

AVR-2

VIDEOTAPE RECORDER



1809177-02

OPERATION AND MAINTENANCE

AMPEX

AVR-2
VIDEOTAPE RECORDER

OPERATION AND MAINTENANCE

AMPEX CORPORATION
AUDIO-VIDEO SYSTEMS DIVISION

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AVSD Technical Publications
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401 Broadway
Redwood City, CA 94063

Catalog No. 1809177-02
Issued: May 1974

Printed in USA

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SECTION I DESCRIPTION

1-1 GENERAL

This manual contains installation and operation instructions, and general descriptive data concerning the AVR-2 Videotape Recorder, manufactured by the Ampex Corporation in Redwood City, California. The AVR-2 is available in three versions which cover the 525-line and 625-line standards for NTSC, PAL, and SECAM. The equipment is identified by basic part number 1373000 followed by the version numbers (-01, -02, and -03). In addition to the three versions, the equipment may also include optional or accessory items. The identification of versions, options, and accessories is given in Table 1-1.

The AVR-2 technical manual is a multiple volume publication having separate volumes for sub-system theory, maintenance, parts lists, and drawings. The material in this volume is divided into five sections. This section contains a physical description of the equipment and accessories. Sections II and III contain the installation and operation instructions, Section IV provides a functional description and the last section, Section V, contains maintenance instructions. This volume may be considered as an operator's handbook with general operating instructions and other general data; subsequent volumes contain more detailed information as may be required for maintenance support.

Table 1-1. AVR-2 Videotape Recorder Versions, Options, and Accessories

IDENTIFICATION NUMBER	DESCRIPTION
1373000-01	NTSC Version with 525-line high-band kit
1373000-02	PAL-M Version with 525-line high-band PAL-M kit
1373000-03	PAL/SECAM Version with 625-line high-band PAL/SECAM kit
Options	
1373047-01	Video Head Assembly, 10-mil
1373047-02	Video Head Assembly, 5-mil
1373297-01	Auto Tracking and Capstan Drive Printed Wiring Assembly
1374171-01	525-Line Two-Line Delay Module Assembly
1374181-01	625-Line Two-Line Delay Module Assembly
	} Two-line delay required for dropout compensator and for velocity compensator accessory

Table 1-1. AVR-2 Videotape Recorder Versions, Options, and Accessories (Continued)

IDENTIFICATION NUMBER	DESCRIPTION
1373242-01	Audio with Monitor Head Assembly (Mono)
1373240-01	Stereo Audit Kit (Mono Erase)
1373240-02	Dual Track Audio Kit (Split Erase)
1373290-01	525-Line NTSC Stable Oscillator
1373291-01	625-Line CCIR Stable Oscillator
1373292-01	525-Line PAL Stable Oscillator
1373251-01	525-Line NTSC/PAL-M Velocity Compensator Kit
1373252-01	625-Line PAL/SECAM Velocity Compensator Kit
1373165-01	Auto Chroma Printed Wiring Assembly
1373249-01	525-Line Editor Kit
1373248-01	625-Line Editor Kit
1373034-01	Console Assembly
1373030-01	Air Compressor Assembly
1373244-01	Service Tool Kit
1373033-01	525-Line Monitor Bridge Assembly
1373033-02	625-Line Monitor Bridge Assembly
545-228	Monochrome Monitor (TEK-632)
545-213	Color Monitor NTSC (TEK-650)
545-215	Color Monitor PAL (TEK-652)
545-233	Waveform Monitor
545-230	Vector Display Monitor

Select one for
525 Line Monitor
Bridge Assembly

Table 1-1. AVR-2 Videotape Recorder Versions, Options, and Accessories (Continued)

IDENTIFICATION NUMBER	DESCRIPTION
545-214	Color Monitor (PAL) TEK 651 for 625-Line Monitor Bridge Assembly
545-232	Waveform Monitor (PAL)

1-2 PHYSICAL DESCRIPTION

The AVR-2 Videotape Recorder, Figure 1-1, consists of the transport assembly, video head assembly, the electronics assembly, and whatever accessories are required by the user. The AVR-2 shown in Figure 1-1 is a typical configuration including an accessory console assembly, accessory monitor bridge assembly, and accessory vector and color monitors. This machine is completely self-contained, and after being connected to electrical power and to a source of compressed air, the recorder is ready for operation. (An accessory air compressor is available if required.)

The accessory console assembly allows the AVR-2 system to be moved about on casters. The front door of the electronics assembly swings down to permit full access to all circuit boards in the electronics rack which is situated just below the transport assembly.

The accessory monitor bridge may be adjusted to hold the monitors at a convenient viewing and operating location above the transport, and is equipped with a control panel which allows selection of various signals for monitoring. The audio monitor, on the right hand side of the bridge, contains an audio amplifier and speaker with the volume control located on the monitor control panel. Other monitors such as the waveform, color, and vector monitors are described by the manufacturer's instruction manual included with the equipment.

Major assemblies of the AVR-2 system can also be delivered and installed without the use of a

console assembly. As shown in Figure 1-2, the transport assembly and system electronics are equipped with separate enclosures which allow the equipment to be stacked or arranged side-by-side on a work bench or table.

1-3 TAPE TRANSPORT ASSEMBLY

Except for the video head assembly, all assemblies and components mounted on the top or bottom of the transport top plate are considered to be part of the transport assembly (Figure 1-3). The transport top plate is a precision machining made from a half-inch thick magnesium plate. The top plate is hinged to the transport housing at the rear, and is locked down in the horizontal position by a latch under the transport control panel.

The transport control panel is hinged to the front edge of the transport housing, and swings open to permit access to the transport top plate latch under the front edge of the transport housing. All transport operating controls are mounted on the transport control panel (refer to operating procedures, Section III, for a complete description of controls and indicators).

When the front latch of the transport is released, the transport top plate swings up and is locked in the upright position by braces on each side of the top plate. With the top plate held in the upright position, all necessary transport maintenance, such as brake or pinch roller adjustments, can be accomplished without disassembly of the transport housing.

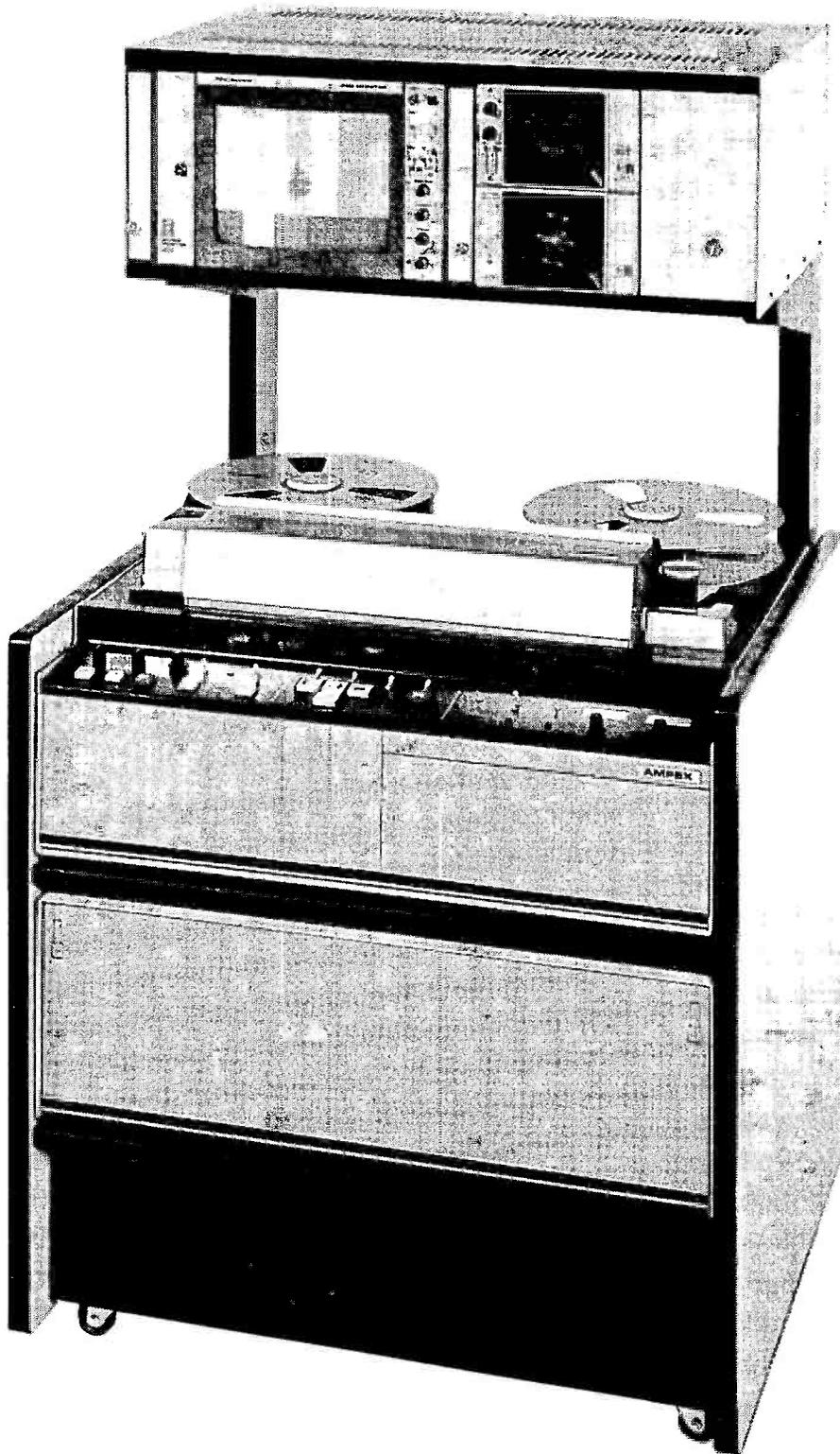


Figure 1-1. AVR-2 Videotape Recorder Overall View

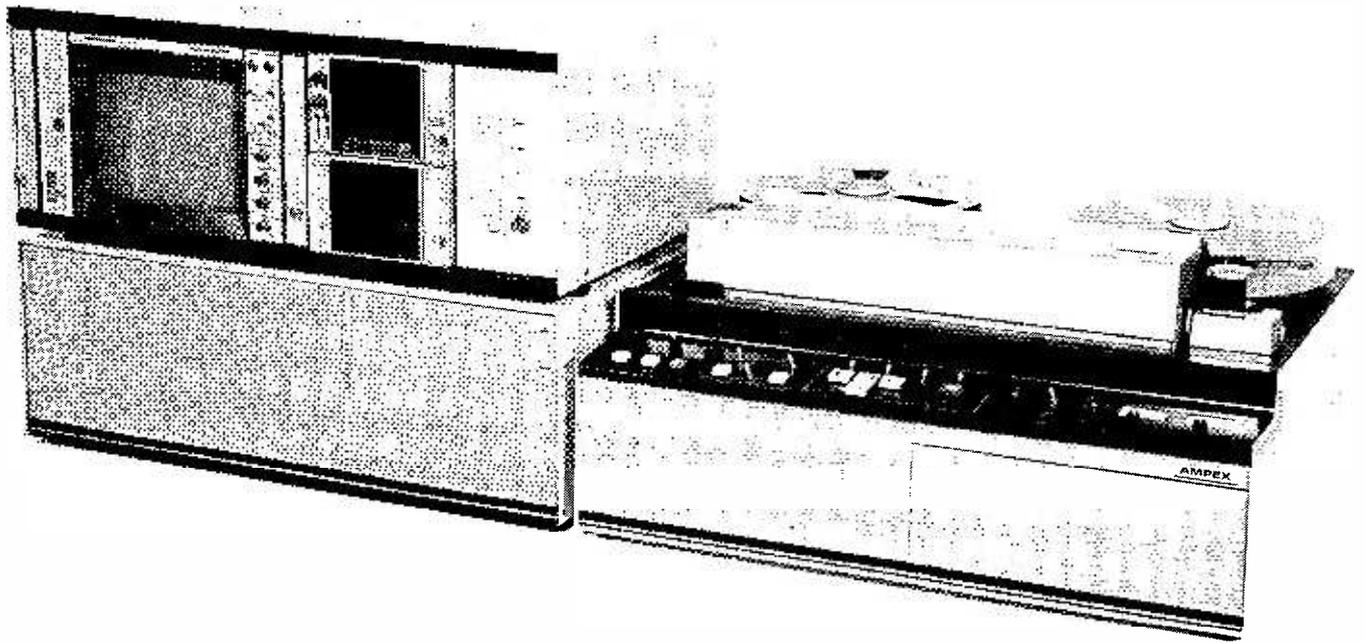


Figure 1-2. Typical AVR-2 Bench Installation

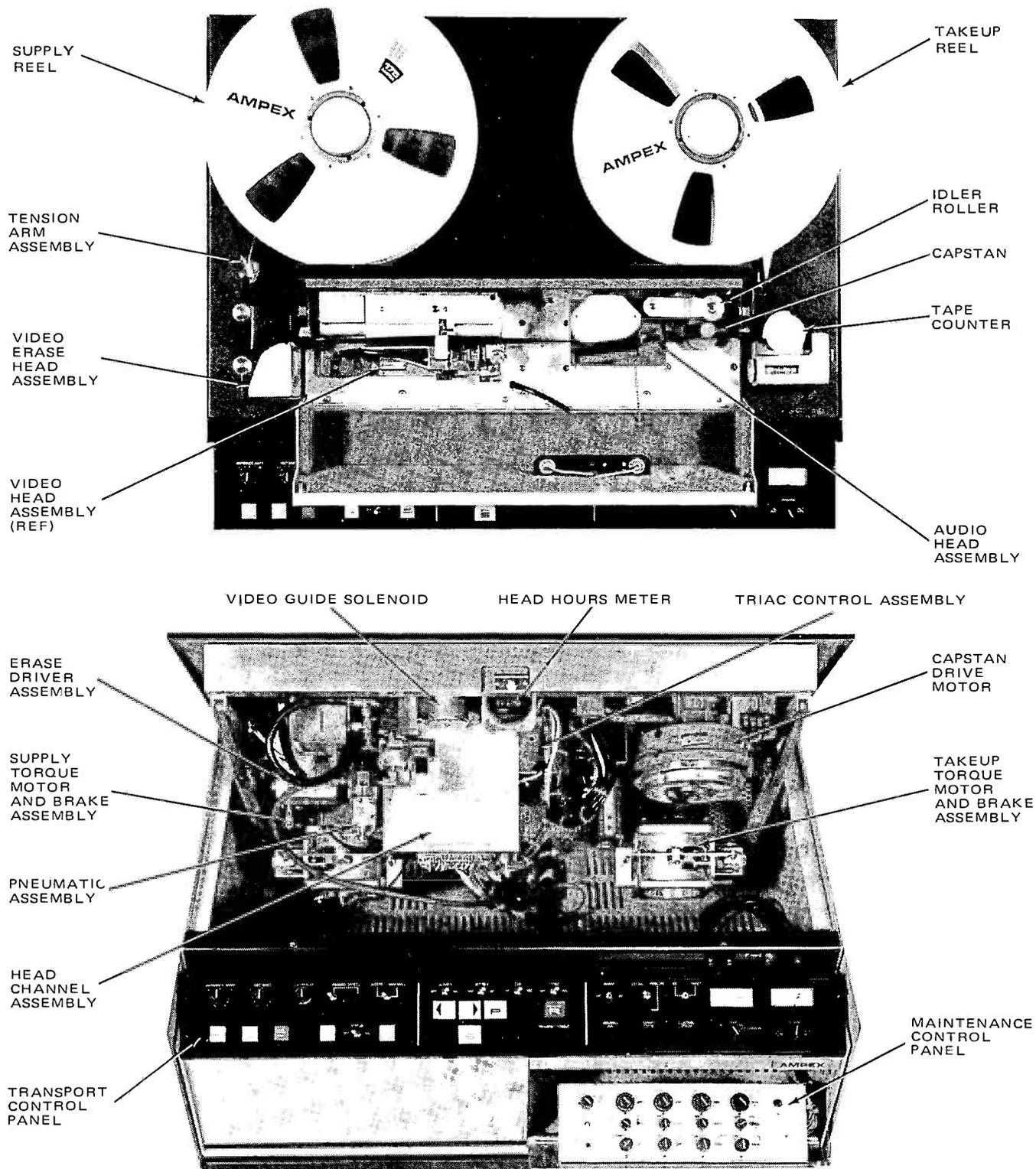


Figure 1-3. Tape Transport Assembly

In addition to the transport control panel, a maintenance control panel is fitted into the front face of the transport housing. This control panel is held in place by a spring-loaded latch which is released by pressing in on the panel door. The maintenance control panel holds controls which are adjusted to accommodate variable video head characteristics (refer to operating procedures in Section III).

1-4 Tape Drive and Tape Handling Components

Tape drive components include two torque motors, turntables, and brake assemblies for the takeup and supply reels; and a capstan drive motor, capstan, and capstan idler assembly. The two torque motors are 110-volt ac, single-phase, heavy-duty induction motors with the motor shaft extending from both ends. The turntable is mounted on one end of the shaft, and the brake assembly is mounted on the other. The brake assembly consists of a drum (secured to the shaft) and a solenoid-actuated brake band which is designed to impinge on the brake drum when the solenoid is deenergized. The torque produced by the supply and takeup motors is controlled by a triac control circuit board assembly which operates to maintain proper tape tension in all modes of operation.

The capstan drive motor is a dc motor fitted with a magnetic tachometer assembly. The motor is mounted on the bottom of the top plate with the motor shaft extending up through the top plate to form the capstan. Motor speed is controlled by the magnitude of the motor drive voltage which is regulated by the servo system. The magnetic tachometer consists of a 384-toothed disc and a magnetic pickup. The disc is attached to the motor shaft, and as the shaft turns, the teeth on the periphery of the disc interrupt the field of the magnetic pickup. For each revolution of the capstan, the tachometer produces 384 output pulses.

The capstan idler (pinch roller) is a hard rubber tire supported by a yoke assembly. The yoke is pinned to a shaft which extends through a bearing in the transport top plate. The other end of the shaft, under the top plate, is connected to

a lever which is actuated by a solenoid assembly. When the solenoid is energized (during PLAY or RECORD) a spring load is applied to the lever which turns the yoke shaft and thereby causes the idler to press against the capstan.

Tape handling components include guide posts, idlers, and the tape tension arm assemblies. The guide posts and idler reduce perturbations caused by tape motion, and hold the tape in line with the head assemblies. The two tape tension arm assemblies take up excess tape slack during braking operations and thereby prevent tape spillage. The tension arms also actuate micro-switches to signal an end-of-tape condition when the arms are allowed to swing toward the front edge of the transport.

1-5 Tape Motion Sensor

The tape motion sensor consists of a miniature 24-volt dc motor, a sensor drive arm assembly, a motor mounting bracket and appropriate connectors and wiring. The sensor is mounted on the rear of the supply reel torque motor and provides tape motion signals to the control logic circuit.

1-6 Pneumatic Assembly

The pneumatic assembly, Figure 1-4, comprises pneumatic input and vacuum lines, pressure switch, vacuum transducer and needle valve, an automatic pressure shutoff valve, a pressure manifold, and two filters. The pneumatic assembly requires an external source of air pressure for operation (an accessory air compressor is available); the air supply is connected to the pressure input line. The input line feeds air to an input air filter which routes the air supply through an automatic shutoff valve to a manifold. The automatic shutoff valve closes the air line when the video head assembly is removed from the transport; the manifold routes the air pressure to the video head motor air bearings, and to a vacuum transducer. The vacuum transducer creates a vacuum by venturi effect and the exhaust air is routed through another filter before being discharged into the interior of the transport housing. The needle valve adjusts the vacuum level and the vacuum is applied to the video head guide.

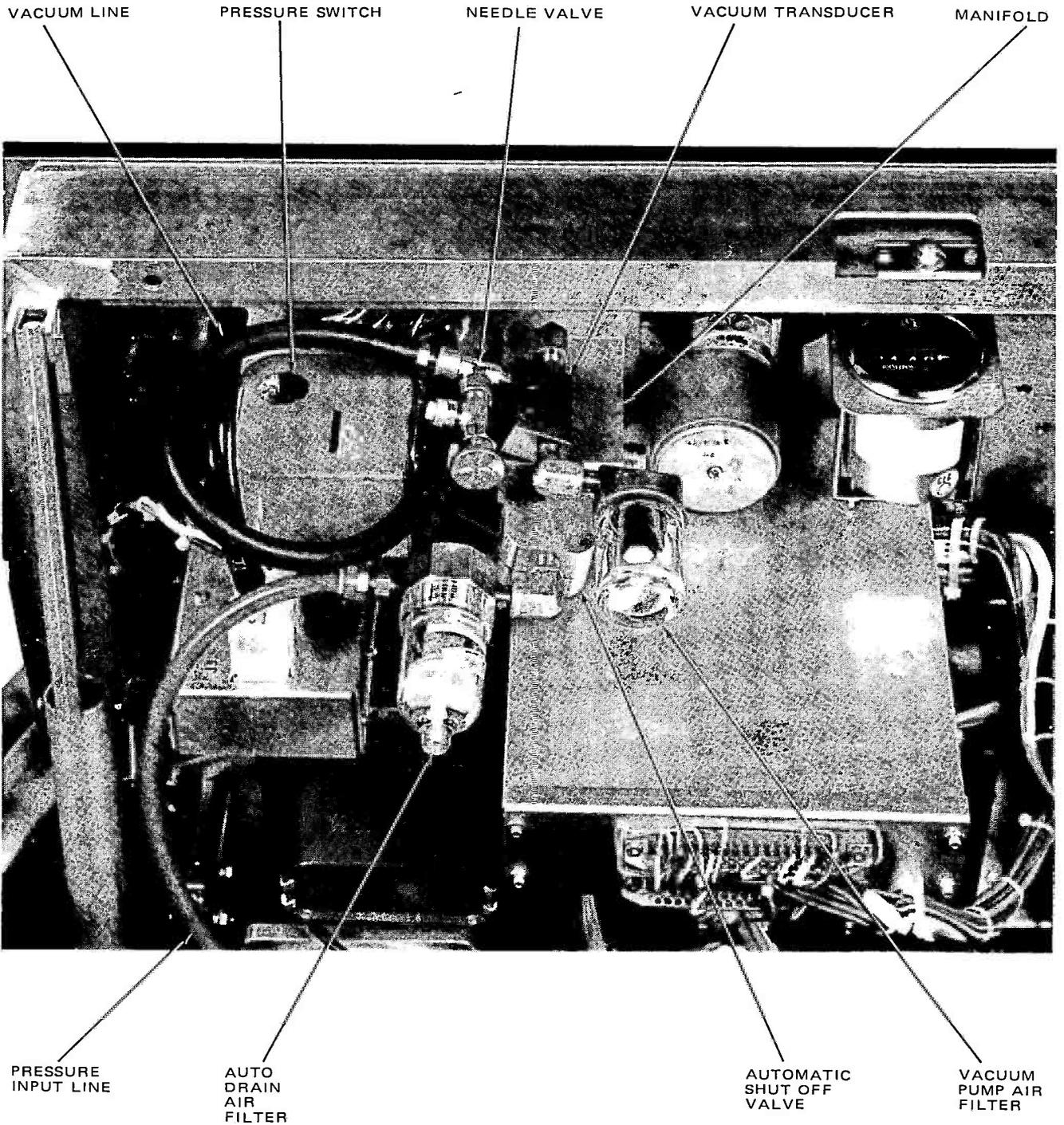


Figure 1-4. Pneumatic System

1-7 Head Channel Assembly

The head channel assembly is mounted on the bottom of the transport top plate, and consists of the head channel housing, an rf preamplifier printed wiring assembly (pwa), a record amplifier pwa, and an input/output connector. The two pwa's are mounted in guides inside the housing; the connector is mounted on the bottom of the housing. The head channel assembly provides preamplification of the video signal coming from the video head assembly during playback, and provides record amplification of a modulated video signal during record mode.

1-8 Triac Control Assembly

The triac control assembly consists of a printed wiring assembly and housing. The assembly is mounted below the head channel assembly and has appropriate controls for tape tension adjustments. The triac control assembly sets the amount of tape tension by controlling the voltage applied to the takeup and supply reel torque motors. The triac control assembly is also equipped with a circuit breaker in the torque motor ac line (130 volts ac) and switches +24 volts to the capstan solenoid during play or record modes. The triac control assembly responds to inputs from the system control logic.

1-9 Video Erase Head Assembly

The video erase head assembly consists of two rotating tape guides, a video erase head, an erase indicator lamp, a stationary tape guide, mounting plate and housing. The assembly is mounted on the transport top plate just to the left of the video head housing. The rotating and fixed guides route the tape past the erase head which contacts the back side of the tape (the side away from oxide). The lamp lights when the erase head is energized.

The video erase head is connected to an erase driver assembly mounted under the transport top plate behind the pneumatic assembly. The erase driver chassis is enclosed, and holds a printed wiring assembly and two connectors (J5 and J6). The erase driver provides drive current for the video erase head.

1-10 Audio Head Assembly

The audio head assembly, Figure 1-5, is mounted just to the right of the video head assembly, and includes the audio and cue erase head, the audio and cue play/record heads, and the optional audio monitor playback head. The audio and cue heads are mounted in a protective housing on the audio head assembly baseplate. The audio monitor head is mounted outside the housing and is positioned to contact the back side of the tape. All head stacks are fix-mounted and require no adjustment.

1-11 Tape Counter and Head Hours Meter

A tape counter, calibrated in hours, minutes, and seconds is mounted on top of the transport top plate, in the tape path just before the takeup reel. The tape counter is driven by a grooved idler roller which is turned by tape motion. The counter indication is applicable when the transport is operated at 15 inches-per-second. A knurled knob on the side of the counter allows the counter to be reset to zero.

A head hours meter, mounted under the top plate, is an electrical meter which records the time, in hours, that the video head assembly is in use. The head hours meter is useful for predicting head wear, and for scheduling maintenance.

1-12 VIDEO HEAD ASSEMBLY

The AVR-2 Videotape Recorder uses the Mark XV video head assembly. The assembly is built on a rigid machined base plate which mates with machined surfaces on the transport top plate. The head assembly is secured to the top plate with three screws. The video head assembly includes a video headwheel, a motor and optical commutator, and a magnetic tachometer.

1-13 Video Headwheel

The video headwheel is mounted on the motor armature shaft, and holds four video head tips spaced 90-degrees apart around the periphery of a two-inch diameter drum. Each head tip is connected to the primary of a rotary transformer

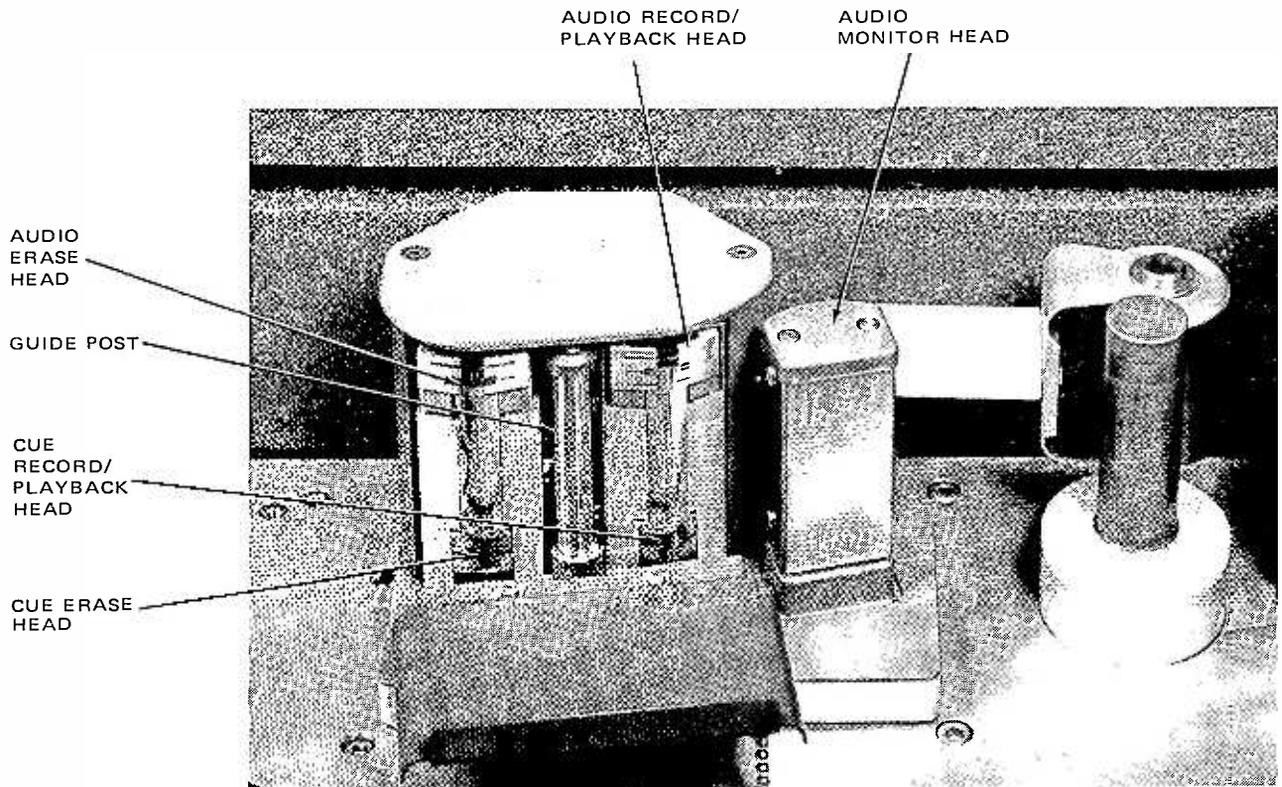


Figure 1-5. Audio Head Assembly

mounted on the drum shaft. The primary windings rotate within the secondary windings which are attached to the head assembly base plate. Output leads from the secondary are routed to the rf preamplifier assembly under the transport top plate.

1-14 Headwheel Motor

The headwheel motor is a three phase, delta-wound motor fitted with an optical commutator. The armature of the motor rides on air-bearings, the air being supplied by the pneumatic system. The thin cushion of air allows the armature to float in a nearly frictionless condition.

The optical commutator comprises a split cone reflector attached to the armature shaft, a light-emitting diode (LED), and three light sensors spaced 120-degrees apart around the base of the cone. The half of the cone that is cut

away is painted black and does not reflect light from the LED; the other half, the hemi-conical section, is polished to reflect light from the LED onto the three sensors. As the cone rotates, the output from the sensors is an indication of the armature position, and this indication is routed to the servo system to commutate the motor input. The motor receives a square wave input, the amplitude of which determines the motor speed.

1-15 Magnetic Tachometer

The magnetic tachometer comprises a timing wheel assembly and a pickup coil. The timing wheel is a 1-3/4 inch aluminum disc fitted with eight magnetic inserts spaced 45-degrees apart on the periphery of the disc. The wheel is secured to the motor shaft and the pickup coil is mounted adjacent to the edge of the disc. Each revolution of the motor produces eight output pulses from the pickup coil, and these pulses are routed to the servo system.

1-16 Vacuum Tape Guide

The vacuum tape guide is machined to fit the curvature of the head drum and thereby holds the tape against the video head tips. A small vacuum chamber in the tape guide pulls the tape into conformance with the guide curvature, and a small shoulder on the inside edge of the guide holds the tape in vertical alignment. Vacuum for the tape guide is provided by the pneumatic system.

A tape guide solenoid is energized during play or record mode, and advances the tape guide toward the video head drum. In all other modes, the solenoid is deenergized and the tape guide pulls the tape away from the video heads to minimize head wear and avoid possible tape damage.

1-17 ELECTRONICS ASSEMBLY

The electronics assembly, Figure 1-6, is a single card rack assembly housed in an enclosed chassis which holds up to 30 printed wiring assemblies (pwa's). Each pwa is constructed on a 9-inch by 13-inch printed wiring board, and the circuits are all solid state electronics.

The pwa slides in and out of the chassis on nylon guides, and the pwa edge connector mates with female connectors at the rear of the rack assembly. The female connectors form part of a mother board assembly which routes the pwa signals throughout the system and to input/output connectors on the rear panel of the chassis.

1-18 Power Supplies

The system power supplies, Figure 1-7, consist of a dc voltage source and eight regulators. The dc source comprises an iron-core transformer, diode

bridge full-wave rectifiers, and 40-volt filter capacitors. The dc source is mounted in a removable tray at the rear of the electronics card rack. The tray is secured to the chassis with two screws, and the dc source is connected to the regulators through an extra long cable which allows the tray to be removed for maintenance without disconnecting any of the wiring.

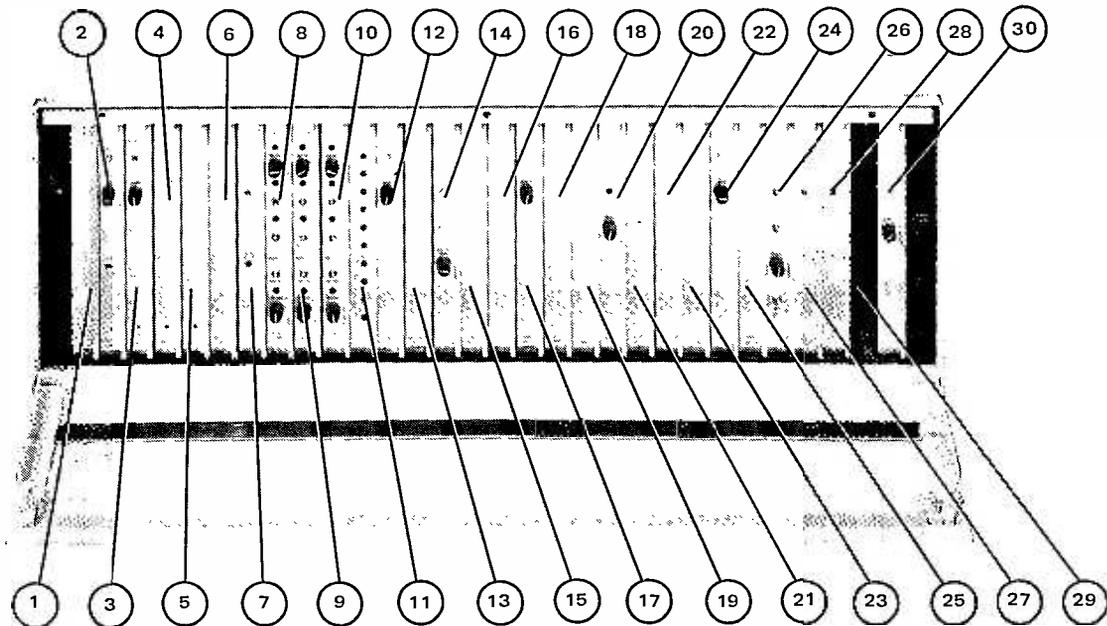
The regulators are contained on two printed wiring assemblies (pwa's) with series-element power transistors mounted on heatsinks separate from the pwa's. The +12-volt and -24-volt regulator pwa is mounted on the inside of the electronics chassis rear panel. Series-element transistors and 25-watt series resistors are mounted adjacent to this pwa. The rear panel is hinged to fold down for easy access to power supply components.

The other regulator pwa is a plug-in assembly which fits in card rack slot 11. This regulator feeds power transistors mounted on heatsinks on a vertical panel behind the electronics card rack. With the dc power source tray removed, all of the power transistors are accessible for testing if required.

