount (one or two revolutions) and observe the Wow and Flutter meter. If a change in Wow and Flutter performance is observed, continue adjusting VR1 until the best performance is observed. If no change is observed in the first one or two revolutions of the trimmer, return the trimmer to its initial position and continue with the next step.

(8) Set the SPEED switch on the Transport Control Panel to the L position (15 ips).

(9) Place the machine in Record mode, and repeat step 7 using VR2 for adjustment.

(10) Set SW2 on the Transport Control PCB (the H/L Speed Pair switch) to the L position.

(11) Place the machine in Record mode, and repeat step 7 using VR3 for adjustment.

The capstan motor should lock (as indicated by the bi-color LED on the Capstan Control PCB changing from Red to Green) quickly and smoothly when the Capstan Motor speed or direction is changed.

4.1.5 Pinch Roller Timing

Switch SW6 on the Transport Control PCB adjusts the delay time between pressing the PLAY button and the Pinch Roller pulling in against the Capstan Shaft. These switches have been preset at the OTARI factory and do not require adjustment.

4.1.6 Tape Lifter Adjustment

Adjustment of the Tape Lifter position should not be necessary unless a Tape Lifter is changed or a Head is replaced

(1) Turn Off the Power to the machine and wait 30 seconds to allow the power supply capacitors to discharge.

(2) Open the VU Meter panel by removing the outer two screws from the top of the panel, and folding it down to a horizontal position.

(3) Thread a reel of the tape on the machine.

NOTE: This is necessary because the Tape Lifter adjustment must be made with tape on the machine.

(4) Remove the 4.5 mm socket head cap screw from the underside of each side of the Transport Deck Plate, and carefully lift the Transport Deck Plate until it latches in the open position.

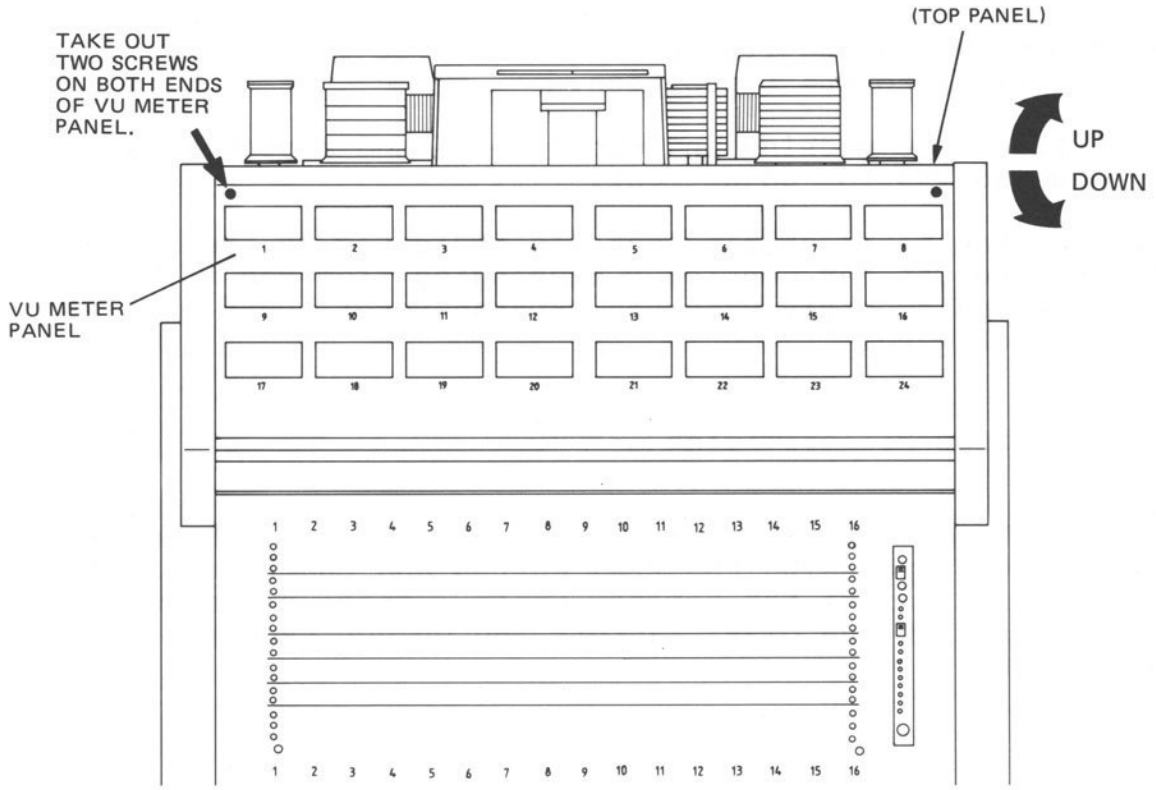


Figure 4-13 Opening the Transport

(5) Loosen the four screws which attach the Lifter Solenoid to the Deck Plate, and move the Lifter Solenoid as far toward the left side of the machine as it will go. Refer to Figure 4-14.

(6) Push the right Tape Lifter toward the front of the machine, and adjust Stopper A so that the right Tape Lifter (between the Repro Head and the Flutter Filter Roller) moves the tape 0.5 mm (0.02 in) away from the Repro Head.

NOTE: Be sure that the Tape Lifter Arm does not hit the Head Shield Plate, when the Shield Plate is in its retracted position.

