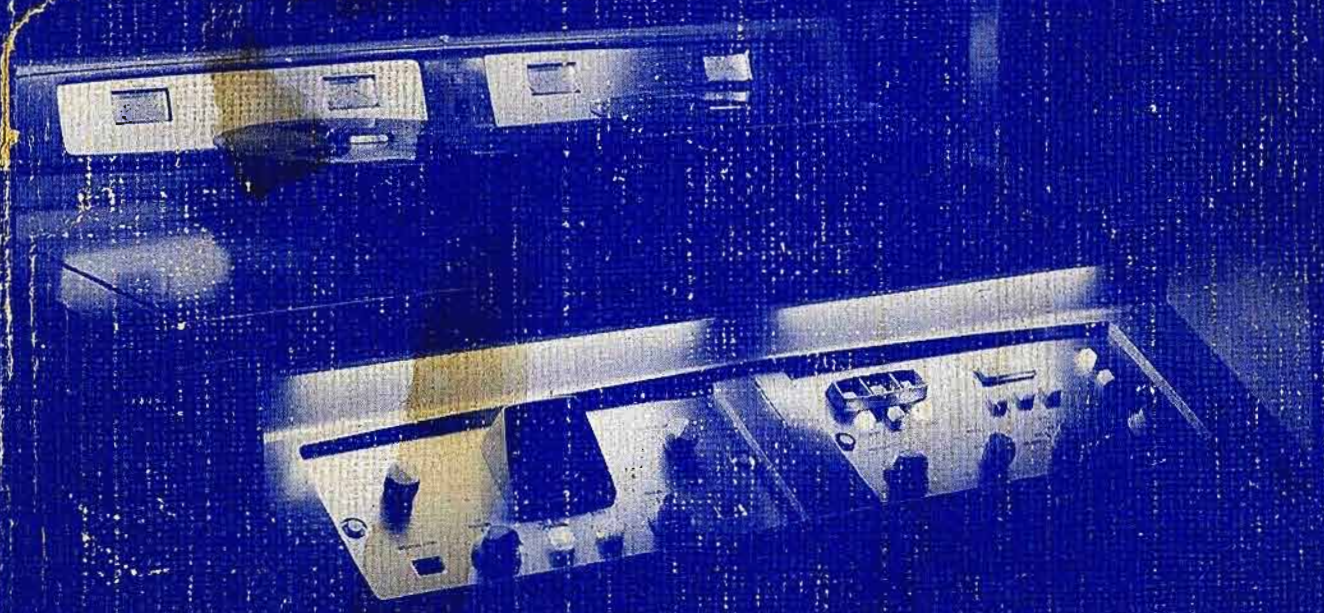
VR 1000B VIDEOTAPE* RECORDER



PRELIMINARY

INSTRUCTION MANUAL

AMPEX CORPORATION

IB 57020-01

TM AMPEX CORP

VOLUME I

(VOLUME II SHOWS PIN VOLTAGES,
WAVEFORMS AND PARTS LISTS)

May 1959
First Edition
1M

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DESCRIPTION AND PERFORMANCE DATA

GENERAL

The Ampex Model VR1000B Videotape* Recorder/Reproducer, a precision system for storing standard EIA and FCC signals on two inch wide magnetic tape, is capable of recording the complete video and audio signal, and two additional tracks are provided, one for tape speed control and the other for cueing information. These signals can be reproduced immediately after recording with no need for processing.

Provisions are made within the system for complete erasure of all signals or portions thereof, and, if desired, individual erasure of audio and cueing signals. Cueing and tone signals also can be recorded on the tape during the reproduction process. A tape timer, calibrated in hours, minutes and seconds, affords a means for determining program and recording duration.

To permit accurate splicing, field pulses are generated by the equipment and recorded onto the tape in the record mode.

The dubbing feature allows complete or partial copying of a master tape. Because the dubbing is done on an rf to rf basis, with no modulation and demodulation involved, all copies of the master tape are the same quality with no degradation. All duplicates are first copies of the masters. The number of copies that can be made is limited only by master tape life.

Because no processing is necessary after recording, this versatile equipment provides the television broadcaster with a fast, easy and economical method of handling program material from a variety of sources.

All components of the system are contained in a console and two racks with the racks combined in one cabinet. In addition, monitoring equipment is furnished in one of two options, a monitor rack, or an over-console monitor mount which can be mounted above the console.

COMPONENTS OF THE MONOCHROME SYSTEM

(See applicable Ampex Videocolor Supplements for details of the color equipment.)

* Trade Mark Ampex Corporation

Component	Quantity	Location	Ampex Catalog Number
Console Assembly	1		57023-01
Right Control Panel	1	Console Assembly	13256-01
Right Hand Meter Panel	1	Console Assembly	14828-03
Left Hand Meter Panel	1	Console Assembly	14782-03
System Control Unit	1	Console Assembly	51470-01
Record Driver	1	Console Assembly	50532-01
Tape Transport Assembly	1	Console Assembly	50533-01
Left Control Panel	1	Console Assembly	50640-01
Video Erase and Cueing Unit	1	Console Assembly	50738-01
One Amp Power Supply 250 Volt	2	Console Assembly	50800-01
24 Volt Power Supply	1	Console Assembly	50933-01
Tape Guide Servo Assembly	1	Console Assembly	50993-01
Head Channel Assembly	1	Console Assembly	50531-01
Head Channel Unit	1	Console Assembly	50537-01
	Cables and Connectors		
Record Drive Cable Assembly	1	Console Assembly	50770-05
Record Drive Cable Assembly	1	Console Assembly	50770-06
Record Drive Cable Assembly	1	Console Assembly	50770-07
Record Drive Cable Assembly	1	Console Assembly	50770-08
Connector, Male 3 contact	1	Console Assembly	145-009
2 Rack Assembly	1		57021-01
Modulator, Monochrome	1	Rack 1	13253-01
Processor	1	Rack 1	51450-01
Demodulator, Monochrome	1	Rack 1	13271-01
Channel Switcher	1	Rack 1	50804-01
Guide Position Sensor	1	Rack 2	13259-01
Capstan Signal Generator	1	Rack 2	13258-01
Motor Power Amplifier	2	Rack 2	50750-01
One Amp Power Supply	2	Rack 2	50800-01
Drum Servo Control	1	Rack 2	50805-01
Power Control Panel	1	Rack 2	51296-01

Component	Quantity	Location	Ampex Catalog Number
		Cables and Connectors	
Video Cable Assembly	1	Rack 1 to Console (furnished)	50522-04*
Power Cable Assembly	1	Rack 2 to Console (furnished)	51194-04*
Ac Harness Assembly	1	Rack 2 to Rack 1	50502-01
Control Cable Assembly to	1	Rack 2 to Rack 1	50504-01
Control Cable Assembly to	1	Rack 2	50519-01
Control & Audio Cable Assembly	1	Rack 2 to Console (furnished)	51144-04*
Monitor Rack Assembly	1		59105-01
Power Switch Panel	1	Monitor Rack Assembly	51050-02
Switching Panel	1	Monitor Rack Assembly	51146-01
Test Equipment Picture Monitor, Conrac CM17AR	1	Monitor Rack Assembly	545-001
Test Equipment Oscilloscope, Tektronix Type 525	1	Monitor Rack Assembly	545-002
Speaker	1	Monitor Rack Assembly	51397-01
Audio Monitor Amplifier Assembly	1	Monitor Rack Assembly	51398-01
		Cables and Connectors	
Connector, Play F, 3 contact	1	Monitor Rack Assembly	144-003
Connector, Play M, 3 contact	5	Monitor Rack Assembly	145-009
Connector, Play M, 1 contact	14	Monitor Rack Assembly	145-058
Connector, Recep F, 3 contact	1	Monitor Rack Assembly	146-086
Connector, Adaptor, Reducint	14	Monitor Rack Assembly	169-008
Over-Console Monitor Mount	1		59125-01
Switching Panel Assembly	1	Over-Console Monitor Mount	51146-01
Speaker Monitor	1	Over-Console Monitor Mount	51397-01
Audio Monitor Amplifier Assembly	1	Over-Console Monitor Mount	51398-01
Test Equipment Picture Monitor, Conrac CM17AR	1	Over-Console Monitor Mount	545-001
Test Equipment, Tektronix Type 525	1	Over-Console Monitor	545-002

*Dash numbers -01, -02, -03 and -05 indicate cable lengths and can be obtained on special order.

Component	Quantity	Location	Ampex Catalog Number
		Cables and Connectors	
Cable Assembly-Video Source	1	Over-Console Monitor Mount	51477-04* (furnish
Cable Assembly-Video Source	1	Over-Console Monitor Mount	51477-05 (furnishe
Cable Assembly-Video Source	1	Over-Console Monitor Mount	51147-04
Bridge Harness Assembly	1	Over-Console Monitor Mount	51478-01
Cable Assembly-Audio Source	1	Over-Console Monitor Mount	51486-01
Speaker Cable	1	Over-Console Monitor Mount	51489-01
Connector, Receptacle, F. 3 contact	1	Over-Console Monitor Mount	145-086
Connector, Receptacle, F. 1 contact	1	Over-Console Monitor Mount	146-067
Connector, Adapter	1	Over-Console Monitor Mount	169-005
Connector, Adapter, Hood	1	Over-Console Monitor Mount	169-010
Tape Transport Assembly	1	Console Assembly	50533-01
Video Head Assembly	1	Tape Transport Assembly	50010-01
Audio Head Assembly	1	Tape Transport Assembly	51170-01
Supply Idler and Erase Head Assembly	1	Tape Transport Assembly	50530-01
Tape Timer Assembly	1	Tape Transport Assembly	59102-01
Auto Compensation Assembly	1	Tape Transport Assembly	50670-01
		Cables and Connectors	
Control Track Cable Assembly	1	Tape Transport Assembly	50201-02
Harness Tape Transport	1	Tape Transport Assembly	51269-01
Audio and Cueing Cable Assembly	1	Tape Transport Assembly	51282-01

* Dash numbers -01, -02, and -03 indicate cable lengths and can be obtained on special order.

Component	Quantity	Location	Ampex Catalog Number
Console Cooling Blower	1	Console Assembly	51506-01*
Head Fan Power Assembly	1	Console Assembly	13792-02
Vacuum Pump Assembly	1	Console Assembly	50005-01

ACCESSORY EQUIPMENT FURNISHED

Touch Up Paint	2		087-012 and 087-022
Empty Tape Reel	1		50260-01
Instruction Book	2		IB57020
Video Head Reference Tape	1		50262-01
Dial Indicator Assembly	1		50420-01
Hand Type Demagnetizer	1	Ampex Model No. 704	
Zero- two pound scale	1		650-103
Zero- four pound scale	1		650-104
Zero- ten pound scale	1		650-105
Oil (for tape guide motor)			51513

ACCESSORY EQUIPMENT AVAILABLE

Special Cabling -- As ordered to allow other than normal location of racks and console (see cable listings for special orders).

AMPEX Video Tape -- Magnetic tape specially manufactured to Ampex standards for the Videotape Recorder.

Video Tape Splicer -- Ampex Catalog Number 50300.

Monitor Amplifier/Loudspeaker -- Ampex Model No.

Video Head Assembly -- (Two spares recommended) Ampex Part No. 50010-01

Ampex Reference Tape -- Ampex Catalog No. 50262-02

*50 cycle version is catalog number 51506-02

PERFORMANCE DATA

PHYSICAL CHARACTERISTICS

Dimensions

1. The Monochrome System is comprised of one console and two racks plus monitoring facilities housed in standard third rack or over console horizontal monitor rack.

   a. RACKS -- E.I.A. Standard, over-all height 84 inches, vertical rack mounting space 77 inches, base height 4 inches, complete with front and rear doors giving immediate access to all components of rack assemblies. Rack doors are readily removable.

   b. CONSOLE -- 34-3/4 inches deep, 55 inches wide, and 42 inches high, with 6 doors providing clear access to all four sides. Hinged steel frames bear racked assemblies giving immediate access to all components. Mounted on heavy casters, permitting easy roll-out during operation.

   c. MONITORING RACK -- Either E.I.A. Standard Rack (as above) or over console rack attached to console by means of four supports. Dimensions: 29 inches deep, 58 inches wide and 20-1/2 inches high, located at eye level 15 inches above tape transport. Total available rack space is 52-1/2 inches.

2. The Color System is comprised of the basic monochrome system plus one additional rack of electronic components housed in the standard E.I.A. rack (as above).

Weight

1. The Monochrome System total weight is approximately 1860 pounds. Console: Approximately 780 pounds. Racks: Approximately 1080 pounds.

2. The Color System total weight is approximately 2250 pounds. Console: Approximately 780 pounds. Racks: Approximately 1470 pounds.

3. Installation floor-loading requirements: 180 pounds per square feet minimum.

Ventilation

1. The Console is equipped with integral forced air, filtered, cooling. The air temperature rise at any point within the console does not exceed 10° F above room ambient temperature.

2. The Racks are provided with louvres for convection cooling in normal room ambient temperatures less than 80° F. Under higher ambient temperature conditions, auxiliary cooling equipment is recommended.

Acoustic Noise

1 Does not exceed 60 db above threshold, measured on Curve A of A.S.A. Standard Noise Level Meter at distances 3 feet from nearest point on the console.

Temperature and Humidity

Meets specifications in spaces of ambient temperature range 40° to 100° F., relative humidity range 30% to 90%.

Interconnections

All internal connections between component chassis are by means of plug connectors. Interconnections between racks and console are made by plug connectors and barrier strip fittings.

POWER REQUIREMENTS

Monochrome System: 117-0-117 volts, 60 cycle single phase, three wire, 4 kva maximum. Voltage tolerance, each leg, 105-125. Load distribution: less than 25 amperes per leg.

Color System: 117-0-117 volts, 60 cycle single phase, three wire, 5 kva maximum. Voltage tolerance, each leg, 105-125. Load distribution: less than 30 amperes per leg.

GENERAL SPECIFICATIONS

Recording Medium: Magnetic tape, 2 inches wide, "Mylar" base of 0.001-inch thick, in accordance with standard proposed by S.M.P.T.E. to A.S.A., American Standard (proposed VTR 16.2-393).

Tape Speed: 15 inches-per-second in normal record or reproduce mode.

Picture-Sound Separation: 18 frames, sound leads.

Recording Time: Up to 96 minutes on a 14 inch reel of tape.

Reproduce Timing: Synchronous with system timing reference.

Rewind Time: Approximately 4-1/2 minutes for a 7200 ft reel (96 minute reel). Rewind speed averages 300 inches per second, a 20:1 ratio.

Starting Time: Adjustable from 8 seconds to minimum 2 seconds for stabilized operation.

Stopping Time: Less than 3 inches of tape from record or reproduce mode.

Shuttling Speed: Manipulation of fast-forward and rewind pushbuttons allows speeds from 0 to 300 inches per second.

Tape Handling:

1. Tape stops automatically without spilling in case of power failure or tape slack.
2. Automatic cut-off switch halts tape motion at end of reel.
3. All tape transport controls are interlocked against simultaneous engagement of conflicting functions.
4. Supply and take-up turntable brakes are automatically disengaged during threading or splicing operations, permitting easy "pull-out" of tape.
5. Factory specified tape tensions far below elastic limits of tape.

Interchangeability: Tapes are completely interchangeable among heads and machines provided tape recordings are made in accordance with presently proposed S.M.P.T.E. Recommended Engineering Practice, relating to carrier frequency, clamping and deviation in the recorder's FM system.

Video Head Life: Guaranteed minimum life of 100 hours with normal routine maintenance. Ampex video head assembly replacement policy provides for rapid service on an exchange basis.

Tape Timer: The tape-passage indicator can be reset and is calibrated in hours, minutes and seconds. Directly driven by tape motion in all modes of operation. Timing accuracy is better than ± 0.14% in all modes of operation, providing accuracy of better than ± 5 seconds per hour (length) of tape, regardless of cycling through normal fast-forward and rewind operations.

Tape Speed-Override: The normal 15 inches per second tape speed in PLAY mode is variable by ± 15% for precise sound synchronization of two Videotape recorders.

Tape Life: Magnetic tape carries its manufacturer's guarantee only. The performance of the equipment is such that all applicable requirements of this specification are met for at least 100 passages of commercially acceptable tape.

Color Frequency Standard: The color system includes a precision color sub-carrier generator.

System Timing Reference: Switchable selection of four system references, choice clearly indicated by means of colored tally lights.

1. 60-cycle line, internal connection (monochrome use only).

2. Internal composite video and sync.

3. External signal, 0.5 to 2.0 volt peak-to-peak.

4. Color frequency standard, color composite video and sync or color sync only. 0.5 to 1.4 volt peak-to-peak, composite video and sync.

Signal (S) Track Standard: All recorded signal track specifications, with respect to positioning, spacing and widths, are in accordance with Standards currently proposed by S.M.P.T.E. to A.S.A.

Full Width Erase: 100 kilocycle erase frequency, synchronized with audio erase and bias frequency, degausses full tape width. Recorded signal attenuation 50 db below peak video signal.

Remote Control: Any part or all of the following operating functions can be controlled remotely. PLAY, STOP, FAST-FORWARD, REWIND, RECORD, AUDIO ONLY, AUDIO NORMAL, CUE ONLY, CUE NORMAL, VIDEO LEVEL, SYNC LEVEL, and "Set-Up". Remote connections and required control circuit and tally light voltage source (24 volt dc) are provided on barrier strip terminals at the back of the racks.

VIDEO CHANNEL

Input Signal

1. Composite video signal in accordance with E.I.A. Standard No. TR-135 and F.C.C. Technical Standards Sec. 3.682, Subsection (a), Transmission Standards, and Sec. 3.699, Figures 5, 6 & 7.

2. Video input adjustable for levels from 0.5 to 1.4 volts peak-to-peak for composite signal

3 Black is negative.

4 Input is terminated in 75 ohms ± 1% unbalanced.

Output Signals

1. Program line output impedance 75 ohms adjustable to 1% or better, unbalanced. Monochrome level adjustable from 0.5 to 1.4 volts peak-to-peak. Color level adjustable from 0.5 to 1.0 volts peak-to-peak.

2 Monitor line output same as program line output.

3 Composite monochrome or color signal in accordance with E.I.A. and F.C.C. standards (VIDEO CHANNEL, Input Signal above).

4. Utility composite sync output, impedance 75 ohms ± 5% unbalanced at a nominal level of 6 volts peak-to-peak.

5 Rf Output: Tape reproduce signal before demodulation (rf signal after limiting) for use in rf-to-rf dubbing operation to another machine. Impedance 75 ohms ± 5% unbalanced at a nominal level of 1 volt peak-to-peak.

Performance

1. Monochrome Frequency Response: uniform within ± 2 db from 20 cycles to 3.6 megacycles and down no more than 4 db at 4.2 mc, with relation to the 100 kilocycle level, measuring sine wave bursts keyed by sync. The horizontal or vertical tilt as measured with a standard window signal is less than 2%. Maintains full specified bandwidth performance at specified signal-to-noise ratio. (See below.) Typical day-to-day resolution performance exceeds 350 lines.

2. Color Frequency Response: ± 1.5 db from 20 cycles to 4.1 megacycles. Full Bandwidth chrominance channel, 1.5 megacycles within ± 1.5 db. Luminance channel ± 1.5 db from 20 cucles to 3 megacycles.

3 Transient Response: Less than 0.2 microsecond rise time (10% to 90% points) measured with a 15 kilocycle square wave having a rise time of no less than 0.02 microsecond. Overshoot is less than 7%.

4. Monochrome Differential Gain: no more than 10% at peak white or black levels, at normal video signal levels, and with input duty cycle of either 10% or 90%; no more than 10% in intermediate range. Measurement by I. R. E. Standard stop signal method.

5. Color Differential Gain: less than 5%, measured as above.

6. Horizontal Stability: well within F. C. C. Standards of Good Engineering Practice, III, A, 3.687a (8).

7 Vertical Line Displacements: horizontal displacements of vertical picture elements do not exceed 0. 05 microsecond.

8 Signal-to-Noise Ratio: better than 36 db, peak-to-peak video to rms wideband noise, on an interchanged tape basis. (Noise measurement includes unweighted noise components from 100 kc to more than 4. 2 mc.) Typical day-to-day performance as high as 40 db can be realized. Operation of adjacent recorders produces no visible interference in the reproduced picture.

PROGRAM AUDIO CHANNEL

Input Signal (Selectable)

1. 300, 000 ohm balanced bridge for 500/600 ohm line at -10 dbm minimum level; or

2 140, 000 ohm unbalanced bridge for 500/600 ohm line at -13 dbm minimum level; or

3 150 to 250 ohms nominal microphone input, (transformer can be strapped for 30-50 ohms nominal). Input level as low as 150 microvolts will produce recommended record level.

Output Signals

1. 600 ohm balanced or unbalanced, +8 vu level. +4 vu can also be obtained by strapping. Transformer output is center-tapped.

2. Unbalanced high impedance monitor output at 1 volt rms to feed input of unbalanced monitoring amplifier.

3. The vu design is in accordance with A. S. A. Standards.

Performance

1. Frequency Response: ± 2 db, 50 to 10,000 cycles/second.

2. Signal-to-Noise Ratio: 50 db measured overall with reference to a recorded level corresponding to 3% total rms distortion at 400 cycles per second.

3 Flutter and Wow: less than 0.15% rms measuring all components from 0 to 200 cycles per second.

4 Distortion: 1% total rms at 400 cycles measured at normal operating level, (normal operating level is 6 db below 3% rms distortion level, or peak recording level).

5. The vu meter is of A.S.A. Standard ballistics.

CUE AND AUDIO CHANNEL

Input Signal

1. 10,000 ohm balanced bridging for 600 ohm line, +8 vu input level.

2. Self-contained tone generator (325 cycles ± 10%), actuated by push-button on console front panel.

Output Signals

600 ohm balanced, +8 vu level.

Performance

1. Frequency Response: ± 3 db, 50 to 3,000 cycles per second.

2 Signal-to-Noise Ratio: 35 db measured with reference to normal operating level.

3. Flutter and Wow: less than 0.15% rms measuring all components from 0 to 200 cycles per second.

4. Distortion: 5% total rms at 400 cycles measured at normal operating level.

MONITORING FACILITIES

Video

1. Instrument quality 17 inch picture monitor built for Ampex by Conrac. Model CM17R, featuring low and high voltage regulation, small-large picture selector, selectable dc restoration, etc.

2. Instrument quality waveform monitor, Tektronix Model 525.

3. Preview switcher, 1 x 4 with illuminated pushbuttons; coupled to picture and waveform monitors, for use in monitoring input lines and system output line.

Audio

1. Professional quality monitoring system employing matched enclosure and 8 inch speaker. 10 watt Amplifier, response of ± 1/2 db from 20 cycles to 20,000 cycles; overall acoustic response of ± 5 db from 50 cycles to 10,000 cycles.

2. Speaker system may be wall mounted, without modification. (Normally mounted in monitor rack.)

3. Preview switcher, 1 x 4 with illuminated pushbuttons, for use in monitoring input lines and system output lines.

SYSTEM METERING

Console Panels

1. Vacuum: Indicates video head tape guide vacuum. Operating limits scaled in red.

2. Control Track Level: Indicates record or reproduce level, operation mode automatically relay switched.

3. Video Record Current: Indicates level of rf record currents in video heads, through selector switch.

4. Audio Level: vu meter indicates program audio level -- both input and output -- mode automatically relay switched, relative audio erase and bias levels, and one record audio level.

5. Panel Oscilloscope: in record mode indicates head servo stability and (simultaneously) splicing pulse phase; in play mode indicates head switcher output.

6. Capstan Servo: indicates capstan signal generator (servo) phasing.

7. Operating Hours: indicates accumulated machine video recording and reproducing time in hours.

8. Tape Timer: indicates elapsed tape time, calibrated in seconds, minutes and hours.

9 Power Supply: switchable meter, indicates current drain on each section of all regulator tubes, total supply drain, and supply voltage output. (Located within console.)

WARNING TALLY

Blower: tally warning light with push-to-test feature, indicates air flow through video head meter

Video Erase: tally light with push-to-test feature, located on console meter housing, indicates video erase circuit operation.

Dubbing Mode: tally warning light with push-to-test feature, located on console meter housing indicates that system is in rf dubbing mode.

On Air: tally warning light, located on top of console meter housing for viewing at removed location, indicates system "on the air" (connected to station switching system by user).

Rack Equipment, Monochrome

1. Capstan Motor Amplifier: meter, capable of being switched, indicates two phase voltage levels, power line voltage, and power tube (4) current balance.

2. Head Motor Amplifier: meter, capable of being switched, indicates three phase voltage levels, power line voltage, and power tube (4) current balance.

3. Head Servo Unit: phase meter indicates phase lock to system timing reference.

4 Capstan Signal Generator: phase meter indicates capstan servo phasing.

5. Power Supply (2 units): meter, capable of being switched, indicates current drain on each section of all regulator tubes, total supply drain, and supply voltage output.

Rack Equipment, Color

1 Frequency Meter. indicates modulator carrier frequency.

2. Power Supply Metering: same as Rack Equipment, Monochrome 5.

OPERATING CONTROLS

Primary. basic group controlling all tape transport modes, record and reproduce functions located on console right control panel. Tape transport controls located on panel in convenient cluster.

1. Play: momentary contact, activates tape transport for normal operating motion: illuminated tally.

2. Stop: bar type, momentary contact, stops tape transport motion and de-activates record and reproduce relays (where applicable): illuminated tally.

3 Fast Forward: momentary contact, places tape in high speed forward motion; illuminated tally (tape contact is removed from video heads in this mode).

4 Rewind: momentary contact, places tape in high speed reverse motion; illuminated tally (tape contact is removed from video heads in this mode).

NOTE

FAST-FORWARD and REWIND functions may be operated simultaneously or sequentially for wide range control in tape shuttling and cueing.

5 Record: momentary contact after recorder is placed in play mode, activates all record and erase functions for audio, video and cue.

6 Audio Only: momentary contact, activates erase and record functions for audio channel only; illuminated tally. Full width erase remains inactive: video and cue may remain in play mode, or cue erase and record may be independently but simultaneously engaged.

NOTE

This mode is automatically de-activated upon activation of STOP, FAST-FORWARD, REWIND, or NORMAL buttons.

7. Normal (audio only): momentary contact, de-activates AUDIO ONLY record functions; illuminated tally.

NOTE

Tape transport maintains normal operation and the system reverts to play mode upon actuation of this button.

8. Cue Only: momentary contact, activates erase and record functions for cue channel only; illuminated tally. Full width erase remains inactive; video and audio can remain in play mode, or audio only erase and record can independently but simultaneously engaged.

NOTE

This mode is automatically de-activated upon activation of STOP, FAST-FORWARD, REWIND, or NORMAL buttons.

9 Normal (Cue Only): momentary contact, de-activates CUE ONLY record functions; illuminated tally.

NOTE

Tape transport maintains normal operation and the system reverts to reproduce mode upon activation of this button.

10. Cue Tone: momentary contact, activates 325 cycle tone record on cue channel at normal operating level as long as the button is depressed; illuminated tally (equipment must be in record or cue only record mode to record tone).

11. Start Over-ride: toggle switch, activates head motor and capstan motor prior to play mode action.

Secondary: auxiliary group; need for manipulation is infrequent, as opposed to the more or less constant use of the primary control group.

1. Local-Remote: momentary contact, delegate switches, permit delegation of system control to remote control panel; illuminated tally indicators.

2. Audio Record Level: calibrated dial, sets proper audio recording level.

3. Audio Playback Level: calibrated dial, sets proper level of audio output signal.

4. Monitor: two position switch, used primarily as a test control, selects video channel output between tape or input signal via system electronics (electronics-to-electronics, E-E). The switch is overridden whenever the transport is in record or play mode, automatically selecting input signal (via system electronics) or tape output, respectively.

5. Meter (selector): four position switch, selects vu meter to read cue record level, audio record or reproduce level (relay switched), audio bias level, or audio erase (current) level.

6. Scope Selector: two position switch, selects built-in panel oscilloscope to read system stability Lissajous and field pulse, or head switcher output.

7. Video Record Current Metering: four position switch, selects panel meter to read individual video head relative currents.

8. Tip Projection: calibrated dial control, adjusts video head guide for proper head-to-tape contact. Dial is calibrated in mils and is used to read actual video head tip projections. This control is automatically de-activated during automatic operation of tape guide servo.

9. Automatic Compensation: two position self illuminating push switch indicator, selects guide servo control, manual or automatic.

10. Tracking: calibrated dial control, vernier adjustment of tape reproduce tracking.

11. Tape Speed Over-ride: know on capstan signal generator provides smooth momentary override of automatic tape motion servo, permitting two machines to be brought into lip synchronism.

INSTALLATION

LOCATION REQUIREMENTS

Locate the equipment in a well ventilated room having relatively dust-free air. If the equipment will be operated with the front doors installed, circulation of cooling air must be provided for dissipation of the heat generated by the 3 kw power load. Avoid locating the equipment near strong magnetic fields, or sources of electrostatic noise such as motors, generators or voltage regulators.

UNPACKING THE CONSOLE AND CONSOLE COMPONENTS

CAUTION

IN SHIPMENT, THE CONSOLE FRAME IS BOLTED TO THE FLOORBOARD ASSEMBLY BY SIX 1/4 INCH 20 x 1-1/2 INCH SOCKET HEAD CAP SCREWS. REMOVE THESE SCREWS AND SAVE THEM. THEY MUST BE REPLACED IF THE CONSOLE IS SHIPPED AT SOME FUTURE TIME.

Right Control Panel

If the right control panel is shipped separately from the console, unpack it carefully and place it on a working stand moved to a position directly in front of the right control panel console location.

Step 1 Attach each of the nine connecting cables. These cables are captive at the console.

NOTE

Each of the connecting cables is fitted with a different style or type of connector, making it impossible to make the individual connections incorrectly.

Step 2. Lift the right control panel by grasping it firmly at each end, and seat it in the right hand panel opening in the console.

CAUTION

1. DURING THIS PLACEMENT USE CARE TO AVOID MARRING THE CONSOLE OR THE PANEL.

2. ALLOW THE CABLES TO PASS THROUGH THE OPENING, BEING CAREFUL TO AVOID PINCHING, KINKING OR OTHER DAMAGE TO THE CABLES OR PANEL COMPONENTS.

Step 3. With the right control panel seated correctly in the opening, press downward firmly at both ends. Spring catches will engage, locking the panel to the console.

NOTE

These spring catches can be released, when it is desired to remove the panel, by pressing the recessed buttons at each end of the panel.

Left Control Panel

If the left control panel is shipped separately from the console, it should be unpacked carefully and placed on a working stand, and moved to a position directly in front of the left control panel console location.

Step 1. Attach each of the four connecting cables. These cables are captive at the console.

NOTE

Each of the connecting cables is fitted with a different type or style of connector making it impossible to make individual connections incorrectly.

Step 2. Lift the left control panel by grasping it firmly at each end, and seat it in the left hand panel opening in the console.

CAUTION

1. USE CARE TO AVOID MARRING THE CONSOLE OR THE PANEL.

2 PASS THE CABLES THROUGH THE OPENING, USING CARE TO AVOID PINCHING, KINKING OR CAUSING DAMAGE TO THE CABLES OR PANEL COMPONENTS.

Step 3: With the left control panel seated correctly in the opening, press downward firmly at both ends. Spring catches will engage, locking the panel to the console.

NOTE

These spring catches can be released when it is desired to remove the panel, by pressing the recessed button at each end of the panel.

WEIGHT AND SPACE REQUIREMENTS

Uncrated weight of the equipment, with all components mounted, is:

Console (without over-console mount and monitor equipment)	765 pounds approximately.
Racks	755 pounds approximately for two racks.
Over Console Monitor Mount	145 pounds approximately, including legs and hardware.
Vertical Monitor Rack	465 pounds approximately, including all test units. (Monitor speaker, waveform scope, 17 inch tv monitor and tube are shipped separately.)
Speaker and Amplifier	20 pounds approximately.
Waveform Oscilloscope	80 pounds approximately.
17-inch TV Monitor & Tube	105 pounds approximately.

Installation for maximum efficiency in operation with minimum use of floor space is promoted by the wide variety of possible arrangements. Some of these are detailed in the Installation Criteria illustration FLOOR SPACE REQUIREMENTS. Twelve feet of cable are provided, to interconnect the console and associated racks. The console is mounted on heavy swivel casters, permitting it to be normally located near walls or adjacent studio equipment, yet to be rolled out ready for access to right side and rear doors. Removal of rack doors will not impair operation, and may promote convenience of installation. Studies of Videotape Television Recorder operations reveal that most users engage the machines in recording and production operations during more than 70% of use hours. The console was especially designed for maximum convenience in this service, as well as in reproduction. Consideration should therefore be given to location of the equipment near production operations.

Connecting The Console To The Two Rack Assemblies

Racks 1 and 2 are interconnected prior to shipment, and shipped as one unit. All connecting cables are captive within the rack assembly. There are four connecting cables when the over console monitor mount is used, and three when the monitor rack assembly is used. In the latter case, the customer supplies the fourth cable. These cables must be uncoiled and passed through the three 2 inch holes provided in the right side of the rack base. Three of the cables must be connected through the flooring to the console termination assembly panel in the right end of the console. The fourth cable enters the console through the left floor entry and must be connected to the monitor bridge termination assembly.

Step 1: Refer to illustrations 57024 sheets 1 and 2 INSTALLATION CRITERIA FOR CATALOG ITEM 57020 and 57025 sheets 1, 2, 5, and 6 WIRE DIAGRAM FOR CATALOG ITEM 57020, and make the connections. Fit the cables into the J-bolts located in the console floor, and tighten the nuts.

Installation Of The Over Console Monitor Mount

The over console monitor mount is shipped partly disassembled and must be installed.

Step 1: Open the console end doors.

Step 2: Refer to illustration 57024 sheet 4 INSTALLATION CRITERIA FOR CATALOG ITEM 57020, and 59125 sheets 1 and 2, MONITOR BRIDGE ASSEMBLY ASSOCIATED EQUIPMENT. Mount one re-inforcing plate number 51406, beneath the console top, at each end of the console using four 5/16 inch cap screws and lockwashers. Fasten each cap screw to leg number 41404, located on the console top surface. Orient leg 41404 to receive the firming screw from the leg casing number 51405 to be installed in Step 4.

Step 3: Place a leg gasket number 51466 over each of the four legs and slide it down to the console top surface, orienting it so that the formed ring fits into the hole in the console top surface and the re-inforcing plate beneath.

Step 4: Place a leg casing number 51405 over each of the four legs, orienting it to rest on the leg gasket. Install and tighten the firming screws.

Step 5: Place a leg gasket number 51466 on the upper end of each leg casing, orienting it as before but with the formed ring up, instead of down. Holes are provided in the main housing assembly of the over console monitor to receive these formed ring surfaces on the leg gasket.

Step 6: Position the main bridge housing over the four legs. Insert and tighten the four 5/16 inch cap screws and lockwashers required to fasten the main bridge housing to the four supporting legs.

Step 7: Harnesses 51478 Bridge Harness Assembly, and 51485 Power Cable, are coiled within the main bridge housing. Facing the front of the console, install harness 51485 Power Cable, downward through the left rear leg, and make the connections at the twelve point power terminal board shown on illustration 13362 WIRE DIAGRAM FOR CATALOG NUMBER 59125.

Step 8: Install number 51478 Bridge Harness Assembly downward through the left front leg.

NOTE

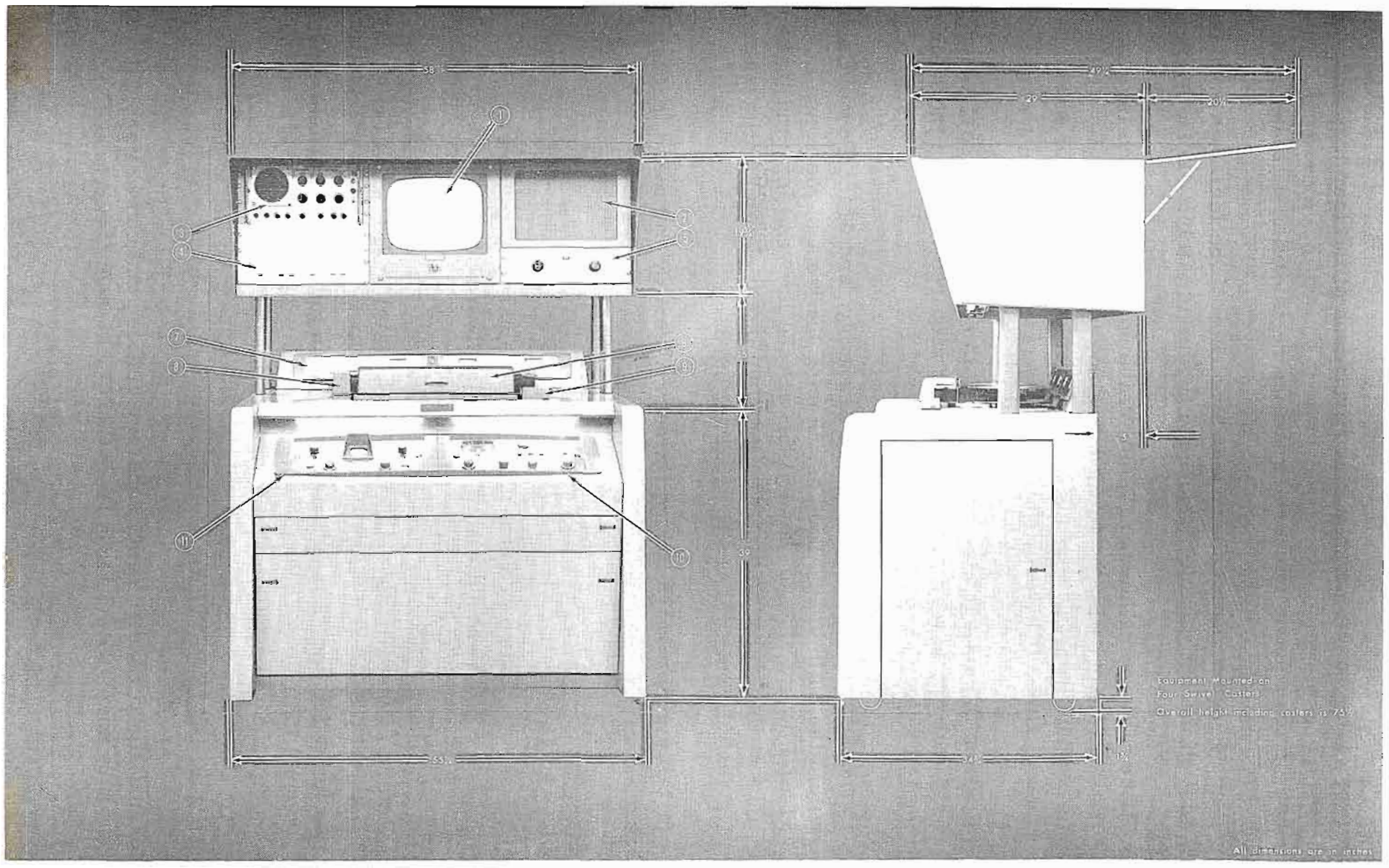
There are nine uhf coaxial female receptacles and hoods with mounting hardware supplied for this harness assembly.

Step 9: Refer to illustrations 13363 WIRE DIAGRAM FOR CATALOG NUMBER 59125, and 59125 sheet 1 MONITOR BRIDGE ASSEMBLY. Attach the coaxial receptacles to the specifically marked wires in the Bridge Harness Assembly and connect them in accordance with the diagrams to the video terminal board. Solder the remaining marked wires to the audio terminal board.

POWER AND SIGNAL CRITERIA

Four power and signal requirements, characteristics, and connections data, refer to illustration 57024 sheet 1 INSTALLATION CRITERIA FOR CATALOG ITEM 57020.

Outline and Dimensions Console & Console Monitor Mount



		Ampex Catalog No.			Ampex Catalog No.			Ampex Catalog No.
(1)	17" Picture Monitor	545—001	(5)	Monitor Amplifier	51398—01	(9)	Tape Timer	59102—01*
(2)	Monitor Speaker	51397—01	(6)	Video and Audio Head Cover	13875—01	(10)	Right Control Panel	13256—01
(3)	TV Waveform Oscilloscope	545—002	(7)	Meter Housing	50530—01	(11)	Left Control Panel	50640—01*
(4)	Video and Audio Switching Panel	51146—01	(8)	2" Erase Head				

NOTE: *—02 are for 50 cycles

VBR 1
INS

IB57020

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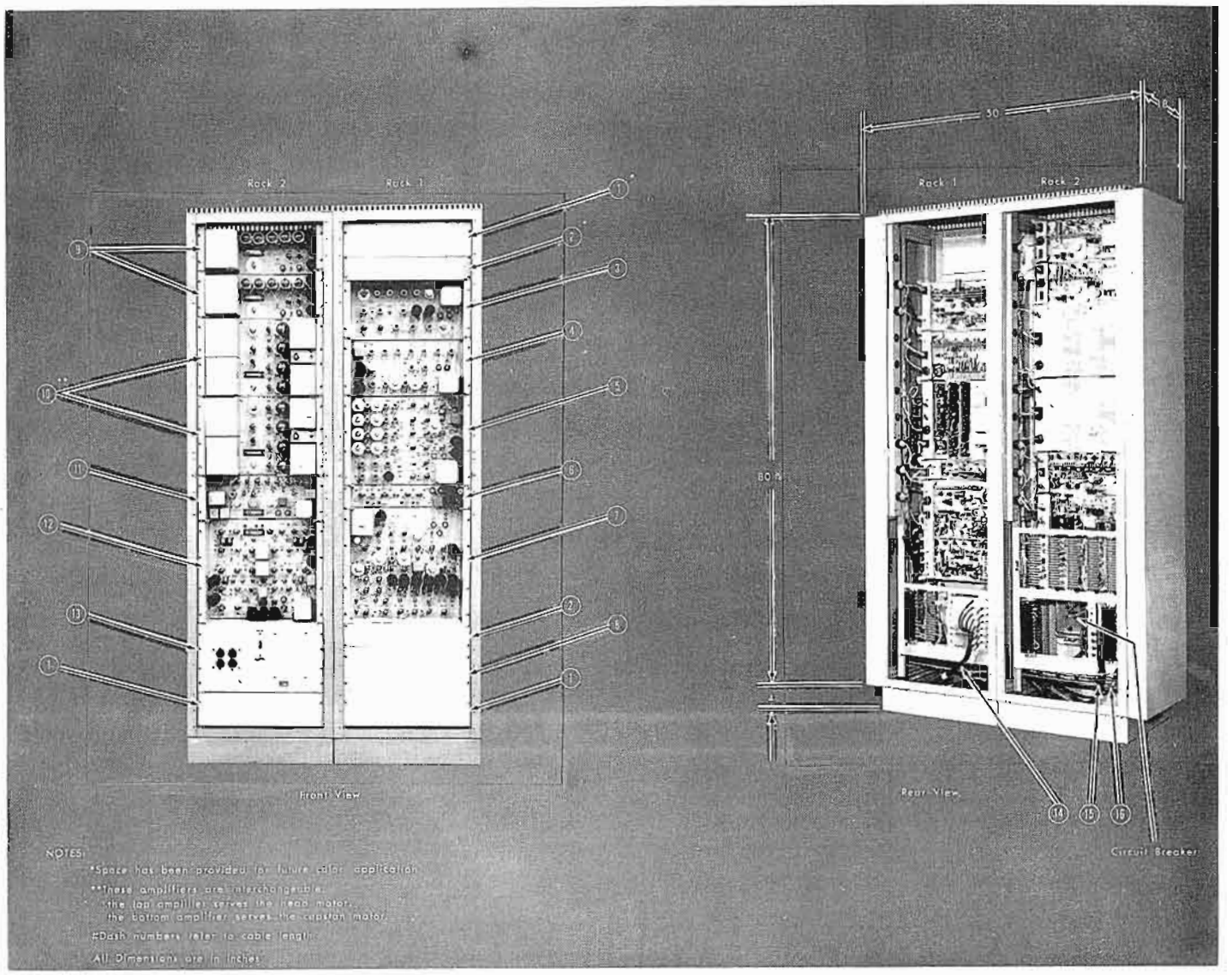
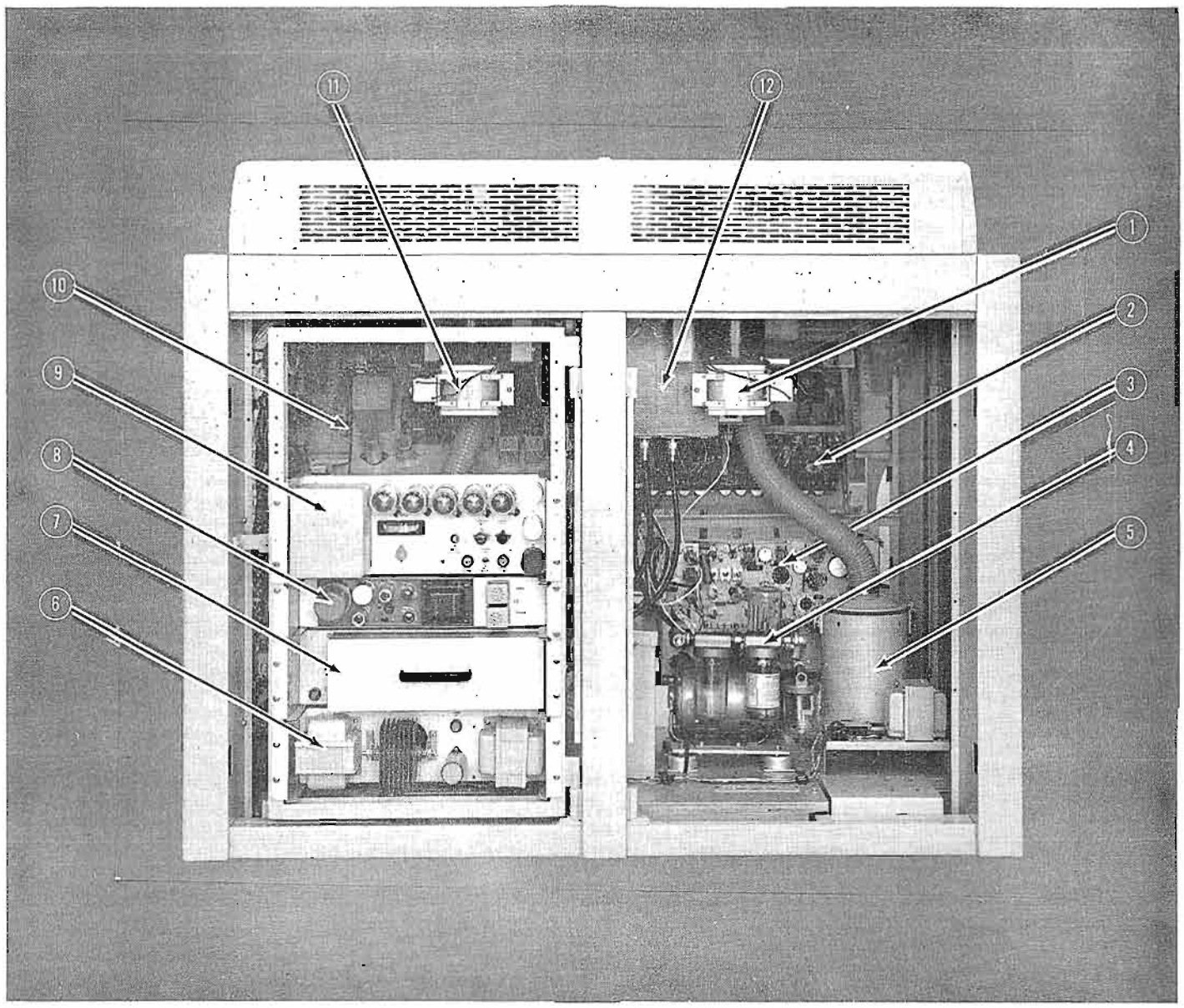


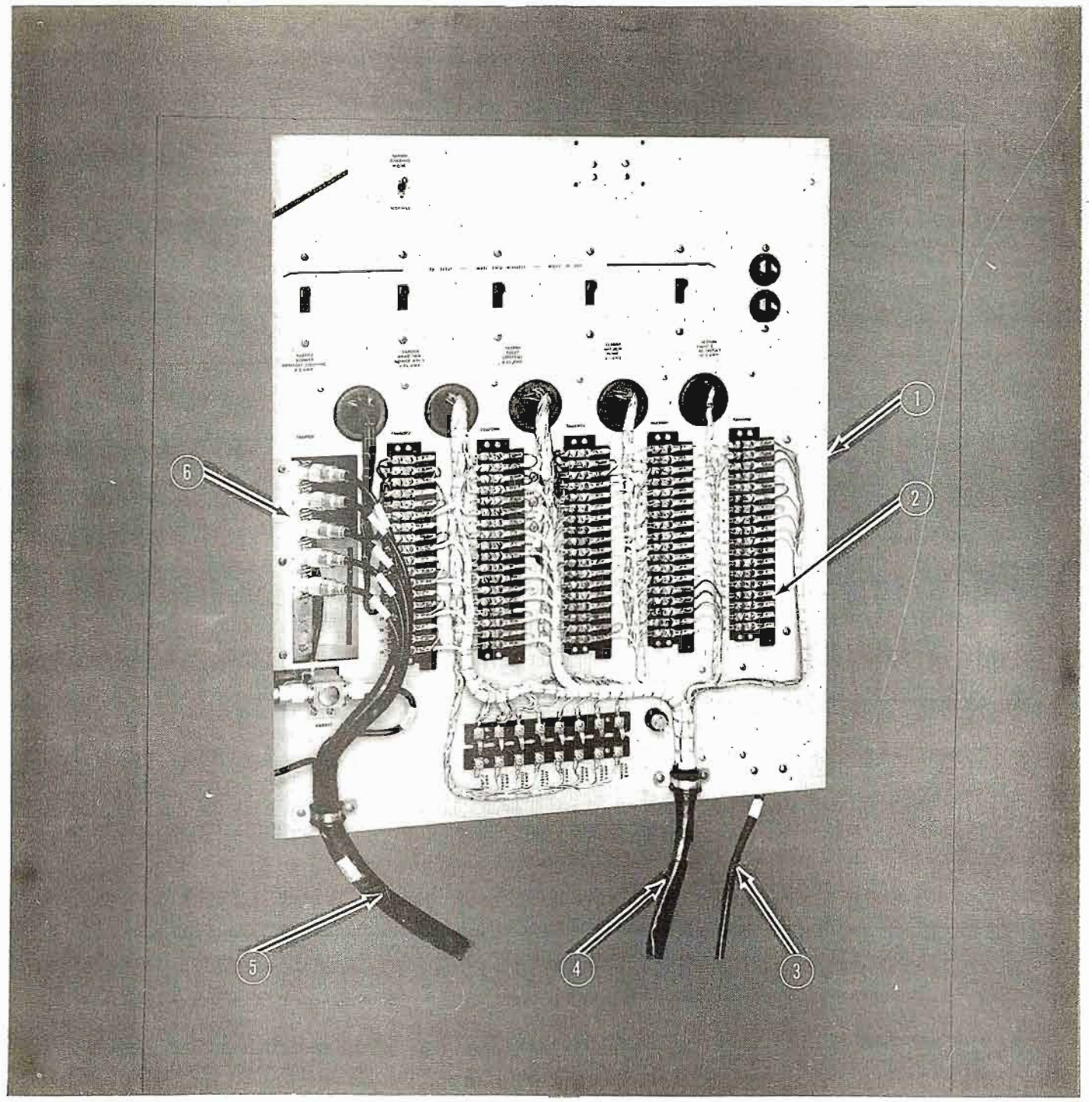
		Ampex Catalog No.			Ampex Catalog No.
1	Panel Blank	13570—04	9	Dive Ampere Power Supply	50860—01
2	Vent Shield, Blank Panel Assembly	50706—01	10	Motor Power Amplifier	50750—01
3	Modulator, Monochrome	13253—01	11	Capstan Signal Generator	13273B—01
4	Demodulator, Monochrome	13271—01	12	Drum Servo Control	50809 —01
5	Channel Switcher	50804—01	13	Power Control Panel	51296—01
6	Guide Position Sensor	13259 —01	14	Video Cable Assembly	50522—04#
7	Processor	51450—01	15	Control & Audio Cable Assembly	51144—04#
8	Panel Blank	13570—03	16	Power Cable Assembly	51194—04#

Two Rack Assembly and Arrangement of Chassis



1. Supply Motor Assembly
2. Left Control Panel Assembly
3. Video Erase and Cueing Unit
4. Vacuum Pump Assembly
5. Head Blower Assembly
6. 24 Volt Power Supply
7. System Control Unit
8. Tape Guide Servo
9. One Ampere Regulated Power Supply 'C'
10. Right Control Panel Assembly
11. Takeup Motor Assembly
12. Head Channel Assembly

Console Rear View Showing Assemblies



(1) Terminal Block 68007 ,on rear of panel
(2) Terminal Block 6
(3) Power Cable Assembly
(4) Control & Audio Cable Assembly
(5) Video Cable Assembly
(6) Terminal Block 1

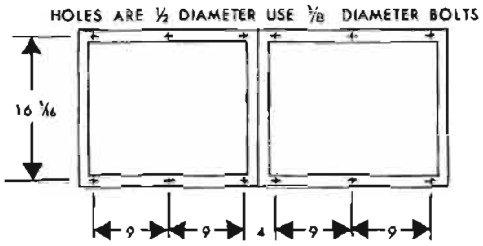
See Wire Diagram for Cat. Item 57020 (1 to 6) for Details

Console Termination Assembly

VBR INS 4

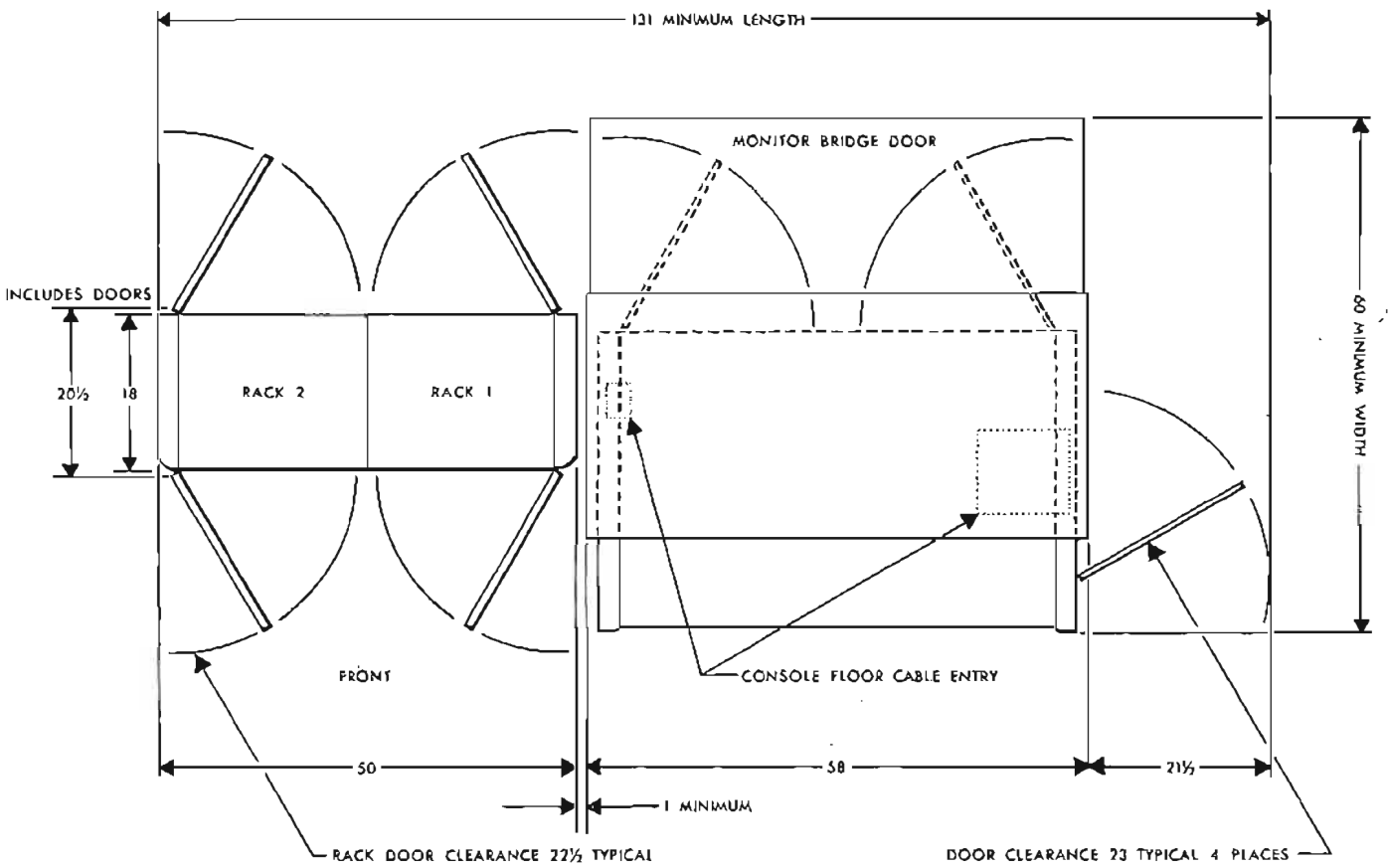
RACK BASE MOUNTING

HOLES ARE ½ DIAMETER USE ⅜ DIAMETER BOLTS



FLOOR SPACE REQUIREMENTS

MINIMUM FLOOR SPACE



NOTES:

1. All dimensions are in inches.

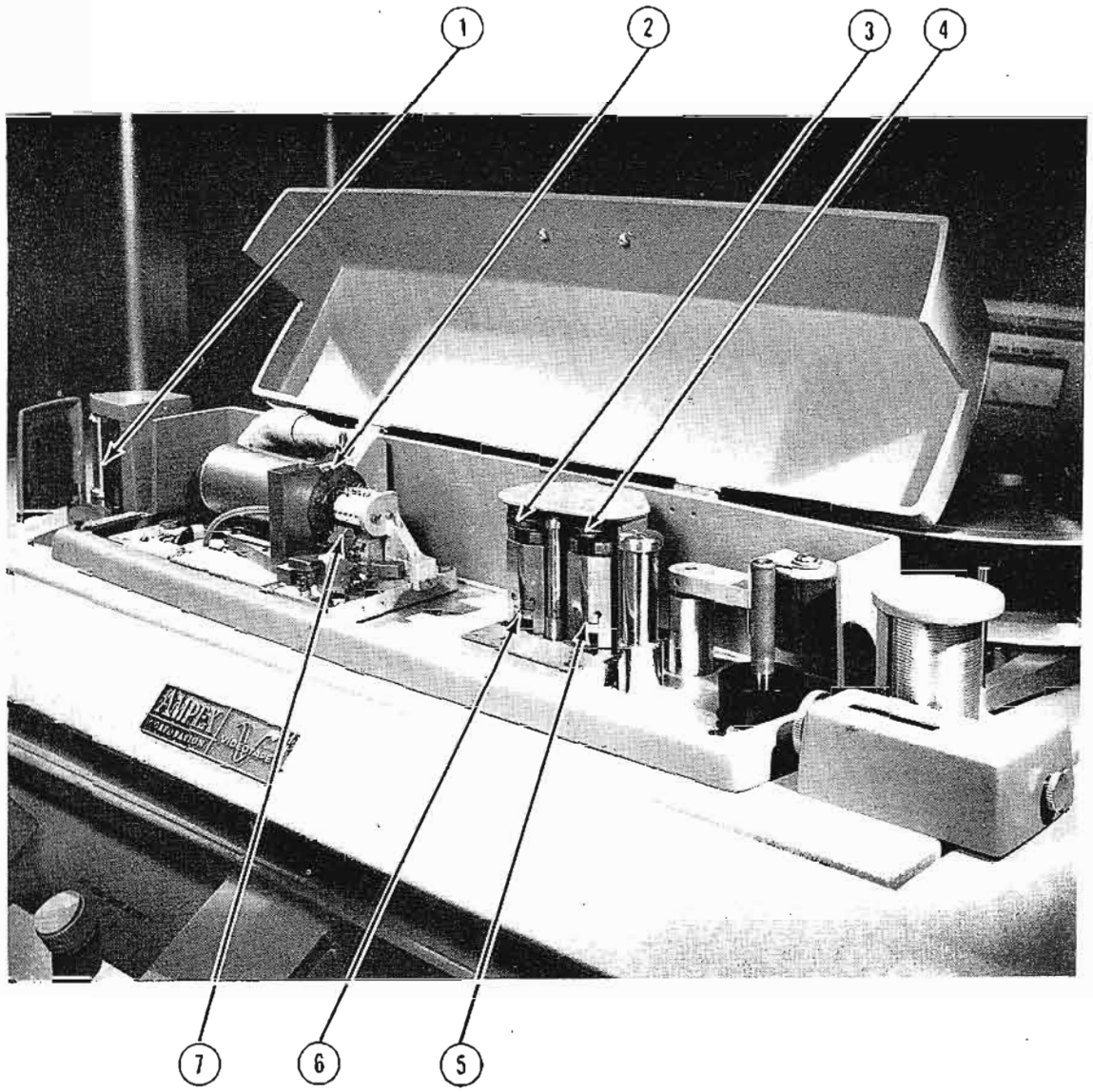
2. Placement of the console in relation to the racks depends on interconnecting cable lengths which are controlled by dash numbers.* Cables for 10 foot separation of rack and console are supplied.

3. For maneuverability, the console moves on four swivel casters.

Cable Assembly	Ampex Catalog Number	Desired Separation in Feet Between Console and Racks				
		1	10	20	25	50
Video Cable Assembly	30522 *	-01	-04	-05	-02	-03
Control and Audio Cable Assembly	51144 *	-01	-04	-05	-02	-03
Power Cable Assembly	51194 *	-01	-04	-05	-02	-03
Cable Assembly Video Source	51477 *	-01	-04	-05	-02	-03

Floor Space Requirements

IB57020



Identification of Heads

1. 2" Erase Head
2. Video Record & Reproduce Head (One of Four)
3. Audio Erase Head
4. Audio Record & Reproduce Head
5. Cue Record & Reproduce Head
6. Cue Erase Head
7. Control Track Record & Reproduce Head

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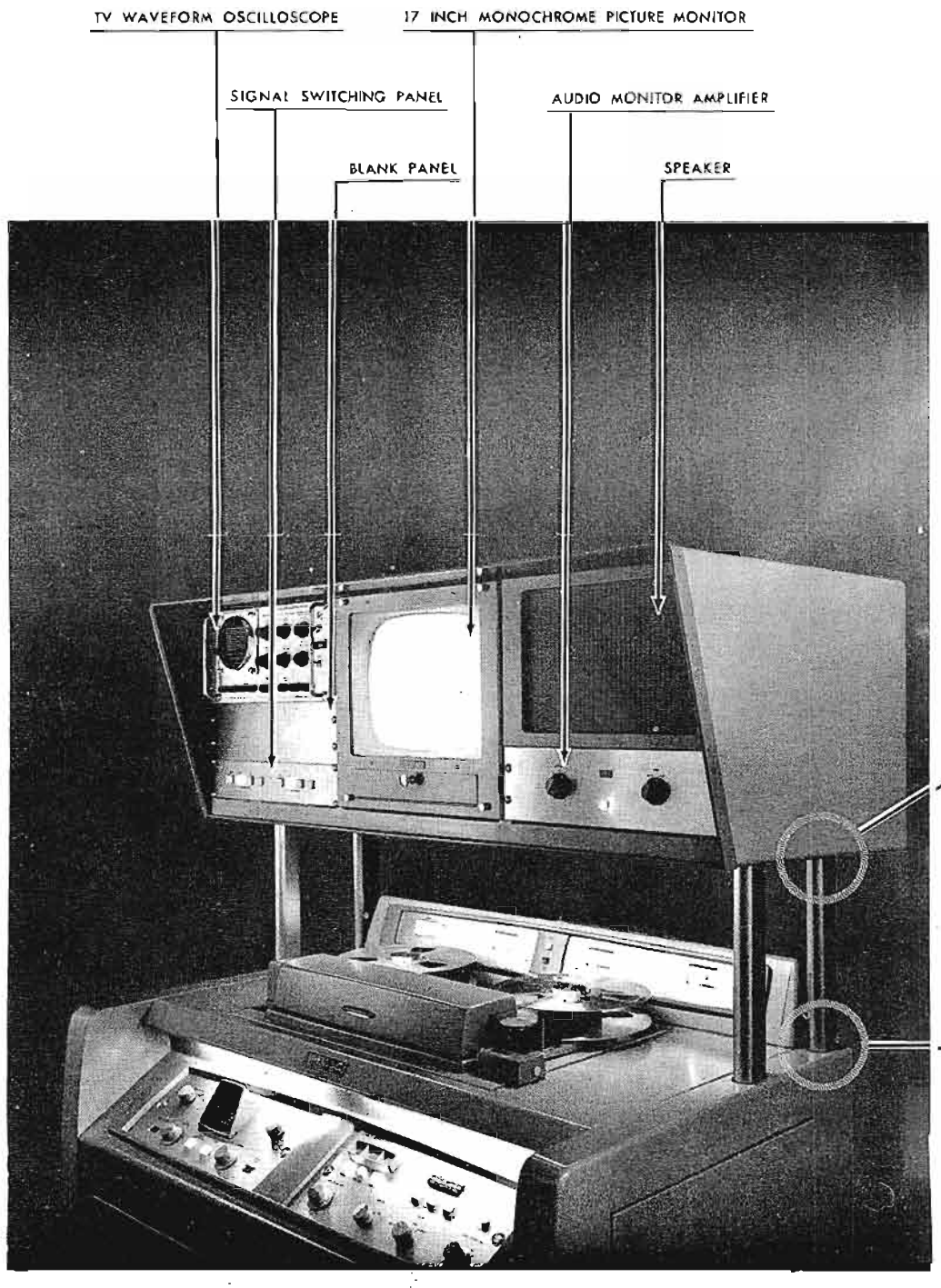
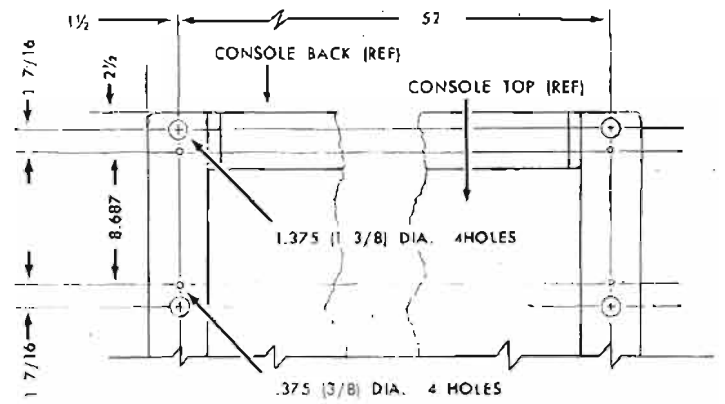
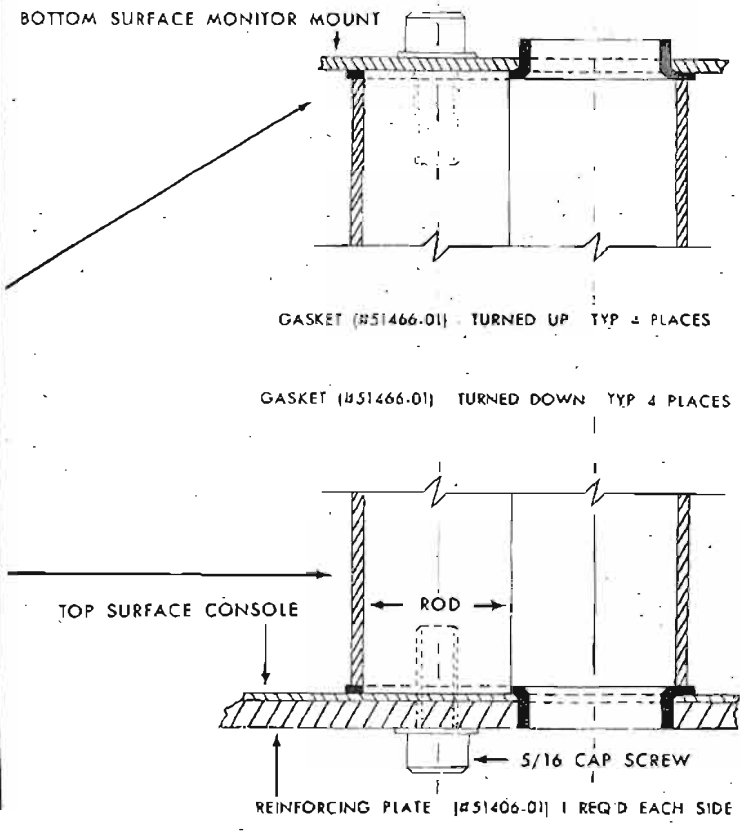
Installing Over Console Monitor Mount



MONITOR BRIDGE MOUNTING HOLES. DIMENSIONS INDICATED FOR REFERENCE



5/16 x 1 LG SOCKET HD CAP SCR.
5/16 LOCK WASHER TYP 8 PLACES



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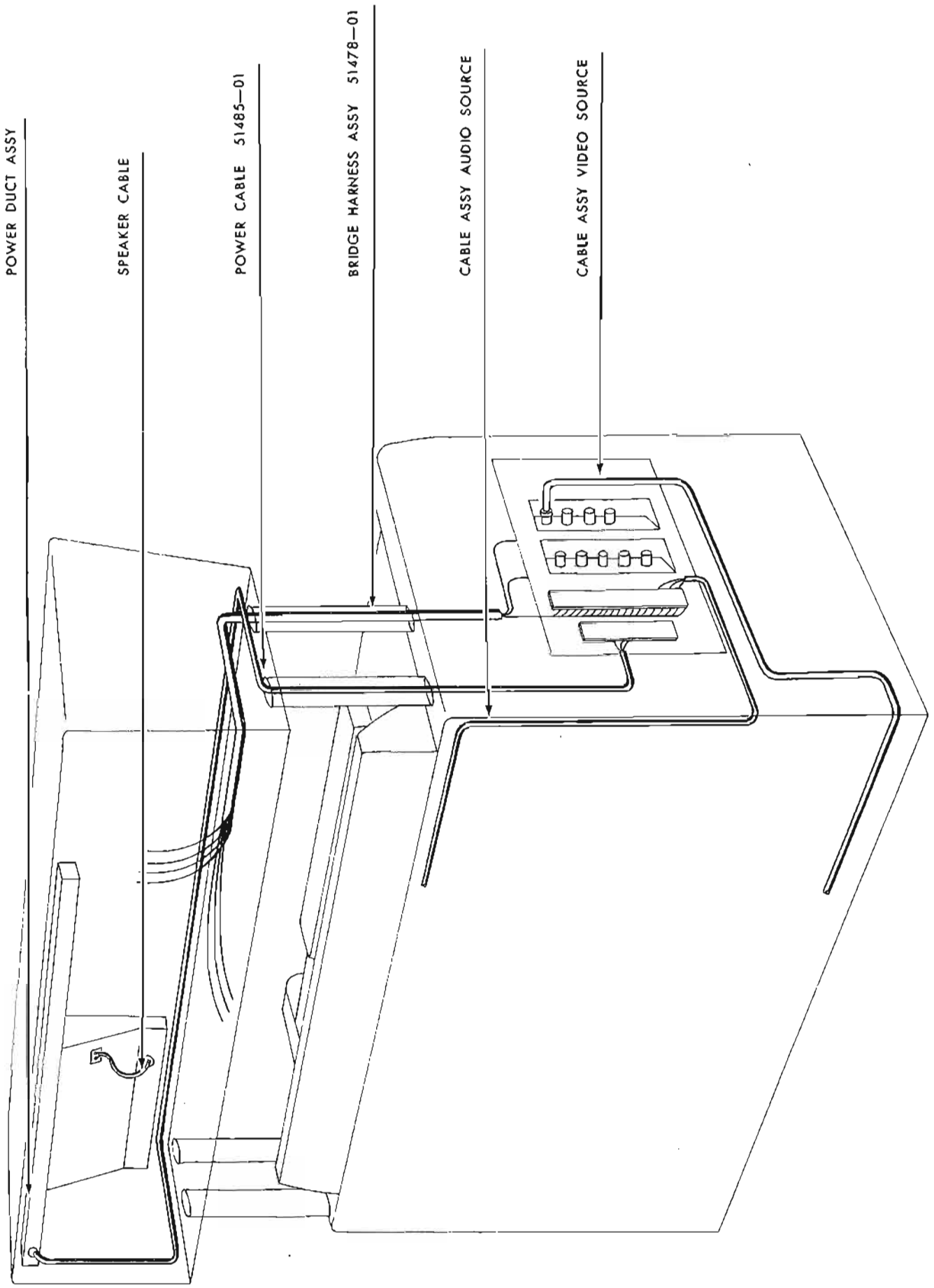
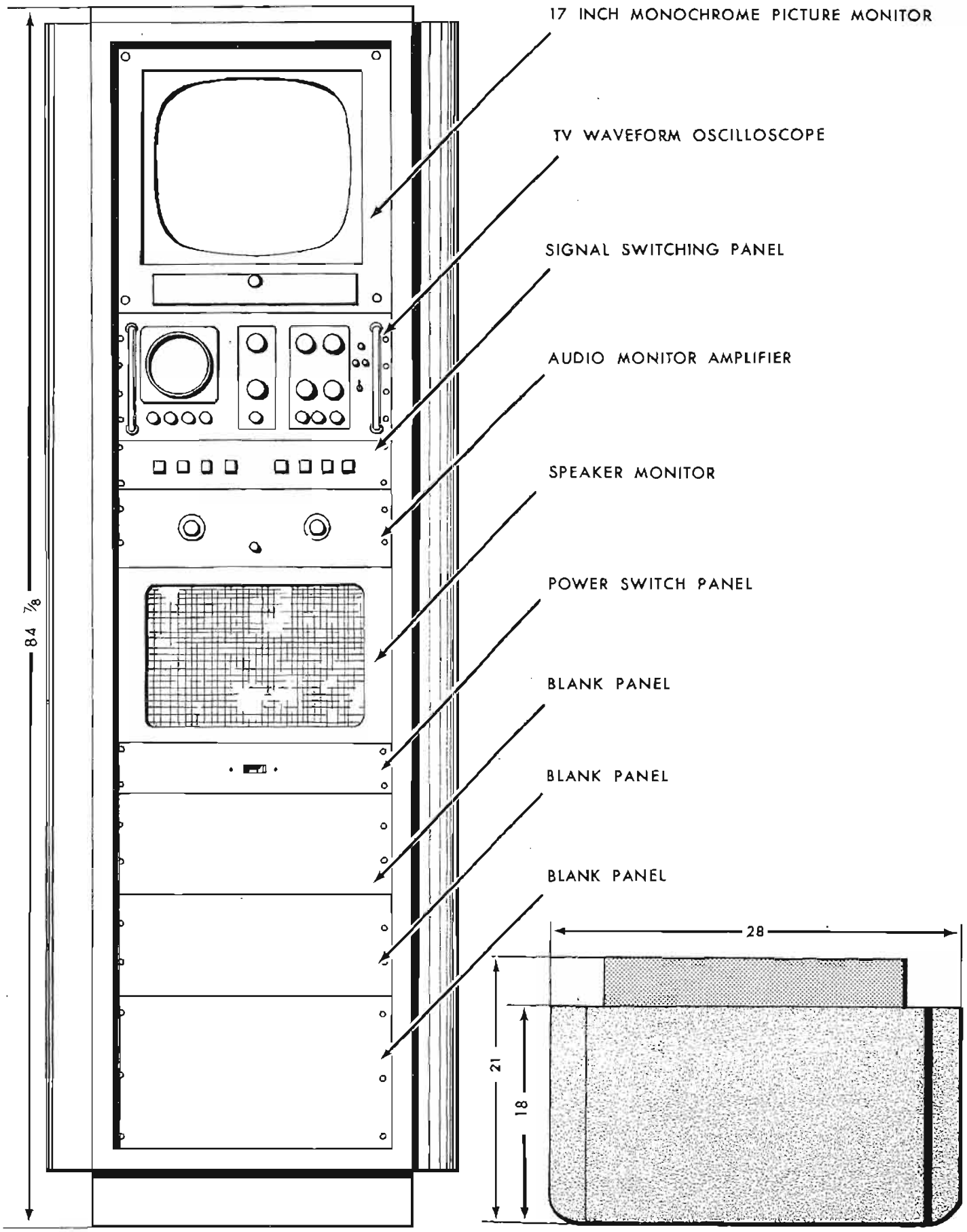


Over Console Monitor Mount Cable Path

VBR
INS 8



Vertical Monitor Rack Layout

VBR 9
INS

57020
-01. -03. -05. & -06 ONLY

1.0 POWER REQUIREMENTS:

1.1 DASH -01 & -05 VERSIONS ONLY.

1.1.1 208/240 VOLT - THREE WIRE (ONE AS NEUTRAL) 60 CYCLES, SINGLE PHASE SUPPLY FOR A MINIMUM OF 45 AMPERES WITH NO MORE THAN 5% TOTAL HARMONIC DISTORTION OF THE WAVE FORM. FEED MAY ENTER EITHER FROM ABOVE OR BELOW RACK 2. CIRCUIT SHOULD BE CONTINUOUS TO CIRCUIT BREAKER. RACK FRAME SHOULD BE CONNECTED TO STATION GROUND SYSTEM WITH NUMBER 8 COPPER.