An ac input 10-ampere circuit breaker is mounted just to the left of the power transformer on the power source tray. A pushrod is secured to the breaker switch with a clevis and bolt attachment. The pushrod enables breaker switching from the front of the electronics assembly.

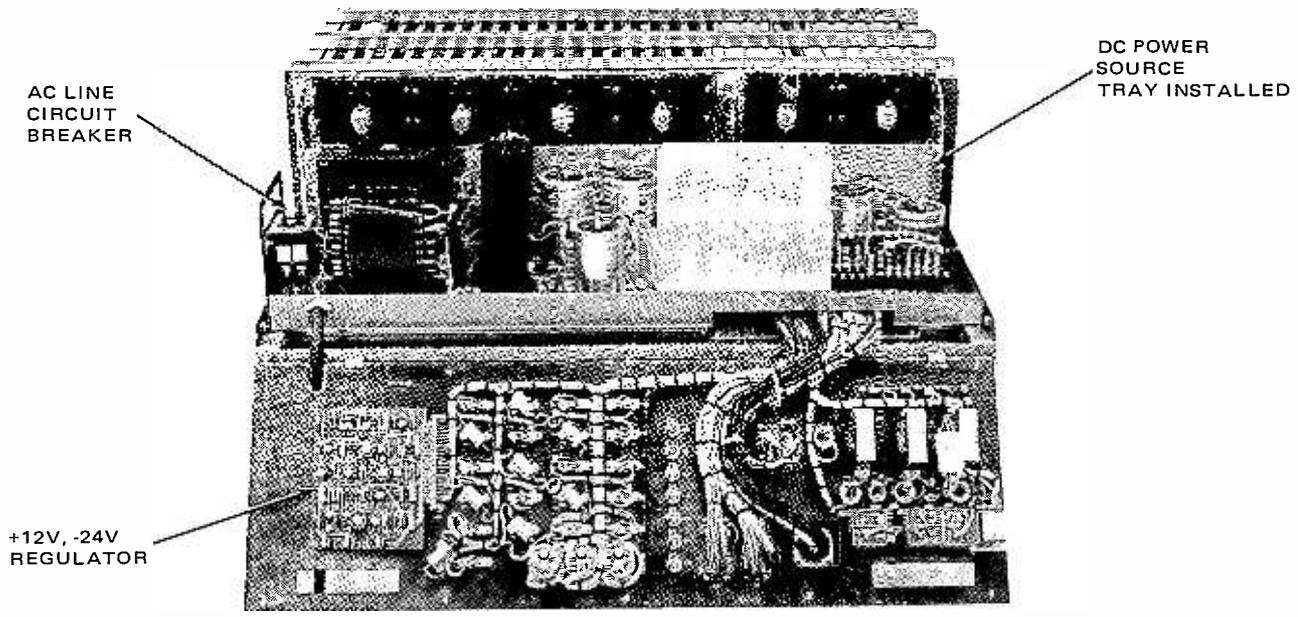
1-19 SPECIFICATIONS

Table 1-2 gives specifications and performance characteristics for the AVR-2 Videotape Recorder. These specifications are subject to change without prior notice.



- | | |
|---|--|
| 1. TRACKING AND CAPSTAN DRIVE PWA OR
AUTO TRACKING ACCESSORY | 16. DEMODULATOR PWA |
| 2. CAPSTAN SERVO PWA | 17. VIDEO INPUT PWA |
| 3. CT & SYNC PROC PWA | 18. A/D CONVERTER A PWA |
| 4. HEAD PHASE COMP PWA | 19. A/D CONVERTER B PWA |
| 5. HEAD DRIVER PWA | 20. CLOCK GENERATOR PWA |
| 6. CONTROL LOGIC PWA | 21. BURST STORE GENERATOR PWA |
| 7. EDITOR OR PWA (Accessory) | 22. MEMORY PWA |
| 8. CUE PWA | 23. DATA BYPASS PWA (Standard) TWO-LINE
DELAY PWA (Accessory) |
| 9. AUDIO I PWA | 24. MAIN D/A PWA |
| 10. AUDIO II PWA (Stereo Option) | 25. VIDEO OUTPUT PWA |
| 11. POWER SUPPLY REGULATOR PWA | 26. VELOCITY COMPENSATOR I PWA (Accessory) |
| 12. MODULATOR PWA | 27. VELOCITY COMPENSATOR II PWA (Accessory) |
| 13. MONITOR SWITCH & COLOR FRAMING
PWA | 28. LOGIC PWA |
| 14. AUTO CHROMA PWA (Accessory) | 29. SYNC GENERATOR LOGIC PWA (PAL-M & PAL/
SECAM ONLY) |
| 15. SW EQUALIZER PWA | 30. SYNC GENERATOR PWA |

Figure 1-6. Electronics Assembly



+12V, -24V
REGULATOR
SERIES ELEMENTS

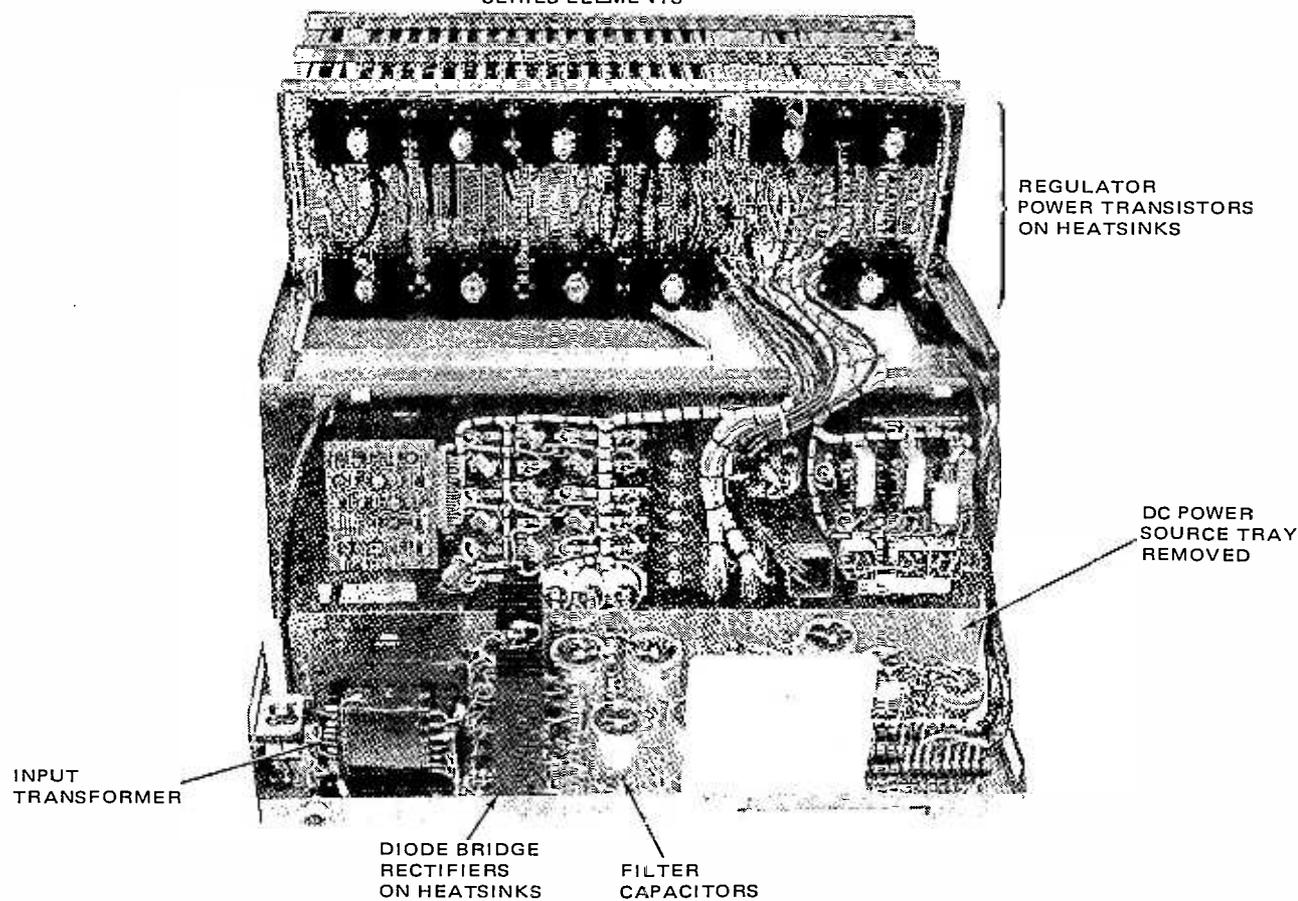


Figure 1-7. Card Rack Assembly Switches and Controls

Table 1-2. Specifications

VIDEO PERFORMANCE	525/60 NTSC	625/50 PAL/SECAM
Bandwidth	Flat to 4.5 MHz; -3 dB at 5.0 MHz; Tolerance ± 0.5 dB	Flat to 5.5 MHz; -3 dB at 6.0 MHz; Tolerance ± 0.5 dB
Signal-to-Noise Ratio (Rohde & Schwarz Unweighted)	15 in/s: 46 dB peak-to-peak video to rms noise on inter- change basis 7-1/2 in/s: 43 dB peak-to-peak, video to rms noise on inter- change basis	39.7 cm/s: 43 dB minimum peak-to-peak, video to rms noise on interchange basis 19.85 cm/s: 40 dB peak-to- peak, video to rms noise on interchange basis
Low Frequency Linearity	2% Blanking to White (max)	2% Blanking to White (max)
Differential Gain	4% max Blanking to White	4% max Blanking to White
Differential Phase	4° max at 3.58 MHz off tape	4° max at 4.43 MHz off tape
Chrominance to Luminance Delay	25 nsec max	30 nsec max
Transient Response Max K-factor 2T sine ² pulse	1.0 percent	1.0 percent
Moire	-40 dB (color bars 75% ampli- tude, 3.58 MHz subcarrier)	-36 dB (color bars 75% ampli- tude, 4.43 MHz subcarrier; without setup)
AUDIO PERFORMANCE	STANDARD AUDIO TRACK	DUAL AUDIO TRACK (Optional) As Measured on Either Track
Frequency Response ¹ (400 Hz Reference) at 15 in/s or 7-1/2 in/s	± 2 dB, 50 to 15,000 Hz	± 2 dB, 50 to 15,000 Hz
Signal-to-Noise at 15 in/s or 7-1/2 in/s	Down 53 dB from peak operat- ing level	Down 46 db from peak operat- ing level Down 50 dB from peak op- erating level (Ampex 175 Videotape)
Distortion (Measured at 1 kHz)	Less than 1% rms at operating level (flux density – 110 nWb/meter of track width)	Less than 1% rms at operating level (flux density – 110 nWb/meter of track width, or 175 nWb/meter on Ampex 176 Videotape)
Crosstalk	Not applicable	-45 dB at 1 kHz
Flutter & Wow (NAB unweighted; 0.6 Hz to 250 Hz)	15 in/s: 0.10% rms 7-1/2 in/s: 0.15% rms	Same
Flutter & Wow (Din weighted)	39.7 cm/s: 0.08% rms 19.85 cm/s: 0.1% rms	Same

All performance measured using Ampex 175 Videotape or Equivalent, except as noted.

Table 1-2. Specifications (Continued)

CUE TRACK PERFORMANCE

Frequency Response	15 in/s: ± 2 dB, 60 to 10,000 Hz 7-1/2 in/s: ± 2 dB, 60 to 8,000 Hz (A 30 dB notch filter is provided at the control track frequency)
Distortion (Measured at 1 kHz)	Operating level 1% rms maximum

PHYSICAL DIMENSIONS

	TRANSPORT PACKAGE	ELECTRONICS PACKAGE	CONSOLE	MONITOR BRIDGE	COMPLETE SYSTEM W/CONSOLE AND MONITORING
Height	17 in (432 mm)	12 in (305 mm)	43 in (1092 mm)	12-1/4 in (311 mm)	65-3/4 in min (1657 mm) 71-3/4 in max (1810 mm)
Width	34 in (864 mm)	34 in (864 mm)	37 in (940 mm)	34 in (864 mm)	37 (940 mm)
Depth	27 in (686 mm)	27 in (686 mm)	32 in (813 mm)	21 in (533 mm)	32 in min (813 mm) 36 in max (914 mm)
Weight	155 lbs (70 kg)	190 lbs (86 kg)	475 lbs (216 kg)	128 lbs (58 kg)	638 lbs (290 kg)

TEMPERATURE & HUMIDITY

Temperature: 0°C to 45°C
Relative Humidity: 10% to 90% (non-condensing)

OPERATION

Tape Speed: 60 Hz 7-1/2 in/s or 15 in/s
50 Hz 19.85 cm/s or 39.7 cm/s

POWER INPUT

Input Voltages: 105, 110, 115, 120, 125, 127, 210, 220, 230, 240, 257

Input Current (without Monitor Bridge):

115V	10 amps (max)	7 amps (nominal)
230V	5 amps (max)	3.5 amps (nominal)

Air Input: 1 SCFM at 45 PSI

VIDEO SIGNAL INPUT (75 OHMS IMPEDANCE)

Composite Video:	0.7 to 1.8V P-P
Reference Input (75 ohms impedance):	0.7 to 1.8V P-P
Composite Color Signal:	0.7 to 1.8V P-P

VIDEO SIGNAL OUTPUT (75 OHMS IMPEDANCE)

Composite Video Signal:	1.0 Vp-p
Non-Composite:	0.714 V (525)

RECORD TIME – 7200 FT REEL

7.5 in/s	192 min
19.85 cm/s	185 min
15.0 in/s	96 min
39.7 cm/s	92 min

STARTING TIME

From Ready Mode: 1.0 sec (525/60)
2.0 sec (625/50)

AUDIO INPUT SIGNAL

Impedance:	50K ohms balanced or unbalanced bridging input
Amplitude:	-24 dBm to +16 dBm
Source:	Line

AUDIO OUTPUT SIGNAL

Output Impedance:	10 or 600 Ohms
Peak Output Level:	+27 dBm

Table 1-2. Specifications (Continued)

AUDIO OUTPUT SIGNAL (Continued)

Nominal Output at 0 VU on Level Meter: +8 dBm
Playback Equalization: ANSI: 2000/35 μ sec

CUE INPUT SIGNAL

Impedance:

Line: 50K ohms balanced or unbalanced
bridging input
MIC: 200 ohms, -55 dBm

Amplitude: -24 dBm to +16 dBm
Source: Line, microphone, cue tone
oscillator (built in for editing use)

CUE OUTPUT SIGNAL

Impedance: 10 or 600 ohms

Peak Output Level: +27 dBm

Nominal Output at 0 VU on level meter: +8 dBm

Playback Equalization:

ANSI: 2000/35 μ sec

SECTION II INSTALLATION

2-1 GENERAL

This section provides shipping, unpacking, assembling, siting, and installation information for the AVR-2 Videotape Recorder/Reproducer.

2-2 UNPACKING

The AVR-2 is shipped with its major units, e.g., the tape transport, electronics tray, console, and monitor bridge (if one is ordered), in separate containers. To unpack the units, use a nail puller to remove the top and sides of the containers. Use care when unpacking the equipment to prevent damage to any mechanical and electrical parts, or to the finish on the units.

Check the equipment received against the packing list to ensure that the shipment is complete. Examine the units carefully for damage that may have occurred during shipment and report any shortages or damage to the carrier and to the nearest Ampex representative or

Ampex Video Technical Support, MS 3-46
401 Broadway
Redwood City, CA 94063

2-3 ASSEMBLING THE AVR-2 CONSOLE

In some instances the AVR-2 console is shipped disassembled. To assemble the console proceed as follows:

1. Select an area free from obstruction and set the lower console frame (see Figure 2-1) on its casters.
2. Select one of the side panels (see Figure 2-1) and fasten it to the lower console frame using eight 1/4 x 5/8-inch hex socket capscrews. Use a 1/4-inch spring lockwasher and a 1/4-inch plain washer with each capscrew. Do not completely tighten the screws.
3. Fasten the other side panel as described in step 2.
4. Fit the upper console frame between the two side panels above the lower console frame and fasten it with four 1/4-20 capscrews, 1/4-inch lockwashers, and 1/4-inch plain washers on each side.
5. When both upper and lower console frames are fastened in place, tighten all of the screws.

If a monitor bridge is purchased and shipped with the units of the AVR-2, assemble the bridge as follows:

1. Fasten a spacer plate (see Figure 2-1) to the inside, near the top rear, of each side panel of the console. Use two number 8 spring lockwashers and two 8-32 x 7/16 hex socket capscrews for each spacer. Align the spacer plate so that four holes are aligned with the captive nuts in the side panel. These are used to mount the bridge support columns.
2. Mount the left-hand monitor bridge support column to the left side panel using four 1/4-inch spring lockwashers,

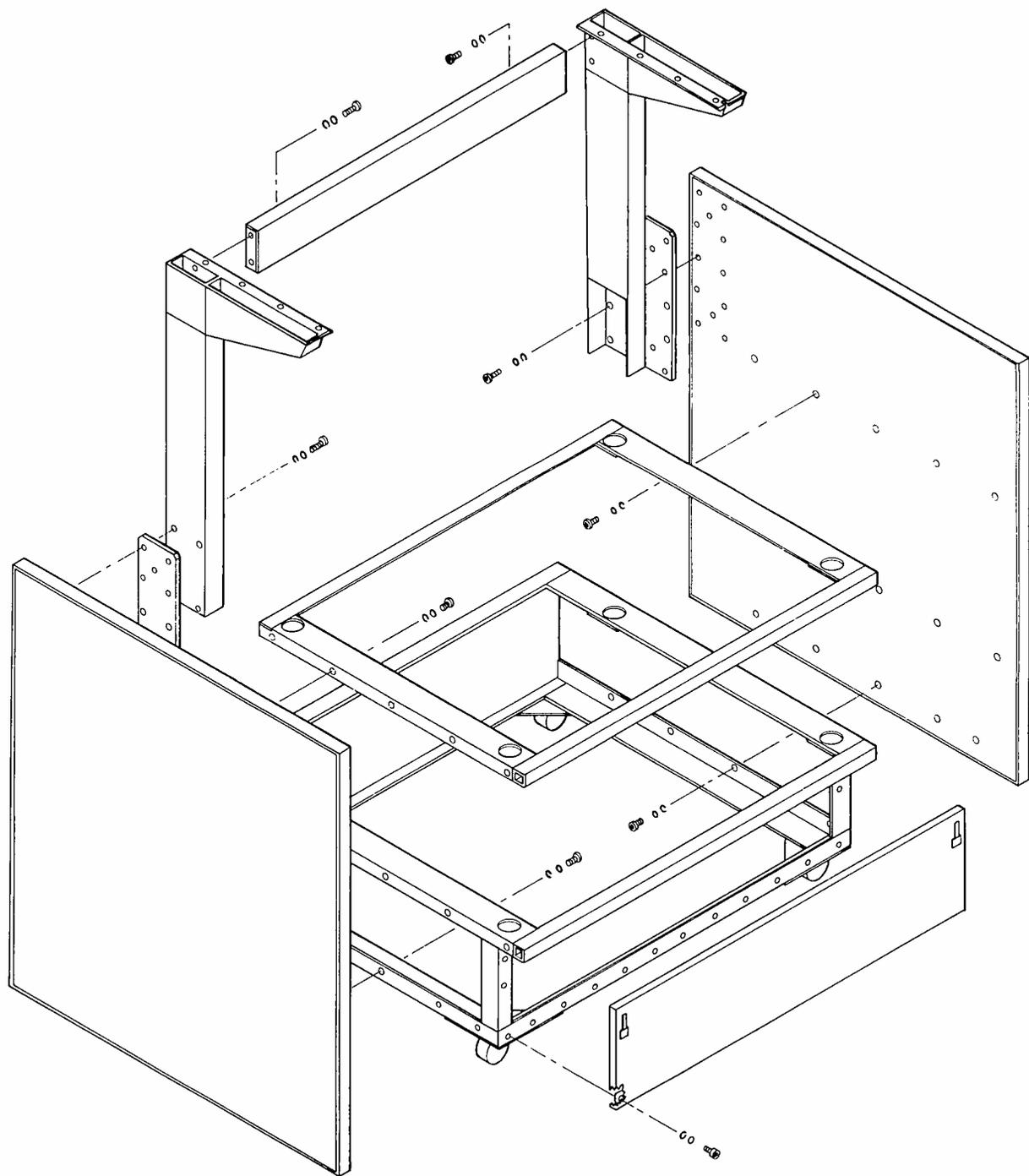


Figure 2-1. Exploded View, AVR-2 Console

four 1/4-inch plain washers, and four 1/4-20 x 1-inch hex socket capscrews. These screws go through the spacer plate into the captive nuts in the side panel.

3. Mount the right-hand monitor bridge support column to the right side panel as directed in step 2.
4. Fit the column brace between the two support columns and fasten it in place using two 1/4-20 x 5/8-inch hex socket capscrews, two 1/4-inch spring lock-washers, and two plain washers.
5. Check that all screws are tight.

Mount the monitor case on the monitor bridge support columns and the column brace, and fasten with four 10-32 x 1/2 inch long hex socket capscrews, four number 10 flat washers, and four number 10 spring lock washers on each side. See Figure 2-2 for the position of the monitor bridge that may be selected. Note that the monitor case may be mounted with the rear flush with the support columns or extended 4 inches in back of the support columns. Also the support columns may be raised or lowered 5-1/2 inches.

2-4 INSTALLING THE ELECTRONICS ASSEMBLY

Remove the electronics assembly from its shipping container. The electronics assembly is installed in the console by lifting it by the front and the rear, and sliding it onto the lower rack of the console. Be certain that the rubber feet of the electronics assembly seat firmly in the four round recesses in the lower frame.

2-5 INSTALLING THE TAPE TRANSPORT

Remove the tape transport from its shipping container. The tape transport is installed in the cart by lifting it from under its front panel and by the channel bar in the rear. Set the tape transport on the upper rack of the console so that the rubber feet, under the tape transport, seat in the round recesses in the console frame.

2-6 SITE SELECTION

The area chosen for the installation of the AVR-2 Recorder/Reproducer should be adequately lighted and ventilated, and relatively dust free. The area should not be close to any strong electromagnetic fields; inasmuch as recording is by an electromagnetic process, it is possible that strong electromagnetic fields may affect system performance. Common sources of interference are fluctuating loads on nearby high-voltage lines, heavy-duty transformers, elevator motors, and radio transmitting equipment.

CAUTION

DURING SYSTEM OPERATION, COOLING AIR IS BROUGHT IN THROUGH THE BOTTOM OF THE ELECTRONICS ASSEMBLY. THIS AIR FLOW MUST NOT BE IMPEDED OR DAMAGE TO THE ELECTRONICS WILL RESULT. THE ELECTRONICS ASSEMBLY MUST BE MOUNTED ON A SURFACE THAT IS FIRM ENOUGH SO THAT AT LEAST 1/2-INCH CLEARANCE BETWEEN THE MOUNTING SURFACE AND THE BOTTOM OF THE UNIT IS MAINTAINED.

The AVR-2 Videotape Recorder/Reproducer occupies a floor area of approximately 36-1/2 inches by 32 inches. Refer to recorder outline drawing Figure 2-2 for the area required when the monitor bridge is mounted at its rear extremity. All normal adjustment and maintenance points are accessible from the front of the recorder. In the standard configuration, in which the monitor bridge is mounted to the console, the entire unit weighs 630 pounds.

2-7 POWER AND SIGNAL CABLE CONNECTIONS

All electrical connections to and from the recorder are made to connectors at the rear of the recorder. See Figure 2-3 for locations of the connectors. The signal cables from the monitor bridge to the electronics tray are routed through the channel in the monitor bridge support column.

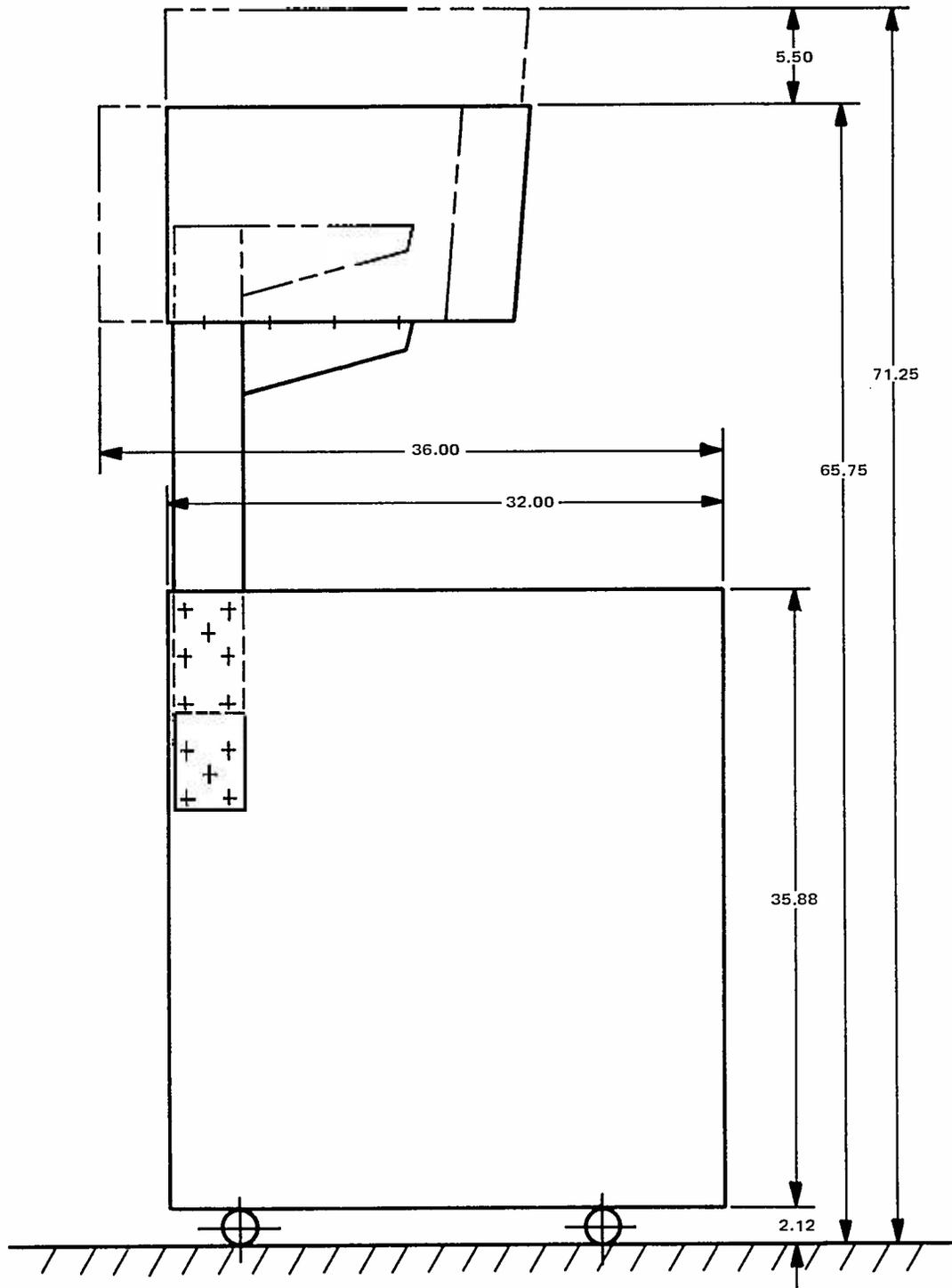


Figure 2-2. Dimensions of AVR-2 Videotape Recorder/Reproducer

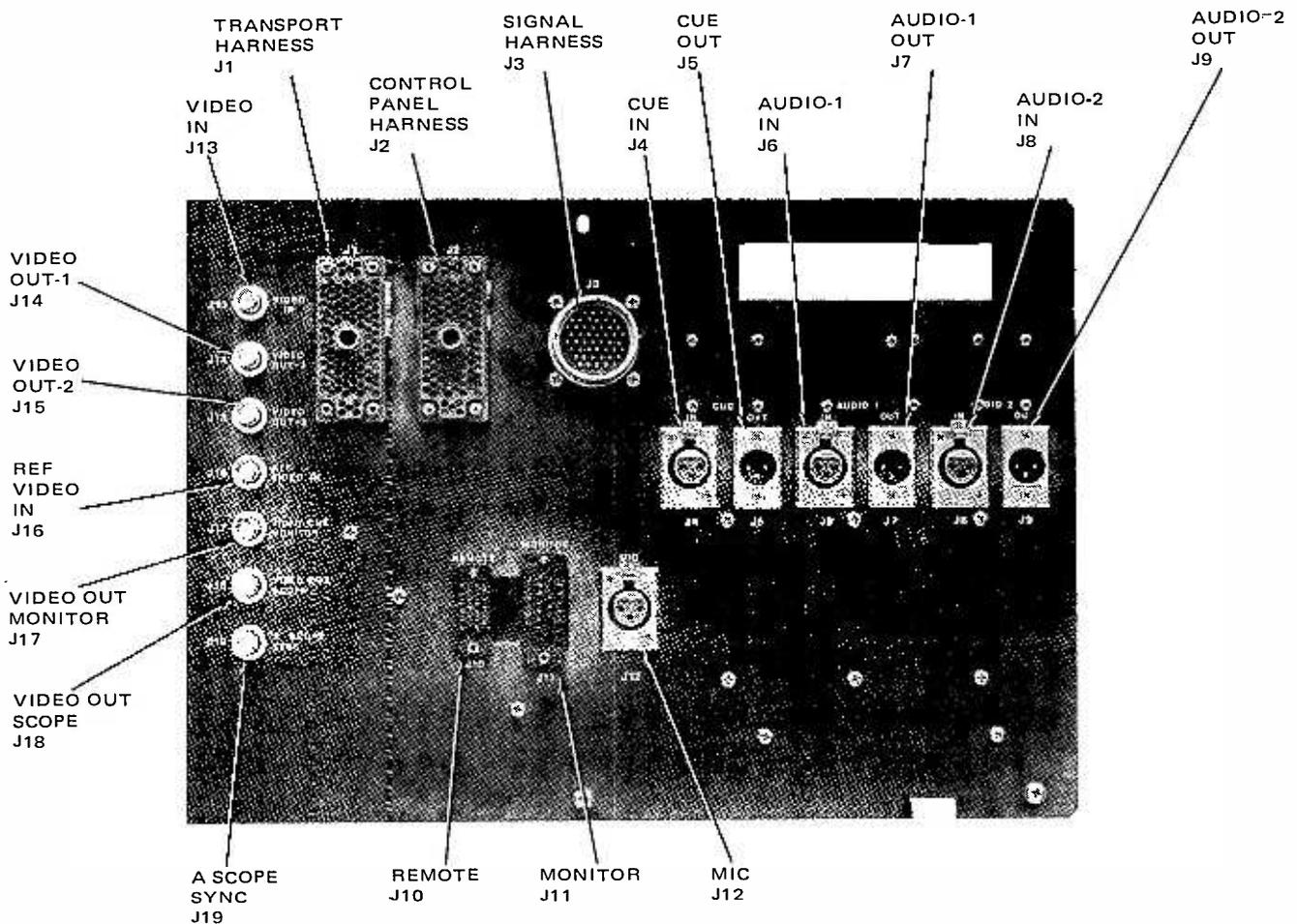


Figure 2-3. Signal and Power Connections

2-8 SYSTEM POWER CONNECTION

Main power is connected to the system through a captive power cable that is attached to circuit breaker CB1 in the power supply. The ac power cable is a 10-AWG standard three-conductor, rubber insulated cable fitted with a molded three-prong plug, P1. The ac receptacle supplying power to the system must be a female type to fit P1. The system requires an input voltage of 115 Vac at 10 amperes or 220 Vac at 5 amperes, 50 or 60 Hz.

The main power transformer (see Figure 2-4) has various taps that permit the system to use any one of ten different input voltages: 105, 110, 115, 120, 127, 210, 220, 230, 240, and 254 Vac.

The transformer is factory-set to 115 Vac for systems to be delivered to domestic locations. Line voltage at the power transformer should be measured under load conditions and, if required, the taps reset to correspond to the line voltage. Table 2-1 lists the tap connections on the transformer and the circuit breaker for the various input voltages.

2-9 SIGNAL CONNECTIONS

Video input and output connectors, audio input and output connectors, and all necessary reference connections are on the rear of the signal electronics tray. Certain connectors are supplied to the customer, but the cables that interface the

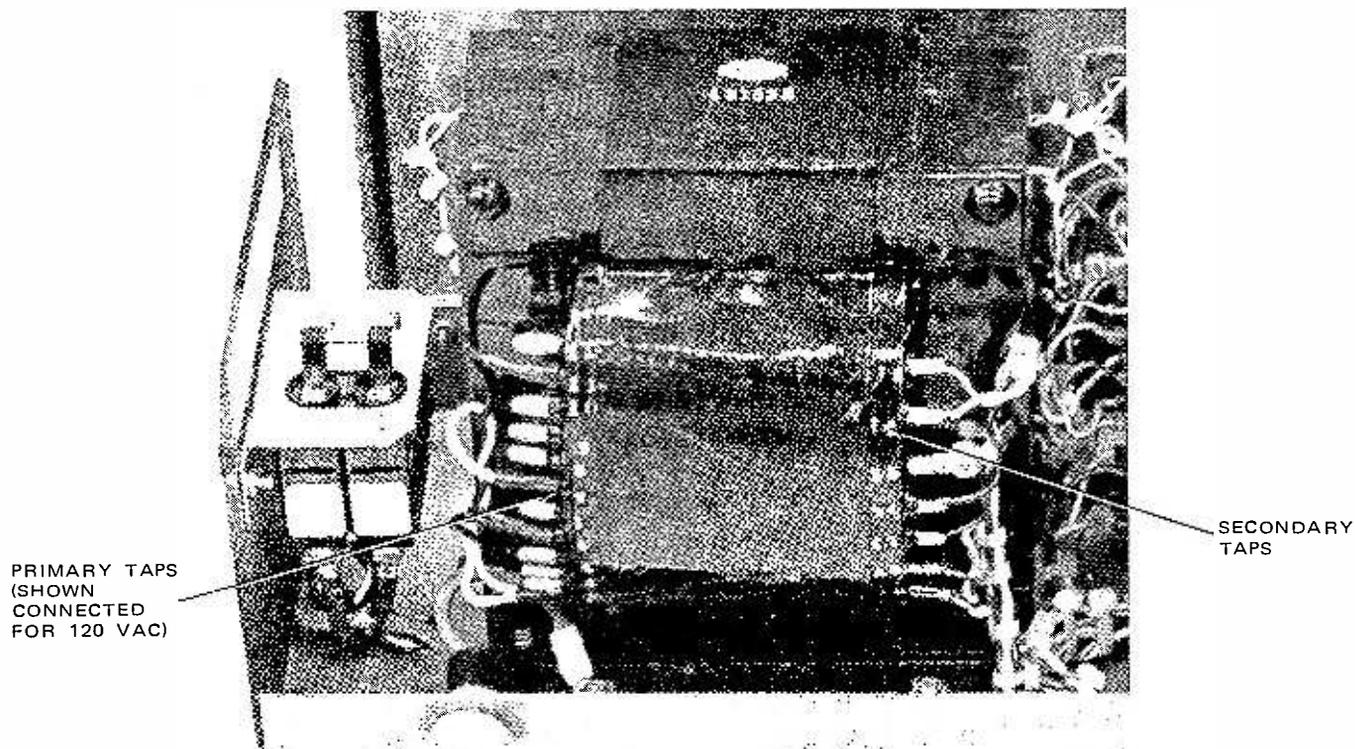


Figure 2-4. Power Transformer Tap Connections

AVR-2 with the external equipment must be supplied by the user. All video and reference interconnecting cables should be of minimum length, yet permit free movement of the AVR-2 cart within the operating area. The video input and output cables should be Belden No. 8281 coax, or equivalent, and all reference cables should be RG59B/U coax, or equivalent. The audio and cue cabling should be two-conductor, 20 or 22 AWG shielded, insulated cables fitted with three-pin audio connectors furnished (ITT/Cannon XLR-3-12C male and XLR-3-11C female, or equivalent). Connect as shown in Figure 2-5.