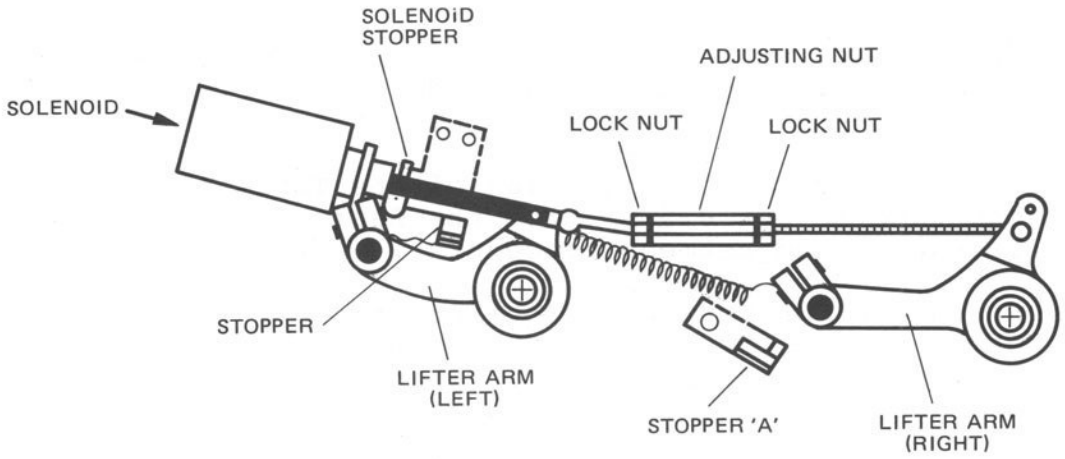


Figure 4-14 Tape Lifter Adjustments

(7) Hold the right Tape Lifter so that it is extended fully (against Stopper A), and adjust the threaded standoff so the left Tape Lifter (between the left Tape Guide and the Impedance Roller) holds the tape 0.5 mm (0.02 in) away from the Record Head.

NOTES:

a) The lock-nuts at each end of the standoff must be loosened before adjusting the standoff.

b) Turn the standoff clockwise to decrease the clearance between the tape and the Record Head.

c) If the standoff is turned too far counterclockwise, the left Tape Lifter will hit the Deck Plate when extended, and the right Tape Lifter will not be able to be adjusted properly.

(8) Tighten the locknuts on each end of the standoff when adjustment is correct.

(9) Push the Lifter Solenoid plunger into the solenoid body, and adjust the position of the solenoid until the left Tape Lifter holds the tape 0.5 mm from the Record Head when it is extended. Tighten the screws to hold the solenoid in position.

(10) Secure both Tension Arms at the top of their travel.

(11) Set Switch 3-3 on the Transport Control PCB to the On position.

(12) Apply Power to the MX-80. Press the STOP button to place the Transport in Load mode. Press the CUE button to cause the Tape Lifters to be extended.

(13) Carefully check the position of the Tape Lifters. If the tape is not 0.5 mm from the Repro and Record Heads, repeat the adjustment procedure.

(14) Press the CUE button to retract the Tape Lifters, and check to see that the left Tape Lifter is approximately 1 mm behind the tape. If it is not, adjust the positior of Stopper B until the retracted position is correct.

(15) Adjust the position of the Solenoid Plunger Stopper so that the solenoid plunger contacts it at the same time that the left Tape Lifter Arm contacts Stopper B.

4.1.7 Pinch Roller Position and Pressure Adjustment

(1) Adjust the position (from beneath the Transport Deck Plate) of the Solenoid Stopper so the Pinch Roller is 4 - 5 mm from the Capstan Shaft when it is its disengaged position.

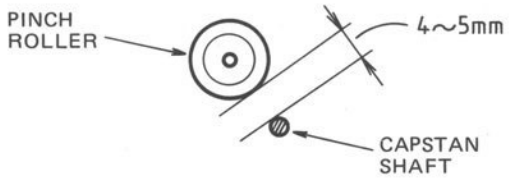


Figure 4-15 Pinch Roller Pressure Measurement

(2) Secure both Tension Arms at the top of their travel.

(3) Attach the 0 - 4000 gram spring scale to the Pinch Roller with a loop of string.

(4) Place the MX-80 in Play mode.

(5) Pull the spring scale toward the rear of the machine until the Pinch Roller just loses contact with the Capstan Shaft (and stops turning), and measure the Pinch Roller pressure.

(6) If the Pinch Roller pressure is not 2500 grams ± 300 grams, adjust the position of the Pinch Roller solenoid slightly and repeat the measurement.

4.1.8 Brake Adjustment

Some of these adjustments can be performed with the Reel Motor Assembly installed in the MX-80, or with the Reel Motor Assembly on the work bench. If the adjustments are performed at the bench, the final adjustments for tension must be made after the Assembly is re-installed in the MX-80.