1.1.2 117V - SINGLE PHASE, 60 CYCLES, 15 AMPERE SUPPLY FOR CONVENIENCE OUTLET. CIRCUIT SHOULD BE CONTINUOUS TO RECEPTACLE BOX IN RACK 2.

1.1.3 117V - SINGLE PHASE, 60 CYCLES, 10 AMPERE SUPPLY WITH NO MORE THAN 5% TOTAL HARMONIC DISTORTION OF THE WAVE FORM. CIRCUIT SHOULD BE CONTINUOUS TO CIRCUIT BREAKER IN MONITOR RACK ASSY. (FOR DASH - 01)

1.2 DASH - 03 & - 06 VERSIONS ONLY.

1.2.1 SAME AS 1.1.1 BUT 50 CYCLES.

1.2.2. SAME AS 1.1.2 BUT 50 CYCLES.

1.2.3 SAME AS 1.1.3 - 50 CYCLES FOR DASH - 03.

2.0 SIGNAL REQUIREMENTS: VIDEO
ALL INCOMING & OUTGOING SIGNAL CONNECTIONS ARE FROM FLOOR OR ABOVE AND TERMINATE AT RACK CABLE TERMINATION ASSEMBLIES.

2.1 VIDEO INPUT: 75 OHM LINE SUPPLYING 1.0 TO 1.4 VOLT PEAK-TO-PEAK COMPOSITE VIDEO SIGNAL TO RACK 2 TERMINATION ASSY, TB-J2.

2.2 COLOR 59.94 INPUT OR COMPOSITE CHROMACHROME VIDEO SIGNAL INPUT } 75 OHM LINE SUPPLYING 1 TO 1.4 VOLTS PEAK-TO-PEAK TO RACK 2 TERMINATION ASSY, TB-J3.

2.3 EXTERNAL SYNC INPUT: 75 OHM LINE SUPPLYING 1 TO 1.4 VOLTS PEAK-TO-PEAK TO RACK 2 TERMINATION ASSY, TB-J6.

2.4 DUBBING INPUT: 75 OHM LINE SUPPLYING 1 VOLT PEAK-TO-PEAK MODULATED FM CARRIER SIGNAL TO RACK 1 TERMINATION ASSY, TB-E16.

2.5 VIDEO OUTPUT #1: 75 OHM LINE SUPPLYING 1.0 TO 1.4 VOLT PEAK-TO-PEAK MONOCHROME COMPOSITE VIDEO SIGNAL FROM RACK 1 TERMINATION ASSY, TB-E4.

2.6 VIDEO OUTPUT #2: 75 OHM LINE SUPPLYING 1.0 TO 1.4 VOLT PEAK-TO-PEAK MONOCHROME COMPOSITE VIDEO SIGNAL FROM RACK 1 TERMINATION ASSY, TB-E5.

2.7 SYNC OUTPUT: 75 OHM LINE SUPPLYING 5 VOLTS PEAK-TO-PEAK SIGNAL FROM RACK 1 TERMINATION ASSY, TB-E8.

2.8 DUBBING OUTPUT: 75 OHM LINE SUPPLYING 1.0 VOLT PEAK-TO-PEAK MODULATED FM CARRIER SIGNAL FROM RACK 1 TERMINATION ASSY, TB-E6.

2.9 COLOR KILL INPUT: FUTURE COLOR APPLICATION AT RACK 1 TERMINATION ASSY. TERMINALS TB-B17 & 18. #18 IS SHIELD.

2.10 3.58MC INPUT: FUTURE COLOR APPLICATION AT RACK 1 TERMINATION ASSY, TB-E7.

2.11 VERTICAL DRIVE OUTPUT. FUTURE COLOR APPLICATION FROM RACK 1 TERMINATION ASSY, TB-C1.

2.12 BURST KEY IN: FUTURE COLOR APPLICATION AT RACK 1 TERMINATION ASSY TB-E9.

3.0 SIGNAL REQUIREMENTS: AUDIO
INCOMING & OUTGOING AUDIO CONNECTIONS ARE FROM THE FLOOR OR ABOVE & TERMINATE IN RACK 2 TERMINATION ASSY WITH ONE EXCEPTION.

3.1 AUDIO INPUT, HIGH IMPEDANCE BRIDGING, +8 DBM LEVEL. TERMINALS 1, 2 & 3 OF TB-A. #3 IS SHIELD.

3.2 AUDIO OUTPUT, 600 OHM BALANCED LINE +8 DBM LEVEL. TERMINALS 4, 5 & 6 OF TB-A. #6 IS SHIELD.

3.3 AUDIO MONITOR OUTPUT, HIGH IMPEDANCE. TERMINALS 15 & 16 OF TB-B. #16 IS SHIELD.

3.4 MICROPHONE AUDIO INPUT, 50 OR 250 OHMS AT RIGHT CONTROL PANEL, J46010S, IN CONSOLE.

3.5 CUE CHANNEL INPUT, HIGH IMPEDANCE BRIDGING, +8 DBM LEVEL. TERMINALS 7, 8 & 9 OF TB-A. #9 IS SHIELD.

3.6 CUE CHANNEL OUTPUT, 600 OHM BALANCED LINE, +8 DBM LEVEL. TERMINALS 10, 11 & 12 OF TB-A. #12 IS SHIELD.

4.0 RACK TO CONSOLE CABLES (REF. WIRE DIAGRAM 57025) TWO RACKS ARE SHIPPED AS ONE UNIT AND ARE COMPLETELY INTERCONNECTED. THE CONSOLE CABLES ARE ROLLED & FASTENED TO THE TERMINAL BOARD FRAME IN THE RACKS. THE THREE CABLES SHOULD BE UNROLLED & RUN THROUGH THE THREE TWO INCH HOLES LOCATED IN THE BASE OF THE RIGHT SIDE OF THE RACK ASSEMBLY. THE CABLES RUN UNDER THE CONSOLE TO THE CONSOLE TERMINATION ASSEMBLY PANEL IN THE RIGHT END. THE CABLES ARE MARKED WITH THE TERMINAL BOARD NUMBERS & THE POWER AND THE CONTROL CABLES HAVE FANNING STRIPS FOR SCREW CONNECTIONS. THE VIDEO CABLES ARE ATTACHED WITH U.H.F. THREADED CONNECTORS.

5.0 MONITOR RACK ASSY IS SHIPPED AS A SEPARATE RACK. LOCATION IN RESPECT TO THE OTHER RACKS AND CONSOLE IS NOT CRITICAL. CABLING REQUIREMENTS ARE NOT SPECIFIED. THE TEKTRONIC SCOPE AND PICTURE MONITOR ARE SHIPPED SEPARATELY FOR CUSTOMER MOUNTING WITHIN THE MONITOR RACK ASSEMBLY.

6.0 REMOTE CONTROL CONNECTIONS:
REMOTE CONTROL CONNECTIONS ARE MADE TO RACK CABLE TERMINATION ASSEMBLIES PER SCHEMATIC 13347, IF REQUIRED.

7.0 CONSOLE INTERIOR ACCESSIBILITY:
FOUR HINGED DOORS PROVIDED: ONE EACH ON RIGHT AND LEFT ENDS WITH TWO REAR DOORS. THE RIGHT SIDE DOOR PROVIDES ACCESS TO INFREQUENTLY USED SWITCHES AND FUSES ON CONSOLE TERMINATION ASSEMBLY. THE CONSOLE FRONT LOWER SECTION HAS A TILT-OUT PANEL.

8.0 CRATED DIMENSIONS AND WEIGHTS:

8.1 CONSOLE: LENGTH 70" WIDTH 50" HEIGHT 59" APPROXIMATE WEIGHT 1400 POUNDS.

8.2 TWO RACK ASSEMBLY: LENGTH 111" WIDTH 59" HEIGHT 37" APPROXIMATE WEIGHT 1100 POUNDS.

8.3 MONITOR RACK ASSY: LENGTH 94" WIDTH 38" HEIGHT 37" APPROXIMATE WEIGHT * POUNDS.

8.4 CRATES MUST BE SHIPPED AND HANDLED IN THE ABOVE POSITION.

* WEIGHTS TO BE ADDED TO THIS DWG BEFORE PRODUCTION RELEASE

57020
-02 & -04 ONLY

1.0 POWER REQUIREMENTS:

1.1 DASH -02 VERSION.

1.1.1 208/240 VOLT -2 WIRE (1 AS NEUTRAL) 60 CYCLES, SINGLE PHASE SUPPLY FOR A MINIMUM OF 45 AMPERES WITH NO MORE THAN 5% TOTAL HARMONIC DISTORTION OF THE WAVE FORM. FEED MAY ENTER EITHER FROM ABOVE OR BELOW RACK 2. CIRCUIT SHOULD BE CONTINUOUS TO CIRCUIT BREAKER. RACK FRAME SHOULD BE CONNECTED TO STATION GROUND SYSTEM WITH NUMBER 8 COPPER.

1.1.2 117V - SINGLE PHASE, 60 CYCLES, 15 AMPERE SUPPLY FOR CONVENIENCE OUTLET. CIRCUIT SHOULD BE CONTINUOUS TO RECEPTACLE BOX IN RACK 2.

1.1.3 117V - SINGLE PHASE, 60 CYCLES, 10 AMPERE SUPPLY WITH NO MORE THAN 5% TOTAL HARMONIC DISTORTION OF THE WAVE FORM. CIRCUIT SHOULD BE CONTINUOUS TO MONITOR BRIDGE TERMINATION ASSY IN CONSOLE.

1.2 DASH -04 VERSION.

1.2.1 SAME AS 1.1.1 EXCEPT 50 CYCLES.

1.2.2 SAME AS 1.1.2 EXCEPT 50 CYCLES.

1.2.3 SAME AS 1.1.3 EXCEPT 50 CYCLES.

2.0 SIGNAL REQUIREMENTS: VIDEO
ALL INCOMING & OUTGOING SIGNAL CONNECTIONS ARE FROM FLOOR OR ABOVE AND TERMINATE AT RACK CABLE TERMINATION ASSEMBLIES.

2.1 VIDEO INPUT: 75 OHM LINE SUPPLYING 1.0 TO 1.4 VOLT PEAK-TO-PEAK COMPOSITE VIDEO SIGNAL TO RACK 2 TERMINATION ASSY, TB-J2.

2.2 COLOR 59.94 INPUT OR COMPOSITE CHROMACHROME VIDEO SIGNAL INPUT } 75 OHM LINE SUPPLYING 1 TO 1.4 VOLTS PEAK-TO-PEAK TO RACK 2 TERMINATION ASSY, TB-J3.

2.3 EXTERNAL SYNC INPUT: 75 OHM LINE SUPPLYING 1 TO 1.4 VOLTS PEAK-TO-PEAK TO RACK 2 TERMINATION ASSY, TB-J4.

2.4 DUBBING INPUT: 75 OHM LINE SUPPLYING 1 VOLT PEAK-TO-PEAK MODULATED FM CARRIER SIGNAL TO RACK 1 TERMINATION ASSY, TB-E16.

2.5 VIDEO OUTPUT #1: 75 OHM LINE SUPPLYING 1.0 TO 1.4 VOLT PEAK-TO-PEAK MONOCHROME COMPOSITE VIDEO SIGNAL FROM RACK 1 TERMINATION ASSY, TB-E4.

2.6 VIDEO OUTPUT #2: 75 OHM LINE SUPPLYING 1.0 TO 1.4 VOLT PEAK-TO-PEAK MONOCHROME COMPOSITE VIDEO SIGNAL TO MONITOR BRIDGE TERMINATION ASSY.

2.7 SYNC OUTPUT: 75 OHM LINE SUPPLYING 5 VOLTS PEAK-TO-PEAK SIGNAL FROM RACK 1 TERMINATION ASSY, TB-E8.

2.8 DUBBING OUTPUT: 75 OHM LINE SUPPLYING 1.0 VOLT PEAK-TO-PEAK MODULATED FM CARRIER SIGNAL FROM RACK 1 TERMINATION ASSY, TB-E6.

2.9 COLOR KILL INPUT: FUTURE COLOR APPLICATION AT RACK 1 TERMINATION ASSY. TERMINALS TB-B17 & 18. #18 IS SHIELD.

2.10 3.58MC INPUT: FUTURE COLOR APPLICATION AT RACK 1 TERMINATION ASSY, TB-E7.

2.11 VERTICAL DRIVE OUTPUT: FUTURE COLOR APPLICATION FROM RACK 1 TERMINATION ASSY, TB-C1.

2.12 BURST KEY IN: FUTURE COLOR APPLICATION AT RACK 1 TERMINATION ASSY, TB-E9.

3.0 SIGNAL REQUIREMENTS: AUDIO
INCOMING & OUTGOING AUDIO CONNECTIONS ARE FROM THE FLOOR OR ABOVE & TERMINATE IN RACK 2 TERMINATION ASSY WITH TWO EXCEPTIONS.

3.1 AUDIO INPUT, HIGH IMPEDANCE BRIDGING, +8 DBM LEVEL. TERMINALS 1, 2 & 3 OF TB-A. #3 IS SHIELD.

3.2 AUDIO OUTPUT, 600 OHM BALANCED LINE+8 DBM LEVEL. TERMINALS 4, 5 & 6 OF TB-A. #6 IS SHIELD.

3.3 AUDIO MONITOR OUTPUT, HIGH IMPEDANCE. TERMINATES AT MONITOR BRIDGE TERMINATION ASSY IN CONSOLE.

3.4 MICROPHONE AUDIO INPUT, 50 OR 250 OHMS AT RIGHT CONTROL PANEL, J46010S, IN CONSOLE.

3.5 CUE CHANNEL INPUT, HIGH IMPEDANCE BRIDGING, +8 DBM LEVEL. TERMINALS 7, 8 & 9 OF TB-A, #9 IS SHIELD.

3.6 CUE CHANNEL OUTPUT, 600 OHM BALANCED LINE, +8 DBM LEVEL. TERMINALS 10, 11 & 12 OF TB-A, #12 IS SHIELD.

4.0 RACK TO CONSOLE CABLES (REF. WIRE DIAGRAM 57025) TWO RACKS ARE SHIPPED AS ONE UNIT AND ARE COMPLETELY INTERCONNECTED. THE CONSOLE CABLES ARE ROLLED & FASTENED TO THE TERMINAL BOARD FRAME IN THE RACKS. THE FOUR CABLES SHOULD BE UNROLLED & RUN THROUGH THE THREE TWO INCH HOLES LOCATED IN THE BASE OF THE RIGHT SIDE OF THE RACK ASSEMBLY. THREE OF THE CABLES RUN UNDER THE CONSOLE TO THE CONSOLE TERMINATION ASSEMBLY PANEL IN THE RIGHT END. ONE OF THE CABLES ENTERS THE CONSOLE THROUGH THE LEFT FLOOR ENTRY & IS FASTENED TO THE MONITOR BRIDGE TERMINATION ASSY. THE CABLES ARE MARKED WITH THE TERMINAL BOARD NUMBERS & THE POWER AND THE CONTROL CABLES HAVE FANNING STRIPS FOR SCREW CONNECTIONS. THE VIDEO CABLES ARE ATTACHED WITH U.H.F. THD CONNECTORS.

5.0 MONITOR BRIDGE ASSEMBLY TO CONSOLE:
THE MONITOR BRIDGE CABINET IS MOUNTED ABOVE CONSOLE BY CUSTOMER USING LEGS AND HARDWARE SUPPLIED. THE CABLE HARNESS FOR INTERCONNECTING UNITS WITHIN THE MONITOR BRIDGE IS ROLLED INSIDE FOR SHIPMENT. THE TWO CABLES ARE UNROLLED AND PASSED THROUGH THE TWO LEFT MOUNTING LEGS FOR TERMINATION WITHIN THE CONSOLE AT THE BRIDGE TERMINATION ASSEMBLY. THE CABLES ARE MARKED WITH THE TERMINAL BOARD NUMBERS AND ARE FASTENED WITH CONNECTORS SUPPLIED. WIRE DIAGRAM 13362 DETAILS ALL CONNECTIONS. THE TEKTRONIC SCOPE AND PICTURE MONITOR ARE SHIPPED SEPARATELY FOR CUSTOMER MOUNTING WITHIN THE MONITOR BRIDGE.

6.0 REMOTE CONTROL CONNECTIONS:
REMOTE CONTROL CONNECTIONS ARE MADE TO RACK CABLE TERMINATION ASSEMBLIES PER SCHEMATIC 13347, IF REQUIRED.

7.0 CONSOLE INTERIOR ACCESSIBILITY:
FOUR HINGED DOORS PROVIDED: ONE EACH ON RIGHT AND LEFT ENDS WITH TWO REAR DOORS. THE RIGHT SIDE DOOR PROVIDES ACCESS TO INFREQUENTLY USED SWITCHES AND FUSES ON CONSOLE TERMINATION ASSEMBLY. THE LEFT SIDE DOOR PROVIDES ACCESS TO MONITOR BRIDGE TERMINATION ASSEMBLY AND SHOULD HAVE LIMITED USE AFTER CABLING CONNECTIONS ARE MADE. THE CONSOLE FRONT LOWER SECTION HAS A TILT-OUT PANEL.

8.0 CRATED DIMENSIONS AND WEIGHTS:

8.1 CONSOLE: LENGTH 70" WIDTH 50" HEIGHT 59" APPROXIMATE WEIGHT 1400 POUNDS.

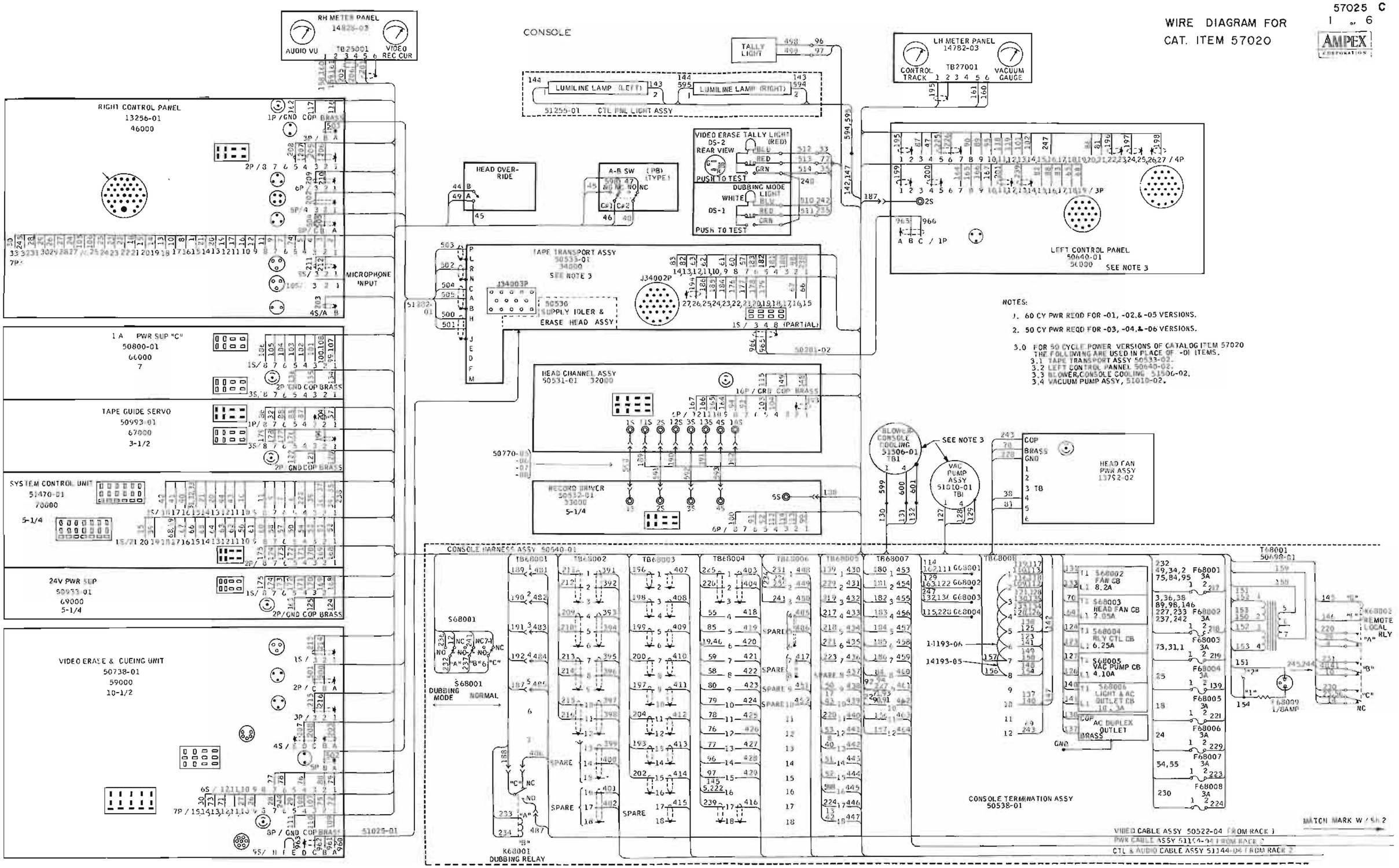
8.2 TWO RACK ASSEMBLY: LENGTH 111" WIDTH 59" HEIGHT 37" APPROXIMATE WEIGHT 1100 POUNDS.

8.3 MONITOR BRIDGE ASSY: LENGTH 67" WIDTH 41" HEIGHT 37" APPROXIMATE WEIGHT * POUNDS.

8.4 CRATES MUST BE SHIPPED AND HANDLED IN THE ABOVE POSITION.

WIRE DIAGRAM FOR
CAT. ITEM 57020

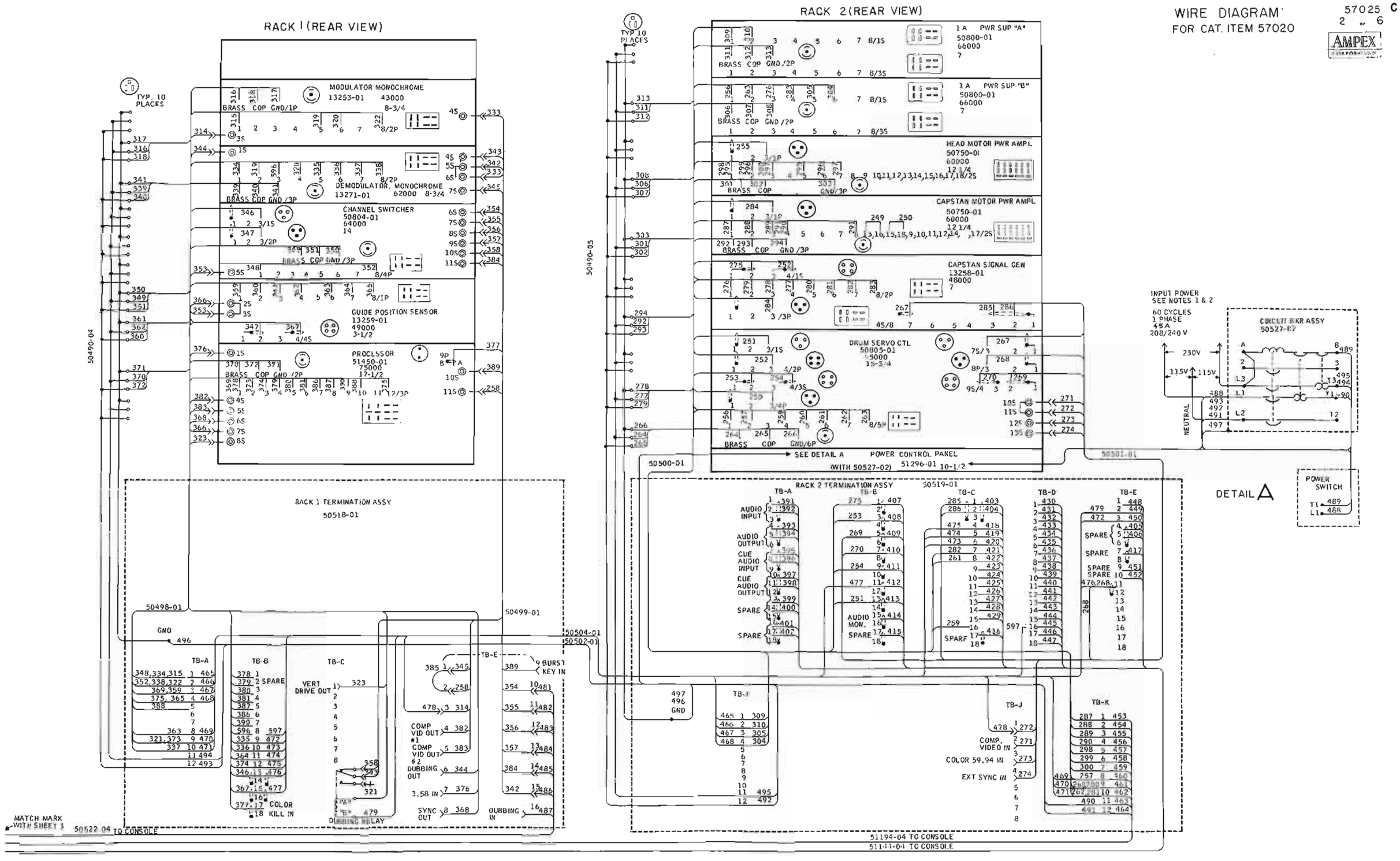
AMPEX CORPORATION



WIRE DIAGRAM
FOR CAT. ITEM 57020

57025 C
2 ~ 6

AMPEX



WIRE	KIND	GAUGE	COLOR	LGTH	FROM	REF #	SHIELD	TO	REF #	SHIELD	HARNESS ASSY
1	SST	20			RIGHT CTL PNL	J46007P-15		CONS TERM. ASSY	F68003-1		50540-01
2	SST	20			RIGHT CTL PNL	J46007P-1		CONS TERM. ASSY	F68001-1		50540-01
3	SST	20			RIGHT CTL PNL	J46007P-2		CONS TERM. ASSY	F68002-1		50540-01
4	SST	20			RIGHT CTL PNL	J46007P-3		CONS TERM. ASSY	K68002-"A" NC		50540-01
5	SST	20			RIGHT CTL PNL	J46007P-4		CONS TERM. ASSY	TB68004-16		50540-01
6	SST	20			CONS TERM. ASSY	S68001 "C" C		SYSTEM CTL UNIT	J70003S-5		50540-01
7	SST	20			RIGHT CTL PNL	J46007P-6		SYSTEM CTL UNIT	J70003S-6		50540-01
8	SST	20			RIGHT CTL PNL	J46007P-16		CONS TERM. ASSY	TB68005-13		50540-01
9	SST	20			RIGHT CTL PNL	J46007P-7		SYSTEM CTL UNIT	J70003S-7		50540-01
10	SST	20			RIGHT CTL PNL	J46007P-17		CONS TERM. ASSY	K68002-"B" NC		50540-01
11	SST	20			RIGHT CTL PNL	J46007P-8		SYSTEM CTL UNIT	J70003S-8		50540-01
12	SST	20			RIGHT CTL PNL	J46007P-9		CONS TERM. ASSY	S68001-"A" NC		50540-01
13	SST	20			RIGHT CTL PNL	J46007P-18		CONS TERM. ASSY	TB68005-18		50540-01
14	SST	20			RIGHT CTL PNL	J46007P-19		CONS TERM. ASSY	K68002-"C" NC		50540-01
15	SST	20			RIGHT CTL PNL	J46007P-20		SYSTEM CTL UNIT	J70001S-20		50540-01
16	SST	20			RIGHT CTL PNL	J46007P-10		SYSTEM CTL UNIT	J70003S-10		50540-01
17	SST	20			RIGHT CTL PNL	J46007P-11		CONS TERM. ASSY	TB68005-10		50540-01
18	SST	20			RIGHT CTL PNL	J46007P-21		CONS TERM. ASSY	F68005-1		50540-01
19	SST	20			RIGHT CTL PNL	J46007P-12		CONS TERM. ASSY	TB68004-6		50540-01
20	SST	20			RIGHT CTL PNL	J46007P-13		SYSTEM CTL UNIT	J70003S-13		50540-01
21	SST	20			RIGHT CTL PNL	J46007P-14		SYSTEM CTL UNIT	J70003S-14		50540-01
22	SST	20			RIGHT CTL PNL	J46007P-22		CONS TERM. ASSY	TB68007-10		50540-01
23	SST	20			RIGHT CTL PNL	J46007P-23		CONS TERM. ASSY	K68002 "C" C		50540-01
24	SST	20			RIGHT CTL PNL	J46007P-27		CONS TERM. ASSY	F68006-1		50540-01
25	SST	20			RIGHT CTL PNL	J46007P-24		CONS TERM. ASSY	F68004-1		50540-01
26	SST	20			RIGHT CTL PNL	J46007P-29		VIDEO ERASE & CUE	J59007P-9		50540-01
27	SST	20			RIGHT CTL PNL	J46007P-28		VIDEO ERASE & CUE	J59007P-10		50540-01
28	SST	20			RIGHT CTL PNL	J46007P-31		VIDEO ERASE & CUE	J59007P-7		50540-01
29	SST	20			RIGHT CTL PNL	J46007P-30		VIDEO ERASE & CUE	J59007P-5		50540-01
30	SST	20			RIGHT CTL PNL	J46007P-33		VIDEO ERASE & CUE	J59007P-14		50540-01
31	SST	20			SYSTEM CTL UNIT	J70003S-15		CONS TERM. ASSY	F68003-1		50540-01
32	SST	20			SYSTEM CTL UNIT	J70003S-15		TAPE GUIDE SERVO	J67001P-7		50540-01
33	SST	20			SYSTEM CTL UNIT	J70003S-15		VIDEO ERASE LAMP	KNIFE DISC		50540-01
34	SST	20			SYSTEM CTL UNIT	J70003S-1		CONS TERM. ASSY	F68001-1		50540-01
35	SST	20			SYSTEM CTL UNIT	J70003S-1		VIDEO ERASE LAMP	KNIFE DISC		50540-01
36	SST	20			SYSTEM CTL UNIT	J70003S-2		CONS TERM. ASSY	F68002-1		50540-01
37	SST	20			SYSTEM CTL UNIT	J70003S-2		TAPE GUIDE SERVO	J67001P-1		50540-01
38	SST	20			CONS TERM. ASSY	F68002-1		HEAD FAN ASSY	TB1-4		50540-01
39	SST	20			SYSTEM CTL UNIT	J70003S-3		CONS TERM. ASSY	K68002-"A" C		50540-01
40	SST	20			SYSTEM CTL UNIT	J70003S-16		CONS TERM. ASSY	TB68005-13		50540-01
41	SST	20			SYSTEM CTL UNIT	J70003S-17		CONS TERM. ASSY	K68002-"B" C		50540-01
42	SST	20			SYSTEM CTL UNIT	J70003S-18		CONS TERM. ASSY	TB68005-18		50540-01
43	SST	20			SYSTEM CTL UNIT	J70003S-11		CONS TERM. ASSY	TB68005-10		50540-01
44	SST	20			SYSTEM CTL UNIT	J70003S-12		HEAD OVERRIDE SW	"B"		50540-01
45	SST	20			"A-B" SW	#1-NO		HEAD OVERRIDE SW	"A"		50540-01
46	SST	20			"A-B" SW	#1-C		CONS TERM. ASSY	TB68004-6		50540-01
47	SST	20			"A-B" SW	#2-NC		LEFT CTL UNIT	J56004P-4		50540-01
48	SST	20			"A-B" SW	#2-C		CONS TERM. ASSY	K68002-"B"-C		50540-01
49	SST	20			HEAD OVERRIDE SW	"A"		CONS TERM. ASSY	F68001-1		50540-01
50	SST	20			SYSTEM CTL UNIT	J70001S-5		CONS TERM. ASSY	TB68005-9		50540-01
51	SST	20			SYSTEM CTL UNIT	J70001S-2		CONS TERM. ASSY	TB68005-14		50540-01
52	SST	20			SYSTEM CTL UNIT	J70001S-1		CONS TERM. ASSY	TB68005-15		50540-01
53	SST	20			SYSTEM CTL UNIT	J70001S-3		CONS TERM. ASSY	TB68005-12		50540-01
54	SST	20			SYSTEM CTL UNIT	J70001S-4		CONS TERM. ASSY	F68007-1		50540-01
55	SST	20			CONS TERM. ASSY	TB68004-4		CONS TERM. ASSY	F68007-1		50540-01
56	SST	20			SYSTEM CTL UNIT	J70001S-10		CONS TERM. ASSY	K68002-"C" C		50540-01
57	SST	20			SYSTEM CTL UNIT	J70001S-6		TAPE XPRT	J34002P-7		50540-01
58	SST	20			SYSTEM CTL UNIT	J70001S-7		CONS TERM. ASSY	TB68004-8		50540-01
59	SST	20			SYSTEM CTL UNIT	J70001S-19		CONS TERM. ASSY	TB68004-7		50540-01
60	SST	20			SYSTEM CTL UNIT	J70001S-8		TAPE XPRT	J34002P-8		50540-01
61	SST	20			SYSTEM CTL UNIT	J70001S-9		TAPE XPRT	J34002P-9		50540-01
62	SST	20			SYSTEM CTL UNIT	J70001S-11		TAPE XPRT	J34002P-11		50540-01
63	SST	20			SYSTEM CTL UNIT	J70001S-12		TAPE XPRT	J34002P-12		50540-01
64	SST	20			SYSTEM CTL UNIT	J70001S-13		CONS TERM. ASSY	S68003-L1		50540-01
65	SST	20			SYSTEM CTL UNIT	J70001S-14		LEFT CTL UNIT	J56003P-18		50540-01
66	SST	20			SYSTEM CTL UNIT	J70001S-15		TAPE XPRT	J34002P-15		50540-01
67	SST	20			SYSTEM CTL UNIT	J70001S-16		TAPE XPRT	J34002P-16		50540-01
68	SST	20			SYSTEM CTL UNIT	J70001S-17		LEFT CTL UNIT	J56003P-19		50540-01
69	SST	20			CONS TERM. ASSY	TB68008-12		SYSTEM CTL UNIT	J70001S-17		50540-01
70	SST	20			CONS TERM. ASSY	S68003-T1		HEAD FAN ASSY	P-2 BRASS		50540-01
71	SST	20			CONS TERM. ASSY	TB68007-10		VIDEO ERASE & CUE	J59007P-12		50540-01
72	SST	20			VIDEO ERASE LAMP	KNIFE DISC		VIDEO ERASE & CUE	J59007P-1		50540-01

WIRE	KIND	GAUGE	COLOR	LGTH	FROM	REF #	SHIELD	TO	REF #	SHIELD	HARNESS ASSY
73	SST	20			VIDEO ERASE & CUE	J59007P-13		CONS TERM. ASSY	F68003-1		50540-01
74	SST	20			RIGHT CTL PNL	J46007P-5		CONS TERM. ASSY	S68001-"C"		50540-01
75	SST	20			VIDEO ERASE & CUE	J59007P-2		CONS TERM. ASSY	F68001-1		50540-01
76	SST	20			VIDEO ERASE & CUE	J59006S-8		CONS TERM. ASSY	TB68004-12		50540-01
77	SST	20			VIDEO ERASE & CUE	J 59006S-7		CONS TERM. ASSY	TB68004-13		50540-01
78	SST	20			VIDEO ERASE & CUE	J59006S-6		CONS TERM. ASSY	TB68004-11		50540-01
79	SST	20			VIDEO ERASE & CUE	J59006S-1		CONS TERM. ASSY	TB68004-10		50540-01
80	SST	20			VIDEO ERASE & CUE	J59006S-2		CONS TERM. ASSY	TB68004-9		50540-01
81	SST	20			HEAD FAN ASSY	TB1-5		LEFT CTL PNL	J56004P-21		50540-01
82	SST	20			TAPE XPRT	J34002P-13		LEFT CTL PNL	J56003P-15		50540-01
83	SST	20			TAPE XPRT	J34002P-14		LEFT CTL PNL	J56003P-17		50540-01
84	SST	20			CONS TERM. ASSY	F68001-1		CONS TERM. ASSY	TB68007-8		50540-01
85	SST	20			TAPE GUIDE SERVO	J67001P-5		CONS TERM. ASSY	TB68004-5		50540-01
86	SST	20			TAPE GUIDE SERVO	J67001P-8		LEFT CTL PNL	J56004P-20		50540-01
87	SST	20			TAPE GUIDE SERVO	J67001P-4		LEFT CTL PNL	J56004P-3		50540-01
88	SST	20			TAPE GUIDE SERVO	J67001P-6		LEFT CTL PNL	J56003P-16		50540-01
89	SST	20			CONS TERM. ASSY	F68002-1		LEFT CTL PNL	J56004P-9		50540-01
90	SST	20			CONS TERM. ASSY	TB68007-10		LEFT CTL PNL	J56004P-8		50540-01
91	SST	20			CONS TERM. ASSY	TB68007-10		REC DRIVER	J33006P-6		50540-01
92	SST	20			CONS TERM. ASSY	TB68007-9		REC DRIVER	J33006P-5		50540-01
93	SST	20			CONS TERM. ASSY	TB68007-10		HEAD CHAN. ASSY	J32006P-7		50540-01
94	SST	20			CONS TERM. ASSY	TB68007-9		HEAD CHAN. ASSY	J32006P-8		50540-01
95	SST	20			CONS TERM. ASSY	F68001-1		LEFT CTL PNL	J56004P-1		50540-01
96	SST	20			CONS TERM. ASSY	TB68004-14		TALLY LIGHT	KNIFE DISC		50540-01
97	SST	20			CONS TERM. ASSY	TB68004-15		TALLY LIGHT	KNIFE DISC		50540-01
98	SST	20			CONS TERM. ASSY	F68002-1		TAPE XPRT	J34002P-2		50540-01
99	SST	20			1 AMP P.S. "C"	J66001S-1		RECORD DRIVER	J33006P-1		50540-01
100	SST	20			1 AMP P.S. "C"	J66001S-2		RECORD DRIVER	J33006P-8		50540-01
101	SST	20			1 AMP P.S. "C"	J66001S-3		LEFT CTL PNL	J56004P-13		50540-01
102	SST	20			1 AMP P.S. "C"	J66001S-4		LEFT CTL PNL	J56004P-14		50540-01
103	SST	20			1 AMP P.S. "C"	J66001S-5		HEAD CHAN. ASSY	J32006P-5		50540-01
104	SST	20			1 AMP P.S. "C"	J66001S-6		HEAD CHAN. ASSY	J32006P-6		50540-01
105	SST	20			1 AMP P.S. "C"	J66001S-7		RIGHT CTL PNL	J46007P-26		50540-01
106	SST	20			1 AMP P.S. "C"	J66001S-8		RIGHT CTL PNL	J46007P-25		50540-01
107	SST	20			1 AMP P.S. "C"	J66001S-1		VIDEO ERASE & CUE	J59007P-3		50540-01
108	SST	20			1 AMP P.S. "C"	J66001S-2		VIDEO ERASE & CUE	J59007P-4		50540-01
109	SST	20			CONS TERM. ASSY	TB68008-2		VIDEO ERASE & CUE	J59008P BRASS		50540-01
110	SST	20			CONS TERM. ASSY	TB68008-1		VIDEO ERASE & CUE	J59008P COP		50540-01
111	SST	16			CONS TERM. ASSY	G68001		VIDEO ERASE & CUE	J59008P GND		50540-01
112	SST	20			CONS TERM. ASSY	TB68008-2		RECORD DRIVER	J33006P-4		50540-01
113	SST	20			CONS TERM. ASSY	TB68008-1		RECORD DRIVER	J33006P-2		50540-01
114	SST	16			CONS TERM. ASSY	G68001		RECORD DRIVER	J33006P-3		50540-01
115	SST	16			CONS TERM. ASSY	G68004		HEAD CHAN. ASSY	J32016P GND		50540-01
116	SST	20			CONS TERM. ASSY	TB68008-2		RIGHT CTL PNL	J46001P BRASS		50540-01
117	SST	20			CONS TERM. ASSY	TB68008-1		RIGHT CTL PNL	J46001P COP		50540-01
118	SST	20			CONS TERM. ASSY	TB68008-2		LEFT CTL PNL	J56004P-11		50540-01
119	SST	20			CONS TERM. ASSY	TB68008-1		LEFT CTL PNL	J56004P 12		50540-01
120	SST	20			CONS TERM. ASSY	TB68008-4		TAPE GUIDE SERVO	J67002P BRASS		50540-01
121	SST	20			CONS TERM. ASSY	TB68008-3		TAPE GUIDE SERVO	J67002P COP		50540-01
122	SST	16			CONS TERM. ASSY	G68002		TAPE GUIDE SERVO	J67002P GND		50540 01
123	SST	20			CONS TERM. ASSY	S68004-L1		CONS TERM. ASSY	TB68008-6		50540-01
124	SST	20			CONS TERM. ASSY	S68004-T1		24V PWR SUP	J69002P BRASS		50540-01
125	SST	20			CONS TERM. ASSY	TB68008-5		24V PWR SUP	J69002P COP		50540-01
126	SST	20			CONS TERM. ASSY	S68005-L1		CONS TERM. ASSY	TB68008-4		50540-01
127	SST	20			CONS TERM. ASSY	S68005-T1		VACUUM PUMP	TB1-1		50540-01
128	SST	20			CONS TERM. ASSY	TB68008-3		VACUUM PUMP	TB1-4		50540-01
129	SST	16			CONS TERM. ASSY	G68002		VACUUM PUMP	CASE GND		50540-01
130	SST	20			CONS TERM. ASSY	TB68008-3		BLOWER	KNIFE DISC		50540-01
131	SST	20			CONS TERM. ASSY	S68002-T1		BLOWER	KNIFE DISC		50540-01
132	SST	16			CONS TERM. ASSY	G68003		BLOWER	KNIFE DISC		50540-01
133	SST	20			CONS TERM. ASSY	TB68008-4		CONS TERM. ASSY	S68002-L1		50540-01
134	SST	20			CONS TERM. ASSY	TB68008-4		1 AMP P.S. "C"	J66002P BRASS		50540-01
135	SST	20			CONS TERM. ASSY	TB68008-3		1 AMP P.S. "C"	J66002P COP		50540-01
136	SST	16			CONS TERM. ASSY	G68003		1 AMP P.S. "C"	J66002P GND		50540-01
137	SST	16			CONS TERM. ASSY	TB68008-10		CONS TERM. ASSY	DUPLEX OUT. BRASS		50540-01
138	SST	16			CONS TERM. ASSY	TB68008-5		CONS TERM. ASSY	DUPLEX OUT. COP		50540-01
139	SST	20			CONS TERM. ASSY	F68004-2		CONS TERM. ASSY	TB68005-1		50540-01
140	SST	16			CONS TERM. ASSY	TB68008-10		CONS TERM. ASSY	S68006-T1		50540-01
141	SST	16			CONS TERM. ASSY	TB68008-6		CONS TERM. ASSY	S68006-L1		50540-01
142	SST	20	9		CONS TERM. ASSY	TB68008-5		CTL PNL LT ASSY	KNIFE DISC		50540-01
143	SST	20	6		CTL PNL LT ASSY	R LAMP-2		CTL PNL LT ASSY	L LAMP-2		51255-01
144	SST	20	7		CTL PNL LT ASSY	R LAMP-1		CTL PNL LT ASSY	L LAMP-1		51255-01

KIND OF CABLE AS FOLLOWS:

- RG - COAX
- SSH - SINGLE CONDUCTOR SHIELDED
- DSH - DOUBLE CONDUCTOR SHIELDED
- SST - SINGLE LEAD STRANDED
- TW PR - TWISTED PAIR

AMPEX CORPORATION

WIRE	KIND	GAUGE	COLOR	LGTH	FROM	REF #	SHIELD	TO	REF #	SHIELD	HARNESS ASSY
145	SST	20			CONS TERM. ASSY	TB68004-16		CONS TERM. ASSY	K68002-COIL "G"		50540-01
146	SST	20			CONS TERM. ASSY	F68002-1		CONS TERM. ASSY	K68002-COIL "F"		50540-01
147	SST	20	0		CTL PNL LT ASSY	KNIFE DISC		CONS TERM. ASSY	TB68006-10		51255-01
148	SST	20			HEAD CHAN. ASSY	J320168-BRS		CONS TERM. ASSY	TB68006-8		50540-01
149	SST	20			HEAD CHAN. ASSY	J320168-COP		CONS TERM. ASSY	TB68006-7		50540-01
150	SST	20			CONS TERM. ASSY	T68001-2		CONS TERM. ASSY	TB68006-7		50540-01
151	SST	20			CONS TERM. ASSY	F68009-2		CONS TERM. ASSY	T68001-1		50540-01
152	SST	20			CONS TERM. ASSY	T68001-3		CONS TERM. ASSY	T68001-1		50540-01
153	SST	20			CONS TERM. ASSY	T68001-2		CONS TERM. ASSY	T68001-4		50540-01
154	SST	20			CONS TERM. ASSY	F68009-1		CONS TERM. ASSY	TB68008-3		50540-01
156	SST	14			CONS TERM. ASSY	TB68008-8		CONS TERM. ASSY	TB68007-11		50540-01
157	SST	14			CONS TERM. ASSY	TB68008-7		CONS TERM. ASSY	TB68007-12		50540-01
158	SST	20			CONS TERM. ASSY	T68001-5		RH METER PANEL	TB25001-1		50540-01
159	SST	20			CONS TERM. ASSY	T68001-7		RH METER PANEL	TB25001-2		50540-01
160	SST	20			LH METER PANEL	TB27001-6		RH METER PANEL	TB25001-1		50540-01
161	SST	20			LH METER PANEL	TB27001-5		RH METER PANEL	TB25001-2		50540-01
162	SST	16			CONS TERM. ASSY	G68001		RIGHT CTL PNL	J46001P-GND		50540-01
163	SST	16			CONS TERM. ASSY	G68002		24V PWR SUP	J69002P-GND		50540-01
164	SST	20			HEAD CHAN. ASSY	J32006P-9		LEFT CTL PNL	J56003P-7		50540-01
165	SST	20			HEAD CHAN. ASSY	J32006P-10		LEFT CTL PNL	J56003P-8		50540-01
166	SST	20			HEAD CHAN. ASSY	J32006P-11		LEFT CTL PNL	J56003P-9		50540-01
167	SST	20			HEAD CHAN. ASSY	J32006P-12		LEFT CTL PNL	J56003P-10		50540-01
168	SST	20			SYSTEM CTL UNIT	J70002P-1		24V PWR SUP	J690015-1		50540-01
169	SST	20			SYSTEM CTL UNIT	J70002P-2		24V PWR SUP	J690015-2		50540-01
170	SST	20			SYSTEM CTL UNIT	J70002P-3		24V PWR SUP	J690015-3		50540-01
171	SST	20			SYSTEM CTL UNIT	J70002P-4		24V PWR SUP	J690015-4		50540-01
172	SST	20			SYSTEM CTL UNIT	J70002P-5		24V PWR SUP	J690015-5		50540-01
173	SST	20			SYSTEM CTL UNIT	J70002P-6		24V PWR SUP	J690015-6		50540-01
174	SST	20			SYSTEM CTL UNIT	J70002P-7		24V PWR SUP	J690015-7		50540-01
175	SST	20			SYSTEM CTL UNIT	J70002P-8		24V PWR SUP	J690015-8		50540-01
176	SST	20			TAPE GUIDE SERVO	J67003S-5		TAPE XPRT	J34002P-22		50540-01
177	SST	20			TAPE GUIDE SERVO	J67003S-6		TAPE XPRT	J34002P-21		50540-01
178	SST	20			TAPE GUIDE SERVO	J67003S-7		TAPE XPRT	J34002P-20		50540-01
179	SST	20			TAPE GUIDE SERVO	J67003S-8		TAPE XPRT	J34002P-19		50540-01
180	SST	20			CONS TERM. ASSY	TB68007-1		TAPE XPRT	J34002P-3		50540-01
181	SST	20			CONS TERM. ASSY	TB68007-2		TAPE XPRT	J34002P-4		50540-01
182	SST	20			CONS TERM. ASSY	TB68007-3		TAPE XPRT	J34002P-5		50540-01
183	SST	20			CONS TERM. ASSY	TB68007-4		TAPE XPRT	J34002P-6		50540-01
184	SST	20			CONS TERM. ASSY	TB68007-5		TAPE XPRT	J34002P-23		50540-01
185	SST	20			CONS TERM. ASSY	TB68007-6		TAPE XPRT	J34002P-24		50540-01
186	SST	20			CONS TERM. ASSY	TB68007-7		TAPE XPRT	J34002P-25		50540-01
187	RG				CONS TERM. ASSY	TB68001-6		LEFT CTL PNL	J56002S		50540-01
188	RG				CONS TERM. ASSY	K68001-C		REC DRIVER	J33009S		50540-01
189	RG				CONS TERM. ASSY	TB68001-1		HEAD CHAN. ASSY	J32011S		50540-01
190	RG				CONS TERM. ASSY	TB68001-2		HEAD CHAN. ASSY	J32012S		50540-01
191	RG				CONS TERM. ASSY	TB68001-3		HEAD CHAN. ASSY	J32013S		50540-01
192	RG				CONS TERM. ASSY	TB68001-4		HEAD CHAN. ASSY	J32014S		50540-01
193	SSH				CONS TERM. ASSY	TB68003-13	3-14	HEAD CHAN. ASSY	J32006P-1	6P/2	50540-01
194	SSH				TAPE GUIDE SERVO	J67003S-2	3S-1	TAPE XPRT	J34002P-26	2P-27	50540-01
195	SSH				LEFT CTL PNL	J56004P-1	4P-2	LH METER PANEL	TB27001-1	1-2	50540-01
196	SSH				LEFT CTL PNL	J56004P-22	4P-23	CONS TERM. ASSY	TB68003-1	3-2	50540-01
197	SSH				LEFT CTL PNL	J56004P-24	4P-25	CONS TERM. ASSY	TB68003-9	3-10	50540-01
198	SSH				LEFT CTL PNL	J56004P-27	4P-26	CONS TERM. ASSY	TB68003-3	3-4	50540-01
199	SSH				LEFT CTL PNL	J56003P-1	3P-2	CONS TERM. ASSY	TB68003-5	3-6	50540-01
200	SSH				LEFT CTL PNL	J56003P-4	3P-5	CONS TERM. ASSY	TB68003-7	3-8	50540-01
201	SSH				LEFT CTL PNL	J56003P-11	3P-12	RH METER PANEL	TB25001-5	1-6	50540-01
202	SSH				RIGHT CTL PNL	J46005P-3	5P-1	CONS TERM. ASSY	TB68003-15	3-16	50540-01
203	SSH				RIGHT CTL PNL	J46004S-B	4S-A	VIDEO ERASE & CUE	J59004S-A	4S-B	50540-01
204	SSH				TAPE GUIDE SERVO	J67001P-2	1P-3	CONS TERM. ASSY	TB68003-11	3-12	50540-01
205	DSH				RIGHT CTL PNL	J46002P-3	2P-1	RH METER PANEL	TB25001-3	SH-NC*	50540-01
206	DSH				RIGHT CTL PNL	J46002P-2		RH METER PANEL	TB25001-4		50540-01
207	DSH				RIGHT CTL PNL	J46002P-4	SH-NC*	VIDEO ERASE & CUE	J59004S-B	4S-E	50540-01
208	DSH				RIGHT CTL PNL	J46002P-5		VIDEO ERASE & CUE	J59004S-C		50540-01
209	DSH				RIGHT CTL PNL	J46006P-1	6P-1	CONS TERM. ASSY	TB68002-4	2-6	50540-01
210	DSH				RIGHT CTL PNL	J46006P-2		CONS TERM. ASSY	TB68002-5		50540-01
211	DSH				RIGHT CTL PNL	J46009S-3	9S-1	CONS TERM. ASSY	TB68002-1	1-3	50540-01
212	DSH				RIGHT CTL PNL	J46009S-2		CONS TERM. ASSY	TB68002-2		50540-01
213	DSH				VIDEO ERASE & CUE	J59001S-3	1S-1	CONS TERM. ASSY	TB68002-7	2-9	50540-01
214	DSH				VIDEO ERASE & CUE	J59001S-2		CONS TERM. ASSY	TB68002-8		50540-01
215	DSH				VIDEO ERASE & CUE	J59003P-3	3P-1	CONS TERM. ASSY	TB68002-10	2-12	50540-01
216	DSH				VIDEO ERASE & CUE	J59003P-2		CONS TERM. ASSY	TB68002-11		50540-01

* SHIELD NOT CONNECTED

WIRE	KIND	GAUGE	COLOR	LGTH	FROM	REF #	SHIELD	TO	REF #	SHIELD	HARNESS ASSY
217	SST	20			CONS TERM. ASSY	F68001-2		CONS TERM. ASSY	TB68005-4		50540-01
218	SST	20			CONS TERM. ASSY	F68002-2		CONS TERM. ASSY	TB68005-5		50540-01
219	SST	20			CONS TERM. ASSY	F68003-2		CONS TERM. ASSY	TB68005-3		50540-01
220	SST	20			CONS TERM. ASSY	K68002-"A" NO		CONS TERM. ASSY	TB68005-11		50540-01
221	SST	20			CONS TERM. ASSY	F68005-2		CONS TERM. ASSY	TB68005-6		50540-01
222	SST	20			SYSTEM CTL UNIT	J70003S-4		CONS TERM. ASSY	TB68004-16		50540-01
223	SST	20			CONS TERM. ASSY	F68007-2		CONS TERM. ASSY	TB68005-7		50540-01
224	SST	20			CONS TERM. ASSY	F68008-2		CONS TERM. ASSY	TB68005-17		50540-01
225	OSH				LEFT CTL PNL	J56004P-5	4P-7	CONS TERM. ASSY	TB68004-1	4-3	50540-01
226	OSH				LEFT CTL PNL	J56004P-6		CONS TERM. ASSY	TB68004-2		50540-01
227	SST	20			CONS TERM. ASSY	F68002-1		CONS TERM. ASSY	TB68007-9		50540-01
228	SST	16			CONS TERM. ASSY	G68004		HEAD FAN PWR ASSY	1P GND		50540-01
229	SST	20			CONS TERM. ASSY	F68006-2		CONS TERM. ASSY	TB68005-2		50540-01
230	SST	20			CONS TERM. ASSY	K68002-"C" NO		CONS TERM. ASSY	F68005-1		50540-01
231	SST	20			CONS TERM. ASSY	K68002-"B" NO		CONS TERM. ASSY	TB68006-1		50540-01
232	SST	20			CONS TERM. ASSY	S68001-"A"		CONS TERM. ASSY	F68001-1		50540-01
233	SST	20			CONS TERM. ASSY	K68001-COIL "A"		CONS TERM. ASSY	F68002-1		50540-01
234	SST	20			CONS TERM. ASSY	K68001-COIL "B"		CONS TERM. ASSY	TB68006-2		50540-01
235	SST	20			CONS TERM. ASSY	TB68006-2		DUBBING MODE LAMP	KNIFE DISC		50540-01
236	SST	20			CONS TERM. ASSY	S68001-"A" NO		CONS TERM. ASSY	TB68006-2		50540-01
237	SST	20			CONS TERM. ASSY	S68001-"B" C		CONS TERM. ASSY	F68002-1		50540-01
238	SST	20			TAPE XPRT	J34002P-1		SYSTEM CTL UNIT	J70003S-1		50540-01
239	SSH				LEFT CTL PNL	J56003P-13	3P-14	CONS TERM. ASSY	TB68004-17	4-18	50540-01
240	SST	20			VIDEO ERASE LAMP	TERM, GRN		DUBBING LAMP	TERM, GRN		50534-01
241	SST	20			CONS TERM. ASSY	S68001-"B" NC		CONS TERM. ASSY	TB68006-2		50540-01
242	SST	20			DUBBING LAMP BLU	KNIFE DISC		CONS TERM. ASSY	F68002-1		50540-01
243	SST	20			HEAD FAN ASSY	P-1 COP		CONS TERM. ASSY	TB68008-12		50540-01
244	SST	20			VIDEO ER/CUE UNIT	J59007P-6		CONS TERM. ASSY	K68002-"B" C		50540-01
245	SST	20			RIGHT CTL PANEL	J46007P-32		CONS TERM. ASSY	K68002-"B" C		50540-01
246											
247	SST	16			LEFT CTL PNL	J56004P-16		CONS TERM. ASSY	GA8003		50540-01
248											
249	SST	20			CAPSTAN M.P.A.	J60002S-13		CAPSTAN M.P.A.	J60002S-16		50500-01
250	SST	20			CAPSTAN M.P.A.	J60002S-15		CAPSTAN M.P.A.	J60002S-18		50500-01
251	SSH	24			DRUM SERVO CTL	J65001S-2	1S-1	RACK 2 TERM. ASSY	TB-B-13	B-14	50500-01
252	SSH	24			DRUM SERVO CTL	J65002P-3	2P-1	CAP. SIG GEN	J48003S-4	1S-3	50500-01
253	SSH	24			DRUM SERVO CTL	J65003S-2	3S-1	RACK 2 TERM. ASSY	TB B-3	B-4	50500-01
254	SSH	24			DRUM SERVO CTL	J65003S-4	3S-3	RACK 2 TERM. ASSY	TB B-9	B-10	50500-01
255	SSH	24			DRUM SERVO CTL	J65004P-3	4P-1	HEAD M.P.A.	J60001P-3	1P-1	50500-01
256	SST	20			DRUM SERVO CTL	J65005P-1		1 AMP PWR SUP "B"	J60001S-1		50500-01
257	SST	20			DRUM SERVO CTL	J65005P-2		RACK 2 TERM. ASSY	TB K-8		50500-01
258	RG				PROCESSOR	J75011S		RACK 1 TERM. ASSY	TB E-2		50499-01
259	SST	20			DRUM SERVO CTL	J65005P-4		RACK 2 TERM. ASSY	TB C-16		50500-01
260	SST	20			DRUM SERVO CTL	J65005P-5		RACK 2 TERM. ASSY	TB K-9		50500-01
261	SST	20			DRUM SERVO CTL	J65005P-6		RACK 2 TERM. ASSY	TB C-8		50500-01
262	SST	20			DRUM SERVO CTL	J65005P-7		RACK 2 TERM. ASSY	TB K-10		50500-01
263	SST	20			DRUM SERVO CTL	J65005P-7		1 AMP PWR SUP "B"	J60001S-2		50500-01
264	SST	20			DRUM SERVO CTL	J65006P-BRS		RACK 2 PWR DUCT	BRASS		50500-01
265	SST	20			DRUM SERVO CTL	J65006P-COP		RACK 2 PWR DUCT	COP		50500-01
266	SST	16			DRUM SERVO CTL	J65006P-GND		RACK 2 PWR DUCT	GND		50500-01
267	SSH				DRUM SERVO CTL	J65007S-3	7S-1	CAP. SIG GEN	J48004S-7	4S-8	50501-01
268	SSH				DRUM SERVO CTL	J65008P-3	8P-1	RACK 2 TERM. ASSY	TB I-11	E-12	50501-01
269	SSH				DRUM SERVO CTL	J65009S-2	9S-1	RACK 2 TERM. ASSY	TB B-5	B-6	50501-01
270	SSH				DRUM SERVO CTL	J65009S-4	9S-3	RACK 2 TERM. ASSY	TB B-7	B-8	50501-01
271	RG				DRUM SERVO CTL	J65010S		RACK 2 TERM. ASSY	TB J-2		50501-01
272	RG				DRUM SERVO CTL	J65011S		RACK 2 TERM. ASSY	TB J-1		50501-01
273	RG				DRUM SERVO CTL	J65012S		RACK 2 TERM. ASSY	TB J-3		50501-01
274	RG				DRUM SERVO CTL	J65013S		RACK 2 TERM. ASSY	TB J-4		50501-01
275	SSH	24			CAPSTAN SIG GEN	J48001S-2	1S-1	RACK 2 TERM. ASSY	TB B-1	B-2	50500-01
276	SST	20			CAPSTAN SIG GEN	J48002P-1		1 AMP PWR SUP "B"	J60001S-3		50500-01
277	SST	20			CAPSTAN SIG GEN	J48002P-4		RACK 2 PWR DUCT	BRASS		50500-01
278	SST	16			CAPSTAN SIG GEN	J48002P-3		RACK 2 PWR DUCT	GND		50500-01
279	SST	20			CAPSTAN SIG GEN	J48002P-2		RACK 2 PWR DUCT	COP		50500-01
280	SST	20			CAPSTAN SIG GEN	J48002P-5		RACK 2 TERM. ASSY	TB K-9		50500-01
281	SST	20			CAPSTAN SIG GEN	J48002P-6		RACK 2 TERM. ASSY	TB K-10		50500-01
282	SST	20			CAPSTAN SIG GEN	J48002P-7		RACK 2 TERM. ASSY	TB C-7		50500-01
283	SST	20			CAPSTAN SIG GEN	J48002P-8		1 AMP PWR SUP "B"	J60001S-4		50500-01
284	SSH	24			CAPSTAN SIG GEN	J48003P-3	3P-1	CAPSTAN M.P.A.	J60001P-3	1P-1	50500-01
285	DSH				CAPSTAN SIG GEN	J48004S-3	4S-1	RACK 2 TERM. ASSY	TB C-1	C-3	50501-01
286	DSH				CAPSTAN SIG GEN	J48004S-2		RACK 2 TERM. ASSY	TB C-2		50501-01
287	SST	20			CAPSTAN M.P.A.	J60002S-1		RACK 2 TERM. ASSY	TB K-1		50500-01
288	SST	20			CAPSTAN M.P.A.	J60002S-2		RACK 2 TERM. ASSY	TB K-2		50500-01

WIRE DIAGRAM FOR CAT. ITEM 57020

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AMPEX CORPORATION

WIRE	KIND	GAUGE	COLOR	LGTH	FROM	REF #	SHIELD	TO	REF #	SHIELD	HARNESS ASSY
289	SST	20			CAPSTAN M.P.A.	J600025-3		RACK 2 TERM. ASSY	TB K-3		50500-01
290	SST	20			CAPSTAN M.P.A.	J600025-4		RACK 2 TERM. ASSY	TB K-4		50500-01
291	SST	20			CAPSTAN M.P.A.	J600025-4		CAPSTAN M.P.A.	J600025-8		50500-01
292	SST	20			CAPSTAN M.P.A.	J60003P-BRS		RACK 2 PWR DUCT	BRASS		50500-01
293	SST	20			CAPSTAN M.P.A.	J60003P-COP		RACK 2 PWR DUCT	COP		50500-01
294	SST	16			CAPSTAN M.P.A.	J60003P-GND		RACK 2 PWR DUCT	GND		50500-01
295	SST	20			HEAD M.P.A.	J600025-1		HEAD M.P.A.	J600025-5		50500-01
296	SST	20			HEAD M.P.A.	J600025-2		HEAD M.P.A.	J600025-6		50500-01
297	SST	20			HEAD M.P.A.	J600025-3		HEAD M.P.A.	J600025-7		50500-01
298	SST	20			HEAD M.P.A.	J600025-1		RACK 2 TERM. ASSY	TB K-5		50500-01
299	SST	20			HEAD M.P.A.	J600025-2		RACK 2 TERM. ASSY	TB K-6		50500-01
300	SST	20			HEAD M.P.A.	J600025-3		RACK 2 TERM. ASSY	TB K-7		50500-01
301	SST	20			HEAD M.P.A.	J60003P-BRS		RACK 2 PWR DUCT	BRASS		50500-01
302	SST	20			HEAD M.P.A.	J60003P-COP		RACK 2 PWR DUCT	COP		50500-01
303	SST	16			HEAD M.P.A.	J60003P-GND		RACK 2 PWR DUCT	GND		50500-01
304	SST	16			1 AMP PWR SUP "B"	J66001S-6		RACK 2 TERM. ASSY	TB F-4		50500-01
305	SST	16			1 AMP PWR SUP "B"	J66001S-5		RACK 2 TERM. ASSY	TB F-3		50500-01
306	SST	20			1 AMP PWR SUP "B"	J66002P-BRS		RACK 2 PWR DUCT	BRASS		50500-01
307	SST	20			1 AMP PWR SUP "B"	J66002P-COP		RACK 2 PWR DUCT	COP		50500-01
308	SST	16			1 AMP PWR SUP "B"	J66002P-GND		RACK 2 PWR DUCT	GND		50500-01
309	SST	16			1 AMP PWR SUP "A"	J66001S-1		RACK 2 TERM. ASSY	TB F-1		50500-01
310	SST	16			1 AMP PWR SUP "A"	J66001S-2		RACK 2 TERM. ASSY	TB F-2		50500-01
311	SST	20			1 AMP PWR SUP "A"	J66002P-BRS		RACK 2 PWR DUCT	BRASS		50500-01
312	SST	20			1 AMP PWR SUP "A"	J66002P-COP		RACK 2 PWR DUCT	COP		50500-01
313	SST	16			1 AMP PWR SUP "A"	J66002P-GND		RACK 2 PWR DUCT	GND		50500-01
314	RG				MOD, MONOCHROME	J43003S		RACK 1 TERM. ASSY	TB E-3		50498-01
315	SST	20			MOD, MONOCHROME	J43002P-1		RACK 1 TERM. ASSY	TB A-1		50498-01
316	SST	20			MOD, MONOCHROME	J43001P-BRS		RACK 1 PWR DUCT	BRASS		50498-01
317	SST	16			MOD, MONOCHROME	J43001P-GND		RACK 1 PWR DUCT	GND		50498-01
318	SST	20			MOD, MONOCHROME	J43001P-COP		RACK 1 PWR DUCT	COP		50498-01
319	SST	20			MOD, MONOCHROME	J43002P-5		DEMOD, MONOCHROME	J62002P-2		50498-01
320	SST	20			MOD, MONOCHROME	J43002P-6		DEMOD, MONOCHROME	J62002P-4		50498-01
321	SST	20			RACK 1 TERM. ASSY	TB A-9		RACK 1 TERM. ASSY	TBC RLY "A"		50498-01
322	SST	20			MOD, MONOCHROME	J43002P-8		RACK 1 TERM. ASSY	TB A-2		50498-01
323	RG				PROCESSOR	J75008S		RACK 1 TERM. ASSY	TB C-1		50498-01
333	RG				MOD, MONOCHROME	J43004S		DEMOD, MONOCHROME	J62006S		50499-01
334	SST	20			DEMOD, MONO	J62002P-1		RACK 1 TERM. ASSY	TB A-1		50498-01
335	SST	20			DEMOD, MONO	J62002P-5		RACK 1 TERM. ASSY	TB B-9		50498-01
336	SST	20			DEMOD, MONO	J62002P-6		RACK 1 TERM. ASSY	TB B-10		50498-01
337	SST	20			DEMOD, MONO	J62002P-7		RACK 1 TERM. ASSY	TB A-10		50498-01
338	SST	20			DEMOD, MONO	J62002P-8		RACK 1 TERM. ASSY	TB A-2		50498-01
339	SST	20			DEMOD, MONO	J62003P-BRS		RACK 1 PWR DUCT	BRASS		50498-01
340	SST	20			DEMOD, MONO	J62003P-COP		RACK 1 PWR DUCT	COP		50498-01
341	SST	16			DEMOD, MONO	J62003P-GND		RACK 1 PWR DUCT	GND		50498-01
342	RG				DEMOD, MONO	J62005S		RACK 1 TERM. ASSY	TB E-15		50499-01
343	RG				DEMOD, MONO	J62004S		RACK 1 TERM. ASSY	TBC-RLY-ARM		50499-01
344	RG				DEMOD, MONO	J62001S		RACK 1 TERM. ASSY	TB E-6		50498-01
345	RG				DEMOD, MONO	J62007S		RACK 1 TERM. ASSY	TB E-1		50499-01
346	SSH				CHAN. SWITCHER	J64001S-3	1S-1	RACK 1 TERM. ASSY	TB B-13	B-14	50498-01
347	SSH				CHAN. SWITCHER	J64002P-3	2P-1	GUIDE POS SENSOR	J49004S-2	4S-1	50498-01
348	SST	20			CHAN. SWITCHER	J64004P-1		RACK 1 TERM. ASSY	TB A-1		50498-01
349	SST	20			CHAN. SWITCHER	J64003P-BRS		RACK 1 PWR DUCT	BRASS		50498-01
350	SST	16			CHAN. SWITCHER	J64003P-GND		RACK 1 PWR DUCT	GND		50498-01
351	SST	20			CHAN. SWITCHER	J64003P-COP		RACK 1 PWR DUCT	COP		50498-01
352	SST	20			CHAN. SWITCHER	J64004P-8		RACK 1 TERM. ASSY	TB A-2		50498-01
353	RG				CHAN. SWITCHER	J64005S		GUIDE POS SENSOR	J49003S		50498-01
354	RG				CHAN. SWITCHER	J64006S		RACK 1 TERM. ASSY	TB E-10		50499-01
355	RG				CHAN. SWITCHER	J64007S		RACK 1 TERM. ASSY	TB E-11		50499-01
356	RG				CHAN. SWITCHER	J64008S		RACK 1 TERM. ASSY	TB E-12		50499-01
357	RG				CHAN. SWITCHER	J64009S		RACK 1 TERM. ASSY	TB E-13		50499-01
358	RG				CHAN. SWITCHER	J64010S		RACK 1 TERM. ASSY	TBC-RLY-NC		50499-01
359	SST	20			GUIDE POS SENSOR	J49001P-1		RACK 1 TERM. ASSY	TB A-3		50498-01
360	SST	20			GUIDE POS SENSOR	J49001P-2		RACK 1 PWR DUCT	COP		50498-01
361	SST	16			GUIDE POS SENSOR	J49001P-3		RACK 1 PWR DUCT	GND		50498-01
362	SST	20			GUIDE POS SENSOR	J49001P-4		RACK 1 PWR DUCT	BRASS		50498-01
363	SST	20			GUIDE POS SENSOR	J49001P-6		RACK 1 TERM. ASSY	TB A-8		50498-01
364	SST	20			GUIDE POS SENSOR	J49001P-7		RACK 1 TERM. ASSY	TB B-11		50498-01
365	SST	20			GUIDE POS SENSOR	J49001P-8		RACK 1 TERM. ASSY	TB A-4		50498-01
366	RG				GUIDE POS SENSOR	J49002S		PROCESSOR	J75007S		50498-01
367	SSH				GUIDE POS SENSOR	J49004S-4	4S-3	RACK 1 TERM. ASSY	TB B-15	B-16	50498-01
368	RG				PROCESSOR	J75006S		RACK 1 TERM. ASSY	TB E-8		50498-01
369	SST	20			PROCESSOR	J75003P-1		RACK 1 TERM. ASSY	TB A-3		50498-01