2-10 AIR CONNECTION

Bearing-air must be supplied to the tape transport. An air fitting is supplied on the rear of the tape transport that mates with an air hose

coupler type Tru Mate 12C, or equivalent. If the user does not have an air supply, one may be purchased from Ampex corporation as an accessory to the AVR-2. The air compressor must supply a nominal 45 psig of air pressure at a consumption rate of 1.0 scfm to the recorder.

2-11 HEAD INSTALLATION

The Ampex Mark XV head assembly is shipped in its own protective container and the head assembly must be mounted on the tape transport by the user. Before installing the head assembly, determine that its characteristics are correct for the operation of the AVR-2. The proper head tip width should be 5 mils for 7.5 in/s and either 5 mils or 10 mils for 15 in/s.

Mount the head assembly to the tape transport of the recorder using two 50074 mounting screws

Table 2-1. Main Power Transformer Primary Taps

PRIMARY CURRENT	PRIMARY VOLTAGE	CONNECTIONS	
		FROM	TO
10 AMPS	105 VAC	CB1-2B	T1-1
		T1-1	T1-7
		T1-2	T1-8
		AC COM	T1-2
	110 VAC	CB1-2B	T1-1
T1-1		T1-7	
T1-3		T1-9	
AC COM		T1-3	
115 VAC	CB1-2B	T1-1	
	T1-1	T1-7	
	T1-4	T1-10	
	AC COM	T1-4	
120 VAC	CB1-2B	T1-1	
	T1-1	T1-7	
	T1-5	T1-11	
	AC COM	T1-5	
127 VAC	CB1-2B	T1-1	
	T1-1	T1-7	
	T1-6	T1-12	
	AC COM	T1-6	
5 AMPS	210 VAC	CB1-1B	T1-1
		T1-2	T1-7
		AC COM	T1-8
	220 VAC	CB1-1B	T1-1
		T1-3	T1-7
AC COM		T1-9	
230 VAC	CB1-1B	T1-1	
	T1-4	T1-7	
	AC COM	T1-10	
240 VAC	CB1-1B	T1-1	
	T1-5	T1-7	
	AC COM	T1-11	
254 VAC	CB1-1B	T1-1	
	T1-6	T1-7	
	AC COM	T1-12	

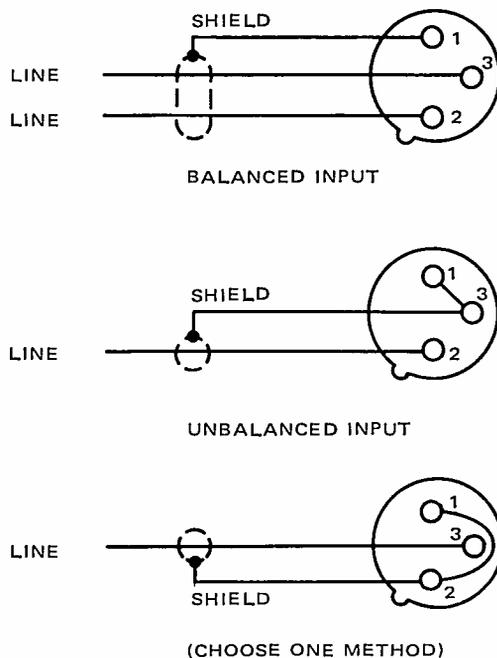


Figure 2-5. Audio and Cue Connections

that are supplied with the recorder and the mounting screw that is held captive in the head assembly plate.

CAUTION

USE CARE WHEN MOUNTING THE HEAD TO AVOID BENDING ANY OF THE CONNECTOR PINS. AVOID WARPING THE HEAD PLATE BY FIRST TIGHTENING ALL SCREWS FINGER TIGHT. THEN TIGHTEN THE TWO SCREWS AT THE RIGHT-HAND SIDE OF THE HEAD. TIGHTEN THE SCREW AT THE LEFT-HAND SIDE OF THE HEAD LAST.

2-12 REMOTE CONTROL

The cable from the remote control is plugged into the REMOTE receptacle J10. This connector is on the rear of the electronics tray.

2-13 INITIAL CHECKS PRIOR TO USE

The audio and cue boards should be checked to ascertain that the input attenuator and the output impedance shorting plugs are in the desired position. The positions are as follows:

The input attenuator, J1, is normally shipped with the shorting plug between A and B, which provides zero attenuation. When it is between A and C, 20 dB attenuation is provided; when it is between A and D, 40 dB attenuation is provided.

The output impedance, J11, is normally shipped with the shorting plug between A and B, which provides a 600-ohm output; when the shorting plug is between A and C, a low impedance output is provided.

SECTION III

OPERATION

3-1 GENERAL

The AVR-2 Videotape Recorder system is used for high quality recording and playback of color or monochrome video tape recordings. The system is adaptable for operation within NTSC, PAL, PAL-M and SECAM standards. It may be used in conjunction with various remote control systems and programming units.

This section describes the common operating procedures for the AVR-2 Videotape Recorder. Step-by-step procedures are given for preparing the equipment for operation and for operating the equipment. The section also provides tables listing all the controls and indicators with which the operator must be familiar in order to operate the system. Tables 3-1 through 3-7 list each control or indicator by name, describe its function, and show its location on the equipment.

3-2 PRELIMINARY PROCEDURES

Cleaning, degaussing, video head optimizing, and tape threading are procedures necessary for the proper operation of the system. Clean, degaussed, optimized heads give the highest quality of system performance, and these procedures should be carried out at the beginning of each operating period or at any time that poor performance indicates the need for it (and the circumstances permit). These preliminary procedures are described in the following paragraphs.

3-3 Head and Tape Path Cleaning

An effective cleaning agent recommended for a thorough cleaning of the heads and the complete

removal of oxide and dust accumulation is Ampex Head Cleaner, part number 087-007. If this is unavailable, pure xylene may be used as a temporary substitute. In areas where flammable cleaning materials are not permitted, Freon TF* (Ampex part number 050-104) may be used. However, Freon TF is not as efficient as the other two cleaners. Isopropyl alcohol is recommended for cleaning the pinch roller.

A soft lint-free cloth is recommended to clean surface areas such as the tape guides, compliance arms and the tape timer; a Q-tip (or equivalent) is recommended to clean smaller or less accessible surfaces, such as the video head tips and stationary heads. When using either, moisten (but do not saturate) the applicator with the cleaning agent. When cleaning any of the heads, exercise great care to avoid scratching the tape contacting surfaces.

CAUTION

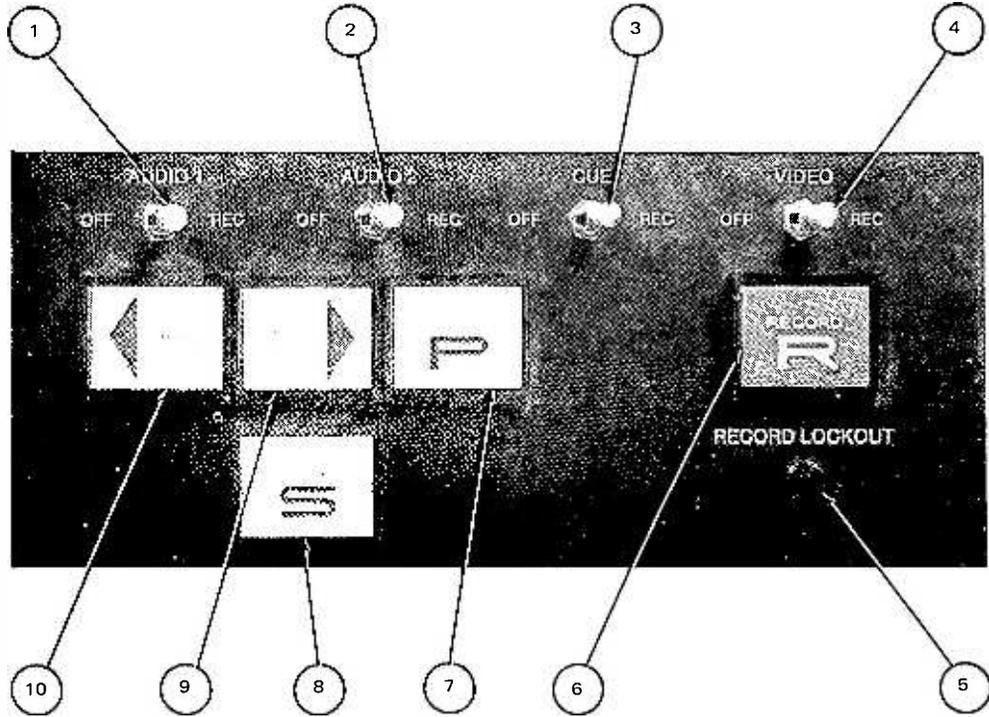
THE HEAD CLEANER WILL CAUSE DAMAGE IF IT COMES IN CONTACT WITH THE TAPE, PINCH ROLLER, OR PAINTED SURFACES.

Clean the heads and tape path as follows:

1. The system should be turned on (and in the stop mode) in order to supply air for the video head bearing. Push the MAIN POWER switch (Table 3-6, Index No. 40) inward to supply power to the system. Ensure that READY toggle switch (Table 3-2, Index No. 1) is set to OFF.

*Freon TF is a registered trademark of E.I. Dupont DeNemours Co.

Table 3-1. Control Panel (Middle Section) Operating Controls and Indicators

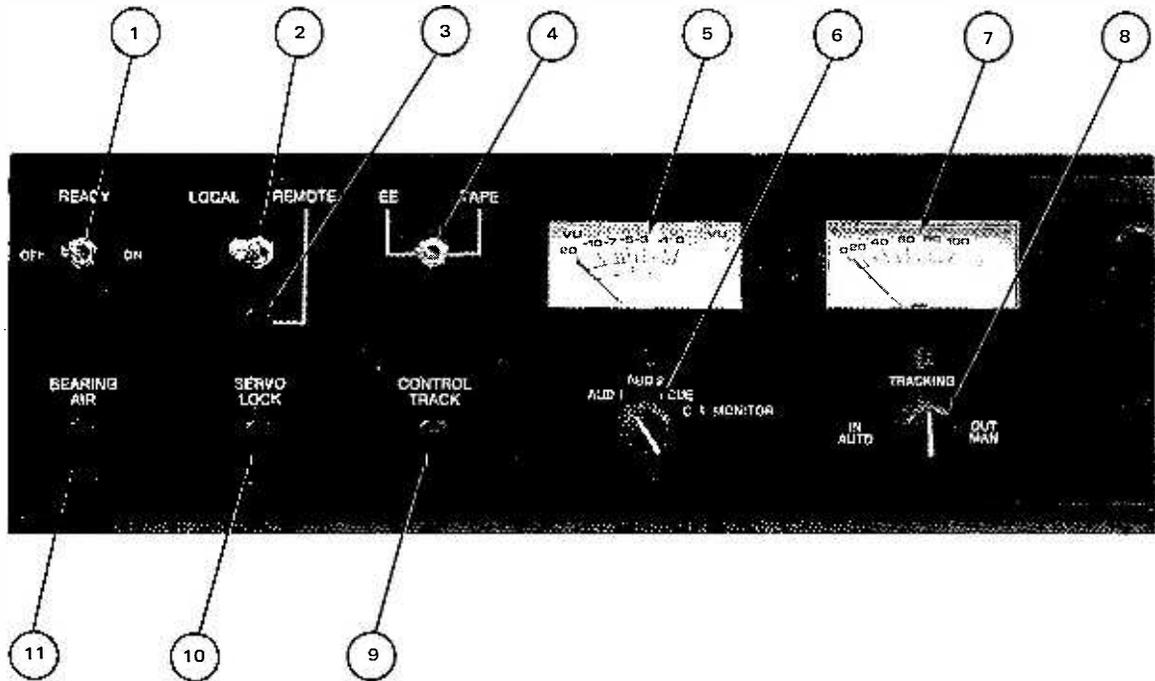


INDEX NO.	NAME	FUNCTION
1*	AUDIO 1 Toggle Switch	Effective only when system is in record mode. While set to OFF, recording may not be made on audio 1 track of tape.
2*	AUDIO 2 Toggle Switch	Effective only when system is in record mode. While set to OFF, recording may not be made on audio 2 track of tape.
3	CUE Toggle Switch	Effective only when system is in record mode. While set to OFF, cue track signals cannot be recorded.
4	VIDEO Toggle Switch	Effective only when the system is in the record mode. While set to OFF, video signals cannot be recorded.
5	RECORD LOCKOUT Indicator	Red indicator. Lights steadily when RECORD LOCKOUT toggle switch on maintenance control panel is set to ON or when both the RECORD SAFETY and EDITOR toggle switches on the editor control panel are set to ON. Indicator flashes when one or more of the AUDIO 1, AUDIO 2, CUE or VIDEO toggle switches are set to OFF.

Table 3-1. Control Panel (Middle Section) Operating Controls and Indicators (Continued)

INDEX NO.	NAME	FUNCTION
6	RECORD Pushbutton	Initiates record mode when pressed simultaneously with PLAY pushbutton.
7	PLAY Pushbutton	Initiates playback mode.
8	STOP Pushbutton	Stops the system from any mode.
9	FAST FWD Pushbutton	Initiates rapid transfer of tape from supply reel to takeup reel.
10	RWD Pushbutton	Initiates rapid transfer of tape from takeup reel to supply reel.
<p>*The AVR-2 may have been configured with a one-track audio system, a stereo audio system, or a dual track audio system. In the one-track system, the AUDIO 1 toggle switch enables or inhibits audio recording on track 1 (the only audio track). The AUDIO 2 toggle switch is not effective. In the stereo system, two audio tracks are used. The AUDIO 1 toggle switch enables or inhibits recording on track 1; AUDIO 2 toggle switch enables or inhibits recording on track 2. Erase for both of the tracks is controlled by the AUDIO 1 toggle switch. In the dual track system, audio recording may be made on track 1 or track 2 or both. In this system, a split erase head is used; when recording over a prerecorded tape, existing material on one of the audio tracks may be preserved while the other track is rerecorded. The AUDIO 1 toggle switch controls recording (and erase) on track 1; AUDIO 2 toggle switch controls recording on track 2.</p>		

Table 3-2. Control Panel (Right Section) Operating Controls and Indicators

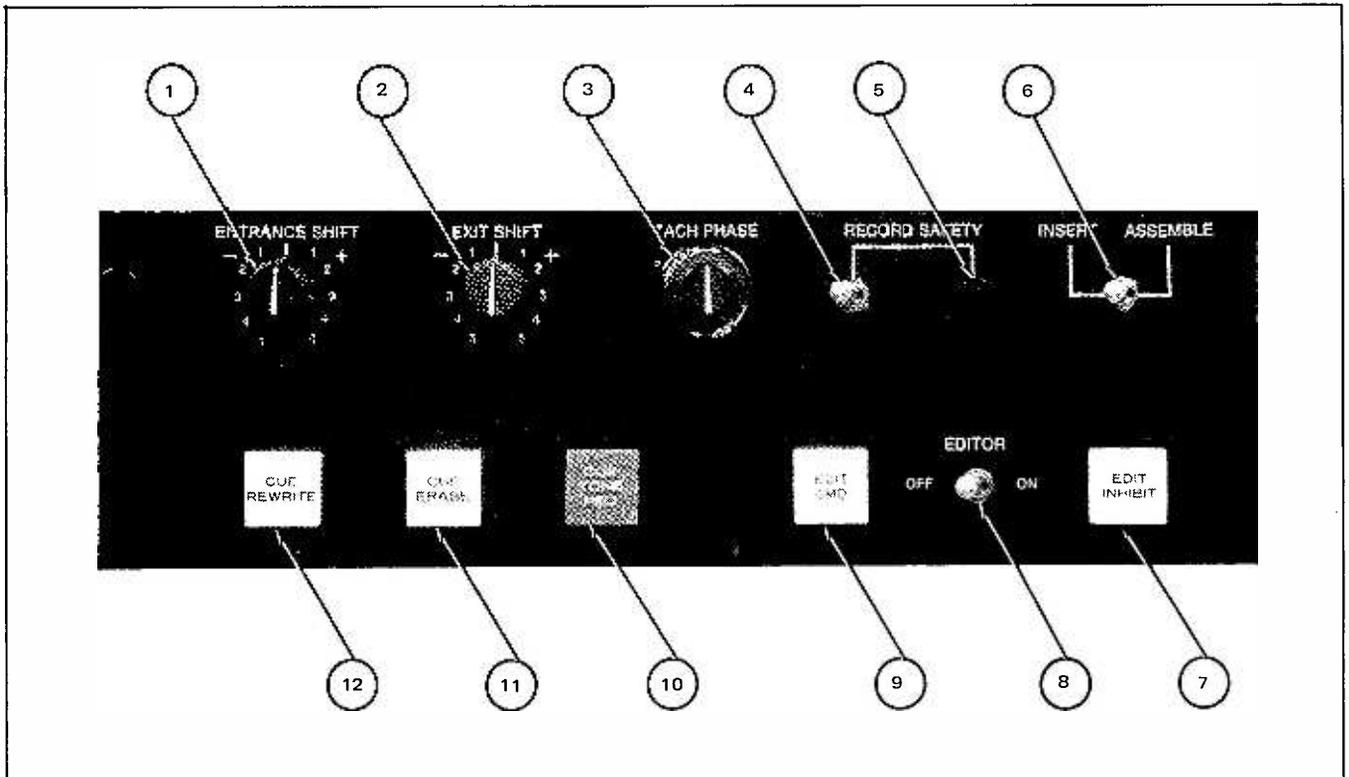


INDEX NO.	NAME	FUNCTION
1	READY Toggle Switch	When set to ON, applies power to the video head motor and causes the video head to spin. When set to OFF, video head spins only when the system is in the play or record mode.
2	LOCAL-REMOTE Toggle Switch	When set to REMOTE, operating controls (PLAY, RECORD, FAST FWD, RWD and STOP) on remote control panel (if provided) are enabled.
3	REMOTE Indicator	Blue indicator. Lights when LOCAL-REMOTE toggle switch is set to REMOTE.
4	EE-TAPE Toggle Switch	When set to EE (electronics-to-electronics) the system's record/playback heads are isolated from the record/playback electronics. Audio/video input signals are passed through the record electronics and the playback electronics but are not recorded on the tape. When set to TAPE, normal system operating modes are enabled.

Table 3-2. Control Panel (Right Section) Operating Controls and Indicators (Continued)

INDEX NO.	NAME	FUNCTION
5	VU Meter	In playback, indicates the level of the signal recorded on the track chosen by the AUD 1-AUD 2-CUE C.T. MONITOR switch. In record mode, indicates the level of the audio 1 or audio 2 input signals.
6	AUD 1-AUD 2-CUE-C.T. MONITOR Four position switch	Selects the track to be monitored by the VU meter.
7	TRACKING meter	In playback mode, indicates off-tape rf level to allow manual adjustment of the TRACKING potentiometer for optimum tracking. In record and stop modes, indicates level of input video to system.
8	TRACKING Control	Controls video head-to-track position. Control is manual (adjust the potentiometer) when knob is pulled out. Control is automatic when knob is pressed in and system is supplied with an Auto Tracking PWA (optional).
9	CONTROL TRACK Indicator	Red indicator. Lights when control track level in record or playback is lower than the established optimum level.
10	SERVO LOCK Indicator	Red indicator. Lights when the video headwheel is not locked to its speed reference or capstan servo is not locked.
11	BEARING AIR Indicator	Red indicator. Lights if pressure of air supplied to video head air bearing is below 35 psi.

Table 3-3. Editor Control Panel Controls and Indicators

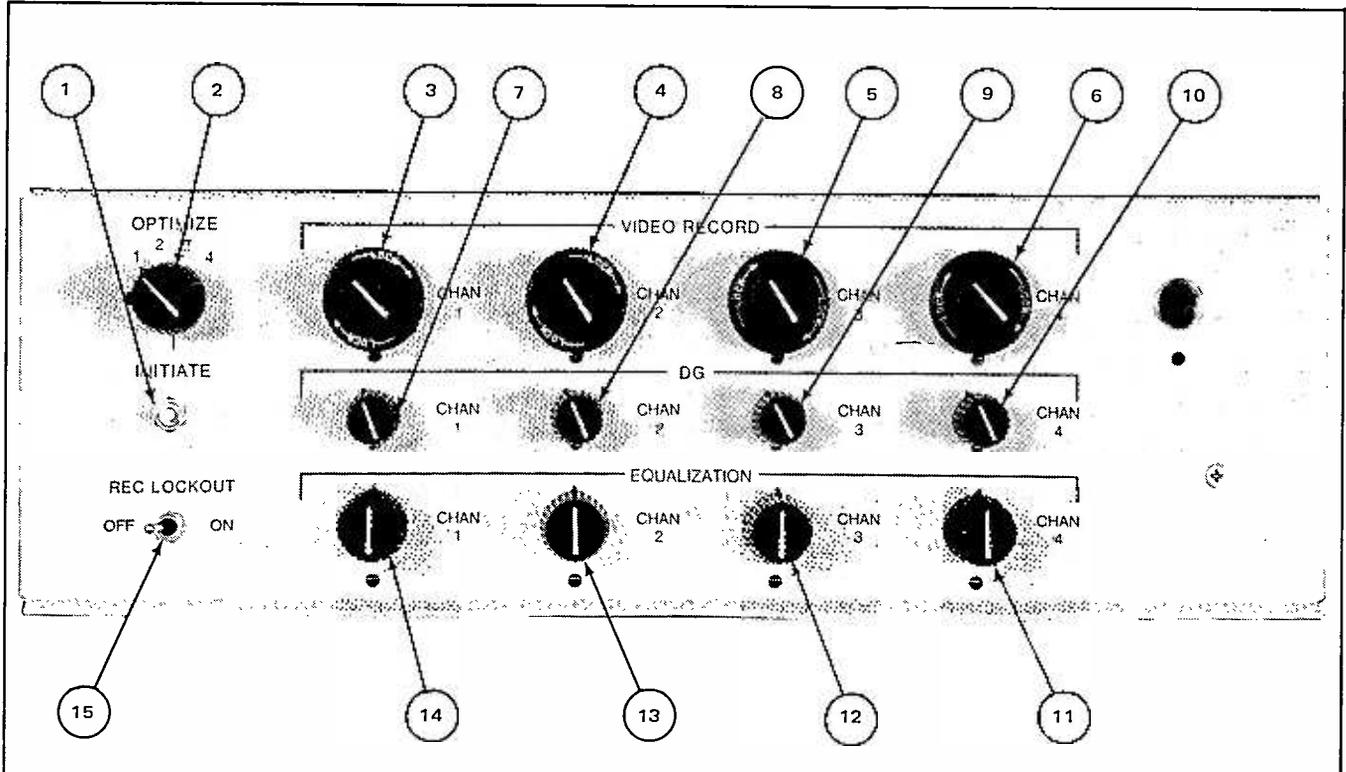


INDEX NO.	NAME	FUNCTION
1	ENTRANCE SHIFT Potentiometer	Advances or retards the effective location of the entrance edit cue tone (each dial unit equals approximately three frames).
2	EXIT SHIFT Potentiometer	Advances or retards the effective location of the exit cue tone (each dial unit equals approximately three frames).
3	TACH PHASE Potentiometer	Used to match the off-tape video signal exactly with the incoming video so that no time discontinuity occurs at the electronic splice.
4	RECORD SAFETY Toggle Switch	When set to ON (thrown to right), system cannot be placed in record mode unless the electronic editor is enabled. This prevents inadvertent erasure of material during an editing session.

Table 3-3. Editor Control Panel Controls and Indicators (Continued)

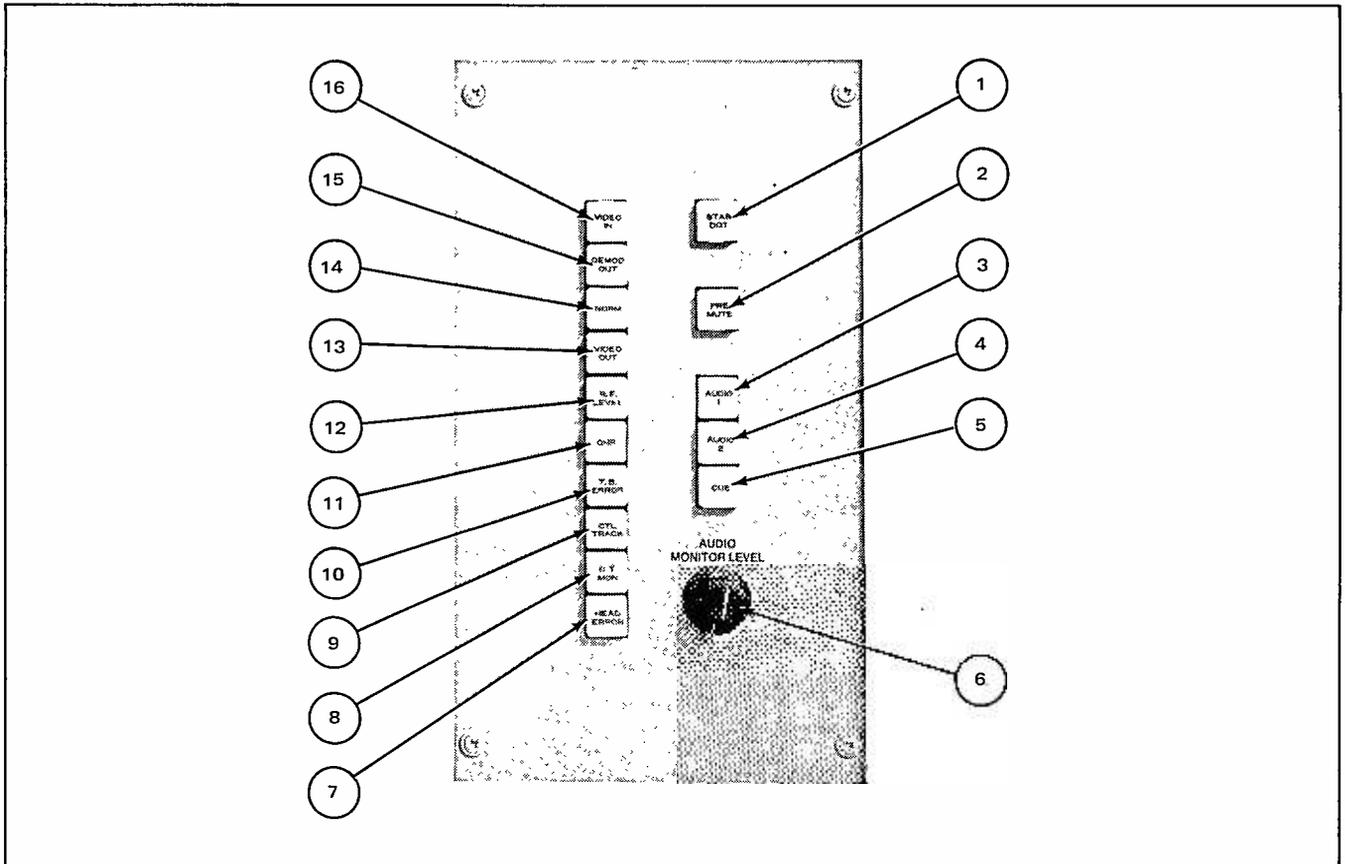
INDEX NO.	NAME	FUNCTION
5	RECORD SAFETY Indicator	Red indicator. Lights when RECORD SAFETY toggle switch is set to ON.
6	INSERT-ASSEMBLE Toggle Switch	Prepares editor for insert or assembly operation. In INSERT mode, the editor inserts new video material while retaining the previously recorded control track. In assembly mode, the editor follows the previously recorded control track up to the point of the electronic splice, then records a new track as a continuation.
7	EDIT INHIBIT Pushbutton	Inhibits editor control of the system when lit. Lights when the editor is turned on and whenever a new system mode is selected; will also light if cues are shifted erroneously while editing.
8	EDITOR ON-OFF Toggle Switch	When set to ON, electronic editor is enabled.
9	EDIT CMD Pushbutton	Initiates edit (electronic splice) without recording cue tones on tape. Illuminates while pressed or when a cue tone is read.
10	CUE TONE REC. Pushbutton	Records a cue tone (10 millisecond burst of 4 kHz) on cue track each time the pushbutton is pressed.
11	CUE ERASE Pushbutton	Erases cue tones while pushbutton is pressed. Illuminates only while pushbutton is pressed and a cue tone is being erased.
12	CUE REWRITE Pushbutton	Erases previously recorded cue tones and rewrites them at the advanced or retarded positions determined by the ENTRANCE SHIFT and EXIT SHIFT controls. If editor is in inhibit, cue tones are erased without rewriting them.

Table 3-4. Maintenance Panel Controls and Indicators



INDEX NO.	NAME	FUNCTION
1	INITIATE Pushbutton	Initiates video head optimization mode if pressed simultaneously with PLAY and RECORD pushbuttons.
2	OPTIMIZE Selector Switch	Selects video channel to be optimized when the system is in the video head optimization mode.
3	VIDEO RECORD CHAN 1	Adjusts the recording level for the channel indicated.
4	VIDEO RECORD CHAN 2	
5	VIDEO RECORD CHAN 3	
6	VIDEO RECORD CHAN 4 Potentiometers	

Table 3-5. Monitor Control Panel



INDEX NO.	NAME	FUNCTION
NOTE		
The monitor control panel is part of the optional monitor bridge assembly (see Figure 3-1).		
1	STAB DOT	Displays head wheel servo stability marker pattern, superimposed on the picture monitor.
2	PRE MUTE	Permits aural monitoring of audio 1, audio 2 and cue channels during tape shuttle (fast forward or rewind). Normally audio is muted during tape shuttle.
3	AUDIO 1	Audio 1 channel is aurally monitored during play or record mode.

Table 3-5. Monitor Control Panel (Continued)

INDEX NO.	NAME	FUNCTION
4	AUDIO 2*	Audio 2 channel is aurally monitored during play or record mode.
5	CUE	Cue channel is aurally monitored during play or record mode.
6	AUDIO MONITOR LEVEL Potentiometer	Varies level of sound from loudspeaker.
7	HEAD ERROR	Displays rotary head drum position error on waveform monitor.
8	C.T. MON	Displays amplified control track signals from monitor head (optional) in either record or playback on waveform monitor.
9	CTL TRACK	Control track playback output displayed on waveform monitor.
10	T.B. ERROR	Time base corrector error is displayed on waveform monitor.
11	CHR	Rectified color bursts are displayed on waveform monitor.
12	R.F. LEVEL	Displays detected output of all four video heads on the waveform monitor.
13	VIDEO OUT	Displays video signal at the output of the system, in playback operation.
14	NORM	Displays output of demodulator in any mode except play. In play mode, system output is displayed.
15	DEMOD OUT	Displays output of demodulator in any mode.
16	VIDEO IN	Incoming video signal displayed on picture and waveform monitors.

*The two channel audio head is an optional accessory.