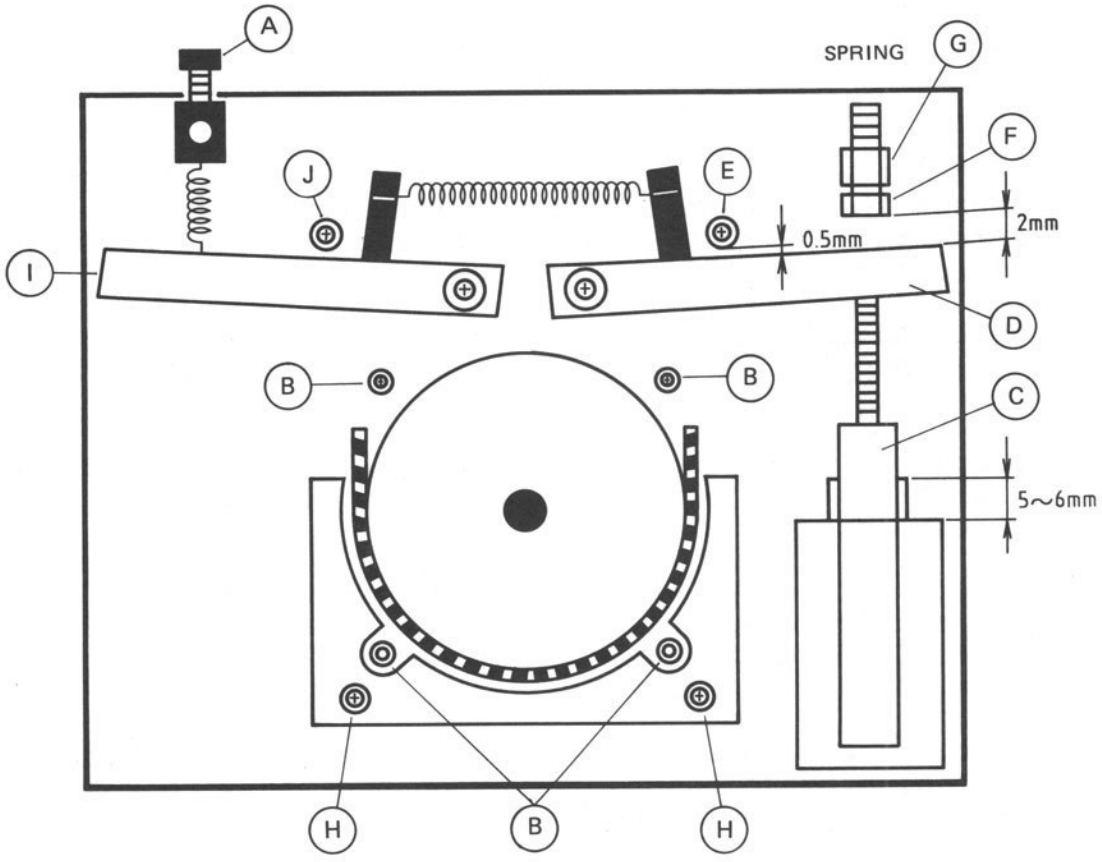


Figure 4-16 Brake Adjustments

(1) Loosen the screws marked "B" in Figure 4-16 and adjust the Brake Assembly on the motor so that there is 0.5 mm clearance between arm "D" and post "E". Securely tighten the screws.

(2) Adjust the double-nut "F" so that 5-6 mm of plunger body protrudes from the solenoid body, while pushing in on "G" to remove any slack in the linkage.

(3) Adjust bracket "C" for 1 mm clearance between the fiber washer "F" and the arm "D" while pulling out on "G" to remove any slack in the linkage.

(4) Loosen the screws marked "H" and adjust the guide so that the band does not rub on the brake drum when the solenoid is energized (push "G" all the way in to check).

(5) Check the Holdback tension by winding the free end of a piece of string or twine around an NAB reel hub (clockwise for the Supply reel, counterclockwise for the Take-up reel), and pulling on the string with a spring scale to unwind the string. Since the reading on the spring scale is dependent on the speed at which the string is pulled, it is recommended that two or three readings be made and the results averaged.

(6) If the tension is not approximately 1200 - 1500 grams, loosen the tension bracket locking screw and adjust the screw marked "A" so that the tension in the "holdback" direction is within that range.

NOTE: Adjust the brake tension so that both Take-up and Supply sides show the same tension ± 100 grams in the "holdback" direction.

(7) Check the feed tension by repeating the above procedure with the string wound on the hub in the opposite direction.

The brake tension in the feed direction is not separately adjustable, and should be approximately one-half of the value measured in the "holdback" direction (i.e., 600 - 750 grams).

If correct holdback tension cannot be obtained after replacing Brake Bands, it may be necessary to rotate the drum against the brake band to "wear in" the brake bands.

4.1.9 Variable Speed Range Criterion Setting

Variable Speed Range in the EXT and VARI mode has been set at the factory so that the FIX speed is set at the middle of the variable range. If this setting shifts, adjust VR3 on the Transport Control PCB as follows.

(1) After extending the Transport Control PCB, connect the voltmeter at pin 11 of IC 40.

(2) If the Remote Controller has been connected, set the Speed Mode Selector to the FIX position.

(3) Adjust VR 3 on the Transport Control PCB so that the voltmeter indicates +2.5V.

4.2 ROUTINE AUDIO ALIGNMENT

4.2.1 Tools, Materials, and Test Equipment Required

Speed	EQ	Ref. Flux	MRL Cat. No.
30 ips	AES	250 nWb/m	51L214
15 ips	NAB	250 nWb/m	51J213
7.5 ips	NAB	250 nWb/m	51T212
15 ips	IEC	320 nWb/m	51J323
15 ips	IEC	250 nWb/m	51J223
7.5 ips	IEC	320 nWb/m	51T322
7.5 ips	IEC	250 nWb/m	51T222

NOTE: Standard equalization for 2" 24 track machines at 15 and 7.5 ips is NAB. Standard equalization for 2" 32 track machines at 15 and 7.5 ips is IEC. Standard equalization at 30 ips is AES for all track formats.

4.2.2 Demagnetizing the Heads and Tape Path

Demagnetizing (sometimes called degaussing, although that term is more often applied to bulk tape erasure) is a necessary procedure, and should be performed prior to every alignment and before every recording session. Demagnetizing should always be done with extreme caution:

DEMAGNETIZING CAUTION:
To avoid damage to the MX-80, always make sure the POWER switch is Off before proceeding. Make sure that all recording tapes, especially alignment tapes, are removed from the vicinity of the MX-80. The AC field created by the demagnetizer is extremely powerful and could seriously damage the electronics if they are On.

Never turn On or Off the power to the demagnetizer unless it is at least 3 feet (1 meter) away from the MX-80. This would cause an extremely strong moving magnetic field which could possibly place a permanent magnetic charge on parts of the machine. The demagnetizer would not be powerful enough to remove these charges under normal circumstances, and the parts might have to be removed and discarded.

USE ONLY A DEMAGNETIZER WITH HIGH FLUX DENSITY, INEXPENSIVE "HI-FI" TYPE DEMAGNETIZERS CAN LEAVE RESIDUAL FIELDS THAT WILL CAUSE MORE HARM THAN BENEFIT.

(1) Turn off the MX-80 POWER switch.

(2) With the demagnetizer at least 3 feet (1 meter) from the MX-80, plug the demagnetizer into the AC mains and turn it on.