WIRE	KIND	GAUGE	COLOR	LGTH	FROM	REF #	SHIELD	TO	REF #	SHIELD	HARNESS ASSY
370	SST	20			PROCESSOR	J75002P-BRS		RACK 1 PWR DUCT	BRASS		50498-01
371	SST	16			PROCESSOR	J75002P-GND		RACK 1 PWR DUCT	GND		50498-01
372	SST	20			PROCESSOR	J75002P-COP		RACK 1 PWR DUCT	COP		50498-01
373	SST	20			PROCESSOR	J75003P-2		RACK 1 TERM. ASSY	TB A-9		50498-01
374	SST	20			PROCESSOR	J75003P-3		RACK 1 TERM. ASSY	TB B-12		50498-01
375	SST	20			PROCESSOR	J75003P-12		RACK 1 TERM. ASSY	TB A- 4		50498-01
376	RG				PROCESSOR	J75001S		RACK 1 TERM. ASSY	TB E-7		54098-01
377	SSH				PROCESSOR	J75009P-A	9P-B	RACK 1 TERM. ASSY	TB B-17	B-18	50499-01
378	SST	20			PROCESSOR	J75003P-1		RACK 1 TERM. ASSY	TB B-1		50498-01
379	SST	20			PROCESSOR	J75003P-4		RACK 1 TERM. ASSY	TB B-2		50498-01
380	SST	20			PROCESSOR	J75003P-5		RACK 1 TERM. ASSY	TB B-3		50498-01
381	SST	20			PROCESSOR	J75003P-6		RACK 1 TERM. ASSY	TB B-4		50498-01
382	RG				PROCESSOR	J75004S		RACK 1 TERM. ASSY	TB E-4		50498-01
383	RG				PROCESSOR	J75005S		RACK 1 TERM. ASSY	TB E-5		50498-01
384	RG				CHAN. SWITCHER	J64011S		RACK 1 TERM. ASSY	TB E-14		50499-01
385	RG				RACK 1 TERM. ASSY	TB E-1		RACK 1 TERM. ASSY	TB E-2		50499-01
386	SST	20			PROCESSOR	J75003P-7		RACK 1 TERM. ASSY	TB B-6		50498-01
387	SST	20			PROCESSOR	J75003P-8		RACK 1 TERM. ASSY	TB B-5		50498-01
388	SST	20			PROCESSOR	J75003P-10		RACK 1 TERM. ASSY	TB A-5		50498-01
389	RG				PROCESSOR	J75001OS		RACK 1 TERM. ASSY	TB E-9		50499-01
390	SST	20			PROCESSOR	J75003P-9		RACK 1 TERM. ASSY	TB B-7		50498-01
391					CONS TERM. ASSY	TB68002-1	2-3	RACK 2 TERM. ASSY	TB A-1	A-3	51144-04
392					CONS TERM. ASSY	TB68002-2		RACK 2 TERM. ASSY	TB A-2		
393					CONS TERM. ASSY	TB68002-4	2-6	RACK 2 TERM. ASSY	TB A-4	A-6	51144-04
394					CONS TERM. ASSY	TB68002-5		RACK 2 TERM. ASSY	TB A-5		51144-04
395					CONS TERM. ASSY	TB68002-7	2-9	RACK 2 TERM. ASSY	TB A-7	A-9	51144-04
396					CONS TERM. ASSY	TB68002-8		RACK 2 TERM. ASSY	TB A-8		51144-04
397					CONS TERM. ASSY	TB68002-10	2-12	RACK 2 TERM. ASSY	TB A-10	A-12	51144-04
398					CONS TERM. ASSY	TB68002-11		RACK 2 TERM. ASSY	TB A-11		51144-04
399					CONS TERM. ASSY	TB68002-13	2-15	RACK 2 TERM. ASSY	TB A-13	A-15	51144-04
400					CONS TERM. ASSY	TB68002-14		RACK 2 TERM. ASSY	TB A-14		51144-04
401					CONS TERM. ASSY	TB68002-16	2-18	RACK 2 TERM. ASSY	TB A-16	A-18	51144-04
402					CONS TERM. ASSY	TB68002-17		RACK 2 TERM. ASSY	TB A-17		51144-04
403					CONS TERM. ASSY	TB68004-1	4-3	RACK 2 TERM. ASSY	TB C-1	C-3	51144-04
404					CONS TERM. ASSY	TB68004-2		RACK 2 TERM. ASSY	TB C-2		51144-04
405					CONS TERM. ASSY	TB68006-4	6-6	RACK 2 TERM. ASSY	TB E-4	E-6	51144-04
406					CONS TERM. ASSY	TB68006-5		RACK 2 TERM. ASSY	TB E-5		51144-04
407					CONS TERM. ASSY	TB68003-1	3-2	RACK 2 TERM. ASSY	TB B-1	B-2	51144-04
408					CONS TERM. ASSY	TB68003-3	3-4	RACK 2 TERM. ASSY	TB B-3	B-4	51144-04
409					CONS TERM. ASSY	TB68003-5	3-6	RACK 2 TERM. ASSY	TB B-5	B-6	51144-04
410					CONS TERM. ASSY	TB68003-7	3-8	RACK 2 TERM. ASSY	TB B-7	B-8	51144-04
411					CONS TERM. ASSY	TB68003-9	3-10	RACK 2 TERM. ASSY	TB B-9	B-10	51144-04
412					CONS TERM. ASSY	TB68003-11	3-12	RACK 2 TERM. ASSY	TB B-11	B-12	51144-04
413					CONS TERM. ASSY	TB68003-13	3-14	RACK 2 TERM. ASSY	TB B-13	B-14	51144-04
414					CONS TERM. ASSY	TB68003-15	3-16	RACK 2 TERM. ASSY	TB B-15	B-16	51144-04
415					CONS TERM. ASSY	TB68003-17	3-18	RACK 2 TERM. ASSY	TB B-17	B-18	51144-04
416					CONS TERM. ASSY	TB68004-17	4-18	RACK 2 TERM. ASSY	TB C-17	C-18	51144-04
417					CONS TERM. ASSY	TB68006-7	6-8	RACK 2 TERM. ASSY	TB E-7	E-8	51144-04
418					CONS TERM. ASSY	TB68004-4		RACK 2 TERM. ASSY	TB C-4		51144-04
419					CONS TERM. ASSY	TB68004-5		RACK 2 TERM. ASSY	TB C-5		51144-04
420					CONS TERM. ASSY	TB68004-6		RACK 2 TERM. ASSY	TB C-6		51144-04
421					CONS TERM. ASSY	TB68004-7		RACK 2 TERM. ASSY	TB C-7		51144-04
422					CONS TERM. ASSY	TB68004-8		RACK 2 TERM. ASSY	TB C-8		51144-04
423					CONS TERM. ASSY	TB68004-9		RACK 2 TERM. ASSY	TB C-9		51144-04
424					CONS TERM. ASSY	TB68004-10		RACK 2 TERM. ASSY	TB C-10		51144-04
425					CONS TERM. ASSY	TB68004-11		RACK 2 TERM. ASSY	TB C-11		51144-04
426					CONS TERM. ASSY	TB68004-12		RACK 2 TERM. ASSY	TB C-12		51144-04
427					CONS TERM. ASSY	TB68004-13		RACK 2 TERM. ASSY	TB C-13		51144-04
428					CONS TERM. ASSY	TB68004-14		RACK 2 TERM. ASSY	TB C-14		51144-04
429					CONS TERM. ASSY	TB68004-15		RACK 2 TERM. ASSY	TB C-15		51144-04
430					CONS TERM. ASSY	TB68005-1		RACK 2 TERM. ASSY	TB D-1		51144-04
431					CONS TERM. ASSY	TB68005-2		RACK 2 TERM. ASSY	TB D-2		51144-04
432					CONS TERM. ASSY	TB68005-3		RACK 2 TERM. ASSY	TB D-3		51144-04
433					CONS TERM. ASSY	TB68005-4		RACK 2 TERM. ASSY	TB D-4		51144-04
434					CONS TERM. ASSY	TB68005-5		RACK 2 TERM. ASSY	TB D-5		51144-04
435					CONS TERM. ASSY	TB68005-6		RACK 2 TERM. ASSY	TB D-6		51144-04
436					CONS TERM. ASSY	TB68005-7		RACK 2 TERM. ASSY	TB D-7		51144-04
437					CONS TERM. ASSY	TB68005-8		RACK 2 TERM. ASSY	TB D-8		51144-04
438					CONS TERM. ASSY	TB68005-9		RACK 2 TERM. ASSY	TB D-9		51144-04
439					CONS TERM. ASSY	TB68005-10		RACK 2 TERM. ASSY	TB D-10		51144-04
440					CONS TERM. ASSY	TB68005-11		RACK 2 TERM. ASSY	TB D-11		51144-04
441					CONS TERM. ASSY	TB68005-12		RACK 2 TERM. ASSY	TB D-12		51144-04

WIRE DIAGRAM
PACIFIC 57020

57025 C
6 of 6

AMPEX CORPORATION

WIRE	KIND	GAUGE	COLOR	LGTH	FROM	REF #	SHIELD	TO	REF #	SHIELD	HARNESS ASSY
442	SST	20			CONS TERM. ASSY	TB68005-13		RACK 2 TERM. ASSY	TB D-13		51144-04
443	SST	20			CONS TERM. ASSY	TB68005-14		RACK 2 TERM. ASSY	TB D-14		51144-04
444	SST	20			CONS TERM. ASSY	TB68005-15		RACK 2 TERM. ASSY	TB D-15		51144-04
445	SST	20			CONS TERM. ASSY	TB68005-16		RACK 2 TERM. ASSY	TB D-16		51144-04
446	SST	20			CONS TERM. ASSY	TB68005-17		RACK 2 TERM. ASSY	TB D-17		51144-04
447	SST	20			CONS TERM. ASSY	TB68005-18		RACK 2 TERM. ASSY	TB D-18		51144-04
448	SST	20			CONS TERM. ASSY	TB68006-1		RACK 2 TERM. ASSY	TB E-1		51144-04
449	SST	20			CONS TERM. ASSY	TB68006-2		RACK 2 TERM. ASSY	TB E-2		51144-04
450	SST	20			CONS TERM. ASSY	TB68006-3		RACK 2 TERM. ASSY	TB E-3		51144-04
451	SST	20			CONS TERM. ASSY	TB68006-9		RACK 2 TERM. ASSY	TB E-9		51144-04
452	SST	20			CONS TERM. ASSY	TB68006-10		RACK 2 TERM. ASSY	TB E-10		51144-04
453	SST	16			CONS TERM. ASSY	TB68007-1		RACK 2 TERM. ASSY	TB K-1		51194-04
454	SST	16			CONS TERM. ASSY	TB68007-2		RACK 2 TERM. ASSY	TB K-2		51194-04
455	SST	16			CONS TERM. ASSY	TB68007-3		RACK 2 TERM. ASSY	TB K-3		51194-04
456	SST	16			CONS TERM. ASSY	TB68007-4		RACK 2 TERM. ASSY	TB K-4		51194-04
457	SST	16			CONS TERM. ASSY	TB68007-5		RACK 2 TERM. ASSY	TB K-5		51194-04
458	SST	16			CONS TERM. ASSY	TB68007-6		RACK 2 TERM. ASSY	TB K-6		51194-04
459	SST	16			CONS TERM. ASSY	TB68007-7		RACK 2 TERM. ASSY	TB K-7		51194-04
460	SST	16			CONS TERM. ASSY	TB68007-8		RACK 2 TERM. ASSY	TB K-8		51194-04
461	SST	16			CONS TERM. ASSY	TB68007-9		RACK 2 TERM. ASSY	TB K-9		51194-04
462	SST	16			CONS TERM. ASSY	TB68007-10		RACK 2 TERM. ASSY	TB K-10		51194-04
463	SST	14			CONS TERM. ASSY	TB68007-11		RACK 2 TERM. ASSY	TB K-11		51194-04
464	SST	14			CONS TERM. ASSY	TB68007-12		RACK 2 TERM. ASSY	TB K-12		51194-04
465	SST	16			RACK 1 TERM. ASSY	TB A-1		RACK 2 TERM. ASSY	TB F-1		50504-01
466	SST	16			RACK 1 TERM. ASSY	TB A-2		RACK 2 TERM. ASSY	TB F-2		50504-01
467	SST	16			RACK 1 TERM. ASSY	TB A-3		RACK 2 TERM. ASSY	TB F-3		50504-01
468	SST	16			RACK 1 TERM. ASSY	TB A-4		RACK 2 TERM. ASSY	TB F-4		50504-01
469	SST	16			RACK 1 TERM. ASSY	TB A-8		RACK 2 TERM. ASSY	TB K-8		50504-01
470	SST	16			RACK 1 TERM. ASSY	TB A-9		RACK 2 TERM. ASSY	TB K-9		50504-01
471	SST	16			RACK 1 TERM. ASSY	TB A-10		RACK 2 TERM. ASSY	TB K-10		50504-01
472	SST	20			RACK 1 TERM. ASSY	TB B-9		RACK 2 TERM. ASSY	TB E-3		50504-01
473	SST	20			RACK 1 TERM. ASSY	TB B-10		RACK 2 TERM. ASSY	TB C-6		50504-01
474	SST	20			RACK 1 TERM. ASSY	TB B-11		RACK 2 TERM. ASSY	TB C-5		50504-01
475	SST	20			RACK 1 TERM. ASSY	TB B-12		RACK 2 TERM. ASSY	TB C-4		50504-01
476	SSH				RACK 1 TERM. ASSY	TB B-13	B-14	RACK 2 TERM. ASSY	TB E-11	E-12	50504-01
477	SSH				RACK 1 TERM. ASSY	TB B-15	B-16	RACK 2 TERM. ASSY	TB B-11	B-12	50504-01
478	RG				RACK 1 TERM. ASSY	TB E-3		RACK 2 TERM. ASSY	TB J-1		50504-01
479	SST	20			RACK 1 TERM. ASSY	TBC-RLY-"B"		RACK 2 TERM. ASSY	TB E-2		50504-01
480											
481	RG			247	RACK 1 TERM. ASSY	TB E-10		CONS TERM. ASSY	TB68001-1		50522-04
482	RG			245 1/2	RACK 1 TERM. ASSY	TB E-11		CONS TERM. ASSY	TB68001-2		50522-04
483	RG			243-1/2	RACK 1 TERM. ASSY	TB E-12		CONS TERM. ASSY	TB68001-3		50522-04
484	RG			242-1/2	RACK 1 TERM. ASSY	TB E-13		CONS TERM. ASSY	TB68001-4		50522-04
485	RG			239-1/2	RACK 1 TERM. ASSY	TB E-14		CONS TERM. ASSY	TB68001-5		50522-04
486	RG			237	RACK 1 TERM. ASSY	TB E-15		CONS TERM. ASSY	K68001-NC		50522-04
487	RG			237	RACK 1 TERM. ASSY	TB E-16		CONS CTL ASSY	K68001-NO		50522-04
488	SST	20			POWER CTL PNL	CKT BKR-L1		POWER CTL PNL	SW-L1		51296-01
489	SST	20			POWER CTL PNL	CKT BKR-B		POWER CTL PNL	SW-T1		51296-01
490	SST	14			POWER CTL PNL	CKT BKR-T1		RACK 2 TERM. ASSY	TB K-11		50502-01
491	SST	14			POWER CTL PNL	CKT BKR-L2		RACK 2 TERM. ASSY	TB K-12		50502-01
492	SST	14			POWER CTL PNL	CKT BKR-L2		RACK 2 TERM. ASSY	TB F-12		50502-01
493	SST	14			POWER CTL PNL	CKT BKR-L2		RACK 1 TERM. ASSY	TB A-12		50502-01
494	SST	14			POWER CTL PNL	CKT BKR-T3		RACK 1 TERM. ASSY	TB A-11		50502-01
495	SST	14			POWER CTL PNL	CKT BKR-T3		RACK 2 TERM. ASSY	TB F-11		50502-01
496	SST	14			RACK 2 TERM. ASSY	GROUND		RACK 1 TERM. ASSY	GROUND		50502-01
497	SST	14			PWR CTL PNL	CKT BKR CASE		RACK 2 TERM. ASSY	GROUND		50502-01
498	SST	20			TALLY LIGHT	CONSOLE		CONSOLE	KNIFE DISC.		50534-01
499	SST	20			TALLY LIGHT	CONSOLE		CONSOLE	KNIFE DISC.		50534-01
500	DSH	22			TAPE XPRT	J34003S-H	3S-J	VIDEO ER/CUE UNIT	J59002P-B	2P-A	51282-01
501	DSH	22			TAPE XPRT	J34003S-K		VIDEO ER/CUE UNIT	J59002P-C		51282-01
502	SSH	30	W	44	TAPE XPRT	J34003S-R	3S-N	VIDEO ER/CUE UNIT	J59005P-B	5P-A	51282-01
503	SSH	30	W	44	TAPE XPRT	J34003S-P	3S-L	RIGHT CTL PNL	J46003P-B	3P-A	51282-01
504	DSH	22	R	44	TAPE XPRT	J34003S-C	3S-B	RIGHT CTL PNL	J46008P-C	8P-A	51282-01
505	DSH	22	BLU	44	TAPE XPRT	J34003S-A		RIGHT CTL PNL	J46008P-B		51282-01
506											
507											
508											
509											
510	SST	20			DUB LIGHT DS-1	BLUE		CONSOLE	KNIFE DISC.		50534-01
511	SST	20			DUB LIGHT DS-1	RED		CONSOLE	KNIFE DISC.		50534-01
512	SST	20			ERASE LIGHT DS-2	BLUE		CONSOLE	KNIFE DISC.		50534-01
513	SST	20			ERASE LIGHT DS-2	RED		CONSOLE	KNIFE DISC.		50534-01

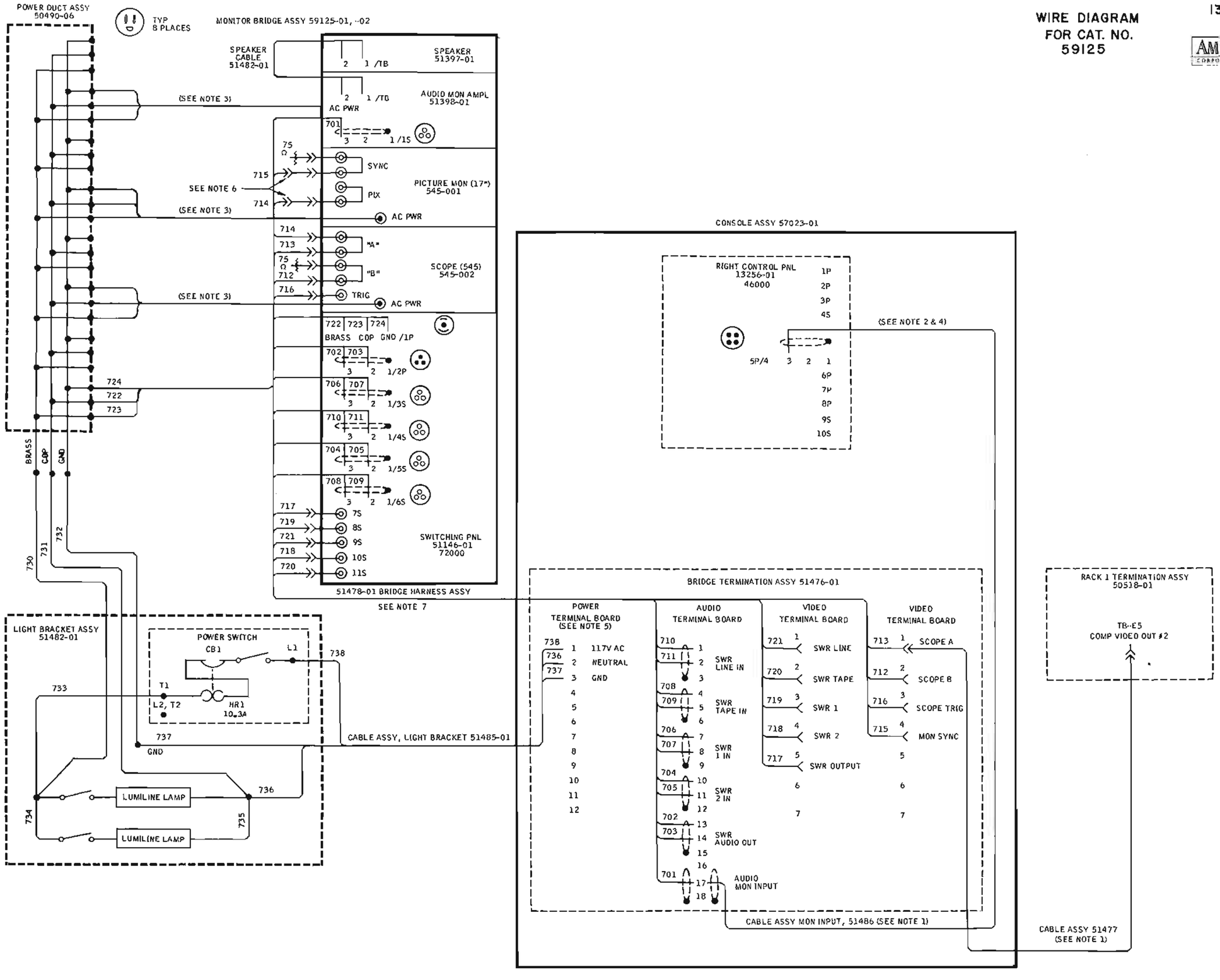
} CONS MECH ASSY

WIRE	KIND	GAUGE	COLOR	LGTH	FROM	REF #	SHIELD	TO	REF #	SHIELD	HARNESS ASSY
514	SST	20			ERASE LIGHT DS-2	GREEN		CONSOLE	KNIFE DISC.		50534-01
590	RG	33		24	RECORD DRIVER	J33001S		HEAD CHAN. ASSY	J32001S		50770-05
591	RG	33		24	RECORD DRIVER	J33002S		HEAD CHAN. ASSY	J32002S		50770-06
592	RG	33		24	RECORD DRIVER	J33003S		HEAD CHAN. ASSY	J32003S		50770-07
593	RG	33		24	RECORD DRIVER	J33004S		HEAD CHAN. ASSY	J32004S		50770-08
960	SPEC	22	9		VIDEO ER/CUE UNIT	J59009S-A	9S-D	SUP IDLER/ER HD	INTERNAL		51025-01
961	SPEC	22	2		VIDEO ER/CUE UNIT	J59009S-B		SUP IDLER/ER HD	INTERNAL		51025-01
962	SPEC	22	0		VIDEO ER/CUE UNIT	J59009S-C		SUP IDLER/ER HD	INTERNAL		51025-01
963	BARE	22	—		VIDEO ER/CUE UNIT	J59009S-E		VIDEO ER/CUE UNIT	J59009S-F		51025-01
965	DSH	22			LEFT CTL PNL	J56001P-B	1P-A	TAPE XPRT	J34001S-4	1S-B	50201-02
966	DSH	22			LEFT CTL PNL	J56001P-C		TAPE XPRT	J34001S-3		50201-02
594	SST	20			CTL PNL LT ASSY	2		CONS TERM. ASSY	KNIFE DISC.		51255-01
595	SST	20			CTL PNL LT ASSY	1		CONS TERM. ASSY	KNIFE DISC.		51255-01
596	SST	20			DEMOD	J62002P-3		RACK 1 TERM. ASSY	TB B-8		50498-01
597	SST	20			RACK 2 TERM. ASSY	TB D-16		RACK 1 TERM. ASSY	TB B-8		50504-01
598	SST	20			CONS TERM. ASSY	TB68005 -16		A & B SWITCH	#1-NC		50504-01
599	SST	20	9	10	CONS BLOWER	TB1-1		KNIFE DISC			51506-01
600	SST	20	0	10	CONS BLOWER	TB1-4		KNIFE DISC			51506-01
601	SST	16	5	10	CONS BLOWER	GND		KNIFE DISC			51506-01
601											

WIRE DIAGRAM
FOR CAT. NO.
59125

13362 C

AMPEX CORPORATION



NOTES:

1. CABLE ASSYS 51477 & 51486 SUPPLIED ONLY WITH -01 & -03 VERSION OF MONITOR BRIDGE ASSY.
2.0 FOR -02 VERSION OF MONITOR BRIDGE USE FOLLOWING SIGNAL SOURCES.
2.1 VR1000 PLAYBACK VIDEO AVAILABLE AT RACK 1 TB9-5/6.
2.2 VR1000 PLAYBACK AUDIO AVAILABLE IN CONSOLE AT RIGHT HAND CTL PNL, CAT. NO. 50151-01, CONNECTOR J22006P.
3. AC POWER CORD FURNISHED WITH EQUIP.
4. CONNECTOR J46005S THIS ASSEMBLY WILL REPLACE J46005 CONNECTOR IN 50540-01 (CONSOLE HARNESS ASSY).
5.1 117V AC, 10 AMPS, SINGLE PHASE, 60 CYCLES POWER REQUIRED FROM EXTERNAL SOURCE FOR -01 & -02 VERSIONS.
5.2 50 OR 60 CYCLES FOR -03 & -04 VERSIONS.
6. UHF 90 DEGREE ANGLE CONNECTOR (2 PLACES).
7. CABLE ASSY 51478 SUPPLIED ONLY WITH -01, -02 & -03 MONITOR BRIDGE ASSY.

VRB
INS 17

SCHEMATIC
SYSTEM LINE
FOR CATALOG ITEM
57020
(SIGNAL CIRCUITS)

57026 B
1 of 4

AMPEX CORPORATION

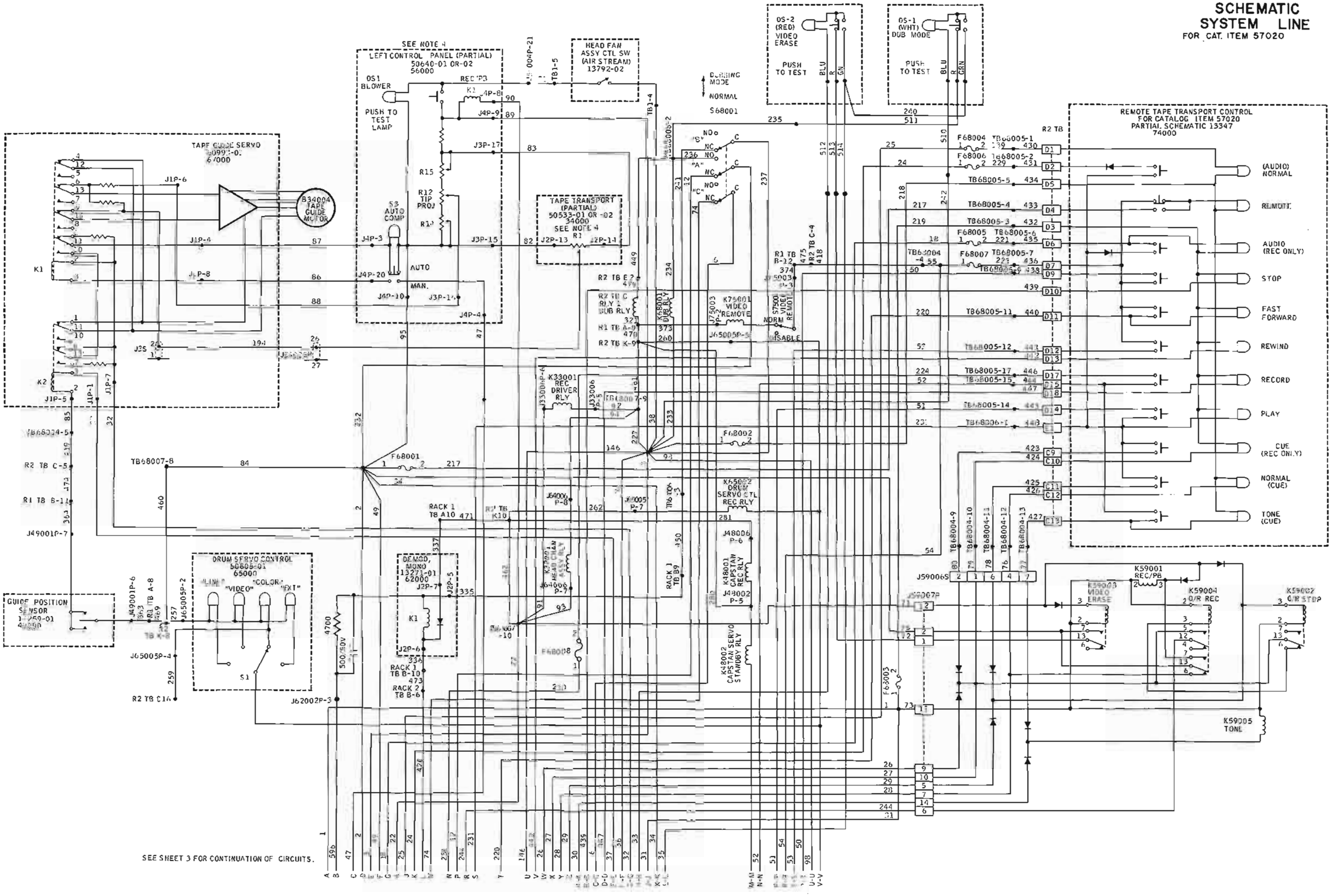
NOTES:

1. FOR SYSTEM NUMBERS SEE WIRE DIAGRAM 057035 FOR CATALOG ITEM 57020.
2. 60 CYCLE POWER REQUIRED FOR -01, -02 & -05 VERSIONS.
3. 50 CYCLE POWER REQUIRED FOR -03, -04 & -06 VERSIONS.
4. 0 FOR 50 CYCLE POWER VERSIONS OF CATALOG ITEM 57020 THE FOLLOWING ARE USED IN PLACE OF -01 ITEMS.
   - 4.1 TAPE TRANSPORT ASSEMBLY 50533-02.
   - 4.2 LEFT CONTROL PANEL 50640-02.
   - 4.3 BLOWER, CONSOLE COOLING 51506-02.
   - 4.4 VACUUM PUMP ASSEMBLY 51010-02.

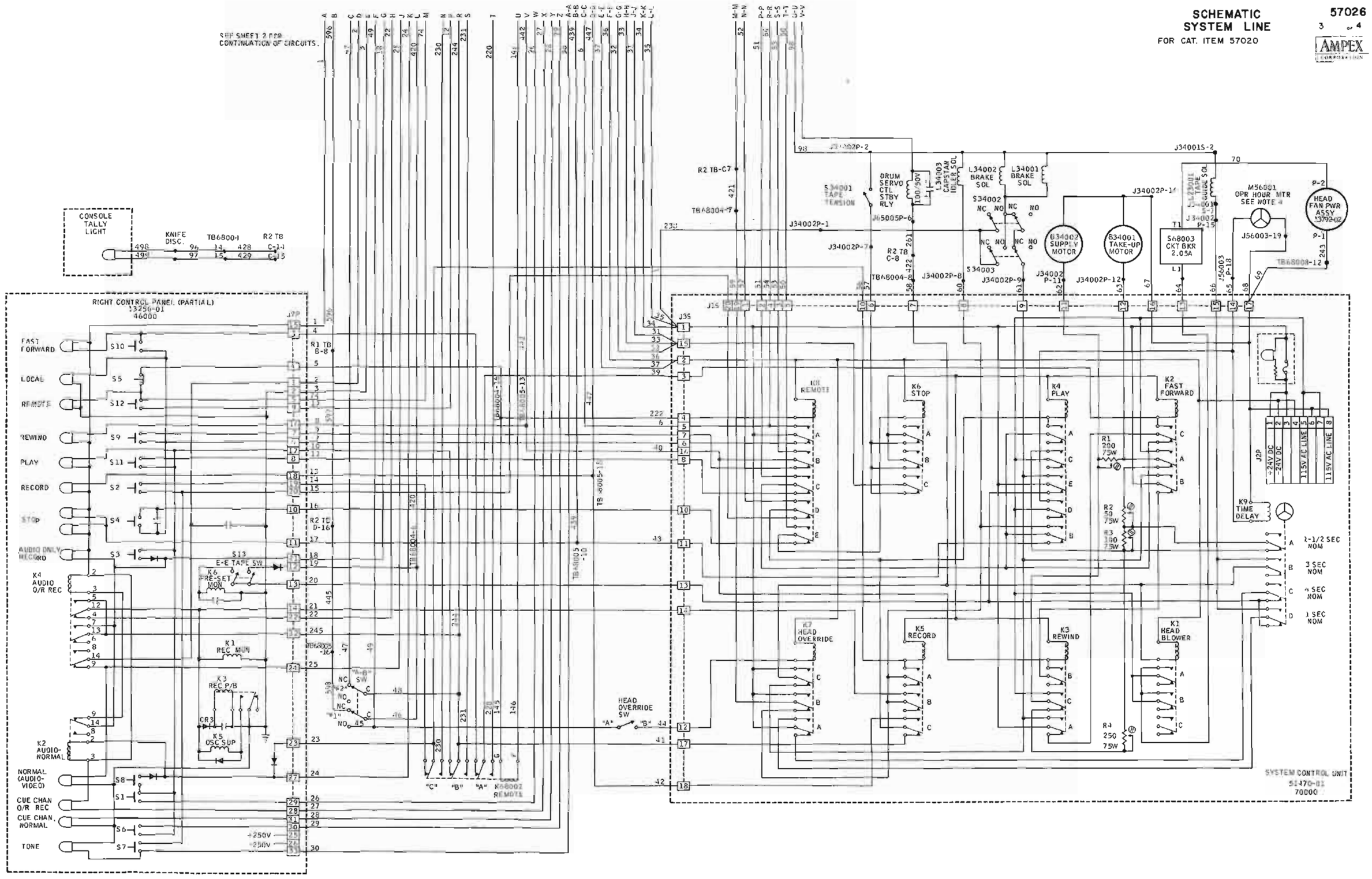
SCHEMATIC SYSTEM LINE

FOR CAT. ITEM 57020

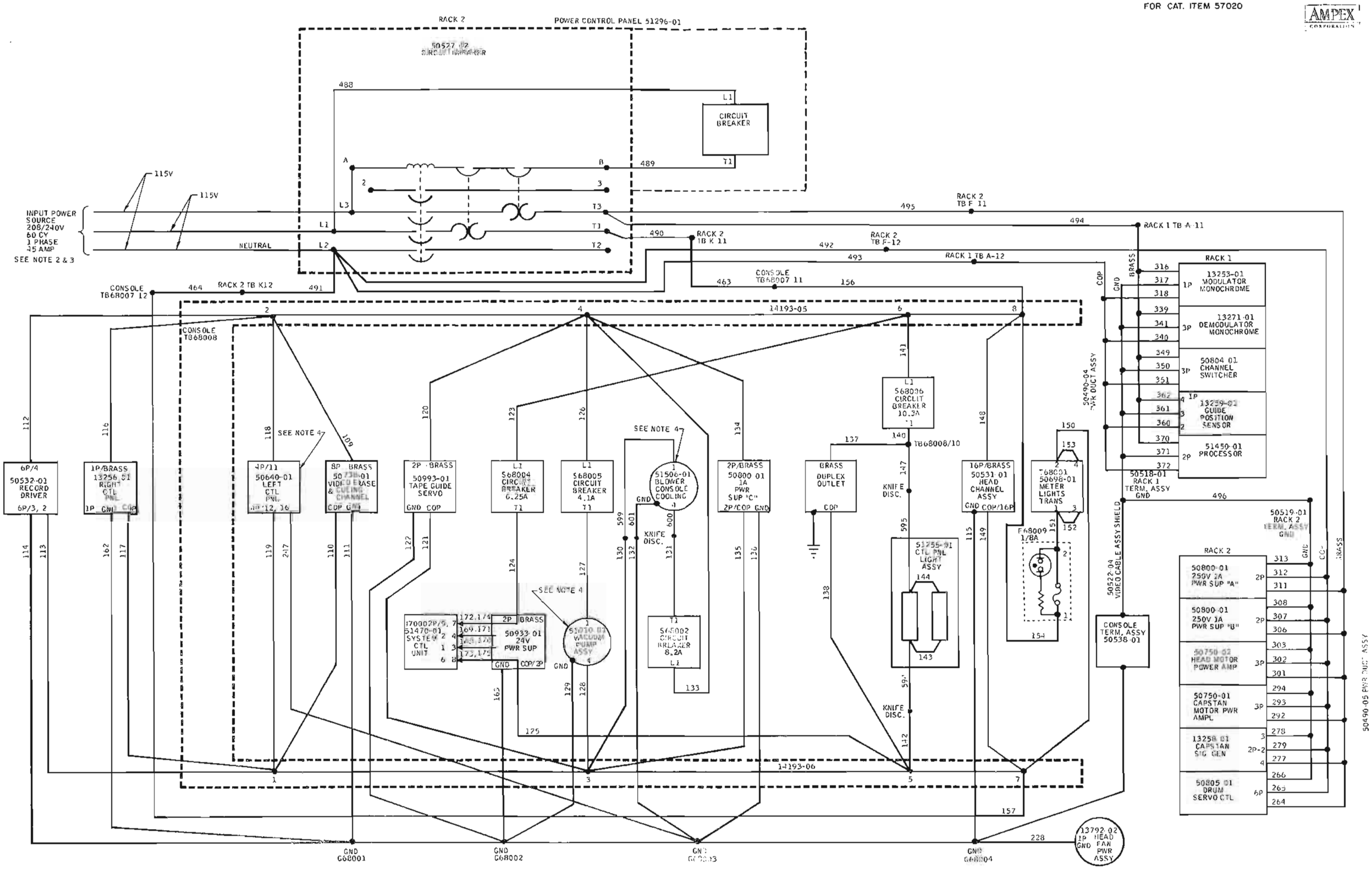
AMPEX CORPORATION



AMPEX CORPORATION



VRB
INS 20



SYSTEM CHECKOUT AND ROUTINE MAINTENANCE

Checkout Sequence

I. Primary Visual Inspection

II. Ac Power (lights, circuit breakers, subassemblies)

III. Right Control Panel - control functions

IV. Tape Transport Operation

V. Video Head and Time Delays

VI. EE picture check of Modulator and Demodulator

VII. EE picture check of Processor

VIII. Drum Servo Control

IX. Left Control Panel

X. Capstan Signal Generator

XI. Head override check of Channel Switcher

XII. Video Reproduce System

XIII. Video Record System

XIV. Guide Position Sensor

XV. Audio System

XVI. Video Erase and Cueing Unit

XVII. Remote Control Operation

XVIII. System Functions Evaluation

EQUIPMENT REQUIRED

Oscilloscope -- Tektronix Model 543 with Pre-amplifier model 53/54C 5 mv sensitivity single trace, and Pre-amplifier model 53/54L fast rise high gain.

Vacuum Tube Voltmeter -- Hewlett-Packard Model 400D or equivalent.

Multimeter -- Simpson Model 262 or equivalent.

Audio Oscillator -- Hewlett-Packard Model 200CD or equivalent.

Test Signal Source -- Telechrome Model 1003C is a complete source. A wide-range square-wave generator, such as Tektronix Model 525, will serve most test purposes.

I PRIMARY VISUAL INSPECTION

Step 1: Turn all ac power switches to their OFF positions. These switches are located as follows:

Console One switch on the 250 volt, one ampere power supply C.
Five circuit breakers on right side panel labelled:

Blower Console Cooling.
Head Fan Power Assembly.
Relay Control.
Vacuum Pump.
Light and Ac Outlet.

Rack 1: None.

Rack 2 Power Switch (main system circuit breaker, mounted on bottom panel of rack).
250 volt, one ampere power supply A.
250 volt one ampere power supply B.
Capstan Motor Drive Amplifier.
Drum Motor Drive Amplifier.

Step 2 Make a careful visual inspection of all chassis and subassemblies for damage, missing components, and faulty connections. Make sure that all tubes and plug-in components are properly seated in their sockets, and that all cable connectors are correctly installed and firmly in place.

Step 3 Remove the clip-on cover from the head blower assembly in the console to determine that an air filter has been installed and that all masking tape has been removed from the air vents.

II. AC POWER (lights, circuit breakers, and subassemblies).

CAUTION

BEFORE PROCEEDING WITH CHECK OF AC POWER CIRCUITS DE-ENERGIZE THE INCOMING AC LINE. IF A FLOOR RECEPTACLE IS USED AS THE POWER SOURCE DISCONNECT PLUG. IF MAIN FEEDER IS CONNECTED DIRECTLY TO STATION SUBDISTRIBUTION PANEL, OPEN BREAKER AT SUBDISTRIBUTION PANEL.

Step 1 With all ac switches in their OFF positions, remove ac plugs from remaining unit chassis

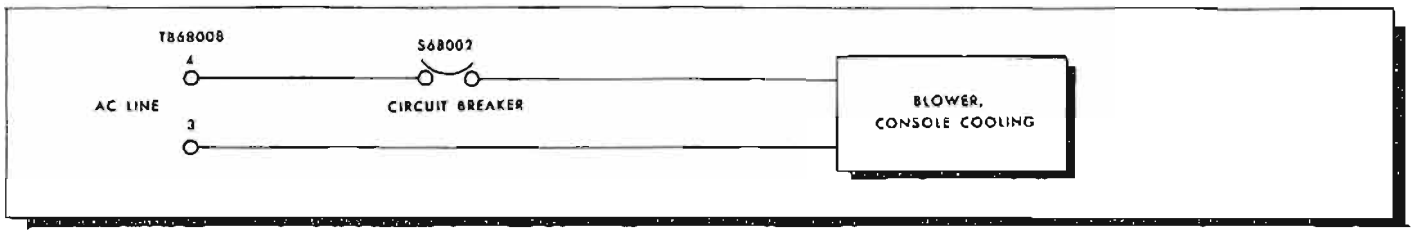
Step 2 Using Simpson Model 262 Multimeter or equivalent, set to the low ohms scale, measure dc resistance from terminal L2 on MAIN POWER circuit breaker in rack 2. The reading should be approximately 70 ohms. Using the high ohms scale, measure the dc resistance from terminals L2 to terminal T3 on the same circuit breaker. Reading should indicate an open circuit.

Step 3 Replace all ac plugs. Replace main power plug, or close breaker at station subdistribution panel. Switch on MAIN POWER circuit breaker in rack 2; this will apply ac power to all units, and cause the left and right meter panel indicator lamps to light.

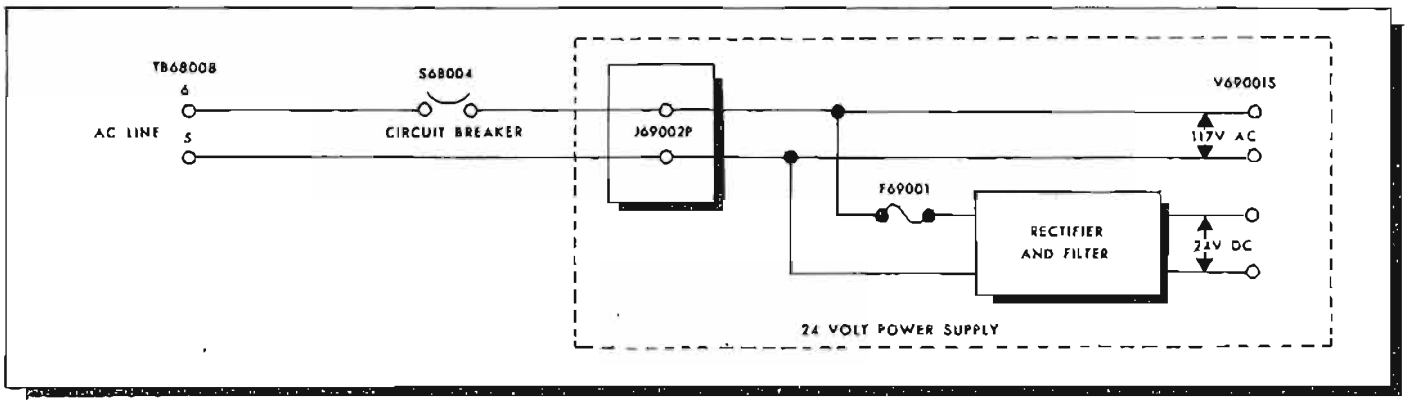
Step 4 At the console breaker panel, switch on circuit breaker marked BLOWER CONSOLE COOLING. Console blower will operate continuously.

Step 5 At the console breaker panel, switch on circuit breaker marked RELAY CONTROL. This will apply ac power to the 24 volt dc relay power supply.

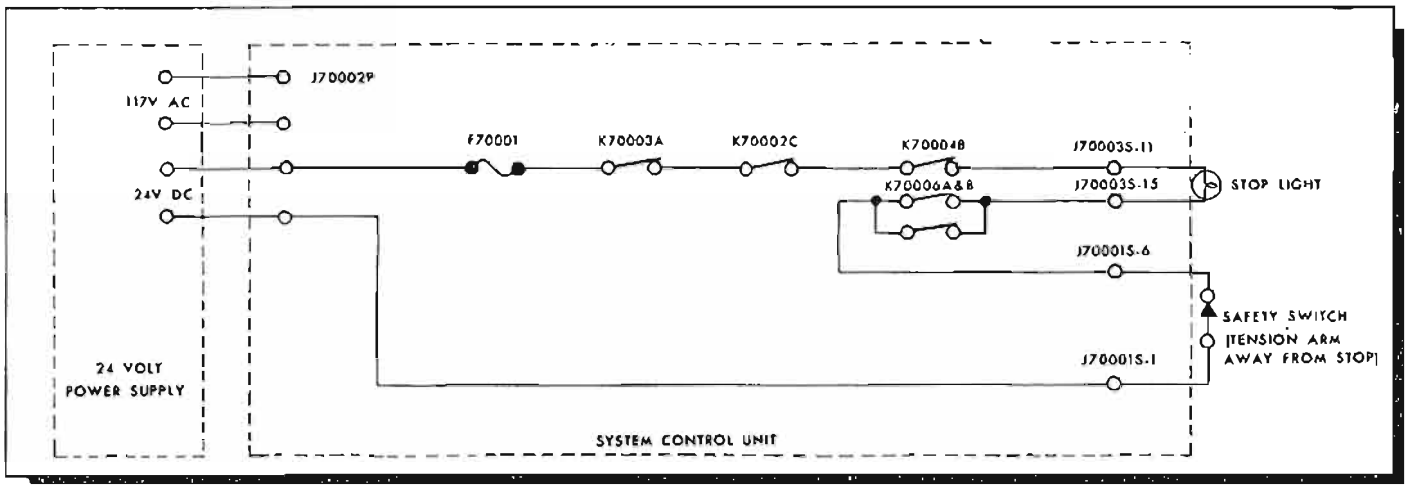
Step 6. With no tape pressure applied, check operation of the left and right tape tension arms. Outward motion of either arm will cause the brake relay associated with each motor to operate. In addition, outward motion of the left tape tension arm will actuate the tape tension safety switch, and cause



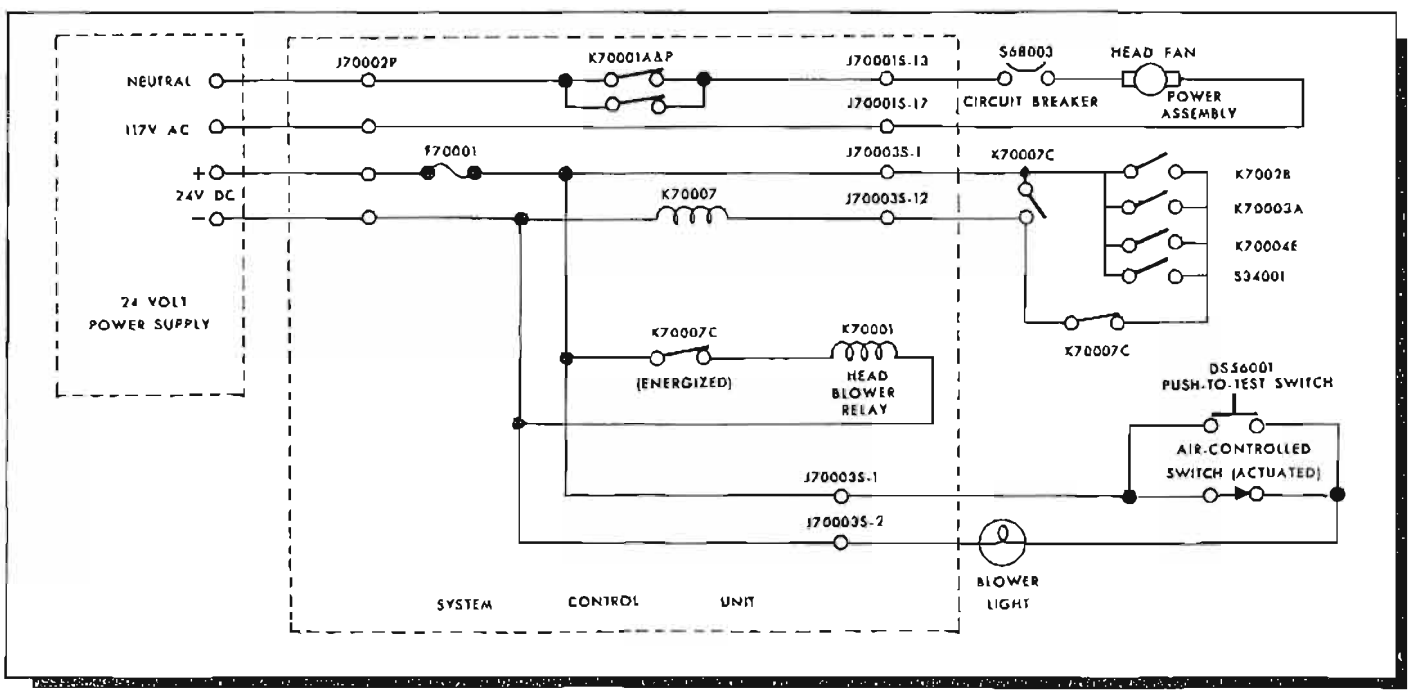
STEP 2 CIRCUITRY



STEP 3 CIRCUITRY

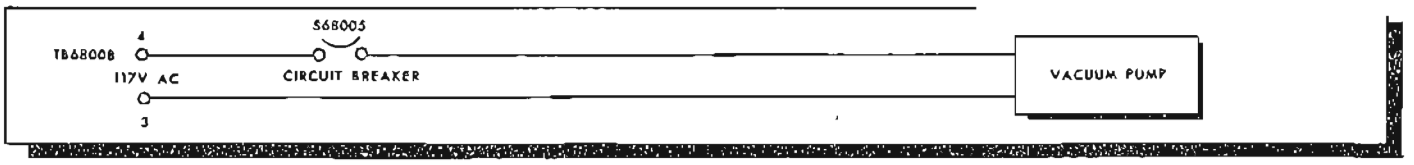


STEP 4 CIRCUITRY

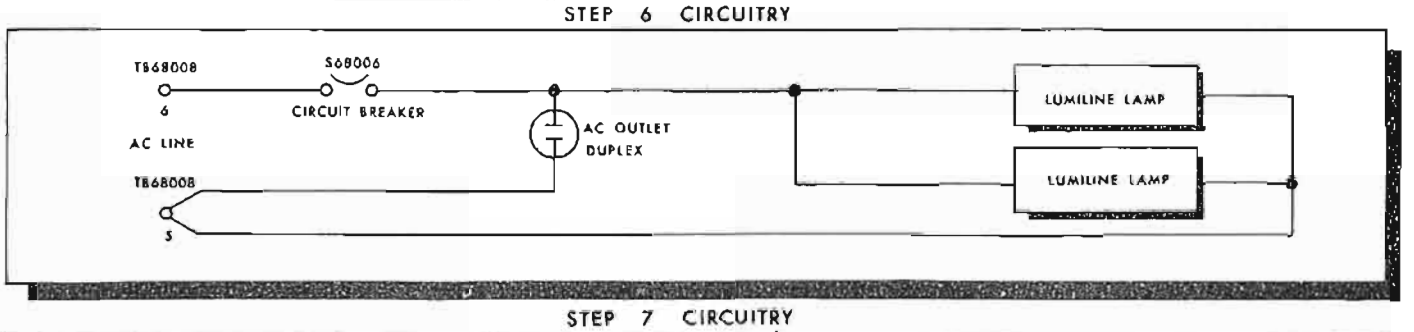


STEP 5 CIRCUITRY

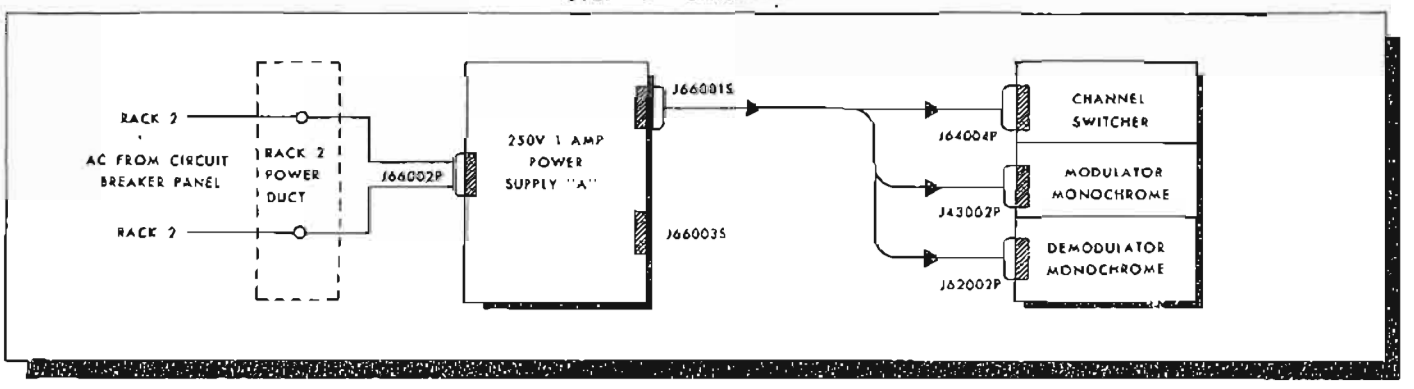
Check of AC Power



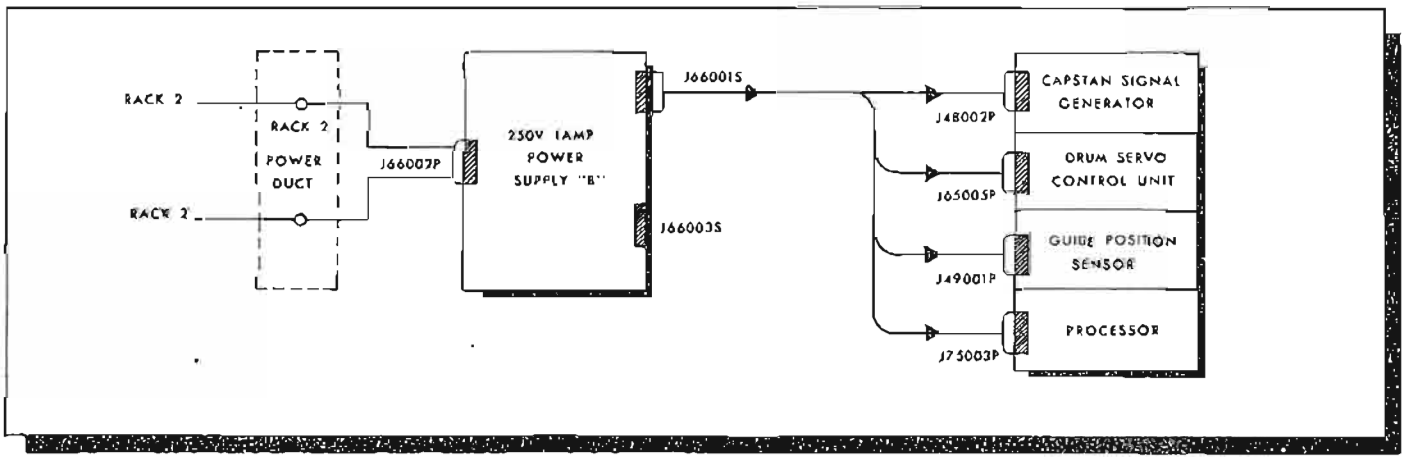
STEP 6 CIRCUITRY



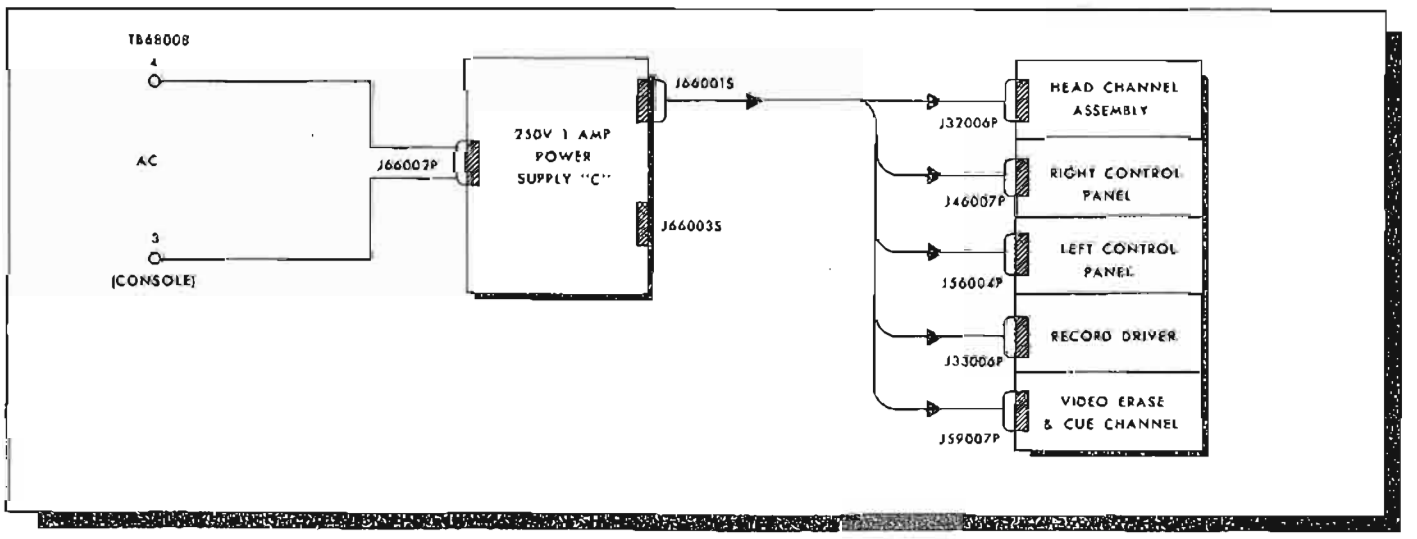
STEP 7 CIRCUITRY



STEP 8 CIRCUITRY



STEP 9 CIRCUITRY



STEP 10 CIRCUITRY

the lamp under the red STOP bar on the right control panel to light. With masking tape or a similar material, hold the left tape tension arm so that the stop light remains lighted.

Step 7. At the console breaker panel, switch on circuit breaker marked HEAD FAN POWER ASSEMBLY. The lamp will light when BLOWER push button on left control panel is depressed. Switch on the HEAD OVERRIDE switch located above the right control panel within the light well. The BLOWER lamp will light and remain lighted, indicating that a sufficient air stream is flowing through the video head assembly.

Step 8. At the console breaker panel, switch on circuit breaker marked VACUUM PUMP. The vacuum pump will begin to operate, applying suction to the female tape guide. If the vacuum meter on the left hand meter panel does not show an indication within the red portion of the scale, adjust the knurled nut on the vacuum pump assembly until a meter reading of 40 is obtained.

Step 9. At the console breaker panel, switch on circuit breaker marked LIGHT and AC OUTLET. Slimline lamps on the lower portion of the console will light and ac power will be available at the console outlets. Check operation of the individual on-off switches mounted on each "Slimline" lamp housing.

Step 10. Switch on the three 250 volt one ampere power supplies, one of which is located in the console, the others in rack 2.

CAUTION

NEVER OPERATE THESE POWER SUPPLIES WITH LOADS DISCONNECTED. DAMAGE CAN RESULT.

Allowing five minutes for warm-up then place the meter selector switch in the SET VOLTS position. If the meter needle does not indicate 125, corresponding to 250 volts dc output, adjust VOLT ADJ until this reading is obtained.

Step 11. Close circuit breaker on monitor bridge, or monitor rack. In the case of a bridge installation, the slimline lamps will light and ac power will be available to all the monitor components. Check operation of the individual on-off switches mounted on each "Slimline" housing. For a rack installation, no lighting circuit is provided, closing the breaker provides ac power for the monitor components. The feeder for the monitor circuit breaker can be connected to the hot side of the main circuit breaker on rack 2, or connected directly to the station ac distribution system.

III. RIGHT CONTROL PANEL - Control Functions

NOTE

The control circuits are detailed in the SYSTEM CONTROL section of this manual. Throughout the following procedure hold the left tape tension arm away from its rest stop by masking tape or some other convenient means.

Step 1. Press the REMOTE pushbutton. its lamp will light and relays K70008 and K68002 will energize. Press the LOCAL pushbutton: its lamp will light, relays K70008 and K68002 will de-energize, and the REMOTE pushbutton will release, extinguishing its lamp. Leave the equipment in LOCAL operation.

Step 2. Press the PLAY pushbutton. its lamp will light and relay K70004 will energize. Press the FAST FORWARD pushbutton. its lamp will light, relay K70002 will energize and the PLAY pushbutton lamp and relay will release. Press the REWIND pushbutton: its lamp will light, relay K70003 will energize and the FAST FORWARD pushbutton lamp and relay will release.

Step 3. Place the MONITOR switch on the right control panel in the EE position. Relay K62001 in the demodulator will energize. Return the MONITOR switch to the TAPE position. relay K62001 will de-energize.

Step 4. Press the PLAY pushbutton first and then the RECORD pushbutton The RECORD pushbutton will light and all the associated relays detailed in the system control section of this manual will energize The VIDEO ERASE lamp located between the two meter panels will light.

Step 5. Press the STOP pushbutton and then the PLAY pushbutton. Press the AB pushbutton switch located in the light well above the left control panel. Relay K62001 in the demodulator will energize and remain energized as long as the AB button is pressed.

Step 6. With the system still in the play mode, press the CUE pushbutton; its lamp will light. Press the NORMAL pushbutton directly below the CUE pushbutton; its lamp will light and the CUE pushbutton lamp will become extinguished.

Step 7: With the system still in the play mode, press the AUDIO pushbutton; its lamp will light. Press the NORMAL pushbutton directly below the AUDIO pushbutton; its lamp will light and the AUDIO pushbutton lamp will become extinguished.

Step 8: Check the press-to-test feature of the DUBBING MODE and VIDEO ERASE indicators, located between the two meter panels on the console. Each will light when pressed.

IV. TAPE TRANSPORT OPERATION

Equipment required for this check:

1. The three spring scales supplied with the system: a 2, 4 and 10 pound scale.

NOTE

Tubular scales are supplied. In making the measurements described, the spring scales normally will be held in a horizontal position. Hold each of the scales in this position to determine its zero reading. If the pointer does not rest at zero, make the proper allowance when taking the readings. If using other than tubular scales, it is best to make several test measurements to determine the true zero point.

2. Four foot length of nylon cord.

3. Three foot length of magnetic tape (2 inches wide).

4. Twelve-inch jumper wire with alligator clips on both ends.

Momentary Boost Torque

Step 1: Pull the supply tape tension arm toward the outside of the tape transport until it clears the safety switch. Hold it in that position by some means (such as pressure sensitive tape).

Step 2: Place the main POWER SWITCH, Rack 2, in the OFF position. Use a jumper wire to short out resistor R70003. (This resistor is located, with the other resistors used in this adjustment procedure, at the back of the control relay unit mounted at the rear of the console. Resistor R70003 is accessible when the rack containing the control relay unit is swung out from the console.)

Step 3. Place the main POWER SWITCH Rack 2, in the ON position.

Step 4 Anchor one end of the cord to the takeup reel hub by placing the knot under the reel spring, slipping it up so it is held between the spring and the hub, and taking several turns around the hub in a clockwise direction.

Step 5 Attach the loop at the free end of the cord to the 4 pound spring scale and hold the scale so that the string is taut between the scale and the reel hub.

Step 6 Press the PLAY button. The takeup turntable will attempt to turn. Allow the spring scale to follow the string slowly as it is wound on the reel hub; take the reading with the scale in steady motion. Press the STOP push-button after taking the reading.

Step 7 The scale should indicate 56-58 ounces. It is recommended that the measurement in Step 6 be performed several times to minimize the possibility of an erroneous reading. If the above scale reading is not obtained, proceed to Step 8 following.

Step 8 The adjusting resistor for the momentary boost torque is R70002, also located on the rear of the control relay unit. Increasing the resistance in the circuit decreases the torque of the motor. Adjust the slider arm on the resistor until the proper scale indication is achieved.

Step 9 Remove the jumper wire installed across R70003 in Step 2.

Normal Takeup Torque

Step 1 Repeat Steps 1, 3, 4, 5, and 6 (omitting Step 2) under Momentary Boost Torque.

Step 2 The scale should indicate 18-19 ounces. Make the measurement several times to ensure that an erroneous indication is not obtained. If the correct scale indication is not obtained, proceed to Step 3 following.

Step 3. The adjusting resistor for the normal takeup torque is R70003. Increasing the resistance decreases the torque of the motor. Adjust the slider arm on the resistor until the proper scale indication is achieved.

Fast Forward and Rewind Holdback Torque

Step 1 Repeat Steps 1, 3, and 4 (omitting Step 2) under Momentary Boost Torque.

Step 2: Attach the loop at the free end of the cord to the 2 pound spring scale, and hold the scale so that the cord is taut between the scale and the takeup reel hub.

Step 3: Press the REWIND pushbutton. Allow the scale to follow the string slowly as it is wound on the reel hub; take the reading while the scale is in steady motion. Press the STOP pushbutton after taking the reading.

Step 4: The scale indication should be 8-9 ounces. Make the measurement several times to ensure a correct reading. If the quoted scale indication is not obtained, proceed to Step 5, following.

Step 5: The adjusting resistor for fast winding torque is R70001. Increasing the resistance decreases the motor torque. Adjust the sliding arm on the resistor until the correct scale indication is achieved.

NOTE

Resistor R70001 adjusts the torque of both the supply (fast forward mode) and the takeup (rewind mode) motors for the fast winding operations. It is switched back and forth between the motors depending on the fast winding mode being utilized.

Normal Holdback Torque

Step 1: Anchor one end of the cord to the supply reel hub by slipping the knot between the reel spring and the hub, sliding it up so it is held between the spring and the hub, and taking several turns around the hub in a counterclockwise direction.

Step 2: Attach the loop at the free end of the cord to the 2 pound spring scale and hold the scale so that the spring is taut between the scale and the reel hub.

Step 3: Press the PLAY pushbutton. Allow the spring to follow the string slowly as it is wound on the reel hub; take the reading while the scale is in steady motion. Press the STOP pushbutton after taking the reading.

Step 4: The scale should indicate 8-9 ounces. Make the measurement several times to ensure that an erroneous indication is not obtained. If the quoted scale indication is not obtained, proceed to Step 5, following.

Step 5. The adjusting resistor for normal holdback torque is R70004. Increasing the resistance decreases supply motor torque. Adjust the slider arm on the resistor until the correct scale indication is achieved.

Brakes

NOTE

The brakes are applied when the brake solenoids are de-energized; therefore, no power is needed when making these measurements and adjustments.

Step 1. Anchor the cord to the supply reel by slipping the knot between the reel spring and hub, then sliding it up until it is held between the spring and the hub. Wrap almost the entire length of cord around the hub in a clockwise direction.