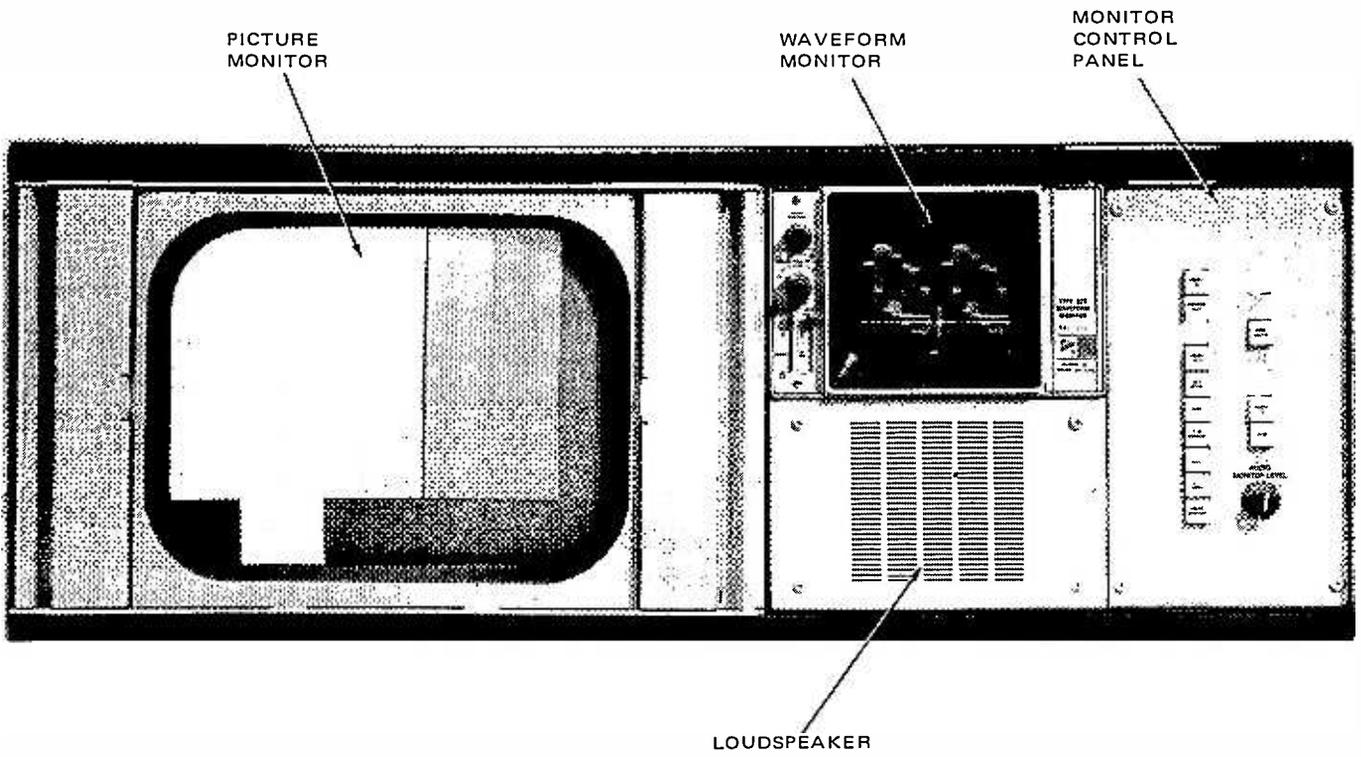
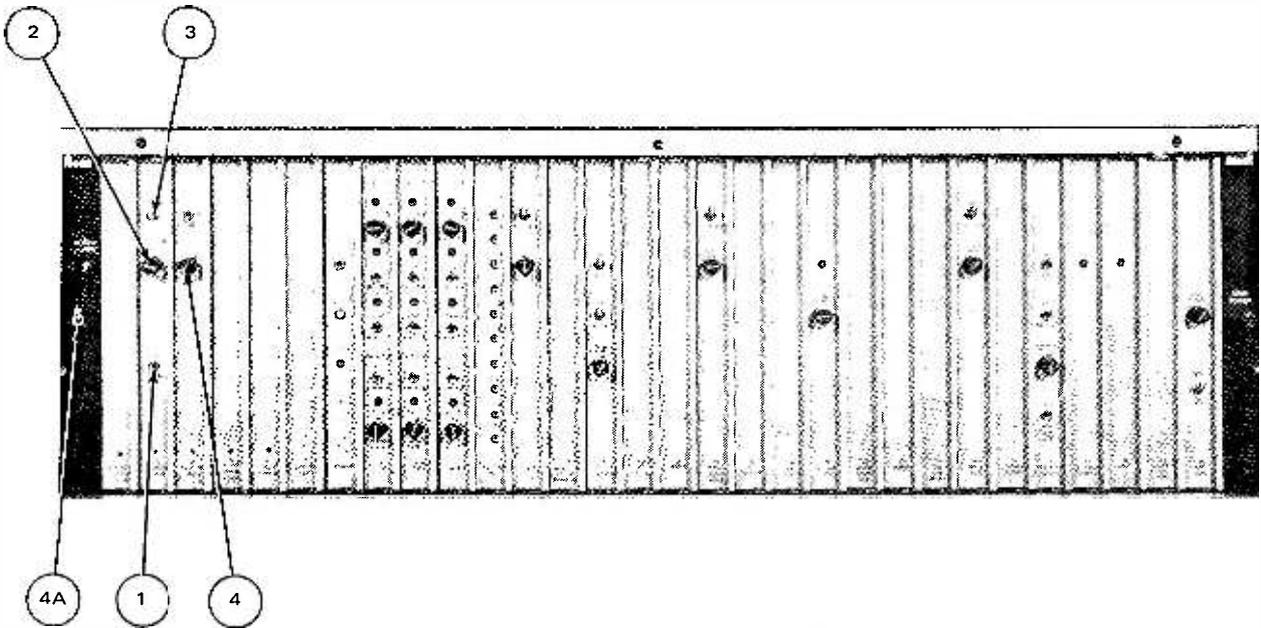


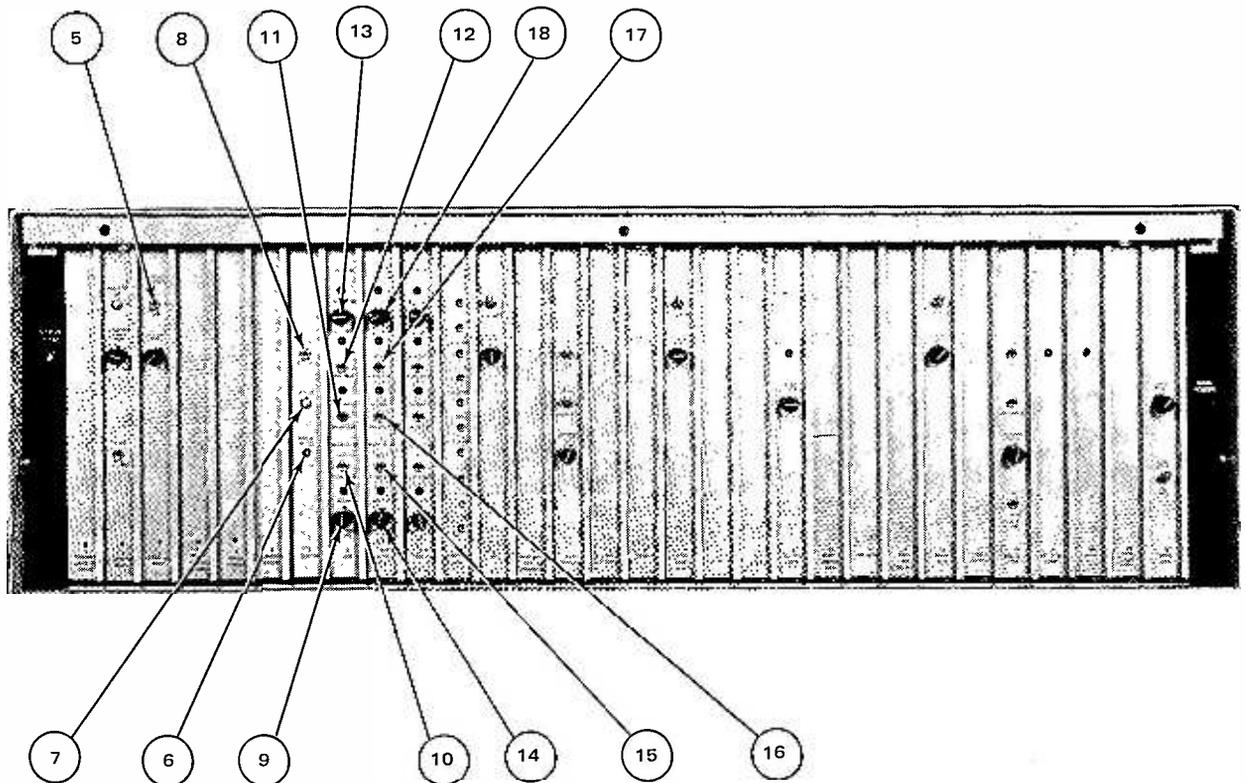
Figure 3-1. Monitor Bridge Assembly

Table 3-6. Card Rack Assembly Switches and Controls



INDEX NO.	NAME	FUNCTION
1	15 IPS-7-1/2 IPS Toggle Switch	Selects tape speed.
2	ASSEMBLE SPEED SET Potentiometer	Used during assemble edits to match recorder speed to non-standard tape speeds.
3	PUSH TO SET Push-button	Places capstan speed under the control of the ASSEMBLE SPEED SET potentiometer.
4	C.T. REC LEVEL	Adjusts control track record current level.
4A	AUDIO NORMAL/COMBINED	When set to COMBINED, the AUDIO 1 IN feeds both channels and the outputs are combined to give a standard output level.

Table 3-6. Card Rack Assembly Switches and Controls (Continued)



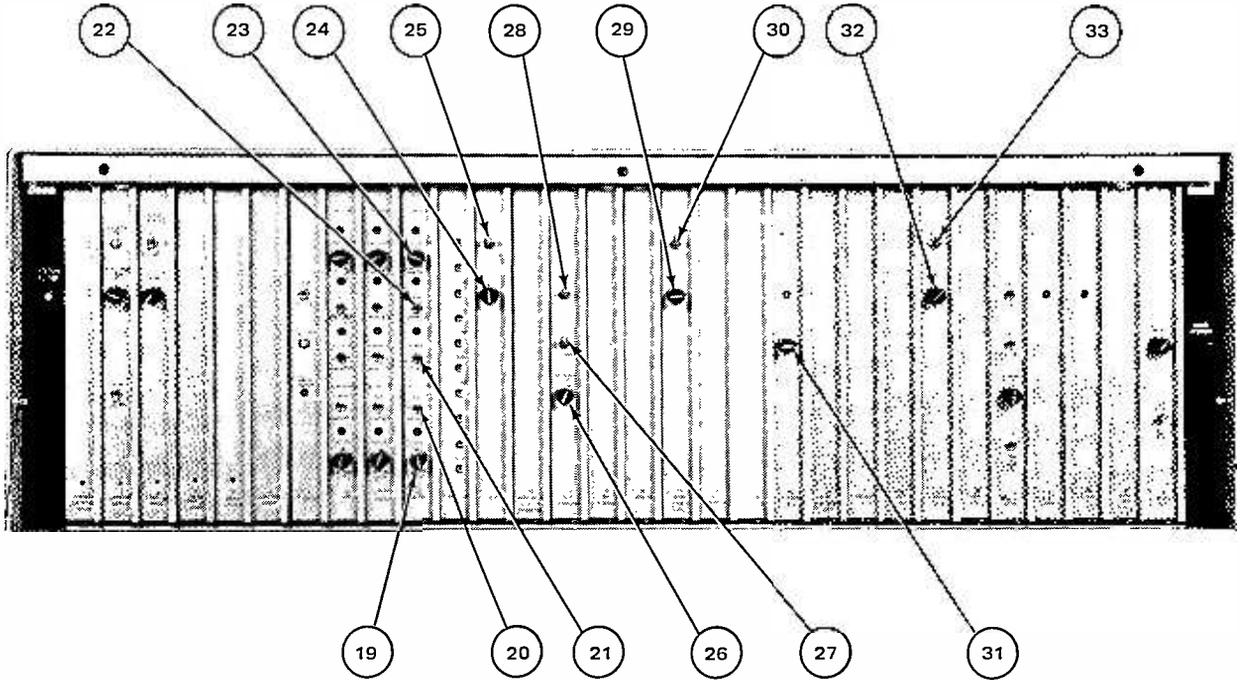
INDEX NO.	NAME	FUNCTION
5	EDIT-PLAY-OFF Toggle Switch	Turns on color framer and selects the mode (play or edit) in which the color framer is activated.
6*	ERASE DELAY Potentiometer	Adjusts video erase timing relative to head 4 video.
7*	SET UP Pushbutton	Enables erase delay setup mode.

Table 3-6. Card Rack Assembly Switches and Controls (Continued)

INDEX NO.	NAME	FUNCTION
8*	TEST Toggle Switch	Initiates editor test mode.
9*	REPRO-LEVEL Potentiometer	Adjusts the level of the cue output when UNITY-VARIABLE toggle switch is set to VARIABLE.
10*	UNITY-VARIABLE Toggle Switch	Cue playback gain is standard when set to UNITY and variable when set to VARIABLE.
11*	NORMAL-MONITOR Toggle Switch	When set to NORMAL, the source of the cue signal applied to the system output line and available at the VU meter and loudspeaker depends upon the mode the system is in. In record mode the EE signal is present. In playback mode, the off-tape signal is present. The monitor position is not used.
12	RECORD UNITY-VARIABLE Toggle Switch	Cue record gain is standard when set to UNITY and variable when set to VARIABLE.
13	REC LEVEL Potentiometer	Adjusts the cue record level when RECORD UNITY-VARIABLE toggle switch is set to VARIABLE.
14	REPRO LEVEL Potentiometer	Adjusts the level of the Audio 1 output when UNITY-VARIABLE toggle switch is set to VARIABLE.
15	UNITY-VARIABLE Toggle Switch	Audio 1 playback gain is standard when set to UNITY and variable when set to VARIABLE
16	NORMAL-MONITOR Toggle Switch	When set to NORMAL, the audio signal at the system output line and available at the VU meter and loudspeaker depends upon the mode the system is in. In record mode the EE signal is present. In playback mode, the off-tape signal is present. When set to MONITOR the audio signal detected by the monitor head (optional) is made available when the system is in either record or shuttle (fast forward or rewind) modes. The signal from the monitor head is not applied to the system output line.
17	UNITY-VARIABLE Toggle Switch	Audio 1 record gain is standard when set to UNITY and variable when set to VARIABLE.
18	REC LEVEL Potentiometer	Adjusts the audio 1 record level.

*Control is part of an optional accessory

Table 3-6. Card Rack Assembly Switches and Controls (Continued)



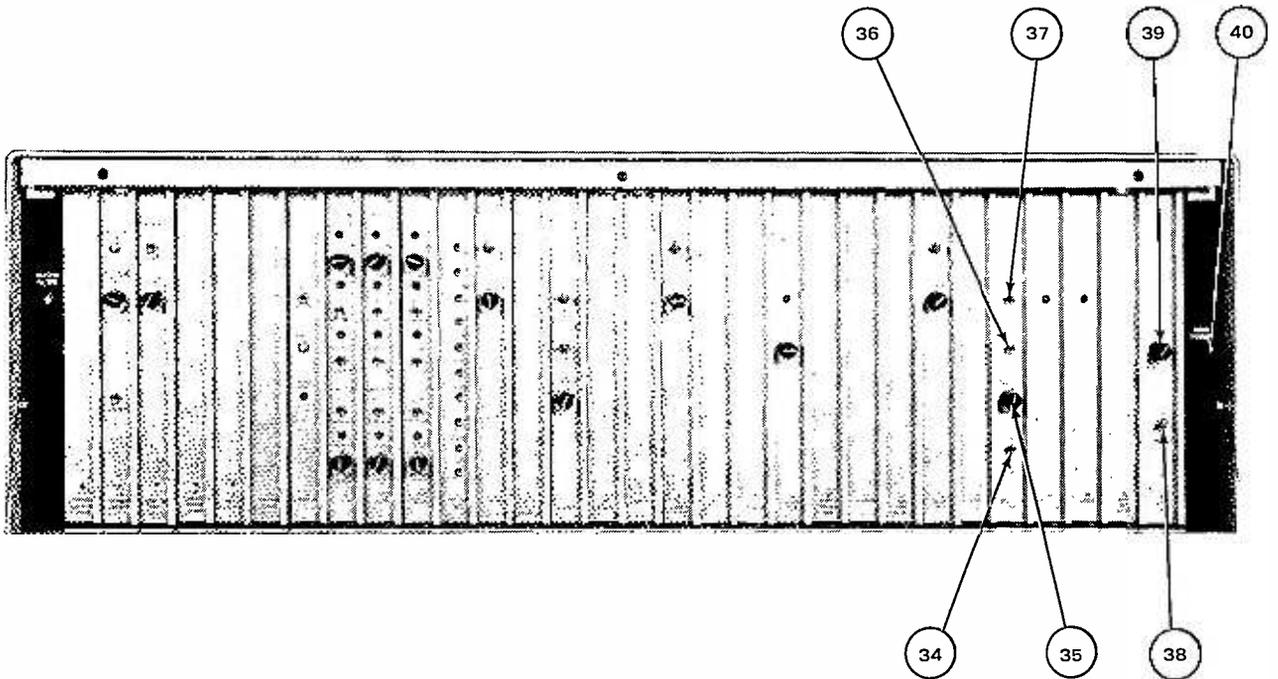
INDEX NO.	NAME	FUNCTION
19*	REPRO LEVEL Po- tentiometer	Adjusts the level of the Audio 2 output when UNITY-VARIABLE toggle switch is set to VARIABLE.
20*	UNITY-VARIABLE Toggle Switch	Audio 2 playback gain is standard when set to UNITY and variable when set to VARIABLE.
21*	NORMAL-MONITOR Toggle Switch	When set to NORMAL, the audio signal at the system's output line that is available at the VU meter and loud-speaker depends upon the mode the system is in. In record mode the EE signal is present. In playback mode,

Table 3-6. Card Rack Assembly Switches and Controls (Continued)

INDEX NO.	NAME	FUNCTION
21*	NORMAL-MONITOR (Cont)	the off-tape signal is present. When set to MONITOR the audio signal detected by the monitor head (optional) is made available when the system is in either record or shuttle (fast forward or rewind) modes. The signal from the monitor head is not applied to the system output line.
22*	UNITY-VARIABLE Toggle Switch	Audio 2 record gain is standard when set to UNITY and variable when set to VARIABLE.
23*	REC LEVEL Potentiometer	Adjusts the Audio 2 record level when RECORD UNITY-VARIABLE toggle switch is set to variable.
24	VIDEO GAIN Potentiometer	Adjusts video input level to modulator.
25	UNITY-VARIABLE Toggle Switch	Video input gain is standard when set to UNITY and variable when set to VARIABLE.
26*	CHROMA LEVEL Potentiometer	Adjusts the chrominance level during playback of color recordings when the UNITY-VARIABLE toggle switch is set to VARIABLE.
27*	UNITY-VARIABLE Toggle Switch	When set to VARIABLE, CHROMA LEVEL potentiometer is enabled.
28*	ON-OFF Toggle Switch	When set to ON, video channels are automatically equalized during color playback.
29	BLACK LEVEL Potentiometer	Adjusts the black level on the video output signal when the UNITY-VARIABLE switch is set to VARIABLE.
30	UNITY-VARIABLE Toggle Switch	When set to VARIABLE, black level is under control of BLACK LEVEL potentiometer.
31	SUBC PHASE Potentiometer	Adjusts the phase of the color subcarrier reference with respect to external signal sources.
32	VIDEO GAIN Potentiometer	Varies the gain of the amplification supplied to the outgoing video signal.
33	UNITY-VARIABLE Toggle Switch	When set to VARIABLE the VIDEO GAIN potentiometer is enabled. When set to UNITY, video gain is standard.

*Control is part of an optional accessory.

Table 3-6. Card Rack Assembly Switches and Controls (Continued)

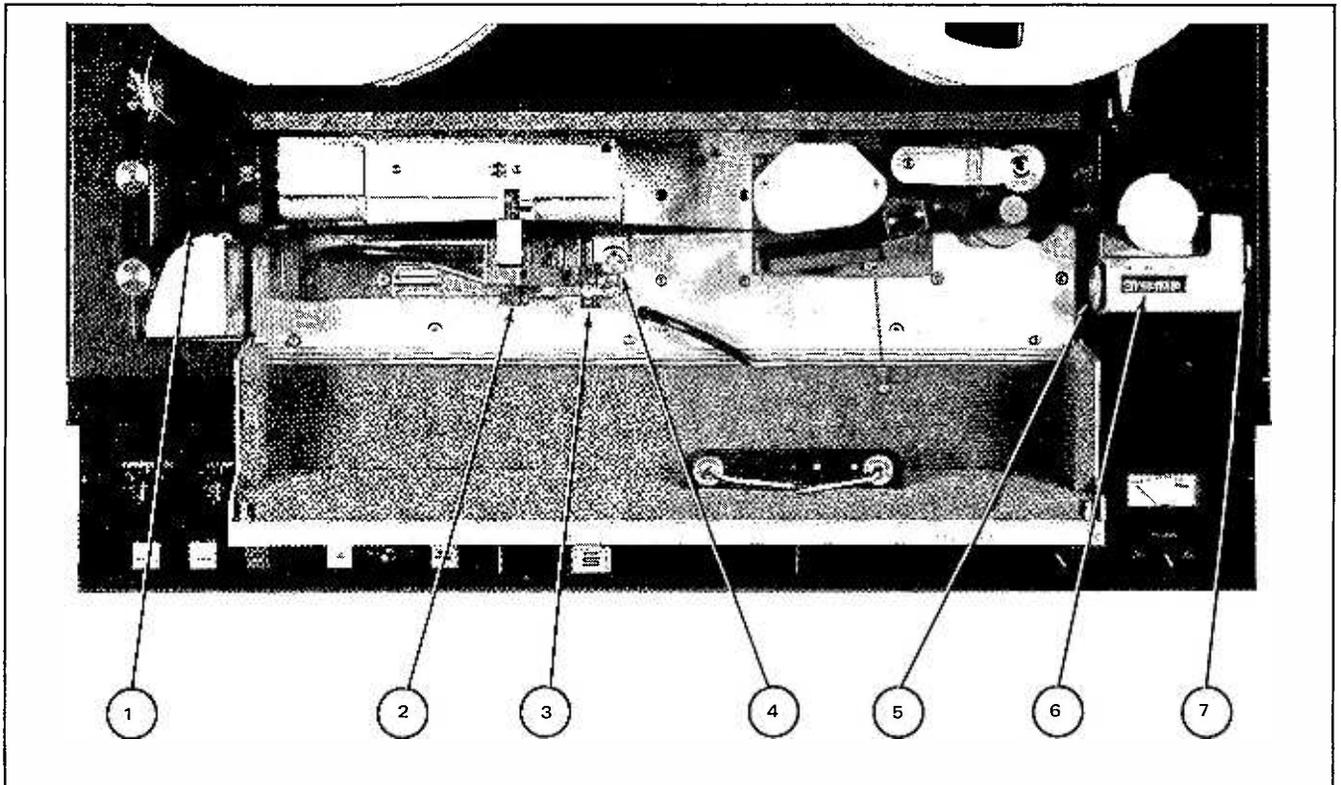


INDEX NO.	NAME	FUNCTION
34*	ON-OFF Toggle Switch	Turns on last line velocity compensation.
35*	CHROMA PHASE Potentiometer	Adjusts the phase of the picture chrominance information with respect to color burst during playback.
36*	UNITY-VARIABLE Toggle Switch	When set to VARIABLE, CHROMA PHASE potentiometer is enabled.
37*	ON-OFF Toggle Switch	Turns on velocity compensator.

Table 3-6. Card Rack Assembly Switches and Controls (Continued)

INDEX NO.	NAME	FUNCTION
38	GEN LOCK-INT REF Toggle Switch	Phase locks the system sync generator to the reference video input when set to GEN LOCK. When set to INT REF, locks sync generator to internal reference source.
39	HORIZ PHASE Po- tentiometer	Permits phase adjustment of the output video signal with respect to the input reference video signal.
40	MAIN POWER Switch	Applies power to system. Push in to turn system power on; pull out to turn system power off.
*Control is part of an optional accessory.		

Table 3-7. Tape Transport Operating Controls and Indicators



INDEX NO.	NAME	FUNCTION
1	Erase Indicator	Lights when video erase head is energized and operating properly.
2	Vacuum guide height adjustment	Varies the height of the vacuum guide.
3	REC/PLAY lever	Adjusts head tip penetration. When set to REC, tip penetration is fixed; when set to PLAY, head tip penetration is variable.
4	Tip penetration adjust	Adjusts head tip penetration when REC/PLAY lever is set to PLAY.
5	Tape Timer reset knob	Used to manually reset the tape timer to zero.
6	Tape Timer	Reads elapsed time directly at 15 in/s. At a forward tape speed of 7.5 in/s, total elapsed time will be twice what the meter indicates.
7	Tape timer adjustment knob	Pull and turn control. Used to adjust time reading without resetting entire unit to zero.

2. Access the heads by opening the hinged head cover. Ensure that the video head wheel is not rotating.
3. Remove tape if it is threaded on the transport.
4. Swing the hinged vacuum guide away from its latched position close to the video head wheel by pulling latch release lever (see Figure 3-2) backward (towards operator), and pulling the vacuum guide assembly backward at the same time.

CAUTION

THE SYSTEM MUST BE TURNED ON AND SUPPLYING AIR TO THE AIR BEARING IN

THE VIDEO HEAD ASSEMBLY. ENSURE THAT THE BEARING AIR INDICATOR IS NOT LIGHTED. DO NOT MOVE THE HEAD WHEEL IF BEARING AIR IS NOT SUPPLIED.

5. Moving the head wheel by hand, use a cotton swab sparingly moistened with head cleaner (Ampex 087-007) to clean the head wheel. Use a careful, gentle scrubbing motion over each of the four head tips and around the circumference of the video head wheel. Also scrub the surfaces of the vacuum guide that contact the tape.
6. Clean the control track record/reproduce head (see Figure 3-2).

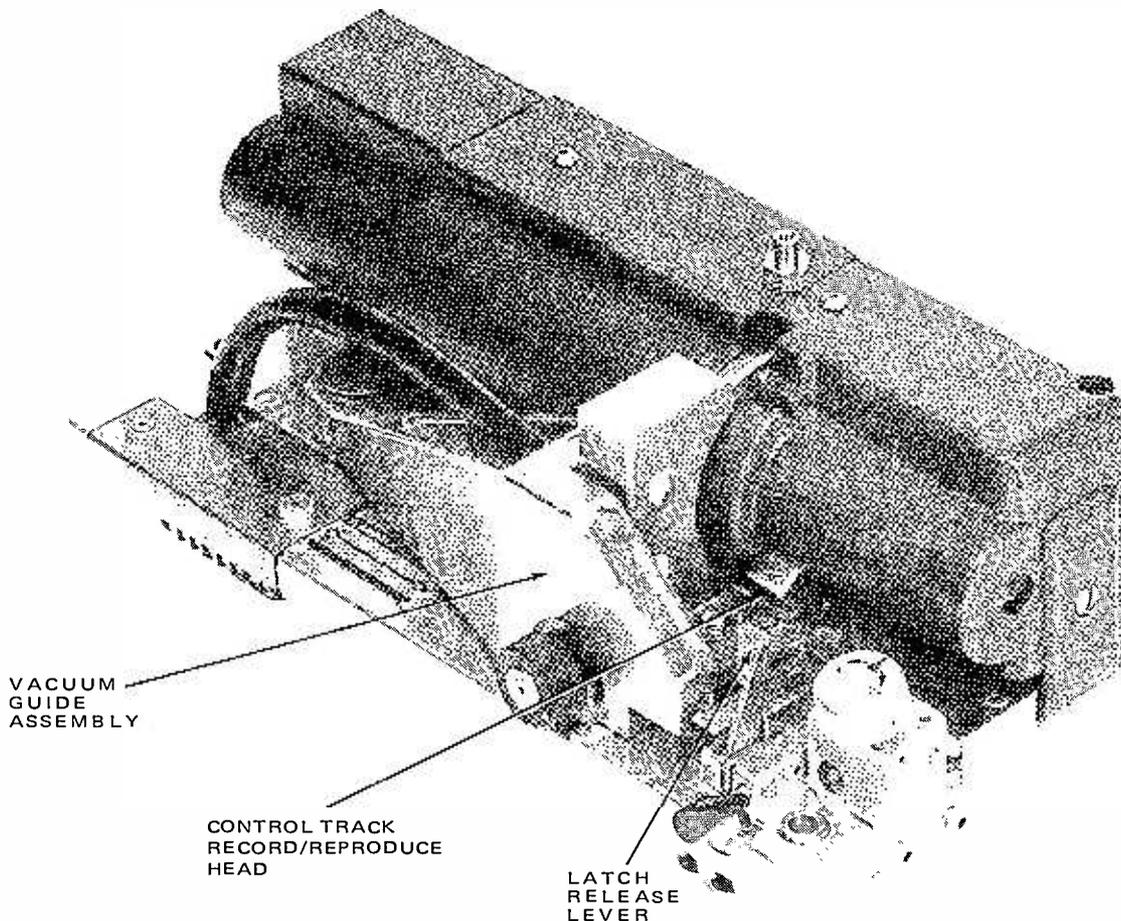


Figure 3-2. Control Track Record/Reproduce Head

- Use a lint-free strip of cloth about two inches long dampened with head cleaner. Insert cloth between control track head and shield; pull cloth back and forth across the control track head.
7. Clean the video erase assembly (see Figure 3-3); pull the erase assembly cover up and off to expose the heads.
 8. Clean the audio and cue head (Figure 3-3).
 9. Clean the audio and control track monitor heads if supplied with system (Figure 3-3).

CAUTION

WHEN CLEANING CAPSTAN SURFACE, BE CAREFUL NOT TO GET HEAD CLEANER ON SURFACES OF PINCH ROLLER.

10. Clean the tape contacting surfaces of the capstan.
11. Clean the pinch roller with a lint-free cloth moistened with isopropyl alcohol. *Do not use head cleaner.* Turn the pinch roller by hand and clean the entire tape contacting surface.

3-4 Tape Threading

Thread tape onto the machine as follows:

1. Ensure that the system is in the stop mode (power applied to system and STOP pushbutton illuminated).

CAUTION

TO PREVENT DAMAGE TO THE HEAD ASSEMBLY AND THE TAPE, THE VIDEO HEAD WHEEL MUST NOT BE ROTATING DURING THE TAPE THREADING PROCEDURE.

2. Set READY toggle switch to OFF.
3. Place the reel of tape on the supply reel hub; orient the reel so that the tape emerges from the left side of the reel (see Figure 3-4).
4. Place the empty takeup reel supplied with the recorder on the takeup turntable.
5. Release the reel brakes by pushing the supply compliance arm fully to the left. Withdraw four to five feet of tape from the reel, while holding the compliance arm in this position.
6. Route the tape to the right of the supply compliance arm-pin, to the left of the rotating tape guides, through the supply idler and erase head assembly, and through the vacuum guide, inserting the edge of the tape into the space between the head drum and the vacuum guide. Bring the tape past the audio and cue head and past the audio and control track monitor heads (the audio and control track monitor heads are supplied as an option). Continue threading the tape between the capstan and pinch roller, around the tape counter idler, to the left of the takeup compliance arm pin and counterclockwise around the takeup reel hub. Wind several layers of tape around the reel until the tape is securely fastened to the reel.
7. Ensure that the tape is properly positioned on the tape guides and that the lower edge of the tape is seated against the shoulder of the lower edge of the vacuum guide.
8. Turn the takeup reel counterclockwise until all slack is removed and both compliance arms are away from the reset positions.

3-5 Video Head Optimization

Optimize the record current to the four video heads as follows.

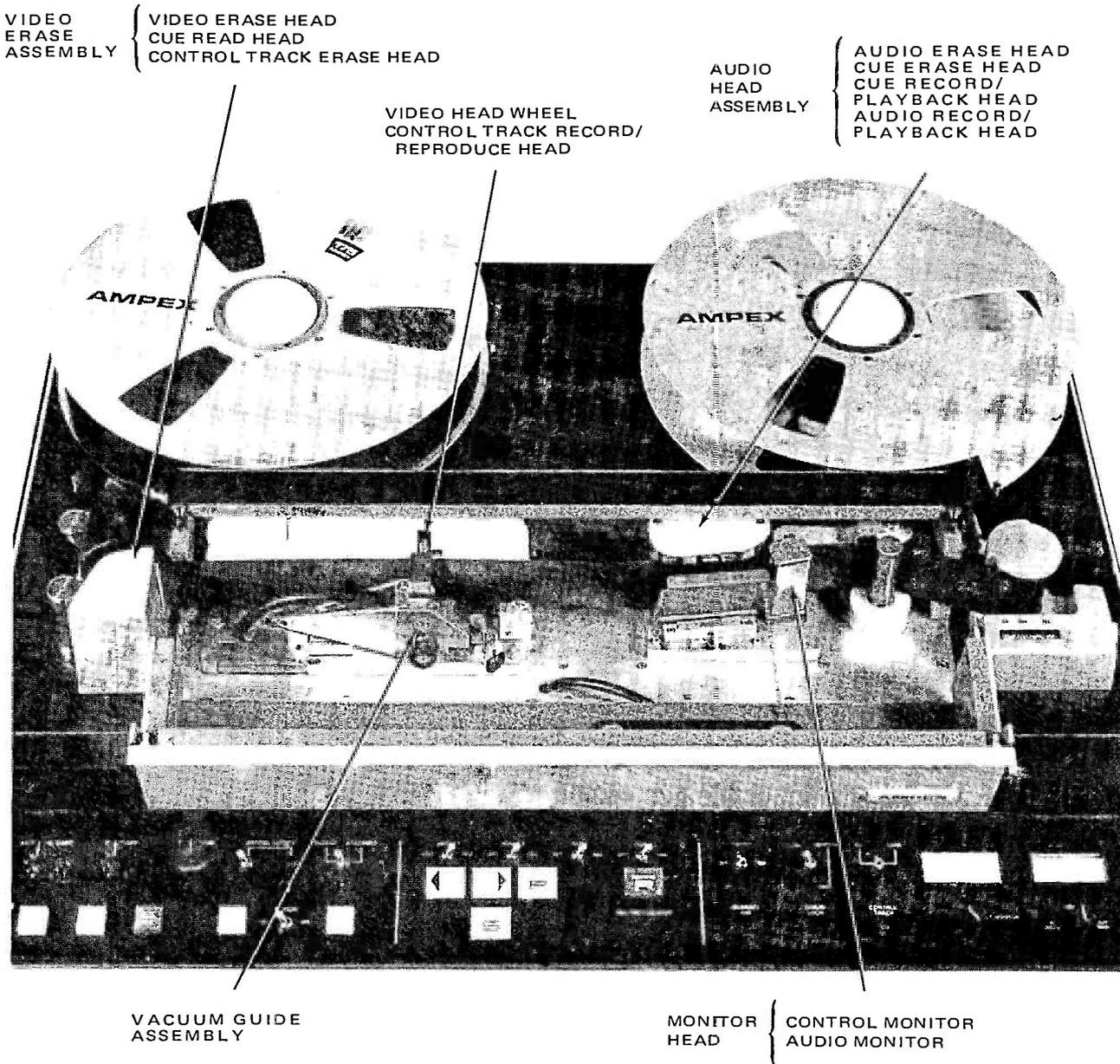


Figure 3-3. Video, Audio, Cue, Control Track, and Erase Heads

1. Supply the system with a composite video input signal.
2. Push MAIN POWER switch (Table 3-6, Index No. 40) inward to apply power to the system.
3. Thread a reel of tape (unused or containing recorded material that is no longer needed) on the transport.
4. Press PLAY and RECORD pushbuttons simultaneously with the INITIATE pushbutton on the maintenance panel. (Table 3-4, Index No. 1).
5. Set OPTIMIZE selector switch on the maintenance panel (Table 3-4, Index No. 2) to 1.
6. Unlock the VIDEO RECORD-CHAN 1 control (Table 3-4, Index No. 3) by turning the locking ring counterclockwise.

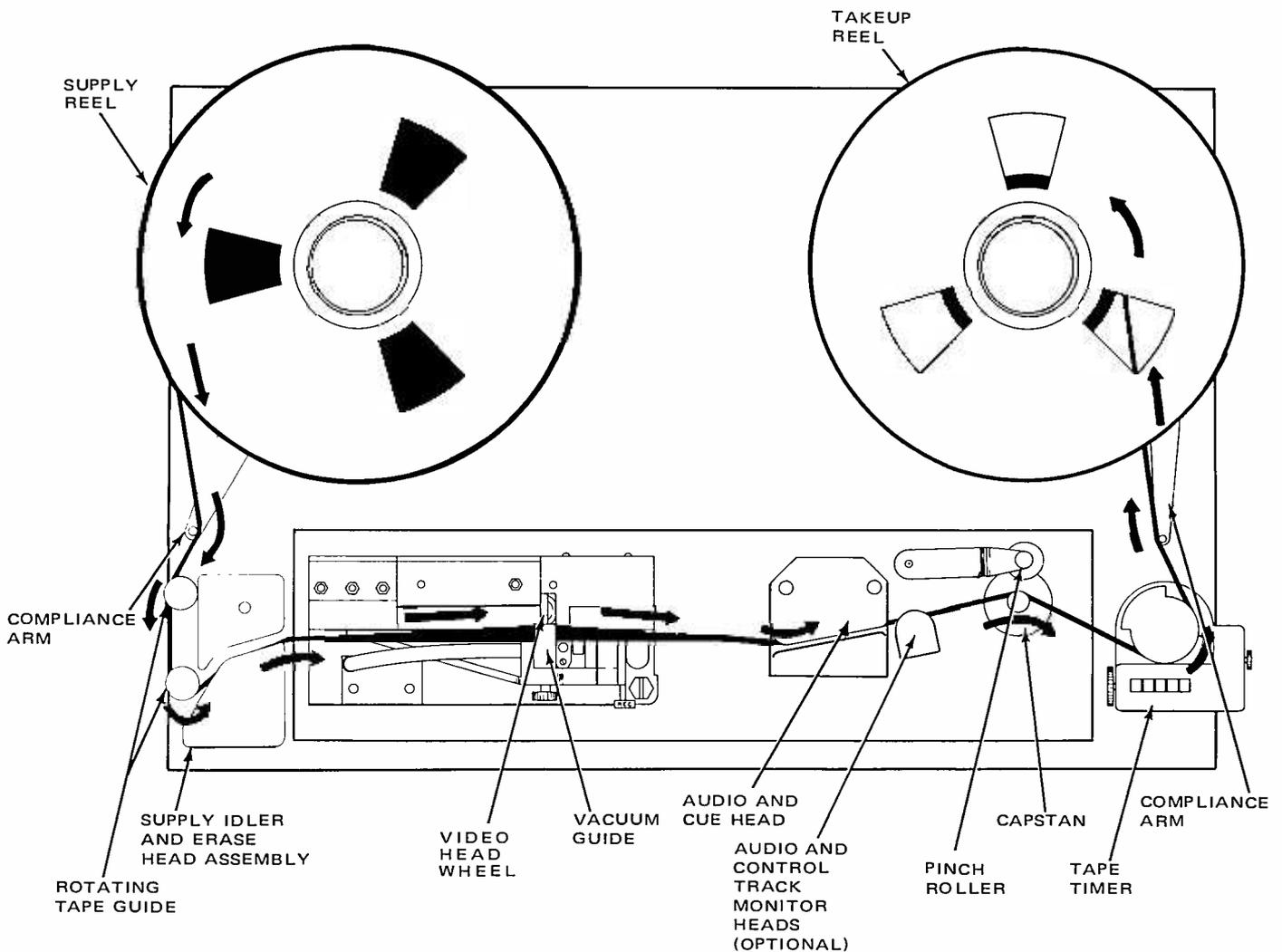


Figure 3-4. Tape Threading Path

7. Turn VIDEO RECORD-CHAN 1 control fully counterclockwise.
8. Turn VIDEO RECORD-CHAN 1 control clockwise slowly until the rf level observed on the TRACKING meter (Table 3-2, Index No. 7) reaches maximum. As the control is turned, the gain will flatten out after a fast initial rise; stop turning the control as soon as a small clockwise movement does not increase meter reading.
9. Lock the VIDEO RECORD-CHAN 1 control in position by turning the locking ring clockwise.
10. Repeat steps 5 through 9 for channels 2 through 4; with OPTIMIZE selector switch set to 2, optimize head 2 record current by adjusting VIDEO RECORD-CHAN 2 control, etc.