(3) Slowly move the demagnetizer toward the supply swing arm roller until the tip is approximately 1/8" (3 mm) away from the roller.

(4) Slowly move the tip of the demagnetizer up and down along the roller so that the entire roller surface is exposed to the demagnetizing field. DO NOT TOUCH ANY PART OF THE MX-80 WITH THE DEMAGNETIZER.

(5) Slowly move the demagnetizer at least 3 feet (1 meter) away from the MX-80.

(6) Working from left to right repeat Steps 3, 4, and 5 for each of the following metal parts in the tape path:

A. Tension Arm Guide Roller (left)

B. Guide Roller (Impedance Roller)

C. Tape Lifter (left)

D. Fixed Tape Guide (left)

E. Erase Head

F. Record Head

G. Flutter Filter Roller

H. Tape Lifter (right)

I. Reproduce Head

J. Fixed Tape Guide (right)

K. Capstan Shaft

L. Tension Arm Guide Roller (right)

(7) When all the above parts have been demagnetized, slowly move the demagnetizer at least 3 feet (1 meter) away from the MX-80 and turn it off or unplug it.

4.2.3 Cleaning the Tape Path and Lublication

It is extremely important to clean the entire tape path regularly. Oxide and dirt will be shed from the tape and accumulate on these parts, causing a build-up that can degrade audio performance, cause slipping, and cause undue wear on the tape.

CAUTION: Never use any metallic item or abrasive to clean the heads or any other tape guidance parts. Never use spirits, lacquer thinner, acetone or other solvents on the tape heads. Rubbing alcohol should be avoided since it contains oil that will leave a residue.

You should clean and demagnetize the entire tape path before performing any adjustments in this section.

(1) Moisten a cotton swab in pure isopropyl alcohol, and wipe the entire surface of the Supply Tension Arm roller. Allow the roller to dry by evaporation.

(2) Moisten additional swabs and clean the following parts:

A. Tension Arm Guide Roller (left)

B. Guide Roller (Impedance Roller)

C. Tape Lifter (left)

D. Fixed Tape Guide (left)

E. Erase Head

F. Record Head

G. Flutter Filter Roller

H. Tape Lifter (right)

I. Reproduce Head

J. Fixed Tape Guide (right)

K. Capstan Shaft

L. Tension Arm Guide Roller (right)

CAUTION: Don't use alcohol moistened swabs to clean the Tachometer Roller or the Pinch Roller. To avoid embedding dust and lint particles in the surface of these rollers, use only an alcohol moistened Lint-Free cloth to gently clean the rollers.

LUBRICATION

The only component requiring lubrication is the Capstan Motor.

Lubricate the capstan every four months, or after each 1000 hours of operation (whichever occurs first), or as required using the lubricating oil (use only OTARI oil PZ9E003). For lubrication, proceed as follows, refering to Section 9, page 9-4, Exploded Views [2] Pinch Roller Assembly KP-6A.

(1) Remove the pinch rollor cap by turning, the hex socket head screw counterclockwise.

(2) Remove the pinch roller from the pinch roller shaft.

(3) Remove the metal dust cap from the capstan shaft by turning it counterclockwise.

(4) The foam ring surrounding the oilite bearing should now be visible.
Apply 3 drops of oil to the foam ring.
Do not over lubricate, and be careful not to apply oil to the portion of the capstan shaft which contacts the tape.

(5) Replace the dust cap, pinch roller and pinch roller cap.

4.2.4 Input Level, Output Level and Peak Indicator Adjustment

NOTE: The MX-80 Outputs are set at the factory for balanced operation. If unbalanced operation is desired, set the BAL/UNBAL switch (SW1) on each Audio Amplifier PCB to the UNBAL position.

(1) Set the test oscillator to produce a 1 kHz sine wave at + 4 dBm, using the AC voltmeter.

(2) Connect the oscillator to the CH1 INPUT connector on the rear panel. Connect the AC voltmeter to the CH1 OUTPUT connector.

(3) Extend the CH1 Audio Amplifier PCB using the Extender PCB (PB-7JEA). Turn On the Power to the MX-80.

(4) Adjust VR14 (Input Level) on the Audio Amplifier PCB until the CH1 VU Meter indicates 0 VU.

(5) Adjust VR12 (Output Level) until the AC voltmeter indicates + 4 dBm at the OUTPUT connector.

(6) Connect the oscillator to the TEST SIGNAL input on the Audio Contol PCB, and adjust VR13 (Test Signal Level) until the CH1 VU Meter indicates 0 VU.

(7) Adjust the test oscillator to produce 1 kHz at + 12 dBm.

NOTE: This level causes the PEAK indicator to become illuminated at a level corresponding to 1040 nWb/m.

(8) Adjust VR11 (Peak Indicator Level) on the Audio Amplifier PCB until the PEAK indicator in the CH1 VU Meter is steadily illuminated.

(9) Repeat steps 2 through 8 for each remaining channel.

Preliminary Record and Erase Transformer Peaking Adjustment

NOTE: This procedure is necessary only when a semi-permanent head format conversion is made, or if the Record or Erase Head are changed. It is not necessary to perform this procedure as part of the routine maintenance procedures.

(10) Disconnect the test oscillator, and thread the machine with tape.

(11) Connect the AC voltmeter to CP1 and CP2 (GND), and place the channel under alignment into Record mode.

(12) Adjust TF1 (Record Bias transformer) on the Audio Amplifier PCB for a peak reading on the AC voltmeter.

NOTE: Use a non-metallic alignment tool for these adjustments.

(13) With the machine still in Record mode, connect the AC voltmeter to CP3 and CP4 (GND), and adjust TF2 (Erase Bias transformer) for a peak reading on the AC voltmeter. For 24 and 32 CH machines the voltage at the peak should be 100 - 130 mV.

(14) Repeat Steps 11 through 13 for all remaining Audio Amplifier PCBs. Replace PCBs when completed.