Step 2. Attach the loop at the free end of the cord to the 4 pound spring scale.

Step 3. Use the scale to pull the cord from the hub (the turntable will rotate in a clockwise direction). Take the reading while the scale is in steady motion.

Step 4. The scale indication should be 24 ounces (± 1 ounce). Make the measurements several times to ensure that an erroneous indication is not obtained. If the quoted scale indication is not obtained proceed to Step 5. If it is obtained proceed to Step 6.

Step 5. The brake adjustment for this direction of rotation is at point A on the brake adjustment illustration. Turning the self-locking nut clockwise increases the brake drag. Adjust the nut until the quoted indication is achieved.

Step 6. Wrap the cord around the supply reel hub in a counterclockwise direction.

Step 7. Attach the loop at the free end of the cord to the 10 pound spring scale.

Step 8. Use the scale to pull the cord from the supply reel hub (the turntable will rotate in a counterclockwise direction), taking the reading with the spring in steady motion.

Step 9. The indication should be 5 times that achieved in Step 4 (± 5 ounces). If that reading were 24 ounces, this one should be 7-1/2 pounds (± 5 ounces); if it were 23 ounces this reading should be 7 pounds 3 ounces (± 5 ounces); if it were 25 ounces this reading should be 7 pounds 13 ounces (± 5 ounces). Make the measurement several times to ensure that an erroneous reading is not obtained. If the quoted indication is not obtained proceed to Step 10, following.

Step 10: The adjustments for this direction of rotation are at points A and B on the brake adjustment illustration. Turning the two hex nuts clockwise increases the braking force. Adjust these nuts until the quoted indication is achieved. Both nuts must be adjusted so that the loading on the two springs is equal.

NOTE

A scale reading that varies as the measurement is made (with the spring scale in steady motion) is an indication that the two springs are not under the same tension, and it will be necessary to adjust the hex nuts until a steady reading is attained.

Step 11. Repeat the entire procedure, steps 1 through 10 above, at the takeup turntable. Note that the spring scale indications will be reversed at this turntable with the lighter brake drag acting when the turntable is rotating counterclockwise and the heavier braking force acting when the turntable is rotating clockwise.

Capstan Idler Pressure

Step 1: Fold approximately 2-inches of the length of magnetic tape back over itself and punch holes through the 2 layers of tape large enough to accommodate the hook on the 4 pound spring scale. Insert the scale hook through the holes.

Step 2. Thread the tape between the capstan and the capstan idler, with the oxide coated side of the tape next to the idler.

Step 3. Disconnect power to the capstan motor by placing the POWER ON-OFF switch on the capstan motor drive amplifier (Rack #2) in its OFF position.

NOTE

Steps 4, 5, and 6 require two operators.

Step 4: Open the rear access door to the console, swing the equipment rack out, and have the helper reach in and hold the capstan flywheel so it cannot rotate.

Step 5: Press the PLAY pushbutton. The capstan idler will clamp against the non-rotating capstan.

Step 6: Use the spring scale to pull the tape between the idler and the capstan, pulling in a line with the stationary tape guide; take the reading with the scale in steady motion. Press the STOP pushbutton after taking the reading. The helper can now release the flywheel.

Step 7: The spring scale should indicate from 30 to 36 ounces. Take the measurement several times to ensure that an erroneous indication is not obtained. If the quoted reading is not obtained proceed to Step 8.

Step 8: The adjustment of the capstan idler pressure is made at a self-locking nut at the end of the capstan idler solenoid plunger. This nut adjusts the spring tension which determines the idler pressure. Turning the nut clockwise increases pressure. Adjust this nut to achieve the quoted scale indication.

CAUTION

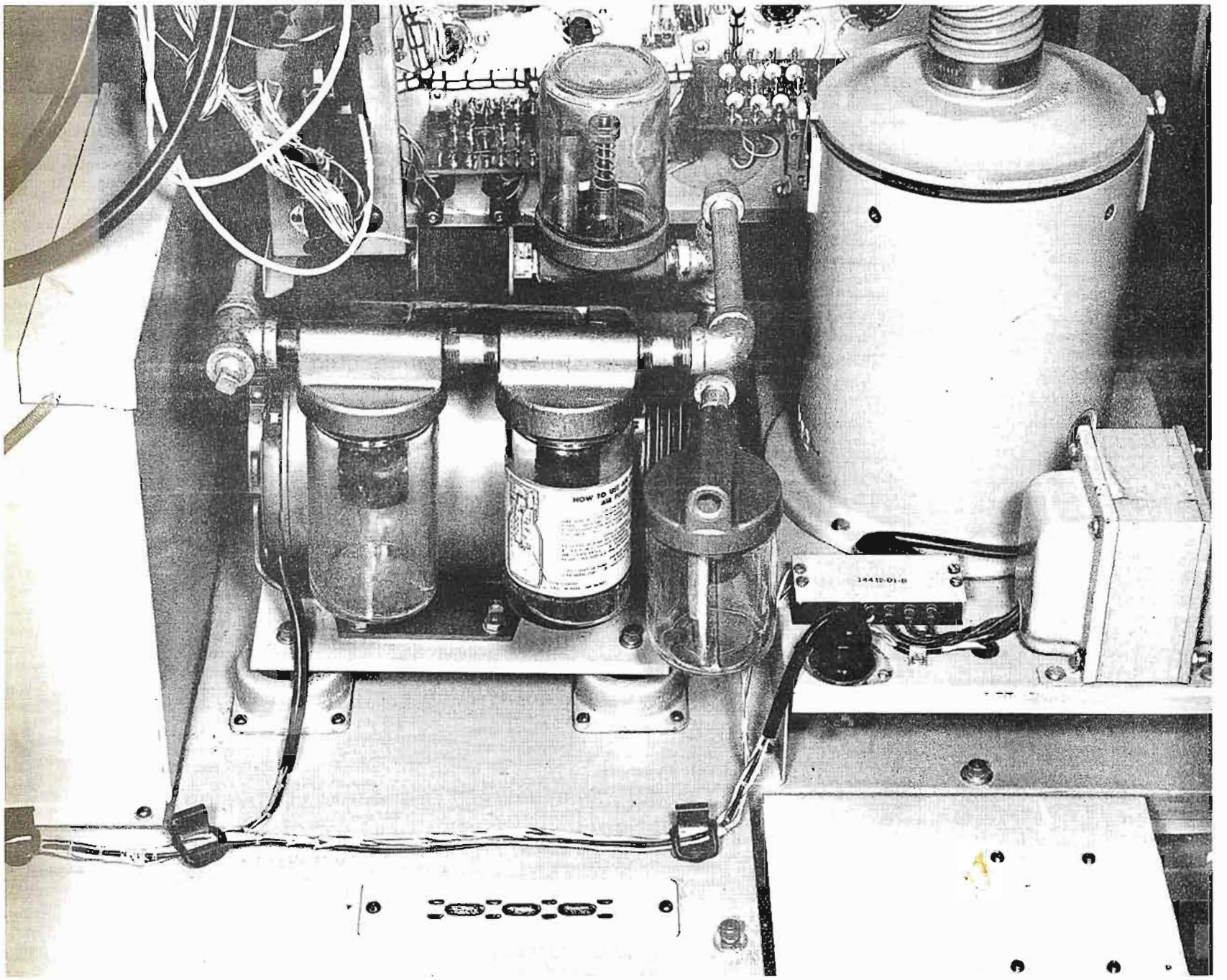
Tightening the locknut increases capstan pressure until a point is reached where the capstan idler solenoid will not bottom. At this point little or no idler pressure will exist. Normal scale indication should be achieved long before this point is reached. This is a sensitive adjustment that should be made with care.

Check of Overall Tape Transport Operation

Step 1. Thread tape on the tape transport as described in the operation section of this manual. Check the vacuum gauge on the left hand meter panel, which should read within the red portion of the scale. If the proper reading is not obtained, adjust the knurled knob on the vacuum pump assembly for a meter reading of 40.

Step 2. Press the PLAY pushbutton The tape should move from the supply reel to the take-up reel at 15 inches per second with no tape loops.

Step 3: Press the FAST FORWARD pushbutton. The forward tape speed should increase rapidly to approximately twenty times the normal speed.



Vacuum Adjustment

Step 4: Press the REWIND pushbutton. The tape should reverse direction quickly and move from the take-up reel to the supply reel at the same speed as in the fast forward operation.

Step 5: Press the STOP pushbutton. Press the FAST FORWARD pushbutton. The tape should move from the supply reel to the take-up reel at 300 inches per second. Press the STOP pushbutton; the tape should stop under tension.

Step 6: Press the REWIND pushbutton. The tape should move from the take-up reel to the supply reel at 300 inches per second. Press the STOP pushbutton.

V. VIDEO HEAD AND TIME DELAYS

Step 1. Install the video head if it is not already installed, and thread the tape along the prescribed path.

Step 2: At the right rear of the head assembly, across pins 4 and 5 of the blue ribbon connector, measure the exciter lamp voltage with the Simpson Model 262 Multimeter on the low dc volts scale. If a reading of 1.5 volts dc is not obtained, adjust R32001 on the head channel assembly. this adjustment is accessible through the right rear door of the console.

Step 3: Place the HEAD OVERRIDE switch in the OVERRIDE position. This switch is located in the light well above the right control panel. Insert the oscilloscope probe into test point TP65004 PE CELL IN on the front of the drum servo control unit. Use line sync for the oscilloscope. A clean 240 cycle square wave with a minimum amplitude of 15 volts peak-to-peak should be obtained. If less than 15 volts is obtained, increase the setting of R32001 until the 15 volt point is reached. The voltage across pins 4 and 5 should not exceed 1.8 volts dc. If 15 volts at TP65004 cannot be obtained with an exciter lamp voltage of less than 1.8 volts, replace the exciter lamp and/or the photo-electric cell.

Step 4: Place the HEAD OVERRIDE switch in its NORMAL position.

Step 5 Turn the POWER ON/OFF switch on the head motor drive amplifier to the ON position and allow the unit one minute to warm up.

Step 6. Place the HEAD OVERRIDE switch in the OVERRIDE position, at the same time observing the video head. The video head should rotate toward the female guide, that is, in a counterclockwise direction when viewed from the right end of the head assembly.

Step 7. At the drum motor drive amplifier on rack 2, place the AC VOLTS selector switch sequentially in the 3Ø-1, 3Ø-2, and 3Ø-3 positions. In each position the meter should read 120. If a correct reading is obtained in each position, proceed to step 9 below. If an incorrect reading is obtained in any position, proceed to step 8.

Step 8. Turn both AC BALANCE controls on the front of the head motor power amplifier completely counterclockwise. Check the meter reading for each phase and leave the meter at whichever phase gives the highest reading. Adjust the VOLTAGE LEVEL control until the meter reads 120. Switch the meter to the lower of the two remaining phases, and adjust the appropriate AC BALANCE control until the meter reads 120. Control R60002 controls the output to phase 1; control R60004 controls the output to phases 2 and 3. Control R60001 controls the output of all three phases.

NOTE

If either AC BALANCE control requires large adjustment with respect to the other, a circuit malfunction is indicated. Both controls should be at approximately the same setting.

Step 9. Place the HEAD OVERRIDE switch in the NORMAL position.

Step 10. Press the PLAY pushbutton. The video head will rotate; the female guide will move into position after a four second delay, and the EE picture will be maintained on the monitor for one second after the female guide contacts the head.

Step 11. Push the STOP pushbutton.

Step 12. Place the HEAD OVERRIDE switch in the OVERRIDE position. Press the PLAY pushbutton. The female guide will move into position after a one second delay and the EE picture will be maintained for one second after the female guide contacts the head.

NOTE

Steps 9 and 10 above cover normal start operation

Steps 11 and 12 cover fast start operation.

VI "EE" PICTURE CHECK OF MODULATOR AND DEMODULATOR

NOTE

EE means "Electronics to Electronics" and provides a method for checking the modulator, demodulator and processor without the need to run tape. The EE-TAPE switch has no effect when tape is in motion during the reproduce or record modes; in either mode the switch is out of the circuit

The A-B switch actuates the circuit (on a momentary basis) during the reproduce mode to provide a comparison between the signal reproduced from the tape and a local video source

CAUTION

THE A-B SWITCH WILL INTERRUPT THE REPRODUCE MODE FOR AS LONG AS IT IS PRESSED, AND THE OUTPUT OF THE SYSTEM WILL BE WHATEVER SIGNAL IS BEING FED TO THE EQUIPMENT THUS, THIS SWITCH SHOULD NEVER BE USED WHILE REPRODUCING A TAPE DURING BROADCAST.

Modulator

Step 1: Place the EE-TAPE switch in the EE position. (Tape should be threaded on the tape transport as described in the OPERATION section of this manual.

Step 2: Feed a video signal to the input of the system

Step 3: Proceed to the front panel of the modulator in Rack 1 Insert the oscilloscope probe in TP43006 VIDEO IN and determine that the input video signal is at least 1 volt peak-to-peak

Step 4: Turn INPUT LEVEL control R43003 fully counterclockwise

Step 5: Set the time base of the oscilloscope for 0.1 microsecond per centimeter. Insert the oscilloscope probe in TP43004 RF OUT. A somewhat rounded off square wave will appear. Adjust FREQUENCY control R43001 for a display of 5.0 megacycles on the oscilloscope.

Step 6: Adjust the INPUT LEVEL control R43003 for a display of 6.8 megacycles on the oscilloscope.

Step 7: Place the oscilloscope probe in TP43003 MULTI-GRID and observe the clamping action. Turn R43002 WHITE CLIP fully counterclockwise. Observe that a minimum of 10 percent of the video portion of the waveform will be clipped. Adjust R43002 WHITE CLIP to the threshold of white compression. At this point the overshoots at the trailing edge of blanking will have an amplitude of from ~~7 to 8~~ 10 volts peak-to-peak.

Step 8: Place the oscilloscope test probe in TP43001 CLAMP and check for a clamp pulse of approximately 75 volts peak amplitude.

Step 9: Insert the oscilloscope probe in TP43004 RF OUTPUT and check for an rf envelope of approximately 1 volt peak-to-peak.

Demodulator

Step 1: Insert the oscilloscope probe in TP62002 LIMITER OUT. An fm signal of least 5.5 volts peak-to-peak ± 0.5 volt will be observed at this point. A small amount of amplitude modulation on the signal is not objectionable.

Step 2: Place the oscilloscope probe in TP62006 DETECTOR IN. A balanced am signal will appear at this point with an amplitude of approximately 5.6 volts from sync tip to sync tip. The video or picture portion of the signal should be less than 50 percent of the total signal amplitude.

Step 3: Place the oscilloscope probe in TP62005 DETECTOR OUT. The amplitude of the composite video signal should be at least 0.25 volt sync tip to peak white. Adjust the DETECTOR BALANCE controls R62002 and R62004 for a balanced am signal at this point.

Step 4: Place the oscilloscope probe in TP62004 VIDEO OUT. Rotate R62001 VIDEO LEVEL through its entire range. The signal should change in level from zero volts to at least 1.8 volts peak-to-peak. Set R62001 VIDEO LEVEL for an output signal of ~~1.4~~ Station Standard. volts peak-to-peak.

Step 5: Place the probe in TP62003 DUBBING OUTPUT. Adjust R62003 DUBBING LEVEL control for a 1 volt peak-to-peak rf signal. with output terminated

Check of EE Picture Quality

Step 1: At the right control panel, place the MONITOR switch in the TAPE position Press the AB button located in the light well above the left control panel. An EE picture will remain on the monitor screen as long as the AB button is depressed. Release the AB button and return the MONITOR switch to the TAPE position.

Step 2: Thread a standard test tape and place the equipment in the reproduce mode A minimum of 375 lines resolution must be observed on the monitor, exhibiting no significant trailing white or black and negligible rf contamination.

Step 3: Place the MONITOR switch on the right control panel in the EE position Feed a standard multi-burst signal to J43003s MODULATOR INPUT. Place the oscilloscope probe in TP43003 MULTI-GRID. Adjust R43003 INPUT LEVEL to achieve a 20 volts peak-to-peak amplitude for the 4.2 megacycle signal burst. The multi-burst frequencies will appear in the relative amplitudes listed below:

Frequency (mc)	Amplitude (peak-to-peak volts)
4.2	20
3.6	16
3.0	14
2.0	11
1.5	9
0.5	5

Tolerances for the above values are ± 10%.

Step 4: Readjust R43003 INPUT LEVEL for an amplitude of 17 volts from sync tip to the center axis of the multi-burst, with no white compression.

Step 5: Place the oscilloscope probe at demodulator TP62004 VIDEO OUT. The multi-burst signal observed at this point will indicate the overall frequency response of the system on an EE basis and must conform within plus or minus 1 db to the values listed below:

Frequency (mc)	Level in db (1.5 mc = 0 db)
0.5	0
1.5	0 (Reference)
2.0	0
3.0	-2
3.6	-3
4.2	-10

VII EE PICTURE CHECK OF PROCESSOR

Step 1: Place the MONITOR switch on the right control panel in the EE position and adjust the demodulator VIDEO OUTPUT LEVEL control R62002 for a demodulator output of ~~1.4~~* volts peak-to-peak as measured at test point TP62004 VIDEO OUT. Place the oscilloscope probe at processor test point TP75006 INPUT. The ~~1.4~~ volts peak-to-peak video signal from the demodulator will be observed at this point.

* Station standard.

Step 2: Place the oscilloscope probe at test point TP75008 CLAMPED COMPOSITE VIDEO. Adjust R57010 INPUT LEVEL for a 7.0 volts peak-to-peak composite video wave form. New Processor 10.0 volts

Step 3: Adjust R75002 WHITE CLIP fully clockwise; adjust R75004 LOCAL PEDESTAL HEIGHT, fully counterclockwise. Place the following potentiometers in the center of their ranges: R75005 LOCAL VIDEO GAIN, R75007 OUTPUT 1 LEVEL, R75008 OUTPUT 2 LEVEL, R75009 OUTPUT 1 Z ADJUST, R75010 LOCAL SYNC GAIN, and R75012 OUTPUT 2 Z ADJUST.

Close R75006 Black clip

Step 4: Synchronize the oscilloscope externally from TP75006 INPUT. Place the oscilloscope probe at TP75017 COMPOSITE GATING. Adjust the oscilloscope for a display of three horizontal gating pulses. Remove V75019, sync amplifier, and adjust control C75001 (horizontal) OSC FREQ ADJUST until horizontal gating pulses on the scope drift slowly. Replace V75019; the horizontal oscillator will lock and the horizontal gating pulses will remain stationary on the scope.

Step 5: Place the oscilloscope probe at TP75009 CLIPPED VIDEO. Rotate R75004 LOCAL PEDESTAL HEIGHT throughout its range to determine that clipping can be accomplished from ~~sync tip~~ to 50% of video level. Adjust it for 1 IRE set-up, resulting in a wave form of approximately 5 volts peak-to-peak amplitude

Blanking

Step 6: With the oscilloscope probe at the same test point, rotate R75002 WHITE CLIP throughout its range to determine that clipping can be accomplished from white peaks to beyond 50% of video level. Leave it in the maximum clockwise position

Step 7: Place the oscilloscope probe in TP75004 VIDEO ONLY. Rotate R75005 LOCAL VIDEO GAIN throughout its range to determine that a minimum 1 volt peak-to-peak signal is available at TP75004. Adjust R75005 for a 0.7 volt peak-to-peak signal at TP75004

Step 8: Place the oscilloscope probe at TP75005 COMPOSITE VIDEO. Rotate R75011 LOCAL SYNC GAIN throughout its range to determine that a composite signal of 4.5 volts peak-to-peak minimum is available at TP75005. Adjust R75011 for a sync amplitude representing 25% of the composite signal level.

Step 9: Place the oscilloscope probe at TP75007 VIDEO OUTPUT 1 Leave J75004s VIDEO OUTPUT 1 connector unterminated Adjust R75007 OUTPUT 1 LEVEL for a 2.8 volt peak-to-peak composite waveform at TP75007 Terminate J75004s with a 75 ohm dummy plug or a 75 ohm terminated coaxial cable, and adjust R75009 OUTPUT 1 Z ADJUST for a ~~1.4~~ volt peak-to-peak video signal as measured at TP75007.

Step 10: Place the oscilloscope probe at TP75010 VIDEO OUTPUT 2. Leave J75005s VIDEO OUTPUT 2 connector unterminated Adjust R75008 OUTPUT 2 LEVEL for a 2.8 volt peak-to-peak composite waveform at TP75010. Terminate J75005s with a 75 ohm dummy plug or a 75 ohm terminated coaxial cable, and adjust R75012 OUTPUT 2 Z ADJUST for a 1.4 volt peak-to-peak video signal as measured at TP75010.

Step 11: Rotate R75014 HORIZONTAL BLANKING WIDTH fully counterclockwise. Adjust the following controls to their mid-range; R75013 HOR GATING WIDTH, R75015 VERTICAL BLANKING POSITION, R75016 VERTICAL BLANKING WIDTH, and R75017 GATE PHASE Adjust the oscilloscope for a display at the horizontal sync rate. Adjust R75004 LOCAL PEDESTAL HEIGHT for 50% set-up.

Step 12: Adjust R75017 GATE PHASE to the point where the trailing edge of sync begins to narrow. Back-off R75017 approximately ~~15 degrees~~ from this point.

Step 13: Adjust R75013 HOR GATING WIDTH to the point where the front porch begins to lengthen. Re-check step 12 and repeat if necessary. If step 12 is repeated, repeat step 13.

Step 14: Adjust R75014 HORIZONTAL BLANKING WIDTH fully clockwise. At this setting blanking will extend approximately 3 microseconds into the active picture area. Re-adjust R75014 to the point where the back porch barely begins to lengthen.

Step 15. Place the oscilloscope on line sync and adjust it for display at the vertical sync rate Use expanded sweep so that the vertical blanking interval occupies approximately one-half of the sweep width. Adjust R75015 VERTICAL BLANKING POSITION until the back porch blanks out one more horizontal line of video information than normal.

Step 16. Adjust R75016 VERTICAL BLANKING WIDTH until the front porch blanks out one more horizontal line of video information than normal.

Step 17. Re-adjust R75004 LOCAL PEDESTAL HEIGHT, which was adjusted in step 11 above for 50% set-up, for a normal set-up of 10%.

Step 18 Check the following test points for output waveforms and amplitudes listed:

TP75011 KEYING PULSE for 15 volts peak-to-peak, with 1 microsecond delay between leading edge of keying pulse and trailing edge of sync

TP75015 SYNC IN for 35 volts peak-to-peak, ±5 volts.

TP75016 SYNC OUT for 10 volts peak-to-peak minimum.

TP75018 SYSTEM SYNC for 2 volts peak-to-peak minimum.

VIII DRUM SERVO CONTROL

Drum Servo Control Unit

Make the following checks with tape threaded on the tape transport and while feeding a video input signal to the system.

Step 1 At the drum servo control unit in rack 2, rotate S65001 SYNC SELECTOR through its four positions, LINE, VIDEO, COLOR and EXT. For each switch position there is a corresponding lamp at the top of the unit, directly above the meter face Determine that in switching from one position to the next, the proper indicator is illuminated

Step 2: Synchronize the oscilloscope to the line frequency. Rotate S65001 SYNC SELECTOR to VIDEO and adjust the following controls in the direction indicated:

R65002 OSC CONTROL SENSITIVITY	fully counterclockwise
R65003 MINIMUM FREQUENCY	fully counterclockwise
R65004 MAXIMUM FREQUENCY	fully clockwise
R65006 DAMP GAIN	fully counterclockwise

Step 3: Insert the scope probe in TP65015 OSC OUT, and the ground probe in TP65014 OSC CONTROL. Adjust R65005 FREQ control for a 140 volts peak-to-peak -- 240 cycle square wave on the oscilloscope. Some slight drift is permissible. for stable frequency.

Step 4: Insert the oscilloscope probe in TP65017 PHASE SHIFTER. Place the oscilloscope on internal sync. Adjust R65007 PHASE SHIFTER SYMMETRY for a symmetrical 240 cycle square wave, ~~1~~ 2 volts peak-to-peak ± 0.3 volt. 1.6

Step 5: Insert the oscilloscope probe in TP65018 240 CY SYM and adjust the 240 CY SYMMETRY control R65008 for a precisely symmetrical (± 2%) 240 cycle square wave of 140 volts peak-to-peak ± 20 volts

Step 6: Place the test probe in TP65016 240 CY TO DRUM and adjust L65006 240 CY TO DRUM (adjacent to the test point) for the maximum 240 cycle sine-wave signal, approximately 30 volts peak-to-peak ± 5 volts. Adjust L65006 counterclockwise to reduce the signal voltage by 2 volts peak-to-peak.

Step 7: Move the oscilloscope probe to TP65013 240 CY REF. Sync the oscilloscope to line and adjust L65005 240 CY (located adjacent to R65003) for the maximum 240 cycle damped sine wave. Minimum allowable amplitude is 80 volts, peak-to-peak.

Step 8: Actuate the HEAD OVERRIDE switch in the light well above the right control panel. The video head will rotate. Check, and if necessary, adjust the voltage for each of the 3 phases on the head motor drive amplifier (as explained under V. VIDEO HEAD AND TIME DELAYS, SYSTEM CHECKOUT).

Step 9: Insert the oscilloscope probe in TP65004 PE CELL IN of the drum servo control unit. Check for a 240 cycle square wave signal of minimum 15 volts peak-to-peak amplitude if not obtain recheck secy. 5 steps 2+3. ↑ Page 15 CKO

NOTE

This signal is from the photoelectric cell amplifier.

14. ±2

Step 10: Insert the probe in TP65012 PHASE COMP and check for a 480 cycle ~~11~~ volts peak-to-peak amplitude square wave (of possible varying symmetry). Remove the test probe from T.P. 14

Step 11: Remove the ground from TP65014 OSC CONTROL. Ground TP65012 PHASE COMP to the chassis. Adjust R65001 METER BALANCE so that the meter on the front panel of the drum servo control unit is zeroed at dead center. Remove the ground from TP65012. The meter indication should remain at approximately zero, although a little drift is allowable.

Step 12: Insert the oscilloscope test probe in TP65005 240 CY SQ WAVE OUT. Check for a 240 cycle square wave of at least 14 volts peak-to-peak amplitude.

Step 13: Insert the probe in TP65007 240 CY SINE WAVE OUT and check for a 240 cycle sine wave of 35 volts peak-to-peak ± 5 volts amplitude. If necessary, adjust L65003 240 CY TO SWITCHER for proper signal symmetry at maximum amplitude.

Step 14: Using the dual-trace oscilloscope attachment, place one test probe in TP65001 60 CY TO CAPSTAN and the other probe in TP65003 DIVIDER OUT. Place the oscilloscope pre-amplifier selector switch in the chopper position. Adjust L65001 until the negative half of the 60 cycle sine wave at TP65001 (20 volts peak-to-peak ± 5 volts) is coincident with the postive half of the ~~240~~ 60 cycle square wave at TP65003 (140 volts peak-to-peak). ± 10 volts

Step 15: Place one test probe in TP65002 240 CY TO SCOPE and the other in TP65013 240 CY REF. Adjust L65002 (located next to L65001) until the ~~negative~~ positive half of the 240 cycle sine wave at TP65002 (3 volts peak-to-peak ± 1 volt) coincides with the ~~negative~~ POSITIVE half of the damped sine wave at TP65013 (80 volts peak-to-peak minimum).

Step 16: Insert one test probe in TP65005 240 CY SQ WAVE OUT at the drum servo control unit and the other probe in TP65009 EDIT PULSE GATE. At the console right control panel, press the RECORD pushbutton. The play button and then the Adjust L65005 (located next to R65003) so that the fall time of the 240 cycle square wave at TP65005 (14 volts peak-to-peak minimum) coincides with the approximate center of the edit pulse gate at TP65009 (200-270 microseconds, 100 volts peak-to-peak minimum).

L65005

Step 17: Move the probe from TP65005 to TP65008 EDIT PULSE. Observe that an edit pulse of approximately ~~18~~ volts peak-to-peak amplitude and 80 microseconds duration is present at TP65008. Continue adjusting L65005 until the leading edge of the edit pulse occurs approximately 60 microseconds after the leading edge of the edit pulse gate at TP65009.

Step 18: Remove probe from TP65008 and insert in TP65002 240 CY TO SCOPE. The edit pulse will be superimposed on each fourth cycle of the 240 cycle signal and will be ~~8~~ 4 volts peak-to-peak minimum amplitude.

Step 19: With the scope on single trace, place the test probe in TP65013 240 CY REF. The signal will be a 240 cycle damped sine wave not less than 160 volts peak-to-peak amplitude. Remove tube V65026 6AW8A. The signal should disappear. Switch the system to reproduce by pressing the PLAY button on the right control panel of the console. The signal should reappear (80 volts peak-to-peak minimum). Replace V65026.

Step 20: Press the STOP pushbutton on the right control panel. The video head will continue to rotate because the HEAD OVERRIDE switch is still in the OVERRIDE position from step 8. Insert the test probe in TP65011 REF PHASE and adjust L65004 REF PHASE for maximum amplitude (35 to 45 volts peak-to-peak) of the 240 cycle sine wave at TP65011. The waveform at this point will not be a pure sine wave.

Step 21: Insert the oscilloscope probe in TP65017 PHASE SHIFTER and rotate R65006 DAMP GAIN throughout its range. The signal should remain symmetrical, showing less than 2% change throughout. If not, adjust L65004 REF PHASE so that the signal will retain its symmetry for all positions of R65006. Turn R65006 fully clockwise.

Step 22: Move the test probe to TP65012 PHASE COMP and observe the 120 cycle square wave. Rotate R65003 MINIMUM FREQUENCY ~~fully~~ clockwise and then R65004 MAXIMUM FREQUENCY ~~fully~~ counterclockwise. The system should remain locked.

Step 23: Insert coaxial shorting plug at J65012s COLOR IN. Switch S65001 SYNC SELECTOR to the COLOR position. The waveform on the oscilloscope will become asymmetrical. Wait approximately five seconds and switch sync selector back to VIDEO. The waveform should recover symmetry slowly. Repeat above steps, with shorting plug removed from J65012a. Increase the waiting interval to approximately ten seconds. The waveform should recover slowly from the opposite direction. This will simulate the two conditions of signal loss, one for a short interval, and the other for a longer interval.

Step 24: Turn R65002 OSC CONT SENSITIVITY to its maximum clockwise position. Adjust R65003 MIN FREQ and R65004 MAX FREQ so that the waveform, for both conditions listed in step 23, recovers in ~~three~~ 4 seconds or less.

IX LEFT CONTROL PANEL

Step 1: Adjust the HEAD OVERRIDE switch to the ON position. Place the automatic compensation circuit in manual operation by releasing the AUTOMATIC COMPENSATION pushbutton so that its lamp is extinguished. Note the indication on the OPERATING HOURS dial.

Step 2: Turn the TIP PROJECTION control throughout its range, observing the action of the tape guide lever which should move the tape guide away from the video head assembly as the control is turned counterclockwise, and toward the video head assembly as the control is turned clockwise. Set the tip projection control at ~~mid range~~ RED Indicator.

Step 3: With tape threaded along tape path and the SCOPE SELECTOR switch on the left control panel to SWITCHER OUTPUT a horizontal trace should appear on the face of the cathode ray tube at the left control panel. Open the top portion of the console front panel to gain access to the under-panel controls of the left control panel. Adjust the scope FOCUS, ASTIG, HOR-POS, and VERT POS controls as necessary. Place the SCOPE GAIN control at mid-range.

Step 4: Switch the SCOPE SELECTOR to SYSTEM STABILITY. A one-to-one Lissajous figure (formed by two 240 cycle signals from the drum servo control unit) will be displayed on the scope face.

Step 5: Switch the HEAD OVERRIDE toggle OFF. Press the PLAY pushbutton and then the RECORD pushbutton to place the system in the record mode. The cathode ray tube on left control panel should display a field pulse on the Lissajous figure. The CONTROL TRACK LEVEL meter on the left meter panel of the console should indicate that the control track signal is present. This signal is from the control track generator whose adjustment procedure follows.

Step 6: Insert the oscilloscope test probe in TP56002 OUTPUT at the under-panel controls of the left control panel. Adjust R56011 LEVEL for maximum undistorted sine wave signal, approximately ~~2.0~~ 4 volts peak-to-peak ~~minimum~~. Adjust R56010 CALIBRATE control until the CONTROL TRACK LEVEL meter on the left meter panel indicates 0 vu. Continue recording for about one minute, then press the STOP pushbutton.

Step 7: Rewind the tape to the beginning of the one minute recording made in the previous step.

Step 8: Place the test probe in TP56001 OUTPUT (PLAYBACK). Press the PLAY pushbutton to reproduce the recorded signal. Adjust R56008 PLAYBACK LEVEL for a 10 volt peak-to-peak undistorted sine wave indication on the oscilloscope. Turn R56007 PLAY. CK CALIBRATE to the point where the CONTROL TRACK LEVEL meter reading is 0 vu. Remove the test probe.

Step 9: Press the RECORD pushbutton and t n the VIDEO RECORD CURRENT METERING selector to each of its four positions. A record current of 40 meter divisions per channel should be indicated on the VIDEO RECORD CURRENT meter on the right hand meter panel at the top of the console. It may be necessary to adjust the gain controls on the record driver on the right side of the console behind the front panel to obtain the specified minimum. Press the STOP button.

St . 10: Determine that the OPERATING HOURS dial has operated during the adjustment process

X CAPSTAN SIGNAL GENERATOR

Step 1: Place the oscilloscope sync selector on line. Adjust R48005 RANGE CONTROL to position number 5. Turn R48001 SENSITIVITY fully counterclockwise. Place the oscilloscope probe in TP48001 OUTPUT. Adjust R48002 BIAS for a stationary 60 cycle display.

Step 2: Place oscilloscope probe in TP48003 BIAS and adjust the oscilloscope for calibrated dc input. A bias level of approximately 11 volts dc should be indicated on the oscilloscope.

Step 3: Adjust R48003 METER BAL until the meter needle is centered.

Step 4: Thread a tape and place the equipment in the record mode. Check the capstan motor power amplifier to determine that both phases read exactly 120 on the capstan motor power amplifier meter. Adjust if necessary. Adjustment proceedure is similar to that described previously for the head motor drive amplifier. Continue to record for at least two minutes.

Step 5. Place the oscilloscope on internal sync. Place the oscilloscope probe in TP48002. Press the REWIND pushbutton on the right control panel and rewind the tape to the beginning of the recording made in step 4. Press the PLAY pushbutton. Adjust R48004 OUTPUT for 120 dial indication for both phases on the capstan motor drive amplifier

Move from max. counterclockwise until meter oscillates very slowly.

Step 6. Adjust R48005 CONTROL RANGE until the meter needle rests at the center of the scale. This may result in a drifting waveform being displayed when the oscilloscope probe is placed at TP48002. This waveform will have an amplitude of approximately 16 volts peak-to-peak.

Step 7. With the oscilloscope probe at TP48002, adjust R48001 SENSITIVITY to the highest clockwise position that will maintain the stability of the displayed waveform. If necessary, re-adjust R48004 to re-center the meter needle.

5

Step 8: Place the system in the reproduce mode and start and stop it several times to determine that the system stabilizes before the female tape guide is actuated.

Step 9: While in the reproduce mode manually interrupt the capstan speed and determine that the system quickly recovers stability when the speed is restored.

Step 10: Continue in the reproduce mode to the end of the recording made in Step 4. At this point the control track signal will cease and relay K48003 will actuate, shorting out the sensitivity control.

Step 11: Place the equipment in standby. Adjust the oscilloscope to internal sync and for a display of four sine waves at the 60 cycle rate. Place the probe at TP48001. Adjust switch Z48001 SPEED OVERRIDE to maximum clockwise position. The display will increase to a minimum of five sine waves. Return Z48001 to NORMAL

Step 12: Adjust the oscilloscope for a display of six sine waves. Adjust Z48001 to maximum counterclockwise position. The display will decrease to five sine waves. Return Z48001 to NORMAL

Step 13: Place the system in head override mode. The capstan should rotate.

XI HEAD OVERRIDE CHECK OF CHANNEL SWITCHER

Step 1: Place the HEAD OVERRIDE switch in the OVERRIDE position and the monitor switch in the TAPE position.

Step 2: Place switch S64001 BLANKING SWITCH in the OUT position. Insert the oscilloscope probe at TP64005 240 CY INPUT and adjust R64010 240 CY LEVEL for a 10 volt peak-to-peak amplitude 240 cycle signal.

Step 3: Move the oscilloscope probe to TP64004 480 CY FILTER and adjust L64002 FILTER (located to the right of R64006) for a symmetrical sine wave approximately 8.0 volts peak-to-peak.

Step 4: Place the oscilloscope probe in TP64008 480 CY LIMITER and adjust R64009 480 CY SYMMETRY for a 480 cycle waveform of optimum symmetry.

Step 5: Using a dual-trace pre-amplifier in the oscilloscope, and synchronizing the oscilloscope externally from TP64004 480 CY FILTER, place one probe in TP64003 CHAN 1 and 2 SWITCH and the other probe in TP64002 CHAN 1 TO SWITCH TUBE. A ~~480~~ 250 cycle trapezoidal waveform with rf superimposed will be observed at TP64002. A ~~240~~ 250 cycle square wave will be observed at TP64003. Adjust L64002 carefully until the positive portion of the ~~480~~ 270 cycle trapezoidal waveform coincides with the center of the positive portion of the ~~240~~ 280 cycle square wave.

Step 6: Remove the probe from TP64002 and place it in TP64007 CHAN 2 TO SWITCH TUBE. The trapezoidal waveform and the square wave will have the centers of their positive portions coincident as in Step 5 above.

Step 7: Remove both probes. Insert one probe in TP64011 CHAN 3 & 4 SWITCH, and the second probe in TP64010 CHAN 3 TO SWITCH TUBE. The trapezoidal wave form and the square wave will have the centers of their positive portions coincident, as in Step 5.

Step 8: Remove the probe from TP64010 and insert it in TP6401~~8~~14 CHAN 4 TO SWITCH TUBE. The trapezoidal waveform and the square wave will have the centers of their positive portions coincident, as in Step 5.

Step 9: Remove both probes. Restore the oscilloscope to single channel operation. Place the oscilloscope probe in TP64020 SWITCH PLATES. With the four channel gain, and channel equalizer controls set at mid-range, and R64013 at mid-setting, the level of each channel as observed at TP64020 should be approximately equal.

Step 10: Place the MONITOR switch in the EE position. Place S64001 BLANKING SWITCH in the IN position. Place S64002 in the NORMAL position. Place the oscilloscope probe in TP64012 BLANKING SWITCHER INPUT. A symmetrical 480 cycle square wave will be observed.

Step 11: Trigger the oscilloscope externally from TP75018 SYSTEM SYNC, in the Processor Place the oscilloscope probe in TP64023 ~~PROCESSED~~ SYNC. The 15,750 cycle horizontal sync pulse input at this point will measure approximately 1 4 volts peak-to-peak. System Min.

Step 12: Return the oscilloscope to dual trace. With the oscilloscope connected as in Step 11, place the second probe in TP64021 PULSE POSITION. Observe that the leading edge of the pulse at TP64021 is coincident with the trailing edge of the pulse at TP64023. Place switch S64002 in the OUT position. The pulse at TP64021 should shift from 5.5 to 10.5 microseconds to the right

Step 13: Place the oscilloscope on line sync. Remove both probes. Place one probe in TP64017 COMPOSITE GATING, and the other probe in TP64018 COMPOSITE GATING. The waveforms at each test point should be identical and exactly 180 degrees out of phase with one another. Both waveforms will consist of 480 cycle square waves with 15,750 cycle sync pulses superimposed. The amplitude of the sync pulses as measured at TP64017 COMPOSITE GATING will be approximately 20 volts peak-to-peak.

XII VIDEO REPRODUCE SYSTEM

Step 1: Degauss the video head with the hand degausser. Turn the TIP PROJECTION control on the left control panel completely counterclockwise. This positions the female guide post to its maximum inward position (away from the operat ') and results in the female guide being at its maximum distance from the head drum.

Step 2: Reset the TIP PROJECTION control to the red mark. Thread the video reference tape and press the PLAY pushbutton.

CAUTION

NEVER TOUGH THE RECORD PUSHBUTTON WHILE A STANDARD REFERENCE TAPE IS THREADED.

With the system in the reproduce mode, adjust the allen head screw on the female guide post for minimum skewing in the reproduced picture. If any scalloping is noted, adjust the guide height by the allen head screw adjustment to correct.

Step 3: Place the oscilloscope probe in TP64019 OUTPUT on the channel switcher. Adjust TRACKING control on the left control panel for maximum output on the oscilloscope.

Keystone is caused by Magnetized Part in Tape path.

Step 4: Adjust R64003 PHASING on the channel switcher and, if necessary, L65003 240 CY TO SWITCHER on the drum servo control for a continuous rf envelope as observed at TP64019 OUTPUT and/or on the left control panel oscilloscope.

Step 5: Adjust the individual channel switcher input level controls for maximum and equal amplitudes per channel below clipping level. to just above noise point Nearly off.

Step 6: Adjust the individual CHANNEL EQUALIZER controls (~~L64001~~, ~~L64003~~, ~~L64004~~, ~~L64005~~, R64002, R64005, R64008, R64012) and R64013 for optimum picture quality.

Step 7: Place switch S64002 OUT-NORMAL on the channel switcher in the OUT position, and observe that the switching transients appear in line vertically at the left side of the picture. Place switch S64002 in the NORMAL position. The switching transients will disappear. Replace the video alignment tape with a new roll.

XIII VIDEO RECORD SYSTEM

Step 1: The record driver operating controls are accessible through the drop-down upper portion of the console front panel. Set all four gain controls 1/4 clockwise. Connect a microphone to the MIC INPUT receptacle at the front of the console below the right control panel. Using a monoscope input signal press the PLAY and then the RECORD pushbuttons

Step 2: Place the oscilloscope probe at TP33005 INPUT at the record driver. The rf envelope observed at this point will measure approximately 1 volt peak-to-peak.

Step 3: Place the oscilloscope probe sequentially at each of the channel test points TP33001 through TP33004. The channel output, as measured at each of these points, should be an rf signal approximately 10 volts peak-to-peak amplitude.

1/4 open 30 Volts wide open

Step 4: Press the STOP pushbutton. Rewind the tape and then press the PLAY pushbutton to reproduce the monoscope signal just recorded. Check the tracking control and channel switcher, if necessary, to determine that all channels are operating satisfactorily.

Step 5: Make a new recording of the monoscope pattern. While the recording is being made, adjust the individual channel level controls in sequence from their extreme counterclockwise to their extreme clockwise positions. Make microphone announcements as each control is adjusted indicating the dial setting of the control at that instant.

Step 6: Reproduce the signal recorded in Step 5 and monitor the audio channel. Determine, by observing the reproduced picture, the optimum setting of each channel control. Place each control at its optimum setting.

Step 7: With each control at its optimum setting, make a new recording. The quality of the reproduced signal from this new recording should be optimum.

Step 8: With the system in the record mode, adjust R56009 VIDEO RECORD METER CALIB. on the left control panel chassis for a reading of approximately 80 on the VIDEO RECORD CURRENT meter on the right hand meter panel with the VIDEO RECORD CURRENT METERING switch in the CH 1 position.

XIV GUIDE POSITION SENSOR

CAUTION 1.

NO ATTEMPT SHOULD BE MADE TO ADJUST THE GUIDE POSITION SENSOR UNLESS THE SYSTEM IS OPERATING PROPERLY AS INDICATED BY THE PRECEDING CHECKOUT PROCEDURES.

CAUTION 2.

NO ADJUSTMENT OF THE CHANNEL SWITCHER SHOULD BE MADE AFTER OR DURING ADJUSTMENT OF THE GUIDE POSITION SENSOR.

Step 1: At the left control panel, set the AUTOMATIC COMPENSATION control for manual operation (indicator lamp will be extinguished). Thread a reel of tape on the tape transport.

Step 2: Feed a standard signal to the equipment. Place the EE-TAPE switch in the TAPE position. Press the PLAY pushbutton, then the RECORD pushbutton to place the equipment in the record mode.

Step 3: Place the oscilloscope test probe in TP49007 on the guide position sensor front panel. A negative sync signal (from the processing amplifier) of at least 2 volts peak-to-peak amplitude should be displayed.

Step 4: Sync the oscilloscope to internal negative and insert the test probe in TP49006. ~~If necessary~~, adjust R49003 DELAY width to obtain a 7 microsecond pulse approximately 100 volts peak-to-peak in amplitude. Turn R 3 fully counterclockwise then adjust for first 7 u s negative pulse.

Step 5: Switch the oscilloscope to dc and insert the test probe in TP49005. If necessary, readjust R49003 DELAY width so that the peaks of the displayed sawtooth waveform are 157 volts (±15 volts) above ground. 175 and a stable waveform.

Step 6: Insert the oscilloscope probe in TP49004. A 5-volt peak-to-peak waveform should be displayed.

Step 7: Insert the oscilloscope probe in TP49001. A 480-cycle square wave signal (from the switcher) of 5 volts peak-to-peak amplitude should be displayed.

Step 8: Sync the oscilloscope to internal positive, with the sweep to 10 microseconds per centimeter. Insert the probe in TP49002. If necessary, adjust R49001 ZERO ADJ to obtain a positive pulse 80 microseconds wide and 30 volts peak-to-peak in amplitude. Continue recording for approximately 2 minutes; then press the STOP pushbutton.

Step 9: Rewind the tape to the beginning of the 2 minute recording following the adjustment in Step 8.

Step 10: Switch the oscilloscope to the 1 volt/cm dc range. Insert the probe in TP49003.

Step 11: Press the PLAY pushbutton, and, as the signal recorded in Step 8 is reproduced, readjust R49001 ZERO ADJ control, if necessary, for a zero volt dc indication. Note that the correct adjustment of this control is the one closest to the setting obtained in Step 8 (several other points in the range of this control may produce a zero indication). Press the STOP pushbutton.

beside focus Holder - in back -

Step 12: At the tape guide servo, turn GAIN CONTROL R67008 fully counterclockwise. Note the setting of the TIP PROJECTION control on the left control panel, then turn it full clockwise to create a large error voltage to the tape guide amplifier. Watch the tape guide gear mechanism and slowly advance GAIN CONTROL R67008 to the point where the gears begin to turn. Return the TIP PROJECTION control to ~~its original position~~. RED indicator.

CAUTION

When switching to automatic in the following steps closely observe the reproduced picture. If the tape guide moves too far, as indicated by a venetian blind effect in the picture, immediately place the equipment in manual operation to prevent possible permanent damage to the head assembly.

Step 13: Rewind the tape to the beginning of the 2 minute recording made in Step 8. Press the PLAY pushbutton to reproduce this signal. Place R49002 SENSITIVITY control on the guide position sensor at midrange.
Try ECC 8! for further adjust.

Step 14: Press the AUTOMATIC COMPENSATION pushbutton at the left control panel (indicator lamp will glow brightly). If any hunting occurs, carefully reduce the setting of R49002 SENSITIVITY on the guide position sensor.

Step 15: When the automatic compensation circuit is operating properly the pilot light will glow brightly and the tape guide will be positioned automatically to eliminate any venetian blind effect. If a small error in this respect still exists, carefully readjust R49001 ZERO ADJ on the guide position sensor. If the pilot light glows, but is dim, adjust R49004 CUTOUT ADJ until it brightens.

Step 16: Misadjust the TRACKING control, at the left control panel, and determine that the equipment is returned to MANUAL operation (illuminating light of AUTOMATIC COMPENSATION glows, but is dim) as the picture deteriorates. If not, readjust R49004 on the guide position sensor until this condition is achieved. Return the TRACKING CONTROL to its normal position and the system should return to automatic a few seconds after the picture becomes stable.

Step 17: Remove V49005 from the guide position sensor. and light will glow dim. The equipment should switch from automatic to manual operation. If not, readjust R49004 CUTOUT ADJ to attain this switching. Then re-check Step 16. A compromise setting R49004 CUTOUT ADJ may be necessary to return the system to manual operation under both conditions of Step 16 and Step 17.

Step 18: Press the STOP pushbutton. This completes the video portion of the check-out procedure.

XV CHECK OF AUDIO SYSTEM

Step 1: Place the MONITOR switch in the TAPE position.

Step 2: Demagnetize the audio head assembly with the hand degausser.

Step 3: Connect the audio oscillator (Hewlett-Packard model 200CD or equivalent) to terminals 1 and 2 of TB-A on the rear of rack 2 and disconnect the incoming audio line. Set the output frequency for 1 kc and the output level for 1.23 volts rms (-6 dbm) as measured with the vtvm (Hewlett-Packard model 400D or equivalent). Place the input selector switch S46015 on the right control panel chassis in the BAL BRIDGE position.

Step 4: Place a 600 ohm, 1 watt resistor across terminals 4 and 5 of TB-A in rack 2 and disconnect the outgoing audio line. Connect the vtvm across this 600 ohm resistor.

Step 5: Thread the standard reference tape, and press the PLAY pushbutton. Place the METER switch on the right control panel in the AUDIO position. Set the AUDIO PLAYBACK LEVEL control on the right control panel so that the AUDIO LEVEL meter on the right-hand meter panel indicates zero vu as the tone on the tape is reproduced.

CAUTION

DO NOT CHANGE THE SETTING OF THE AUDIO PLAYBACK LEVEL CONTROL DURING THE BALANCE OF THE AUDIO CHECKOUT PROCEDURE.

Step 6: During reproduction of the test tape, the vtvm reading should be +8 dbm (0 vu on the AUDIO LEVEL meter). Press the STOP pushbutton. The vtvm reading should drop to -40 dbm or lower, corresponding to a signal (+8 dbm) to noise (-40 dbm) ratio of 48 db or better.

Step 7: Remove the standard reference tape and thread a blank tape on the transport. Press the PLAY and then the RECORD pushbuttons.

Step 16: Rewind the tape to the beginning of the 400 cycle recording made in Step 14. Press the PLAY and RECORD pushbuttons, and allow the equipment to continue to record with no input for 30 seconds. This should completely erase the 400 cycle signal recorded in Step 14. Rewind the tape to the beginning of this erasure. Press the PLAY pushbutton and observe the noise level on the vtvm. It should be -40 dbm or less, indicating a minimum signal-to-noise ratio of 48 db for the +8 dbm (zero vu) signal originally recorded. If the signal-to-noise ratio is lower than 48 db it will be necessary to adjust R46130 NOISE BAL as detailed in the Right Control Panel section of this manual.

Step 17: Re-connect the audio input line to terminals 1 and 2 of TB-A on rack 2. Remove the vtvm and the 600 ohm resistor from terminals 4 and 5 of TB-A and re-connect the audio output line to these terminals.

XVI VIDEO ERASE AND CUEING UNIT

Step 1: Disconnect cueing input and output lines from terminals 7 and 8, and 10 and 11, of TB-E at the rear of rack 2.

Step 2: Thread a tape on the transport and insert the oscilloscope probe at TP59003 CUE ERASE. Place the system in the record mode. Adjust C59001 for a maximum amplitude sine wave on the oscilloscope. Adjust R59005 RECORD ERASE LEVEL until the sine wave is 60 volts peak-to-peak amplitude.

Step 3. Place the system in the reproduce mode and press the CUE ONLY pushbutton. With the oscilloscope probe still at TP59003 CUE ERASE, adjust C59002 ERASE for a 60 volts peak-to-peak sine wave.

Step 4: Place the audio oscillator -- Hewlett-Packard model 200 CD or equivalent -- and the vtvm -- Hewlett-Packard model 400D or equivalent -- across terminals 7 and 8 of TB-E rack 2. Terminate the input of the vtvm with a 600 ohm resistor. Adjust the audio oscillator frequency to 1 kc and the output level for +8 dbm, as read on the vtvm. Do not readjust the audio oscillator level setting Remove the vtvm from terminals 7 and 8. Place one of the vtvm leads in TP59002, and the other to ground with the 600 ohm resistor removed.

Step 5: Remove V59009. Press the RECORD pushbutton. Adjust R59004 RECORD LEVEL for a reading of +8 dbm at TP59002. Place the METER switch on the right control panel in the CUE position. This switch is spring loaded in this position and must be held in place. The AUDIO LEVEL meter should read 0 vu. If it does not, adjust R59007 until it does. Replace V59009 and continue to record the 1 kc, 0 vu signal.

Step 6: Press the STOP pushbutton and rewind the tape to the beginning of the recording started in Step 5. Place the system in the reproduce mode. Place the vtvm across terminals 10 and 11 of TB-E rack 2 with a 600 ohm terminating resistor. Adjust R59003 PLAYBACK LEVEL until the vtvm reads +8 dbm (0 vu).

Step 7: Place the system in the record mode. Without changing the level setting of the audio oscillator, record a series of tones from 50 cycles to 3 kc. Rewind the tape and reproduce this section. The vtvm should read +8 dbm for all of the tones recorded.

Step 8: Record a 1 kc signal at 0 vu for approximately one minute. Rewind the tape and re-record over this signal, with no input signal. Rewind and reproduce this section of the tape and read the noise level on the vtvm. The reading should be -27 dbm or lower, corresponding to a signal (+8 dbm) to noise (-27 dbm) ratio of 35 db or better. Press the STOP pushbutton.

Step 9: Remove the audio oscillator and the vtvm with its 600 ohm resistor; re-connect the cue output and input lines at TB-E.

Step 10: Press the PLAY and then the RECORD pushbuttons. With no audio input to the cue channel, press TONE pushbutton, holding it down for approximately 30 seconds. During this interval turn the METER switch to CUE. In this position the switch is spring loaded and must be held in place. The AUDIO LEVEL meter should read zero vu ± 1 db.

Step 11: Rewind and reproduce the recording made in Step 10. A 325 cycle undistorted tone should be heard on the monitor speaker.

Step 12: Press the PLAY and then the RECORD pushbuttons. Remove the cover from the video erase head.

WARNING

IN THE ADJUSTMENT THAT FOLLOWS EXERCISE EXTREME CARE. 700 VOLTS PEAK-TO-PEAK RF ARE PRESENT ON THE TRIMMER CAPACITOR. USE AN INSULATED TUNING STICK FOR ADJUSTING THIS CAPACITOR.

Place the probe of the oscilloscope on one side of the trimmer capacitor C59001 on the video erase head. With the insulated tuning stick, adjust C59001 for a maximum amplitude undistorted sine wave. Adjust R59002 VIDEO ERASE LEVEL until the sine wave amplitude is 600 volts peak-to-peak. Press the STOP pushbutton. Replace the cover on the video erase head.

XVII REMOTE CONTROL OPERATION

Step 1: Press the REMOTE pushbutton on the right control panel. Its lamp should light, and all of the signal lamps on the right control panel, except STOP, should be extinguished.

Step 2: Have an assistant at the remote location press the following pushbuttons in the order indicated: PLAY, RECORD, FAST FORWARD, and REWIND. Observe proper response at the console.

Step 3: With the system still in REMOTE, have the assistant press the PLAY pushbutton and then the CUE OVERRIDE, TONE, and AUDIO OVERRIDE. The assistant should now press the REWIND pushbutton and then the PLAY pushbutton to reproduce the cue tone just recorded.

Step 4: Place the VIDEO REMOTE switch S75001 (on the processor) in the NORMAL position. Have the assistant adjust the following controls: REMOTE PEDESTAL HEIGHT, REMOTE VIDEO GAIN, and REMOTE SYNC GAIN. Check the monitor for proper operation of these controls. Place the VIDEO REMOTE switch in the DISABLE position. Rotation of the remote video controls should have no effect on the processor output.

Step 5: Press the LOCAL pushbutton on the right control panel. Its lamp should light, and control should be returned to the right control panel.

XVIII SYSTEM FUNCTIONS EVALUATION

Step 1: Record approximately five minutes of tuner audio and video. Rewind to beginning of the recording. Press the PLAY pushbutton.

Step 2. After one minute press the AUDIO ONLY pushbutton, and record a 1000 cycle signal at zero vu for approximately 30 seconds. Press the NORMAL pushbutton, under the AUDIO ONLY pushbutton.

Step 3: After approximately one more minute press the CUE ONLY pushbutton and hold down the CUE TONE pushbutton for approximately 30 seconds. Release the CUE TONE pushbutton and press the NORMAL pushbutton under the CUE ONLY pushbutton.

Step 4: After approximately one more minute press the RECORD pushbutton and record a standard monoscope signal for approximately one minute.

Step 5: Press the STOP pushbutton and rewind the tape to the beginning of the tuner recording.

Step 6: Reproduce the entire five minutes section and observe closely for correct system functions as follows:

(a) Tuner audio and video should be reproduced with no visible or audible degradation.

(b) During the audio only portion of the recording, the original tuner audio should be completely eliminated and the 1000 cycle signal reproduced with no resulting picture degradation.

(c) During the cue only portion of the recording, the 325 cycle cue tone should be reproduced and monitored with no resultant degradation to the tuner audio or video being reproduced at the same time.

(d) The monoscope signal reproduced during the last minute of the five minutes interval should check the efficiency of the video erase unit. There should be no picture degradation of the monoscope pattern due to incomplete erasure of the tuner video. The tuner audio should remain normal.

ROUTINE MAINTENANCE

The routine maintenance of the system has been divided into 10, 25, 100 and 1000 hour operating intervals. The accumulated operating time is displayed on the OPERATING HOURS indicator on the left control panel.

as Needed

10 Hour Checks -- Cleaning

The components on the tape transport must be cleaned regularly. It is recommended that denatured alcohol be used for cleaning all points except the magnetic heads, and that AMPEX head cleaner (Part No. 087-007) be used for cleaning the heads. Pure naphtha may be used to clean all points, including the heads, if desired.

CAUTION

DO NOT USE CARBON TETRACHLORIDE
OR ANY SIMILAR SOLVENT.

Use a lint-free cloth moistened with denatured alcohol or pure naphtha to clean the following components:

a. Supply tension arm.
b. Supply idler.
c. Guide post.
d. Capstan idler.
e. Capstan.
f. Takeup idler.
g. Takeup tension arm.
h. Concave tape guide -- swing the guide away from the video head assembly and clean the interior with a lint-free cloth moistened with the cleaner. Then saturate a cotton swab (Q Tip) with the solution and clean the grooves in the guide. Finally, remove the vacuum hose at the guide and clean out any accumulation of lint or other substances.

Use a lint-free cloth or Q Tip moistened with AMPEX head cleaner to clean the following:

a. Video head drum and head tips.
b. Control track head.
c. Audio and cue heads -- both vertical stacks.
d. Video erase head.

10 Hour Checks -- Electronic Checks

a. Modulator Carrier Frequency

Step 1: Insert the oscilloscope test probe in TP43004 RF OUT, adjusting the time base to 0.1 microsecond per centimeter.

Step 2: Turn INPUT LEVEL control R43003 fully counterclockwise.

Step 3: Adjust FREQUENCY CONTROL R43001 for a 5 megacycle carrier frequency. each Day.

b. Modulation Level

Step 1: Insert the oscilloscope test probe in TP43006 VIDEO INPUT, adjusting the time base to the horizontal line rate.

Step 2: Check the signal level, which should be 1.4 volts peak-to-peak (or station standard).

Step 3: Insert the oscilloscope test probe in TP43003 MULTI GRID and adjust R43003 to obtain a 17 volts video signal measuring from the center of r f at sync tip to center of r f at white base line.

Step 4: Adjust WHITE CLIP LEVEL control R43002 for the proper clipping level as previously described.

c. Tape Guide Servo System

Step 1: Set the AUTOMATIC COMPENSATION control for manual operation.

Step 2: Thread the video head reference tape on the tape transport and adjust the position of the tape guide as explained in the Head Assemblies section.

Step 3. While still reproducing the reference tape, place the oscilloscope test probe in TP49005 on the guide position sensor unit.

Step 4: With the oscilloscope under d c operation, determine that the sawtooth peaks are 160 volts (± 10 volts) above ground. If necessary adjust R49003 DELAY WIDTH to achieve this condition.

Step 5: Insert the oscilloscope test probe in TP49002 and if necessary adjust R49001 ZERO ADJ for a positive pulse width of 80 microseconds, 30 volts peak-to-peak in amplitude.

Step 6: Set the AUTOMATIC COMPENSATION control for automatic operation.

Step 7: If necessary, readjust R49001 to achieve a picture devoid of skew.

25 Hour Checks

a. Video Head Record Current

Adjust the individual record current to each head as described in the Head Assembly section.

b. Head Blower

Replace the paper filters in the head blower assembly.

c. Console Cooling Assembly

Inspect the air filter located on the underside of the console cooling assembly. If necessary, clean the filter using a vacuum cleaner. Replace the filter at 500 hour operating intervals. yearly motor ck.

100 Hour Routine Maintenance Procedures

a. Cleaning

Make a thorough visual inspection of all components. Remove any accumulation of dirt and dust from inside the console and from each unit in the console and the racks. Wherever possible this cleaning should be accomplished with a vacuum cleaner rather than by the use of compressed air.

b. Vacuum Pump Assembly

Remove and clean the three air filters contained in the glass jars on the vacuum assembly. To remove the filter, unscrew the jar and loosen the screw at the bottom of

the filter until the component drops down. Wash the filters in naphtha and relocate them in the assembly, replacing the glass jar.

If adjustment is necessary after the cleaning, see Adjustment in the VACUUM SYSTEM section of this manual.

c. Regulated Power Supplies

Check the output voltages of each regulated power supply, if necessary, adjusting to +250 volts d c. Use an oscilloscope to check the ripple voltage present in the output; ripple should not exceed 10 millivolts.

1000 Hour Routine Maintenance

a. Console cooling fan

Remove the top cover from the console cooling fan and remove any accumulated dirt or dust with a vacuum cleaner. Lubricate each motor at two places, using two drops of number 20 motor oil. Replace the cover.

b. Vacuum Tubes

Check all vacuum tubes and replace as necessary. Normal station practice should be followed in this procedure if it prescribes checking tubes at shorter intervals.

When changing tubes in large numbers, which may be necessary at this time, it is advisable to check thoroughly and adjust each component in accordance with the complete set up procedure described in the SYSTEM CHECKOUT AND ADJUSTMENTS section of this manual.

c. Tape Transport

Check, and if necessary, adjust the tape and brake tensions as described in the Tape Transport section.

d. 5000 Hour Lubrication of Tape Guide Motor

Every 5000 operating hours remove the tape guide motor assembly by disconnecting its power connector and removing the four mounting screws which hold it to the tape transport plate. Have an assistant hold the motor assembly while the screws are removed. Place two drops of oil, Ampex catalog Number 51513 (a bottle of which is furnished), in each of the lubricating holes provided on the side of the motor assembly. Re-install, after wiping off excess oil with a clean cloth.

OPERATION

BASIC PRINCIPLES OF VIDEOTAPE RECORDING

Theory of Magnetic Tape Recording

When a material capable of being magnetized is placed in or near a magnetic field, the molecules of the material become oriented in accordance with the direction and density of that field.

In magnetic tape recording, the material consists of microscopic iron oxide particles loosely bonded to a plastic tape surface. On the core of a highly permeable material are wound a number of turns of wire to form the magnetizing device known as a head. During recording and reproduction the gap in the core is caused to contact the iron oxide coated tape, thus completing the magnetic circuit of the core through the tape surface. If the current through the core winding is varied at a given rate and the tape is moved past the gap, a magnetic pattern directly proportional to the coil current, is laid down on the tape as it leaves the gap. When the process is reversed, and the magnetized tape passes the gap with no coil current flowing, the magnetic circuit is completed again and a voltage, proportional to the rate of change of the magnetic flux at the gap, is induced in the coil. If both the recording and reproducing processes are performed at the same constant speed, the voltage induced during the reproduce mode will follow faithfully the current used during the record mode. The wavelength of the signal recorded on the tape is a function of tape velocity and signal frequency as shown in the formula:

$$\lambda = \frac{V}{f}$$

Where: λ = Tape wavelength in inches

V = Tape Velocity in inches per second

f = Signal frequency in cycles per second

From this formula it can be seen that, for a given speed, the wavelength becomes progressively shorter as the frequency is increased, and, conversely, as the tape speed is increased, the wavelength for any given frequency increases proportionally. The upper frequency limit of the recording head is determined only by the inductive reactance of the coil and its distributed capacitance. The frequency limitations of magnetic tape recording are due almost entirely to the reproduce head limitations.

Limiting Factors of Reproduce Head

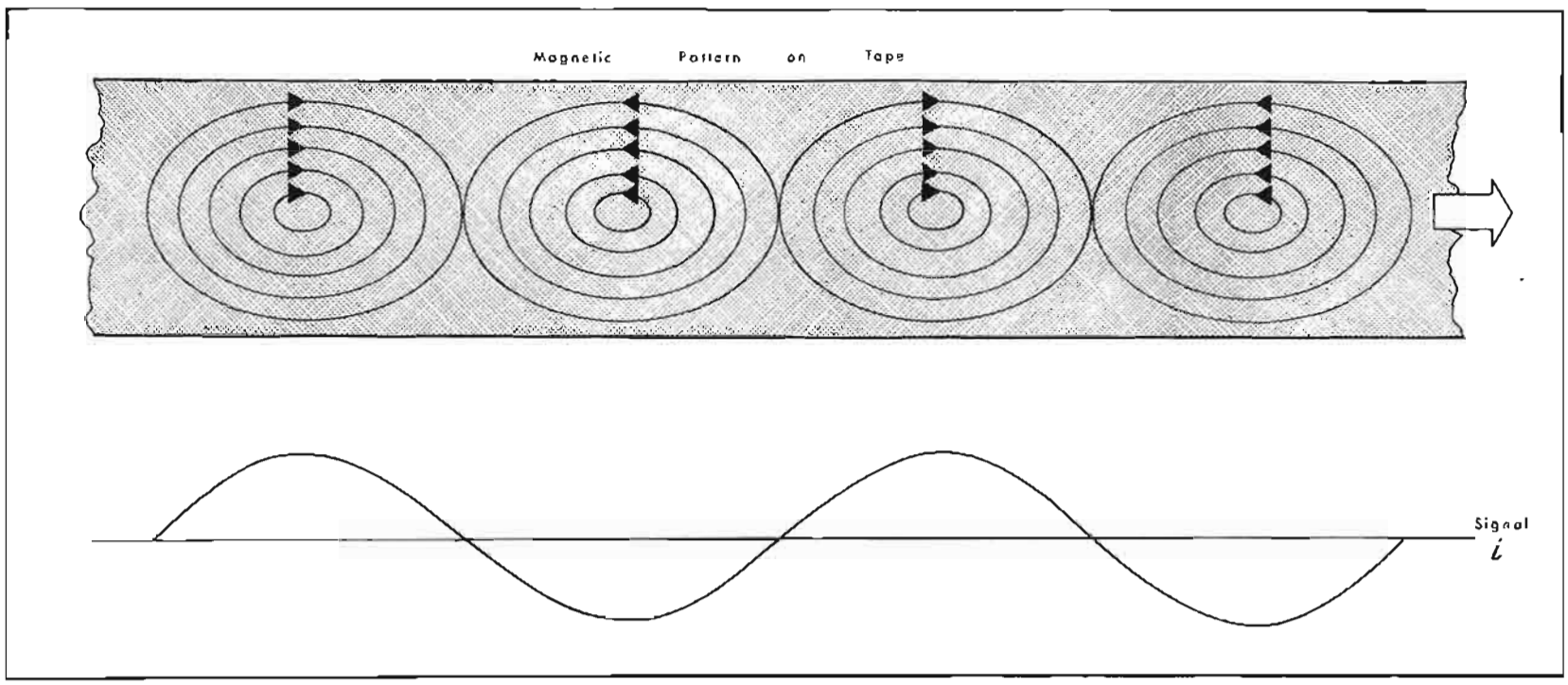
The voltage induced in the core coil during the reproduce operation is proportional to the rate of change of the magnetic flux at the gap. When the tape wavelength equals the width of the gap, the rate of change becomes zero, resulting in no induced voltage. All frequencies above this cutoff frequency cannot be reproduced dependably. In addition, at frequencies just below cutoff, the rate of change of magnetic flux, for a given tape speed, is greater than at lower frequencies. As the frequency is halved, the rate of change is halved and the induced voltage decreases by 6 db. If a recording is made at constant current covering all the frequencies up to cutoff, for a given tape speed and a given reproduce head, the reproduce head output will indicate a characteristic 6 db per octave 'droop' with descending frequency. This 6 db per octave droop is characteristic of all magnetic tape recording systems and limits to approximately 10 the number of octaves that can be practically reproduced. In a 10 octave recording, the signal-to-noise figure for the first octave always will be 60 db poorer than the signal-to-noise figure for the tenth octave. Only radically improved tape with lower inherent surface noise and improved pre-amplifier design can remove this 10 octave limitation.

To summarize: the bandwidth that can be reproduced on magnetic tape is limited to approximately 10 octaves by the nature of the reproducing system; and the maximum frequency that can be reproduced is determined by the reproduce gap width and tape speed. Because the minimum gap width capable of being produced commercially is approximately 0.0001 inch (1/10 mil), the only way to extend the upper frequency limit is to increase the tape speed (tape to head velocity). For example: to reproduce a 1 mc signal using a 0.0001 inch reproduce gap would require a tape speed of 100 inches per second or 30,000 feet of tape for one hour's playing time; to reproduce a 4 mc signal with the same 0.0001 inch gap would require a tape speed of 400 inches per second or 120,000 feet of tape for one hour's playing time. Obviously such a high speed tape system is impractical mechanically and certainly uneconomical.

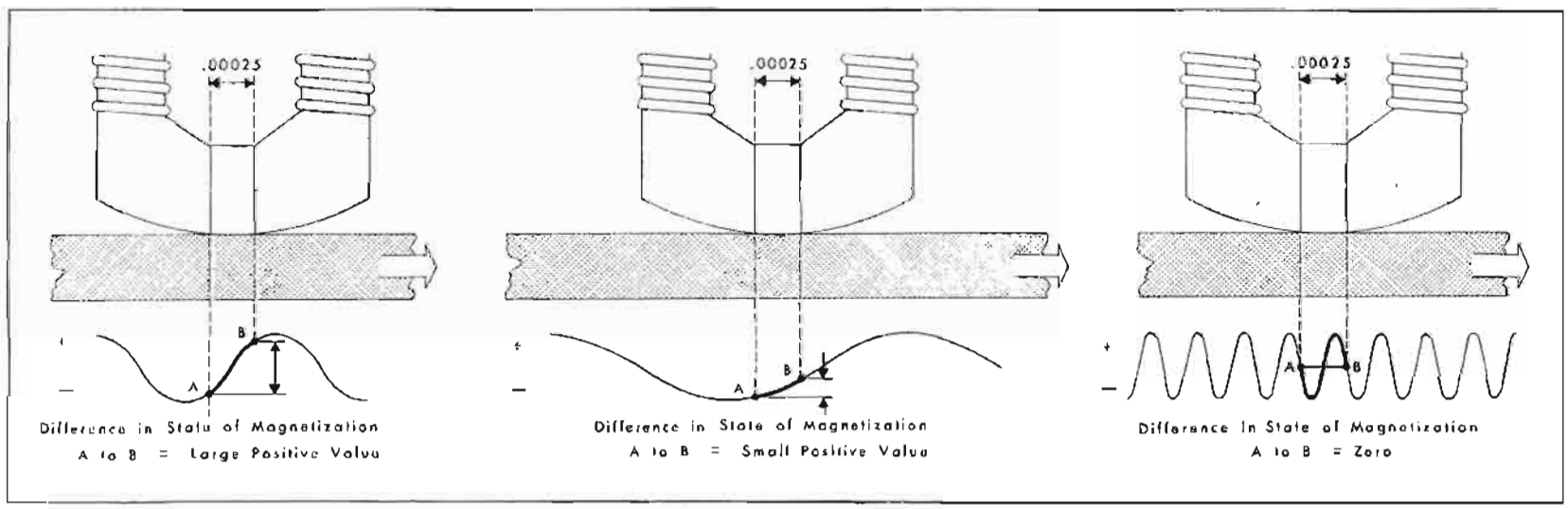
The Problem of Recording a Composite Television Signal

The standard U. S. television signal extends from approximately dc to above 4.25 megacycles, a bandwidth of about 18 octaves. The practical bandwidth limit of magnetic tape recording is approximately 10 octaves. A means was needed to transform the dc to 4.25 megacycle signal into higher frequency sideband information. Ampex devised a method which used the composite TV signal to frequency modulate a 5.00 mc carrier producing sidebands extending from .75 mc to 9.25 mc or 4.25 mc either side of the 5.00 mc carrier frequency. Because the band from .75 mc to 9.25 mc represents only slightly more than 4 octaves, these signals are easily recorded and reproduced.