3-6 Head Degaussing

A head demagnetizer, Ampex Part No. 4010820, should be used as required to remove the residual magnetism that accumulates in the rotary video heads and the stationary control track, cue track and audio track heads. It is recommended that degaussing be performed following head and tape path cleaning.

3-7 Video Head Degaussing. Degauss the video heads as follows:

1. To prevent scratching the head surfaces, cover demagnetizer pole tips with a piece of tape.

CAUTION

THE SYSTEM MUST BE TURNED ON AND SUPPLYING AIR TO THE AIR BEARING IN THE VIDEO HEAD ASSEMBLY. ENSURE THAT THE BEARING AIR INDICATOR IS NOT LIGHTED. DO NOT MOVE THE HEAD WHEEL IF BEARING AIR IS NOT BEING SUPPLIED.

2. Set the READY toggle switch (Table 3-2, Index No. 1) to OFF and ensure that the video head is not rotating.
3. Swing vacuum guide away from video head wheel (refer to heading 3-3, step 4).
4. Manually rotate the video head wheel to position one of the head tips for easy access.
5. With the demagnetizer as far away from the equipment as possible, plug demagnetizer power cord into a 115-volt outlet.
6. Move the demagnetizer slowly and evenly toward the exposed video head tip. Straddle the head gap with demagnetizer pole tips allowing them to touch the head tips lightly (see Figure 3-5).
7. Hold the demagnetizer in this position for approximately three to five seconds, and then withdraw it slowly and evenly from head tip, in the opposite direction from the approach.
8. Move the next head tip into an accessible position and repeat steps 6

and 7. Perform the degaussing procedure for each of the head tips.

3-8 Control Track Record/Reproduce Head Degaussing. Degauss the control track record/reproduce head as follows:

1. Move the demagnetizer slowly and evenly toward the control track record/reproduce head (see Figure 3-2). Straddle head gap with demagnetizer pole tips allowing them to touch head lightly.
2. Hold demagnetizer in this position for approximately 15 seconds. During this period, slowly move demagnetizer pole tips up and down the length of the head gap.
3. Withdraw demagnetizer slowly and evenly from head gap along same path used for approach.

3-9 Audio and Cue Head Degaussing. Degauss the audio and cue head by applying the steps for control track record/reproduce head degaussing (paragraph 3-8) to the audio and cue head.

3-10 Audio and Control Track Monitor Head Degaussing. Degauss the audio and control track monitor head (if this option is supplied with the system) by applying the steps in paragraph 3-8 to the audio and control track monitor head.

3-11 RECORDING

Before making a recording, set the switches and controls in accordance with Table 3-8.

3-12 Control Track Record Current Optimization

Prior to making a recording, optimize the control track record current as follows:

1. Thread tape to be used for recording on the machine.

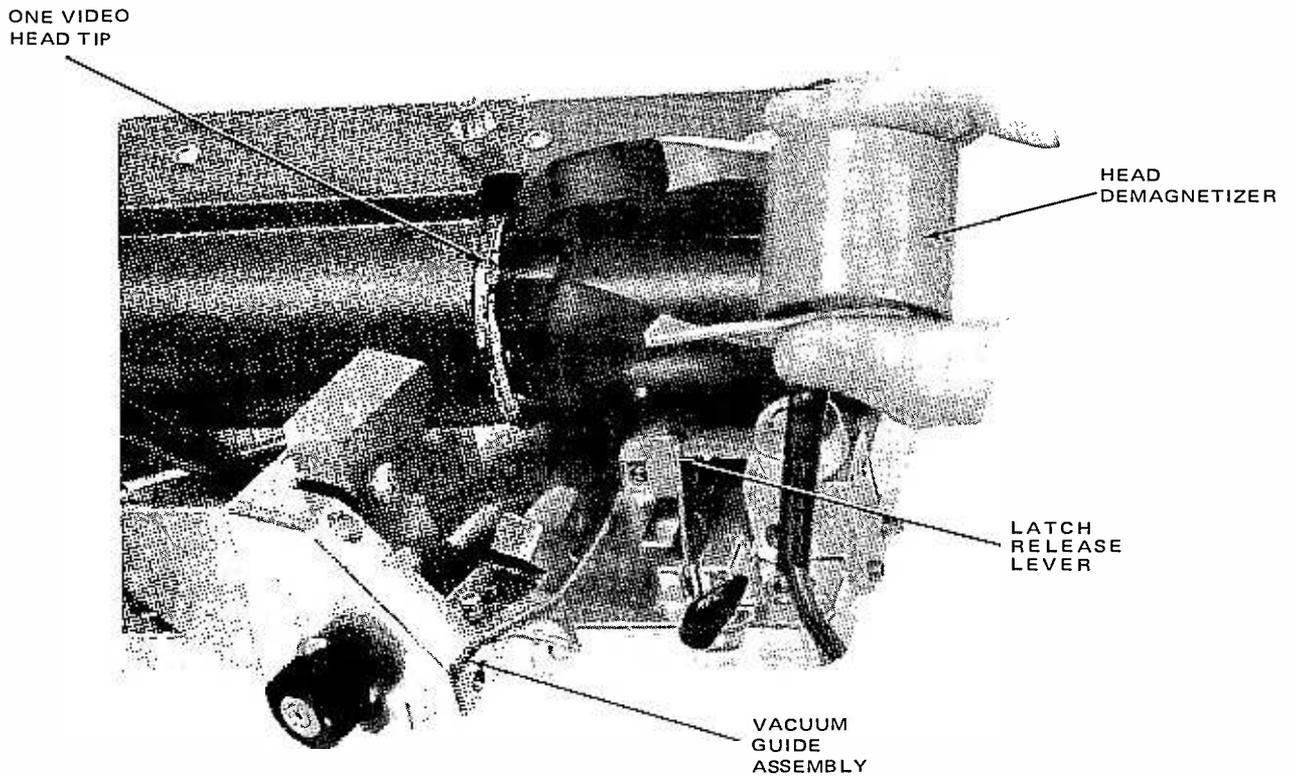


Figure 3-5. Degaussing a Video Head Tip

2. Establish record mode by pressing and illuminating PLAY and RECORD pushbuttons simultaneously; allow the machine to run in the record mode for about 30 seconds to record a control track.
3. Press and illuminate REWIND pushbutton and rewind tape to the start of the recorded control track.
4. Press and illuminate CTL TRACK pushbutton (Table 3-5, Index No. 9).
5. Press and illuminate PLAY pushbutton to enter play mode.
6. Observe the control track on the waveform monitor. The C.T. REC LEVEL potentiometer has been adjusted for optimum control track

Table 3-8. Record Mode — Initial Switch Settings

REF TABLE	INDEX NO.	SWITCH, PUSHBUTTON OR CONTROL NAME	POSITION OR ADJUSTMENT
3-1	1	AUDIO 1 Toggle Switch	Per operator's requirements.
3-1	2	AUDIO 2 Toggle Switch	Per operator's requirements.
3-1	3	CUE Toggle Switch	Per operator's requirements.
3-1	4	VIDEO Toggle Switch	Per operator's requirements.
3-2	2	LOCAL-REMOTE Toggle Switch	Per operator's requirements.
3-3	4*	RECORD SAFETY Toggle Switch	Set to OFF.
3-4	15	RECORD LOCKOUT Toggle Switch	Set to OFF.
3-6	1	15 IPS—7-1/2 IPS Toggle Switch	Select appropriate tape speed.
3-6	4-A	AUDIO NORMAL/COMBINED	Per operator's requirements.
3-6	12	RECORD UNITY-VARIABLE Toggle Switch (Cue Module)	Set to UNITY.
3-6	17*	RECORD UNITY-VARIABLE Toggle Switch (Audio Module)	Set to UNITY.
3-6	22*	UNITY-VARIABLE Toggle Switch (Audio Module)	Set to UNITY.
3-6	25	UNITY-VARIABLE Toggle Switch (Modulator Module)	Set to UNITY.
3-6	40	MAIN POWER Switch	Push switch inward to apply power to the system.
3-7	3	REC/PLAY lever (Videohead assembly)	Set to REC.

*Control is part of an optional accessory.

record current when the monitored waveform indicates that magnetic saturation has just occurred. See Figure 3-6 for proper control track waveform.

NOTE

The control track playback waveform of Figure 3-6 labeled Low Level indicates that the control track has been recorded with insufficient record current and magnetic saturation has not occurred. The waveform labeled Correct Level indicates that the correct level of current has been used and magnetic saturation has just occurred. When the control track is recorded with greater current than is necessary to just cause magnetic saturation of the tape, an improper control track, labeled High Level, results. Note the distinct shoulders that are formed on the trailing end of the control track pulses when excessive current is used.

7. If monitored waveform indicates that greater record current is required (magnetic saturation has not occurred), adjust C.T. REC LEVEL potentiometer (Table 3-6, Index No. 4) clockwise to increase current, rewind to the beginning of the tape, and repeat steps 2 through 6. If monitored waveform indicates less record current is required (magnetic saturation has not occurred), adjust C.T. REC LEVEL potentiometer counterclockwise to decrease current, rewind to the beginning of the tape and repeat steps 2 through 6.
8. Repeat step 7 until saturation has just occurred and control track record current is thus optimized.

NOTE

Control track record current may be optimized more rapidly by using the vu

meter. The following steps which provide for optimizing the control track record current by using the vu meter, are optional.

9. Set AUD 1-AUD 2-CUE-C.T. MONITOR to C.T. MONITOR.
10. Play back the tape recorded with the optimized control track; note the level indicated on the vu meter (Table 3-2, Index No. 5). To optimize control track record current in the future, observe the vu meter and adjust C.T. REC LEVEL for the level noted.

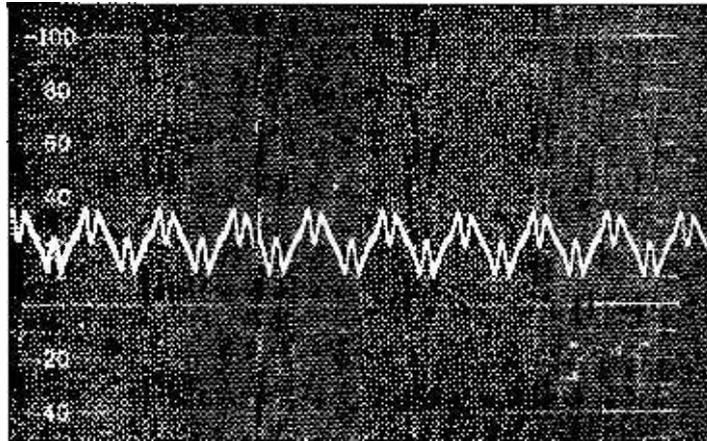
3-13 Recording Procedure

Record audio/video material on tape as follows:

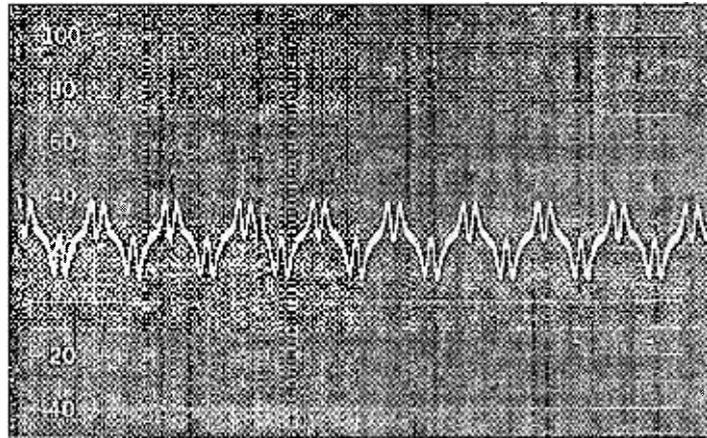
1. Push MAIN POWER switch (Table 3-6, Index No. 40) inward to apply power to the system.
2. Supply machine with audio/video input to be recorded on tape.
3. Set NORMAL-MONITOR toggle switches (Table 3-6, Index Nos. 11, 16 and 21) to NORMAL.
4. Set AUD 1-AUD 2-CUE-CT MONITOR switch (Table 3-2, Index No. 6) to AUD 1.
5. Observe vu meter (Table 3-2, Index No. 5); an audio level of 0 on the vu meter is required for producing a recording of optimum quality. If necessary, set UNITY-VARIABLE toggle switch (Table 3-6, Index No. 17) to VARIABLE and adjust REC LEVEL potentiometer (Table 3-6, Index No. 18) so that audio peaks from the program source read 0 on the vu meter.

NOTE

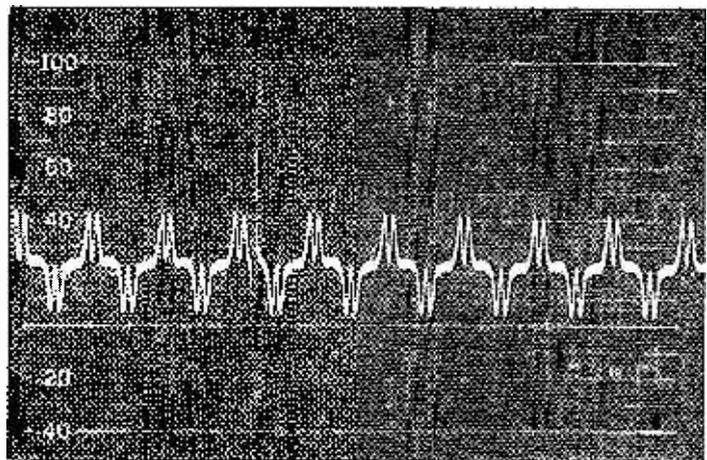
The AVR-2 may have been configured with a one-track audio system, a stereo



LOW LEVEL



CORRECT LEVEL



HIGH LEVEL

Figure 3-6. Control Track Waveforms

audio system or a dual track audio system. Step 6 may be performed only if the AVR-2 has been supplied with a stereo or dual track audio head kit.

6. Set AUD 1-AUD 2-CUE-CT MONITOR switch to AUD 2. Observe vu meter and if necessary set UNITY-VARIABLE toggle switch (Table 3-6, Index No. 22) to VARIABLE and adjust REC LEVEL potentiometer (Table 3-6, Index No. 23) so that audio peaks from the program source read 0 on the vu meter.
7. Set AUD 1-AUD 2-CUE-CT MONITOR switch to CUE. Observe vu meter and if necessary set UNITY-VARIABLE toggle switch (Table 3-6, Index No. 12) to VARIABLE and adjust REC LEVEL potentiometer (Table 3-6, Index No. 13) for 0 on the vu meter.
8. Observe the TRACKING meter (Table 3-2, Index No. 7). A video signal of 1 volt peak-to-peak (140 IRE units) is required for producing a recording of optimum quality. This signal level is indicated as 100 on the TRACKING meter. If necessary, set UNITY-VARIABLE toggle switch (Table 3-6, Index No. 25) to VARIABLE and adjust VIDEO GAIN potentiometer (Table 3-6, Index No. 24) for 100 on the TRACKING meter.
9. Thread tape on machine.
10. Reset tape timer to zero with tape timer reset knob (Table 3-7, Index No. 5).
11. Press and illuminate PLAY and RECORD pushbuttons (Table 3-1, Index Nos. 6 and 7) simultaneously.
12. Press STOP pushbutton (Table 3-1, Index No. 8) when recording has been completed.

3-14 PLAYBACK

Prior to playing a tape, set the switches and controls in accordance with Table 3-9.

Play back prerecorded tapes as follows:

1. Set REC/PLAY lever (Table 3-7, Index No. 3) to PLAY.
2. Thread tape to be played on the machine.
3. Preview the tape; press PLAY and observe picture monitor.
4. If necessary, adjust vacuum guide height control (Table 3-7, Index No. 2) to eliminate any picture scalloping observed on the video monitor.
5. If necessary, adjust tip penetration control (Table 3-7, Index No. 4) to eliminate any picture skewing observed on the picture monitor.
6. Rewind tape and find the beginning of the program material; stop the transport and set the tape timer to zero.
7. Back the tape up (rewind) as required for cueing; be sure there is no slack in the tape.

NOTE

Step 8 is an optional step. When the READY toggle switch is set to ON before the playback mode is initiated, the video head wheel is brought up to operating speed. This minimizes lock-up time when the playback mode is initiated.

8. Set the READY toggle switch to ON before playback is to begin; the head drum should begin to rotate.

Table 3-9. Play Mode-Initial Switch Settings

REF TABLE	INDEX NO.	SWITCH, PUSHBUTTON OR CONTROL NAME	POSITION OR ADJUSTMENT
3-6	1	15 IPS-7-1/2 IPS Toggle Switch	Determine tape speed used to produce recording and set switch accordingly.
3-6	4A	AUDIO NORMAL/COMBINED	NORMAL.
3-6	5	PLAY RECORD OFF	As required.
3-6	10	REPRODUCE UNITY-VARIABLE Toggle Switch (Cue Module)	Set to UNITY.
3-6	15	REPRODUCE UNITY-VARIABLE Toggle Switch (Audio 1 Module)	Set to UNITY.
3-6	20*	REPRODUCE UNITY-VARIABLE Toggle Switch (Audio 2 Module)	Set to UNITY.
3-6	27*	UNITY VARIABLE Toggle Switch (Auto Chroma Module)	Set to UNITY.
3-6	28*	ON-OFF Toggle Switch (Auto Chroma Module)	Set to ON.
3-6	30	UNITY VARIABLE Toggle Switch (DTBC Video Input Module)	Set to UNITY.
3-6	33	UNITY VARIABLE Toggle Switch (Main D/A Module)	Set to UNITY.
3-6	34*	ON-OFF LAST LINE (Velocity Compensator Module)	Set to ON.
3-6	37*	ON-OFF Toggle Switch (Velocity Compensator Module)	Set to ON.
3-6	38	GEN LOCK-INT REF	As required.
3-6	40	MAIN POWER switch	Push switch inward to apply power to system.

* Control is part of an optional accessory.

9. Press the PLAY pushbutton; the tape should be up to speed and the signal locked within a short period.
10. If machine is not equipped with the optional auto tracking accessory, adjust TRACKING potentiometer (Table 3-2, Index No. 8) for maximum reading on the TRACKING meter (Table 3-2, Index No. 7). This ensures that the heads on the video head wheel are passing directly over the recorded tracks. If machine is equipped with auto tracking and manual tracking is desired, pull TRACKING control knob outward before adjusting TRACKING potentiometer. Push TRACKING knob in for auto tracking.

3-15 EDITING

NOTE

The editor is an optional accessory.

The editor performs two main editing operations, insert and assemble. In the insert operation, audio/video material from an external source is inserted into the material of a previously recorded tape. In this way, an existing scene can be removed and be replaced by another scene. In the assemble operation, new audio/video material from an external source is added on to the tape at the end of the previously recorded program material.

Prior to editing a tape, INSERT or ASSEMBLE must be selected according to the nature of the edit. If a new control track is to be recorded, ASSEMBLE is selected; the control track then switches from reproduce to record at the same time as the edit begins. If the edit is to be a segment in a prerecorded tape, INSERT maintains the control track circuits in playback and the existing control track is used.

When using the EDIT CMD pushbutton to establish edit points, note that the actual edit

point is delayed by the time required for the tape to travel from the video erase head to the video record head. Depending on the tape speed and frame rate, the delay will be in the range of one-half second to one second. An ingoing edit occurs when the pushbutton is pressed the first time; an outgoing edit occurs when pressed the second time.

Editing by using cue tones on the cue track is often convenient and provides an opportunity to preview the result before the edit is actually made. Each time the CUE TONE REC pushbutton is pressed, a 10-msec burst of 4-kHz tone is recorded on the cue track. When the tape is rewound and played again with the EDITOR ON-OFF switch set to ON, the editor switches the picture monitor input from the off-tape signal to the E-E signal, showing the external input to the recorder, then switches back to the off-tape signal. When in the record mode, the external input is edited in as previewed.

If the EDIT INHIBIT pushbutton is activated, the cues are passed over without effecting the editor. Cue tones may be aurally monitored during tape shuttling by selecting PRE MUTE and CUE on the monitor control panel. This is useful in locating cues during an edit session.

3-16 Tach Phase Adjustment

The tach phase of the prerecorded tape signal and the input source to be edited in must be synchronized prior to performing an edit. This is done by adjusting the phase relation of the off-tape signal with respect to the incoming signal until the two coincide. Adjust the TACH PHASE as follows:

1. Set the EDITOR ON-OFF switch (Table 3-3, Index No. 8) to ON. Note that the EDIT INHIBIT pushbutton (Table 3-3, Index No. 7) is illuminated.
2. Press and illuminate DEMOD OUT (Table 3-5, Index No. 15).
3. Set the picture monitor for horizontal delay.

4. Press and illuminate the PLAY pushbutton (Table 3-1, Index No. 7).
5. Press and hold down the EDIT CMD pushbutton (Table 3-3, Index No. 9). Observe the split screen effect on the picture monitor.
6. Adjust the TACH PHASE potentiometer (Table 3-3, Index No. 3) until the horizontal blanking interval of the input signal is aligned with the off-tape signal.

3-17 Alternate Method of Tach Phase Adjustment. An alternate method for adjusting the tach phase is as follows:

1. Thread the prerecorded tape to be edited on the transport. Connect the source of the new material to the recorder input.
2. Set the TEST toggle switch (Table 3-6, Index No. 8) to the TEST position.
3. Set the EDITOR ON-OFF switch (Table 3-3, Index No. 8) to ON.
4. Press and illuminate STAB DOT pushbutton (Table 3-5, Index No. 1).
5. Press and illuminate the PLAY pushbutton to initiate the play mode.
6. Press and extinguish the EDIT INHIBIT pushbutton (Table 3-3, Index No. 7).
7. Adjust the TACH PHASE control (Table 3-3, Index No. 3) until the stability dots of both off-tape and input signals coincide both horizontally and vertically. The SERVO LOCK indicator (Table 3-2, Index No. 10) will remain off if it was blinking previously.
8. Make a fine adjustment of the TACH PHASE control to minimize the horizontal flicker at the top of the video frame.

9. Stop the recorder. Set EDITOR ON-OFF switch to OFF.

10. Set TEST switch to OFF.

3-18 Adjustment for Non-Standard Control Track

When an assemble edit must be made on a previously recorded tape with a non-standard control track, the recorder must be adjusted to produce a matching control track. Note that this is not necessary if inserts are to be made, since the control track is not replaced in the INSERT mode. Proceed as follows:

1. Install the previously recorded tape with the non-standard control track on the recorder.
2. Set EDIT toggle switch (Table 3-3, Index No. 8) to ON.
3. Set INSERT-ASSEMBLE toggle switch (Table 3-3, Index No. 6) to ASSEMBLE.
4. Ensure machine is in manual tracking mode. Pull the TRACKING control (Table 3-2, Index No. 8) outward for manual tracking if machine is equipped with an auto tracking module.
5. Press PLAY pushbutton.
6. Press CTL TRACK pushbutton on monitor control panel and observe control track waveform on waveform monitor.
7. Press and hold PUSH TO SET pushbutton (Table 3-6, Index No. 3).
8. Adjust ASSEMBLY SPEED SET Potentiometer (Table 3-6, Index No. 2) for least rate of drift of waveform display.
9. Release PUSH TO SET pushbutton.
10. Adjust the TRACKING control until a maximum reading is reached on the RF LEVEL display of the waveform monitor or TRACKING meter (Table 3-2, Index No. 7) of the control panel.

Mark the position of the pointer on TRACKING potentiometer knob so potentiometer can easily be reset to this position later.

NOTE

SERVO LOCK warning indicator must not be illuminated while TRACKING potentiometer is set at position that results in maximum RF LEVEL display of the waveform monitor or TRACKING meter. If indicator is illuminated, turn TRACKING control through its range in search of a new position that will cause the SERVO LOCK light to be extinguished and a maximum rf level to be observed. Erase the mark made in step 10 and mark this new position. If SERVO LOCK warning indicator cannot be extinguished, perform procedure of paragraphs 3-16 or 3-17.

11. Press STOP pushbutton to place machine in stop mode.
12. Pull MAIN POWER switch outward to turn system power off.
13. Extend pwa 3, CT and SYNC PROC, from the card rack assembly using an extender card.
14. Push MAIN POWER switch inward to turn system power on.
15. Remove the prerecorded tape and install a work tape suitable for recording.
16. Press PLAY and RECORD pushbuttons simultaneously to put system in record mode.
17. Press and extinguish EDIT INHIBIT pushbutton.
18. Press EDIT CMD pushbutton to initiate edit-record mode.

NOTE

The initial two turn adjustment of R67 is a first trial in a trial and error procedure. More or fewer turns, clockwise or counterclockwise from the original setting, may be required before the procedure is completed. Keep a record of the number of turns R67 has been displaced from its original setting.

19. Adjust R67, on pwa board 3, two turns clockwise (R67 is a twenty turn potentiometer). With R67 in this position, make a recording of the control track about 30 seconds long.
20. Play back the portion of the control track recorded in step 19 and adjust the TRACKING control for maximum RF LEVEL display with SERVO LOCK warning light extinguished. If the maximum rf level occurs when TRACKING control is set to position marked, the procedure is complete and the correct position of R67 has been found for matching the system generated control track with that of the tape to be edited; leave R67 in this position and perform the edit procedure of paragraph 3-21 or 3-22 as desired.

CAUTION

AT THE CONCLUSION OF THE EDIT SESSION, R67 MUST BE READJUSTED FOR A STANDARD CONTROL TRACK. READJUST R67 FOR A STANDARD CONTROL TRACK IN ACCORDANCE WITH THE PROCEDURE ENTITLED CONTROL TRACK RECORD PHASE ADJUSTMENTS, PARAGRAPH 5-38 IN SECTION V, MAINTENANCE.

21. If the maximum rf level occurs when TRACKING control is set to position other than that marked, it will be necessary to repeat steps 16 through 18, readjust R67 by a new trial amount, make a recording of R67 in this position about 30 seconds long and repeat step 20. After a few trials, the correct setting of R67 will be found:

3-19 Erase Delay Adjustment

The beginning of erase should be checked prior to each edit session and if necessary adjusted as follows:

1. Make a recording of a suitable input signal approximately five minutes long. Rewind to the beginning.
2. Set VIDEO toggle switch (Table 3-1, Index No. 4) to REC.
3. Set the EDITOR toggle switch (Table 3-3, Index No. 8) to ON.
4. Set INSERT-ASSEMBLE toggle switch (Table 3-3, Index No. 6) to INSERT.
5. Press and illuminate RF LEVEL pushbutton (Table 3-5, Index No. 12).
6. Press PLAY and RECORD pushbuttons simultaneously to initiate the record mode.
7. Press the SET UP pushbutton (Table 3-6, Index No. 7).
8. Adjust the ERASE DELAY potentiometer (Table 3-6, Index No. 6) so that the envelope of head No. 4 at the beginning of the rf level display is at full level, and the next 15 envelopes (heads 2, 3, 1 and 4 in that order) are completely erased (see Figures 3-7 and 3-8).
9. Stop the recorder; this terminates the erase delay adjustment.

3-20 Initial Switch Settings

Prior to editing a tape, make initial switch settings in accordance with Table 3-10.

3-21 Manual Edit

Audio/video material may be spliced into a previously recorded tape as follows:

NOTE

The procedure that follows does *not* allow for recording cue tones and previewing a proposed edit before making the splice. When the EDIT CMD pushbutton is pressed, the system immediately begins to record the audio/video material supplied from the external source — until the EDIT CMD pushbutton is pressed again. For cue tone controlled edits see paragraph 3-22.

1. Set INSERT-ASSEMBLE toggle switch (Table 3-3, Index No. 6) to INSERT or ASSEMBLE as required.
2. Perform *Tach Phase Adjustment* and *Erase Delay Adjustment* (see paragraphs 3-16 and 3-19).
3. If edit is to be made on a previously recorded tape with a non-standard control track perform *Adjustment For Non-Standard Control Track* (see paragraph 3-18).
4. Supply machine with audio/video input to be spliced on tape.
5. Set NORMAL-MONITOR toggle switches (Table 3-6, Index Nos. 11, 16 and 21) to NORMAL.
6. Set AUD 1-AUD 2-CUE-CT MONITOR switch (Table 3-2, Index No. 6) to AUD 1.
7. Observe vu meter (Table 3-2, Index No. 5). A peak audio level of 0 on the vu meter is required for producing a recording of optimum quality. If necessary, set UNITY-VARIABLE toggle switch (Table 3-6, Index No. 17) to VARIABLE and adjust REC LEVEL potentiometer (Table 3-6, Index No. 18) for a peak level of 0 on the vu meter.

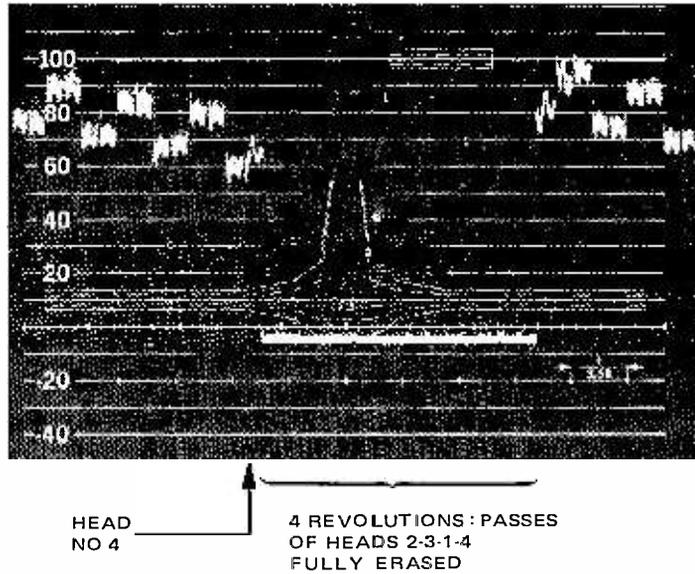


Figure 3-7. Correct Erase Point

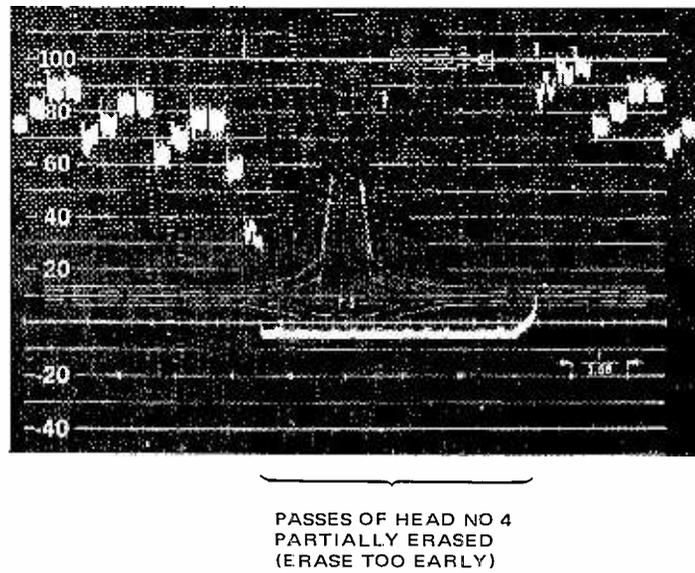


Figure 3-8. Incorrect Erase Point

Table 3-10. Edit Operation — Initial Switch Settings

REF NO.	INDEX NO.	SWITCH, PUSHBUTTON OR CONTROL NAME	POSITION OR ADJUSTMENT
3-1	1	AUDIO 1 Toggle Switch	Per operator's requirements.
3-1	2*	AUDIO 2 Toggle Switch	Per operator's requirements.
3-1	4	VIDEO Toggle Switch	Per operator's requirements.
3-2	2	LOCAL-REMOTE Toggle Switch	Set to LOCAL.
3-2	4	E-E TAPE Toggle Switch	Set to TAPE.
3-3	1	ENTRANCE SHIFT Potentiometer	Set to 0.
3-3	2	EXIT SHIFT Potentiometer	Set to 0.
3-3	5	RECORD SAFETY Toggle Switch	Set to ON.
3-4	15	RECORD LOCKOUT Toggle Switch	Set to OFF.
3-6	1	15 IPS—7-1/2 IPS Toggle Switch	Determine tape speed used in producing recording to be edited, and set switch accordingly.
3-6	5	EDIT PLAYOFF Toggle Switch	Set to EDIT.
3-6	12	RECORD UNITY-VARIABLE Toggle Switch (Cue Module)	Set to UNITY.
3-6	17	RECORD UNITY-VARIABLE Toggle Switch (Audio 1 Module)	Set to UNITY.
3-6	22*	RECORD UNITY-VARIABLE Toggle Switch (Audio 2 Module)	Set to UNITY.
3-6	25	UNITY-VARIABLE Toggle Switch (Modulator Module)	Set to UNITY.
3-6	40	MAIN POWER Switch	Push switch inward to apply power.

*Control is part of an optional accessory.