4.2.5 Reproduce Head Azimuth Alignment

Refer to Figure 4-17 for the location and Reproduce Azimuth Adjustment screws.

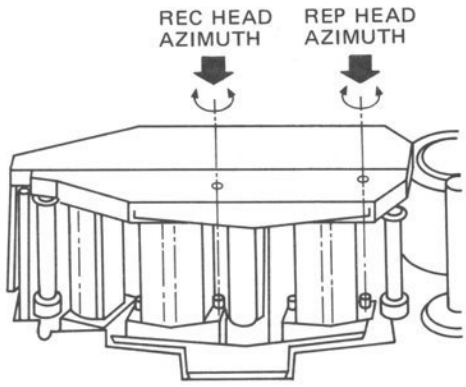


Figure 4-17 Record and Reproduce Azimuth Adjustment Screws

(1) Set the Speed Mode Selector on the Remote Control Unit to the FIX position, and set the SPEED selector on the MX-80 transport to the L position. Set the ALL SAFE switch to the All Safe position. Press the ALL REPRO button on the Remote Control Unit.

(2) Thread the MX-80 with an appropriate Reproduce Alignment Tape for the L speed setting. Refer to Section 4.2.1 for suggestions.

(3) Connect one vertical input of the oscilloscope to the CH2 Output connector. Connect the other vertical input of the oscilloscope to the CH23 (CH15 on 16 channel versions, CH31 on 32 channel versions) Output connector. Adjust the oscilloscope vertical sensitivity so that the output signal from the MX-80 produces a usable display on the oscilloscope.

(4) Insert the 2.5 mm hex key through the right hand hole in the head cover to the azimuth adjustment screw below. Locate and play the 1 kHz portion of the reproduce alignment tape. Adjust the oscilloscope controls until at least two complete cycles are displayed for each channel.

(5) Adjust the Reproduce head azimuth adjustment screw (Figure 4-17) until the two signals displayed on the oscilloscope are in phase.

NOTE: The azimuth adjustment screw is on the right side of the head, and has a hex socket head. The slotted screw should not be adjusted.

(6) Locate and play the 2 kHz portion of the alignment tape. Adjust the Reproduce head azimuth adjustment screw until the two signals on the scope are in phase.

(7) Repeat Step 5 for each frequency on the alignment tape up to 16 kHz. The adjustment of the screw becomes more critical as the frequency increases.

4.2.6 Record Head Azimuth Adjustment

It is not possible to establish proper record head azimuth as a function of Record/Play phase response due to the record phase compensation circuits in the MX-80. The procedure given here adjusts the azimuth of the Record head in Sel-Rep mode, thus ensuring that the azimuth of the Record head is exactly matched to that of the Repro head.

(1) Press the ALL SEL-REP button on the Remote Control unit.

(2) Locate and play the 1 kHz portion of the reproduce alignment tape.

(3) Adjust the Record head azimuth adjustment screw (the left hand hole in the head cover) until the two signals displayed on the oscilloscope are in phase.

(4) Repeat Step 3 for each frequency on the alignment tape up to 16 kHz. The adjustment of the screw becomes more critical as the frequency increases.

4.2.7 Reproduce Level Adjustment

NOTE: The MX-80 does not provide separate REPRO GAIN controls for each speed, therefore perform the Repro Level adjustment at the speed (H or L) which you will use most often. After performing the adjustments in Sections 4.2.7 through 4.2.15, when the tape speed is changed only the Repro Level adjustment needs to be re-adjusted. The Repro EQ adjustments will track the level adjustments.

(1) Press the ALL REPRO button on the Remote Control unit.

(2) Make sure the REF FLUX switch on the Audio Control PCB is set to correspond to the reference level of the Reproduce Alignment tape you are using. The H setting corresponds to 320 nWb/m, the L setting corresponds to 250 nWb/m.

(3) Locate and play the portion of the alignment tape containing the 1 kHz tone at Reference Level. Adjust the REPRO GAIN trimmer on the front of the CH1 Audio Amplifier PCB until the CH1 VU Meter indicates 0 VU.

(4) Repeat step 3 for each remaining Audio Amplifier PCB.

4.2.8 Low Speed Reproduce Equalization Alignment

(1) Set the SPEED selector on the MX-80 Transport to the L position. Press the ALL-REPRO button on the Remote Control unit.

(2) Thread the MX-80 with an appropriate Reproduce Alignment Tape for the Reference Flux level and Equalization you are using.

(3) Locate and play the 1 kHz portion of the alignment tape. If the VU Meter does not indicate 0 VU (it might not if Repro Gain was set at High speed), note the level which is indicated.

(4) Play the equalization adjustment tones and adjust the REPRO EQ LOW SPD trimmer at 10 kHz for the same level as the 1 kHz tone in Step 3. You should adjust all the channels at the same time (writing down the results) to save wear on the reproduce alignment tape.

4.2.9 High Speed Reproduce Equalization Alignment

(1) Set the SPEED selector on the MX-80 Transport to the H position. Press the ALL-REPRO button on the Remote Control unit.

(2) Thread the MX-80 with an appropriate Reproduce Alignment Tape for the Reference Flux level and Equalization you are using.

(3) Locate and play the 1 kHz portion of the alignment tape. If the VU Meter does not indicate 0 VU (it might not if Repro Gain was set at Low speed), note the level which is indicated.

(4) Play the equalization adjustment tones and adjust the REPRO EQ HIGH SPD trimmer at 10 kHz for the same level as the 1 kHz tone in Step 3. You should adjust all the channels at the same time (writing down the results) to save wear on the reproduce alignment tape.

4.2.10 Sel-Rep Level Adjustment

NOTE: The MX-80 does not provide separate SEL-REP GAIN controls for each speed, therefore perform the Sel-Rep Level adjustment at the speed (H or L) which you will use most often.

(1) Press the ALL SEL-REP button on the Remote Control unit.