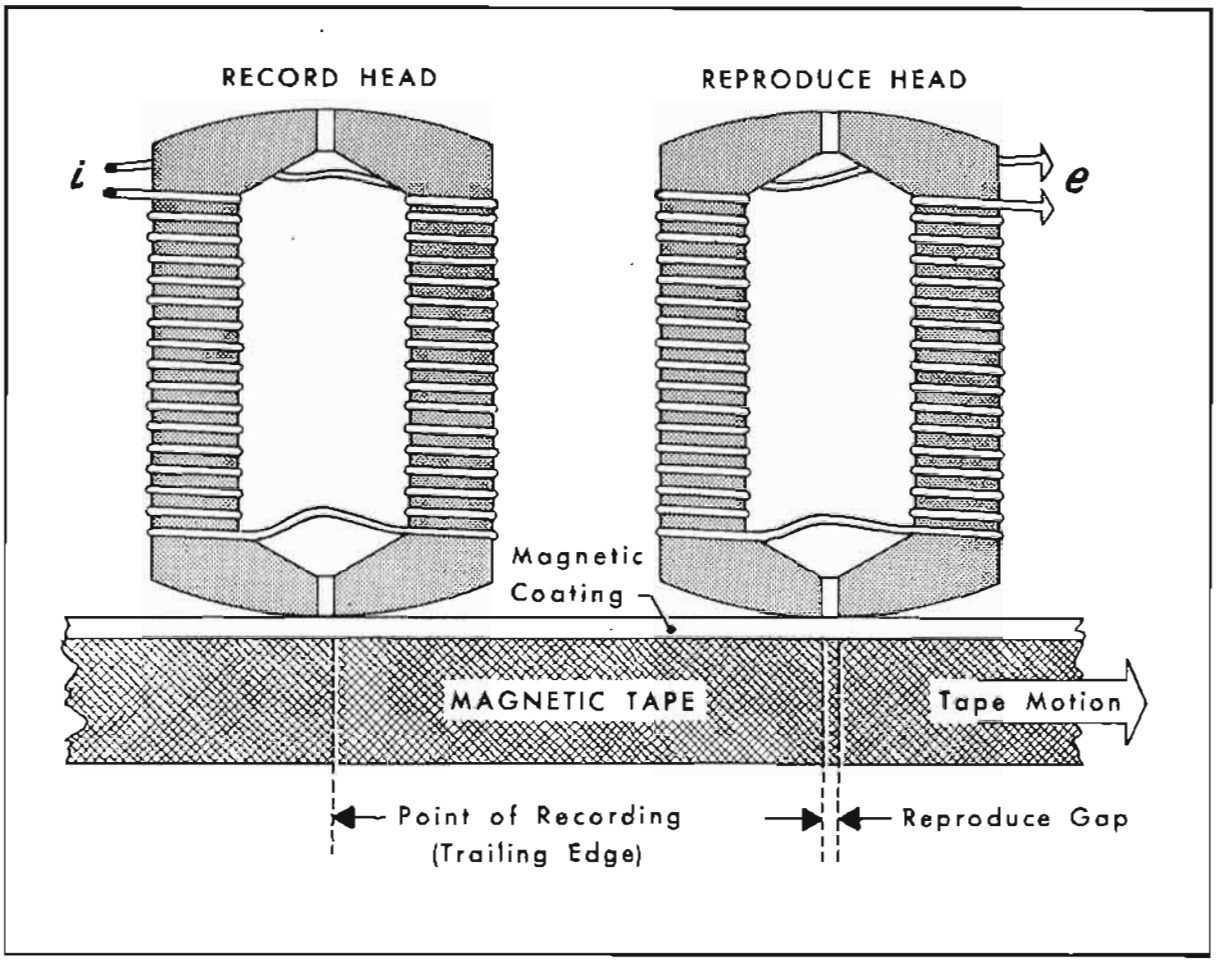
When the highest frequency that the reproduce head must pass has been established and 0.0001 inch minimum practicable gap size is recognized, the necessary tape speed can be calculated. A 10 mc cutoff frequency requires a tape speed of 1000 inches per second. To achieve this



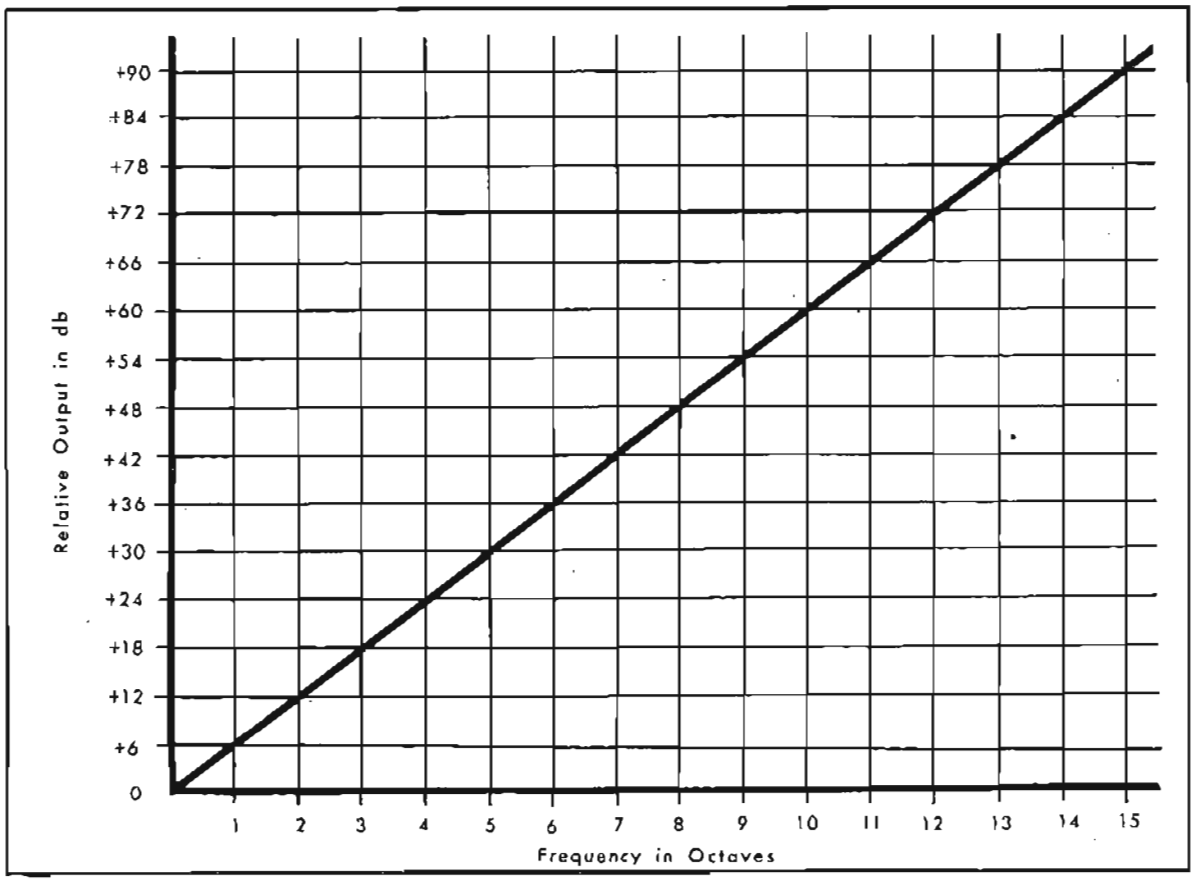
MAGNETIZATION OF TAPE



REPRODUCE HEAD FREQUENCY
VS INDUCED VOLTAGE



RECORD AND REPRODUCE HEADS



REPRODUCE HEAD CHARACTERISTICS ASSUMING CONSTANT CURRENT RECORDING

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head-to-tape velocity it was decided to rotate the head at high speed past the tape and advance the tape at the moderate speed of 15 ips employed in commercial sound recording. The actual head to tape speed used in the AMPEX VIDEOTAPE RECORDER is 1500 inches per second corresponding to a cutoff frequency of 15 mc for a .0001 inch reproduce head gap width. The rotating head assembly consists of four heads on the periphery of a 2 inch diameter drum, each head spaced 90° apart. The tape is 2 inches wide and cupped by a special female guide to contact approximately 120° of the drum periphery. All four heads are identical in construction and are fed identical FM signals simultaneously. Each head is 10 mils wide and therefore lays down a 10 mil wide track on the tape. Due to the 15 ips forward tape motion a 5 mil separation exists between tracks. Also due to forward tape motion, the tracks are laid down at a slight angle across the tape somewhat like successive horizontal scans on a tv raster. It can be seen that a smaller diameter drum and fewer heads could have been used to achieve the same tape-to-head velocity but this would have required greater tape curvature. Conversely, a larger drum with more heads and less tape curvature would have caused added complexity and expense in head construction and in the associated electronics. A 2 inch drum with four heads represents a good compromise between head complexity and tape curvature. The tape is made to contact 120° of the drum periphery so overlapping of the video information will take place at the end of one track and the beginning of the next track. A strip 90 mils wide on the upper edge of the tape and a strip 85 mils wide on the bottom edge of the tape subsequently are erased. A 70 mil wide audio track is recorded on the upper edge at 15 ips in the conventional longitudinal manner. Thus, a 20 mil guard band separates the audio and video information. The control track, 45 mils wide, is recorded at the lower edge of the tape, and contains the 240 cycle control signal and field pulse information. Ten mils above the control track and 10 mils below the lower edge of the video, a 20 mil wide cue track can be recorded at 15 ips also laterally along the tape. Cueing audio or cueing tone can be recorded on this track.

FUNCTIONAL DESCRIPTION OF THE VIDEOTAPE RECORDER

GENERAL DESCRIPTION

AMPEX Videotape Recorder/Reproducers use 4 magnetic heads which are mounted 90° apart on the periphery of a rotating drum to record and reproduce composite video signals. The head drum is approximately 2 inches in diameter, and rotates at 240 revolutions per second. A head-to-tape velocity of approximately 1500 inches per second is achieved as the heads move across the 2-inch wide magnetic tape.

Transverse tracks, 10 mils wide, are recorded across the magnetic tape by the rotating heads. A reel-to-reel tape speed of 15 inches per second provides a 5 mil separation between each recorded track. Center-to-center track spacing is 15 mils.

As each head sweeps across the tape, 16 to 17 horizontal lines of picture information are recorded The 525 lines which constitute 1 frame, are contained in 32 successive tracks and correspond to 1/2-inch of reel-to-reel tape motion.

Audio, Cueing and Control Tracks

Conventional, stationary heads record the audio, cueing, and control tracks in longitudinal strips along each edge of the tape. Upon completion of the recording process, 4 synchronized tracks have been recorded on the magnetic tape The video signal has been recorded across the tape. The audio sound track has been recorded longitudinally along the top edge of the tape The control and cueing tracks also have been recorded longitudinally along the bottom edge. The control track is located above the cueing track. They are separated from each other by an appropriate guard band The audio and cue erase head assembly is located between the video and audio head assemblies It erases the video information from the audio track before the sound portion of the program is recorded. Erasure is not necessary for the control track

Tape Transport

The tape transport is similar to mechanisms found in other professional quality audio recorders. The magnetic tape is controlled by the rotation of the capstan as the tape moves from the supply reel across the supply reel idler and video erase head. It then passes the rotary video head, the erase heads, and the audio and cueing head between the capstan and its associated idler, and moves across the tape timer idler to the takeup reel. Accurate guidance of the tape past the video head assembly is controlled by a concave tape guide, which cups the tape around the rotary head drum Proper contact between the video heads and the tape is maintained by rigid tolerances which cause the guide to fit exactly around the head drum, and by the application of a vacuum on the guide side of the tape

Modulation and Demodulation of the Video Signal

After the tape has passed the video erase head, the video signal is recorded on the tape in the form of a frequency modulated carrier with an unmodulated frequency of 5 00 megacycles During the modulation process, the back porch of the blanking pulse is clamped to a reference dc voltage, establishing that point as the carrier reference Modulation polarity is such that frequency increases as the signal increases toward white level. The total carrier deviation is approximately 2 0 megacycles from tip of sync to peak white Equalization circuits in both the modulator and demodulator compensate for sideband suppression effects in the modulation process, and for frequency response variations in the heads and the magnetic tape Even though the maximum deviation is 2.0 mc or less, the 5 00 mc carrier, when modulated with a composite video signal, contains various sidebands above and below the 5 00 mc carrier corresponding to the instantaneous modulating frequency.

Capstan Servo System

A close relationship must exist between the position of the video heads, which are controlled by the head drum motor rotation, and the longitudinal position of the tape, controlled by the capstan motor rotation This precise relationship must be maintained when the system is switched from the record to the reproduce mode. The capstan servo system locks the relation of the capstan drum motor to that of the head drum motor

During record and reproduce modes, the control signal is generated by a photoelectric cell which scans the rotating surface of a disc mounted on the head drum motor shaft. The disc is painted so that light from an exciter lamp reflects on the photoelectric cell during 1/2 of each revolution The symmetrical square wave output of the cell corresponds in frequency to the nominal 240 rps speed of the drum

During the recording process the photoelectric cell output is divided down to 60 cps, amplified, and used to drive the capstan motor | The 240 cycle photoelectric cell output is also recorded longitudinally along the bottom edge of the tape This output is superimposed over a portion of the video signal, and is used as a control track during reproduction.

When operating the equipment in the reproduce mode, the capstan servo system compares the signal from the reproduced control track with the signal from the photoelectric cell. The capstan motor speed is controlled by the results of this comparison, increasing or decreasing in speed to maintain the exact relationship between the angular head position and the longitudinal tape position that existed during the record function.

Head Drum Motor Servo System

Two servo loops are used in the head drum motor servo system. One, the slow servo loop provides the proper input frequency to the drum motor. It eliminates fast phase motor correction requirements, and ensures the recording of vertical sync at the same physical location on the tape. The other fast servo loop stabilizes the drum motor and suppresses its hunting tendency.

The drum motor can be locked to any of 4 sources during the record mode: external, video, 60 cycle line, or color sync. It can also be set to any of 3 sources during the reproduce process -- external, 60 cycle line or color sync. Normally, the video signal will be used during the record mode. A relay automatically switches to the 60 cycle line during the reproduce mode. Vertical sync is stripped from the composite video signal, multiplied by 4, shaped to a square wave and split in phase, providing a push-pull input to a phase comparator bridge. The dc output of the phase comparator bridge determines the frequency of a voltage controlled oscillator that operates at a nominal frequency of 240 cps This signal, after further processing, drives the synchronous drum motor.

In the first (slow) servo loop the phase position of the drum motor is determined by the photoelectric cell, the 240 cycle output of which is split in phase, providing the other push-pull input to the phase comparator bridge, in which the photoelectric cell output is compared with the incoming sync signal. If the incoming signal suddenly shifts in phase, which could occur, for example when switching a program source from one city to another, the phase comparator immediately would generate an error voltage. Circuits between the phase comparator bridge and the voltage controlled oscillator prevent a large error signal from causing an immediate effect on the drum motor, but the error voltage gradually will shift the voltage controlled oscillator frequency until the drum motor phase matches the phase of the incoming sync.

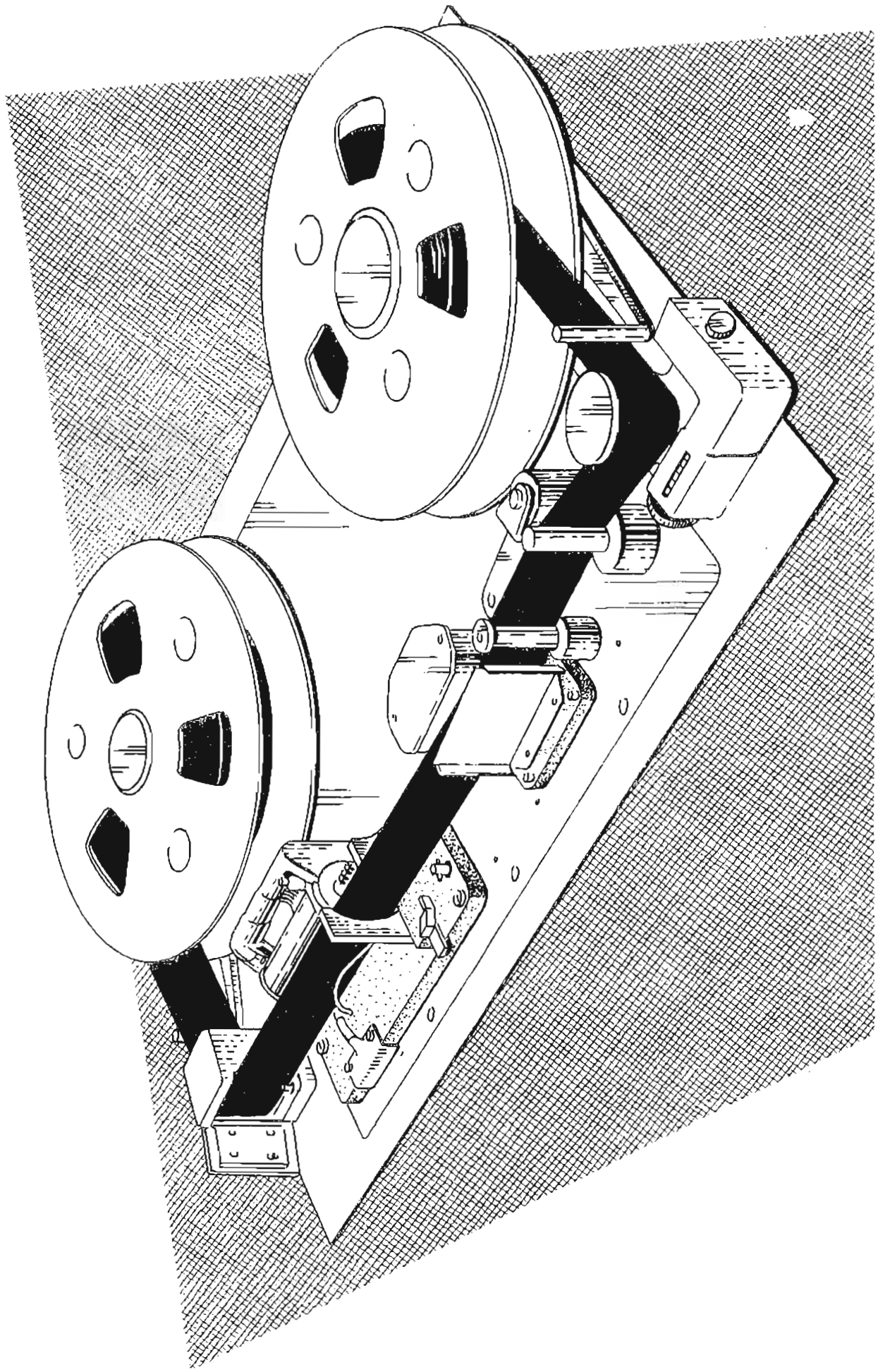
The second (fast) servo loop in the system uses the photoelectric cell output as the excitation signal for a low Q ringing oscillator which is resonant at 240 cps. The oscillator output is compared with its input in another phase comparator bridge arrangement. The ringing oscillator output will shift in phase in comparison to its input if a sudden signal frequency shift should take place. This may occur during drum motor hunting. In such cases, the phase comparator bridge produces an error voltage proportional to the drum velocity change. This voltage controls a phasing circuit that shifts the phase of the voltage applied to the drum motor in a direction opposing the velocity error.

Tape Guide Servo System

The tape guide servo system positions the concave tape guide and controls the contact pressure between the rotating video heads and the tape. A certain amount of head intrusion into the tape is necessary to ensure proper head-to-tape contact. This intrusion causes tape stretch, an effect that can be used to advantage when controlled.

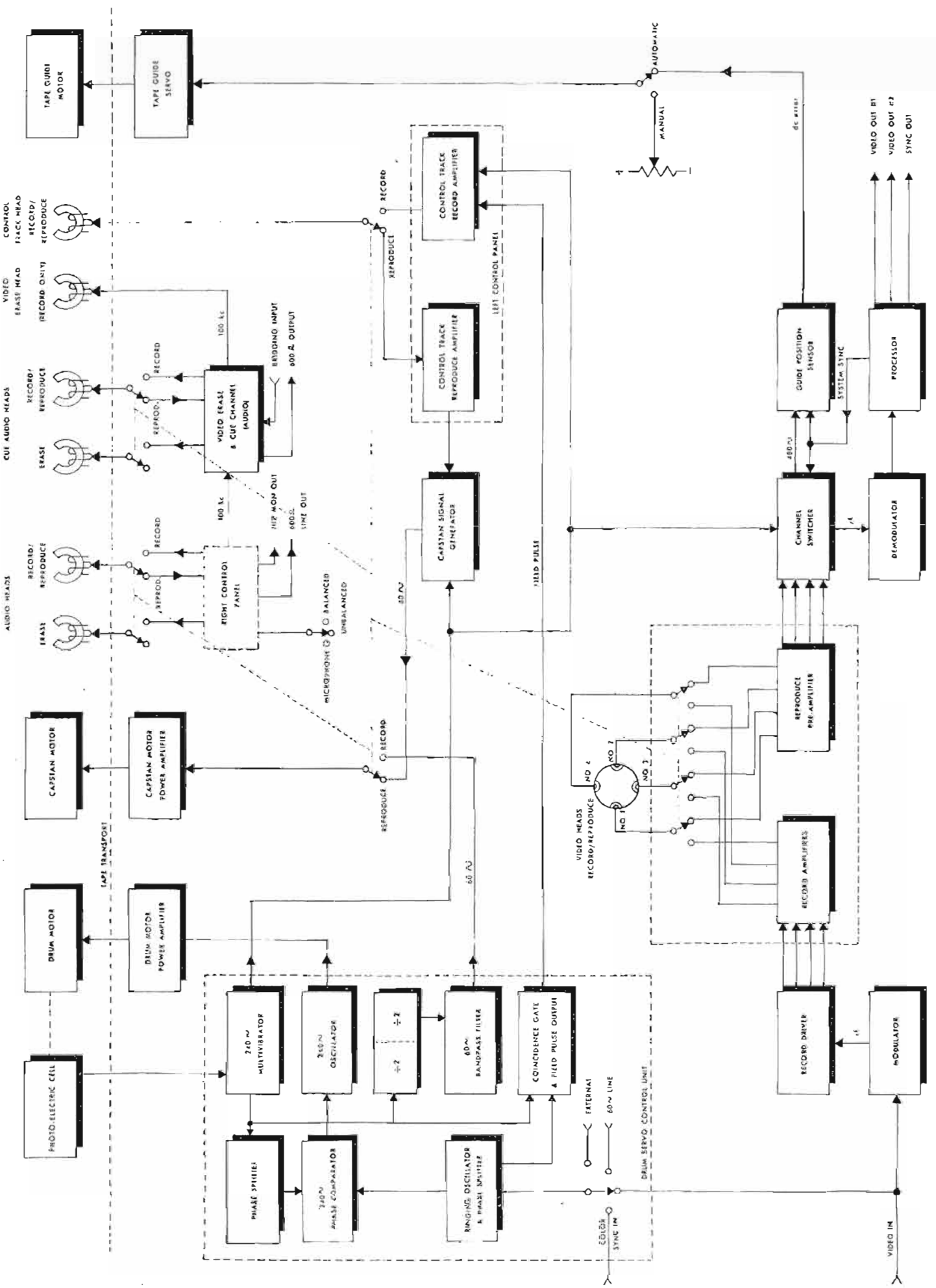
For example, when a recording is made on equipment possessing new heads, head velocity across the tape is a certain speed, and two points of information appear on the tape track with a specified time interval between them. If the same information were then reproduced on equipment with worn heads, the slight difference in circumference would result in a slower head velocity across the tape. A longer time interval would be required for the heads to pass over the reference points, thus introducing a timing error. If the tape were stretched more during the recording process than during reproduction, timing errors would be minimized or eliminated. Any timing error in excess of .05 microseconds will result in visual image defects.

The tape guide position controls the contact pressure between heads and tape. This pressure in turn controls the amount of tape stretch during tape passage across the recording heads. Positioning the tape guide closer to the head produces a tape stretching effect; conversely the stretch is minimized by moving the guide away from the rotating head.



TAPE THREADING PATH

VIDEO SYSTEM BLOCK DIAGRAM



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Operating conditions dictate the use of the manual or automatic mode for control of the tape guide. In either case, the guide is positioned through a gear mechanism by the tape guide motor which receives operating power from the tape guide amplifier. Torque power to the motor is applied by application of dc voltage to the tape guide amplifier input. The speed and direction of motor rotation is determined by both amplitude and polarity of the applied dc voltage.

The tape guide position is controlled manually by the setting of the TAPE GUIDE POSITION potentiometer located on the left control panel. This potentiometer forms one branch of a self-balancing bridge. The other branch consists of a precision potentiometer geared to the guide motor. After amplification in the tape guide amplifier, any voltage differential between the center points of the bridge elements is controlled by the guide motor, which operates to rebalance the bridge. When the balanced bridge condition is attained, the voltage differential is zero and the motor stops. In this manner, the condition of imbalance is corrected when the guide motor repositions the tape guide.

The AUTOMATIC condition is applicable only in the reproduce mode. The guide position sensor detects time displacement errors in the reproduced signal, and develops a dc voltage. Amplitude and polarity are direct functions of the amount and direction of the signal errors. This dc voltage is amplified in the tape guide amplifier and causes repositioning of the tape guide by the guide motor which eliminates time displacement errors.

NOTE

Automatic operation occurs only when the MANUAL-AUTOMATIC switch is in the AUTOMATIC position, and when a good, clean, signal is being reproduced from the tape. If a good quality signal is lacking, operation reverts to MANUAL regardless of the AUTOMATIC-MANUAL switch position and is restored to AUTOMATIC electronically when a quality signal is again available. A pilot lamp on the left control panel indicates when the system is operating automatically. This lamp glows brightly during normal automatic operation and dimly whenever incoming signal quality is impaired. The lamp is not illuminated during manual operation.

RECORDING

Video

During the recording process, the tape passes across the energized video erase head and all signals are erased before the tape contacts the rotating video record head.

The composite video signal is fed to the modulator unit. After amplification and clamping, it is used to frequency modulate a free-running multivibrator normally operating at the 5.00 mc carrier frequency. The rf output of this multivibrator is clipped and fed to the record driver, and is also routed, during the record process only, to the input of the demodulator, thus providing a monitor signal.

The rf signal is amplified in the record driver and fed into four identical, low impedance, output paths. These outputs are routed, through coaxial cables, to the four record amplifiers in the head channel assembly. Individual gain controls are provided for each recording channel.

All channel outputs are fed through slip rings to their respective video heads. A record current meter, located on the right hand meter panel, makes possible rf signal level measurement at each record head. Each head is fed the signal from its record amplifier, and each constantly records that signal during the period it is moving across the tape. Because the heads are mounted 90° apart on the head drum periphery, and the tape is curved to contact 120° of the drum periphery, there is a period when one head makes contact at the top of the tape before the preceeding head loses contact at the bottom of the tape. During this interval identical information is recorded simultaneously by two heads. Some of this redundant information is destroyed in subsequent erasing and recording operations, and the balance provides an overlap period which corresponds to approximately two lines of video information. During reproduction this overlap is eliminated in the switcher unit.

Audio

As the tape passes across the rotary video head assembly, video information is recorded across the entire tape width. Duplicate information exists at the top and bottom of adjacent video tracks. A high frequency bias and erase oscillator, located in the right control panel, drives an erase head which clears a longitudinal strip along the top edge of the tape before the tape passes over the audio record/reproduce head.

The audio signal enters the equipment at the right control panel, where it is routed to a direct record amplifier. It is amplified, mixed with a high frequency ac bias signal from the bias and erase oscillator, and fed to the audio record/reproduce head. This head records the audio signal along the strip previously erased of video information.

A vu meter, located on the right hand meter panel, in conjunction with a selector switch on the right control panel, permits monitoring the audio record, bias, cue channel and erase current levels.

Cue channel audio signals originate at the video erase and cue channel unit. These signals are amplified, mixed with high frequency ac bias and fed to the cue channel record/reproduce head. This head records and reproduces near the lower edge of the tape over a previously erased area above the control track location from which it is separated by appropriate guard bands.

Control Track

Tape speed must be controlled during the recording operation and during the reproduce mode to maintain accurate tracking of the video heads as they scan the recorded information. A reference signal, derived directly from the rotation of the head drum, is recorded as a control track. This reference signal is generated by a photoelectric cell mounted near the head drum. The cell is positioned to pick up light reflected from the rim surface of a metal disc attached to the head drum motor shaft. 180° of this disc is painted black and the other 180° is highly reflective. A small pilot lamp provides the light source. As the disc rotates, the photoelectric cell generates a nominal 240 cps square wave the frequency of which is related directly to the angular head drum rotation.

During the record process, this signal is shaped in the drum servo control unit, amplified by a record amplifier in the left control panel, and directly recorded near the bottom edge of the tape. During subsequent reproducing, this signal controls capstan speed, and ensures accurate tracking of the video heads. Control track record and reproduce levels are indicated by a meter on the left meter panel.

Drum Motor Drive

The rotation of the head drum motor may be locked to any of four 60 cycle reference sources during the record process. These are: the vertical sync pulses of the video signal, which is normally used, an external sync source, color sync, or the 60 cycle line. Selection of the reference source is made by appropriate switching at the drum servo control unit.

The selected reference source triggers a 60 cps multivibrator in the drum servo control unit. The output of this unit serves as a reference signal for the head drum motor servo system which compares the 60 cps reference frequency from the multivibrator with a 60 cps signal derived from the photoelectric cell. The discriminator which performs the comparison, controls a nominal 240 cps oscillator in the drum servo control unit. The output of this oscillator is amplified in the head motor drive amplifier to drive the head motor. Head drum rotation thus is locked tightly to the 60 cycle reference source.

Capstan Motor Drive

The driving signal of the capstan motor produced by the photoelectric cell union scans the head drum during the record mode. This 240 cycle signal is shaped and divided directly through the capstan signal generator to the capstan motor power amplifier. The capstan motor power amplifier supplies power to the capstan motor, the rotation of which thus is locked to the head drum rotation.

Control of Tape Guide

During the record mode, the tape guide position is controlled manually from a potentiometer on the left control panel. The correct position is established during the reproduce process by checking it when reproducing a standard tape and by setting it to manual 2-1/2 dial divisions clockwise from the point at which dropout occurs.

REPRODUCING

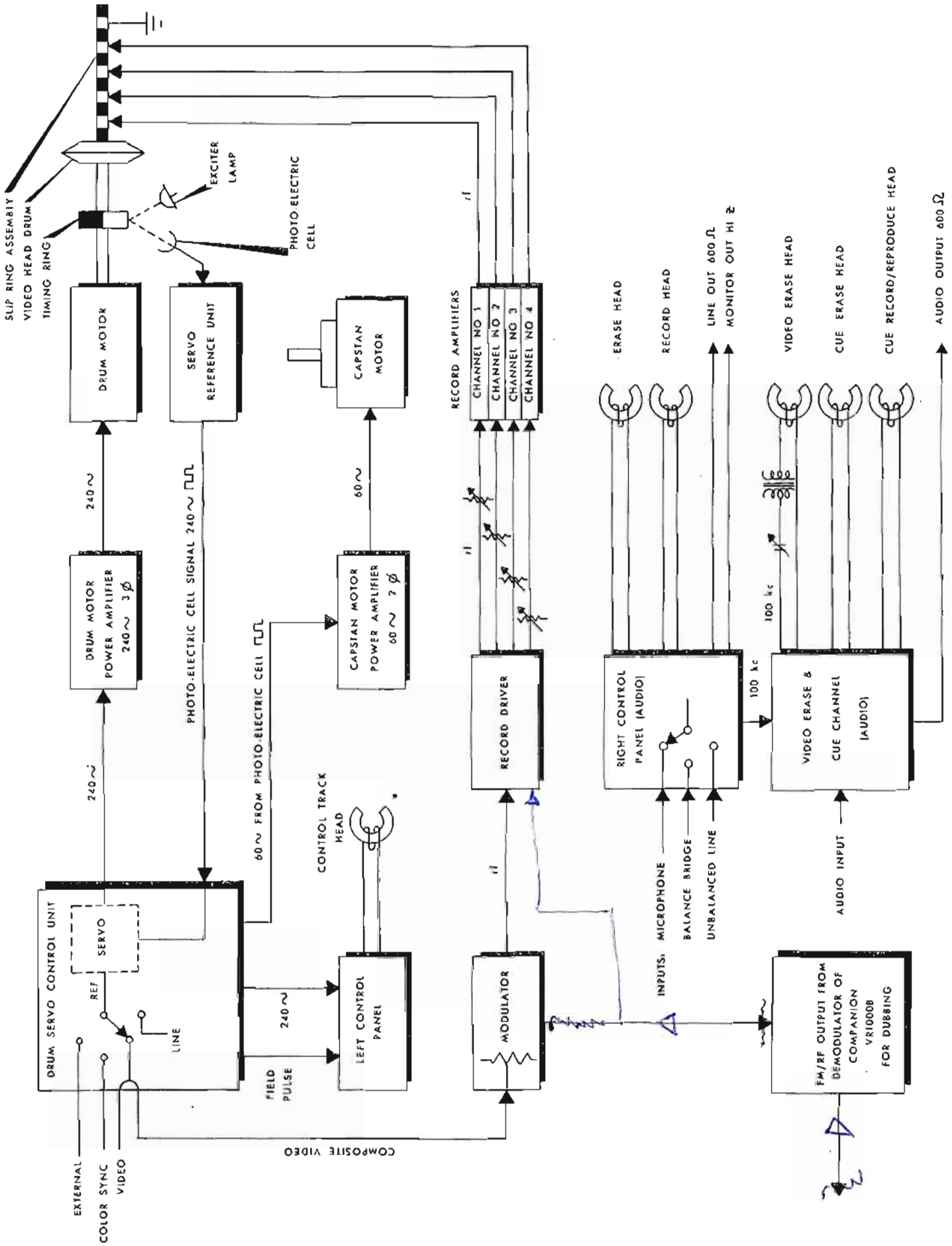
Video and Dubbing

The magnetic flux recorded on the tape induces a voltage in the rotating video heads as they pass over the tracks on the tape during the reproduce mode. This voltage is routed through slip rings to the pre-amplifier portion of the head channel assembly in which each head output is fed to a separate pre-amplifier.

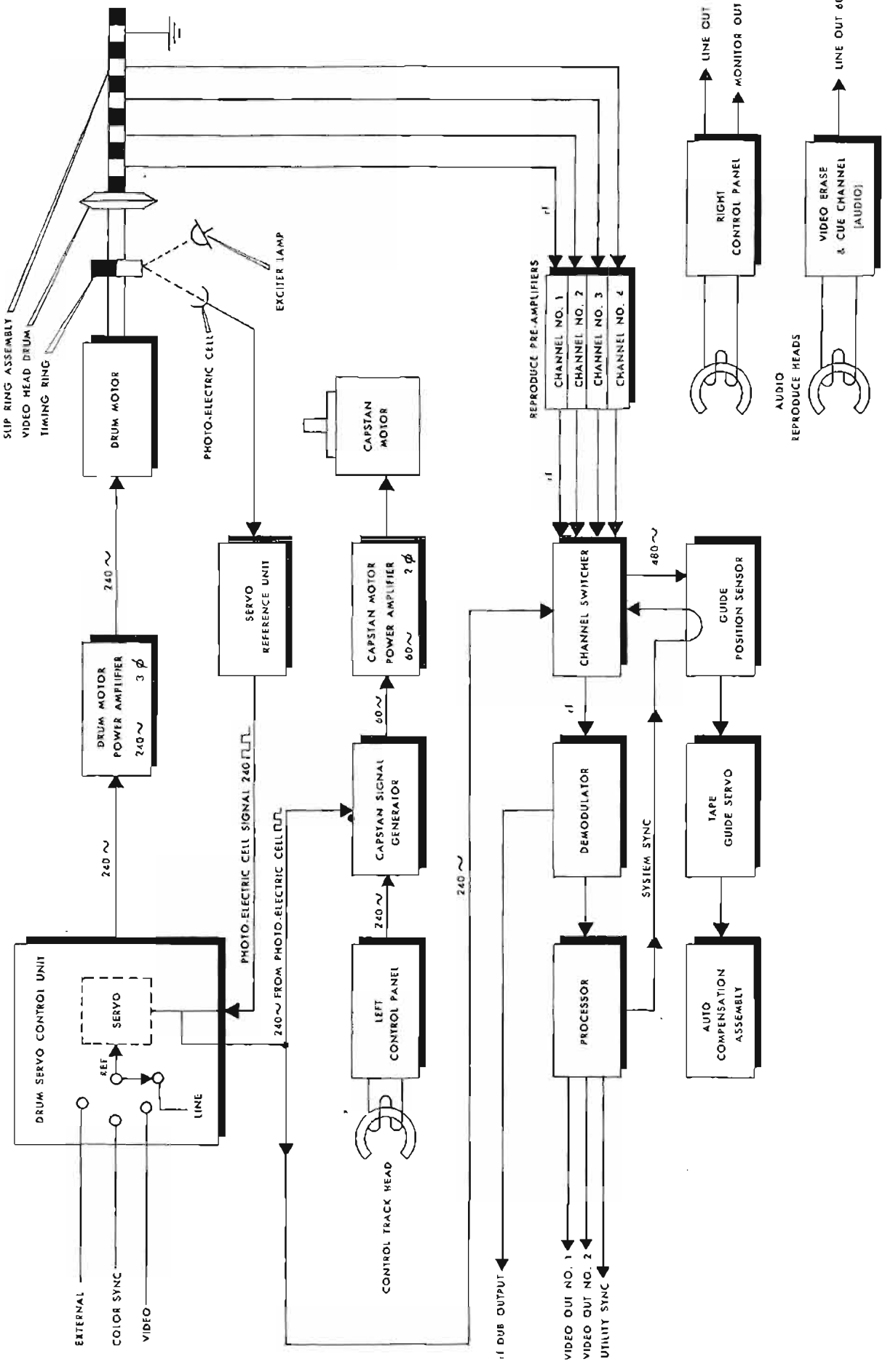
The four pre-amplified outputs are then connected to the switcher, and sequentially gated so that at the instant of the switching operation, the change from one head output to the next head output occurs during the back porch portion of the horizontal blanking period. Monitoring the switcher output can be observed at a cathode ray oscilloscope mounted on the left control panel.

The switcher output is fed to the demodulator where the fm signal is subjected to approximately 40 db of limiting before being demodulated to its original am form. The demodulated signal is then routed to the processor, the function of which is similar to that of a stabilizing amplifier. The sync pulses are stripped from the composite video signal. Adjustable white and black clipping of the video signal eliminates any noise or switching transients in excess of clipping level. The sync pulses, originally stripped from the video signal, are amplified and clipped to steepen the rise time and to remove any noise. New horizontal and vertical blanking pulses are generated. All pulses then are returned to the video portion of the signal to reform the composite signal.

RECORD MODE BLOCK DIAGRAM



REPRODUCE MODE BLOCK DIAGRAM



Individual controls for the sync and video channels provide sync percentage adjustment. These two controls, together with a pedestal level control, can be adjusted from a remote control station.

Two video outputs with individual gain controls are available, one a sync output for studio use, the other a sync output to the switcher and the guide position sensor.

A toggle switch marked NORMAL-DUBBING is mounted on the circuit breaker panel inside the console right hand door. Ordinarily this switch is left in the NORMAL position. Whenever it is desired to dub the video from one equipment to another, this switch is placed in the DUBBING position on the system termed the slave which is recording from the other called the master. Leaving the NORMAL-DUBBING switch in the NORMAL position on the MASTER machine and placing the master system in the reproduce mode and the slave equipment in the record mode, connects the fm/rf signal output of the demodulator limiter strip from the master equipment to the record driver of the slave system, bypassing the slave modulator. The master demodulator continues to function normally and produce normal output. As long as the NORMAL-DUBBING switch of the slave equipment remains in the DUBBING position, the SLAVE system continues to record the video signal that the master equipment is reproducing. A suitable studio type line amplifier, flat to 10 mc, for added gain, isolation and impedance matching, makes possible the use of any number of slave systems with a single master. The accompanying audio and cue channels of the master tape may be dubbed simultaneously with the video by appropriate patching at the studio master control console.

Audio

The magnetic flux of the recorded audio track induces a voltage in the audio head winding as the tape moves past the head. This voltage is fed to a direct reproduce amplifier in the right control panel, where the signal is amplified and equalized. Output level is monitored by a vu meter on the right hand meter panel.

Also, provided for monitoring purposes is a 600 ohm line output and a high impedance output.

Capstan Drive Servo System

The control track head reproduces the recorded 240 cps control track signal, which is amplified in the left control panel and used as one input to a phase discriminator circuit in the capstan signal generator. A second 240 cps signal to this circuit, originated by the photoelectric cell as it scans the rotation of the head drum is processed in the drum servo control unit. These signals, one reproduced from the tape and one generated by the rotation of the head drum, are compared in phase. Any phase difference will result in an error voltage which is used to vary the frequency of a nominal 60 cps Wien bridge oscillator located in the capstan signal generator.

The output of the Wien bridge oscillator is amplified by the capstan motor power amplifier. This output drives the synchronous capstan motor. The speed of capstan rotation is thus slightly varied by the servo system action so that a constant phase relationship is maintained between the head drum rotation and the longitudinal position of the tape as indicated by the reproduced control track signal. Coincidence of the heads with the recorded tracks across the tape is rigidly controlled by this system.

Head Drum Motor Drive Servo System

The drum motor drive is controlled by the same servo circuit in both the record and reproduce modes. During the reproducing process the external color sync source or the 60 cycle line are used only for synchronization purposes. If the selector switch on the drum servo control unit is left in its normal video sync position, a relay automatically transfers the equipment to the 60 cps line reference source when the system is placed in the reproduce mode.

Tape Guide Servo System

During the reproduce mode, the tape guide servo system can be used to automatically position the concave tape guide thus minimizing time displacement errors. Switching the tape guide control to automatic is accomplished at the left control panel. Time displacement errors in the reproduced sync signal, caused by incorrect positioning of the guide, will develop an error signal in the guide position sensor unit. This error signal is amplified in the tape guide servo and is used to control the tape guide motor, which repositions the tape guide to compensate for the error.

OPERATING FUNCTIONS

GENERAL

Tape motion and modes of operation are controlled at the right control panel on the console, or at the remote control unit. Correct operation of the system can be checked at indicators or meters on the right control panel, left control panel, right hand meter panel, and left hand meter panel.

TAPE THREADING

The tape threading path is indicated on the accompanying illustration which shows the tape threaded with the head cover removed to illustrate the path clearly. Threading is relatively a simple operation. Pull approximately 8 feet of tape from the supply reel, then thread the tape as illustrated and anchor it to the takeup reel by turning the reel 2 or 3 revolutions in a counterclockwise direction holding the end of the tape in position on the reel.

When tape threading is completed, reduce all slack by turning the takeup reel in a counter-clockwise direction. Continue the turning motion until the supply reel begins to rotate. This ensures that the supply tape tension arm has moved away from the safety switch.

PLACING THE EQUIPMENT IN STANDBY MODE

The equipment must be allowed a 20 minute warmup period before beginning either the record or reproduce modes of operation. To place the equipment in standby mode for the warmup period, actuate the circuit breaker power switch in the rack assembly.

CHECKING THE POSITION OF THE TAPE GUIDE

The position of the tape guide should be checked by reproducing the video head reference tape before recording. As the tape is being reproduced, with the tape guide control under manual operation, adjust the TIP PROJECTION control on the left control panel for minimum skewing of the bands as displayed on the monitor.

CAUTION

DO NOT RE-ADJUST THE TIP PROJECTION CONTROL AFTER MAKING THE SETTING DETERMINED WHILE REPRODUCING THE VIDEO HEAD REFERENCE TAPE.

RECORDING

Operator's Checklist, Before Recording

1. Provide a 20 minute warmup period.

2. Adjust individual record levels for each channel as explained in the Tape Transport Section of this manual.

3. Thread tape with sufficient tension to hold the supply tension arm from contacting the safety switch.

4. Make certain that the vacuum gauge on the left hand meter panel reads within the limits marked on the gauge.

5. Place the EE-TAPE switch in its EE position. When the video signal appears on the monitor, return the switch to its TAPE position.

6. Make sure that the STOP pushbutton is illuminated.

7. Place the selector switch in the left control panel in the SYSTEM STABILITY position.

Entering Record Mode

Step 1: Press the PLAY pushbutton at least 10 seconds before recording is scheduled to start. Tape motion will begin.

Step 2: Observe the display on the oscilloscope on the left control panel. The Lissajous pattern (1 to 1) will lock when the system has stabilized. Approximately 4 seconds after the PLAY pushbutton has been pressed, the tape guide will move toward the rotating video heads.

Step 3: At the scheduled time, press the RECORD pushbutton, and the system will record the signal applied to the input.

Step 4: Press the STOP pushbutton when the program is completely recorded.

Operator's Checklist - While Recording

1. Ascertain that the control track meter on the left hand meter panel indicates 0 vu.

2 The video record current meter on the right hand meter panel should indicate the same value for each head as noted when adjusting the individual record level controls.

3. The audio meter on the right hand meter panel should indicate 0 vu in any position of the selector switch on the right control panel. This meter measures levels of audio recording and reproduction, bias, erase, cue and tone during recording only.

4. The record pushbutton must be illuminated.

5. The head blower light must be illuminated.

REPRODUCING

Operator's Checklist -- Before Reproducing

1. The equipment must remain in standby mode for at least 20 minutes.

2. Check the tape guide position.

3. Make certain that the recorded tape has been threaded and cued with sufficient tape tension to hold the supply tension arm from contacting the safety switch.

4. Be sure that the vacuum gauge on the left hand meter panel reads within the limits marked on the gauge.

5. Check positions of switches as follows:

   Place BLANKING SWITCHER OUTPUT S64001 in the IN position (blanking switcher in circuit).

   On the right control panel place the meter selector switch in AUDIO position.

6 The tape guide circuit can be under either automatic or manual control. Under automatic the AUTO COMPENSATION pushbutton on the left control panel will be illuminated dimly until the system stabilizes. Under manual control, this pushbutton will not be illuminated.

Entering Reproduce Mode

Step 1. Approximately 5 seconds before the scheduled time, press the PLAY pushbutton to initiate the reproduce mode.

Step 2 Observe the Lissajous pattern on the oscilloscope at the left control panel. This pattern will lock in when the system stabilizes. The tape guide will move toward the head assembly approximately 4 seconds after the PLAY pushbutton is pressed.

Step 3. Place the selector switch in the left control panel in the SWITCHER OUTPUT position. Adjust the TRACKING CONTROL on the left control panel for a maximum, continuous, display on the oscilloscope.

Step 4 If the tape guide system is started under automatic control, the AUTO COMPENSATION pushbutton on the left control panel now should be illuminated brightly, indicating that the automatic circuit has control. If started under manual operation, the system now can be placed in automatic. If desired, the manual operation can be continued. The operator can control the tape guide position by adjusting the TIP PROJECTION control for minimum distortion of the vertical lines in the reproduced picture.

Operator's Checklist -- While Reproducing

1. Check control track reproduce level for 0 vu indication on control track meter at the left hand meter panel.

2 Check audio reproduce level for 0 vu on audio peaks as indicated by the meter at the right hand meter panel.

3. Check monitor picture.

4. Check the switcher display on the oscilloscope at the left control panel. If necessary re-adjust the TRACKING control.

5 If the illumination of the AUTO COMPENSATION pushbutton on the left control panel changes from bright to dim (under automatic control) it indicates that the system has changed to manual operation. This may indicate that the signal from the tape is not clean, or has been lost entirely.

RECORDING AND REPRODUCING AUDIO ONLY

Recording and reproducing of audio only is possible on the system as an override feature. This is accomplished by pressing the AUDIO RECORD switch on the right control panel when the system is in the reproduce mode. The recording and reproducing processes are initiated exactly as previously described.

Actuating the NORMAL switch on the right control panel will de-activate the override feature.

REWIND AND FAST FORWARD

The rewind and fast forward modes of tape travel are initiated by pushbuttons on the right control panel. Note that these fast winding operations can be instigated with the tape at a standstill or from any mode of tape travel, including record or reproduce.

The FAST FORWARD and REWIND pushbuttons may be pressed alternately, without waiting for the tape to stop. This feature facilitates the cueing process. Tape can be run either entirely off the reel or may be stopped at any point by pressing the STOP pushbutton.

CAUTION

ALWAYS BE SURE THAT THE TAPE MAKES A FULL STOP BEFORE PRESSING THE PLAY PUSHBUTTON. THIS AVOIDS STRETCHING AND DISTORTION OF THE TAPE PACK WHEN THE CAPSTAN IDLER CLAMPS AGAINST THE CAPSTAN.

MAINTENANCE OPERATING CONTROLS

Several controls on the console are provided to facilitate maintenance and alignment procedures. These controls normally will not be used during programming intervals.

Head Override Switch -- This switch is located on the console above the right control panel and allows the video heads to rotate without the necessity of running tape when actuated. This feature is used in various setup procedures. This switch also permits fast reproduce operation as described in the SYSTEM CONTROL section of this manual.

EE-TAPE Switch -- This switch, located on the right control panel, allows various video checkout procedures without the necessity of running tape. In its EE position, the signal applied to the input is routed through the system on an electronics-to-electronics basis, and allows the check out of the modulator, demodulator and processor. In its TAPE position, the system is under normal operation, and tape must be run.

A-B Switch -- This switch is located above the left control panel. Its purpose is similar to that of the EE-TAPE switch on a momentary basis. During test of the system, it allows comparison between a signal being fed to the input with a signal being reproduce from the tape. It thus may be used as an aid in isolating trouble.

CAUTION

THE A-B SWITCH SHOULD NEVER BE ACTUATED WHILE "ON THE AIR".

SPLICING RECORDED TAPES

To facilitate the splicing of recorded tapes, a circuit has been included in the drum servo control unit which applies a short duration field pulse within the control track recording at the edge of the tape. The field pulses, visible on the left control panel oscilloscope, are generated during the record mode only when composite monochrome or color video signals are used as the system reference. This pulse corresponds to the beginning of a complete field. A properly made splice has no noticeable effect on the reproduced picture.

Complete splicing technique instructions are contained in the publication, AMPEX VIDEOTAPE SPLICER. The Tape Splicer Kit, catalog number 50300-01, available as an accessory, contains all the equipment needed to insure accurate splicing. A special fluid, Edivue, when applied to the tape makes visible the composite video and all other recorded signals. The two pieces of tape to be spliced are fed into the splicer assembly and referenced at hairlines to the fields originally generated in the drum servo control unit.

SUMMARY OF CONTROLS, SWITCHES AND INDICATORS

Item	Schematic Ref. No.	Title	Unit	Location
Circuit Breaker	------	MAIN POWER SWITCH	----------	Lower Left Rack
Circuit Breaker	S68002	BLOWER CONSOLE COOLING	----------	Right Hand Panel of Console
Circuit Breaker	S68003	HEAD FAN POWER ASSEMBLY	----------	Right Hand Panel of Console
Circuit Breaker	S68004	RELAY CONTROL	----------	Right Hand Panel of Console
Circuit Breaker	S68005	VACUUM PUMP	----------	Right Hand Panel of Console
Circuit Breaker	S68006	LIGHTS & AC OUTLETS	----------	Right Hand Panel of Console
Switch	S66002	POWER ON OFF	1 Amp. Pwr. Sup.	Upper Left Rack
Switch	S66002	POWER ON OFF	1 Amp. Pwr. Sup.	Upper Left Rack
Switch	S66002	POWER ON OFF	1 Amp. Pwr. Sup.	Left Rear Console
Potentiometer	R66001	VOLT ADJ	1 Amp. Pwr. Sup.	Upper Left Rack
Potentiometer	R66001	VOLT ADJ	1 Amp Pwr. Sup.	Upper Left Rack
Potentiometer	R66001	VOLT ADJ	1 Amp Pwr. Sup.	Left Rear Console
Switch	S66001	METER SWITCH	1 Amp. Pwr. Sup	Upper Left Rack
Switch	S66001	METER SWITCH	1 Amp. Pwr. Sup.	Upper Left Rack
Switch	S66001	METER SWITCH	1 Amp. Pwr. Sup.	Left Rear Console
Switch	S60002	POWER ON OFF	Drum Motor Power Amplifier	Center Left Rack
Switch	S60001	METER SWITCH	Drum Motor Power Amplifier	Center Left Rack
Potentiometer	R60001	VOLTAGE LEVEL	Drum Motor Power Amplifier	Center Left Rack

Item	Schematic Ref. No	Title	Unit	Location
Switch	S60002	POWER ON OFF	Capstan Motor Power Amplifier	Center Left Rack
Switch	S60001	METER SWITCH	Capstan Motor Power Amplifier	Center Left Rack
Potentiometer	R60001	VOLTAGE LEVEL	Capstan Motor Power Amplifier	Center Left Rack
Potentiometer	R48004	OUTPUT	Capstan Signal Generator	Lower Left Rack
Potentiometer	R48005	CONTROL RANGE	Capstan Signal Generator	Lower Left Rack
Control	Z48001	TAPE SPEED OVERRIDE	Capstan Signal Generator	Lower Left Rack
Indicator Lamp	DS65001	SYNC SOURCE LINE	Drum Servo Control	Lower Left Rack
Indicator Lamp	DS65002	SYNC SOURCE VIDEO	Drum Servo Control	Lower Left Rack
Indicator Lamp	DS65003	SYNC SOURCE COLOR	Drum Servo Control	Lower Left Rack
Indicator Lamp	DS65004	SYNC SOURCE EXTERNAL	Drum Servo Control	Lower Left Rack
Potentiometer	R43001	FREQUENCY CONTROL	Modulator Monochrome	Upper Right Rack
Potentiometer	R43003	INPUT LEVEL	Modulator Monochrome	Upper Right Rack

Summary of Controls, Switches and Indicators (continued)

Summary of Controls, Switches and Indicators (continued)

Item	Schematic Ref. No.	Title	Unit	Location
Potentiometer	R62001	VIDEO LEVEL	Demodulator Monochrome	Upper Right Rack
Potentiometer	R62002	DETECTOR BALANCE	Demodulator Monochrome	Upper Right Rack
Delay Line Adjustable	DL75001	BURST PHASE	Processor	Lower Right Rack
Potentiometer	R75004	LOCAL PEDESTAL HEIGHT	Processor	Lower Right Rack
Potentiometer	R75005	LOCAL VIDEO GAIN	Processor	Lower Right Rack
Potentiometer	R75011	LOCAL SYNC GAIN	Processor	Lower Right Rack
Switch	S75001	VIDEO REMOTE NORMAL DISABLE	Processor	Lower Right Rack
Potentiometer	R49001	CUTOUT LIMIT	Guide Position Sensor	Lower Right Rack
Potentiometer	R49002	15.75 KC DELAY	Guide Position Sensor	Lower Right Rack
Potentiometer	R49003	SENSITIVITY	Guide Position Sensor	Lower Right Rack
Potentiometer	R49004	ZERO ADJUST	Guide Position Sensor	Lower Right Rack
Push Button Switch	S72001A	VIDEO MONITOR LINE	Switching Panel	Left Hand Bridge
Push Button Switch	S72001B	VIDEO MONITOR TAPE	Switching Panel	Left Hand Bridge

Item	Schematic Ref. No.	Title	Unit	Location
Push Button Switch	S72001C	VIDEO MONITOR 1	Switching Panel	Left Hand Bridge
Push Button Switch	S72001D	VIDEO MONITOR 2	Switching Panel	Left Hand Bridge
Push Button Switch	S72002A	AUDIO MONITOR LINE	Switching Panel	Left Hand Bridge
Push Button Switch	S72002B	AUDIO MONITOR TAPE	Switching Panel	Left Hand Bridge
Push Button Switch	S72002C	AUDIO MONITOR 1	Switching Panel	Left Hand Bridge
Push Button Switch	S72002D	AUDIO MONITOR 2	Switching Panel	Left Hand Bridge
Switch	S1	POWER ON OFF	Audio Amplifier	Left Hand Bridge
Potentiometer	R1	AUDIO LEVEL	Audio Amplifier	Left Hand Bridge
Switch	S64002	SWITCH POSITION NORMAL OUT	Channel Switcher	Right Center Rack
Potentiometer	R64001	CHANNEL 1 GAIN	Channel Switcher	Right Center Rack
Potentiometer	R64002	CHANNEL 1 EQUAL	Channel Switcher	Right Center Rack
Potentiometer	R64004	CHANNEL 2 GAIN	Channel Switcher	Right Center Rack
Potentiometer	R64005	CHANNEL 2 EQUAL	Channel Switcher	Right Center Rack
Potentiometer	R64007	CHANNEL 3 GAIN	Channel Switcher	Right Center Rack
Potentiometer	R64008	CHANNEL 3 EQUAL	Channel Switcher	Right Center Rack
Potentiometer	R64011	CHANNEL 4 GAIN	Channel Switcher	Right Center Rack
Potentiometer	R64012	CHANNEL 4 EQUAL	Channel Switcher	Right Center Rack
Potentiometer	R64003	PHASING	Channel Switcher	Right Center Rack

Summary of Controls, Switches and Indicators (continued)

Summary of Controls, Switches and Indicators (continued)

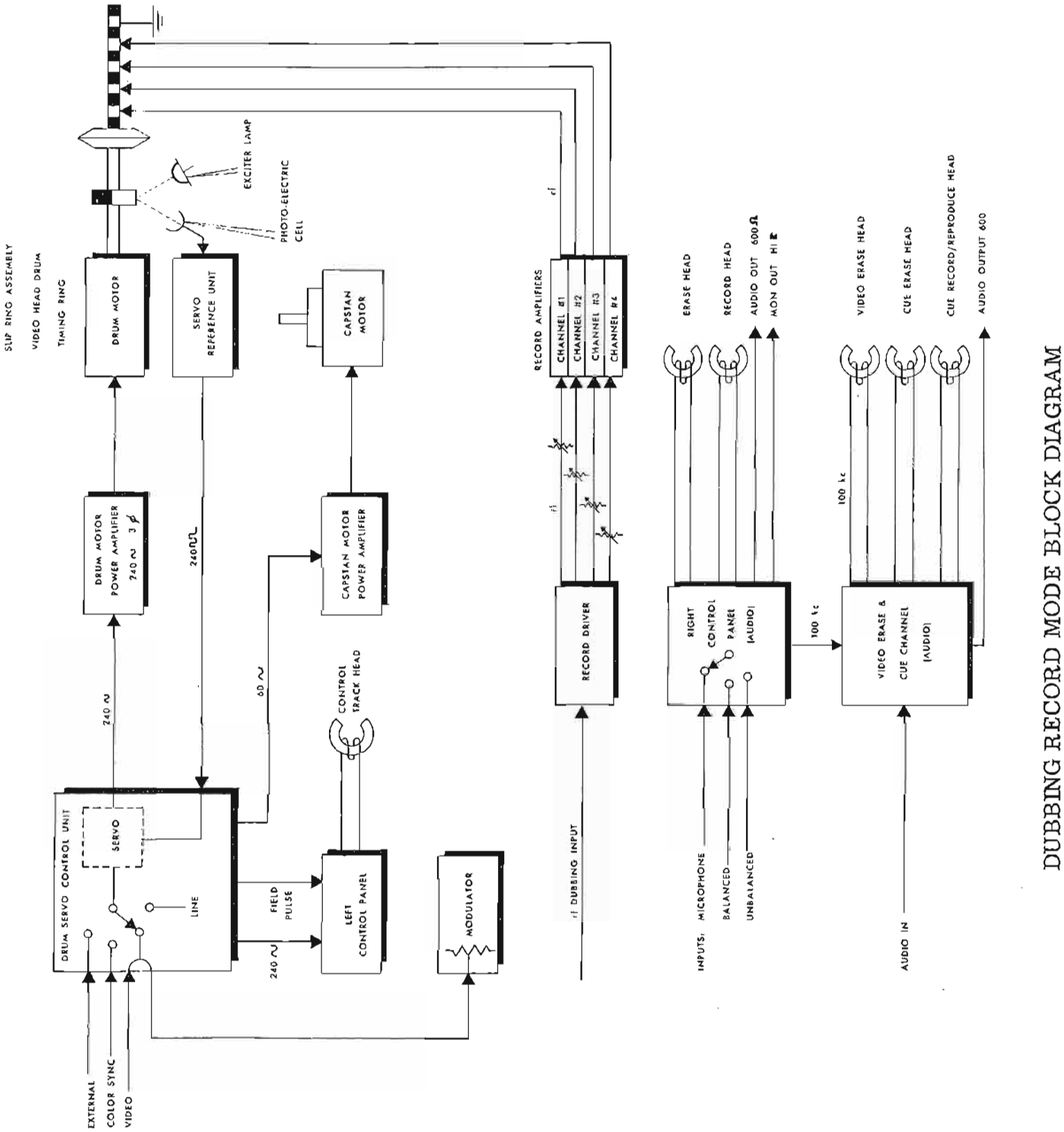
Item	Schematic Ref. No.	Title	Unit	Location
Potentiometer	R33001	CHANNEL 1	Record Driver	Right Lower Console
Potentiometer	R33002	CHANNEL 2	Record Driver	Right Lower Console
Potentiometer	R33003	CHANNEL 3	Record Driver	Right Lower Console
Potentiometer	R33004	CHANNEL 4	Record Driver	Right Lower Console
Switch	S56001	SCOPE SELECTOR SYSTEM STAB-SWITCHER OUT	Left Hand Control Panel	Console
Switch	S56002	VIDEO RECORD CURRENT METERING	Left Hand Control Panel	Console
Push Button Switch	S56003	AUTOMATIC COMPENSATION	Left Hand Control Panel	Console
Push Button Switch	DS56001	BLOWER PUSH-TO-TEST LAMP	Left Hand Control Panel	Console
Potentiometer	R56015	TIP PROJECTION	Left Hand Control Panel	Console
Potentiometer	R56013	TRACKING	Left Hand Control Panel	Console
Switch	S46013	MONITOR EE-TAPE	Right Hand Control Panel	Console
Switch	S46014	METER	Right Hand Control Panel	Console
Potentiometer	R46002	AUDIO RECORD LEVEL	Right Hand Control Panel	Console
Potentiometer	R46208	AUDIO PLAYBACK LEVEL	Right Hand Control Panel	Console

Item	Schematic Ref. No.	Title	Unit	Location
Push Button Switch	S46001	CUE ONLY	Right Hand Control Panel	Console
Push Button Switch	S46006	NORMAL	Right Hand Control Panel	Console
Push Button Switch	S46003	AUDIO ONLY	Right Hand Control Panel	Console
Push Button Switch	S46008	NORMAL	Right Hand Control Panel	Console
Push Button Switch	S46007	CUE TONE	Right Hand Control Panel	Console
Push Button Switch	S46002	RECORD	Right Hand Control Panel	Console
Push Button Switch	S46004	STOP	Right Hand Control Panel	Console
Push Button Switch	S46011	PLAY	Right Hand Control Panel	Console
Push Button Switch	S46009	REWIND	Right Hand Control Panel	Console
Push Button Switch	S46010	FAST FORWARD	Right Hand Control Panel	Console
Push Button Switch	S46005	LOCAL	Right Hand Control Panel	Console
Push Button Switch	S46012	REMOTE	Right Hand Control Panel	Console
Indicator Lamp	DS-1	DUBBING MODE	Right Hand Control Panel	Console
Indicator Lamp	DS-2	VIDEO ERASE	Right Hand Control Panel	Console

Summary of Controls, Switches and Indicators (continued)

Summary of Controls, Switches and Indicators (continued)

Item	Schematic Ref. No.	Title	Unit	Location
Switch	------	A-B SWITCH	Right Hand Control Panel	Console lamp, left
Switch	------	OVERRIDE SWITCH	Right Hand Control Panel	Console lamp, right
Switch	S68001	NORMAL DUBBING	Breaker Panel	Right Side Console



DUBBING RECORD MODE BLOCK DIAGRAM

SCHEMATIC
TAPE GUIDE CONTROL
MANUAL & AUTOMATIC

AMPEX CORPORATION

TAPE TRANSPORT
TAPE TENSION SWITCH
SYSTEM CONTROL UNIT
A-B SWITCH PUSH TO TEST
#598 NC
#45 NO
#47 NC
#46
#48
(SYS CTL UNIT) J70003S-17 +24V PLAY MODE HOLD CKT
2P-2
2P-7
57
IS-6
STOP RLY.
3S-15
#31
#33
#32
C
#98
F68002-1 (CONS TERM ASSY)
-24 V
#36
J70003S-2 (SYS CTL UNIT)
#37
#89
#86
#85
T868004-5 CONSOLE
#419
TB-C5 RACK2
#474
TB-B11 RACK 1
#364
TAPE GUIDE SERVO
1P-8
1P-7
1P-1
1P-5
K1
K2
LEFT CONTROL PANEL
4P-4
4P-20
4P-9
TAPE GUIDE "AUTOMATIC"
2P
117V 60CY
TAPE TRANSPORT ASSY, AUTO COMPENSATOR
TAPE GUIDE 2ø MOTOR
3S-8 #179 2P-19
3S-7 #178 2P-20
3S-6 #177 2P-21
3S-5 #176 2P-22
4P-3
#87
1P-4
3P-15
#82
1P-2
TIP PROJECTION
3P-16
#88
1P-6
1P-3
3P-17
#83
HELIPOT
2P-13
2P-14
2P-26
2P-27
194
3S-2
3S-1
TAPE TRANSPORT ASS'Y
60 CY
CHOPPER
AMPLIFIER
AMPLIFIER
GAIN
AMPLIFIER
DIFF AMPLIFIER
X
4P-10
#95
CONS. F68001-1
+24V
ERROR SIGNAL (NORMALLY "0" VOLTS)
204
412
477
367
TB68003-11,12 CONSOLE
TB-B 11,12 RACK 2
TB-B15,16 RACK 1
"a"
"b"
"c"
+10V CLIPPER FOR NOISE SIGNALS EXCEEDING 10V P.P.
4S-4
1P-7
+B
LIMIT RLY
HORIZONTAL SYNC PULSES DERIVED FROM DEMODULATED PLAYBACK SIGNAL THRU PROCESSING AMPLIFIER
2S
AMPLIFIER, DIFF
15750 MULTI & WIDTH CTL
SAWTOOTH SHAPER
CLIPPER & C.F.
TO CHANNEL SWITCHER
3S
"f"
45V
"d"
"e"
P.E.C. 480 CY DERIVED SIGNAL TIMED WITH PLAYBACK HORIZONTAL SYNC PULSES FROM CHANNEL SWITCHER
4S-2
AMPLIFIER DIFF
PHANTASTRON & DELAY CTL
AMPLIFIER
40V
GUIDE POSITION SENSOR
1P-6
RACK 1 TB-A8 #363
RACK 2 TB-K8 #469
CONS TB68007-8 #460
CONS F68001 #84
+24V

"a" H. PULSE
"b" 15750 MULTI
CONDITION TO PRODUCE ERROR VOLTAGE. WAVEFORM NORMALLY SYMMETRICAL ABOUT "0"
"c" 63.5 µS DURATION 7V P.P. AMPLITUDE SAMPLED EVERY 33 PULSES.
"d" 480 CY
"e" PHANTASTRON
80 µS
480 CY RATE
"f" SAMPLING PULSE
SAMPLING TIME OCCURS EVERY 33 HORIZ PULSES

OPN 32

TAPE TRANSPORT

GENERAL

With the exception of the rotary video head assembly, which is described later in this section, the tape transport mechanism is similar to the familiar mechanical assemblies used in many professional quality magnetic tape recorder/reproducers. Its basic purpose is to transport the magnetic tape from reel to reel at a nominal 15 ips speed and to guide it accurately past the head assemblies during the record and reproduce modes of operation. Fast forward, rewind, video erase, cueing and tape timing functions are provided to facilitate operational procedures.

Tape motion during the record and reproduce processes is controlled solely by the capstan, which pulls the tape from the supply reel (on the supply turntable to the left as the user faces the front of the tape transport) and feeds it to the takeup reel (on the takeup turntable at the right of the tape transport). The supply motor torque opposes this tape motion and thus provides holdback tape tension; the takeup motor torque is such that it will reel in, under tension, any tape supplied to it by the capstan. A prevalent misconception is that the takeup reel pulls the tape from the supply reel; actually, the capstan effectively isolates the reels from each other. (In fact, if the tape were threaded outside the capstan, with slightly more tape on the takeup reel than on the supply reel, and the machine were then started in the record or reproduce mode, the opposing torques of the takeup and supply motors, in conjunction with friction in the tape threading path, would counteract each other exactly and no tape motion would occur.) Ignoring the effect of the safety switch, with no tape threaded, the motors will rotate in opposite directions, the supply motor rotating clockwise, the takeup motor counterclockwise.

In either the fast forward or rewind modes of operation, the capstan is removed as a tape motion determining component. The torque of the appropriate turntable motor is reduced, and tape is pulled from that turntable by the greater torque of the other turntable motor.

DESCRIPTION

The tape transport proper consists basically of a drive system, a stationary tape guide, a supply (or rewind) system, and a takeup system. Components of these systems are mounted on a rigid topplate. Operational controls are located on the right hand control panel, and relays are located on the control relay panel.

Drive System

A capstan drive motor assembly and a capstan idler comprise the drive system.

The drive motor assembly consists of a drive motor, the shaft of which acts as the capstan, a flywheel, two power factor correcting capacitors, and a terminal strip.

The drive motor is a single speed hysteresis synchronous motor which operates from 60 cps, 105-125 volt, 2 phase ac power supplied from the capstan motor drive amplifier. The motor shaft extends through the housing. One end of the shaft is sandblasted to form the capstan, and the flywheel is mounted on the other end. Two 10 microfarad, 600 volt, power factor correcting capacitors are mounted on opposing sides of the motor, with the terminal strip (where all motor connections are made) mounted between the capacitors.

The capstan idler consists of an arm assembly, a housing assembly, and a solenoid assembly. The function of the capstan idler is to provide the necessary frictional engagement -- in the record or reproduce mode -- between the capstan and tape so that the tape can be driven. The tape is threaded between the capstan and the idler, and when the equipment is started in the record or reproduce modes of operation the idler is moved to contact the capstan and thus provides the frictional engagement necessary for tape motion.

The capstan idler arm assembly consists of a neoprene rubber tired hub mounted on a U-shaped bracket (providing a certain amount of self-alignment), which is in turn mounted on an arm directly coupled to the pivoting housing shaft. The housing shaft pivots as dictated by the action of the capstan idler solenoid, which is actuated in the record and reproduce modes of operation and forces the rubber-tired hub to contact the capstan.

Stationary Tape Guide

The stationary tape guide, in conjunction with the supply reel idler assembly, positions the tape vertically with respect to the audio heads. It consists simply of an accurately machined guide post mounted on the topplate.