8. Set AUD 1-AUD 2-CUE-CT MONITOR switch to AUD 2. Observe vu meter and if necessary set UNITY-VARIABLE toggle switch (Table 3-6, Index No. 22) to VARIABLE and adjust REC LEVEL potentiometer (Table 3-6, Index No. 23) for a peak audio level of 0 on the vu meter.
 9. Observe the TRACKING meter (Table 3-2, Index No. 7).
 10. A video signal of 1 volt peak-to-peak (140 IRE units) is required for producing a recording of optimum quality. This signal level is indicated as 100 on the TRACKING meter. If necessary, set UNITY-VARIABLE toggle switch (Table 3-6, Index No. 25) to VARIABLE and adjust VIDEO GAIN potentiometer (Table 3-6, Index No. 24) for 100 on the TRACKING meter.
 11. Thread tape to be edited on machine.
 12. Set EDITOR ON-OFF toggle switch (Table 3-3, Index No. 8) to ON.
 13. Press and illuminate PLAY and RECORD pushbuttons simultaneously.
 14. Press and extinguish EDIT INHIBIT pushbutton.
 15. Observe picture monitor.
 16. Press EDIT CMD pushbutton at the point in the recorded material where the audio/video material supplied from an external source is to be recorded on the tape.
 17. Press EDIT CMD pushbutton when it is desired that the previously recorded audio/video material be resumed.
1. Set INSERT-ASSEMBLE toggle switch (Table 3-3, Index No. 6) to INSERT or ASSEMBLE as required.
 2. Perform *Tach Phase Adjustment* and *Erase Delay Adjustment* (see paragraphs 3-16 and 3-19).
 3. If edit is to be made on a previously recorded tape with a non-standard control track perform *Adjustment For Non-Standard Control Track* (see paragraph 3-18).
 4. Supply machine with audio/video input to be spliced on tape.
 5. Set NORMAL-MONITOR toggle switches (Table 3-6, Index Nos. 11, 16 and 21) to NORMAL.
 6. Set AUD 1-AUD 2-CUE-CT MONITOR switch (Table 3-2, Index No. 6) to AUD 1.
 7. Observe vu meter (Table 3-2, Index No. 5). A peak audio level of 0 on the vu meter is required for producing a recording of optimum quality. If necessary, set UNITY-VARIABLE toggle switch (Table 3-6, Index No. 17) to VARIABLE and adjust REC LEVEL potentiometer (Table 3-6, Index No. 18) for a peak level of 0 on the vu meter.
 8. Set AUD 1-AUD 2-CUE-CT MONITOR switch to AUD 2. Observe vu meter and if necessary set UNITY-VARIABLE toggle switch (Table 3-6, Index No. 22) to VARIABLE and adjust REC LEVEL potentiometer (Table 3-6, Index No. 23) for a peak audio level of 0 on the vu meter.
 9. Observe the TRACKING meter (Table 3-2, Index No. 7).
 10. A video signal of 1 volt peak-to-peak (140 IRE units) is required for

3-22 Cue Tone Controlled Edit

Audio/video material may be spliced onto a previously recorded tape as follows:

producing a recording of optimum quality. This signal level is indicated as 100 on the TRACKING meter. If necessary, set UNITY-VARIABLE toggle switch (Table 3-6, Index No. 25) to VARIABLE and adjust VIDEO GAIN potentiometer (Table 3-6, Index No. 24) for 100 on the TRACKING meter.

11. Thread tape to be edited on machine.
12. Reset tape timer to zero using tape timer reset knob (Table 3-7, Index No. 5).
13. Put system in play mode by pressing and illuminating PLAY pushbutton; observe picture on monitor.
14. Press CUE TONE REC pushbutton (Table 3-3, Index No. 10) to record an entrance cue tone at the point where a new scene is to be spliced into the tape being played. Note the approximate location where the entrance tone was recorded by observing the tape timer readout.
15. Record an exit cue by pressing CUE TONE REC pushbutton at the point where the new scene being spliced into the tape is to end and the previously recorded existing material is to resume.

NOTE

The following six steps provide for *PREVIEWING* the proposed edit. Cue tones may be heard during rewind by selecting CUE and pressing PREMUTE on the monitor control panel.

16. Prepare to preview this proposed splice by rewinding the tape to a point five seconds before the entrance cue recorded in step 14.
17. Set EDITOR ON-OFF toggle switch (Table 3-3, Index No. 8) to ON.
18. Press and illuminate PLAY pushbutton.

19. Press and extinguish EDIT INHIBIT pushbutton.
20. Observe picture monitor. Off-tape video will appear on monitor up to the entry cue; externally supplied video will then appear on the screen and will remain up to the point where the exit cue was recorded; off-tape video will then resume.
21. Press STOP pushbutton when preview of proposed edit has been completed.

NOTE

If after previewing the proposed edit, you are satisfied that the edit cues have been properly placed, steps 22 through 25 need not be performed.

22. If necessary, shift the effective location of the recorded entrance cue tone forward or backward by setting ENTRANCE SHIFT control (Table 3-3, Index No. 1) counterclockwise (forward shift) or clockwise (backward shift). Each dial unit represents a shift of approximately three frames.
23. If necessary, shift the effective location of the recorded exit cue tone forward or backward by setting EXIT SHIFT control (Table 3-3, Index No. 2) counterclockwise (forward shift) or clockwise (backward shift). Each dial unit represents a shift of approximately three frames.

NOTE

If an entrance or exit cue is erroneously shifted so that the exit cue appears before the entrance cue, the EDIT INHIBIT mode is immediately and automatically entered and the EDIT INHIBIT pushbutton will illuminate.

24. Rewind tape to about five seconds before the recorded entrance cue tone and repeat steps 18 through 21 to preview the adjusted edit.
25. Repeat steps 22 through 24 until satisfied with the proposed edit.

NOTE

The effective shift of the cue tones caused by any adjustments having been made to the ENTRANCE SHIFT and EXIT SHIFT controls may now, if desired, be converted to an *actual* shift of recorded cue tones. This is accomplished by rewinding the tape to a point five seconds before the entrance cue, pressing and illuminating the CUE REWRITE pushbutton, pressing and extinguishing the EDIT INHIBIT pushbutton, and pressing and illuminating the PLAY pushbutton to enter the play mode. Play tape to a point just past the exit cue.

26. Press and extinguish EDIT INHIBIT pushbutton.
27. Press and illuminate PLAY and RECORD pushbuttons simultaneously. Have the externally supplied audio/video material ready for insertion on the tape at the cue tone.

NOTE

Cue tones may be erased from tape by putting system in play mode and pressing CUE ERASE pushbutton (Table 3-3, Index No. 11); cue tones may also be erased from tape by putting system in play mode and activating the CUE REWRITE pushbutton (Table 3-3, Index No. 12) with the EDIT INHIBIT pushbutton (Table 3-3, Index No. 7) illuminated.

SECTION IV

FUNCTIONAL SYSTEM DESCRIPTION

4-1 OVERALL SYSTEM

Shown in Figure 4-1 is a simplified block diagram of the AVR-2 Videotape Recorder system. Major subsystems are:

1. **Transport** including all heads, reels, capstan, drive motors, and pneumatic system.
2. **Control** including control logic, control panels, and editor (accessory).
3. **Servo** including head servo, capstan servo and reel drives.
4. **Signal System** including video record/reproduce electronics and video-erase drive.
5. **Time-Base Corrector (TBC)** including TBC circuits, sync generator, dropout compensator (accessory), and velocity compensator (accessory).
6. **Audio and Cue** including one or two audio channels and the cue channel.
7. **Power Supply** providing all necessary voltages. (Not shown in Block Diagram.)
8. **Monitoring** (accessory) including video, waveform, and audio monitors. (Not shown in Block Diagram.)
9. **Compressor** (accessory) provides high-pressure air for the head motor and vacuum supply. (Not shown in Block Diagram.)

4-2 Transport

In addition to providing tape motion, the transport includes all the heads and the pneumatic system. There are two basic modes of operation, record and playback, which appear to be similar as the operator views the transport but are significantly different in the actions of the various heads. In both modes, tape motion is initiated by engaging the pinch roller, and video tip-to-tape contact is accomplished by engaging the vacuum guide. Tape tension is maintained by the reel drive motors and compliance arms, with tape moving from supply to takeup reels.

Differences between record and playback modes are best understood by examining the action of each element in the tape path. Operation during record is as follows:

1. Advance-cue read head provides editor information.
2. Video and control tracks erased at the video erase stack (see Figure 4-2).
3. Video head recording same information on all channels providing about 15% of information overlap.
4. Control-track head recording, video-head rotation and frame-location information (see Figure 4-3).
5. Audio and cue tracks erased at audio-erase stack. Audio erasure may be either full or half-track.

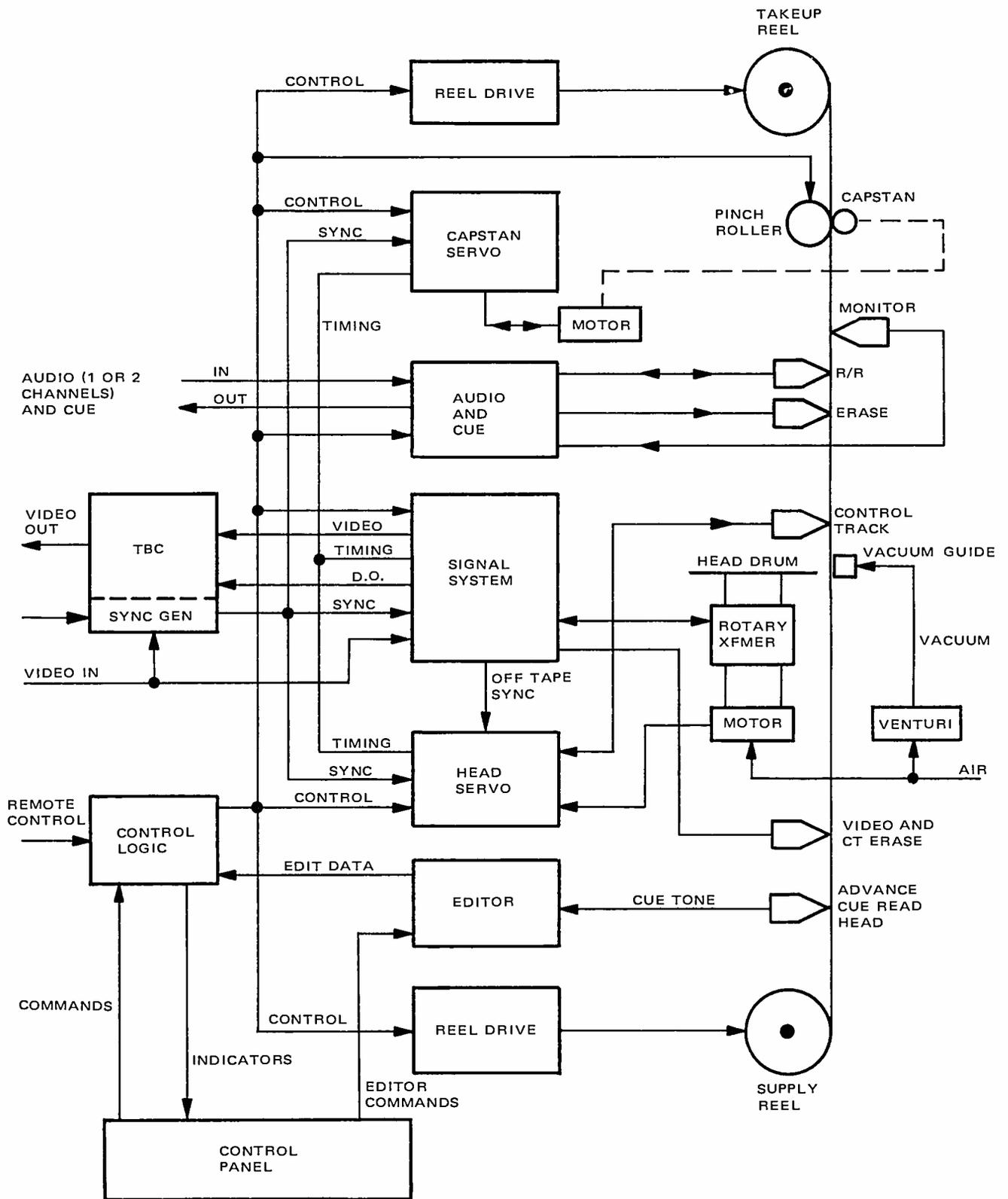


Figure 4-1. AVR-2 Simplified System Block Diagram

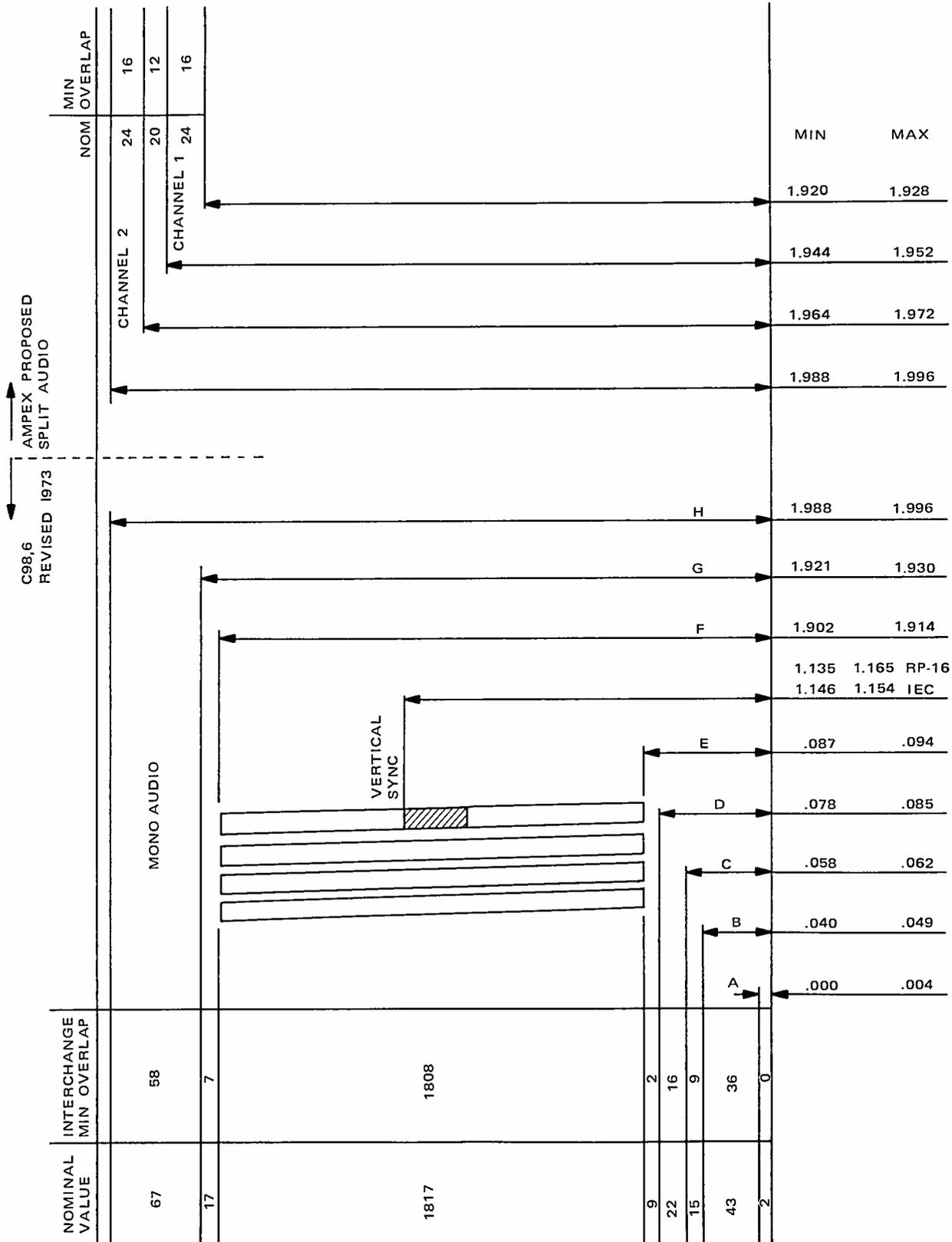


Figure 4-2. Two-Inch Quad Format

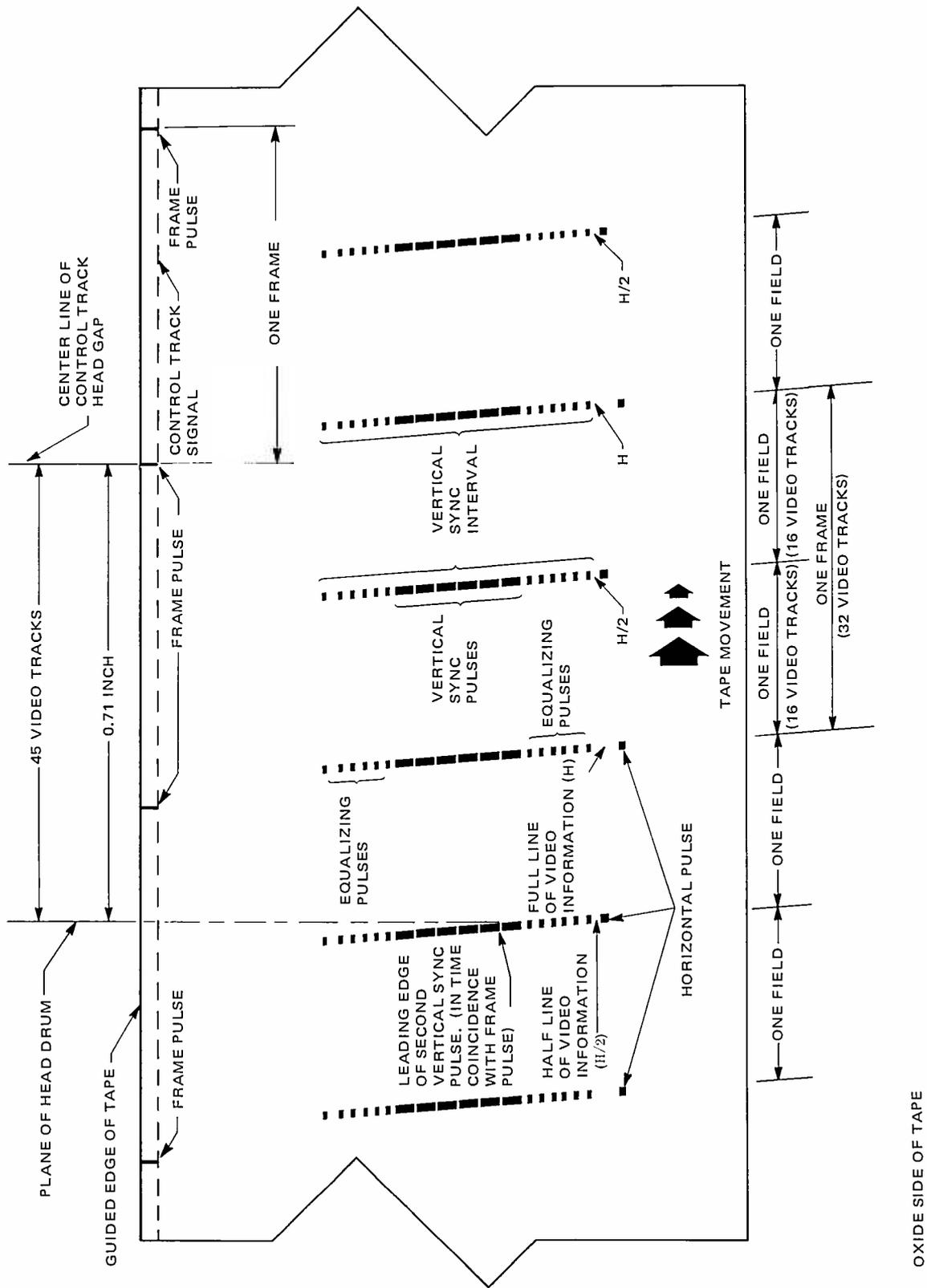


Figure 4-3. Video and Control Track Dimensions

6. Audio and cue recording at audio R/P stack. Audio may be full-track, stereo (accessory), or dual channel (accessory).
7. Back-of-tape monitoring (accessory) of full audio track and control track.

Operation during playback is as follows:

1. Advance-cue read head provides editor information.
2. Video erase stack not used.
3. Video head reads video tracks.
4. Control-track heads provide coarse servo information.
5. Audio erase stack not used.
6. Audio and cue channels read at audio stack.
7. Monitor stack not normally used.

Other combinations are possible in cases where the VTR's are used for editing or recording less than the full set of signals.

4-3 Editor. If an accessory editor is installed in the system, the AVR-2 can be operated in the edit mode, meaning that the AVR-2 is operated in a slave relationship to input video (either from another videotape recorder or from a line source) and cue track information. The editor provides a controlled transfer from the playback mode to the record mode for audio and/or video. The editor may be operated in either the insert mode or assemble mode.

In the insert edit mode, new video material is inserted into a previously recorded program while retaining the previously recorded control track.

In the assemble edit mode, new material is added at the end of the existing program, and a new control track is recorded at the same time as the new material is recorded.

4-4 Control

All actions of the VTR are directed by the control logic using information derived from control-panel commands, remote control, or edit data. Informa-

tion from all parts of the system is processed by the control logic to provide interlocks, warning and operation indications, and smooth transport operation.

4-5 Servo

Servos are required for the head and capstan to insure proper video tip and tape motion during record so that a standard recording is made. The head servo is locked to sync in such a manner as to insure that vertical sync will be recorded on the tape in conformation with standard practice. Using head-servo timing information, the capstan servo insures that the tape speed, hence track-to-track spacing, conforms to ANSI standards. Information is recorded on the control track which will provide track and frame data. Appropriate standards are listed in Section 4-9.

In the playback mode, the servos control the head drum and capstan in a manner which exactly follows the recorded signal so that the video output will have the proper phase relationships with the synchronizing source. If the tape being played is recorded to the published standards, full lock-up will occur in less than one second in NTSC, or two seconds in PAL/SECAM. Briefly, the action is as follows:

1. Capstan servo synchronizes control-track frame pulse with reference frame pulse and locks to the standard phase of the control-track signal.
2. Off-tape video vertical sync is compared to reference vertical, and if necessary, the head servo changes the phase of the head drum slightly to bring video within the TBC range.

4-6 Signal System

During recording, the signal-system processes the incoming video in a manner appropriate for the television and VTR standard being recorded. The AVR-2 is a single-standard machine, thereby greatly simplifying the signal-system circuits.

Standards available are:

- 525/60 NTSC High Band
- 525/60 PAL-M High Band

- 625/50 PAL High Band
- 625/50 SECAM High Band

A special video-head optimize (VHO) mode is available so that each of the four record amplifiers may be set to the correct level for the particular tip and tape being used.

Timing of the tip-to-tip switch during playback is accomplished using information from the head servo and off-tape sync signal. Signal processing is in accordance with the particular standard being used. Automatic equalization on a head-by-head and line-by-line basis is available as an accessory (autochroma).

4-7 Time-Base Correction

Contained in the video signal from the signal system are time-base errors due to various mechanical imperfections. The AVR-2 uses a unique digital time-base corrector (DTBC) which provides a very accurate, wide-window (64 microseconds) correction of timing errors. The incoming signal is converted to digital form at a clock rate which is three times color subcarrier and locked to the off-tape color burst. Errors larger than 1/3 cycle of color subcarrier are removed by passing the digital video through a variable delay. The video is then re-sampled in phase with reference burst and converted back to analog form providing a completely time-base corrected video output signal.

Two accessories are available with the DTBC. A two-line delay in the digital video path allows insertion, during any part or all of a line, of information from a previous line in case a dropout condition should occur. Information about dropout timing is obtained from the signal system. Velocity compensation (fine-error interpolation during a line) is also possible as an additional accessory when the two-line delay (DOC) is installed.

Included in the TBC section is a sync generator which provides synchronizing signals for the rest of the VTR system. The sync generator may be locked to any of the following sources:

- Internal crystal oscillator
- Internal ultrastable crystal oscillator (accessory)

- Incoming video
- External reference sync

4-8 Audio and Cue

A new audio feature is available as an accessory in the AVR-2, stereo, or dual channel audio. This is accomplished by splitting the standard 70-mil audio track into two 25-mil tracks and a 20-mil guard band. For the stereo option a full-track erase head is used, providing complete erasure of old audio recordings. With the dual-channel option, a split-track erase head is used.

Standard bias recording is used for all three channels, and the three pwa's are interchangeable although alignment to a particular head is required for full performance. Back-of-tape monitoring is provided as an accessory.

4-9 RECORDING STANDARDS

A number of organizations have set up standards which have made interchange of two-inch, quadruplex, video recordings possible. These organizations are:

- American National Standards Institute
1430 Broadway
New York, New York 10018

This organization used to be known as the ASA.

- Society of Motion Picture and Television Engineers
862 Scarsdale Avenue
Scarsdale, New York 10583

The SMPTE has recommended practices which cover some areas not covered by ANSI C98. In general, ANSI Standards in the area of VRT's were all adopted from SMPTE RP's.

- International Electrotechnical Commission
Bureau Central de la Commission
Electrotechnique Internationale
1 rue de Varembe, Geneve, Suisse

The following recording standards apply for the AVR-2 Videotape Recorder system.

1. Tape Dimensions	ANSI C98.1 – 1963	7. Color Leader	ANSI C98.9 – 1967
2. Monochrome Leader	ANSI C98.2 – 1963	8. Carrier Frequencies and De-Emphasis	RP6 – 1967
3. Audio for 2-Inch VTR	ANSI C98.3 – 1970	9. Control Track	RP16 – 1970
4. Tape Speed	ANSI C98.4 – 1963	10. Tape Neutral Plane	RP36 – 1969
5. Track Dimensions	ANSI C98.6 – 1972	11. Transverse Track Recorders (625-Line Systems)	IEC Publication 347
6. Audio Reference Level	ANSI C98.7 – 1962		

SECTION V

MAINTENANCE

5-1 GENERAL

This manual contains routine maintenance information, including a schedule of performance, and corrective maintenance information, including corrective adjustment procedures, for the AVR-2 Videotape Recorder.

5-2 ROUTINE PREVENTIVE MAINTENANCE

Table 5-1 lists the recommended routine maintenance procedures and the paragraphs in which they can be located. These adjustment procedures should be performed as required by the operation of the recorder. When these procedures are performed, notation of their completion should be logged as a maintenance record for the user.

The AVR-2 tape transport can be tilted (see Figure 5-1) so that the underside of the tape transport is accessible from the front of the recorder. Extender cards and extended cables facilitate equipment servicing and maintenance.

5-3 CLEANING

Cleaning the magnetic head assemblies, the tape path, and the air filter are necessary steps in the routine maintenance procedures to prevent the buildup of oxide which can be detrimental to the recording and reproducing process.

5-4 Magnetic Head Assemblies

An effective cleaning agent for removing oxide and dust accumulation from the various head assemblies is Ampex Head Cleaner 087-007. The head cleaner should be applied to the heads with a cotton-tipped swab. The applicator should be

moistened (but not saturated) with the head cleaner. When cleaning the heads, exercise extreme care to avoid scratching the tape-contacting surfaces.

CAUTION

THE SOLVENT WILL CAUSE DAMAGE IF IT COMES INTO CONTACT WITH THE TAPE OR PAINTED SURFACES.

Access to the video head assembly and the audio head assembly may be gained by opening the hinged head cover on the tape transport. In order to gain access to the video head tips and the control track head, the vacuum tape guide should be unlatched (see Figure 5-2). The cover plate in front of the audio and cue head assembly flips open when the main head cover is opened.

5-5 Tape Path

Ampex head cleaner may also be used for cleaning surface areas such as the tape guides, compliance arms, and the tape timer. A lint-free cloth moistened with cleaner fluid is recommended for cleaning these surfaces. Use care to avoid scratching the tape-contacting surfaces.

CAUTION

THE SOLVENT WILL CAUSE DAMAGE IF IT COMES INTO CONTACT WITH THE TAPE OR PAINTED SURFACES.

5-6 Filter

It is imperative that the filter in the air system be kept clean. If the filter is allowed to become

Table 5-1. Maintenance Procedure List

PROCEDURE	PARA REF
Air system adjustment	5-23
Audio and cue system performance check	5-25
Brake tension adjustments	5-14
Control Track	5-37
Electronic board cleaning	5-7
Filter cleaning	5-6
Head cleaning	5-4
Head demagnetization	5-10
Head tip projection measurement	5-13
Servo check	5-36
Tape path cleaning	5-5
Transport adjustments	5-14
Vacuum adjustment	5-23
Vacuum guide height adjustment	5-9

clogged, air flow will be impeded and unsatisfactory performance or damage to the system will result; if the filter is damaged, it will not filter efficiently and the results may cause system damage.

1. Ascertain that the system power is turned off and that the air pressure to the system is also turned off. Check that the air pressure gauge on the compressor assembly indicates zero.
2. Pull the control panel up and forward to gain access to the tape transport latch.
3. Release the tape transport by pulling the latch handle down and to the right (See Figure 5-1). When released from the latch, the tape transport pivots (front of the tape transport rises) permitting access to the assemblies on the underside of the tape transport.
4. Unscrew the glass filter bowl in the air supply and remove the bronze filter from the bowl. Remove the bronze filter from the supply line by unscrewing it from its fitting. These filters may be cleaned in an ultrasonic solvent cleaner, or soaked in solvent and blown

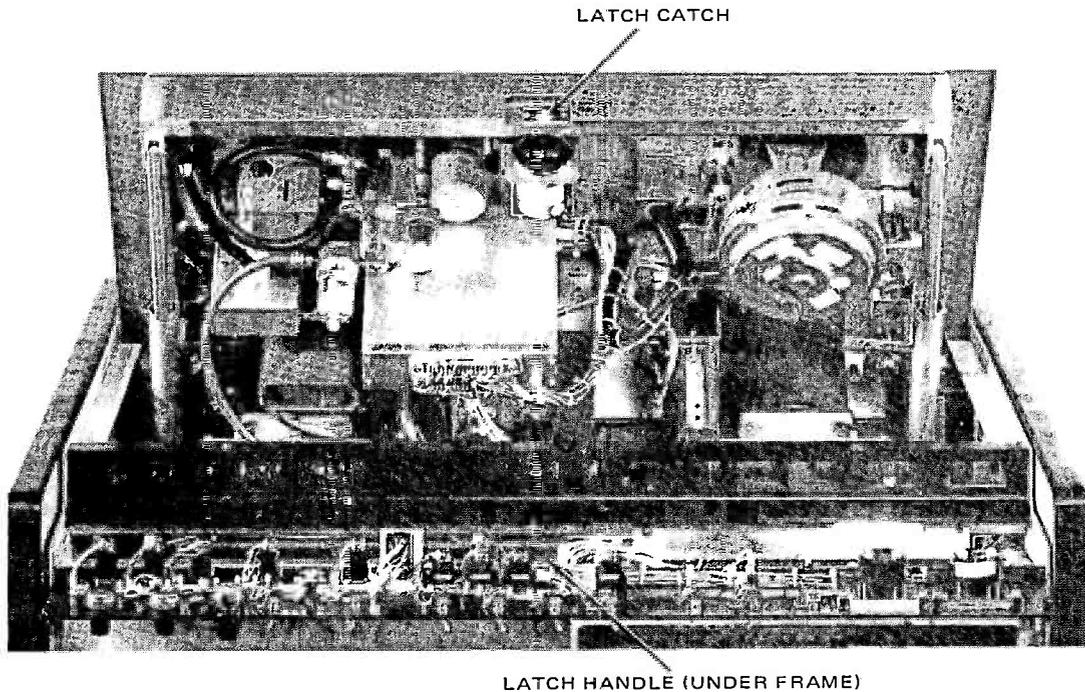


Figure 5-1. AVR-2 Tape Transport Tilted for Access to Underside

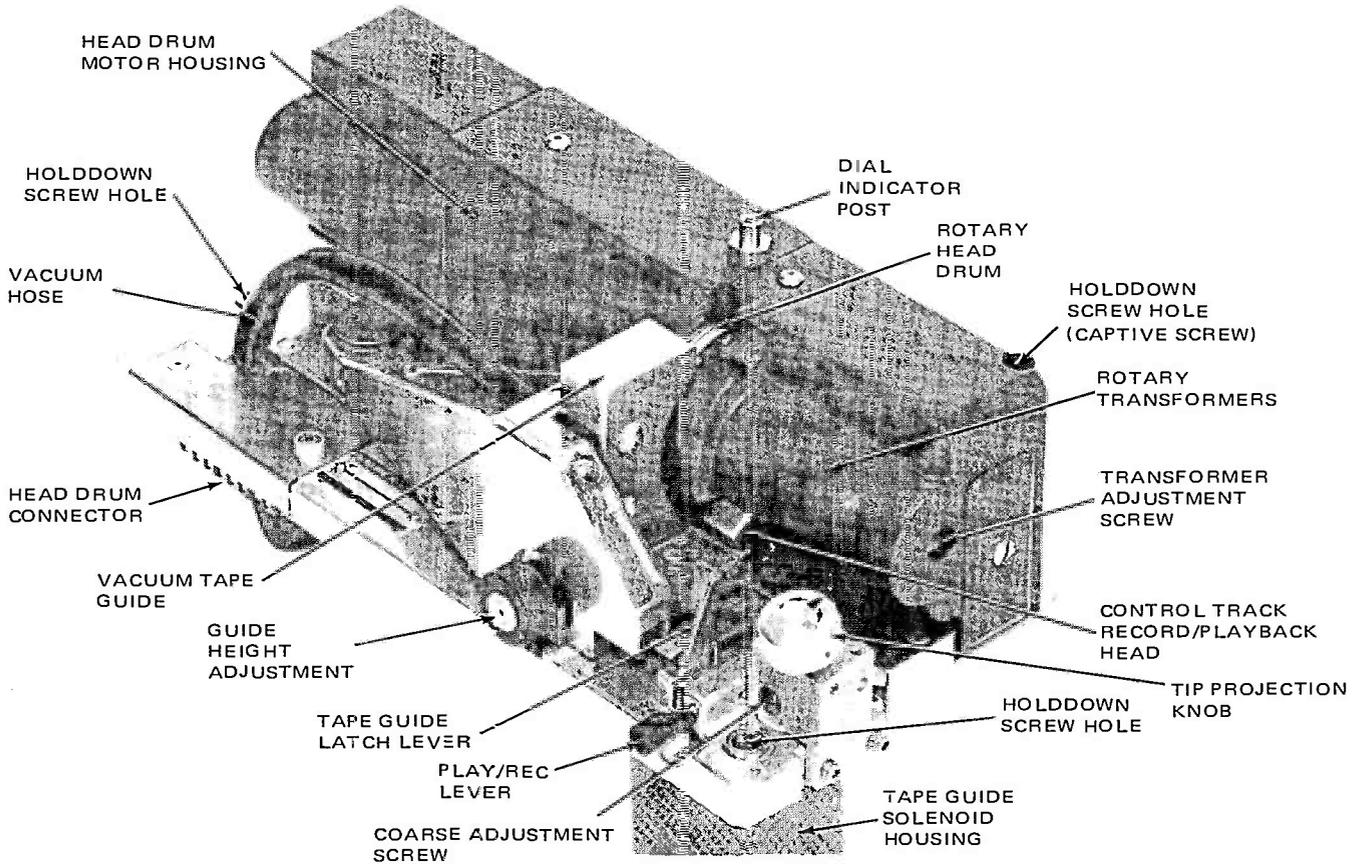


Figure 5-2. Mark XV Head Assembly

dry with a high pressure hose. If neither of these methods can be used, replace the filters with new ones.

5. Clean the inside of the filter bowl and wipe dry with a lint-free cloth.
6. Reinstall the filters and reinstall glass bowl by screwing it to its fitting.
7. Unscrew the glass bowl from the vacuum supply.
8. Clean and reinstall the bowl.
9. Close and latch the tape transport.