(2) Make sure the REF FLUX switch on the Audio Control PCB is set to correspond to the reference level of the Reproduce Alignment tape you are using. The H setting corresponds to 320 nWb/m, the L setting corresponds to 250 nWb/m.

(3) Locate and play the portion of the alignment tape containing the 1 kHz tone at Reference Level. Adjust the SEL-REP GAIN trimmer on the front of the CH1 Audio Amplifier PCB until the CH1 VU Meter indicates 0 VU.

(4) Repeat step 3 for each remaining Audio Amplifier PCB.

4.2.11 Low Speed Sel-Rep Equalization Adjustment

(1) Set the SPEED selector on the MX-80 Transport to the L position. Press the ALL-SEL-REP button on the Remote Control unit.

(2) Thread the MX-80 with an appropriate Reproduce Alignment Tape for the Reference Flux level and Equalization you are using.

(3) Locate and play the 1 kHz portion of the alignment tape. If the VU Meter does not indicate 0 VU (it might not if Sel-Rep Gain was set at High speed), note the level which is indicated.

(4) Play the equalization adjustment tones and adjust the SEL-REP EQ LOW SPD trimmer at 10 kHz for the same level as the 1 kHz tone in Step 3. You should adjust all the channels at the same time (writing down the results) to save wear on the reproduce alignment tape.

4.2.12 High Speed Sel-Rep Equalization Alignment

(1) Set the SPEED selector on the MX-80 Transport to the H position. Press the ALL-SEL-REP button on the Remote Control unit.

(2) Thread the MX-80 with an appropriate Reproduce Alignment Tape for the Reference Flux level and Equalization you are using.

(3) Locate and play the 1 kHz portion of the alignment tape. If the VU Meter does not indicate 0 VU (it might not if Sel-Rep Gain was set at Low speed), note the level which is indicated.

(4) Play the equalization adjustment tones and adjust the SEL-REP EQ HIGH SPD trimmer at 10 kHz for the same level as the 1 kHz tone in Step 3. You should adjust all the channels at the same time (writing down the results) to save wear on the reproduce alignment tape.

4.2.13 Low Speed Record Bias, Equalization, and Record Level Adjustment

The MX-80 provides switch selectable bias settings for two different tape formulations. At the Low tape speed, the Bias level for switch position A is fixed for AMPEX 456 tape. The Bias level for switch position B is adjustable for both speeds. Once the BIAS control on each Audio Amplifier PCB has been properly adjusted, a single control can reset the bias for all channels simultaneously.

NOTE: If the Low speed is 7-1/2 ips, set the oscillator level for -6 dBm and use 5 kHz for adjustment instead of 10 kHz.

(1) Set the BIAS SELECT switch on the Audio Control PCB to the A position.

(2) Set the test oscillator to produce a 10 kHz sine wave at +4 dBm, or whatever standard operating level you have chosen for your system, e.g., -10 dBv (-8 dBm).

(3) Connect the test oscillator to the TEST SIGNAL input on the Audio Control PCB. Connect the AC voltmeter to the CH1 Output connector.

(4) Thread the MX-80 with the tape ;you will use for sessions.

(5) Press the ALL INPUT button on the Remote Control Unit.

(6) Set the ALL SAFE switch to the Ready position.

(7) Set the READY/SAFE switch to the Ready position for all channels.

(8) Set the SPEED SELECT switch on the Transport to the L position, and set the Speed Mode Selector switch on the Remote Control Unit to the Fixed position.

(9) Press the RECORD and PLAY buttons simultaneously to begin recording.

(10) Press the ALL REPRO button on the Remote Control Unit.

(11) Turn the RECORD BIAS trimmer on the CH1 Audio Amplifier PCB counterclockwise until the level on the AC Voltmeter begins to decrease.

(12) Turn the RECORD BIAS trimmer clockwise until the indication on the AC Voltmeter peaks; then continue clockwise rotation until the AC Voltmeter reading decreases (overbias). Refer to Table 4-1 BIAS CHART the amount of overbias that is appropriate for the tape type and speed.

(13) Set the oscillator to 1 kHz and adjust the RECORD GAIN LOW SPD trimmer for 0 VU (-10 VU for 7-1/2 ips).

(14) Set the oscillator to 10 kHz and adjust the RECORD EQ LOW SPD trimmer for 0 VU (-10 VU for 7-1/2 ips).

(15) Repeat Steps 11 through 14 for all remaining channels.

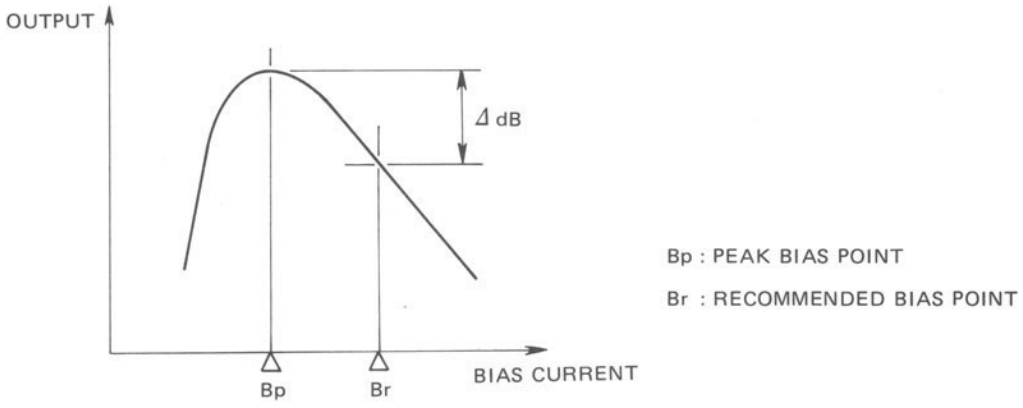
NOTE: If you wish to use a different tape formulation at Low speed, set the BIAS SELECT switch on the Audio Control PCB to the B position, thread the machine with the desired tape, and adjust the LOW SPD B trimmer for the desired bias level. This trimmer will adjust the bias for all channels simultaneously.