Supply and Takeup Systems

Each of these systems consists of a reel assembly, a takeup tension arm assembly, and a reel idler assembly. They are similar to each other, the only differences being that the reel assemblies are mirror images of each other (dictated by the necessity of providing proper braking action), that a safety switch is used in conjunction with the supply takeup tension arm assembly, and that the supply reel idler acts as a tape guiding element while the takeup reel idler does not.

The reel assemblies, which are not interchangeable because of the mirror image configuration, consist of a turntable and reel hub driven directly by an induction torque motor, a starting capacitor, a brake system, and a terminal strip.

The turntable and reel hub are mounted directly on the torque motor shaft, and -- when the motor is mounted on the topplate -- project through the topplate. The reel hubs are designed so that it is necessary only to press the reels down on the springs; no precise positioning is required.

Each torque motor operates from single phase, 60 cps, power. The voltage normally applied will be reduced from the 115 volt line by the insertion of resistance in series with the motor. All connections are made at a terminal strip, mounted with a 10 microfarad, 600 volt, starting capacitor on a bracket at the side of the motor.

The brake systems (also not interchangeable because of the mirror image arrangement) each consist of a brake band assembly, a housing assembly, a solenoid assembly, a brake lever, a brake drum, and brake tensioning springs. The entire system is mounted on the end of the torque motor opposite the turntable and reel hub. Smooth brake operation is primarily important to maintain proper tape tension while stopping tape motion, because all tension supplied by the torque motors is lost as soon as the STOP pushbutton is pressed. In this respect it is important that the braking force applied to the trailing turntable, from which tape is being pulled must be greater than that applied to the leading turntable. The configuration of the brake tensioning springs ensures this action.

The tension arm assemblies are mounted on the tape transport adjacent to the supply and takeup turntables. The purpose of these assemblies is to take up any momentary slack in the magnetic tape that might occur, for example when the equipment is started or stopped. They are spring loaded arms damped by silicone fluid so that smooth action is obtained. With the springs acting to hold both arms toward the center of the transport, stops are provided so that the arms (with no tape threaded) actually incline slightly inward from the perpendicular of the tape transport face. A microswitch is used in conjunction with the supply reel takeup tension arm to stop the equipment when the tape supply is exhausted, or if tape breakage should occur. (Tape breakage is a remote possibility that should never occur if the equipment is adjusted and operated correctly.) The microswitch opens when it is actuated by the tension arm (in its no tape threaded position) and opens the negative return circuit to various operating relays. Tape must therefore be threaded so that the supply reel tension arm is pulled from contacting this microswitch before operation of the system is possible.

When it is desired to move the reels manually, for facility in threading tape, both tape tension arms are so arranged that the brakes will be released if these tension arms are pulled outward from the center of the tape transport to a position approximately 45° from the location they occupy when tape is threaded along the prescribed path.

CAUTION

DO NOT PERMIT EITHER TENSION ARM TO REMAIN IN THE BRAKE RELEASE POSITION WHILE OPERATING IN ANY MODE. THE BRAKES ARE RELEASED, DUE TO OUTWARD POSITIONING OF THE TENSION ARMS, IF EITHER NORMALLY OPEN MICROSWITCH IS CLOSED THEREBY APPLYING POWER TO THE BRAKE SOLENOIDS.

On the supply reel side of the tape transport, the supply idler and erase head assembly performs a dual function as a tape guide and video erase head. The assembly consists of a precisely cast aluminum base on which are mounted the rotary tape guide idler, the erase head, an output transformer, and a cover door -- the whole attached to the tape transport top plate by two mounting screws.

WARNING

HIGH VOLTAGES EXIST ON THE ERASE TRANSFORMER WHEN THE EQUIPMENT IS IN THE RECORD MODE.

DO NOT OPERATE THE EQUIPMENT WITH THE ERASE HEAD COVER ASSEMBLY REMOVED.

The rotary tape guide idler, in conjunction with the stationary guide on the takeup reel side of the tape transport, guides the tape in a vertical plane; and the erase head positions the tape for proper tracking across the video head.

As a tape guiding element this idler is accurately machined so that the tape will fit almost exactly between the flanges. The takeup reel idler acts simply as a radius around which the tape is wrapped in its path to the takeup reel, and as such its tape contacting surface allows the tape a larger vertical clearance. (It would be extremely difficult to guide the tape at more than two points without introducing vibration or skewing in the tape.)

THEORY OF OPERATION

Reproduce (Play)

When tape is properly threaded and the PLAY pushbutton is pressed the capstan motor receives operating power (through the capstan motor drive amplifier and the capstan servo generator) and starts rotating. The capstan idler solenoid is actuated, forcing the capstan idler against the capstan, and the brake solenoids are actuated, releasing the brakes. The takeup and supply motors receive operating power through torque reducing resistors; for a period of 1.5 seconds the takeup motor will be supplied an overvoltage so that it can pick up speed quickly to take up the first stage of tape from the capstan; after that interval it will receive its normal reduced operating voltage. The head blower motor receives operating voltage and supplies cooling air to the video head assembly, and removes any dust or dirt particles that may have accumulated in that assembly. The head drum motor receives operating power through the drum motor drive amplifier and the drum servo control unit.

After a 4 second delay the tape guide solenoid is actuated and moves the guide into the position dictated by the tape guide amplifier.

The reproduce mode can be actuated only when the STOP indicating lamp is lighted, interlocks preventing actuation when the equipment is operating in any other mode.

Record

Relay controlled interlocks prevent the equipment from being placed in the record mode without first being in the reproduce (play) mode. Thus all the actions described above under Reproduce occur (or are occurring) before pressing the RECORD pushbutton will have any effect.

The RECORD pushbutton actuates record relays or solenoids in the modulator, the demodulator, left control panel, capstan signal generator, head channel assembly, the drum servo control unit, the record amplifier driver, the two inch erase head, and the equipment is thus placed in the record mode.

Fast Forward and Rewind

Fast forward or rewind modes can be selected either when the tape is in motion (reproduce or record) or when the tape is not in motion. If tape is in motion when the FAST FWD or REWIND pushbuttons are pressed the equipment drops out of the operational mode previously employed, and it is impossible to select the reproduce or record modes until the STOP pushbutton is pressed.

CAUTION

WHEN OPERATING IN EITHER FAST WINDING FUNCTION, ALWAYS WAIT FOR TAPE MOTION TO STOP COMPLETELY BEFORE PRESSING THE PLAY PUSHBUTTON, TO AVOID BREAKING OR STRETCHING THE TAPE.

Under these circumstances, the capstan motor will stop and the capstan idler will move away from the capstan, thus the capstan is removed as a tape speed determining element. The head drum motor will not stop, but the tape guide will move to its de-energized position, removing the tape from close contact with the video heads. From this point the action, in entering the fast winding mode with tape either in motion or not in motion, is the same.

The brake solenoids are actuated through the fast forward or rewind circuits, releasing the brakes. Power to the takeup and supply motors is controlled by the fast forward or rewind circuits. In the fast forward mode all resistance is removed from the takeup motor circuit and this motor operates at full torque, simultaneously a variable resistor is placed in series with the supply motor. The greater torque of the takeup motor overcomes the holdback torque of the supply motor and tape is pulled from the supply reel to the takeup reel. In the rewind mode the action is reversed -- now the supply motor operates at full torque and the same variable resistor is placed in series with the takeup motor. The greater torque of the supply motor pulls the tape from the takeup reel to the supply reel.

The circuit is so designed that the fast forward and rewind modes can be actuated alternately without stopping the tape; but the STOP button must be pressed before the equipment can be placed in either the reproduce or record modes.

Stopping

Contacts of the stop relay are in series with the play, record, fast forward, and rewind relays, and the momentary actuation of the stop relay when the stop button is pressed will de-energize all these circuits.

Brake operation in the stop function, as previously mentioned, is such that braking force on the trailing turntable must always exceed the force on the leading turntable to ensure maintenance of proper tape tension as tape motion is stopped.

When the brake solenoids are de-energized, the brakes are applied. The amount of braking force acting on the turntable is now determined by the rotational direction of the brake drum (mounted on the motor shaft) in conjunction with the braking springs in the brake system. In one direction of rotation (clockwise for the takeup and counterclockwise for the supply when viewed from the turntable end of the motor shaft) the braking force is greater than

in the other direction. This is caused by the frictional coefficient between the brake band and drum tending in one instance to wrap the band more tightly around the drum and in the other instance to oppose this action. The greater braking force is always applied to the trailing turntable.

The limit for the greater braking force is determined by two springs which load one end of the brake band to the motor frame. When the braking force tries to exceed a pre-set, adjustable limit, the spring action holds it at the predetermined value (in this case 7-1/2 pounds). The smaller braking force (referred to as "drag") is determined by a spring which is connected from one end of the brake lever to the motor frame. This drag is also adjustable and is set on this equipment for 24 ounces. Thus the brake differential is 5 to 1.

Control Circuit

The tape transport control circuit relays are contained in the control relay panel and will be discussed in the section dealing with that component.

HEAD ASSEMBLIES

Five functionally different types of heads are located on the tape transport top plate: the video heads, the 2-inch video erase head, the control track head the audio heads and the cueing heads.

Video Head Assembly

The video head assembly is a plug-in unit incorporating the head drum, drum motor, tape guide, brushes, and the control track head. All video head assemblies are interchangeable on a machine-to-machine or tape-to-tape basis. Ampex has instituted a video head replacement program in which damaged or worn assemblies are exchanged for new or renovated units on a nominal fee basis. The assembly is secured to the tape transport by three shoulder screws.

Photoelectric Cell

At the rear of the motor mounting bracket a photoelectric cell (bottom hole) and an exciter lamp are so focused, in relation to a timing ring turning on the motor shaft, that square wave signals are produced at the 240 rps frequency of shaft rotation. These signals are used in conjunction with motor speed regulation and timing circuits in the system.

Drum Motor and Drum

The drum motor is a 3-phase, 240 cycle, 115 volt, hysteresis synchronous motor drawing approximately 50 watts of power, the normal starting torque of which is from 3 to 4 ounce-inches. The head drum, on the motor shaft, is a high precision device, the run-out and wobble of which is held to a minimum.

Video Heads

Identically constructed, the four magnetic heads present a 25 microhenry inductance at approximately 100 kc. This inductance, combined with stray capacitance, causes head resonance at approximately 6.3 megacycles in the reproduce mode, and about 9 megacycles in the record mode.

Brushes

Signal connections are made to each video head through a pair of graphite brushes which ride on a silver slip ring. A common ground lead is connected to a 5th slip ring. Periodic replacement of these graphite brushes will be necessary when they shorten and no longer contact the slip rings.

Tape Guide

The purpose of the concave female tape guide is to form the tape into an arc which has approximately the same radius as the drum, to ensure good head-to-tape contact. Slots located on either side of the wide center groove are connected to the vacuum pump. The vacuum delivered to these slots holds the tape evenly against the concave surface of the guide. The guide is moved inward during the play and record modes so that the tape contacts the heads. During all other modes of operation the tape is held away from the heads.

Slots, located on either side of the wide center groove, are connected to the vacuum pump, holding the tape evenly against the concave surface of the guide. A cleat at the lower end of the concave surface provides a guide for the lower edge of the tape.

Installing a New Video Head Assembly

Step 1: Remove the three screws that hold the used head assembly to the tape transport. Lift the head assembly free of the tape transport.

Step 2: Place the white arrow head on the TIP PROJECTION control knob at the left control panel against the red arrow head.

Step 3: Carefully wipe clean the tape transport surface that contacts the head assembly.

Step 4: Place the new assembly in position, pressing down firmly so that the Blue Ribbon connectors made proper contact, and insert the three shoulder screws, tightening them until they are snug.

Adjusting The Video Head

NOTE

Always degauss the video head before running the alignment tape.

Photoelectric Cell

Step 1: Actuate the head override switch so the video head will rotate.

Step 2: Check the photoelectric cell lamp voltage across pins 4 and 5 of the connector at the right rear of the head assembly. If necessary, adjust R30001, exciter lamp cell voltage adjustment, (on the right hand side of the head channel assembly housing mounted beneath the tape transport) to achieve between 1.2 and 1.8 volt dc voltage maximum. Measure the signal output of the photoelectric cell, making certain it is at least 6 volts. Exciter lamp longevity will be greater the lower the setting of R30001.

Step 3: Proceed to the drum servo control unit and insert the oscilloscope test probe in P.E.C. IN TP65004, checking for a clean square wave approximately 1.1 volts peak-to-peak in amplitude.

Step 4: If necessary increase the setting of R30001 to achieve the waveform in Step 3, however never make the photoelectric cell lamp voltage exceed 1.8 volts dc; if the clean square wave within the voltage limits is unobtainable, replace the photoelectric cell or the lamp.

Video Head And Guide

Three basic picture defects are a function of mechanical misalignment of the head assembly:

(1) Horizontal time displacement errors, skewing, the venetian blind effect, occurs during the recording process differs from the stretching that occurs during the reproducing process. To equalize the amount of tape stretch and thus eliminate this error it is necessary only to move the tape guide toward

or away from the head assembly. During the original alignment process using this tape it is recommended that the TIP PROJECTION control be set to the red arrow head and the guide position then adjusted with the Allen head screw in the tape guide actuating arm.

(2) Scalloping is caused by a non-linear timing error which results when the guide is at a different height during reproduction than it was during recording. To eliminate this effect, adjust the height of the tape guide.

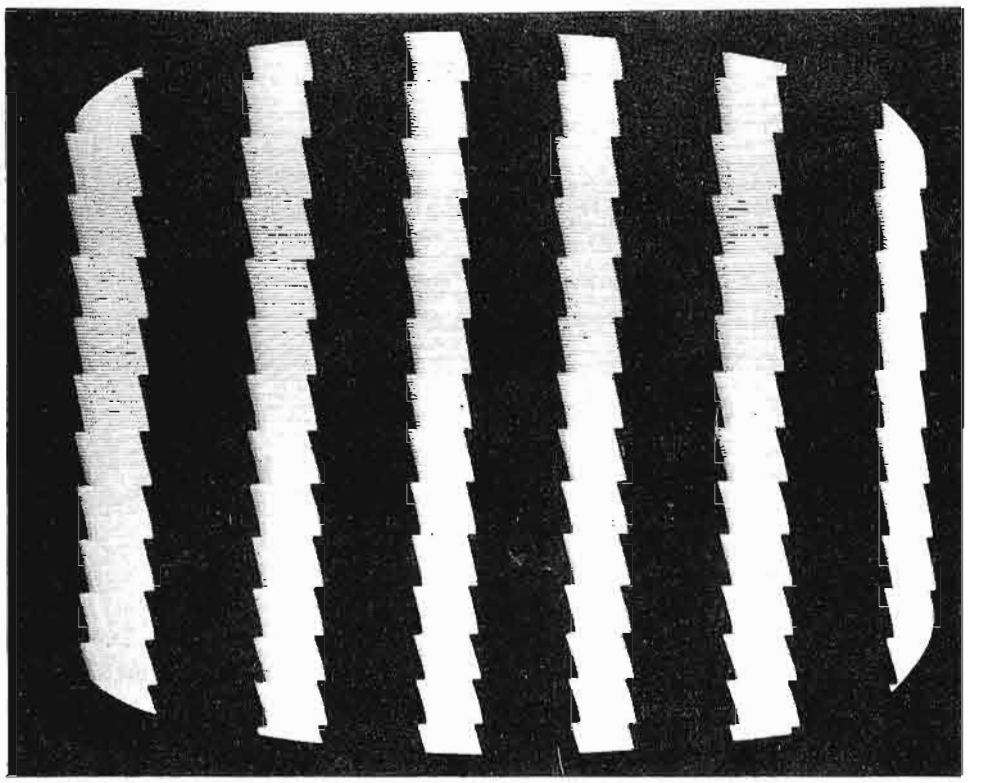
Combinations of (1) and (2) also can occur, in which case adjust both the position and height of the guide.

(3) Horizontal time displacement errors of complete bands are caused by relative departures from standard 90° (quadrature) spacing of the video heads on the drum, between the head used for recording and that used for reproduction. This setting is precisely established as an Ampex manufacturing procedure. Realignment occasionally may be necessary, if so, the following procedure should be followed:

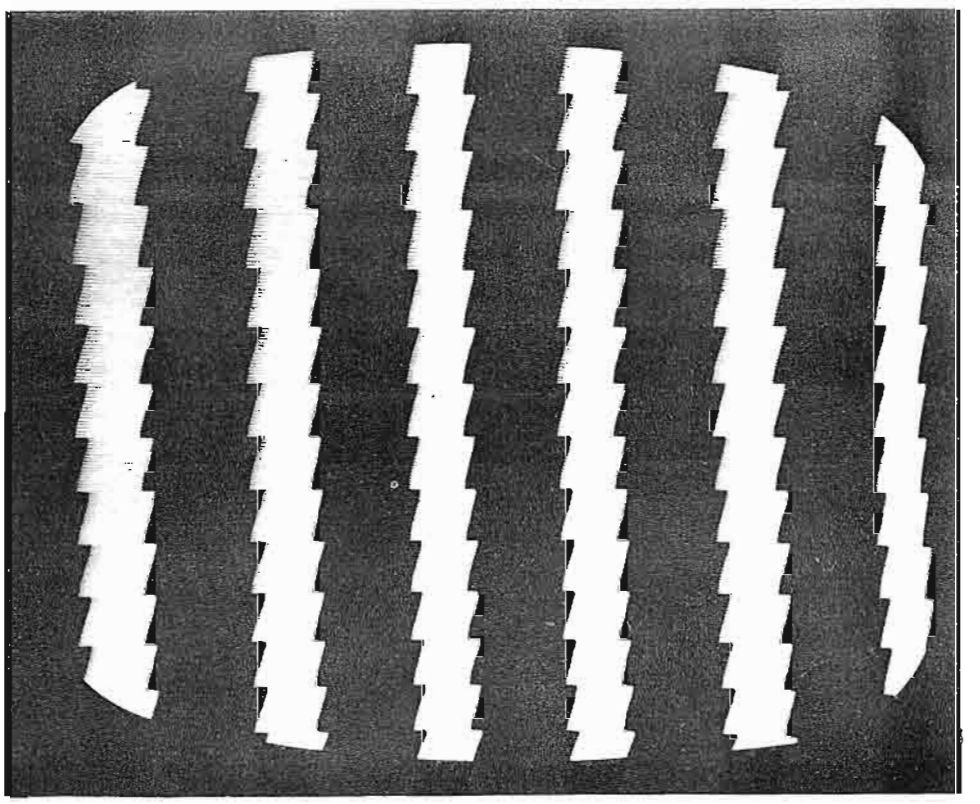
Step 1: Reproduce the test pattern recorded on the alignment tape and identify channel 1 by reducing the setting of its gain control on the switcher unit. Outputs appear in the picture in a 1, 4, 2, 3 order -- that is, channel 4 is directly below channel 1, channel 2 is directly below channel 4, etc.

Step 2: Observe the relative position of the four bands of information as they appear horizontally on the picture, and choose a band which occupies a mean position, and thereafter, use that band as a reference. Assume here that channel 3 is a reference. In respect to channel 3, channels 1 and 2 are early -- that is, they are displaced to the left on the monitor -- and channel 4 is late -- displaced to the right on the monitor.

Step 3: The angular position of any head can be changed by adjusting the tapered Allen head screws (see illustration adjustment points, screw 3 typical). To advance a head it must be moved in the direction of the head drum rotation; conversely to retard a head it must be moved opposite to the direction of rotation. To advance a head (in the example, channel 4 head) first loosen the tapered screw leading the head to be advanced, and then tighten the tapered screw following the head. (This merely shifts the quadrant which contains the head in the direction of head drum rotation.) To retard a head (in the example, channels 1 and 2) first loosen the screw following the head and then tighten the screw leading the head. Make these adjustments in small increments (not more than 1/8 turn of the adjusting screws, checking with the alignment tape after each adjustment. The head corresponding to a given channel can be identified by marks scribed on the bakelite hub of the slip-ring assembly just forward of the terminals where the head leads are connected.



GUIDE TOO CLOSE TO HEAD



GUIDE TOO FAR FROM HEAD

Prior to making a recording, thread the alignment tape on the equipment and make the following adjustments and checks:

Step 1: Place the automatic compensation sensor circuit in the manual mode.

Step 2: Set the TIP PROJECTION control to the red arrow head.

Step 3: If necessary, adjust the Allen head screw in the tape guide actuating arm to eliminate skewing (see illustration, screw 1). Any adjustments necessary during subsequent operating periods now can be made with the TIP PROJECTION control.

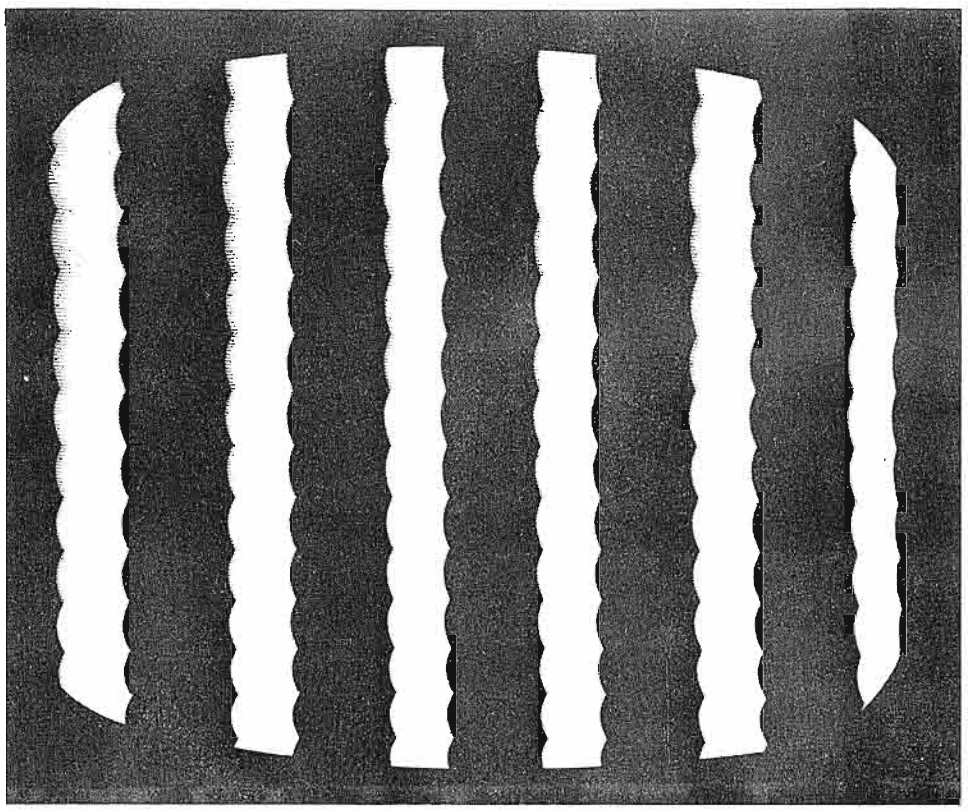
Step 4: If necessary, adjust the height of the guide to eliminate scalloping by inserting a long bandied Allen wrench in the screw at the rear of the assembly (see illustration, screw 2). Insert this wrench before putting the head in motion to prevent head damage. The adjustment is quite critical; a small fraction of a turn is usually all that is required to achieve proper guide height.

NOTE

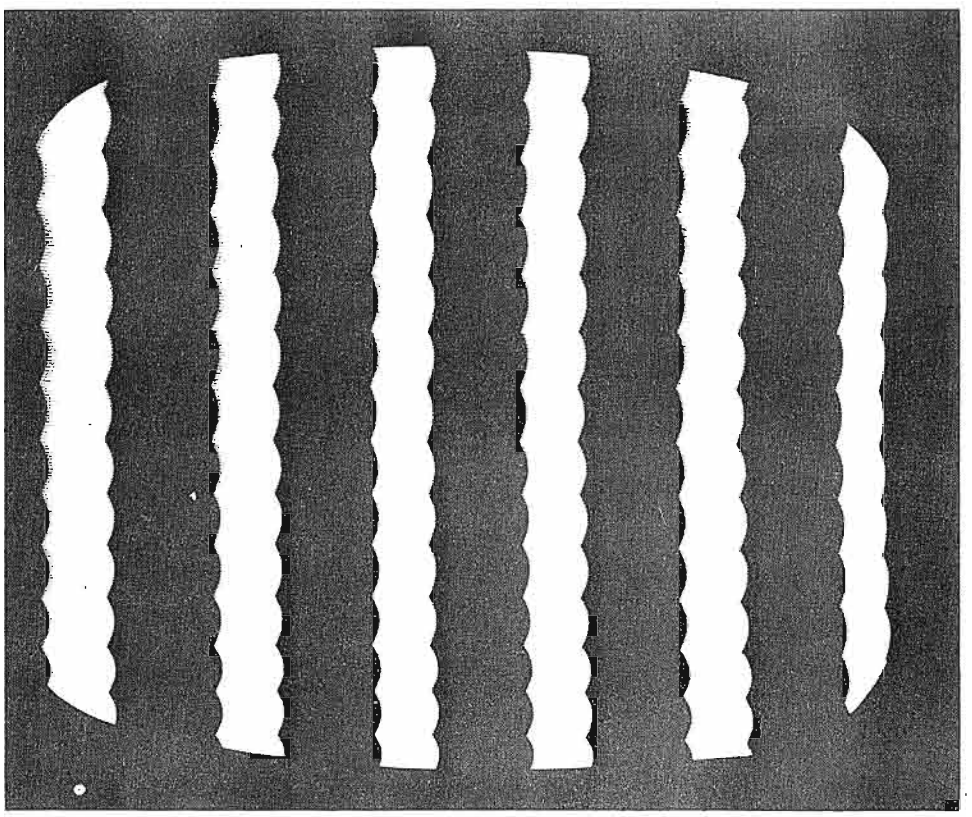
The adjustments in Steps 3 and 4 are interacting and readjustments may be necessary to achieve the final adjustment.

Step 5: Observe the picture to determine that the 90° alignment of the heads is satisfactory; if not, proceed with the alignment procedure previously described.

With the video head thus adjusted, the time base of any tape recorded on the equipment will be identical to that of the reference tape. Any tape now recorded on the equipment can be reproduced successfully on any other VTR system which has been similarly adjusted. During the record mode the guide will assume the position dictated by the TIP PROJECTION control. During the reproduce mode under automatic control, the guide will be positioned automatically to preserve the time base relationship.



GUIDE TOO HIGH



GUIDE TOO LOW

Parts List

Video Head Assembly -- Ampex Catalog No. 50010-1

Brushes, graphite	14622-1
Grommet, #12 screw size	14485-1
Lamp Assembly, exciter, photoelectric cell	14542-1
Photoelectric Cell Assembly	14543-1

ADJUSTING INDIVIDUAL RECORD LEVELS

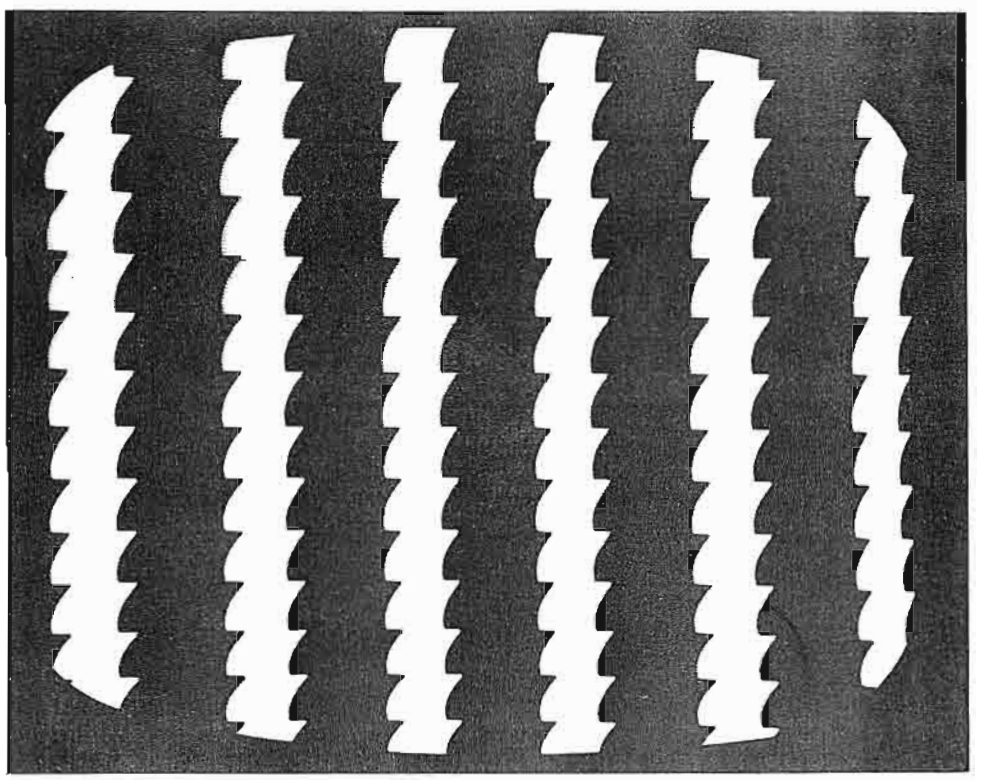
Despite all manufacturing precautions, certain inherent differences are bound to occur among individual heads, and these differences must be resolved if the four video heads are to record and reproduce an integrated picture with the output of one head indistinguishable from any other. It is a comparatively simple operation to achieve this ideal -- by adjusting the reproduce level controls for each channel -- during the reproduce mode if each channel were originally recorded at an optimum level. However, recording at an excessive level (overrecording) or at an insufficient level (underrecording) will both result in effects which cannot be overcome during the reproduce process. The main concern thus, is to adjust the signal during the recording process so that each video track is recorded at an optimum level. As the same head assembly is used during both the record and reproduce modes, the procedure involves a trial-and-error method.

Step 1: Reproduce the video head reference tape, adjusting the heads and the reproduce level controls for an optimum display on the monitor.

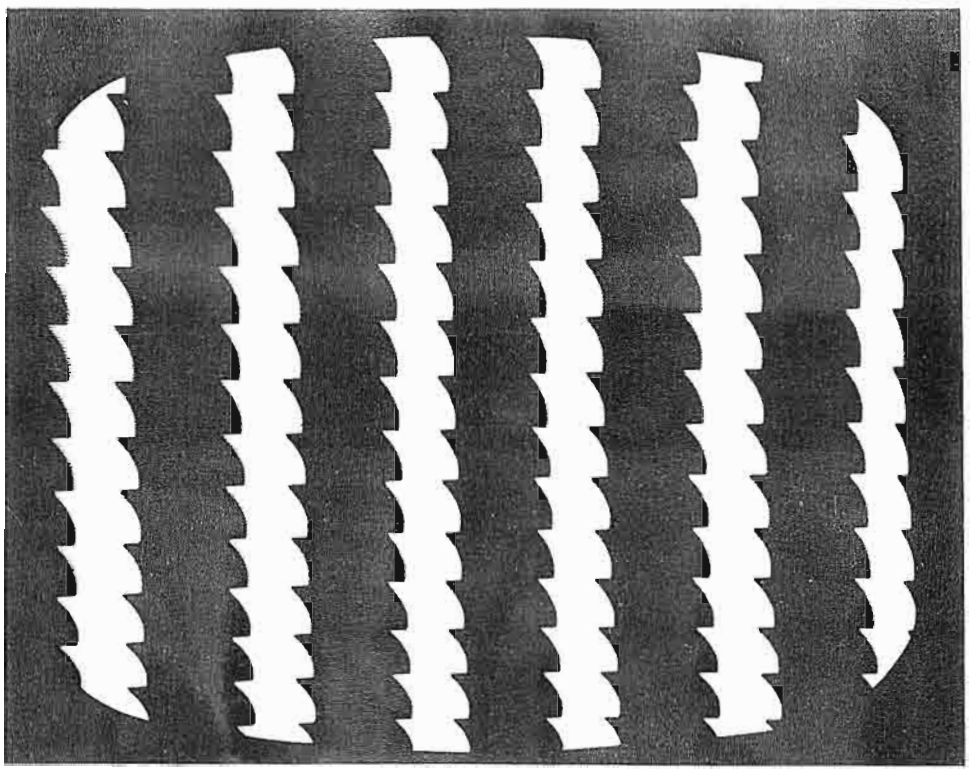
Step 2: Remove the reference tape and install a freshly erased reel of tape on the tape transport. Connect a microphone to the system.

Step 3: Feed a standard test pattern signal to the recorder, place the system in the record mode, and vary the RECORD LEVEL control for each channel, in steps, over its entire range, announcing the channel and each step as it is recorded.

Step 4: Rewind the tape to the beginning of the recording made in Step 3, reproduce the signal, and determine which setting for each channel produced the optimum results.



GUIDE TOO HIGH & TOO FAR FROM HEAD



GUIDE TOO LOW & TOO CLOSE TO HEAD

Step 5: Place each RECORD LEVEL control at the setting indicated in Step 4 and make another recording following the announcement procedure in Step 3, but this time vary the controls only slightly around the original setting. Reproduce this recording and again determine the optimum setting for each control.

Step 6: Re-record and reproduce as necessary to achieve the final, optimum, record level for each channel.

DEMAGNETIZING THE VIDEO HEADS

It will be necessary to demagnetize the video heads occasionally. Need for demagnetization will generally be indicated by an inability to obtain optimum picture quality from individual heads as explained under "Adjusting Individual Record Levels", and/or low head output. The recommended procedure entails the use of an AMPEX Catalog No. 704 demagnetizer with the heads stationary.

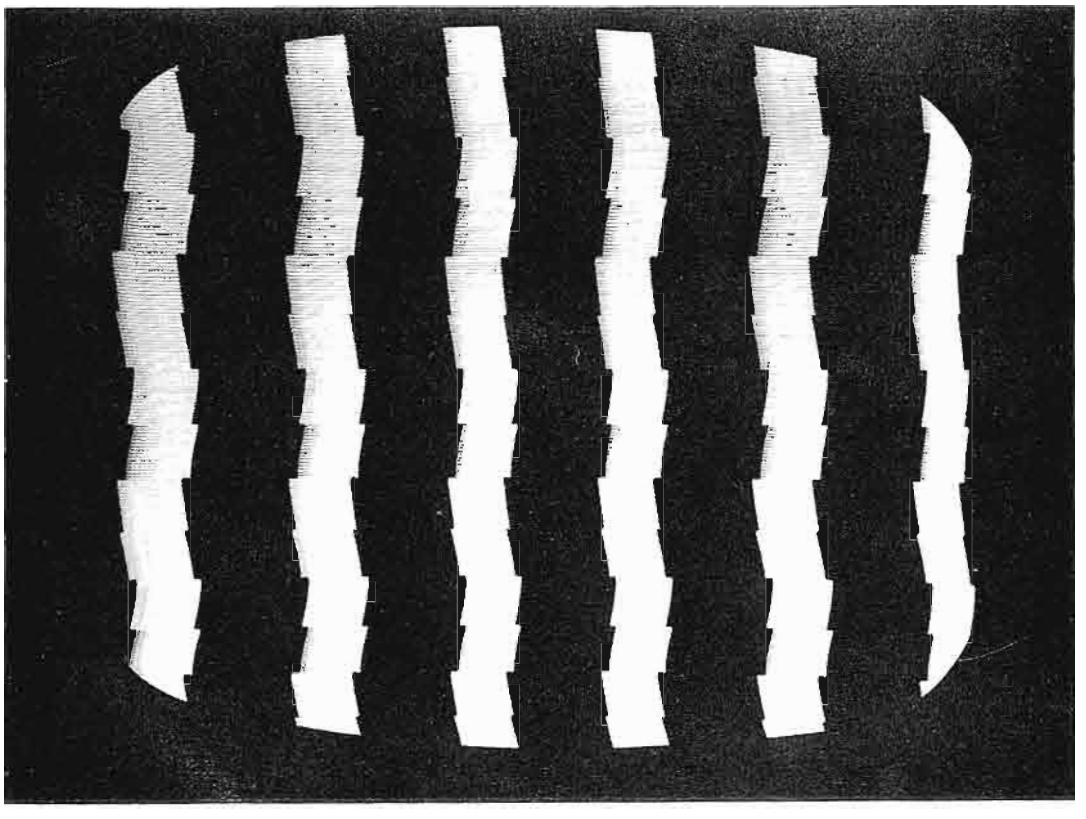
Step 1: Remove any tape threaded on the tape transport, and swing the female guide toward the front of the console, away from the video heads.

Step 2: Plug the demagnetizer into a 60 cycle, 117 volt, ac power source, and slowly bring the demagnetizer tips as close as possible, without touching the head tip in the exposed position at the front of the head drum. Straddle the head tip with the gap in the demagnetizer, and run the demagnetizer up and down over the head tip several times. Then slowly withdraw the demagnetizer.

NOTE

The slow approach and slow withdrawal is necessary to achieve complete demagnetization.

Step 3: Manually rotate the head assembly and repeat Step 2 at each of the four head tips. Unplug the demagnetizer and swing the female guide back into position. Other components on the video head assembly, such as the tape guide and screws in the video head drum, also may become permanently magnetized. If this condition is suspected, the entire assembly from the tape transport perform the demagnetization process using a bulk degausser (such as an Ampex Model III) following the recommended procedures.



QUADRATURE MISALIGNMENT

Video Erase Head

The 2 inch wide video erase head is housed in an assembly which also contains a rotary guide and the erase transformer. The head consists of a ferrite core and one turn of copper ribbon.

Control Track, Audio, Audio Erase and Cueing Heads

These heads are similar to the familiar assemblies found on professional quality audio recorder/reproducers. No adjustments are required, and maintenance consists only of keeping the heads scrupulously clean and demagnetized.

The control track head is an integral part of the video head assembly, while the erase and audio heads are mounted on two separate stacks on the tape transport, (included in one assembly). Audio Head Assembly, Ampex Catalog No. 14383-1.

VACUUM SYSTEM

Vacuum Pump

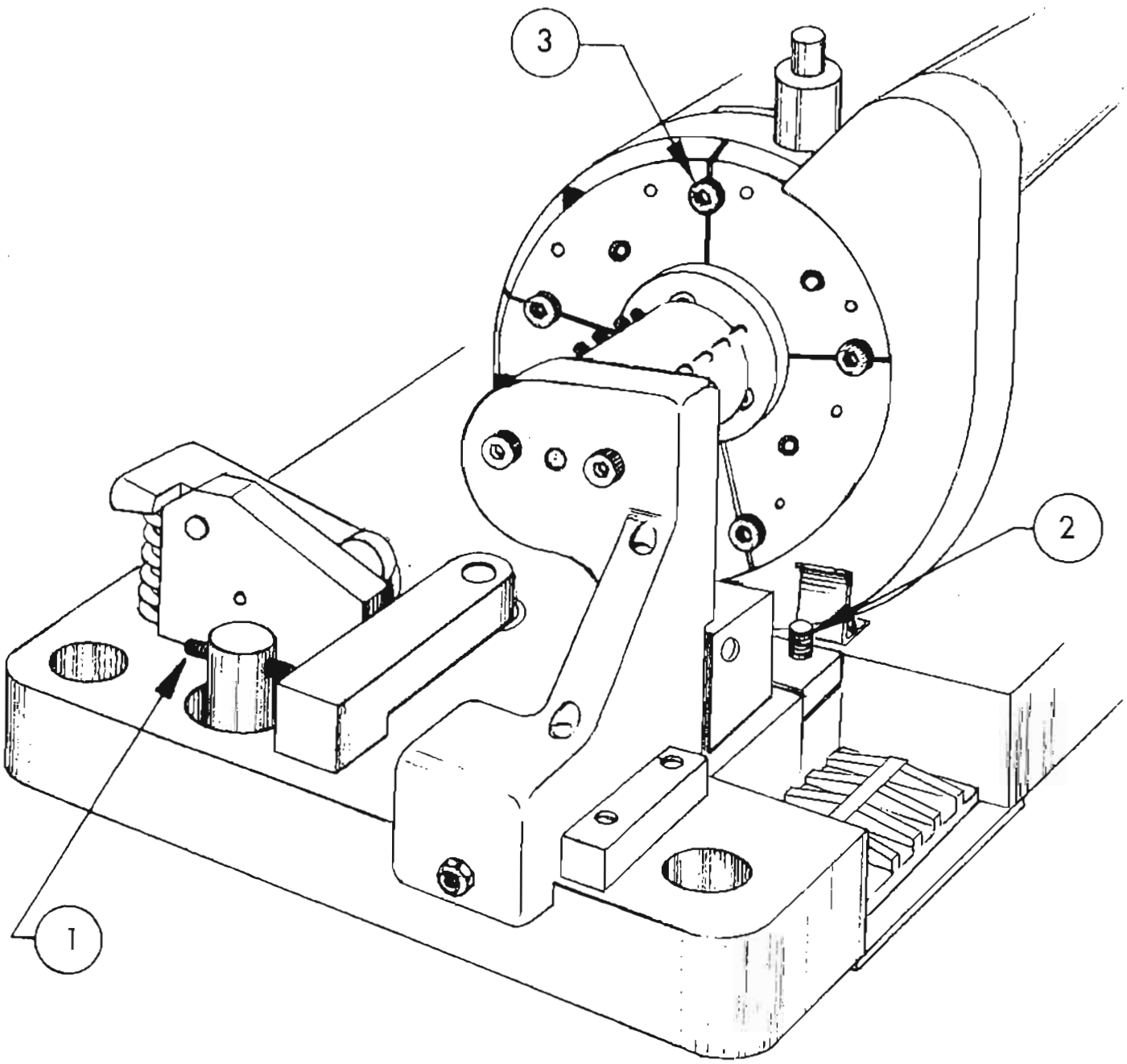
General

The vacuum pump system is used to supply air suction to hold the tape firmly against the concave side of the female tape guide. The suction is applied to the concave side of the guide and permits more uniform head to tape contact when the video heads are being used, and also ensures that the tape does not contact the heads when the equipment is in the stand-by mode (female guide pulled away from the head drum assembly). The developed vacuum equals approximately 40 inches of water; the vacuum gauge on the left hand meter panel indicates the amount developed.

The pump is located on the floor of the console between the head fan assembly and the console blower assembly.

Adjustment

Adjustment of the vacuum pump has been made at the factory, and no further adjustments should be required. If the vacuum gauge fails to read within the red markings on the face of the dial, check for cleanliness of the four air filters, cracked jars, poor gaskets or poor seating of jars, clogged lines, etc. If the gauge cannot be brought to a correct reading by these means, adjust the vacuum by turning the knurled nut on the vacuum control assembly (this nut is under the glass jar which extends upward from the pump assembly).



ADJUSTMENT POINTS

Power to the vacuum pump is supplied through a separate circuit breaker on the console termination assembly at the right end of the console. Because this circuit breaker is normally left in its ON position, the vacuum pump will operate whenever the main power switch is activated.

Maintenance

No lubrication of the vacuum pump is necessary.

Clean the glass jars and the four filters at regular intervals as indicated in the SYSTEM CHECKOUT AND ADJUSTMENTS Section of this manual. Any good solvent may be used for this cleaning.

If the vacuum drops below the limits indicated on the vacuum gauge, check the glass jars for cracks, poor seating, or poor gaskets.

Head Fan Assembly

The head fan assembly provides the video head drum assembly with a vacuum cleaner action to clean out loose oxide particles and provide cooling air for the drum motor. The assembly is located on the floor of the console to the left of the vacuum pump. Proper operation of the fan is indicated by the BLOWER indicator on the left hand control panel, which should be lighted whenever the video head is rotating.

CAUTION

MAINTAIN ADEQUATE HEAD BLOWER AIR SUPPLY AT ALL TIMES OR DAMAGE TO THE HEAD MOTOR WILL RESULT.

Power for the head fan assembly is applied through a separate circuit breaker on the console termination assembly and then through the contacts of the head motor relay. Thus the fan will operate only when power is applied to the head motor.

Maintenance

Maintenance of this assembly consists only of replacing the air filters at regular intervals as indicated in the SYSTEM CHECKOUT AND ADJUSTMENTS section of this manual.

The BLOWER indicator on the left hand control panel indicates sufficient air flow. If this indicator fails to light, (and the push-to-test feature indicates the lamp is not burned out), an insufficient air stream exists, and the air filters should be replaced immediately.

Console Fan Assembly

The console fan assembly operates as a low pressure air conditioning system, supplying cool air to the electronic assemblies and units inside the console. Filtered air if blown into the plenum chamber formed by the upper and lower sections of the console floor, and this air is discharged through four slotted sections of the chamber into the console. Only the head channel assembly receives this forced air through a hose arrangement directed into its chassis. For optimum efficient operation of the blower system, all console doors must be kept closed.

Power is applied to the blower through a separate circuit breaker on the console termination board. This circuit breaker will normally be left in its ON position and the blower will operate whenever the main power switch is actuated.

Maintenance

The motors require only a few drops of oil annually. The air filter should be cleaned at regular intervals as indicated in the SYSTEM CHECKOUT AND ADJUSTMENTS section of this manual.

MEASUREMENTS AND ADJUSTMENTS

All adjustments have been made and carefully checked at the factory before the equipment is shipped, and it normally will not be necessary to follow these procedures. However, as components wear in, or are replaced, it is advisable to check the tape tensions and braking force to ensure that they remain within tolerances.

Equipment required for measurements is as follows:

a. Three scales are furnished with the equipment:
   1. 0-2 lbs. Ampex Catalog Number 650-103
   2. 0-4 lbs. Ampex Catalog Number 650-104
   3. 0-10 lbs. Ampex Catalog Number 650-105

b. Length of cord approximately 4-feet long with loop at 1 end and a large knot at the other.

c. Length of 2-inch magnetic tape approximately 3-feet long.

d. Jumper wire approximately 12 inches long.

Tape Tension Measurement and Adjustment

Momentary Boost Torque

Step 1: Pull the supply tape tension arm toward the outside of the tape transport until it clears the safety switch. Hold it in that position by some means such as pressure sensitive tape.

Step 2: Use a jumper wire to short out resistor R003. This resistor is located, with the other resistors used in this adjustment procedure, at the back of the control relay panel mounted at the right rear of the console. It is accessible when the rack containing the control relay panel is swung out from the console.

Step 3: Turn on power to the equipment.

Step 4: Anchor one end of the cord to the takeup reel hub by slipping the knot under the reel spring, slipping it up so it is held between the spring and the hub, and taking several turns around the hub in a clockwise direction.

Step 5: Attach the loop at the free end of the cord to the 4 lb. scale and hold the scale so that the spring is taut between the scale and the reel hub.

Step 6: Press the PLAY button. The takeup turntable will attempt to turn. Allow the scale to slowly follow the string as it is wound on the reel hub, taking the reading with the scale in steady motion. Press the STOP pushbutton after taking the reading.

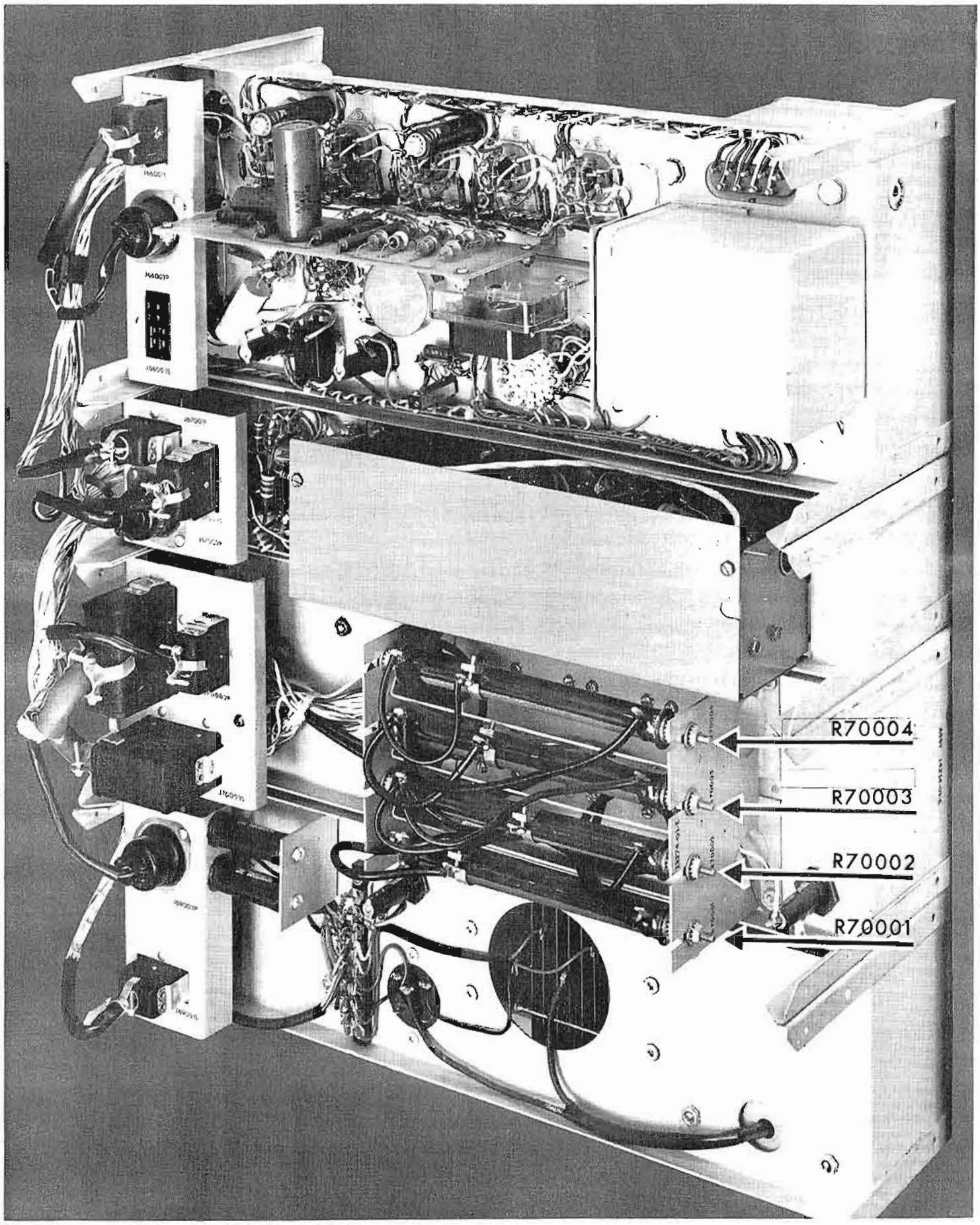
Step 7: The scale should indicate 56-58 ounces. It is recommended that the measurement in Step 6 be performed several times to minimize the possibility of an erroneous reading. If the above scale reading is not obtained, proceed to Step 8.

Step 8: The adjusting resistor for the momentary boost torque is R002, also located on the rear of the control relay panel. Increasing the resistance in the circuit decreases the torque of the motor. Adjust the slider arm on the resistor until the proper scale indication is achieved.

Step 9: Remove the jumper wire installed across R003 in Step 2.

Normal Takeup Torque

Step 1: Using the 2 lb. scale, repeat Steps 1, 3, 4, 5, and 6 (not Step 2) under Momentary Boost Torque.



TAPE TENSION ADJUSTMENT POINTS

Step 2: The scale should indicate 18-19 ounces. Make the measurement several times to ensure that an erroneous indication is not obtained. If the correct scale indication is not obtained, proceed to Step 3.

Step 3: The adjusting resistor for the normal takeup torque is R003. Increasing the resistance decreases the torque of the motor. Adjust the slider arm on the resistor until the proper scale indication is achieved.

Fast Forward and Rewind Holdback Torque

Step 1: Repeat Steps 1, 3, and 4 (not Step 2) under Momentary Boost Torque.

Step 2: Attach the loop at the free end of the cord to the 2 lb. scale, and hold the scale so the cord is taut between the scale and the takeup reel hub.

Step 3: Press the REWIND pushbutton. Allow the scale to slowly follow the string as it is wound on the reel hub, taking the reading while the scale is in steady motion. Press the STOP pushbutton after taking the reading.

Step 4: The scale indication should be 8-9 ounces. Make the measurement several times to ensure a correct reading. If the quoted scale indication is not obtained, proceed to Step 5.

Step 5: The adjusting resistor for fast winding torque is R001. Increasing the resistance decreases the motor torque. Adjust the sliding arm on the resistor until the correct scale indication is achieved.

NOTE

Resistor R001 adjusts the torque of both the supply (fast forward mode) and the takeup (rewind mode) motors for the fast winding operations. It is switched back and forth between the motors depending on the fast winding mode being utilized.

Normal Holdback Torque

Step 1: Hold the supply takeup tension arm in a position so that it clears the safety switch.

Step 2: Turn on power to the equipment.

Step 3: Anchor one end of the cord to the supply reel hub by slipping the knot between the reel spring and the hub, sliding it up so it is held between the spring and the hub, and taking several turns around the hub in a counterclockwise direction.

Step 4: Attach the loop at the free end of the cord to the 2 lb. scale and hold the scale so that the spring is taut between the scale and the reel hub.

Step 5: Press the PLAY pushbutton. Allow the spring to slowly follow the string as it is wound on the reel hub, taking the reading while the scale is in steady motion. Press the STOP pushbutton after taking the reading.

Step 6: The scale should indicate 8-9 ounces. Make the measurement several times to ensure that an erroneous indication is not obtained. If the quoted scale indication is not obtained, proceed to Step 7.

Step 7: The adjusting resistor for normal holdback torque is R004. Increasing the resistance decreases supply motor torque. Adjust the slider arm on the resistor until the correct scale indication is achieved.

Brakes

NOTE

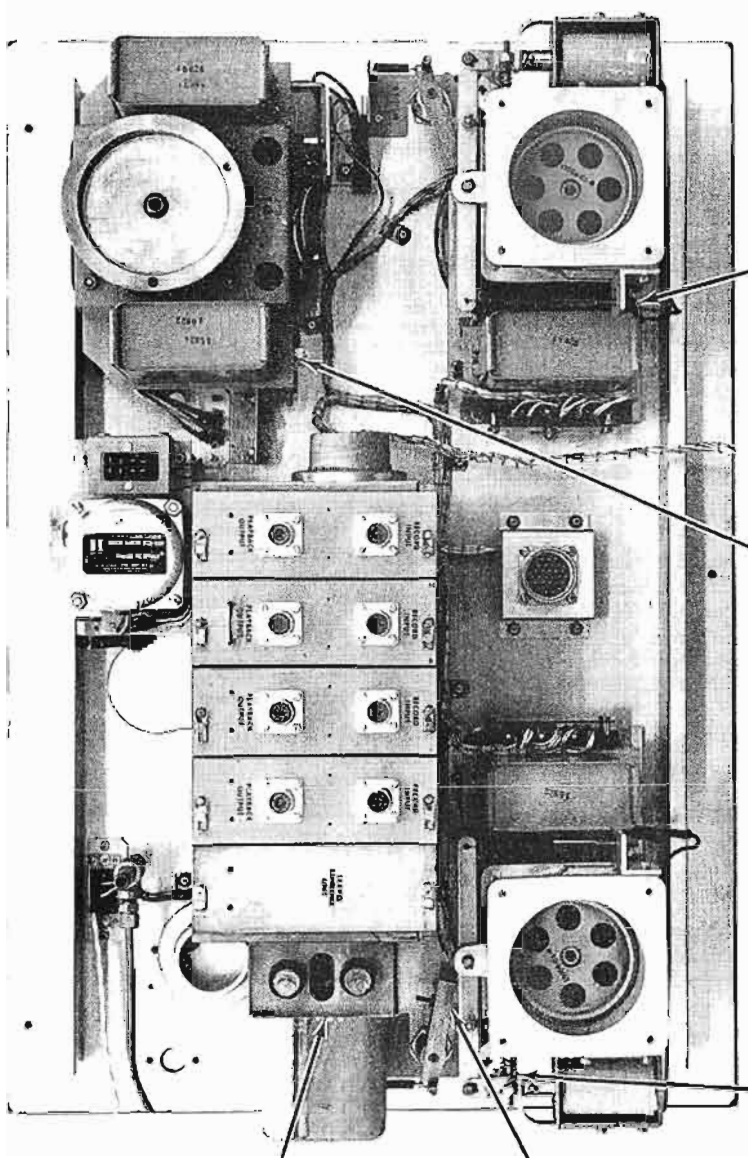
The brakes are applied when the brake solenoids are de-energized, therefore no power is needed when making these measurements and adjustments.

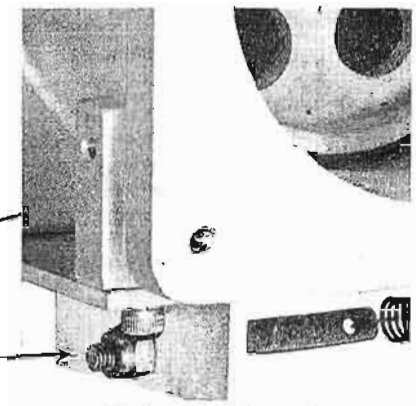
Step 1: Anchor the cord to the supply reel by slipping the knot between the reel spring and hub, then sliding it up until it is held between the spring and the hub. Wrap almost the entire length of cord around the hub in a clockwise direction.

Step 2: Attach the loop at the free end of the cord to the 4 lb. scale.

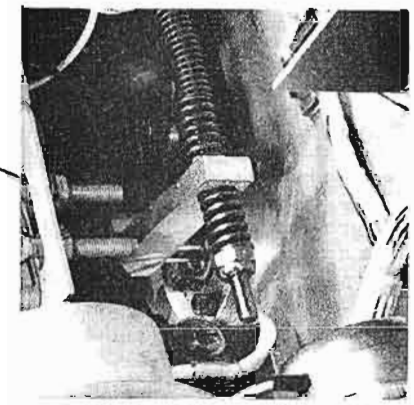
Step 3: Use the scale to pull the cord from the hub (the turntable will rotate in a clockwise direction) taking the reading while the scale is in steady motion.

Step 4: The scale indication should be 24 ounces (± 1 ounce). Make the measurements several times to ensure that an erroneous indication is not obtained. If the quoted scale indication is not obtained proceed to Step 5. If it is obtained proceed to Step 6.

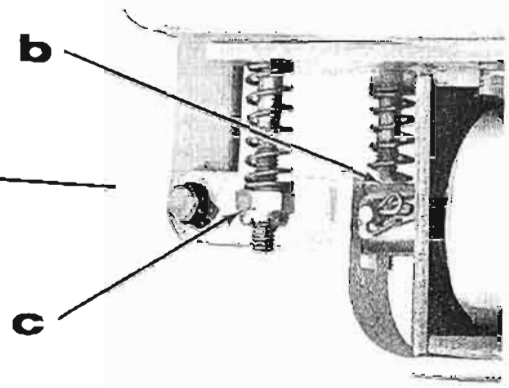




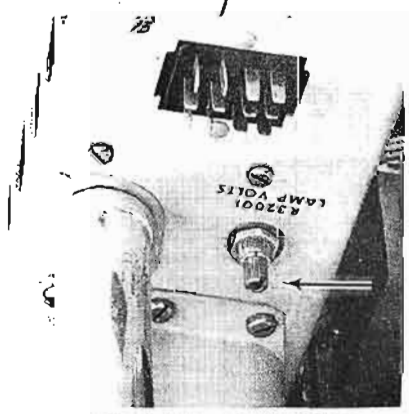
BRAKE ADJUSTMENT



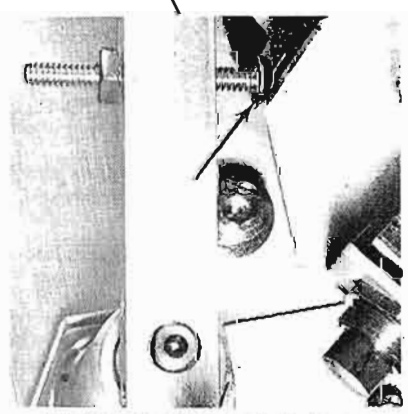
CAPSTAN IDLER ADJUSTMENT



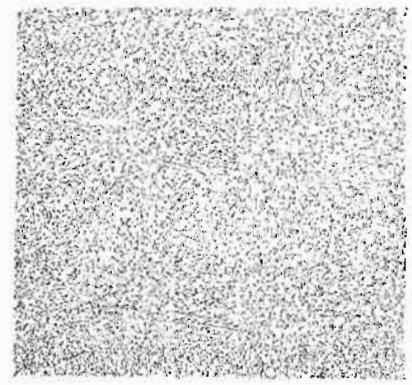
BRAKE ADJUSTMENT



EXCITER LAMP ADJUSTMENT



SAFETY SWITCH ADJUSTMENT



TAPE TRANSPORT ADJUSTMENT POINTS

Step 5: The brake adjustment for this direction of rotation is at point A on the brake adjustment illustration. Running the self-locking nut down increases the brake drag. Adjust the nut until the quoted indication is achieved.

Step 6: Now wrap the cord around the supply reel in a counterclockwise direction.

Step 7: Attach the loop at the free end of the cord to the 10 pound scale.

Step 8: Use the scale to pull the cord from the supply reel hub (the turntable will rotate in a counterclockwise direction), taking the reading with the spring in steady motion.

Step 9: The indication should be 5 times that achieved in Step 4 (± 3 ounces). If that reading were 24 ounces, this one should be 7-1/2 pounds (± 3 ounces); if it were 23 ounces this reading should be 7 pounds 3 ounces (± 3 ounces); if it were 25 ounces this reading should be 7 pounds 13 ounces (± 3 ounces). Make the measurement several times to ensure that an erroneous reading it not obtained. If the quoted indication is not obtained proceed to Step 10.

Step 10: The adjustments for this direction of rotation are at points A and B on the brake adjustment illustration. Running the two hex nuts down increases the braking force. Adjust these nuts until the quoted indication is achieved. Both nuts must be adjusted so that the loading on the two springs is equal.

NOTE

A scale reading that varies as the measurement is made (with the scale in steady motion) is an indication that the two springs are not under the same tension, and it will be necessary to adjust the hex nuts until a steady reading is attained.

Step 11: Repeat the entire procedure at the takeup turntable. Note that the scale indications will be reversed at this turntable with the lighter brake drag acting when the turntable is rotating counterclockwise and the heavier braking force acting when the turntable is rotating clockwise.

Capstan Idler Pressure

Step 1: Tape the supply tape tension arm in a position so that it clears the safety switch.

Step 2: Fold approximately 2-inches of the length of magnetic tape back over itself and punch holes through the 2 layers of tape large enough to accommodate the hook on the 4 lb. scale. Insert the scale hook through the holes.

Step 3: Thread the tape between the capstan and the capstan idler, with the oxide coated side of the tape next to the idler.

Step 4: Disconnect power to the capstan motor by placing switch S60002 on the capstan motor drive amplifier (Rack 2) in its OFF position.

NOTE

Steps 5, 6, and 7 require two operators.

Step 5: Open the rear access door to the console, swing the equipment rack out, and have the helper reach in and hold the capstan flywheel so it cannot rotate.

Step 6: Press the PLAY pushbutton. The capstan idler will clamp against the non-rotating capstan.

Step 7: Use the scale to pull the tape between the idler and the capstan, pulling in a line with the stationary tape guide; take the reading with the scale in steady motion. Press the STOP pushbutton after taking the reading. The helper can now release the flywheel.

Step 8: The scale should indicate from 30 to 36 ounces. Take the measurement several times to ensure that an erroneous indication is not obtained. If the quoted reading is not obtained proceed to Step 9.

Step 9: The adjustment of the capstan idler pressure is made at a self-locking nut at the end of the capstan idler solenoid plunger. This nut adjusts the spring tension which determines the idler pressure. Running the nut down (clockwise) increases pressure. Adjust this nut to achieve the quoted scale indication.

CAUTION

TIGHTENING THE LOCKNUT INCREASES CAPSTAN PRESSURE UNTIL A POINT IS REACHED WHERE THE CAPSTAN IDLER SOLENOID WILL NOT BOTTOM, AT WHICH POINT LITTLE OR NO IDLER PRESSURE WILL EXIST. NORMAL SCALE INDICATION SHOULD BE ACHIEVED LONG BEFORE THIS POINT IS REACHED, BUT THIS IS A SENSITIVE ADJUSTMENT WHICH SHOULD BE MADE WITH CARE.

Safety Microswitch Adjustment

Step 1: Inspect the supply takeup tension arm with no tape threaded on the equipment. This arm should be 1/16-inch (± 1/32-inch) away from its stop, which indicates positive actuation of the safety switch. If it is not in this position, proceed to Step 2.

Step 2: The adjustment is at a switch actuating screw on a lever attached to the lower end of the supply takeup tension arm. The head of this screw actuates the microswitch, opening its normally closed contacts, when tape is not threaded. Adjust this screw so that the quoted clearance between the arm and stop is achieved. Running the screw in (clockwise) decreases the clearance.

Brake Release Microswitch

Although two adjustable mounting nuts for positioning the brake release microswitch are available on the equipment, it is unlikely that adjustment ever will be required.

MAINTENANCE

Cleaning

All tape contacting surfaces of the tape transport must be kept scrupulously clean if the high performance standards inherent in the assembly are to be achieved. Follow the cleaning procedures described under Routine Maintenance in the SYSTEM CHECKOUT AND ADJUSTMENTS section of this manual.

Lubrication

No lubrication is required for any tape transport component.

Replacement of Parts

Brake Bands

The brake bands supplied with the equipment have a long life expectancy and should not require replacement except after long usage. They should be replaced only when it is impossible to attain the braking forces quoted under MEASUREMENTS AND ADJUSTMENTS -- Brakes, in this section, or when they exert a noticeable drag on the turntable as the brake solenoid is actuated.

Step 1: Disconnect the fanning strip from terminals 1, 2, 5 and 6 on the torque motor terminal board.

Step 2: Manually support the reel assembly (it is quite heavy), remove the 4 hex socket screws which bolt the reel assembly to the topplate of the tape transport, and remove the reel assembly.

Step 3: Disconnect the solenoid leads at terminals 5 and 6 of the terminal board.

Step 4: Remove the 4 hex socket screws which bolt the brake housing to the motor frame, manually actuate the brake solenoids, and remove the brake housing from the motor.

Step 5: The brake bands are held in position in the housing by 2 clevis pins, which in turn are locked by cotter pins. Remove the old brake band and install the new band.

Step 6: The brake band supplied by the factory should be exactly the correct length, and when installed should be exactly concentric with the inside of the brake housing. Both of these characteristics can be checked easily by manually actuating the brake solenoid and checking that the band fits exactly around the inner diameter of the brake housing. Check this before proceeding, and if this is not the case follow the procedure under Adjusting Brake Band Length before proceeding to Step 7.

Step 7: Manually actuate the brake solenoid, and carefully slip the housing back over the brake drum so that it mates with the mounting holes on the motor flange. Replace the 4 hex socket screws removed in Step 4. Reconnect the brake solenoid leads to terminals 5 and 6 on the terminal board.

Step 8: Manually actuate the brake solenoid by means of the solenoid plunger (do not use the linkage), and rotate the turntable, checking that no noticeable drag is imparted to the turntable by the brake. If a drag is detected, remove the brake housing and follow the procedure outlined under Adjusting Brake Band Length.

Step 9: Before remounting the reel assembly adjust the brakes as described under MEASUREMENTS AND ADJUSTMENTS -- Brakes, If correct adjustment cannot be achieved follow the procedure outlined under Adjusting Brake Band Length.

Step 10: Remount the reel assembly to the topplate, replacing the 4 hex socket screws removed in Step 2.

Step 11: Reconnect the fanning strip to terminals 1, 2, 5 and 6 of the terminal board.

Adjusting Brake Band Length

Step 1: With the brake band mounted in the housing, check the distance that the solenoid plunger (the plunger itself, not the link attached to it by the clevis pin) protrudes from the solenoid housing. It should be 11/16 inch (± 1/32 inch). If not, follow the procedure in Step 2.

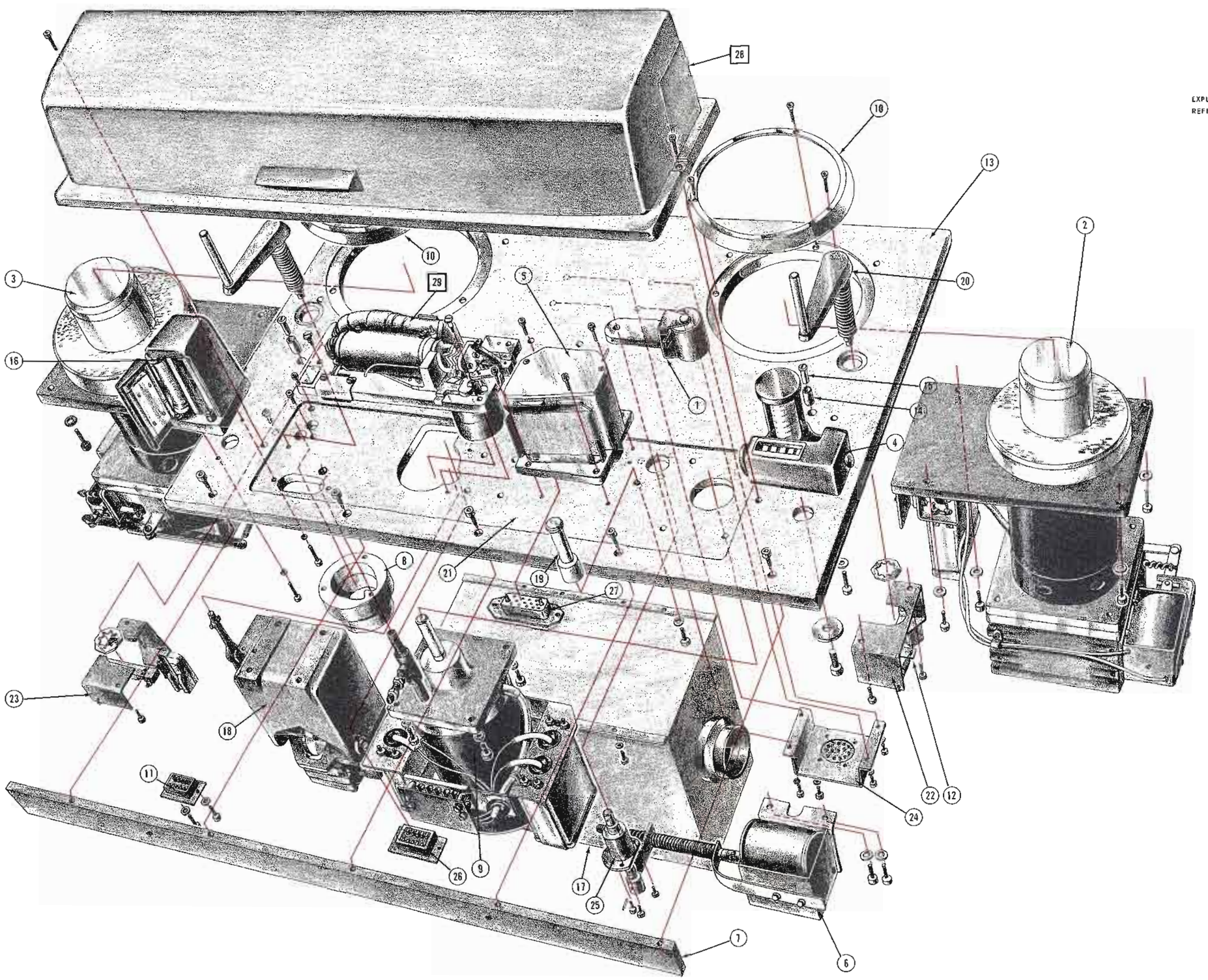
Step 2: One end of the brake band assembly is connected to the brake lever. A loop assembly at this end is held to the brake band by two hex socket head screws which screw into pem nuts. Loosen these screws and adjust the brake band length until the measurement quoted in Step 1 is achieved.

Step 3: Check the distance between the end of the solenoid plunger and the solenoid stop bracket. This should be 3/32-inch (± 1/64 inch). If necessary, loosen the 2 screws which hold the stop bracket to the solenoid housing and position the solenoid stop to achieve the required measurement.