5-7 Electronic Boards

To assure proper operation of each of the electronic boards, accumulated dust should be removed from them as often as required. Remove the board from the electronics tray and take it to an area away from the recorder. Remove the dust from the board by gently brushing with a soft bristle, clean paint brush. If a vacuum cleaner is available, use the vacuum cleaner with a soft brush attachment to remove the dust. When the board is free from the dust, return it to its slot in the electronics tray. Repeat this procedure with each of the electronics boards.

5-8 TAPE TRANSPORT CHECKOUT AND ADJUSTMENTS

The following paragraphs describe the checkout and adjustment procedures concerning the portions of the tape transport that have control of the movement of tape. These adjustment procedures are to be performed only when specified as routine maintenance as listed in Table 5-1, or as required by troubleshooting.

5-9 Vacuum Guide Height Adjustment

The height of the vacuum tape guide relative to the head drum is established by the setting of the large knurled knob indicated on Figure 5-2 as the

GUIDE HEIGHT ADJUSTMENT. The following procedure should be performed to check the vacuum tape guide standard position:

1. Turn on the system power and thread the standard Ampex alignment tape on the tape transport.
2. Press in the REC/PLAY lever, turn it clockwise to the REC position, and release it.
3. Initiate the play mode and observe the video monitor to determine if any skewing is present (see Figure 5-3).
4. If any skewing is present, it may be eliminated by adjusting, in small increments, the coarse adjustment screw at the right side of the tape guide plate.
5. If the monitor shows any scalloping (see Figure 5-4), adjust the HEIGHT control to eliminate it.
6. Turn REC/PLAY lever to play and adjust tip projection knob (Figure 5-2) to obtain minimum skew indication.

5-10 Head Demagnetization

The various record and play heads should be demagnetized to remove the residual magnetism that accumulates in the rotary video heads and the stationary audio, cue, and control track heads.

Prior to demagnetizing the heads, perform the following procedures:

1. If not previously done, cover the demagnetizer pole tips with a small piece of masking tape. On the tape mark the location of the gap.
2. Flip open the head cover to gain access to the head assemblies.
3. Clean the heads and tape path (refer to paragraph 5-5).
4. Place the demagnetizer as far away from the recorder as possible and plug the

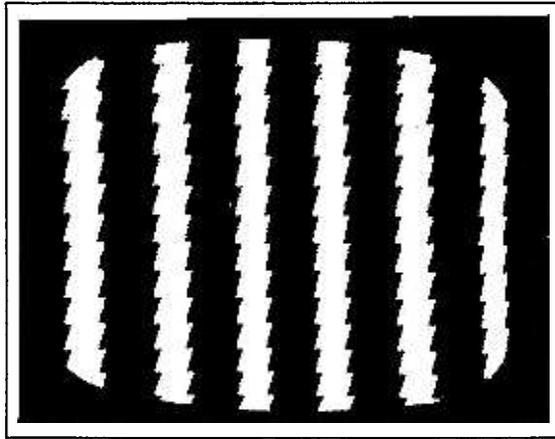


Figure 5-3. Picture Skewing of Vertical Bar Test Signal

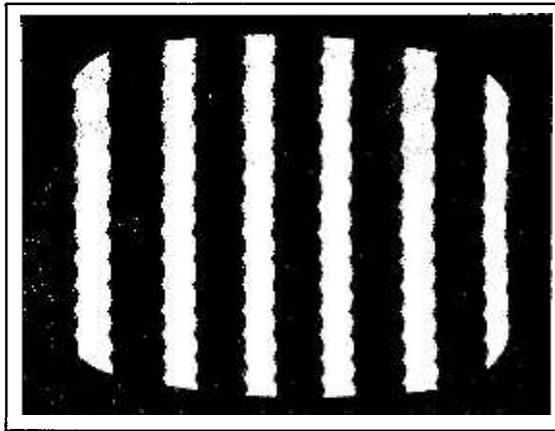


Figure 5-4. Picture Scalloping of Vertical Bar Test Signal

the demagnetizer into an active ac receptacle to energize it.

5-11 Video Head Assembly. Demagnetize the video head assembly as follows:

1. Unlatch the vacuum tape guide and swing it out. Position the video head number 1 (yellow dot) for easy access.
2. Pick up the demagnetizer and move it slowly and evenly toward the head tip. Orient the pole tips of the demagnetizer to straddle the video head gap and touch the demagnetizer to the head tip.
3. After three or four seconds, move the demagnetizer slowly and evenly away from the head tip. The demagnetizer should be withdrawn in the direction opposite from the direction of approach.
4. Hold the demagnetizer away from the recorder with one hand and rotate the video head drum with the other hand so that the next head tip is accessible.
5. Repeat steps 2, 3, and 4 for each of the three remaining head tips.
6. Lay the demagnetizer down as far from the recorder as possible and latch the vacuum tape guide.
7. Pick up the demagnetizer and move it slowly and evenly toward the control track head mounted on the video head assembly. Orient the demagnetizer pole tips to straddle the control track head gap.
8. Hold the demagnetizer to the control track head for about 15 seconds; during this period, slowly move the demagnetizer up and down the length of the head gap.
9. Withdraw the demagnetizer slowly and evenly in the direction opposite from the direction of approach.

5-12 Audio and Cue Heads. Using the techniques in steps 7 through 9 of paragraph 5-11, demagnetize the cue read head in the erase head assembly, and the audio and cue record/playback heads in the audio and cue head assembly.

When the entire demagnetization procedure has been performed, withdraw the demagnetizer as far from the recorder as possible and disconnect the power.

5-13 Head Tip Projection Checkout

Video head tip projection should be measured whenever a head is replaced; the amount of projection should be noted and logged for future reference. Head tip projection should also be measured when the output from a particular video head appears abnormally low. Tip projection of the video head is measured using Ampex gauge, part number 1209742.

To checkout the head tip projection, proceed as follows:

1. At the video head assembly, turn the video head wheel toward the vacuum guide, using a finger tip, until head tip number 1 (identified with a yellow dot) just emerges from the head cover.
2. Mount the tip projection gauge on the video head assembly sub-base by means of the two fluted screws.

CAUTION

USE EXTREME CARE TO AVOID DAMAGING THE VIDEO HEAD TIPS WHILE PERFORMING THE FOLLOWING MEASUREMENT PROCEDURES.

3. Turn the video head wheel slowly *away* from the vacuum guide, until the tapered screw associated with head tip number 1 is under the gauge contact point.
4. Turn the knurled ring around the gauge dial to obtain a zero setting.

5. Turn the head wheel very slowly toward the vacuum tape guide until the gauge pointer registers the maximum indication. Record the total displacement from the zero setting. This is the tip projection for head tip number 4.
6. Repeat step 5 for heads numbered 2, 3, and 1.
7. Turn the head wheel very slowly toward the vacuum tape guide until the gauge contact point is positioned on the head wheel midway between head tip numbers 1 and 4.
8. Remove the text fixture from the video head sub-base.

5-14 Brake Tension Adjustments

The procedures for adjusting and checking the brake tension on each of the reels are described in the following paragraphs. These procedures should be performed in the order given, using the following equipment:

- Dial indicator scale, 0-2 lbs (Ampex 650-105)
- Dial indicator scale, 0-4 lbs (Ampex 650-103)
- Dial indicator scale, 0-15 lbs (Ampex 650-215)
- A 4-foot length of nylon cord with a 1 to 2-inch loop at each end.
- A 3-foot length of 2-inch magnetic tape.

NOTE

Before making any measurement with a dial indicator scale, hold each scale in the position in which it is to be used (parallel to the floor) to determine its

true zero indication. Any deviation must be taken into account when measurements are made.

CAUTION

DUE TO STOP TENSION AND DYNAMIC BRAKING CHARACTERISTICS OF THIS TRANSPORT, CARE MUST BE TAKEN IN PERFORMING THE FOLLOWING PROCEDURES.

5-15 Preliminary Steps. The following steps should be performed prior to making the actual transport tension checks and alignments.

1. Swing the control panel forward to gain access to the tape transport latch.
2. Release the tape transport by pushing down and to the right on the latch handle. When released from the latch, the transport pivots (front of transport rises) permitting access to the triac control box.

5-16 Play Mode Takeup Torque. The following steps should be performed to check the torque of the takeup turntable.

1. Turn on power to the equipment.
2. Place a pencil, or something of equivalent width, between the left compliance arm and the compliance arm stop.
3. Place one end of the nylon cord through the reel guide and the hub of the takeup turntable (see Figure 5-5).
4. Feed one of the loops in the nylon cord through the other loop to fasten the cord to the reel guide. Wrap two or three turns of the cord clockwise around the hub and fasten the hook of the 0-2 lb scale to the remaining cord loop.

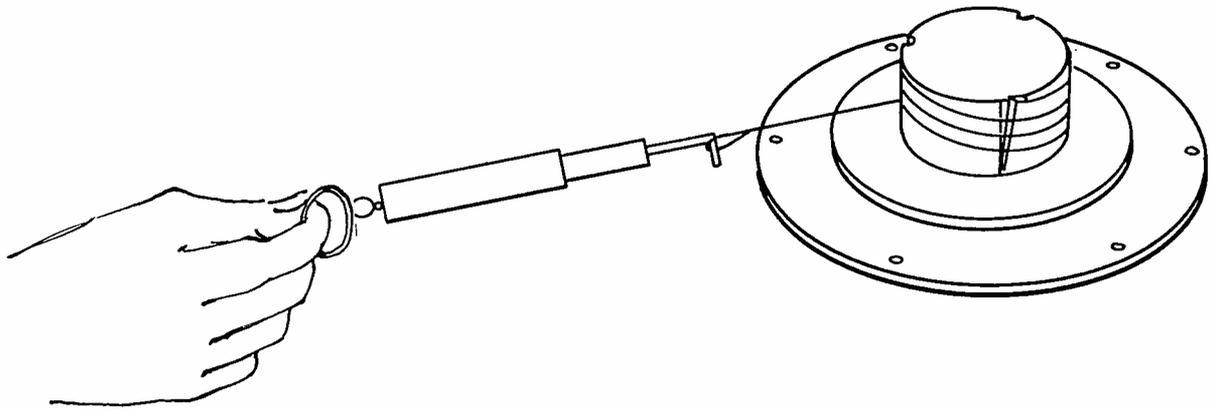


Figure 5-5. Preparing for Reel Tension Adjustment

5. When measuring, hold the scale off to the side of the tape transport and parallel to the floor.
6. Hold onto the takeup reel hub momentarily and press the PLAY pushbutton. As the cord is wound onto the reel hub, move the scale smoothly towards the reel hub, keeping the cord at the tension that just balances the torque. Note an indication of 1 lb 8 oz (+2, -0 oz) on the scale. Adjust the T.U. control on the triac control box, if necessary, to obtain this reading. (See Figure 5-6.)
7. When the adjustment is completed satisfactorily, remove the pencil from the compliance arm.
8. Turn the power off.
9. Place the triac in the boost mode by placing the CONTROL LOGIC board, number 6, on an extender board and connecting shorting plug J2 between B and C. If the board has no J2, jumper the negative end of 6C28 to ground.
10. Turn on the power and place a pencil between the left compliance arm and the compliance arm stop.
11. Fasten the hook of the 0-4 lb scale to the end loop of the cord.
12. Hold the takeup reel, momentarily, and press the PLAY pushbutton. Hold the scale off to the side of the transport and parallel to the floor. As the cord is wound onto the reel hub, allow the scale to follow smoothly, keeping the cord at the tension that just balances the torque to give a steady indication. Note a torque of 2 lbs 4 oz (± 4 oz).
13. Remove the pencil from the compliance arm. Turn off the power and place the shorting plug at J2 on the CONTROL LOGIC board between A and B. On those boards that do not have a J2, remove the jumper from the negative side of 6C28. Remove the extender board from its receptacle and remove the CONTROL LOGIC board from the extender board. Return the CONTROL LOGIC board to its number 6 receptacle.

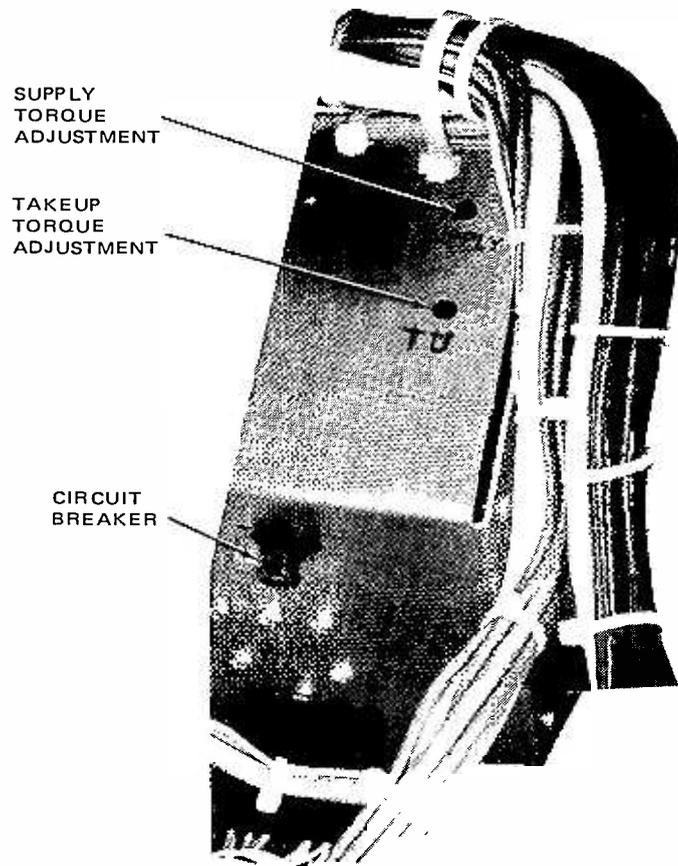


Figure 5-6. Triac Control Box

14. Do not remove the cord from the reel hub; it will be used in the following procedure.

5-17 Rewind Holdback Torque. The following steps should be performed to check the holdback tension on the takeup reel when the recorder is in the rewind mode.

1. Use the 0-2 lb scale and the nylon cord wrapped around the hub of the takeup turntable hub.
2. Turn on the power.
3. Place a pencil between the left compliance arm and the compliance arm stop.
4. Hold onto the takeup reel hub momentarily and press the REWIND push-button.
5. Hold the scale as previously described and note an indication of 8 to 9 oz on the scale. If such a reading is not obtained, recheck the Play Mode Takeup Torque procedure in paragraph 5-16.
6. When completed, remove the pencil and turn off the power.

5-18 Takeup Reel Braking Force. The following steps should be performed to check the

braking force on the takeup reel when the recorder is stopped.

1. Wrap the entire length of the nylon cord ccw around the takeup reel hub and fasten the hook of the 2 lb scale to the cord loop.
2. Hold the scale parallel to the floor close to the reel hub, and pull the scale to unwind the cord from the reel hub (the takeup turntable will rotate ccw). The scale should indicate 1 lb 8 oz (± 4 oz). If necessary, adjust the nut on the takeup reel brake assembly (the nut is on the spring-loaded arm opposite the brake solenoid) to achieve this indication. Turn the nut cw to increase tension. See Figure 5-7.
3. Wrap the entire length of the nylon cord cw around the takeup turntable hub and fasten the hook of the 0-15 lb scale to the cord loop.
4. Wrap the entire length of the nylon cord cw around the takeup turntable hub and fasten the hook of the 0-15 lb scale to the cord loop.
5. Hold the scale parallel to the floor, as close as possible to the reel hub.
6. Pull the scale to unwind the cord from the reel hub (the turntable will turn cw).
7. While the cord is being pulled from the hub at a steady rate, read the scale tension.
8. Repeat step 7 until several readings of the same value have been made; the scale should indicate 7 to 8 lbs of tension. If the indication is not within these limits, perform step 9.
9. Adjust the double set of spring-loaded arms (move both nuts equal distance) extending on either side of the brake solenoid (See Figure 5-7) to change the tension. Repeat step 8.

NOTE

Brake tension is increased by increasing the tension on the two springs associated with the brake solenoid. Both

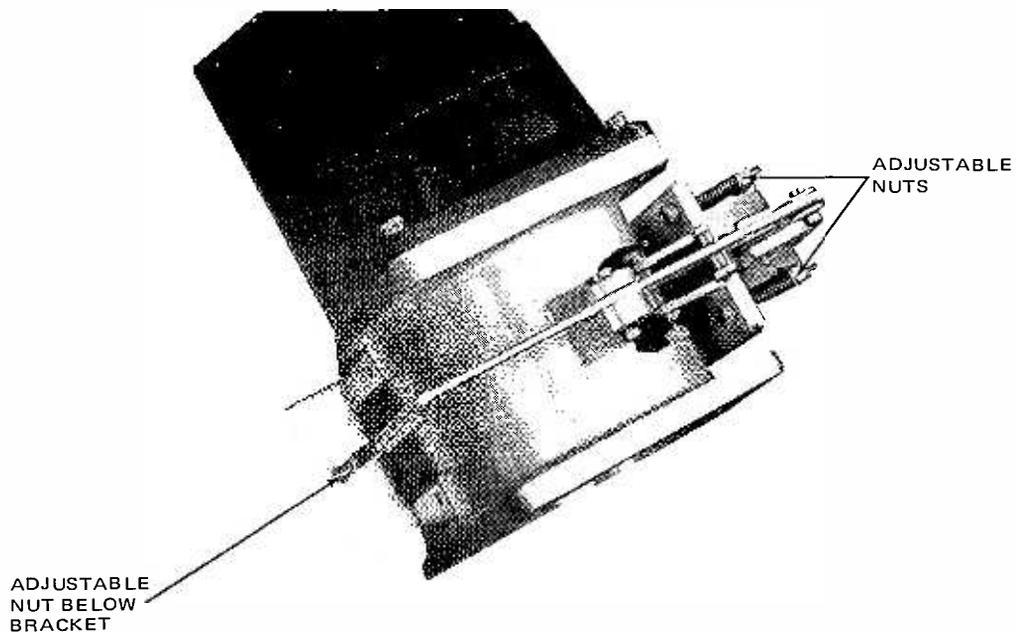


Figure 5-7. Takeup Reel Brake Assembly

springs must be loaded to the same tension; if the indicated tension varies while the cord is being pulled at a steady rate, the spring tensions may be unequal.

10. Remove the scale and the nylon cord from the takeup turntable hub.

5-19 Play Mode Supply Reel Torque. The following steps should be performed to check the holdback tension on the supply reel when the recorder is in the play or record mode.

1. Turn on the power.
2. Place one end of the nylon cord through the reel guide on the supply reel turntable as was done previously when adjusting the takeup reel. Feed one of the loops in the cord through the other in order to fasten the cord to the reel guide. Wrap two or three turns of the cord ccw around the reel hub and hook the 0-2 lb scale to the remaining loop.
3. Place a pencil between the left compliance arm and the compliance arm stop.
4. Hold onto the supply reel hub momentarily and press the PLAY pushbutton; as the cord is wound onto the reel hub, allow the scale to follow smoothly, keeping the cord at a tension that just balances the holdback torque.
5. Repeat step 4 until several indications of the same value have been made; in each case, the scale should indicate 9 to 11 oz of tension. If the indication is not within these limits, perform step 6.
6. If necessary, lift the tape transport to the tilted position and adjust the SUPPLY potentiometer in the triac control box (see Figure 5-6) under the tape transport and repeat step 5.

When proper indications are achieved, proceed to step 7.

7. Remove the pencil from the compliance arm, but do not remove any of the measuring equipment until the procedures in the following paragraph have been performed.

5-20 Fast Forward Holdback Torque. The following steps should be performed to check the holdback tension on the supply reel when the recorder is in the fast forward mode.

1. Turn on the power.
2. Place a pencil between the left compliance arm and the compliance arm stop.
3. Hold onto the supply reel hub momentarily and press the FAST FWD pushbutton; hold the scale to the side of the transport and parallel to the floor. As the cord is wound onto the reel hub, allow the scale to follow smoothly, keeping the cord at a tension that just balances the torque.
4. Repeat step 3 until several indications of the same value have been made; in each case, the scale should indicate 7 to 9 oz of tension. If a satisfactory reading is not obtained, recheck the Play Mode Supply Reel Torque procedure in paragraph 19.
5. When a proper reading is obtained, remove the pencil from the compliance arm and turn off the power.

5-21 Supply Reel Braking Force. The following steps should be performed to check the braking force on the supply reel when the recorder is stopped.

1. Wrap the entire length of the nylon cord ccw around the supply reel turntable hub and fasten the 0-15 lb scale to the loop on the cord.

2. Hold the scale parallel to the floor, as close as possible to the hub.
3. Pull the scale to unwind the cord from the reel hub (the turntable will rotate ccw).
4. While the cord is being pulled from the supply reel hub at a steady rate, read the tension measurement on the scale.
5. Repeat step 4 until several readings of the same value have been made; in each case, the scale should indicate 7 to 8 lbs of tension. If the reading is not within these limits, perform step 6.
6. Turn the nuts on either side of the brake solenoid (see Figure 5-8) to adjust the tension, then repeat step 5.

NOTE

Brake tension is increased by increasing the tension on the two springs associated with the brake solenoid. Both springs must be loaded to the same tension; if the tension varies while the

cord is being pulled at a steady rate, the spring tensions may be unequal.

7. Wrap the entire length of the nylon cord cw around the supply turntable hub and fasten the hook of the 0-2 lb scale to the cord loop.
8. Hold the scale parallel to the floor, as close as possible to the hub.
9. Pull the scale to unwind the cord from the reel hub (the supply turntable will rotate cw).
10. While the cord is being pulled from the supply reel hub at a steady rate, read the indication on the scale.
11. Repeat step 10 until several indications of the same value have been made; in each case, the scale should indicate 1 lb 8 oz (± 4 oz). If the reading is not within these limits, perform step 12.
12. Turn the nut on the spring-loaded arm opposite the brake solenoid on the supply reel brake assembly (see Figure

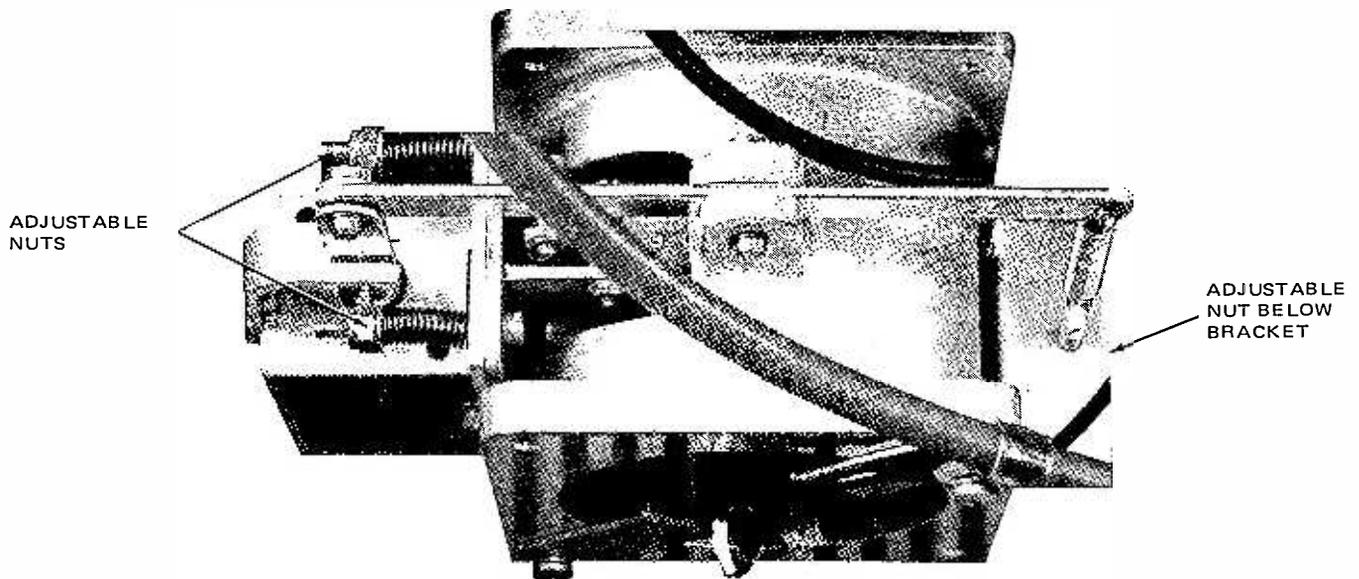


Figure 5-8. Supply Reel Brake Assembly

5-8) to adjust the tension, then repeat step 11.

13. When the proper tension is reached, remove the scale and the nylon cord from the supply reel hub.

5-22 Capstan Idler Pressure. The following steps should be performed to check the pressure of the solenoid which holds the capstan idler against the capstan.

1. Remove the head cover assembly from the tape transport.
2. Install the pressure measurement attachment (Ampex 1360943) on the capstan idler yoke.
3. Secure the supply compliance arm approximately 1/2 inch from its stop.
4. Attach a 0-15 lb dial indicator scale to the capstan idler yoke.
5. Turn on the power and initiate the play mode.
6. Pull the dial indicator parallel to the top plate and perpendicular to the pinchroller until the pinchroller just disengages from the capstan (place a fingertip lightly on the pinchroller surface in order to sense the point at which the capstan no longer drives the pinchroller). The indication should read 13.0 (± 0.5) lbs. Repeat this step several times to ensure an accurate reading.
7. If the reading is not within the limits stated in step 6, adjust the nut at the end of the solenoid arm (see Figure 5-9) to obtain the proper setting.
8. When the indication is correct, press the STOP pushbutton and remove the measurement yoke. Replace the head cover assembly and release the supply reel compliance arm.

5-23 Air and Vacuum Adjustments

The source of the air supply to the recorder must provide a nominal 45 psig of air at a consumption rate of 1.0 scfm to the air input to the recorder. To adjust the vacuum pressure to the vacuum guide on the video head assembly, proceed as follows:

1. Ascertain that a video head assembly is installed on the tape transport.
2. Pull the control panel forward to gain access to the transport latch.
3. Push down and to the right on the latch to release the tape transport. When released, the tape transport will pivot with its forward part rising. This allows access to the components mounted on the underside of the tape transport. Raise transport and be sure it is securely locked.
4. Disconnect the air hose from the vacuum adjustment valve and connect a vacuum gauge to the valve as shown in Figure 5-10.
5. Turn on the recorder power.
6. Adjust the vacuum valve to obtain 40 inches of water indicated on the vacuum gauge.
7. Lower the input air pressure to the system, at the regulator valve at the source, until the red low pressure warning lamp lights. Observe that this occurs at 25 (± 2) psi and that the head wheel motor has stopped running. Adjust the cutout range control, if necessary. To raise the cutout setting (which will also raise the cut-in setting), turn the range nut cw.
8. Increase the input air pressure to the system and observe that the low pressure warning light goes out at approximately 35 psi. Observe that the

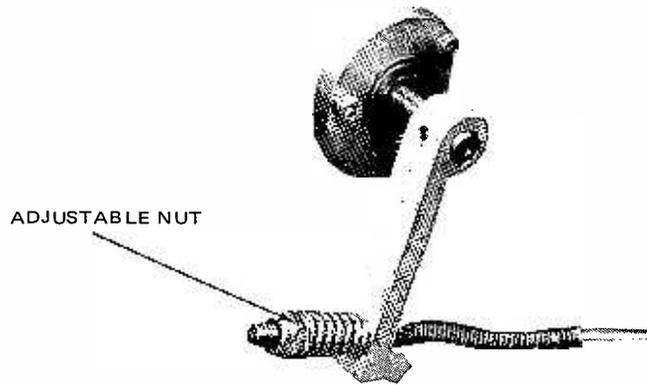


Figure 5-9. Pinchroller Adjustment

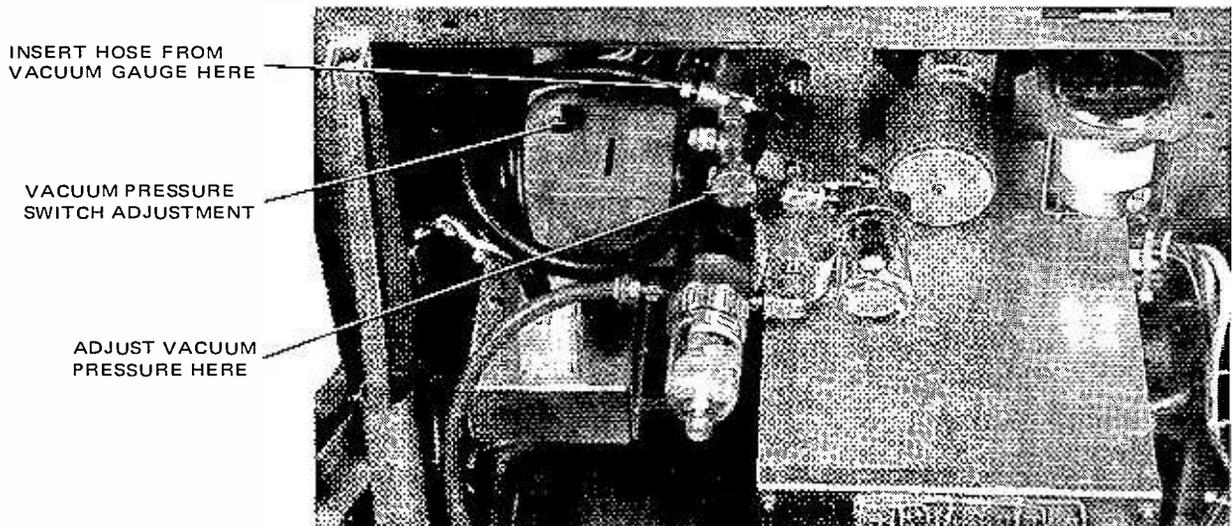


Figure 5-10. Vacuum Pressure Adjustment

head wheel motor is running. Adjust the cut-in setting, if necessary. To raise the cut-in setting, turn the cut-in screw cw.

9. Remove the vacuum gauge and re-connect the air hose to the vacuum valve.
10. Move the supply reel compliance arm approximately 0.5 inch clockwise, listen for the microswitch click, then press the FAST FWD pushbutton. Observe that the supply and takeup reel turntables rotate.
11. Decrease the system input air until the red low pressure warning lamp lights with the system in the fast forward mode. Observe that the head wheel motor and both reel turntables stop running.
12. Increase the system air to 45 psi with the system in the fast forward mode. Observe that the head wheel motor and both reel turntables rotate and that the red warning light goes out.
13. Press the STOP pushbutton to dis-engage the system from the fast forward mode.

5-24 ELECTRONICS CHECKOUT AND ADJUSTMENTS

The following paragraphs detail the checkout and adjustment procedures necessary for proper operation of the audio and cue electronics, the video electronics, and the servo electronics. These checkout and adjustment procedures should be performed only when specified as a routine maintenance or as required by troubleshooting.

5-25 Audio and Cue System Performance Checkout

The following pages contain the procedures for aligning the various portions of the audio and cue system, and also tables listing the position and

function of the many shorting plugs (jumpers) that are contained on the audio board and the cue board.

5-26 Alignment Procedures. To ensure the optimum conditions for aligning the audio and the cue printed wiring assemblies, clean each of the heads and guides with head cleaner (see paragraphs 5-4 and 5-5); then degauss all heads and guides (see paragraph 5-12).

CAUTION

DO NOT REMOVE OR REPLACE ANY PRINTED WIRING ASSEMBLY WHEN POWER IS ON. TO DO SO IS HAZARDOUS TO COMPONENTS AND MAY CAUSE MAGNETIZATION OF THE HEADS.

Prior to alignment procedures, perform the following:

1. Place all jumpers that facilitate the test setup (see Table 5-3) in their normal operating position.
2. Place all jumpers listed in Table 5-2 in the position desired for operation.
3. Set the two switches to UNITY (on the front panel of the pwa).
4. Set the Normal/Monitor switch on the front panel of the pwa to NORMAL.
5. Starting with audio number 1 pwa (board position 9), remove the assembly board from its receptacle and insert it onto the extender card.
6. Insert the extender card with the pwa on it into the receptacle number 9 in the card rack.
7. Turn on the power.

5-27 Reproduce Level Set. To adjust the reproduce level, proceed to the following page.

1. Thread alignment tape, Ampex 52269-01, on the tape transport and initiate the play mode.
2. Connect an ac vtm to the output receptacle on the line output transformer on the rear panel of the equipment.
3. Adjust R124 for an indication on the vtm of -2 dBm for the 400 Hz (-10 dB level) reproduced from the alignment tape.
4. Adjust the meter calibrator R159 for a zero indication on the vu meter on the front control panel.

5-28 Reproduce Equalization. To align the reproduce equalization, proceed as follows:

1. Lift the alignment tape away from the heads and place a flux loop (Ampex 4050238-02) on the record/reproduce head of the channel that is being adjusted. Place jumper J13 in the A-D (no mute) position.
2. Connect the flux loop to an oscillator and adjust the oscillator frequency to 1 kHz.
3. Switch to the tape mode and note the output level.
4. Change the oscillator frequency to 4.55 kHz and adjust C79 for an output level that is 3 dB higher than previously noted.
5. Rethread the alignment tape around the heads and reproduce all tones on the tape. The frequency response should be ± 2 dB to 10 kHz at 7-1/2 in/s and ± 2 dB to 15 kHz at 15 in/s. It may be necessary to readjust C79 slightly to meet these requirements.

If there is an audio pwa in position 10 (audio number 2), follow the procedures as described in paragraphs 5-26, 5-27, and 5-28 to align this pwa also.

When aligning a cue printed wiring assembly, the 240/250 Hz notch filter should be adjusted to ensure proper operation. Notch filter jumper J9 should be removed for record and reproduce equalization measurements. To adjust the notch filter, proceed as follows:

1. Remove the alignment tape from the heads and replace the flux loop for the channel being tested.
2. Set the oscillator frequency to 240 Hz for 525 line operation, or 250 Hz for 625 line operation.
3. Adjust L1, on the left side of the card rack, for a minimum output.
4. Replace jumper J13 to its normal position.

5-29 Bias Frequency and Level Set. The audio and the cue printed wiring assemblies are interlocked in such a manner that when more than one audio or cue board is installed, only one board is used to supply the bias frequency for all of the audio and cue boards.

In order to check and adjust the bias frequency, only the audio or cue board for the channel being checked should be left in the card rack; the other audio and cue boards should be removed. After the other two boards have been removed, proceed as follows:

1. Thread a reel of degaussed tape on the tape transport.
2. Connect a probe from an oscilloscope to TP4 (ground clip to TP5) and turn on the power.
3. Adjust R88 for a 10 μ s square wave display on the oscilloscope.
4. Turn the power off and return the boards that were removed to their receptacles in the card rack.
5. Turn the power back on and initiate the record mode.

6. Connect an audio oscillator to the input. Set the oscillator frequency for 500 Hz for 7-1/2 in/s and 1 kHz for 15 in/s tape speed. The input level should be +8 dBm.
7. Set the REC CAL, R37, to a relatively low setting.
8. Adjust the BIAS level control, R71, for maximum recording on the tape as indicated by maximum monitor head output. (This is LINE OUTPUT when in record and S2 when in monitor.)

NOTE

If the recorder is not equipped with a monitor head, or a cue channel is being adjusted, the tone must be recorded at various bias levels, then reproduced to find the optimum setting. A microphone on the cue channel can help in verbally noting the bias levels. Bias level, for this purpose, can be monitored at TP2.