Table 4-1 Recommended Record Bias Setting

Record Head: GH6R016 (32CH)
GH6R017 (24CH) (Wg = 6 um)

		Bias Setting Δ dB			
	Speed (ips)	3-3/4	7-1/2	15	30
	Frequency (Hz)	10k	10k	10k	10k
Type of Tape	AGFA PEM468				
	AGFA PEM169				
	AMPEX 406/407				
	AMPEX 456		7.0	3.5	1.7
	BASF LGR50P				
	BASF SPR50LH/50LHL				
	SCOTCH(3M) 206/207				
	SCOTCH(3M) 226/227		7.0	3.5	1.7
	SCOTCH(3M) 250				

(Unit:dB)



4.2.14 High Speed Record Bias, Equalization, and Record Level Adjustment

(1) Reset the BIAS SELECT switch on the Audio Control PCB to the A position, set the SPEED SELECT switch on the transport to the H position, thread the machine with a reel of the desired tape, and repeat Steps 7 through 12 of Section 4.2.13 (Low Speed Record Bias adjustment) using the HIGH SPD A trimmer on the Audio Control PCB for the desired amount of overbias.

(2) Repeat Steps 13 through 15 of Section 4.2.13 using the RECORD GAIN HIGH SPD and RECORD EQ HIGH SPD trimmers.

To set the machine for an alternate tape type, having different bias requirements, at High speed, set the BIAS SELECT switch on the Audio Control PCB to the B position and repeat Step 2 above for all channels. Thereafter, whenever that tape type is to be used, set the BIAS SELECT switch to the B position, and the bias level for all channels is automatically adjusted for that tape type.

4.2.15 Low Frequency Compensation Adjustment

(1) Connect the test oscillator to the TEST SIGNAL input on the Audio Control PCB. Set the oscillator to produce 100 Hz at + 4 dBm.

(2) Set the SPEED SELECT switch on the transport to the H position.

(3) Press the ALL REPRO button on the Remote Control unit. Set the ALL SAFE switch to the Ready position.

(4) Set the READY/SAFE switches for all channels to the Ready position.

(5) Press the RECORD and PLAY buttons simultaneously to begin recording.

(6) Adjust the REPRO LF COMP HI SPD trimmer for 0 VU on the MX-80 VU Meter. Repeat for each channel.

(7) Rewind the tape to the beginning of the recorded section.

(8) Press the ALL SEL-REP button on the Remote Control PCB.

(9) Play the tape and adjust the SEL-REP LF COMP HI SPD trimmer for 0 VU on the MX-80 VU Meter. Repeat for each channel.

(10) Set the SPEED SELECT switch on the transport to the L position.

(11) Repeat Steps 3 through 9 using the REPRO and SEL-REP LF COMP LOW SPD trimmers.

4.2.16 Record Phase Compensation Adjustment

(1) Set the SPEED SELECT switch on the transport to the H position. Press the ALL REPRO button on the Remote Control unit.

(2) Set the test oscillator to produce a 10 kHz square wave, and connect it to the TEST SIGNAL input on the Audio Control PCB.

(3) Connect the oscilloscope to either the CH1 OUTPUT on the rear panel, or to the 1/8" mini-jack LINE OUTPUT connector on the front of the CH1 Audio Amplifier PCB.

(4) Press RECORD and PLAY to begin recording.

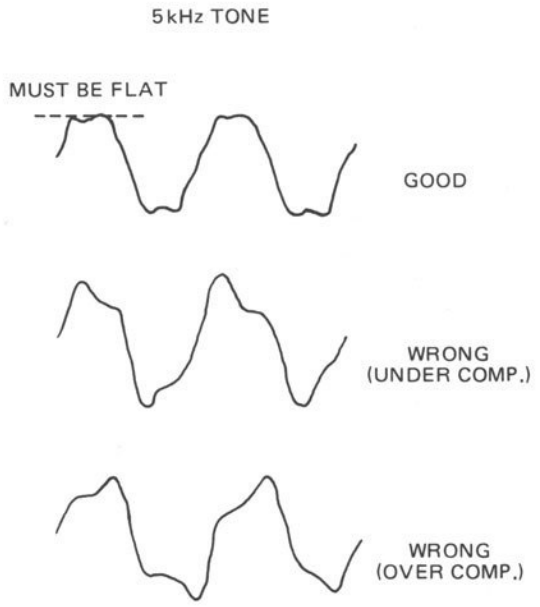


Figure 4-18 Record Phase Compensation Waveform

(5) While recording the square wave, adjust the RECORD PHASE HI SPD trimmer for the best square wave response shown on the oscilloscope. (Refer to Figure 4-18).

(6) Repeat for all remaining channels.

(7) Set the SPEED SELECT switch on the transport to the L position and repeat Steps 3 through 6 using the RECORD PHASE LOW SPD trimmers. NOTE: Use 5 kHz for 7-1/2 ips adjustment.

4.2.17 Erase Bias Symmetry Adjustment

NOTE: This adjustment is necessary only to minimize Punch In/Punch Out noise. It is not necessary to perform this procedure as part of normal maintenance procedures.

(1) Clean and demagnetize the Heads and tape path.

(2) Turn Off the power to the MX-80 and wait 30 seconds for the power supply capacitors to discharge.

(3) Remove the Head Assembly Cover.

(4) Unplug the Record Head connectors. The left-hand connector is for the upper tracks.

(5) Thread the machine with a reel of the tape which is usually used for sessions. Set the SPEED SELECT switch on the transport for 15 ips operation.

(6) Extend the CH1 Audio Amplifier PCB with the Extender PCB (PB-7JEA). Turn On the power to the machine.

(7) Press the ALL REPRO button on the Remote Control unit, set the ALL SAFE switch to the Ready position, and set the CH1 READY/SAFE switch to the Ready position.