Replacement of Other Assemblies

The removal and installation of other tape transport assemblies should be achieved easily by following the exploded view at the back of this section. DO NOT attempt disassembly beyond the points shown on this exploded view, and always maintain the relation of parts during reassembly.

SEE VOLUME 2 FOR PARTS LIST.



TAPE TRANSPORT ASSEMBLY (CONSOLE)
Ampex Catalog No. 50533-01

EXPLODED VIEW REFERENCE NO.		AMPEX PART NO.
1	CAPSTAN IDLER ARM ASSEMBLY	13860—01
2	TAKEUP REEL ASSEMBLY	13950—01
3	SUPPLY REEL ASSEMBLY	13960—01
4	TAPE TIMER ASSEMBLY	59102—01
5	AUDIO HEAD ASSEMBLY	51170—01
6	CAPSTAN, SOLENOID ASSEMBLY	14388—01
7	BRACE	14483—01
8	ADAPTER, HEAD BLOWER LINE	14503-01
9	CAPSTAN MOTOR ASSEMBLY	14650—01
10	REEL GUARD	50002—01
11	PLUG ASSEMBLY	50073—01
12	LEVER—SPRING	50076—01
13	OVERLAY—TOPPLATE	50096—01
14	SLEEVE—BUMPER	50115—01
15	STOP—TENSION ARM	50116—01
16	SUPPLY IDLER & ERASE HEAD ASSEMBLY	50530—01
17	HEAD CHANNEL ASSEMBLY	50531—01
18	AUTOMATIC COMPENSATOR ASSEMBLY	50670—01
19	GUIDE POST ASSEMBLY	50722—01
20	TAPE TENSION ARM ASSEMBLY	51060—01
21	TOPPLATE	51260—01
22	BRACKET, SPRING	51271—01
23	BRACKET, SPRING	51271—02
24	CONNECTOR MOUNTING BRACKET ASSEMBLY	50075—01
25	CAPSTAN IDLER HOUSING ASSEMBLY	13870—01
26	CONNECTOR, FEMALE	146—052
27	PLUG ASSEMBLY	51270—01

ASSOCIATED ASSEMBLIES USED ON TAPE TRANSPORT

28	HEAD COVER ASSEMBLY	13873—01
29	VIDEO HEAD ASSEMBLY	50010—01

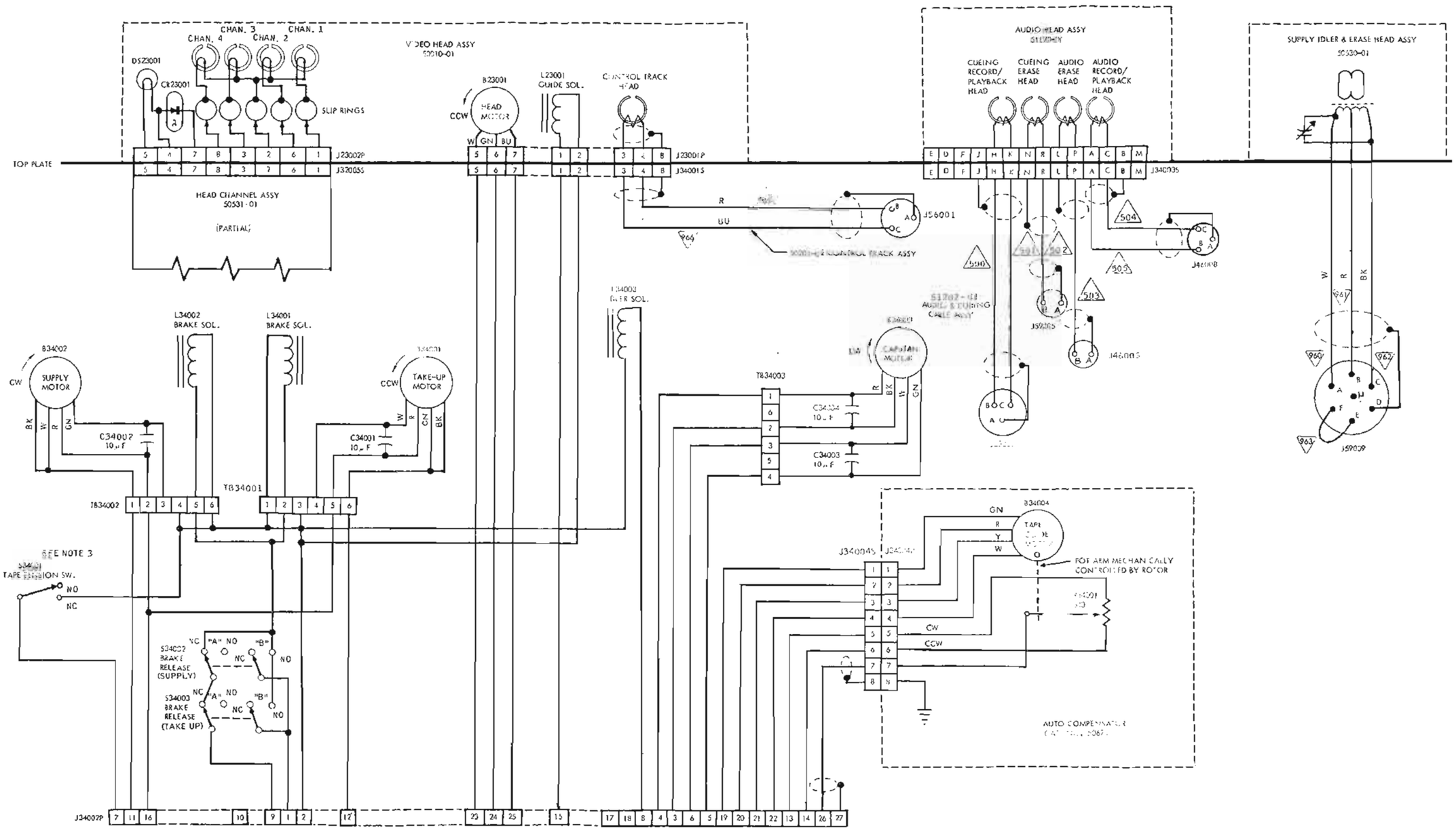
NOTE: See volume 2 for complete parts list.

SCHEMATIC - TAPE TRANSPORT

13314

CAT. NO. 50533

AMPEX CORPORATION



NOTE:
1. FOR SYSTEM NUMBERS SEE WIRE DIAGRAM FOR CAT. NO. 50719 (57025).
2. PERFORMANCE PER A.E.S. 12-287.
3. SWITCH POSITION SHOWN WITHOUT VIDEOTAPE THREADED ON TRANSPORT.

MONOCHROME MODULATOR AND MONOCHROME DEMODULATOR

GENERAL

The video signal frequency modulates a radio frequency signal, and the fm signal then is impressed on the video heads. The modulator produces the fm signal during the recording process, and the demodulator recovers the original video signal by demodulation during the reproducing process.

Two separate units -- the modulator and the demodulator -- are used, both operating in the record mode; only the demodulator operates during the reproduce mode (the modulator operation during the reproduce mode is determined by a relay, the action of which will be described later in this discussion).

Located on Rack 1, the units receive operating power from regulated power supply A, located on Rack 2. Power supply A also supplies the channel switcher.

Vacuum Tube Complement

Type	Qty.		Schematic Ref. No.	
	Modulator	Demodulator	Modulator	Demodulator
5687	4	4	V43002, V43007, V43008, V43009	V62007, V62008, V62009, V62010
6677	2		V43010, V43011	
6CL6/6677*	2		V43005, V43006	
6AW8A	1		V43003	
12AT7	2	1	V43004, V43012	V62012
6AU8		6		V62001, V62002, V62004, V62005, V62006
6AL5	1		V43001	
6CB6		1		V62011
12AU7		1		V62013

* Selected tube Ampex Catalog No. 50899-01.

THEORY OF OPERATION

Modulator, Monochrome

The composite video signal enters the modulator unit at J43003S, where it is terminated in 75 ohms. Four stages of video amplification are provided by V43012b, V43012a, V43011a, and V43010. All four stages are overcompensated so that an increase in gain of at least 10 db is obtained in the vicinity of 5 megacycles (over that at 0.5 megacycle). This increased gain compensates for an opposite characteristic inherent in the modulation process and in the demodulator circuit. The video gain control, R43003 INPUT LEVEL, which determines the fm deviation (or percentage of modulation) is inserted in the input circuit of V43012b. The amplified signal is routed to cathode follower stage V43009. The output from the cathode follower is the modulating signal, which is connected to the grids of multivibrator V43005-V43006.

Peaking capacitors C43001 and C43002, shunted by the respective resistors R43064 and R43056, provide a steadily rising response slope from 2 mc through 4 mc which is continued smoothly to 5 mc by the combination of capacitor C43037 paralleled by resistor R43045 in the cathode circuit of video amplifier V43012b.

V43005 and V43006 employ pentode tubes in a high frequency multivibrator circuit. The plate load resistors are of as small value as possible, with their effect minimized by coupling at a low voltage point. The screens are unbypassed so that they vary in voltage in unison with the plate, thus facilitating the change from a conducting to a nonconducting state (and vice-versa); this also results in the tubes acting more nearly like true pentodes, and prevents the conducting tube from shorting out the nonconducting tube.

The video which appears at the grids of the multivibrator is clamped at blanking level during the back porch interval by clamping pulses from the circuit of V43001 through V43004. Stage V43003a is a low resolution video amplifier which drives a sync pulse separator stage V43003b. Differentiated pulses, coinciding with the trailing edges of sync, appear at TP43002 with clipping of the negative going spikes taking place in CR43001. The positive pulses are amplified in V43002a, then routed to the phase splitting circuit of V43002b. Differentiated pulses -- corresponding to the trailing edges of sync -- appear as keying pulses at dual diode tube V43001, causing the video signal at the control grid of V43009 to be clamped at the voltage level fixed by frequency control potentiometer R43001. As direct coupling is used from the cathode of V43009 to the grids of the multivibrators, the dc component is not lost during the modulation process. Diode CR43002, with bias voltage regulation provided by V43002 and adjusted at potentiometer R43002, furnishes clipping action to remove excessively high white overshoots.

The characteristics of the multivibrator are such that its natural frequency increases as grid voltage increases, thus the synchronizing pulses cause this frequency to decrease while signals in the white direction cause the frequency to increase. If the multivibrator is adjusted so that its unmodulated frequency is 5.00 megacycles, a standard 15 volt peak-to-peak video signal at the grids of the multivibrator will cause the frequency to vary from 4.75 megacycles (sync tips) to 6.80 megacycles (white base line). Note that input level control R43003 is in the modulating circuit only, and will not affect the amplitude of the keying pulses.

The multivibrator output is taken through transformer T43001. This transformer permits balanced coupling, so that any simultaneous excursion of the multivibrator plates in the same direction (which could occur if the video signal fed through the tube) will be canceled (If this "feed through" were permitted, the base line of the fm signal would shift up and down accordingly, and undesirable amplitude modulation would result).

Output stage V43008 is connected to J43004S; the output impedance of this tube matches the characteristic impedance of the coaxial cable.

Demodulator, Monochrome

Frequency modulated rf signals from the channel switcher enter the demodulator at J62006s. Whenever the demodulator relay K62001 is de-energized, as in the reproduce mode, the demodulator input from the switcher is coupled to the grid of V62001 through relay contacts 13 and 6. Whenever relay K62001 is energized, as in the record mode, the input signal from the modulator is coupled to the grid of V62001 through relay contacts 7 and 13. V62001 is a low noise cascode amplifier, with a sufficiently broad band to pass the fm carrier and all carrier sidebands. Five stages of limiting amplifiers follow V62001. These five limiters, V62002 through V62006, provide a total of 60 db limiting. Because the modulation index in the original process is less than 1.0 for the higher video frequencies, the higher order sidebands are recorded at a considerably reduced amplitude. By employing 60 db limiting in the demodulation process, these higher order sidebands are raised to a level comparable to the lower frequency sidebands. In addition, the limiting minimizes any noise or amplitude modulation introduced by the video heads.

The output of V62006 is fed to stages V62007 and V62008. Both are totem pole cathode followers. V62007 provides a low impedance output to a companion VR1000B for rf dubbing. The dubbing output at J62001s can be checked at TP62003 DUBBING OUTPUT and adjusted by R62003 DUBBING LEVEL control. The output at J62001s is a limited rf signal approximately 1 volt peak-to-peak in amplitude.

The output of V62008 is fed through a delay line DL62001 to the grid of V62009a and directly to the grid of V62009b. Stage V62009 is the fm to am converter. The cathode resistor and cathode bypass capacitor and the plate load resistor are common to both halves of the tube. The a section of the tube receives the incoming fm/rf signal after passing through delay line DL62001 while the b section receives the incoming fm/rf signal without delay. The delay line provides a delay of .05 microseconds corresponding to a phase shift of 90 degrees at 5.0 megacycles, the zero modulation frequency. A greater phase shift results for frequencies above 5 megacycles, and a lesser phase shift for frequencies below 5 megacycles. The resultant plate output increases for frequencies below 5 megacycles, and decreases for frequencies above.

The output of V62009 is fed to cathode follower V62013. The amplitude modulated rf signal at the cathode, with its higher frequency components greatly attenuated, is capacitor coupled to transformer T62001. The signal at this point consists of the original rf varying in amplitude proportionately with respect to the instantaneous frequency of the fm signal.

The secondary of transformer T62001 is a balanced full wave detector. The carrier frequency is effectively cancelled in the balanced secondary circuit. Perfect balance is achieved by adjusting resistor R62004. The two detector diodes, CR62011 and CR62012, are balanced by adjusting R62002. As in all full wave rectifiers, a ripple component is present at the output, equal to twice the fundamental frequency. This 8-12 megacycle ripple component is shunted to ground through adjustable rf bypass capacitor C62001.

The signal across R62103 is a standard amplitude modulated video signal, which is fed through three stages of video amplification, V62012a, V62012b, and V62011. High frequency peaking capacitors are provided in the cathode of the first two stages; low frequency equalization and compensation is provided in the plate circuit of the second stage, and shunt peaking is provided in the plate of the third stage. The gain of the third stage is controlled by potentiometer R62001. The setting of this control determines the output level of the demodulator.

The output of the third video amplifier V62011, is capacitor coupled to totem pole cathode follower V62010. The output impedance of this stage in series with the negligible capacitance of C62004 and the resistance of R62075 matches the characteristic impedance of the 75 ohm output co-axial cable which connects to J62007s. TP62004 VIDEO OUT is provided for observing the output wave form.

Relay Control

Relay K62001 is energized in the record mode through pin 6 of J62002P or pin 7 of J62002P and through CR62013. When the EE-TAPE switch on the right control panel is placed in its EE position, this relay is energized through pin 6 of J62002P. In its energized condition contact set 12-5 connects plate voltage to the tubes of the modulator circuit, contact

set 8-14 grounds the rf input to J62006S, and contact set 7-13 connects the output of the modulator circuit to the input of the demodulator circuit. Thus monitoring is possible in the record mode, and the electronics to electronics is available for the EE test position.

The relay is de-energized in the reproduce mode, at which time plate voltage is removed from tubes in the modulator section and the rf input signal is connected to the grid of V62001 through contact set 6-13. Also at this time, rf output jack J62005S is shorted to ground through contact set 11-1 to eliminate rf pickup on the cable leading to the record amplifier driver.

UNIT SET UP

Modulator

Step 1: Thread tape along the prescribed path on the tape transport mechanism. Place the EE-SWITCH on the right control panel in the EE position.

Step 2: Feed a video signal to the input of the system.

Step 3: Insert an oscilloscope probe in TP43006 VIDEO INPUT and check to see that the input video signal is at least one volt peak-to-peak.

Step 4: Place INPUT LEVEL control R43003 in the full counterclockwise position (zero).

Step 5: Insert the oscilloscope probe in TP43004 RF OUTPUT. Set the oscilloscope timing switch to .1 microsecond per centimeter and observe that a somewhat rounded off square wave appears.

Step 6: Place R43001 FREQ CONT in the full clockwise position. The oscilloscope display should show a minimum frequency of 6.8 megacycles. Adjust R43001 FREQ CONT for a frequency display of 5.00 megacycles.

Step 7: Adjust the oscilloscope for a display at the horizontal sync rate and insert the probe into TP43003 MULTI GRID. Now advance INPUT LEVEL control R43003 to obtain an 17 volt sync tip to peak white amplitude, disregarding high overshoots. Proper clamping action will be indicated by no tilt in the vertical interval.

Step 8: Place R43002 WHITE CLIP in the full counterclockwise position and observe that the positive overshoot at the trailing edge of blanking is limited to no less than 5 volts above the white base line.

Step 9: Adjust R43002 WHITE CLIP to achieve the threshold of white compression and observe an overshoot, the amplitude of which is approximately 10 volts peak-to-peak.

Step 10: Insert the oscilloscope probe in TP43001 CLAMP and check for a clamp pulse of 40 volts peak-to-peak ±5 volts amplitude.

Step 11: Insert the oscilloscope probe in TP43004 RF OUTPUT and check for an rf envelope approximately 1 volt peak-to-peak.

Demodulator

Step 1: At the demodulator, insert the probe in TP62002 LIMITER OUT. Observe at least 4 volts peak-to-peak with small visible am indications when a small amount of the sync envelope is synchronized at the frame or line rate.

Step 2: At the demodulator, insert the probe in TP62006 DETECTOR IN and observe that the display is converted balanced am readily seen during sync pulse time. Amplitude from sync tip to sync tip should be 6 volts of which each protruding sync pulse in the envelope should be at least 20% of the total tip-to-tip voltage amplitude. Balance the two halves of the composite video signal by adjusting R62002 DETECTOR BALANCE.

Step 3: At the demodulator, insert the oscilloscope probe in TP62005 DETECTOR OUT and observe that the amplitude of the composite video signal is 0.5 volt minimum sync tip to white peak. Adjust BALANCE CONT R62002 for a balanced am signal.

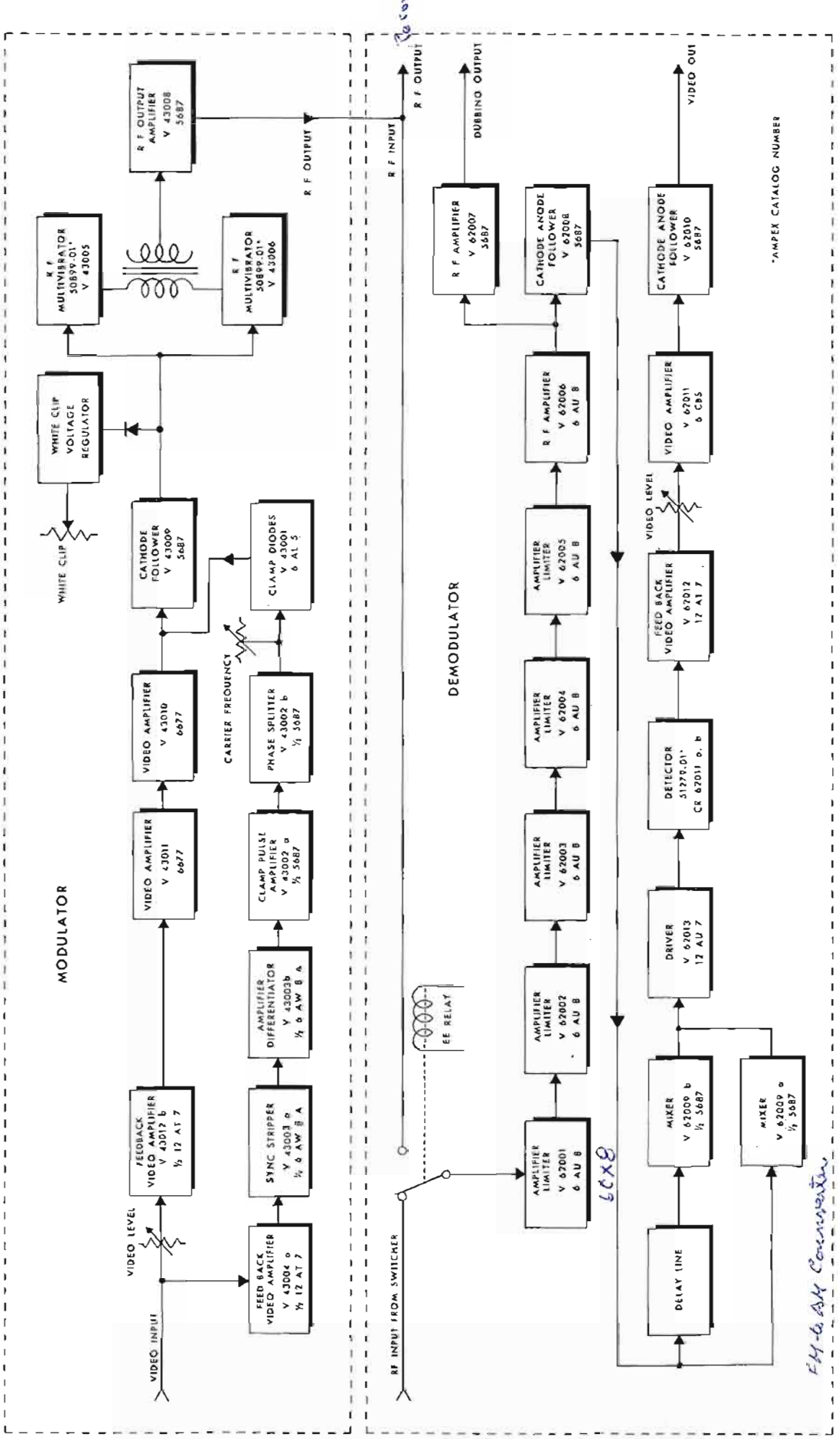
Step 4: Insert the oscilloscope probe in TP62004. VIDEO OUT level control R62001 when rotated through its range should vary the output level from zero to at least 2 volts peak-to-peak. Adjust R62001 for an output level of 1.4 volts peak-to-peak.

NOTE

To achieve the proper settings of DETECTOR BALANCE potentiometers R62002 and R62004, connect a 1.0 volt peak-to-peak 5 mc test signal to input connector J62006 RF INPUT and, with R62001 VIDEO LEVEL in the maximum clockwise position, observe on the oscilloscope the signal at TP62004 VIDEO OUT. Now, adjust R62002 and R62004 DETECTOR BALANCE to achieve undistorted symmetrical 10 mc output.

SEE VOLUME 2 FOR PIN VOLTAGES, WAVEFORMS AND PARTS LIST.

MODULATOR-DEMODULATOR BLOCK DIAGRAM



VRB
MDM 1

SCHEMATIC-
MODULATOR
MONOCHROME

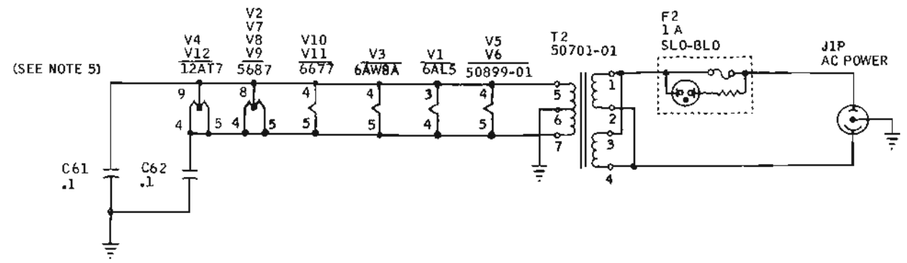
CATALOG NO. 13253

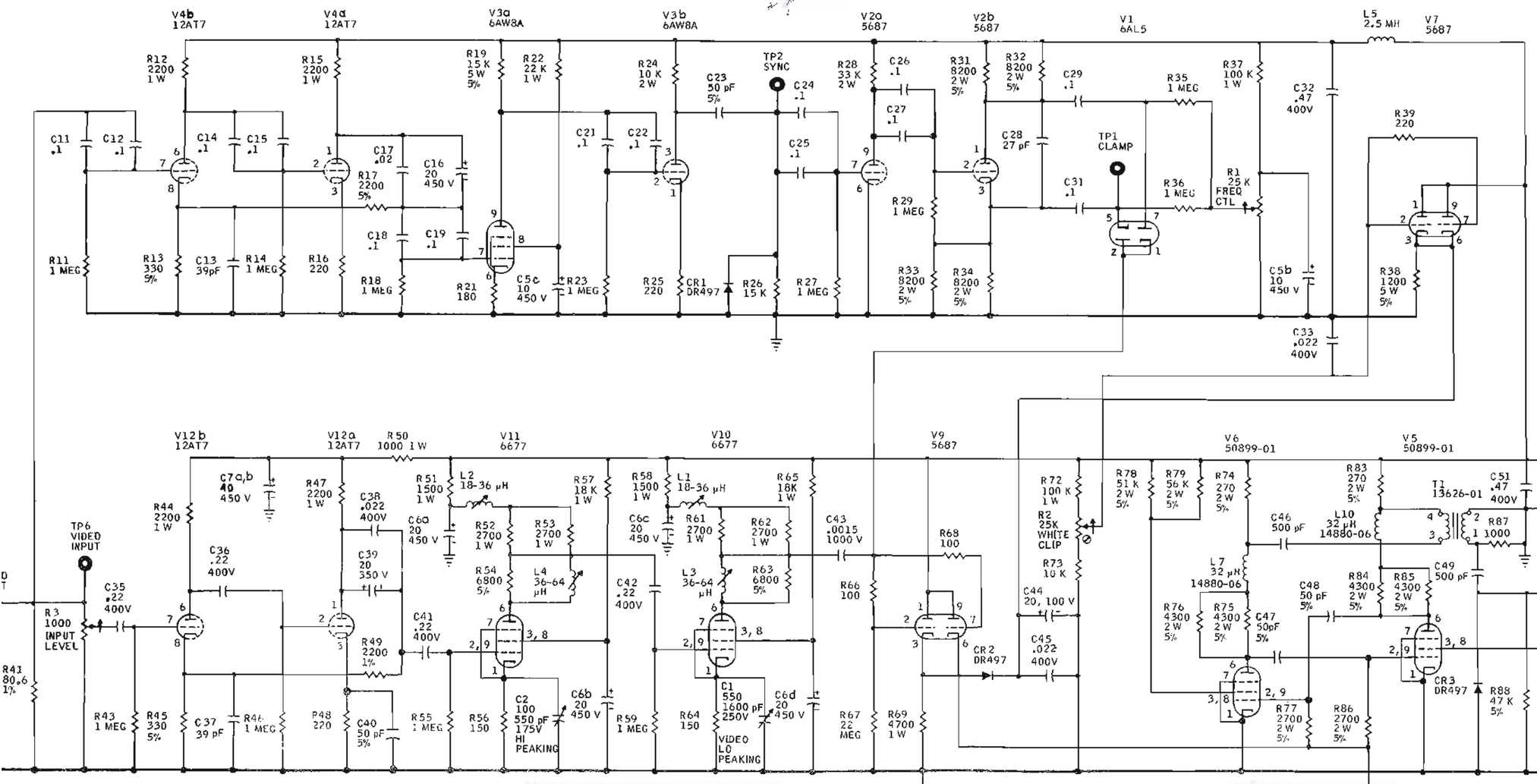
13303 J

AMPEX CORPORATION

NOTES:

1. ALL SCHEMATIC REFERENCE NUMBERS ARE 43000 SERIES. ONLY LAST DIGITS ARE SHOWN (EXAMPLE: R12 INDICATES R43012).
2. ALL RESISTORS IN OHMS, 1/2 W, 10% UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITORS IN MICROFARADS, RATED 500 V UNLESS OTHERWISE SPECIFIED. MULTIPLE ELECTROLYTIC CAPACITORS CODED AS FOLLOWS: a = ⌓, b = □, c = △, AND d = UNCODED TERMINAL.
4. ALL POTENTIOMETERS ARE LINEAR TAPER, 2 W, UNLESS OTHERWISE SPECIFIED.
5. CAPACITORS C61 AND C62 TO BE MOUNTED AT SOCKET OF V12.
6. WAVEFORM VOLTAGES ARE PEAK TO PEAK.
7. PERFORMANCE PER AES NO 12-284.



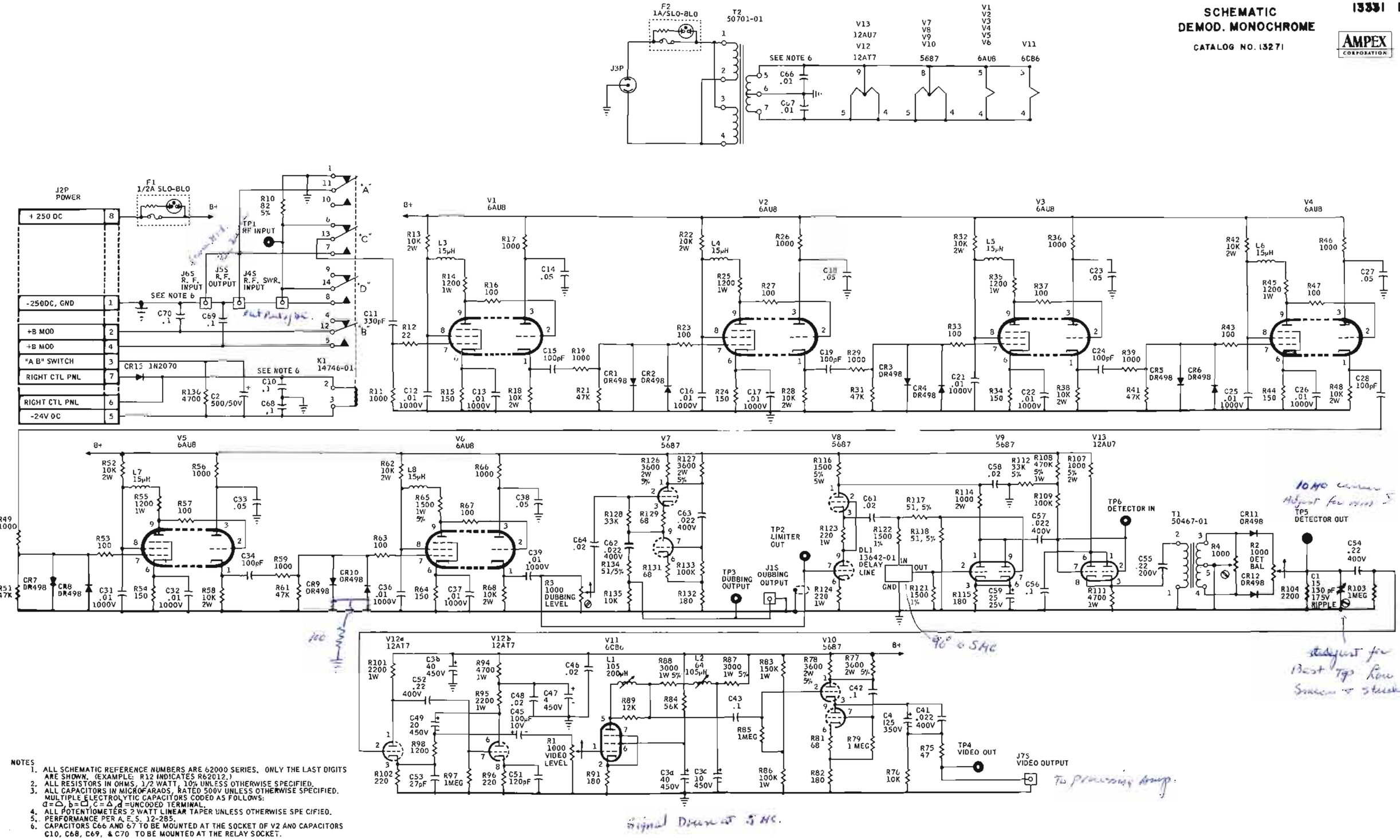


SCHEMATIC
DEMOD. MONOCHROME

CATALOG NO. 13271

13331 K

AMPEX CORPORATION



NOTES

1. ALL SCHEMATIC REFERENCE NUMBERS ARE 62000 SERIES. ONLY THE LAST DIGITS ARE SHOWN. (EXAMPLE: R12 INDICATES R62012.)
2. ALL RESISTORS IN OHMS, 1/2 WATT, 10% UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITORS IN MICROFARADS, RATED 500V UNLESS OTHERWISE SPECIFIED. MULTIPLE ELECTROLYTIC CAPACITORS CODED AS FOLLOWS: a=○, b=□, c=△, d=UNCODED TERMINAL.
4. ALL POTENTIOMETERS 2 WATT LINEAR TAPER UNLESS OTHERWISE SPE CIFIED.
5. PERFORMANCE PER A. E. S. 12-285.
6. CAPACITORS C66 AND 67 TO BE MOUNTED AT THE SOCKET OF V2 AND CAPACITORS C10, C68, C69, & C70 TO BE MOUNTED AT THE RELAY SOCKET.

RECORD DRIVER

GENERAL

The record driver provides preliminary amplification of the frequency modulated signal from the modulator unit, and supplies a low impedance output to each of the four record amplifiers.

This unit is located at the right front of the console when the user faces the front of the console. It occupies 5-1/4 inches of vertical space. Adjustment points are located on the front of the unit and consist of four gain controls for the individual channels. Interconnections are made from the rear panel.

Plate and heater power for the vacuum tubes in the record driver is provided by regulated power supply C, also located in the console. The tubes in the component draw approximately 300 ma of current at +250 volts dc, and 3.64 amperes of heater current at 6.3 volts ac, which is supplied by a filament transformer in the unit, drawing .255 ampere at 115 volts ac.

Vacuum Tube Complement

Type	Qty.	Schematic Ref. No.
EL84/6BQ5	4	V33001, V33002, V33003 V33004
E88CC/6922	2	V33005, V33006

THEORY OF OPERATION

The video signal, after undergoing the frequency modulation process in the modulator, enters the record driver chassis at connector J33005. Resistor R33057, in parallel with channel gain controls R33001, R33002, R33003 and R33004, provides a 75 ohm input impedance.

Four identical two stage amplifiers with gains of 30 at 5 megacycles feed the output connectors J33001, J33002, J33003 and J33004. Frequency response is flat within .7 db from 350 kc to 6 mc, and is down about 2.8 db at 10 mc. Test points are provided at the input and at each output.

UNIT SET UP

Step 1: Set the four controls on the record driver at midrange; thread tape onto the tape transport; connect a microphone to the MICROPHONE INPUT receptacle at the front of the console to the right of the record driver assembly.

Step 2: Feed a signal, preferably a test pattern, into the equipment. Press the PLAY pushbutton, then press the RECORD pushbutton.

Step 3: At the record driver, insert the oscilloscope probe successively in TP33001 CH 1, TP33002 CH 2, TP33003 CH 3, and TP33004 CH 4, checking that an rf output exists for each channel. If no rf signal is present on any channel, check the rf input from the modulator at TP33005 INPUT; if rf is present at the output of some channels, but absent on one or more channels, check the record driver.

Step 4: Press the REWIND pushbutton and rewind the tape to the beginning of the recording started in Step 2.

Step 5: Reproduce the recording by pressing the PLAY pushbutton. Carefully check the reproduce system, as previously explained*, adjusting tracking and the switcher if necessary to determine that all channels are operating.

Step 6: With the test pattern signal, make a new recording. This time vary the individual channel GAIN controls R33001, R33002, R33003 and R33004 for channels 1, 2, 3, and 4 respectively at the record driver, using the microphone to announce the varying settings as each control is varied.

Step 7: Reproduce this recording and determine the optimum control setting for each individual channel.

Step 8: Set the individual channel controls to the optimum settings as determined in Step 7. Make another recording.

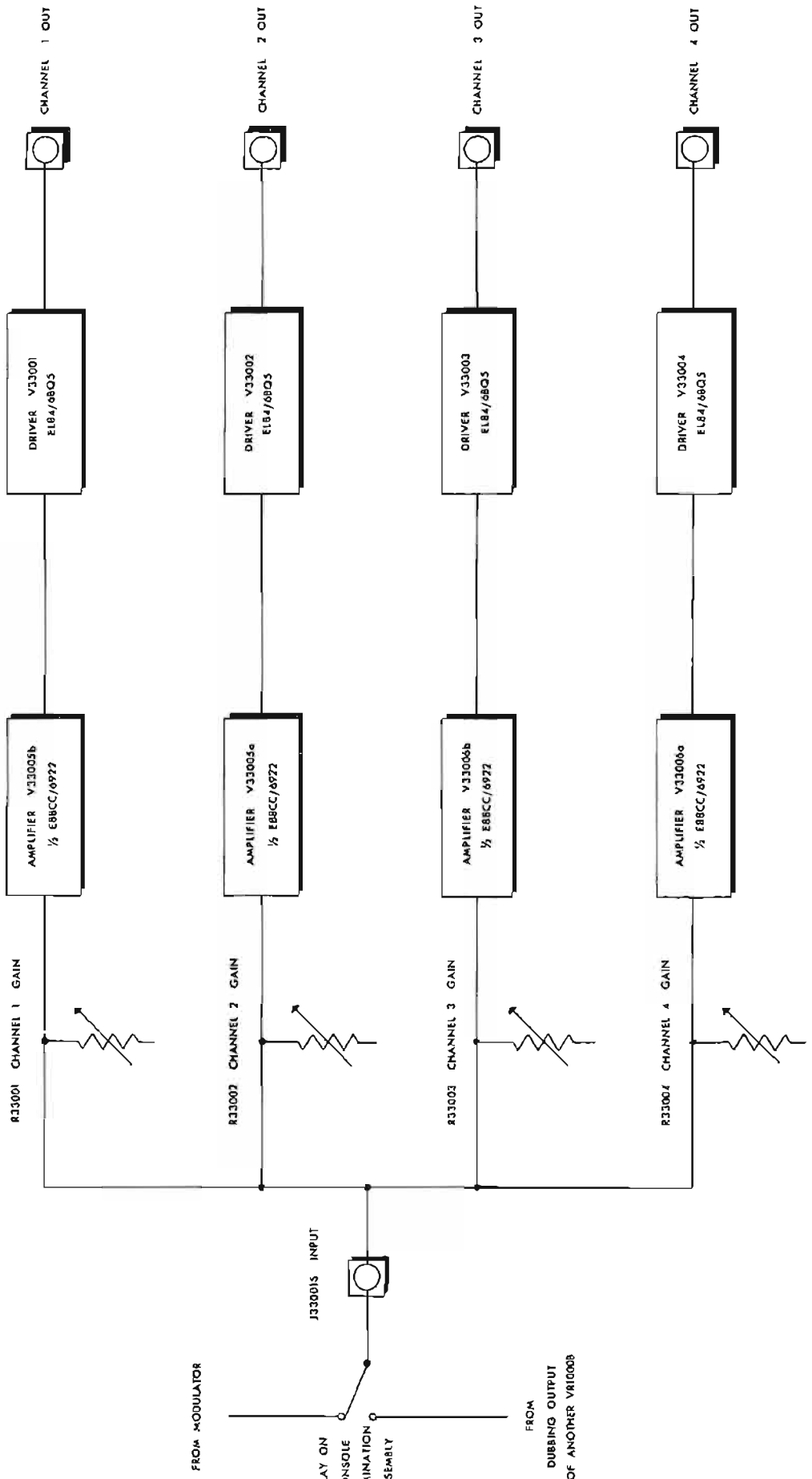
Step 9: Reproduce and re-record as required adjusting the individual channel gain controls if necessary until an optimum picture is obtained during the reproduce function.

* in SYSTEM CHECKOUT AND ADJUSTMENTS

Step 10: At the left control panel (behind the front panel) adjust control R56009 VIDEO REC METER CALIB until the video record current meter indicates an average of 80 during the record mode for the channels selected by the rotary switch in the left control panel.

SEE VOLUME 2 FOR PIN VOLTAGES AND PARTS LIST.

Record Driver Block Diagram

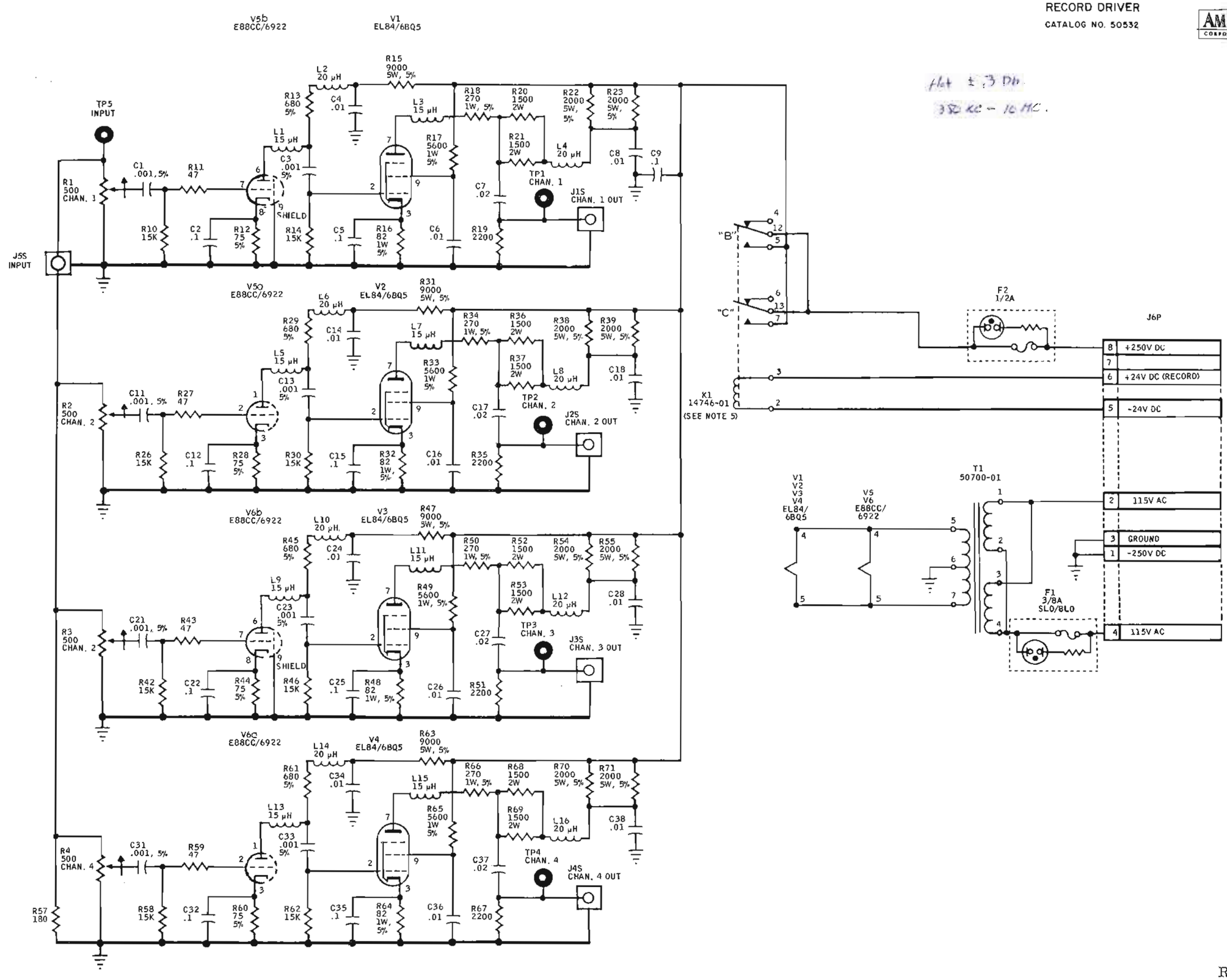


VRB / RDR 1

SCHEMATIC–
RECORD DRIVER

CATALOG NO. 50532

AMPEX CORPORATION



ALL SCHEMATIC REFERENCE NUMBERS ARE 33000 SERIES. ONLY LAST DIGITS ARE SHOWN. (EXAMPLE: R12 INDICATES R33012).

ALL RESISTORS IN OHMS, 1/2W, 10% UNLESS OTHERWISE SPECIFIED.

ALL CAPACITORS IN MICROFARADS. RATED 500V, 10% UNLESS OTHERWISE SPECIFIED.

ALL POTENTIOMETERS ARE LINEAR TAPER, 2W, UNLESS OTHERWISE SPECIFIED.

SECTIONS "A" & "D" OF K1 ARE NOT USED.

PERFORMANCE PER A.E.S. NO. 12-250.

HEAD CHANNEL ASSEMBLY

GENERAL

The head channel assembly consists of a head channel housing, four plug-in head channel units and one plug-in servo reference unit. The four head channel units are identical and therefore interchangeable.

During the record mode, the head channel units amplify the fm modulated rf signal required to drive the video heads. During the reproduce mode, the head channel units function as pre-amplifiers for the relatively low level signal picked up by the heads from the tape.

The servo reference unit amplifies the output of the photoelectric cell. This output is essentially a square wave generated by the rotation of a segmented disc on the head drum. The clipping action of the amplifier produces a clean square wave at its output.

The servo reference unit performs the secondary function of switching the B+ to either the record amplifiers or the reproduce pre-amplifiers of the individual head channel units depending on the mode of operation.

In addition to containing all the connectors for the plug-in units, the head channel housing also contains a potentiometer for adjusting the intensity of the light source that excites the photoelectric cell.

Vacuum Tube Complement -- Each Head Channel Unit

Type	Qty.	Schematic Reference No.
EL34/6CA7	1	V32101
E88CC/6922	3	V32102, V32103, V32104

Vacuum Tube Complement -- Reference Unit

Type	Qty.	Schematic Reference No.
6C4	1	V32201

THEORY OF OPERATION

Head Channel Housing

A total of eight connectors are mounted on the head channel housing, five connecting to the plug-in units, one to the video head assembly, one supplying the necessary dc power, metering and signal connections, and one ac connector providing the 117 volts ac to the primary of filament transformer T32001.

The secondary of this transformer supplies 6.3 volts ac to the filaments of all tubes in the head channel assembly. Capacitors C32007 through C32016 bypass both sides of the filament circuit to ground for rf. The 6.3 ac secondary voltage is also fed to a full wave voltage doubler rectifier, consisting of diodes CR32001, CR32002, and associated double capacitors, producing a dc output voltage for the exciter lamp, adjustable from zero to approximately +5 volts by potentiometer R32001 LAMP VOLTS. This control is normally set for a voltage of 1.5 as measured at pin 5 of connector J32005S.

The individual channel record metering circuits to connector J32006P are bypassed for rf by rc networks, R32003 through R32006 and C32003 through C32006.

Two fuses are provided, one for the incoming B+ line and one for the primary of the filament transformer.

Head Channel Unit - Record Amplifier

In the record mode, relay K32101 energizes each head channel unit, connecting the output of record amplifier V32101 through coupling capacitor C32129 and across parallel combination R32101 and R32102 to contact number 5 of the head channel connector. From this point, in each of the four channels, the signal is fed by way of the slip ring assembly to its corresponding video head.

Record amplifier V32101 is a conventional cathode biased pentode amplifier. A portion of the input signal is coupled from the cathode through capacitor C32130 and is rectified and fed, via the channel connector, to the record metering circuit. In this manner the record level of each channel can be monitored. The dc plate load for this stage consists of a 15 microhenry inductance, L32104, in series with a 2.5 mh inductance L32103. Capacitors C32131 and C32127 are rf by-pass capacitors, which in combination with rf choke L32103, prevent the rf signal from coupling into the B+ supply.

The rf plate load of V32101 consists of four components in parallel: L32104, R32101, R32102, the inductance of the video head, and the distributed capacitance of the video head. This combination, because of the swamping action of resistors R32101 and R32102, produces the desired broad band record characteristic. Because of the relatively low plate circuit impedance, record amplifier V32101 behaves essentially as a constant current generator.

Head Channel Unit - Reproduce Pre-amplifier

In the reproduce mode, relay K32101 is de-energized, connecting the video head to the junction of C32103 and R32103. Resistor R32103 acts as a swamping resistor across the inductance of the video head with its distributed capacitance in parallel. This produces the desired band pass characteristics for reproduce operation.

The signal voltage induced in the head is coupled to the grid of V32102 through capacitor C32103 and developed across grid resistor R32104. Resistor R32106, in series with the control grid, prevents oscillations that otherwise might occur, due to tube interelectrode capacitance feeding back part of the amplified signal.

The first and second pre-amplifiers, V32102 and V32103, are dual triodes connected for cascode low noise operation. In terms of the rf signal, the cascode amplifier consists of a conventional grounded cathode plate loaded amplifier feeding a grounded grid amplifier. The combination has the gain of a pentode but the noise figure of a triode.

The second pre-amplifier output is fed to totem-pole cathode follower V32104. This stage behaves as a constant current generator with a 0.5 volt gain. The two triodes comprising this stage are in series, relative to the dc current flow, but in push pull regarding signal, resulting in even harmonic cancellation and a corresponding reduction in overall distortion.

The totem-pole output impedance, approximately 30 ohms, in series with R32125 and the negligible reactance of C32120 results in an effective output impedance of 35 ohms, the characteristic impedance of the output cable.

Servo Reference Unit

Supply voltage for the photoelectric cell is obtained from the voltage divider network consisting of R32208 and R32206. The cell output is coupled to the grid of V32201 through C32204. Capacitor C32205 by-passes any high frequency signals to ground.

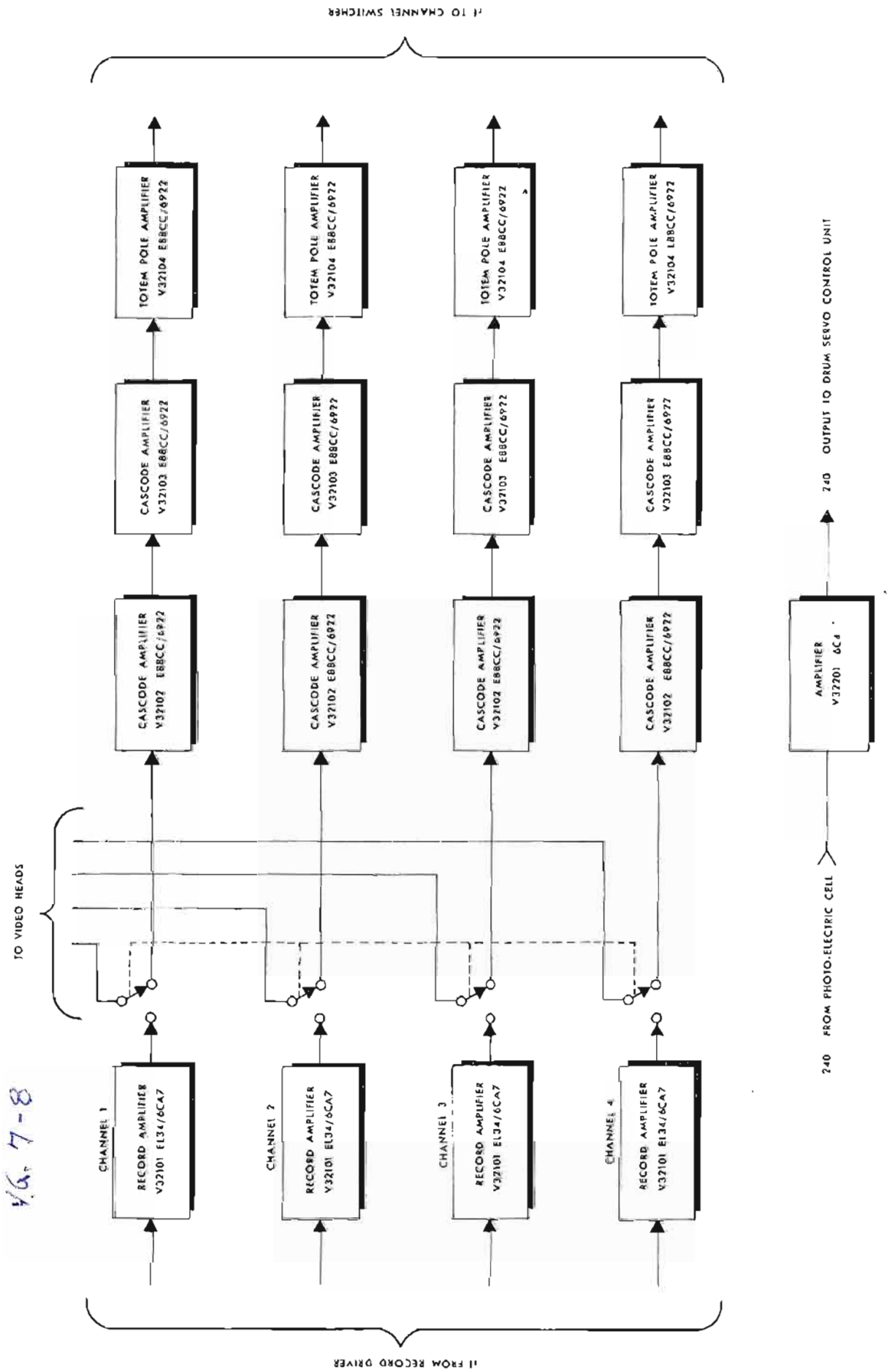
V32201 is a conventional cathode biased low frequency compensated triode network. Low frequency boost is provided by capacitor C32201c across the cathode resistor, and low frequency equalization is provided by a plate decoupling network R32203 and C32201a. The output signal, coupled from the plate through C32203, is clamped to ground potential by CR32202 and clipped at approximately 9.5 volts by CR32201. The resulting square wave, approximately 9.5 volts in amplitude is coupled to pin 2 of connector J32015P through capacitor C32202.

Unit Set-up

Place a Simpson model 262 multi-meter on the 2.5 volt dc scale. Connect the positive lead to pin 5 of connector J32005S. Connect the negative lead to ground, pin 4 of connector J32005S. Adjust potentiometer R32001 LAMP VOLTS for a reading of 1.5 volts.

SEE VOLUME 2 FOR PIN VOLTAGES, WAVEFORMS AND PARTS LIST.

HEAD CHANNEL BLOCK DIAGRAM



VG 7-8

RIGHT CONTROL PANEL

GENERAL

The right control panel contains electronic circuitry used for recording, erasing, and reproducing the audio portion of the program. Pushbuttons for control of tape motion, audio cueing and erasing, and the modes of operation are mounted on the front panel of this unit. Cue and erase amplifier circuitry is located on another chassis, but the right hand control panel oscillator circuit supplies cue and erase signal during the record mode. In the reproduce mode, if the CUE button is pressed, the oscillator supply is derived from the cue and erase electronic assembly.

Circuits controlled by all other right control panel pushbuttons are described in the RELAY CONTROL PANEL section of this manual.

Power for vacuum tubes in the right control panel is furnished by regulator power supply C in the console. The electronic circuitry consists of a record amplifier, a reproduce amplifier, a bias and erase oscillator, a monitoring and metering circuit.

Vacuum Tube Complement

Type	Qty.	Schematic Ref. No.
12AT7	1	V46002
12AX7	3	V46003, V46005, V46006
12AU7	2	V46001, V46004

THEORY OF OPERATION

Record Amplifier

The audio signal enters the panel at either J46009S LINE INPUT or J46010S MICROPHONE INPUT. A 3 position rotary switch provides a means to select UNBALANCED BRIDGE, BALANCED BRIDGE, or MICROPHONE inputs; in the UNBALANCED BRIDGE position the first stage of the record amplifier is bypassed.

The record channel consists of a 4 stage resistance coupled amplifier the first stage of which is a triode circuit V46003a used to provide pre-amplification when the microphone or balanced bridge inputs are selected. Following are 2 triode amplifier stages, V46003b and V46002a, and a constant current output stage V46002b. All are conventional audio amplifier circuits and are located on the record etched board assembly.

Audio RECORD LEVEL is adjusted at R46002 in the grid input circuit of V46003b. High frequency pre-emphasis is provided by the lc combination of L46101 - C46109 in the cathode circuit of V46002b. Low frequency pre-emphasis is furnished by C46105 connected across a portion of the cathode resistor in V46002a. High frequency bias is added to the output signal in the plate circuit of V46002b.

In the record mode, relay K46003 is energized and contact set 5-12 of this relay connects the output of constant current stage V46002b to the record/reproduce audio head through J46008p RECORD/PB HEAD. In the reproduce mode, this relay is de-energized, and contact set 9-14 grounds the record amplifier output, thus minimizing the possibility of cross talk between the record and reproduce channels which might occur within relay K46003.

Reproduce Amplifier

The audio reproduce channel consists of a 3 stage resistance coupled amplifier -- V46006a, V46006b, V46005a -- a phase splitter V46005b and push-pull output stage V46004.

In the reproduce mode, relay K46003 is de-energized and its contact set 4-12 connects the signal from the record/reproduce head through J46008P to transformer T46003 and thence to the grid of V46006a. All stages in the reproduce amplifier are conventional audio circuits and are located on the reproduce board assembly.

Adjustable reproduce equalization is provided in the rc circuit composed of C46202, R46205 and R46208 connected between the plate of V46006a and the cathode of V46006b. The amplifier output is transformer coupled to J46006P, where a +8 vu 600 ohm output is provided and resistively coupled to J46005P to make available a monitor line.

Bias and Erase Oscillator

The bias and erase oscillator is composed of dual triode tube V46001 connected in an lc push-pull circuit. The frequency is approximately 100 kc, the exact frequency not being critical. Plate voltage is applied to only the oscillator in the record mode through contact set 8-14 of relay K46005 in the energized position.

NOISE BALANCE control R46130 is common to both grids of the oscillator, and is adjusted to eliminate any asymmetry in the oscillator output. Lack of wave symmetry would cause a dc component to appear in the bias current and would decrease the signal-to-noise ratio and increase distortion.

The oscillator output is taken from transformer T46101 and fed through variable capacitor C46004, which adjusts the erase current. From this point it is routed to J46003 ERASE HEAD and thence to the erase head, and through adjustable capacitor C46005, which adjusts the bias current, to the output of the record amplifier.

Monitor and Meter Circuit

Audio signals fed to the record amplifier input can be monitored when the equipment is in the standby condition or the record mode.

In standby condition, the state when power is applied to the equipment but no tape motion occurs, relay K46006 is energized if the EE/TAPE switch is placed in the EE position. Under these conditions, the output of V46003b is connected, through INPUT MONITOR control R46003, contact set 7-13 and 5-12 of K46006 and contact set 9-14 of K46001, to the grid of V46005a and thus to the reproduce amplifier output stages. The signal is thus available for monitoring purposes at J46005P, J46006P or at the vu meter as long as the EE-TAPE switch is in the EE position.

During the record mode, relays K46003 and K46001 are energized, connecting the negative return for the head to the RECORD MONITOR control R46004 through contact set 13-7 of K46003. Signals developed in R46004 are fed through the bias filter network R46019, R46020, C46012, C46013 by means of contact set 8-14 of K46001 to the grid of V46005a, and again are made available for monitoring purposes at J46005P, J46006P or at the vu meter, providing aural monitoring of the audio signal in either the standby or record mode with individual level controls for either mode.

A vu meter on the right hand meter panel makes possible visual monitoring of the audio, bias, or erase signals. Selection of the signal for connection to this meter is made at S46014.

Through J46002P REMOTE CONTROL METER, the signal across the secondary of the reproduce amplifier output transformer, when S46014 is in the AUDIO position, is delivered to the meter so that readings are available for setting record and reproduce levels. In the BIAS position, the meter is connected from the swinger of BIAS CALIBRATION control R46005 to ground; connecting R46005 to the negative return of the audio head, providing a meter indication of the bias current flowing in the head. R46005 normally will be adjusted so that zero vu indicates proper bias current. In the ERASE position, S46014 connects the meter across R46118, which is in series with the secondary of oscillator transformer T46101.

Cue position of switch S46014 indicates record audio or tone level from video erase and cue channel unit and is spring loaded to return to erase position when not held in place.

Because the voltage across this resistor is a function of the bias and erase current totals, and bias current usually is negligible compared to erase current, the meter can be considered as indicating erase current. The value of R46118 has been selected to provide a meter indication of zero vu for an erase current of approximately 70 milliamperes.

Power Supply

A 12.6 volt dc tube heater supply is provided for the five amplifier stages. Oscillator stage V46001 uses ac heater power from a 6.3 volt winding of the power transformer.

The 60 cycle ac power line is connected to J46001P, and is fused at 1/2 amperes by F46002. Fuse failure is indicated by a light on the fuse post.

UNIT SET UP

To maintain lip synchronism, the same head must be used for recording and reproducing, and because of this single, dual purpose head, adjustment of the audio record circuits must be made using a trial and retrial method in which a signal is recorded at varying levels and then reproduced to determine the correct setting.

Equipment required for the complete audio adjustment and alignment procedures is:

Vacuum Tube Voltmeter -- Hewlett Packard Model 400D or equivalent.

Audio Oscillator -- Hewlett Packard Model 200 CD or equivalent.

Resistors -- 10 ohm, 600 ohm, 100,000 ohm.

Record Bias

Improper adjustment of the record bias can cause undesirable results in high frequency response, distortion, and noise. Because tapes from different manufactures require differing bias levels, bias must be adjusted for the type of tape to be used.

Step 1: Remove any right control cables from J46009S LINE INPUT and J46006P LINE OUTPUT.

Step 2: Terminate pins 2 and 3 of J46006P LINE OUTPUT with a 600-ohm resistance, and connect the vtvm across this load. Place the meter selector switch S46014 in the AUDIO position.

Step 3: Thread the video head reference tape onto the equipment and reproduce the signal. As the audio tone is reproduced, set the reproduce (PLAYBACK) LEVEL control to achieve a +8 dbm indication on the vtvm. RETAIN THIS SETTING.

Step 4: Stop tape motion and remove the video head reference tape. Then thread the tape transport with tape of the quality and make to be used on the equipment.

Step 5: Place the equipment in the record mode, and adjust C46005 BIAS CALIB in steps, noting each setting, from full counterclockwise to full clockwise. Stop tape motion.

Step 6: Rewind the tape to the beginning of the recording made in Step 5, and reproduce the recorded signal. Determine which setting of C46005 BIAS CALIB resulted in the highest output as indicated on the vtvm.

Step 7: Adjust C46005 BIAS CALIB to the setting indicated in Step 6. Record another signal, varying C46005 slightly around this setting, noting each position. Then repeat the procedure in Step 6.

Step 8: Record and reproduce as necessary to achieve the final setting of C46005 to achieve maximum output during the reproduce mode.

Step 9: While recording the signal as finally adjusted in Step 8, place the meter selector switch S46014 in the BIAS position. Adjust BIAS CALIB control R46005 to attain a zero vu indication on the meter of the right hand meter panel. If record amplifier calibration is to follow, leave the equipment setup intact.

Record Monitor Calibration (Record Level)

Step 1: Perform Steps 1, 2, 3, and 4 under Record Bias.

Step 2: Connect the audio oscillator to pins 2 and 3 of LINE INPUT connector J46009S and set for 500 cycles.

Step 3: Record a section of tape, varying R46002 RECORD LEVEL control in steps, noting the settings. Reproduce the signal from this section of tape and determine which setting of R46002 most closely approaches a +8 dbm output indication on the vtvm during the reproduce mode. Record and reproduce as necessary to achieve the final setting of R46002 which results in a reproduce output of +8 dbm on the vtvm.

Step 4: Place the equipment in the record mode leaving R46002 in the position finally established in Step 3. Place the meter selector switch in the AUDIO position, and adjust REC MONITOR control R46004 to obtain a zero vu indication on the audio meter at the right hand meter panel.

Step 5: Place the EE/TAPE switch in its EE position, and adjust INPUT MONITOR control R46003 for a zero vu indication on the audio meter at the right hand meter panel.

Step 6: Remove the audio oscillator from J46009S LINE INPUT. If a record noise balance check is to follow leave the vtvm and load resistor at J46006P LINE OUTPUT.

Record Noise Balance

Step 1: With no input to J46009S LINE INPUT, record a section of tape, varying NOISE BAL control R46130 from full clockwise to full counterclockwise in steps, noting each setting.

Step 2: Reproduce this section of tape and determine which setting of R46130 NOISE BAL results in the least noise as indicated on the vtvm. This can also be checked aurally by checking the audio monitor speaker for minimum low frequency rumble. Place R46130 NOISE BAL in the indicated position, then record and reproduce as necessary to achieve the least noise output.

Step 3: Remove the test equipment, restore operating connections, and replace the right control panel in the console.

AUDIO ALIGNMENT PROCEDURE

Step 1: Connect the audio oscillator to pins 2 and 3 of LINE INPUT connector J46009S. Set its output to 500 cps at 1.95 volts rms.

Step 2: Remove the cable from J46008P RECORD/PB HEAD. Terminate pins A and B of this receptacle with a 1000 ohm resistor, and connect the vtvm across this load.

Step 3: Remove bias and erase oscillator tube V46001.

Step 4: Hold the supply tape tension arm from contacting the safety switch, by using some device such as pressure sensitive tape to hold it. Place the equipment in the record mode.

Step 5: Adjust the record level control to produce a -10 db (.241 volt rms) reading on the vtvm.

Step 6: Sweep the oscillator through the range from 50 to 10,000 cps, observing the indication on the vtvm. The response should follow the record amplifier response curve within ±1/2 db. If necessary, set the oscillator at 10 kc and adjust RECORD EQUALIZATION control C46105 for a -4.5 db indication on the vtvm (+5.5 db over the -10 db reference or .4 volt rms). Then re-check the response. Press the STOP pushbutton to release the record mode.

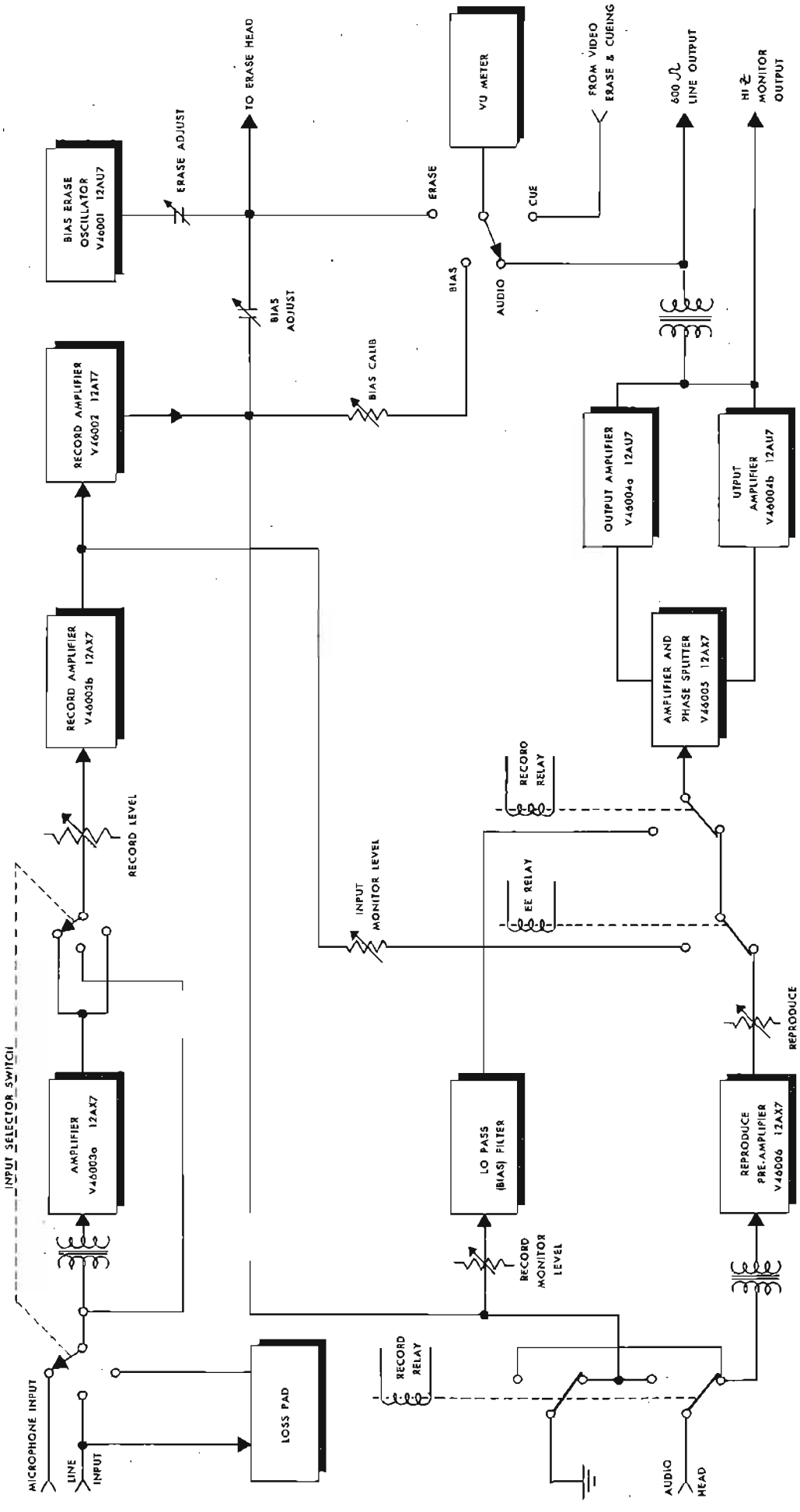
Step 7: Remove the oscillator and the vtvm. Connect the audio oscillator to pins B and C of J46008P, through a resistance network as shown on the illustration. Set the oscillator output to 500 cps at 1 volt rms. Terminate the LINE OUTPUT receptacle J46006P with a 600 ohms resistance and connect the vtvm across this load.

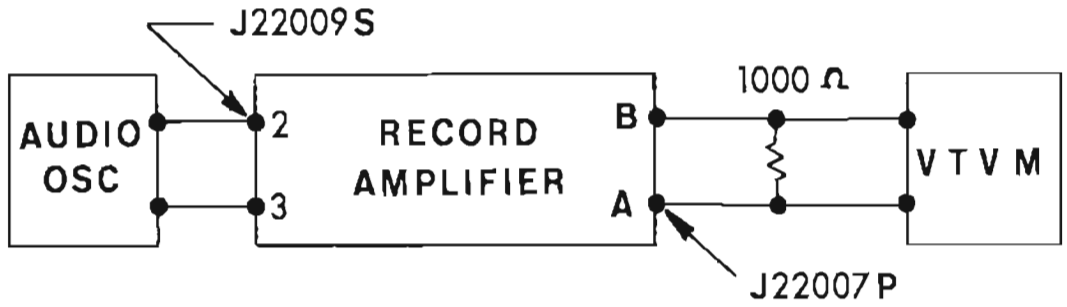
Step 8: Adjust the PLAYBACK LEVEL control to achieve a -10 db (.241 volts rms) output as indicated on the vtvm.

Step 9: Sweep the oscillator through the frequency range from 50 to 10,000 cps, observing the indication on the vtvm. Response should follow the reproduce amplifier response curve within ± 1/2 db. If necessary, set the audio oscillator at 6,000 cps and adjust reproduce (PLAYBACK) EQUAL control R46208 to obtain a reading 15.5 db below the -10 db reference (.04 volts rms). Then recheck the response.