5-30 Record and E-E Level Set. To set the record and e-e level, proceed as follows:

1. Connect an oscillator that is set at 1 kHz and +8 dBm output to the audio input.
2. Thread a reel of degaussed tape on the tape transport.
3. Initiate the record mode.
4. Reproduce the tape and note the level of the output.
5. Switch the electronics to e-e and note the level of the output.
6. While monitoring the e-e, adjust the record level, R37, to change the e-e

level by an amount that is equivalent to the amount required to bring the reproduce level to +8 dBm. Then adjust the e-e level, R3, for +8 dBm.

5-31 Record Equalization. To adjust the record equalization, proceed as follows:

1. Thread a reel of degaussed tape onto the tape transport.
2. Connect an oscillator to the input and record a series of frequencies from 1 kHz to 10 kHz at 7-1/2 in/s and from 1 kHz to 15 kHz at 15 in/s at a level of -2 dBm.
3. Reproduce these frequencies and note the levels.
4. Adjust C11 at 7-1/2 in/s and C10 at 15 in/s to achieve a flat (± 2 dB) response of these tones. Several recordings and playing back of the tones may have to be made to achieve the correct settings.

5-32 Cue Tone Setting. To adjust the cue tone, which applies to the cue board only, proceed as follows:

1. Short pin 36 to ground.
2. Connect a probe from an oscilloscope to TP6 and adjust R87 to obtain a waveform displayed on the oscilloscope of 125 μ s.
3. Adjust R41 for an e-e output of +18 dBm.

5-33 Monitor Head Level Set. If the recorder has a monitor head installed, set the level of the monitor signal in the following manner:

1. Thread a reel of degaussed tape on the tape transport.
2. Connect an audio oscillator to the input. Set the oscillator frequency to 500 Hz at a level of +8 dBm.

3. Initiate the record mode.
4. While monitoring the 500 Hz tone on the monitor head, adjust R127 for an output of +8 dBm.

5-34 Erase Adjustment. The erase adjustment may be made as follows:

1. Initiate the record mode with a reel of degaussed tape in the recorder.
2. Monitor the erase current at TP3 relative to TP5, ground.
3. Adjust R208 for a p-p amplitude of 3V for a monaural audio track, or 2V for a cue or dual track audio track.

5-35 SHORTING PLUGS (JUMPERS) AND TEST POINTS

On the audio and cue pwa's and the servo system pwa's, there are, within the circuits, a number of shorting plugs (jumpers) and test points. The jumpers, for the purpose of discussion, can be arranged into two groups: those used for the selection of standards and modes of operation, and those used to facilitate testing and setup of the equipment. The test points, of course, are used for testing and setup. The following tables (Table 5-2 through 5-13) list the various jumpers and test points and their functions.

5-36 SERVO SYSTEM PERFORMANCE CHECKOUT

The following paragraphs describe the procedures necessary for the proper operation of the servo system. The adjustments are made on boards 1, 2, 3, 4, and 5 in the electronics tray. The adjustments must be made in the order designated and as described.

5-37 Control Track and Sync Processor; Board 3

Two adjustments are made on this board, the control track record phase adjustment and the

control track playback adjustment. These two adjustments must be performed in the order in which they are described.

5-38 Control Track Record Phase Adjustment. To adjust the control track record phase (R67), proceed as follows:

1. Ascertain that the power is turned off. Remove board 3, CT & SYNC PROC, from its receptacle and place it on the extender card.
2. Insert the extender card in the board 3 receptacle.
3. Connect the probe from an oscilloscope to the lower end of R23. Set the scope for 0.5V per cm vertical and 5 ms per cm horizontal.
4. Turn the power on and initiate the record mode.
5. Observe the control track record current on the oscilloscope; two frame pulses should be seen. Sync the oscilloscope to the first frame pulse and use the sweep magnifier to observe the second frame pulse.
6. Adjust R67 to position the frame pulse in the center of the positive half-cycle of the sine wave, as shown in Figure 5-11.

5-39 Control Track Playback Delay Adjustment. Before performing the control track playback delay adjustment, it is necessary that the control track record phase adjustment be completed. To perform the control track playback delay adjustment (R2), proceed to page 28.

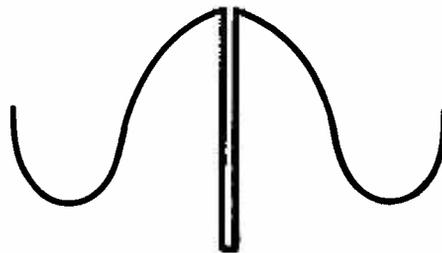


Figure 5-11. Frame Pulse

Table 5-2. Jumpers for the Selection of Operating Modes on Audio and Cue Boards

JUMPER	DESCRIPTION	POSITION	FUNCTION
J1	Input attenuator	A to B A to C A to D	Zero Attenuation of input signal. 20 dB attenuation of input signal. 40 dB attenuation of input signal.
J2	Input signal/mic/preamp	A to B A to C Jumper removed	On pwa not equipped with the mic/pre-amplifier (e.g., audio pwa), or on a cue pwa to bypass the preamp. Normal setting on a cue pwa to use the mic/preamplifier TP1 can be used for signal injection by-passing the input transformer for test purposes.
J3	Low frequency recording preemphasis	A to B A to C	2,000 μ s (NAB Standard) low frequency preemphasis. No low frequency preemphasis (constant current).
			NOTE
			This jumper must be selected to coincide with jumper J12.
J6	Erase circuit activator or inhibitor	A to B A to C	Activates the erase circuit (normal operation). Inhibits the erase circuit (at all times).
J8	Muting circuit activator	A to B A to C	Muting occurs for 100 ms during switching period and in all modes except the play mode. Muting occurs for 100 ms during the switching period and in all modes except the play mode and the record mode.
J9	240/250 Hz trap	A to B A to C	The 240/250 Hz trap is connected to the line driver circuit. The 240/250 Hz trap is disconnected from the line driver circuit.
J10	VU metering selector	A to B	The meter monitors the output line prior to muting. Hence, it indicates even in muted modes.

Table 5-2. Jumpers for the Selection of Operating Modes on Audio and Cue Boards (Continued)

JUMPER	DESCRIPTION	POSITION	FUNCTION
J10 (Cont)	VU metering selector	A to C	The meter monitors the output line signal after muting. NOTE When the jumper is changed from one position to another, the meter must be recalibrated by adjusting R159.
J11	Output impedance selector	A to B	The output impedance is 600Ω and the output level is attenuated by 10 dB. This position is used for driving long 600Ω lines, such as telephone lines.
		A to C	The output impedance is approximately 10Ω.
J12	Low frequency reproduce deemphasis	A to B	2,000 μs (NAB Standard) low frequency reproduce deemphasis.
		A to C	No low frequency reproduce deemphasis (straight integrating). NOTE This jumper must be selected to coincide with jumper J3.
J13	Degree of muting selector	D to A	No muting at any time.
		C to B	Essentially 100% muting (no signal passes) during muting periods.
		D to C	20 dB attenuation during muting periods.

Table 5-3. Jumpers for Facilitating Test Setup on Audio and Cue Boards

JUMPER	DESCRIPTION	POSITION	FUNCTION
J4	Bias/head relay activator	A to B	The bias is turned on and the headswitching relay is energized. The assembly is in record at all times. Used for monitoring the bias and record current.
		A to C	This is the position for normal operation.

Table 5-3. Jumpers for Facilitating Test Setup on Audio and Cue Boards (Continued)

JUMPER	DESCRIPTION	POSITION	FUNCTION
J5	E-E and monitor calibrator	A to B A to C	This is the normal operating position. The line amplifier is connected to either the record amplifier (e-e) or the monitoring amplifier, depending on the position of the Normal/Monitor switch on the front panel of the module.
J7	Erase amplifier monitor	A to B A to C	This is the normal operating position. Permits monitoring the erase current (always in erase).

Table 5-4. Test Points on Audio and Cue Boards

TEST POINT	PURPOSE	DESCRIPTION
TP1	Signal input or preamplifier output	This is a dual purpose test point. If jumper J2 is placed between A and B or A and C, the test point is an input or microphone preamplifier output monitoring point. If jumper J2 is removed from the assembly, the test point may be used as a signal injection point for troubleshooting.
TP2	Record head current	At this point, the record head current, either signal or bias, in milliamperes is equal to the voltage in volts relative to ground, times ten.
TP3	Erase head current	The erase head current, at this point, in milliamperes is equal to the voltage in volts relative to ground, times 100.
TP4	Bias and erase oscillator divider frequency	This is a convenient point to monitor the bias/erase oscillator while adjusting its frequency (100 kHz).
TP5	Ground reference	This point is the ground reference for all of the other test points.
TP6	Cue tone oscillator frequency	This test point is the output of the cue tone oscillator before the divider. The cue tone may be monitored here while adjusting the oscillator frequency (8 kHz).
TP7	100 ms muting pulse generator output	This test point is at the output of the one-shot that generates the 100 ms muting pulse. This point can act as a sweep trigger for an oscilloscope that is monitoring the record head and the erase head turn-on/turn-off current profiles.

Table 5-4. Test Points on Audio and Cue Boards (Continued)

TEST POINT	PURPOSE	DESCRIPTION
TP8	Line amplifier output	This test point may be used to monitor the output of the line amplifier before the signal goes through the output transformer or the impedance selector.

Table 5-5. Jumpers on Board 1, Tracking and Capstan Drive

JUMPER	DESCRIPTION	POSITION	FUNCTION
J1	Capstan motor run signal	A to B	Normal position. Capstan motor runs on play command.
		B to C	Capstan motor runs on motors run command.
		Removed	This jumper should not be removed; if removed, the capstan will not run.
J2	Sequence register	A to B	Normal position. The jumper is out of the circuit in this position. Register clocks through in normal sequence.
		B to C	Jumper ground input to gate and forces register to any sequence selected by J3.
J3	Sequence register reset	A to E	Normal position. Register in normal sequence.
		B to E	When used in conjunction with J2, remains in sequence 2.
		C to E	When used in conjunction with J2, remains in sequence 3.
		D to E	When used in conjunction with J2, remains in sequence 4.
		Removed	Equipment should not be operated with this jumper removed.
J4	300 Hz filter jumper	A to B	Normal position. Passes signal through the filter.
		Removed	Permits signal injection into the filter to measure the response.
J5	Bandwidth jumper	A to B	Normal operation. Carries signal from the 300 Hz notch filter to the loop compensator.
		Removed	Permits measurement of capstan servo bandwidth.

Table 5-6. Jumpers on Board 2, Capstan Servo

JUMPER	DESCRIPTION	POSITION	FUNCTION
J1	Framing counter preset	A to B B to C Removed	Normal operation. For test purposes, forces up frequency. Should be removed when using J3 for down frequency.
J2	Enables framing counter preset	A to B B to C Removed	Normal operation Used when J1 and J3 are removed. Used with J1 and J3 to set the up and down frequency.
J3	Framing counter preset	A to B B to C Removed	Normal operation. For test purposes, forces down frequency. Should be removed when using J1 for up frequency.
J4	Framing bias reference	A to B Removed	Normal operation. Removes the framing bias from the servo loop.
J5	Capstan error	A to B Removed	Normal operation. Capstan error signal enters circuit for correction. Capstan error signal is removed from the servo loop.
J6	Standby bias reference	A to B Removed	Normal operation. Removes standby bias from servo loop.
J7	External capstan speed control	A to B Removed	Normal operation. Inhibits external capstan control.

Table 5-7. Jumpers on Board 4, Head Phase Comparator

JUMPER	DESCRIPTION	POSITION	FUNCTION
J1	Selects vertical lock only if a nonstandard tape is used	A to B A to C Removed	Normal operation. Always vertically locked in sequence 4. Stays in tach lock.

Table 5-7. Jumpers on Board 4, Head Phase Comparator (Continued)

JUMPER	DESCRIPTION	POSITION	FUNCTION
J2	Record sync selector	A to B	Normal operation.
		A to C	Forces selection of reference sync in the record mode.
		Removed	This jumper should not be removed while in operation.
J3	Horizontal phase lock	A to C	Selects horizontal lock in edit only.
		A to B	Goes into horizontal lock in play mode.
		Removed	Will not go into horizontal lock in any mode.
J4	Horizontal lock in edit mode, disable	A to B	Disables horizontal lock in the edit test mode.
		A to C	Inhibits horizontal lock in any mode.
		Removed	Enables horizontal lock in the edit test mode.

Table 5-8. Jumpers on Board 5, Head Driver

JUMPER	DESCRIPTION	POSITION	FUNCTION
J1	Down phase counter	B to C	Normal position. Enables down count.
		A to B	Disables the down count.
		Removed	All the counter to recycle.
J2	Up phase counter	A to B	Normal position. Enables up count.
		B to C	Disables the up count.
		Removed	Allows the counter to cycle.
J3	Autophasing counter wake-up	A to B	Normal position
		A to C	Disables the midrange wake-up.
		Removed	This jumper should not be removed.
J4	Autophasing counter	A to B	Normal position.
		B to C	Freezes counter to last known count.
		Removed	This jumper should not be removed.

Table 5-8. Jumpers on Board 5, Head Driver (Continued)

JUMPER	DESCRIPTION	POSITION	FUNCTION
J5	Autophasing up/down count	A to B	Normal position.
		B to C	Count down only.
		Removed	Count up only.
J6	Autophasing input override	A to B	Normal position.
		Removed	Overrides multiple input gate and enables autophasing at all times even if servo is not locked.
J7	Autophasing error	A to B	Normal position.
		Removed	Removes autophasing from servo loop.
J8	Head phase comparator error	A to B	Normal position.
		Removed	Removes phase comparator from the servo loop.
J9	Head frequency discriminator error	B to C	Normal position.
		A to C	Runs head wheel at nominal speed (open loop).
		Removed	Removes the discriminator from the servo loop.

Table 5-8A. Jumpers on Board 6, Control Logic

JUMPER	DESCRIPTION	POSITION	FUNCTION
J1	Video EE/Tape Command	A to B	Normal position (video EE/Tape command corresponds to EE/TAPE switch setting).
		A to C	Holds video command in EE until video headwheel comes up to speed, and then switches to TAPE automatically. (Prevents display jitter during startup.)
J2	Boost torque test.	A to B B to C	Normal position. Boost torque test.

Table 5-9. Jumpers on Board 12, Modulator

JUMPER	DESCRIPTION	POSITION	FUNCTION
J1	Video input clamp	NORM	Normal position. Allow video input to damp.
		TEST	Opens the error feedback loop to the video input. Input clamp is disabled.
J2	Preemphasis.	NORM	Normal position. Preemphasis network is in the circuit.
		TEST	Jumper bypasses the preemphasis network.
J3	AFC feedback	A to B	Normal position. Afc is feedback to the modulator circuit.
		Removed	Opens the afc feedback line to the modulator circuit.

Table 5-10. Jumpers on Board 16, Demodulator

JUMPER	DESCRIPTION	POSITION	FUNCTION
J1 & J3	Pulse switch input	A to C	Normal position. Conducts signal to low pass filter driver.
		A to B	Test position for low pass filter setup.
J4	Low pass filter	A to B	Normal position. Passes signal from the low pass filter to the equalizer.
		Open	Test position. Extracts signal from jumper position A to C for filter setup.
J5 & J6	Video feedback clamp	A to B	Normal position. Conducts video feedback clamp.
	Clamp for video sync	Open	Test position. Used for low pass filter setup.
J7	Deemphasis	Open	Normal position.
		400 μ F A to B	Capacitor connected from A to B, is an ac bypass of the deemphasis network for the low pass filter setup.

Table 5-11. Jumpers on Board 11, Switcher and Equalizer

JUMPER	DESCRIPTION	POSITION	FUNCTION
J1	Test input	A to B	Normal position. Connects signal through to the equalizer.
		B to C	Test. Connects TEST INPUT to equalizer for equalizer setup.
J3	Equalization control	A to B	Normal position. Conducts signal to master equalizer.
		Open	Test. Removed for equalizer setup.
J4	Low pass filter	A to B	Normal position. Connects signal to low-pass filter.
		A to C	Test position. For equalizer setup.
		B to C	Test position. For low-pass filter setup.
J6	Differential gain bypass	Open	Normal position.
		A to B	Test. Bypasses the differential gain adjustment network.

Table 5-11. Jumpers on Board 11, Switcher and Equalizer (Continued)

JUMPER	DESCRIPTION	POSITION	FUNCTION
J7	Equalizer test	Open A to B	Normal position. Test. Used for equalizer setup.

Table 5-12. Jumpers on Board 13, Monitor Switcher and Color Framing

JUMPER	DESCRIPTION	POSITION	FUNCTION
J1	E-E/tape	A to B	Video goes to black in e-e. Video does not go to black in tape.
J2	Record	A to B	Inhibits video from black in record.
J3	RF absent	A to B	Goes to black if no rf.
J4	Servo lock	A to B	Goes to black if there is no servo lock.
J5	Edit	A to B	Inhibits from black when editor is on.
J6	Sync generator delay control	A to B	Routes input video to the sync generator for locking purposes when in e-e
J7	Sync generator delay control	A to B	Routes input video to the sync generator during record.
J8	Sync generator delay control	A to B	Routes input video to the sync generator during the editor process.
J9	Line standard	A to B A to C	525 line standard. 625 line standard.
J10		A to B B to C	Normal position. Test position.

Table 5.13. Jumpers on Board 30, Sync Generator

JUMPER	DESCRIPTION	POSITION	FUNCTION	
J1	Reference selector	B to C	Automatic mode. Selects between external reference (if in system) and internal reference crystal oscillator.	
		A to B	Uses external reference only.	
J2	Sync lock	A to B	Normal crystal lock condition.	
		B to C	Line lock sync.	
J3	Vertical interval test signal 	A to B	Line 17 of the first field.	
J4		A to B	Line 18 of the first field.	
J5		A to B	Line 19 of the first field.	
J6		A to B	Line 20 of the first field.	
J7		A to B	Line 21 of the first field.	
J8		A to B	Line 17 of the second field.	
J9		A to B	Line 18 of the second field.	
J10		A to B	Line 19 of the second field.	
J11		A to B	Line 20 of the second field.	
J12		Vertical interval test signal	A to B	Line 21 of the second field.

1. With the power off, remove the HEAD DRIVER board 5 and place it on an extender card. Insert the extender card in the receptacle for board 5.
2. Connect Channel 1 of the oscilloscope to pin 47 of board 5, head tach phase number 5 (at 2V/cm).
3. Connect Channel 2 of the oscilloscope to pin 38 of board 3, control track 240 Hz, 180° out-of-phase (2V/cm).
4. Turn on the power.
5. Initiate the record mode and record a short segment of video on the tape.
6. Rewind the tape and play back the segment just recorded. Set the TRACKING control on the control panel to carefully peak the rf level.
7. Adjust the playback delay potentiometer on board 3, R2, until the negative edge of the control track signal is in time with the positive edge of the head tach.

5-40 TRACKING AND CAPSTAN DRIVE BOARD 1

Before performing the manual tracking adjustment to board number 1, it is necessary to first set up the control track record and phase adjustments as outlined in paragraphs 5-37 and 5-38. When these adjustments have been performed, the following adjustments may be made.

5-41 Tracking Centering Adjustment. To adjust the tracking centering (R13), proceed as follows:

1. With the power off, place the TRACKING & CAPSTAN DRIVE board 1 on an extender card.
2. Set the TRACKING control on the front control panel to midrange and select RF LEVEL on the A-scope monitor.
3. Turn the power on and initiate the record mode.
4. After recording a small portion of the tape, rewind and then play back the recording just made.
5. During playback, adjust the tracking centering potentiometer, R13, on board 1, for peak rf level as indicated on the TRACKING meter and the A-scope display.
6. When peak rf level is obtained, turn off the power and remove board 1 from the extender card. Reinsert board 1 in its receptacle in the card rack.

5-42 Capstan Servo Board 2

The adjustment performed on this board is the tape speed override centering. The following paragraph describes this adjustment.

5-43 Tape Speed Override Centering (TSO). To perform tape speed override adjustment, proceed as follows:

1. With the power turned off, place the CAPSTAN SERVO board 2 on an

extender card and insert the extender card in the receptacle for board 2.

2. Select the control track display on the A-scope.
3. Set the input error to zero by shorting pin 78 to ground. Select TSO mode by connecting pin 38 to ground.
4. Turn on the system power.
5. Initiate the play mode.
6. Observe that the control track waveform drifts across the display and that the picture drifts across the monitor.
7. Adjust the TSO centering potentiometer, R52, for a stationary display.
8. Turn off the power, remove board 2 from the extender card, and reinsert it in its receptacle.

5-44 Head Phase Comp Board 4

Two adjustments are made on the head phase comparator board 4: the edit tach phase centering adjustment and the horizontal timing adjustment. It is required that an editor be connected to the equipment in order to perform both of these adjustments.

5-45 Edit Tach Phase Centering Adjustment. To perform the edit tach phase centering adjustment (R5), proceed as follows:

1. With the power off, place the HEAD PHASE COMP board 4 on an extender card and insert the extender card in the board 4 receptacle.
2. Turn the power on.
3. Record a short portion of video and use it for playback throughout the procedure.
4. Rewind the tape portion that was just recorded.

5. Turn the editor on and set the switch on the editor pwa panel to TEST.
6. Set the monitor for DEMOD OUT, and set the TACH PHASE control on the front panel to midposition. Set the picture monitor for horizontal delay.
7. Initiate the play mode. Press and hold down the EDIT CMD pushbutton and observe the display on the monitor as it switches between e-e and tape. Adjust the tach phase centering potentiometer, R5, until the horizontal blanking interval of the input signal is aligned with the off-tape signal. Because this potentiometer has a range of three lines, make sure that the correct line is selected by having the stabilizing dots superimposed on one another and not viewed as separate dots.
8. Turn off the power.

5-46 Horizontal Timing Adjustment. To perform the horizontal timing adjustment, proceed as follows:

1. With the power off, place the HEAD PHASE COMP board 4 on an extender card and insert the card in board 4 receptacle.
2. Turn on the power.
3. Connect Channel 1 of the oscilloscope to pin 55, input H trigger. Connect Channel 2 of the oscilloscope to pin 30, demod H trigger. Set the monitor to HEAD ERROR. Set the oscilloscope time base to 110 ns/cm.
4. Initiate the edit mode and sync the oscilloscope to the positive edge of the input H trigger and note the position of the negative edge of the demod H trigger in the e-e mode.
5. Initiate the play mode and again observe the position of the negative edge of the demod H trigger. Adjust the horizontal

timing control, R7, for a 350-ns delay from the position in the e-e mode.

NOTE

It may be necessary to adjust the tip penetration control for minimum head error as observed on the A-scope in order to obtain the best timing stability of demod H trigger pulse.

5-47 HEAD DRIVER BOARD 5

On the head driver board 5, there is one adjustment to be made; this is the frequency discriminator.

5-48 Frequency Discriminator Adjustment. To perform the frequency discriminator adjustment, (R1), proceed as follows:

1. With the power off, place the HEAD DRIVER board 5 on an extender card and insert the extender card in the board 5 receptacle.
2. Turn on the power and, with an oscilloscope set for 1V/cm, place the oscilloscope probe on the lower end of R28 and display the autophasing error.
3. With the recorder in the ready mode, turn the discriminator adjustment, R1, very slowly and observe the autophasing error display, which should operate between 0V and +5V. At either end of this range, the servo lock lamp will remain lit until R1 is brought back within range again.
4. Set the control so that the autophasing is at midrange, +2.5V.
5. Turn off the power. Remove board 5 from the extender card and reinsert it in its receptacle.

5-49 Signal System, E-E

To check the e-e signal path, proceed as follows:

1. Select a multiburst signal to the system that is 1 (± 0.1)V composite and verify the oscilloscope calibration using the internal oscilloscope calibrator.
2. Press the VID IN pushbutton on the monitor panel and observe the video monitor and the waveform monitor. Verify that there is a video picture on the video monitor and that the waveform monitor composite signal is 140 (± 7) IRE. If not as specified, place modulator board 12 on an extender and adjust unity gain potentiometer 12R56 as required.
3. Press the DEMOD OUT pushbutton on the monitor panel and observe a video picture on the video monitor. Verify that the signal on the waveform monitor is within ± 5 IRE of the signal verified in step 2 above. Adjust 16R1, video gain control on the demodulator board, if necessary.

To check the modulator afc, place the modulator board number 12 on an extender board. Remove shoring plug 12J2 and connect oscilloscope probe to 12TP1. Verify a voltage level of 0 (± 0.2) Vdc. Adjust 12R65, if necessary.

5-50 SIGNAL SYSTEM RECORD/PLAYBACK CHECK

To test the record/playback operation of the signal system, proceed as follows:

1. Turn power on the equipment.
2. Select a multiburst signal to the system.
3. Press the RF LEVEL pushbutton on the monitor panel.

5-51 Video Head Optimization

Check the optimization of the video head as follows:

1. Simultaneously press the PLAY and RECORD pushbuttons on the main control panel, and at the same time press the INITIATE switch on the maintenance control panel. Release the pushbutton and switch and observe that the tape speed is approximately 1/4 normal speed, and that the SERVO lamp is not lit.
2. Select Channel 1 on the OPTIMIZE rotary switch, and observe the playback TRACKING meter and the waveform monitor.
3. Adjust the VIDEO RECORD CHAN 1 control to obtain a peak indication on the TRACKING meter and the waveform monitor. The VIDEO RECORD CHAN 1 control should be locked at the position of the peak of maximum tracking. If the meter indicates off-scale when the current is increased, reduce the monitor signal gain by adjusting 16R172 on the DEMOD board.
4. Repeat steps 2 and 3 above for channels 2, 3, and 4. Observe that both meter and monitor indications are present for each channel. Verify that each channel goes through a peak.
5. Press the STOP pushbutton.

5-52 Control Track Optimization

Two methods that may be used for optimizing the control track record current are given in the paragraph titled Control Track Record Current Optimization, Section III.

5-53 VIDEO ERASE CURRENT

To check the video erase current, proceed as follows:

1. Remove the cover from the video erase head assembly.
2. Connect current probe TEK 131, or equivalent to the large wire on the erase head that goes to the top terminal.
3. Adjust the probe to 1A/div. Adjust the oscilloscope to 0.5V/cm and the sweep to 5 μ s/cm. A current of 5A will indicate 1 cm p-p.
4. Turn on power to the equipment.
5. Initiate the record mode and observe on the oscilloscope a sine wave with an amplitude of 27 (\pm 3) A p-p (5 to 6 divisions on the oscilloscope). Verify that the erase head lamp (on top of the erase head) is lit.
6. Press the STOP pushbutton.
7. Remove the current probe and replace the head cover.

5-54 SIGNAL ELECTRONICS CONTROLS

Table 5-15 lists the various adjustments on the signal electronics pwa, their functions, and their locations.

5-55 REPAIR AND REPLACEMENT

In this section of the maintenance chapter, descriptions of the procedures for removing and replacing various assemblies of the recorder are found. Some of these assemblies are the video head assembly, the audio and cue head assembly, the erase head assembly, the capstan drive

assembly, the reel motor brake assemblies, the reel motor assemblies, the guides, rollers, and other tape path components, and the electronics subassemblies. Parts lists and assembly drawings are contained in the last volume of this manual.

5-56 Video Head Assembly

To remove the video head assembly, proceed as follows:

1. Turn off the power to the equipment.
2. Unscrew the three holddown screws and remove the two that are not captive to the head assembly.
3. Remove the head assembly by lifting it away from the tape transport.

To install a video head assembly, proceed as follows:

1. Ascertain that the power to the equipment is turned off.
2. On the head assembly, push in the REC/PLAY lever, turn it clockwise to the REC position, and release it.
3. Position the head assembly so as to align both of the connector plugs with their mating receptacles.
4. Secure the assembly to the top plate with the three holddown screws (one is a captive screw to the assembly).
5. If the assembly is air-bearing equipped, turn on the air pressure to the recorder. Insert a fingertip in the opening adjacent to the tach wheel and spin the rotor. If the rotor does not spin freely, an adjustment of the clearance between the rotor and the stator of the rotary transformer may be required.

Table 5-14. Signal Electronics Printed Wiring Assembly Adjustments

PWA	LOCATION	REF	FUNCTION	ADJUSTMENT
RF Record Amplifier	Head Channel Assy	R35	Chan 1 balance adj for minimum second harmonic.	Factory setting. Do not adjust.
		R22	Chan 1 balance adj for output.	Factory setting. Do not adjust.
		R62	Chan 2 balance adj for minimum second harmonic.	Factory setting. Do not adjust.
		R49	Chan 2 balance adj for output.	Factory setting. Do not adjust.
		R89	Chan 3 balance adj for minimum second harmonic.	Factory setting. Do not adjust.
		R76	Chan 3 balance adj for output.	Factory setting. Do not adjust.
		R116	Chan 4 balance adj for minimum second harmonic.	Factory setting. Do not adjust.
		R103	Chan 4 balance adj for output.	Factory setting. Do not adjust.
RF Preampifier	Head Channel Assy	C62	H. F. Equalization Chan 1	Factory setting. Do not adjust.
		R143	L. F. Equalization Chan 1	Factory setting. Do not adjust.
		R158	AGC level adj Chan 1.	Factory setting. Do not adjust.
		R83	Scope Display D. C. Centering	May be adjusted for 0V dc with no RF at RF envelope output.
		C41	H. F. Equalization Chan 2	Factory setting. Do not adjust.

Table 5-14. Signal Electronics Printed Wiring Assembly Adjustments (Continued)

PWA	LOCATION	REF	FUNCTION	ADJUSTMENT
RF Preamplicifier (Continued)	Head Channel Assy (Continued)	R101	L. F. Equalization Chan 2	Factory setting. Do not adjust
		R113	AGC level adj Chan 2.	Factory setting. Do not adjust.
		C1	H. F. Equalization Chan 4	Factory setting. Do not adjust.
		R17	L. F. Equalization Chan 4.	Factory setting. Do not adjust.
		R28	AGC level adj Chan 4.	Factory setting. Do not adjust.
		C22	H. F. Equalization Chan 3	Factory setting. Do not adjust.
		R59	L. F. Equalization Chan 3	Factory setting. Do not adjust.
		R70	AGC level adj Chan 3.	Factory setting. Do not adjust.
Switch Equalizer Board 15	Electronics Assembly	R45	Playback slope adj.	Factory setting. Do not adjust.
		R138	Equalizer adj.	Factory setting. Do not adjust.
Demodulator Board 16	Electronics Assembly	R30	Limiter balance adj video rf in.	Factory setting. Do not adjust.
		R93	Limiter balance adj sync rf in.	Factory setting. Do not adjust.
		R19	Detector balance adj minimum fundamen- tal carrier frequency.	Factory setting. Do not adjust.
		R1	Video gain adj.	Set level to 1V composite video
		R172	Level meter calibrate.	Adjust the level meter on the console.

Table 5-14. Signal Electronics Printed Wiring Assembly Adjustments (Continued)

PWA	LOCATION	REF	FUNCTION	ADJUSTMENT
Autochroma Board 14	Electronics Assembly	R121	Burst detector gain adj.	Factory setting. Do not adjust.
		R135	Chroma level adj.	Permits variable control of chroma level when S2 is set at VARIABLE.
		R87	D. C. Offset Adj	Factory setting. Do not adjust.
Sync Generator Board 30	Electronics Assembly	R159	Horizontal Phase adj.	Adjust phase of output video with respect to reference signal.
		R151	Sets position of vertical reset pulse.	Factory setting. Do not adjust.

6. Clearance between the rotor and the stator of the rotary transformer is adjusted by means of the slotted-head screw accessible through the round hole in the right end of the transformer cover. While manually turning the rotor, turn the slotted-head screw slowly ccw until a drag is just perceptible; then turn it cw until the drum rotates freely. Finally, turn the screw cw an additional 1/16 turn (22.5°). Reactivate power to the drum motor.

The initial effect of insufficient contact is a loss of bias, shown as variations in playback level and an excessive number of dropouts. Head repositioning is indicated whenever light pressure on the back of the tape (at the audio head) corrects an audio playback problem.

The following tools are required to complete this procedure:

1. Hex-head wrench set, including 3/64-inch, 5/64-inch, 7/64-inch, and 9/64-inch (Ampex 1221545).
2. Right-angle Phillips-head screwdriver, No. 1 size.
3. Phillips-head screwdriver, No. 1 size.
4. Hex-head wrench, 5/32-inch, short end cut to 7/16-inch (Ampex 55585).

5-57 Audio and Cue Head Assembly

The individual heads within the audio and cue head assembly are adjustable and can be repositioned to increase the effective life of the heads. If the performance of the audio and cue system is degraded by insufficient head-to-tape contact, the record/playback heads should be removed to restore the original head protrusion.

5. Hex-head wrench, 3/32-inch.
6. Step alignment gauge, 3-mil (Ampex 52534).

The audio head assembly must be partially disassembled to perform this procedure; refer to Figure 5-12 throughout. The item numbers referred to are shown in the figure (note that these item numbers are for the purpose of this procedure only and are not the same as the LM item numbers in the parts list).

1. Remove the audio and cue head assembly (1) from the recorder by removing the four cap head screws (2) with a hex-head wrench.
2. Remove the decorative overlay (3) and shields (4 and 5) by removing two flat-head screws (6) with a 5/64-inch hex-head wrench.
3. Remove the shield (9) and hinge base (7) by removing two screws (8) with the No. 1 Phillips screwdriver. Cap (10) and spring (11) are also removed in this operation; do not lose these parts.
4. Free the audio record/playback head (19) by loosening mounting screw (25 in Detail A) with the wrench (31) described in step 4 of the previous paragraph through the slot in the shield.
5. Free the cue record/playback head (21) by loosening the mounting screw (26 in Detail A) with the hex wrench described in step 5 of the previous paragraph.
6. Place the step alignment gauge (30) on the record/playback head plate (20). The short end of the gauge should face head (19).
7. Hold the gauge (30) against the plate (20) and push head (19) out until it touches the gauge. At this point it will project 3 mils into the tape path, which is the proper projection.
8. Use a magnifying glass and check that the head gap is in line with the center of the

worn area of the plate (20). Maintaining the 3-mil projection, tighten mounting screw (25) with wrench (31).

CAUTION

DO NOT OVERTIGHTEN THE SCREWS BECAUSE OF THE POSSIBILITY OF STRIPPING THREADS IN THE HEAD.

9. Maintaining this projection, tighten mounting screw (26) with wrench (32).
10. Free the audio erase head (22) by loosening mounting screw (27 Detail A) with wrench (32).
11. Place the step alignment gauge (30) on the erase head plate (23). The short end of the gauge should face head (22).
12. Hold gauge (30) against plate (23) and push head (22) out until it touches the gauge.
13. Maintaining this projection, tighten mounting screw (27) with wrench (31).
14. Hold gauge (30) against plate (23) and push head (24) out until it touches the gauge.
15. Maintaining this projection, tighten mounting screw (28) with wrench (32).
16. Adjust the position of the guide post (12) so that a straightedge contacting the audio record/playback head (19) and the surface of the guide clears the erase head (22) by 0.030 inch. If the guide (12) or base (13) shows wear, rotate to expose a new surface to the tape.
17. Apply a light coating of thinned Dykem (or equivalent) mechanic's dye to the tape-contacting surface of heads (19, 21, 22, and 24).
18. Without reassembling the audio and cue head assembly (1), mount it on the tape transport using the original mounting screws (2).



AVR-2

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