(8) Connect an amplifier and monitor speaker to the CH1 OUTPUT connector on the rear panel.

(9) Press PLAY and RECORD to begin recording.

(10) While listening to the monitor speaker, repeatedly Punch In and Punch Out of Record. If any click or thump noise is heard, adjust VR23 (Erase Symmetry) on the Audio Amplifier PCB to minimize the noise.

(11) Repeat Steps 6 through 10 for each remaining channel.

(12) Reconnect the Record Head connectors and replace the Head Assembly Cover when the procedure is completed.

ERASE CURRENT ADJUSTMENT

Erase current should be set to the value as explained in the table below for the serial number suffix B and after.

	Parts No. of Erase Head		Erase Current Setting for B and after
Suffix	A	B	
16CH	------	GH6E020A	100 +5/-0 mA
24CH	GH6E014A	GH6E021A	90 +5/-0 mA
32CH	GH6E013A	GH6E022A	80 +5/-0 mA

NOTE: VR24 on the Audio Amplifier PCA is assigned for Erase Current Setting. When this PCA is used for A lot machine, set VR24 to the position all the way turned clockwise.

4.2.18 Record Bias Symmetry Adjustment

NOTE: This adjustment is necessary only to minimize Punch In/Punch Out noise. It is not necessary to perform this procedure as part of normal maintenance procedures.

(1) Clean and demagnetize the Heads and tape path.

(2) Turn Off the power to the MX-80 and wait 30 seconds for the power supply capacitors to discharge.

(3) Remove the Head Assembly Cover.

(4) Unplug the Erase Head connectors. The left-hand connector is for the upper tracks.

(5) Thread the machine with a reel of the tape which is usually used for sessions. Set the SPEED SELECT switch on the transport for 15 ips operation.

(6) Extend the CH1 Audio Amplifier PCB with the Extender PCB (PB-7JEA). Turn On the power to the machine.

(7) Press the ALL REPRO button on the Remote Control unit, set the ALL SAFE switch to the Ready position, and set the CH1 READY/SAFE switch to the Ready position.

(8) Connect an amplifier and monitor speaker to the CH1 OUTPUT connector on the rear panel.

(9) Press PLAY and RECORD to begin recording.

(10) While listening to the monitor speaker, repeatedly Punch In and Punch Out of Record. If any click or thump noise is heard, adjust VR22 (Record Symmetry) on the Audio Amplifier PCB to minimize the noise.

(11) Repeat Steps 6 through 10 for each remaining channel.

(12) Reconnect the Erase Head connectors and replace the Head Assembly Cover when the procedure is completed.

NOTE: If it is not possible to totally eliminate the thump or click noise, additional demagnetization might be necessary. Use a demagnetizer rated at 40 - 60 watts minimum.

4.2.19 Gapless Punch-In/Punch-Out Test and Adjustment

NOTE: It is very important that the Erase Current and Record Bias adjustments be correctly performed prior to adjusting the Gapless timing.

(1) Record a 1 kHz tone at 0 VU at 15 ips on all channels for 10 minutes, and Rewind to the beginning of the recorded section.

(2) Set the GAPLESS RECORD switch (SW6) on the Audio Control PCB to the Off position.

(3) Connect the CH8 Output to the CH1 Input. Press the INDIVIDUAL button on the Remote Control unit. Set CH8 to Sel-Rep mode. Set CH1 to Repro mode. Set the CH1 READY/SAFE switch to the Ready position, and set the ALL SAFE switch to the Ready position.

(4) Connect the oscilloscope to the CH1 OUTPUT connector on the rear panel. Adjust the oscilloscope for a usable display (either 0.5 or 1.0 Sec/div).

(5) Repeatedly Punch In and Out of Record on Channel 1 while observing the oscilloscope. The oscilloscope should display a 100 - 200 mSec overlap when Punching In, and a 100 - 200 mSec gap when Punching Out.

(6) Repeat Steps 3 through 5 for all remaining channels. The results should be the same on all channels ± 20m Sec.

(7) Set the GAPLESS RECORD switch (SW6) on the Audio Control PCB to the On position, and repeat Steps 3 through 5. Set the oscilloscope timebase for 5 or 10 m Sec/div. The oscilloscope should display a maximum overlap of 15 m Sec on Punching In, and a maximum gap of 15 m Sec on Punching Out. If correct results are not obtained, adjust the position of SW2-3, 2-4, and 2-5 on <u>each</u> Audio Amplifier PCB, to adjust the Punch Out gap, and adjust SW2-6, 2-7 and 2-8 to adjust the Punch In overlap. The Factory settings of SW2 are shown in Section 6.2.2.

SECTION 5:
OPTIONAL EQUIPMENT AND FIELD UPGRADES

5.1 WIDE BAND MODIFICATION

The following modification is required for reproducing SMPTE/ EBU Time Code in Fast Wind and Spooling modes, and should be carried out on Audio PCB Assembly (PB-19JA).

(1) Resolder J1 (located between IC3 and IC4).

(2) Solder a jumper wire to J2 (in the vicinity of IC1) instead.

(3) Check the following parts and solder them to the specified positions respectively.

R501	1/4W, 5%, 8.2k ohm carbon resistor
R503	1/4W, 5%, 470 ohm carbon resistor
R505	1/4W, 5%, 1 M ohm carbon resistor
R506	1/4W, 5%, 1 M ohm carbon resistor
R507	1/4W, 5%, 1 M ohm carbon resistor
Q501	2SK336 (FET SW)
Q503	2SK336 (FET SW)
C5	0.00luF, mylar film capacitor (± 5%, 50V)
C17	0.00luF, mylar film capacitor (± 5%, 50V)
C26	47 pF, polypropylene film capacitor (± 5%, 50V)
C37	47 pF, polypropylene film capacitor (± 5%, 50V)
C501	0.1 uF, mylar film capacitor (± 5%, 50V)

R502, R504, Q502, Q504 must be removed.