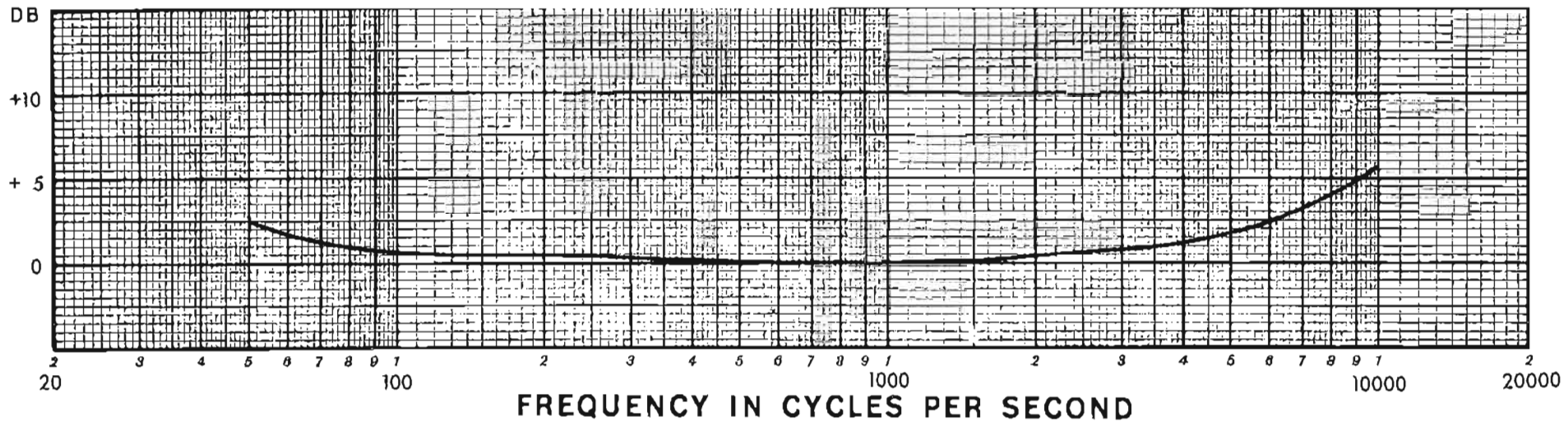
SEE VOLUME 2 FOR PIN VOLTAGES AND PARTS LIST.

RIGHT CONTROL PANEL BLOCK DIAGRAM



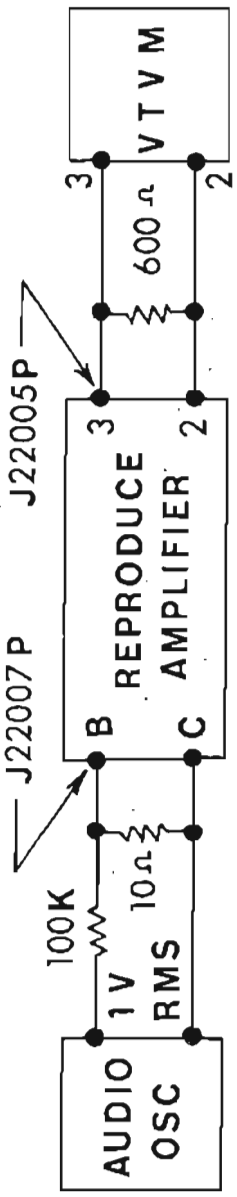


+4 DBM IN, BALANCE OR UNBALANCED BRIDGING, ADJUST RECORD LEVEL
FOR .241 VOLT VTVM READING AT 500~.
UNIT MUST BE IN RECORD MODE. REMOVE BIAS OSC TUBE.

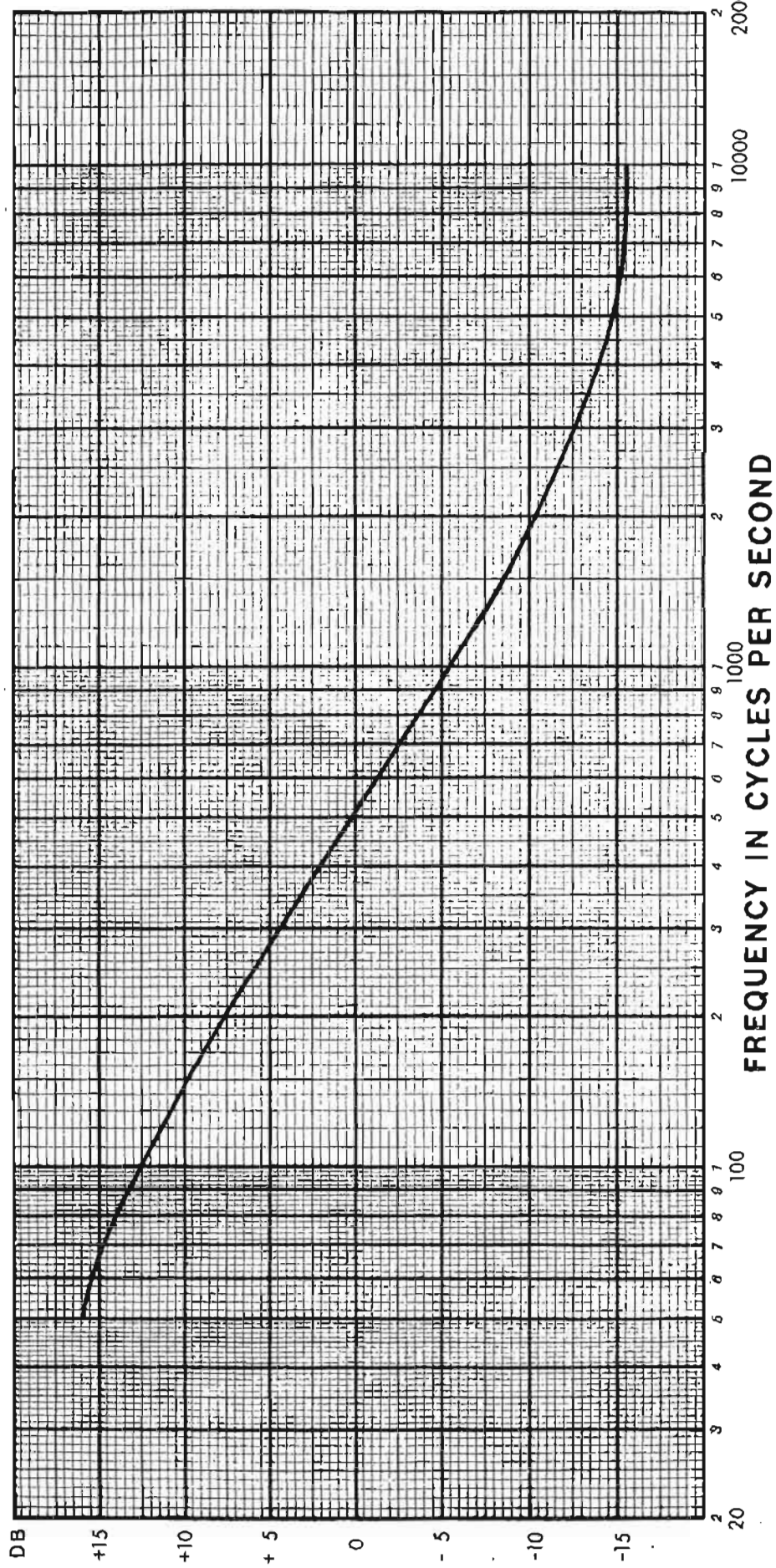


AUDIO RECORD AMPLIFIER RESPONSE

AUDIO REPRODUCE AMPLIFIER



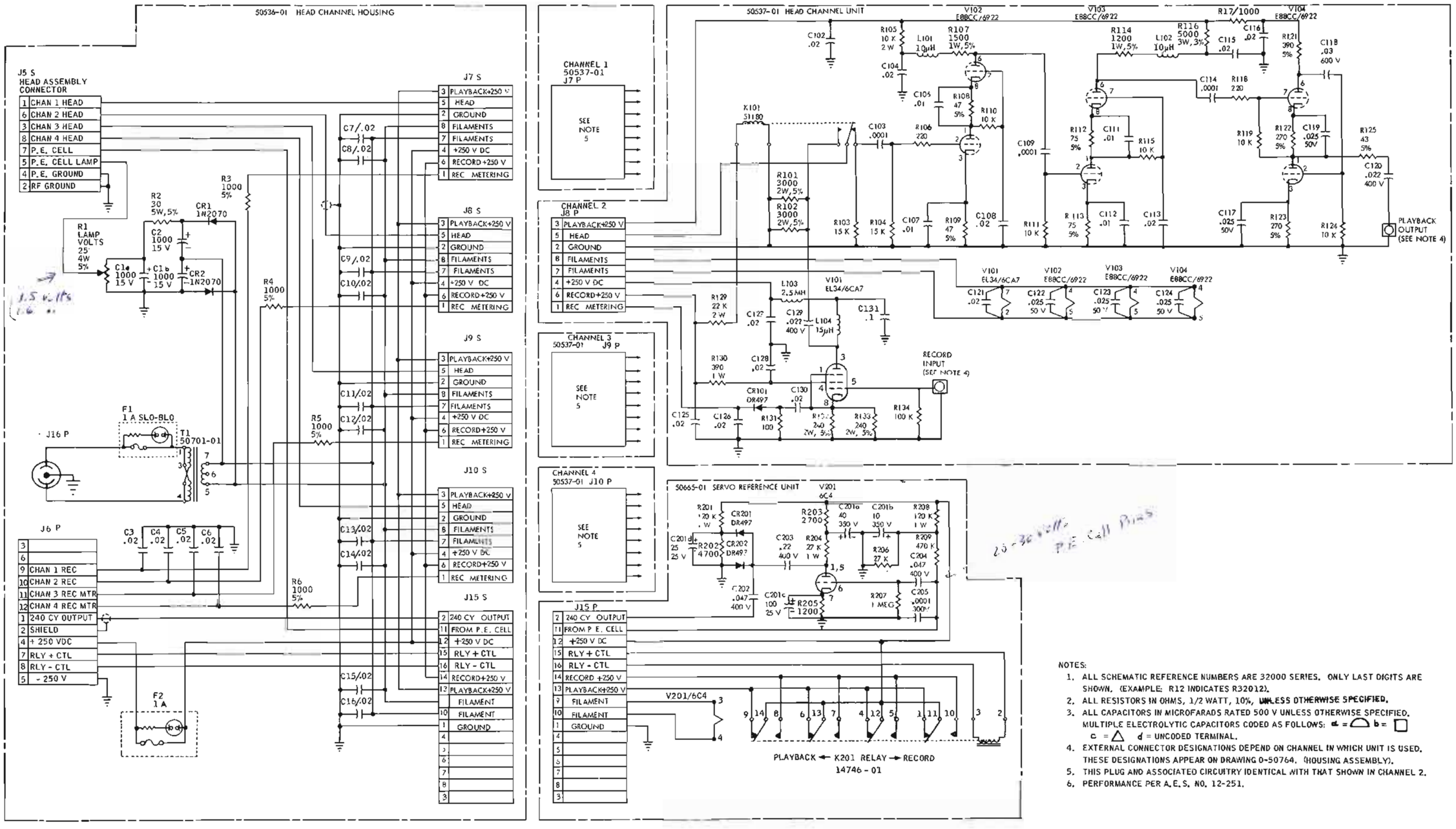
ADJUST AMPLIFIER LEVEL CONTROL FOR -10 DBM OUTPUT AT 500 CYCLES.



VRB RCP 3

SCHEMATIC— HEAD CHANNEL ASSEMBLY CAT. NO. 50531

AMPEX CORPORATION



NOTES:

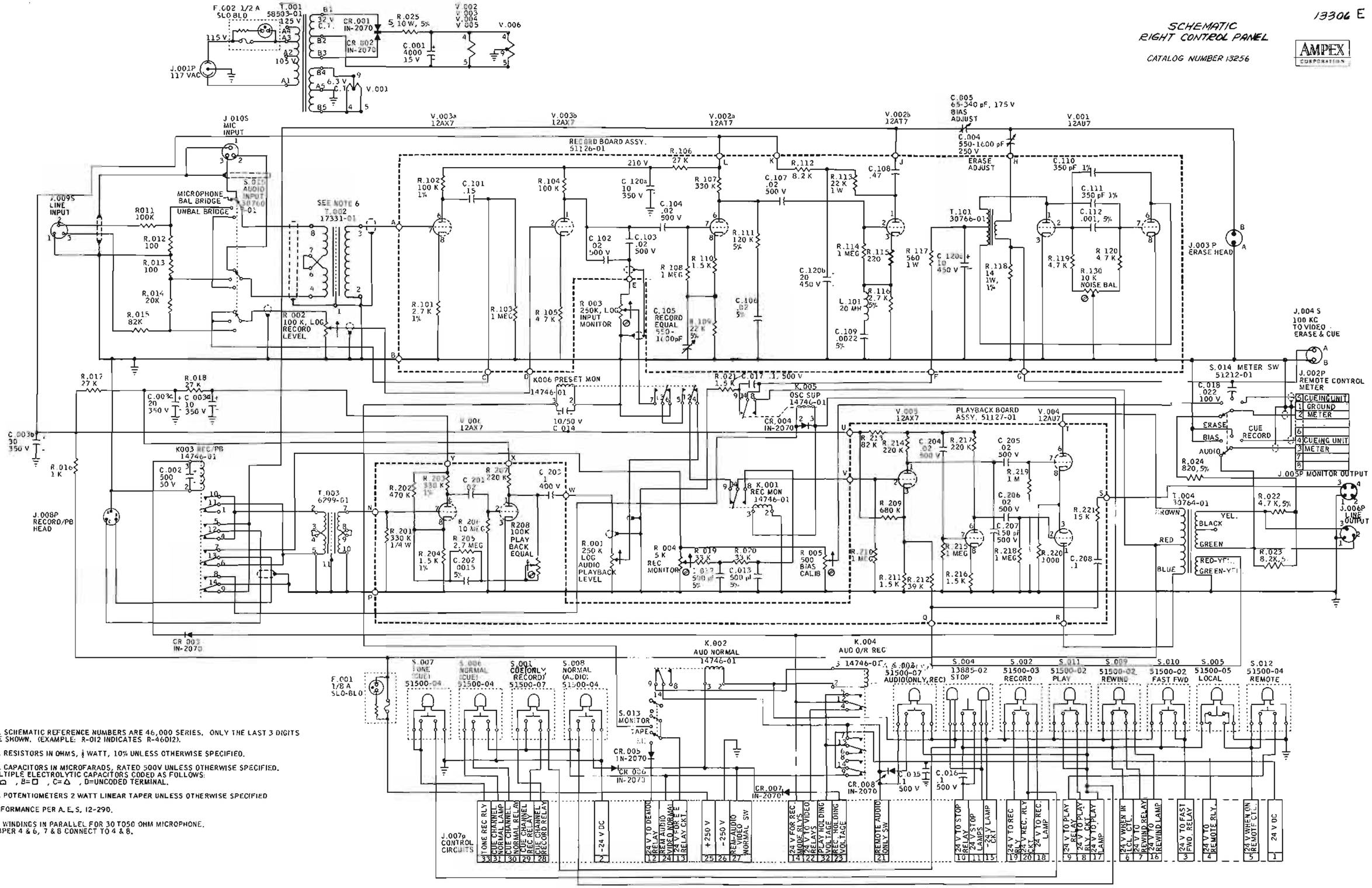
1. ALL SCHEMATIC REFERENCE NUMBERS ARE 32000 SERIES. ONLY LAST DIGITS ARE SHOWN. (EXAMPLE: R12 INDICATES R32012).
2. ALL RESISTORS IN OHMS, 1/2 WATT, 10%, UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITORS IN MICROFARADS RATED 500 V UNLESS OTHERWISE SPECIFIED. MULTIPLE ELECTROLYTIC CAPACITORS CODED AS FOLLOWS: a = ⌓ b = □ c = △ d = UNCODED TERMINAL.
4. EXTERNAL CONNECTOR DESIGNATIONS DEPEND ON CHANNEL IN WHICH UNIT IS USED. THESE DESIGNATIONS APPEAR ON DRAWING 0-50764. (HOUSING ASSEMBLY).
5. THIS PLUG AND ASSOCIATED CIRCUITRY IDENTICAL WITH THAT SHOWN IN CHANNEL 2.
6. PERFORMANCE PER A.E.S. NO. 12-251.

13306 E

SCHEMATIC
RIGHT CONTROL PANEL

CATALOG NUMBER 13256

AMPEX CORPORATION



NOTE:

1. ALL SCHEMATIC REFERENCE NUMBERS ARE 46,000 SERIES. ONLY THE LAST 3 DIGITS ARE SHOWN. (EXAMPLE: R-012 INDICATES R-46012).
2. ALL RESISTORS IN OHMS, ½ WATT, 10% UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITORS IN MICROFARADS, RATED 500V UNLESS OTHERWISE SPECIFIED. MULTIPLE ELECTROLYTIC CAPACITORS CODED AS FOLLOWS: A=△ , B=□ , C=△ , D=UNCODED TERMINAL.
4. ALL POTENTIOMETERS 2 WATT LINEAR TAPER UNLESS OTHERWISE SPECIFIED
5. PERFORMANCE PER A. E. S. 12-290.
6. USE WINDINGS IN PARALLEL FOR 30 TO 50 OHM MICROPHONE. JUMPER 4 & 6, 7 & 8 CONNECT TO 4 & 8.

CHANNEL SWITCHER

GENERAL

The basic function of the switcher unit is to switch sequentially the outputs of the four video heads during the reproduce mode This switching is necessary to minimize noise and crosstalk, and to prevent cancellation effects which would occur as two heads reproduced identical information during the overlap period.

The blanking switcher portion of the unit serves to delay the time of head switching so that it will occur during the horizontal retrace period thus preventing switching transients from appearing in the picture When such transients are caused to occur approximately in the center of the blanking pulse back porch, they are eliminated from the composite video signal by action of the processing amplifier which completely reforms the blanking pulse.

The blanking switcher section can be bypassed by S64001 in the switcher section in case of failure, and the reproduced output would then contain switching transients appearing at random on the raster. The very short duration (approximately 0.1 microseconds) of these transients would not be objectionable under emergency conditions. (If the blanking switcher section is bypassed, it is very important to place the tape guide servo system in the manual mode of operation.)

The switcher is mounted on Rack 1, occuping 14 inches of vertical rack space All connections are made at the rear of the rack, and all adjustment points are available at the front of the rack.

Vacuum Tube Complement

Type	Qty.	Schematic Ref. No.
6BN6	1	V64011
5725	4	V64003, V64009, V64015 V64021
6CB6	8	V64001, V64002, V64007, V64008, V64013, V64014, V64019, V64020
6CL6	2	V64004, V64016
6922	3	V64025, V64027, V64029
12AT7	10	V64005, V64017, V64018, V64023, V64024, V64026, V64028, V64030, V64031, V64032
12AU7	4	V64006, V64012, V64022, V64010

THEORY OF OPERATION

Functional Description of the Switching Section

The switching function is accomplished in four gated tubes which act as individual switches for the incoming signals from the video heads during the reproduce process. Gating pulses for these tubes are derived from the 240 cycle square wave output of the photoelectric cell, an output the phase of which is directly related to the angular position of the head drum. Two pulses are required to actuate the switching function -- a gating pulse on the control grid and a switching pulse on the suppressor grid of the gating tubes. The signal to each control grid is a 240 cycle trapezoidal wave, with each trapezoidal wave shifted 90° in respect to the next. They provide an initial gate, so that each tube in turn can conduct when the switching pulse appears. The video signal is added to the gating pulse at the control grid. The actual switching time is determined by a positive excursion of a 480 cycle square wave (with extremely fast rise and decay times) applied to the suppressor grids. This signal is derived by doubling, amplifying, and clipping the 240 cycle input signal. The resultant square waves are then applied to the suppressor grids of the gating tubes through a phase splitter, which delivers in-phase positive pulses to channels 1 and 2 and positive pulses shifted 180° to the suppressor grids of channels 3 and 4.

NOTE

Channel numbering does NOT indicate the order of head switching. Channels are gated 1, 4, 2, 3.

Only the tube at which the positive 240 cycle gating pulse and the positive 480 cycle switching pulse arrive in coincidence is able to conduct.

Video Signal

The individual outputs of the four video heads, after amplification in the reproduce preamplifier portion of the head channel assembly unit, are connected to the switcher at connectors J64005S through J64008S, where they are terminated in 75 ohms impedance. Individual gain controls (R64001, R64004, R64007, and R64011) are provided so that the rf signal in each channel can be balanced. Each signal then passes through two stages of rf amplification (V64001-V64002, V64007-V64008, V64013-V64014, and V64019-V64020). These are conventional rf amplifier circuits, employing variable peaking in the plate circuits to adjust the frequency response and small interstage time constants to limit the bandwidth to that of the fm signal. The amplified outputs are delivered to the control grids of the gating tubes (V64003, V64009, V64015, or V64021) for the respective channels, where they are added to the gating signals.

Gating Signal

The 240 cycle signal, originated by the photoelectric cell and processed in the drum servo control unit to a sinusoidal wave, enters the switcher at J64001S. LEVEL control R64010 provides an adjustment for the amplitude of the 240 cps signal as it enters the unit. The signal is then fed to the grid of cathode follower stage V64006a, which provides a low impedance input to the subsequent variable phase shifting network. This phase shifter controls the switching time relative to the angular position of the head drum with phasing control R64003 allowing a total phase variation of approximately 40°. The signal is next routed to the grid of amplifier stage V64006b.

The output of V64006b to the gating channels is taken through C64082 to stages V64010a (which incorporates a 90° phase shift network consisting of R64061, C64101, R64062, and C64099) and V64022a (which does not employ any phase shift). The circuits of V64010 and V64022 are identical from this point, so only that of V64010 will be described V64010a is an amplifier circuit, with diodes CR64013 and CR64014 clipping the output. The result is a trapezoidal waveform which is fed through C64104 to the grid of phase splitter stage V64010b. This stage provides two signals, 180° out of phase, to the grids of V64003 and V64009, where they are added to the video signals. Resistors V64174 and R64172 compensate for low frequency tilt on the gating pulse, so the clipped portion of the waveform is maintained flat. The top of the gating pulse is clamped by CR64015 and CR64016, and thus determines the proper bias on the grids of V64003 and V64009

Action of V64022 is identical to that described for V64010, and gating pulses are supplied from this stage to V64015 and V64022. We thus have developed four 240 cps trapezoidal waves, each 90° displaced from the next, as gating pulses for the control grids of the gating tubes.

Switching Signal

The 240 cps output of V64006 is also taken through transformer T64002 to a full wave rectifier (doubler) circuit consisting of diodes CR64007 and CR64008. An approximate 12 volts output, at 480 cps, is developed across R64141. C64085 and L64002 constitute a resonant bandpass filter tuned to 480 cps. A pure 480 cps sinusoidal waveform is thus delivered to the grid of V64012b.

Stages V64012b and V64012a supply amplifying and clipping. The symmetry of the resultant 480 cycle square wave is adjustable at R64009, which controls the dc level of the signal fed to the first pair of clipping diodes CR64009 and CR64010.

The output of V64012a is routed to switch S64001, which determines if the blanking switcher is IN or OUT of the circuit. Normally, this switch will be in its IN position. Regardless of this switch position, a nominal square wave is delivered to the grid of V64017a. This circuit provides a third stage of amplification and clipping, with a very square waveform delivered to the grid of amplifier V64017b, which produces a 60 volt square wave to V64011.

V64011 performs the final, and most important, clipping action. The waveform at the plate is derived from a very small segment of the grid signal, so its rise time is extremely short. To preserve this rise time requires the use of wideband techniques, and thus a 5 microhenry shunt peaking coil (L64014) is employed in the plate circuit of this stage.

The signal is amplified in V64005a and delivered to V64005b a phase splitter circuit, with each of its outputs feeding a conventional video amplifier (V64016 or V64004), which in turn each drive the suppressor grids of two gating tubes.

We have now generated the two pulses necessary to cause the gating tubes to conduct. The action of these pulses is illustrated in the gating diagram. The sequentially switched outputs of the gating tubes are combined in the plate circuits of these stages (the plates are connected together) to form a continuous rf signal. V64027 provides amplification to drive two separate output amplifiers V64025 and V64029, with output No. 1 connected to the demodulator and output No. 2 to the cathode ray oscilloscope in the left hand control panel (output No. 2 is chopped dc to eliminate rf radiation in cables and the left control panel).

B+ is delivered to the unit from regulated power supply "A" mounted on Rack 2.

Functional Description of the Blanking Switcher Section

A 480 cycle square wave, developed in the switcher unit from the photoelectric cell signal (waveform D on the waveform diagram) is amplified in V64018a, then clipped by the action of diodes CR64023 and CR64024, in order to provide sharp leading edges. The signal is amplified again in V64018b before being connected to phase splitter stage V64024a. The grid of V64024a is connected to approximately +40 volts dc which provides the correct operating bias. Square waves of opposite polarity appear at the cathode and plate of V64024a.

Negative sync pulses from the processing amplifier (waveform A on the waveform diagram) are fed to J64004S and thence to the grid of V64031b. The plate load for this stage is differentiating transformer T64004, the secondary of which is connected to supply positive pulses (corresponding to the trailing edge of the sync pulses) to amplifier V64031a. The amplified, negative pulse output of V64031a is used to trigger free running multivibrator V64032.

Multivibrator V64032 serves two purposes: first, it provides pulses to the circuitry which follows (even if a sync pulse is not present to trigger it); second, with S64002 in its OUT position, it provides delayed pulses which cause switching transients to appear in the picture (this latter purpose is utilized when adjusting the blanking switcher).

With S64002 in its NORMAL position (where it should be placed except when adjusting the unit) the output of the multivibrator is taken from pin 6 of V64032 and routed through the clipping circuit of CR64026 which removes the positive spikes from the signal, leaving the negative pulses which are fed to the grid of V64028b. Sharp, positive pulses (waveforms B and C on the waveform diagram) corresponding to the trailing edge of the original sync pulses, thus appear at the plate of V64028b.

We have now created 3 signals -- two 480 cps square waves of opposite polarity which were originated by the photoelectric cell scanning the head drum, and a 15,750 pps signal corresponding in time to the trailing edges of the sync pulses. The 15,750 pps signal is added to both 480 cps square wave signals in the circuits consisting of R64217-R64235 and R64218-R64236. The resulting 2 composite signals (waveforms E and F on the waveform diagram) are then each applied to a grid of a clamped grid clipper (V64024b and V64028a), where the positive tips of the 15,750 pps signal are clamped to zero volts by diode action between the grid and the cathode. Cut off level of these tubes is such that only the gated tips of the 15,750 pps signal (riding on the positive portion of the 480 cps square waves and indicated by "clipping level" on waveforms E and F) will cause the tube to conduct. These tips then appear at the plates of V64024b and V64028a as negative pulses.

Because the outputs of these stages are connected to opposing circuits in the multivibrator formed by V64023a and V64023b, the multivibrator will be alternately triggered by the action of the first negative pulse in the output of either V64024b or V64028a. Thus the waveform from the multivibrator (waveform G on the waveform diagram) has its leading and trailing edges determined by the first negative spike in each clipped waveform from V64024b and V64028a. The reformed 480 cps square wave output, now synchronized with the trailing edge of the first sync pulse that occurs when the heads are to be switched, is fed through S64001 BLANKING-SWITCH OUT to V64017a where it determines the precise moment of head switching.

When the blanking switcher section is bypassed, by positioning S64001 in the OUT position, the leading and trailing edges of the 480 cps square wave developed in the switcher unit will dictate when the heads will be switched. Under these circumstances the switching time will be located randomly with respect to the video information being reproduced. The blanking switcher section recreates this square wave from the switcher section, but the leading and trailing edges of the waveform are delayed approximately 2 microseconds (determined by the delay inherent in the processing amplifier) after the trailing edge of the first sync pulse which occurs following the original switching time.

UNIT SET-UP

NOTE

Have tape threaded on the tape transport.

Switcher Section

Step 1: Actuate the head override switch; place the EE-TAPE switch in its EE position; place BLANKING SW. switch S64001 (on the switcher) in its OUT position

Step 2: Insert the oscilloscope probe in TP64005 240 CYCLE INPUT and check for a 9 volt peak-to-peak 240 cycle sine wave. If necessary adjust R64010 INPUT LEVEL to achieve the quoted amplitude. (This signal is derived from the drum servo control unit.)

Step 3: Insert the oscilloscope probe in TP64004 480 CYCLE FILTER and check for a 480 cycle, symmetrical sine wave. If necessary adjust L64002 (not marked on chassis) for maximum amplitude.

Step 4: Insert the oscilloscope probe in TP64008 480 CYCLE LIMITER and check for a symmetrical 480 cycle square wave. If necessary adjust SYM control R64009. Place the EE-TAPE switch in the TAPE position.

Step 5: Insert one oscilloscope probe in TP64003 CH 1 & 2 SWITCH, insert the second oscilloscope probe in TP64002 CH 1 to SWITCH TUBE. Check that a positive 480 cycle square wave peak falls at the center of a positive 240 cycle trapezoidal peak. If necessary adjust L64002 to achieve this condition.

Step 6: Now insert the second oscilloscope probe in TP64007 CH 2 TO SWITCH TUBE (leaving the first probe in TP64003 CH 1 & 2 SWITCH). Repeat check of Step 5, the waveforms should fall as described.

Step 7: Insert one oscilloscope probe in TP64011 CH 3 & 4 SWITCH, insert the second probe in TP64010 CH 3 TO SWITCH TUBE. Repeat the check of Step 5, the waveforms should fall as described.

Step 8: Now insert the second oscilloscope probe in TP64014 CH 4 TO SWITCH TUBE (leaving the first probe in TP64011 CH 3 & 4 SWITCH). Repeat the check of Step 5, the waveforms should fall as described. Remove both oscilloscope probes.

Step 9: The equalization potentiometers for each of these input pre-amplifiers specifically R64002, R64005, R64008 and R64012 should all be set to mid position. The SWITCHING PLATE equalizing potentiometer R64013 also should be set to mid position.

Step 10: Place R64001 CH 1 GAIN, R64004 CH 2 GAIN, R64007 CH 3 GAIN, and R64011 CH 4 GAIN (video GAIN controls) in their midrange positions.

Step 11: Place the BLANKING SWITCHER switch S64001 in the IN position and proceed to the blanking switcher section.

Blanking Switcher Section

Place EE-TAPE switch in EE position.

Step 1: Insert the oscilloscope probe in TP64012 BLANKING SWITCHER INPUT. Check for a symmetrical 480 cycle square wave (from the switcher).

Step 2: Sync the oscilloscope (external) to TP75016 SYNC. OUT on the processor.

Step 3: Insert one oscilloscopr probe in TP64024 DIFF. SYNC. and the second probe in TP64023 PROCESSED SYNC. The 15,750 cycle multivibrator frequency should be locked to the horizontal sync rate (from the processor at TP64023 PROCESSED SYNC). Remove both probes.

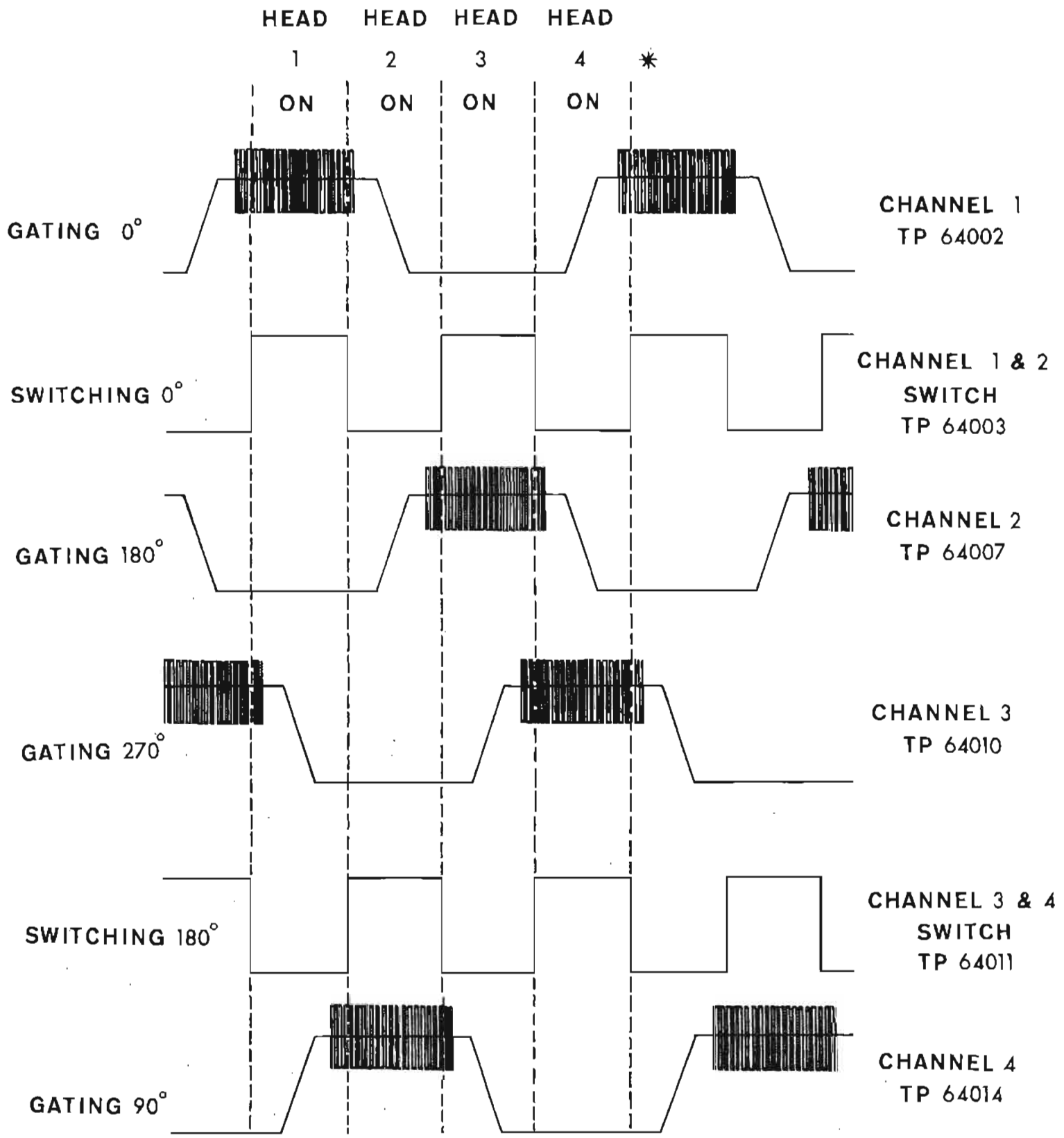
Step 4: Sync the oscilloscope to line. Place one oscilloscope probe in TP64012 BLANKING SWR INPUT, the second in TP64016 BLANKING SWR OUTPUT.

Step 5: The 480 cycle square wave should lock in. The leading and trailing edges will have a slight jitter. Remove both probes.

Step 6: Insert one oscilloscope probe in TP64017 COMPOSITE GATING and the other in TP64018 COMPOSITE GATING. The display should be two 480 cycle square waves exactly 180° out of phase with 15,750 cycle horizontal sync pulses riding thereon.

Step 7: De-actuate the HEAD OVERRIDE switch.

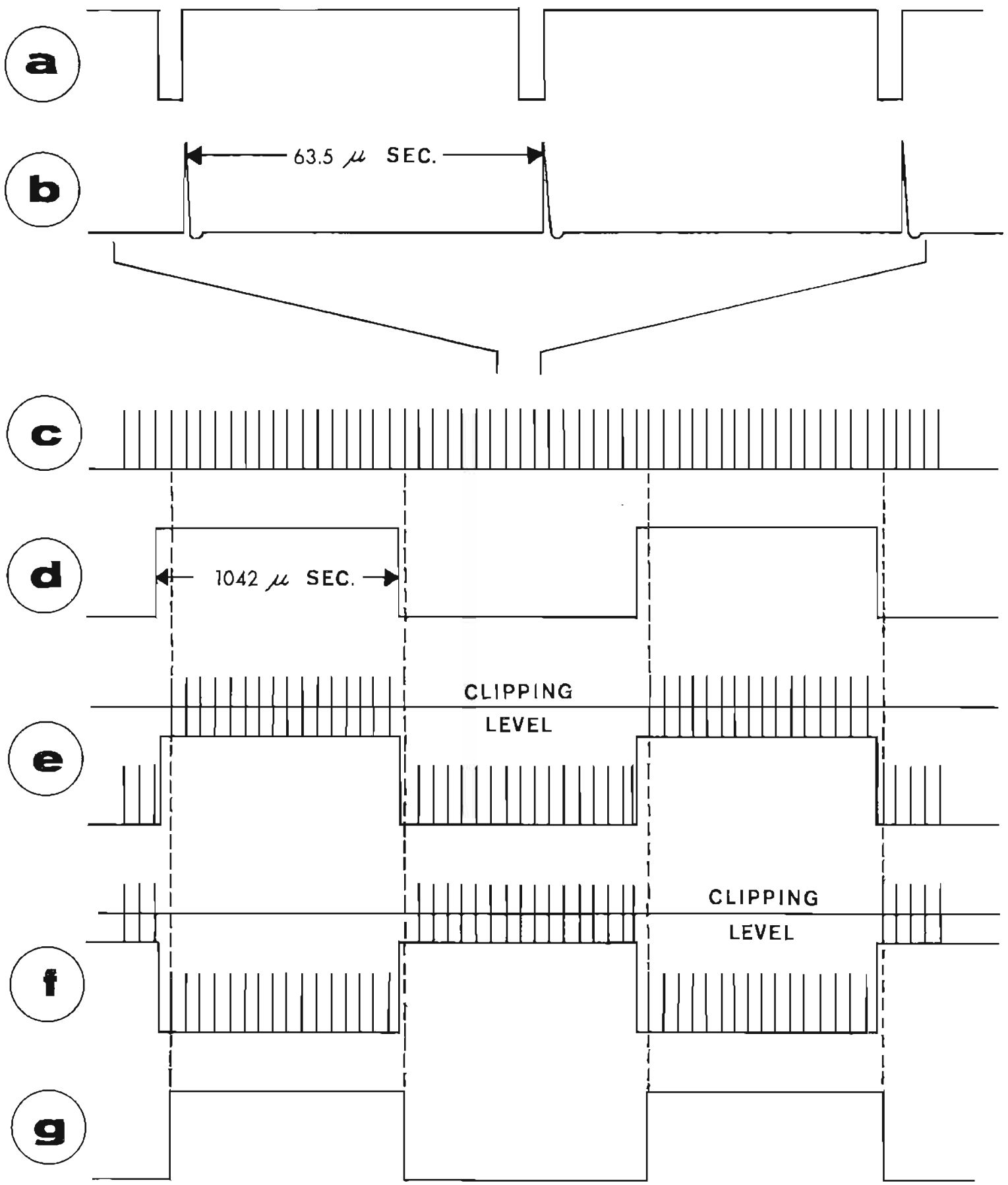
SEE VOLUME 2 FOR PIN VOLTAGES AND PARTS LIST.



* CHANNEL SWITCHING ORDER 1-4-2-3

SWITCHER WAVEFORM DIAGRAM

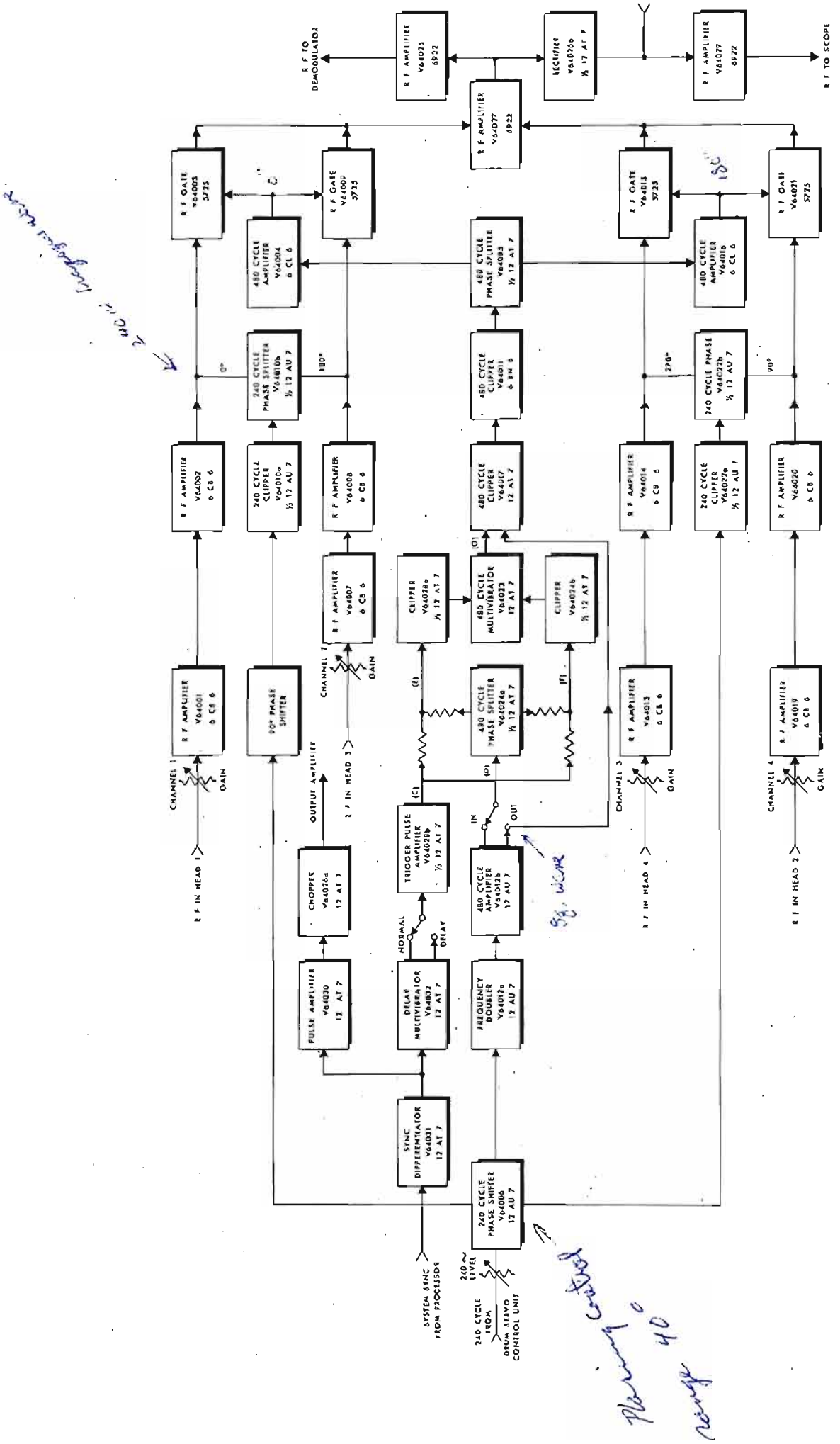
VRB/CSW 1



VRB / CSW 2

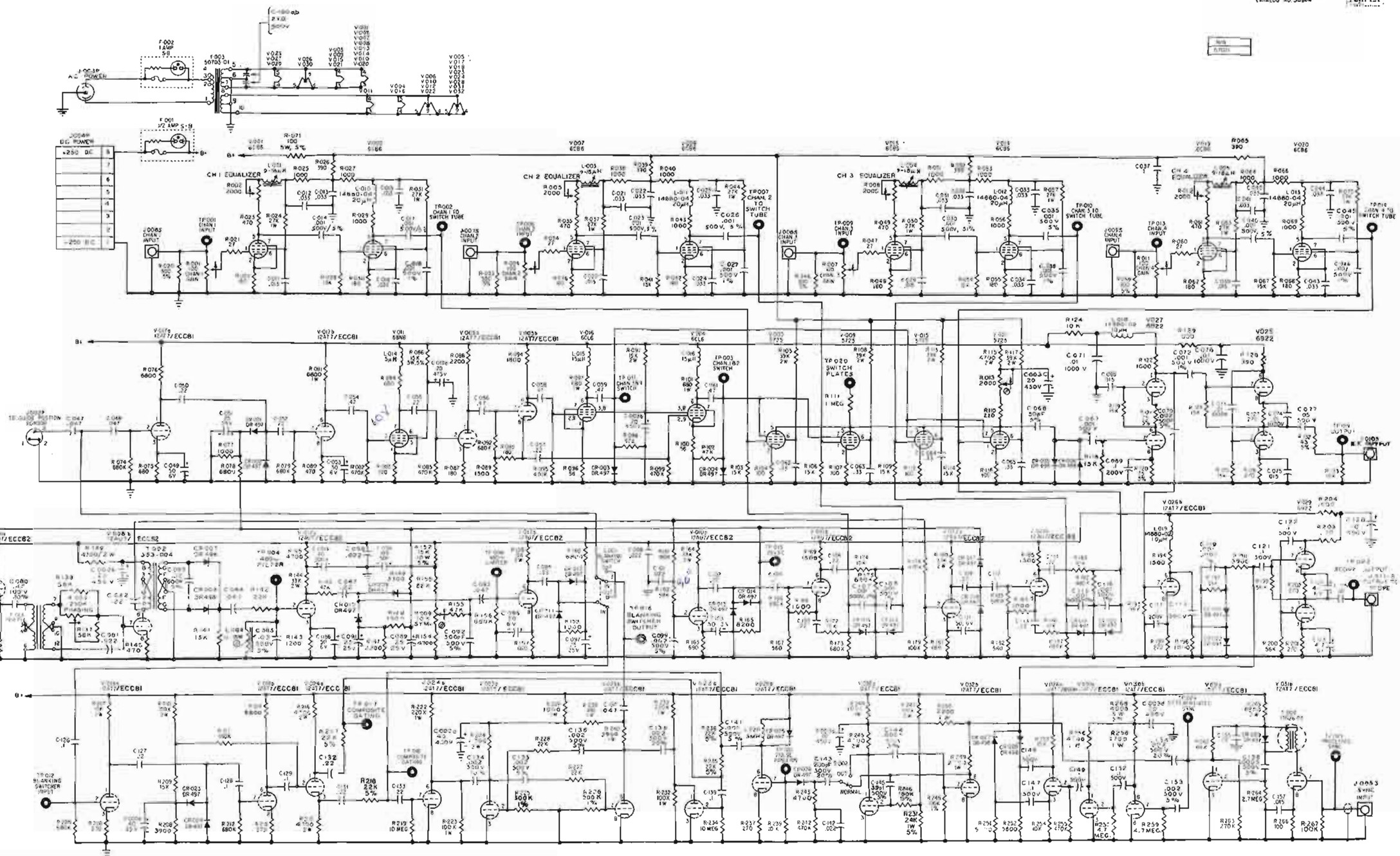
BLANKING SWITCHER WAVEFORM DIAGRAM

CHANNEL SWITCHER BLOCK DIAGRAM



SCHEMATIC—
CHANNEL SWITCHER
CATALOG NO. 50804

AMPEX



NOTES:

1. ALL SCHEMATIC REFERENCE NUMBERS ARE 64000 SERIES. ONLY LAST 3 DIGITS ARE SHOWN. (EXAMPLE: R.012 INDICATES R64012).
2. ALL RESISTORS IN OHMS, 1/2 W. 10% UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITORS IN MICROFARADS, RATED 400V, 10% UNLESS OTHERWISE SPECIFIED. MULTIPLE ELECTROLYTIC CAPACITORS CODED AS FOLLOWS: a = ⏢, b = □, c = △, d = UNCODED TERMINAL. MICA CERAMIC RATED 500V, 5%.
4. ALL POTENTIOMETERS ARE LINEAR TAPER 2 W UNLESS OTHERWISE SPECIFIED.
5. WAVEFORM VOLTAGES ARE PEAK TO PEAK.
6. PERFORMANCE PER A.E.S. 12-277.

VR B
CSW 4

IB57020

PROCESSOR

GENERAL

The Processor performs several functions, some for both Monochrome and color reproduction, others for color only.

Monochrome and Color Reproduction

1. The processor limits all noise to fixed levels during the video portion of the signal so that no negative noise peaks extend below the blanking level, and no positive noise peaks extend above the white level.

2. It eliminates all noise occurring during the vertical and horizontal blanking intervals.

3. Facilities are provided for controlling the video, blanking, and sync levels at either the local (rack) or remote locations.

4. In the processor noise from the incoming sync is removed and sync is reshaped and clipped. This processed sync is then re-inserted with video and blanking.

5. The unit provides two video and two sync outputs. One sync output (monochrome only) is used for synchronizing the guide position sensor and blanking switcher units.

Color Reproduction

1. New horizontal sync pulses to replace the original horizontal sync in the incoming composite color signal are generated in the processor. Because the back porch is occupied by color burst, and cannot be used for a switching point as in monochrome operation, switching takes place at sync tip in color reproduction. This causes superimposition of objectionable switching transients on the horizontal sync, and thus horizontal sync must be generated again.

2. A new color burst on the back porch of horizontal sync is generated in this unit. This color burst coincides in frequency and phase with the original color burst which has been unavoidably distorted in the recording process.

3. It provides for separate adjustment of the black clip level to prevent clipping of low level chroma information (especially cyan and blue) which may extend below the black level.

4. The processor provides a vertical blanking signal to gate the burst flag generator in the color rack.

The processor, mounted in rack 1, occupies 17-1/2 inches of vertical rack space. All adjustments are located at the front of the rack, and all connections made at the rear. Power to the unit is supplied by regulated one-ampere power supply B mounted on rack 2.

The primary processor function is to furnish a composite monochrome or color video output signal suitable for broadcast. The composite signal from the demodulator is not suitable for broadcast because it is excessively noisy. This noise has many sources: tape noise, tape drop-outs, head brushes, crosstalk, unfiltered rf, switching transients, etc. and, if not minimized, can cause malfunctioning of standard studio video equipment. By eliminating noise during sync and blanking periods, and by limiting it to a predetermined, adjustable level during the video portion of the signal, the processor produces an output signal which meets broadcast requirements.

Vacuum Tube Complement

Type	Qty.	Schematic Ref. No.
5687	6	V75008, V75010 V75014, V75017 V75022, V75030
12AT7	8	V75016, V75018 V75019, V75020 V75026, V75027 V75028, V75029
12AU7	2	V75007, V75025
6AU6	2	V75001, V75003
5725	3	V75002, V75012 V75024
6AQ6	2	V75004, V75006
6U8	1	V75005
6BN6	2	V75013, V75021
6AL5	1	V75015
6AB4	1	V75023
E88CC/6922	1	V75011

THEORY OF OPERATION

Video Section

The processor video section consists of five voltage amplification stages V75010a, V75004, V75010b, V75009, and V75005a, one mixer stage V75006 (V75005b color only), and V75007a, two cathode follower stages V75011b and V75007b and two cathode follower totem-pole output stages V75008 and V75014.

In passing through the video section, the composite video signal is clamped and then clipped to remove sync and blanking and to limit noise to peak white in the positive direction and to blanking level in the negative direction. Blanking is reinserted and the non-composite signal further amplified. Cleaned-up sync is reinserted in the mixer stage (along with color burst when reproducing a color signal) and the composite signal is fed to its two outputs via separate cathode-anode followers.

The overall bandpass of the video section extends from 30 cycles to 6 megacycles as measured at the -3db points Response is essentially flat within 1 db from 1 kilocycle to 4 megacycles.

The video signal from the demodulator enters the processor at J75011S, where it is terminated in 75 ohms, the characteristic impedance of the interconnecting coaxial cable, by the parallel combination R75010 and R75021. The signal level to the grid of the first video amplifier, V75010a, is adjustable at R75010 INPUT LEVEL. Video amplifier V75010a is a conventional cathode-biased triode. High frequency compensation is provided by L75011 and C75021. Low frequency equalization is provided by R75025 and C75009a.

The output of V75010a is coupled to the grid of the second video amplifier, V75004, through coupling capacitor C75022. V75004 is a conventional cathode-biased pentode. High frequency compensation is provided by L75012. Low frequency compensation is provided by C75019. Low frequency equalization is provided by R75029 and C75010a.

The output of the second video amplifier is fed through coupling capacitor, C75023, to the grid of cathode follower, V75011b. At the grid, the sync tips of the composite video signal are clamped by the action of the keyed clamper tube, V75015. This clamper is keyed by pulses generated from the horizontal sync pulses which are removed from the composite signal later in the video chain and fed back to this point. A clamped composite video signal is thus available at the cathode of cathode follower, V75011b and may be observed at test point TP75008, CLAMPED COMPOSITE VIDEO. Sync is now stripped from the composite signal by the conduction of diode CR75003 at the junction of L75013 and R75036. The conduction path for CR75003 is from ground, through R75033, L75013, CR75003, R75037 and R75038 to B+. C75025 acts as a decoupler, preventing the sync signal

from feeding back into the power supply. This stripped sync will be processed and reinserted later in the video chain. The manner in which the sync is processed is described in detail in the Sync Section of this discussion.

The video signal with sync removed passes through isolation resistor R75036 to the grid of the third video amplifier V75010b. Three diodes CR75001, CR75002 and CR75004 are connected to the grid. Diode CR75004 conducts during the blanking intervals to superimpose new blanking signals coincident with the original blanking signals at this point. These new blanking signals are generated from the sync previously stripped. Their generation is described in detail in the Blanking Section of this discussion. Any noise on the original blanking signal is thus shifted to the new blanking level resulting from the addition of new and old blanking. This new level is more than sufficient to cause conduction of diode CR75001 which clips the most negative portion of the combined signals, thus removing the noise. The back bias and therefore the conduction point of CR75001 is determined by the setting of R75004, LOCAL PEDESTAL HEIGHT. The setting of this potentiometer determines how much of the combined blanking signal will be clipped and therefore how high the pedestal with respect to the video signal will be. The purpose of reinserting blanking, is to move the noisy portion of the original blanking signal well into the conduction point of CR75001. Diode CR75002 is back biased by potentiometer, R75002, WHITE CLIP. The setting of this control determines the conduction point of CR75002 and therefore the maximum excursion of the video signal in the positive (white) direction. Adjusting WHITE CLIP for a less positive voltage on the back of CR75002 causes CR75002 to conduct sooner for a given input signal, clipping the upper (white) portion of the video. To summarize: diodes CR75004 and CR75001 determine the maximum excursion of the video signal in the negative (blanking) direction; diode CR75002 determines the maximum excursion of the video signal in the positive (white) direction. No noise more positive than maximum white or more negative than blanking can occur during the video portion of the signal. No noise at all can occur during the blanking portion of the signal.

The third video amplifier V75010b is a conventional cathode-biased triode. High frequency compensation is provided by L75010. L75005 is the common shunt peaking coil for both V75010b and the following video amplifier V75009. The clipped non-composite video may be observed at cathode test point, TP75009, CLIPPED VIDEO. Potentiometer R75006, BLACK CLIP REF is used only for color operation. Its function will be described in the Color Section of this discussion. A 0.5 microsecond delay line, DL75002, is placed between the plate of the tube and the coupling capacitor, C75027, to delay the non-composite video by 0.5 microseconds, which is the total delay introduced by the sync circuits from the time sync is removed until it is reinserted. This insures that the reinserted sync will have precisely the same time relationship to the non-composite video as did the original sync before stripping. The characteristic impedance of DL75002 is 2000 ohms. Two fixed resistors, not shown on the schematic diagram, are part of the internal construction of the delay line. The internal resistor on the plate end is 1000 ohms which is in series with

R75044 and properly terminates the plate end of the line. The internal resistor on the output end, (1800 ohms in series with R75045 and the negligible reactance of C75121 and C75013), properly terminates the load end of the line. The delayed non-composite video signal is developed across R75045 and coupled to the grid of the fourth video amplifier V75009, through coupling capacitor, C75027.

Video gain amplifier, V75009, and its associated unconventional circuitry are required to permit precise control of video gain from a minimum of 0 db to a maximum of +10 db with differential gain minimized. This is accomplished by maintaining a constant input signal to the control grid. The gain of the stage is controlled by the division of tube current between two separate plates. In this manner, the tube always operates on the linear portion of its characteristic curve

V75009 is a miniature double-plate sheet beam tube with balanced deflectors for directing the electron beam toward either of two plates The control grid, pin 6, controls the intensity of the electron beam. Grid 2, pin 5, of the tube is the focusing electrode and is normally operated at ground potential. Grid 3, pin 5, of the tube is the accelerating electrode and is usually returned directly to B+. Depending upon the voltages applied to the deflectors, the electron beam will be directed entirely to one or the other of the two plates, or proportioned between them. The deflectors normally are operated at a reference voltage somewhere between -8 and 0 volts. When both deflectors are at the same voltage (somewhere between -8 and 0) the tube current is divided exactly between the two plates. When one deflector is positive with respect to the other by 18 or more volts, all the current is directed to its plate. For voltage differences between deflectors within the range of 0 to 18 volts, the division of current is proportional. Because the plate at pin 9 of V75009 is by-passed to ground for video by capacitor C75011b the left section (as shown on the Processor Schematic Diagram) is referred to as the control section. The signal is developed across the plate load of the right (signal) section, and coupled to the fifth video amplifier V75005a by coupling capacitor C75023. With the control section completely cut off, the signal section is operating at maximum gain. With a total plate current of 15 ma flowing, the grid to cathode bias is -2 25 volts. Cut-off for the tube with a B+ of 250 volts is -14 volts, allowing adequate range in the amplitude of the negative going input signal before cutoff is reached Cathode bias for V75009 is provided by R75051. High frequency compensation is provided by C75032 and L75005 Low frequency equalization is provided by the rc plate network, R75046 and C75011a which are common to the plate circuit of V75010b. Capacitors C75028 and C75030 serve the dual purpose of by-passing any video on the deflectors to ground and preventing any noise on the local or remote video gain lines from coupling through the tube. The two sections of R75005 a and b LOCAL VIDEO GAIN potentiometers are connected in such a way that a rotation of the common shaft causes a less negative voltage to be developed on one while a more negative voltage is developed on the other

The output of V75009 is fed to the grid of the fifth video amplifier, V75005a, which is a conventional cathode biased pentode. High frequency compensation is provided by L75003 and C75034. Low frequency equalization is provided by the plate RC network, R75054 and C75011c.

The output of V75005a, is fed via coupling capacitor C75035 to the grid of V75006, which forms the video section of the mixer. Cathode bias for V75006 is developed across unbypassed cathode resistor, R75062. Test point TP75004 VIDEO ONLY, is available in the cathode of V75006 to observe the video signal before mixing. High frequency compensation for the entire mixer is provided by L75004. Low frequency equalization is provided by the plate rc network, R75059 and C75012a. The dc level of the non-composite video signal is clamped by the action of a soft clamp circuit composed of CR75020, R75052 and C75124 shunted by resistor R75058. Any shift in dc level caused by rapid rotation of the LOCAL VIDEO GAIN control or the remote control is corrected by the action of this circuit.

V75007a comprises the Sync adder portion of the mixer. Its operating point is determined by the fixed cathode bias developed across voltage divider, R75071 and R75072, the additional cathode bias developed by tube conduction and the setting of LOCAL SYNC GAIN (or REMOTE SYNC GAIN) R75011, which varies the positive potential on the control grid of V75007a, and therefore determines the operating bias of the tube. Because the gain of V75007a is fixed, setting LOCAL SYNC GAIN for a minimum positive voltage on the control grid allows a maximum amount of the positive going input signal to be amplified before grid current limiting takes place. Conversely, as the grid is made more positive, grid current limiting takes place at a lower level on the input signal with a corresponding reduction in the plate component. In this manner a linear control of sync level with respect to video level is achieved. Because a common plate load is used for all three sections of the mixer, the mixing action is additive and the plate output is the sum of the instantaneous input voltages. No additional clamping of reference levels is required. C75012d in the sync adder cathode circuit serves the dual purpose of de-coupling sync from the B+ line and boosting the low frequency response of the sync adder section of the mixer. The function of the third section of the mixer, Color Burst Adder tube, V75005b, will be described in detail in the Color Section of this discussion.

The composite output signal of the mixer is capacitively coupled by C75041 to the grid of isolation cathode follower V75007b. Test point TP75005 is provided in the cathode circuit for observing the composite video. The cathode circuit consists of parallel potentiometers R75007 OUTPUT 1 LEVEL and R75008 OUTPUT 2 LEVEL, which provide a means for setting the levels of output tubes V75008 and V75014.

Both of these video output tubes are identical "totem-pole" cathode followers, also known as shunt-regulated cathode followers or anode-cathode followers. Because the totem-pole cathode follower behaves as a matched generator, (matching the output impedance of isolation cathode follower V75007 to the impedance of the coaxial cable), its gain is 0.5. The

low output impedance of the totem-pole cathode follower is matched to the coaxial cable impedance through the V75008 circuitry, C75008, R75079, and precision potentiometer R75009.

A discharge path for capacitor C77008 is provided through R75079, R75009 and R75081. Test point TP75007 VIDEO OUTPUT 1 is provided to observe the composite video output, serving also as a convenient point for checking proper setting of OUTPUT 1 Z ADJUST, because the level at this point should be exactly double the terminated level when the connecting coaxial cable is removed.

Sync Section

The sync signal taken from the cathode circuit of V75011b and delivered through CR75003 to the grid of V75019a is amplified and inverted by this stage and delivered to the grid of clipping amplifier V75019b, through a low pass filter circuit formed by L75017 and C75065 that removes high frequency noise and any rf components of the signal. Diode action between the grid and cathode of V75019a clamps the tips of sync to zero volts. Low plate voltage on V75019, derived through the voltage divider circuit of R75142 and R75140, results in a very small negative voltage on the grid, cutting off the tube. Thus the waveform at the plate is derived from the peaks of the sync pulses.

The signal is next amplified in V75020a, which delivers positive pulses to the control grid of sync gating tube V75021 and to the vertical and horizontal gate generating circuits. Gating signals applied to the suppressor grid of V75021 are slightly wider than the sync pulses applied to the control grid. Consequently any noise pulse between sync pulses is eliminated in the output. Specifically, the gating signal consists of the vertical blanking pulse, plus horizontal gating pulses which extend from the start of horizontal blanking time to barely past the trailing edge of sync. Thus they are considerably narrower than the horizontal blanking pulses.

The gated sync output of V75021 is amplified in V75020b and coupled to dual stage V75022, one output of this stage is coupled to the grid of V75004a discussed in the Video Section, and another output fed to SYNC OUT J75006S. V75022 is a dual triode tube, with the sections connected in parallel. Utility sync for studio purposes is available at J75006S. Driving impedance is approximately 75 ohms.

A sync signal is taken from each cathode of V75022, one of which drives V75012 in the phantastron color section the output of which is routed through J75007S to the channel switcher and automatic compensation sensor. The other signal is delivered to the keyed clamp circuit at V75016b.

A delay of the trailing edge of the sync pulse is introduced in the input to V75016b by the circuit consisting of L75016, C75061, and CR75008. During the initial rise of the pulse CR75008 conducts, shorting out L75016 and quickly charging C75061, so the leading edge of the sync pulse is virtually unaffected. When the trailing edge occurs, the anode of CR75008 suddenly returns to zero, while the cathode is held at +7 volts by the charge on C75061. Since the diode cannot conduct, C75061 starts to discharge sinusodially through L75016. When the voltage across C75061 attempts to fall below zero volts the diode will again conduct, dissipating the energy stored in L75016. Thus the trailing edge of the sync pulse as it appears at the grid of V75016b is delayed approximately 1 microsecond after the normal trailing edge. Specifically, this trailing edge occurs as 1/4 cycle of a 250 kc sine wave, with the maximum slope occurring at the point the waveform returns to zero volts. This delay, in conjunction with delays inherent in the sync amplifier, causes the clamping action to take place well out on the back porch of the blanking pulse, and ensures the elimination of any clamping transients from the final signal, by the action of the sync gating circuit.

The sync pulse is amplified by V75016b and differentiated in the plate circuit, with a positive spike, produced by the trailing edge, delayed approximately 1 microsecond from the normal trailing edge. These positive peaks are clamped to zero volts by diode action between the grid and cathode of V75016a. The negative pulses corresponding to the leading edge of sync are below cutoff level for V75016a and thus are eliminated from the waveform. The output of this stage is thus negative spikes only.

The clamping circuit design is quite conventional. Clamping pulses from V75016a are fed to the phase splitting circuit of V75011a, which delivers equal pulses of opposite polarity to the dual clamping diode circuit of V75015. The two diodes are series connected so that they conduct during the pulse time, causing the grid of V75011b to be clamped to zero volts. During the non-pulse time the diodes are back biased, causing the junction of the diodes at pins 1 and 2 to float. Resistor R75116 softens the clamping action.

Vertical Gating and Blanking Generator Circuit.

The positive sync signals at the plate of V75020a (waveform "a" on the waveform diagram) are integrated by R75226-C75103 to develop positive pulses from the vertical sync pulse (wave-form "b"). The tips of these pulses are clamped by cathode to grid diode action in V75026b, and appear at the plate of this tube as amplified, negative, pulses (waveform "c").

The diode circuit of CR75023 provides a delay of the trailing edge of this pulse. The leading (negative going) edge of the pulse drives the cathode of CR75023 in a negative direction, and C75105 can rapidly discharge through the diode. At the end of the pulse the cathode of CR75023 rapidly returns to its normal potential and stops conducting. At this time capacitor

C75105 can charge only through the circuit of R15015 VERTICAL BLANKING POSITION and R75231 and the plate potential rises at an exponential rate determined by the adjustment of R15015. Thus the trailing edge of the pulse (waveform "d") has a slope whose angle is controlled by R15015.

The positive portion of this signal is clamped at zero volts at the grid of V75027a. The portion of the waveform which lies between zero volts and the grid cutoff voltage of V75027a, appears at the plate of V75027a as a positive pulse (waveform "e") whose trailing edge is determined by the adjustment of R15015. This trailing edge will essentially coincide with the end of the vertical blanking period (the top of the video picture).

The remaining circuits of the vertical gating and blanking generator establish a fixed delay at the start of the next vertical blanking interval. The positive pulse from V75027a is fed to V75027b, the plate load of which consists of a damped, parallel resonant circuit tuned to approximately 1000 cps. The plate (waveform "f") thus consists of two highly damped trains of oscillations for each pulse -- one starting in the negative direction, corresponding to the leading edge of the pulse, and one starting in the positive direction, corresponding to the trailing edge of the pulse. When this signal is applied to V75028a, the positive pulse -- initiated by the trailing edge of waveform "e" -- drives the tube to conduction during the peak of its cycle, thus producing a negative pulse at the plate of V75028a (waveform "g").

The output of V75028a, a 50 volt peak-to-peak negative going pulse, is used to trigger the unblanking phantastron which consists of phantastron generator V75024 and phantastron cathode follower V75028b. This phantastron is basically a cathode coupled type with the cathode follower used to speed up the discharge of C75112. A negative 50 volt vertical sync pulse initiates the phantastron sweep in the plate circuit of V75024. The voltage from which the plate begins its sweep is determined by the setting of R75016 VERTICAL BLANKING WIDTH. With this control in its maximum clockwise position, the initial plate voltage is approximately 170 volts. In its maximum counterclockwise position, the initial plate voltage is approximately 125 volts. Bottoming of the plate run-down takes place at +5 volts and the rate of run-down is determined by the rc time constant of R75249 and C75112 and the gain of V75024. With VERTICAL BLANKING WIDTH in the maximum clockwise position plate run-down, (corresponding to the vertical unblanking interval), takes place in 16,366 microseconds. The phantastron recovers rapidly due to the fast discharge of C75112 through the cathode follower V75028b. Between plate sweeps, essentially all the tube current is drawn by the screen and the screen voltage drops. With a 16,366 microsecond plate run-down time, the negative square wave voltage at the screen has a duration of 300 microseconds. This 300 microsecond square wave is the vertical blanking waveform. With VERTICAL BLANKING WIDTH in the maximum counterclockwise position plate run-down takes place in 11,666 microseconds and the vertical blanking waveform at the phantastron screen is 5,000 microseconds duration.

Thus an adjustment of vertical blanking from 300 to 5,000 microseconds is provided by establishing the point from which plate run-down takes place and therefore the duration of the screen portion of the phantastron cycle. The negative going screen voltage is coupled through C75113 to blanking amplifier V75029a.

The clipped sawtooth waveform is again clipped and amplified by V75029a to produce the finished vertical blanking pulse (waveform "k"). This pulse is used both as a vertical gating pulse and as the actual vertical blanking pulse. V75029b inverts the pulse before it is added to the horizontal gating pulses.

Horizontal Gating Circuit

This circuit consists of V75025 (a and b) and V75026b. The circuit of V75025a is a conventional Hartley oscillator whose frequency is the 15,750 cps horizontal line rate. Since this oscillator operates Class C it draws short pulses of current at the peaks of the grid voltage swing. These pulses of current cause negative voltage pulses to appear at the plate (waveform "a", horizontal gating waveform diagram). These pulses correspond in shape to the tips of high amplitude sine waves, thus the width can be controlled by clipping at an appropriate level.

The clipping is performed by diode CR75017, with the clipping level adjusted at R15013, (the HORIZONTAL GATING WIDTH control), producing waveform "b" at the grid of V75030a. Since this signal drives V75030a deep into cutoff, the waveform at the plate of this tube is the complete horizontal gating pulse. The vertical gating pulse (previously discussed) is introduced through V75029b and lowers the voltage of the grid waveform of V75030a holding this tube at cut-off during the vertical gating interval.

The output of V75030a thus consists of vertical and horizontal gating pulses of positive polarity. These pulses are coupled to the suppressor grid of the sync gate tube V75021. Any noise occurring between pulses at the control grid of V75021 is thus eliminated from the plate waveform.

Oscillator V75025a is locked to the horizontal sync frequency by an AFC circuit consisting of V75026a and V75025b. The waveform at the plate of V75025a is integrated by the action of L75021 and C75093 to produce a sawtooth wave at the junction of L75021 and R75192. This sawtooth can be shifted in phase by R75017 which provides a positioning control for the horizontal gate pulse. The signal is fed to the phase discriminator circuit of V75025b, where sampling pulses -- derived from the positive sync pulses at the plate of V75020a -- sample the voltage of the sawtooth waveform. The sampled voltage appears at the junction of R75183 and R75184. When the oscillator is operating correctly the phase of the sawtooth with respect to the sync pulses will be such that sampling will occur just as the

retrace portion of the sawtooth wave is crossing the zero axis. If the frequency of oscillation tends to decrease or increase, the sampling will occur at a positive or negative point (respectively) on the sawtooth wave, thus generating an error voltage at the junction of R75183 and R75184. Any error voltage will raise or lower the bias level of reactance tube V75026a, which controls the frequency of the oscillator.

The reactance tube injects pulses of current in quadrature to the current in the oscillator tank circuit. The amplitude of these pulses is determined by the control grid bias, which is in turn controlled by the phase detector circuit of V75025b. Diode CR75014 clamps the positive peaks of the ac waveform at the grid of V75026a to the error voltage. Fixed bias is applied to the cathode (through voltage divider network R75189-R75191) ensuring that the angle through which current will flow is directly related to the dc level of the error voltage. The rc network of R75188-C75085 provides a fixed phase shift of the waveform at the plate to provide the necessary quadrature effect.

Blanking Former Circuit

The purpose of this circuit is to reform the horizontal gating pulses into horizontal blanking pulses. The circuit involved is identical in operation to that described in the vertical gating generator (V75026b, CR75023, and V75027a) and consists of V75018 (a and b), CR75022b, and V75017b.

The action of the circuit is shown on the horizontal blanking waveform diagram. Waveform "a" is the composite gating signal as it appears at the plate of V75018a. Waveform "b" shows the same signal at the grid of V75018b, indicating the action of CR75022 and the charging cycle of C75076 through R15014 (HORIZONTAL BLANKING WIDTH control) and R75168. (Clipping action of the tube due to cutoff is also indicated.) Waveform "c" shows the widened pulse as it appears at the grid of V75017b.

Cathode follower V75017a provides a low impedance output to the blanking adder circuit of V75010b (waveform "d"), and provides clipping of the negative peak of the waveform to ensure a constant signal amplitude of 15 volts, peak-to-peak.

The vertical blanking pulses pass through the blanking former circuit essentially unchanged.

Color Circuits

For further information concerning this section refer to the VR1000B COLOR SUPPLEMENT.

UNIT SET UP

Step 1: Place the MONITOR switch on the right control panel in the EE position and adjust the demodulator VIDEO OUTPUT LEVEL control R62002 for a demodulator output of 1.4 volts peak-to-peak as measured at test point TP62004 VIDEO OUT. Place the oscilloscope probe at processor test point TP75006 INPUT. The 1.4 volts peak-to-peak video signal from the demodulator will be observed at this point.

Step 2: Place the oscilloscope probe at test point TP75008 CLAMPED COMPOSITE VIDEO. Adjust R75010 INPUT LEVEL for a 7.0 volt peak-to-peak composite video waveform.

Step 3: Adjust R75002 WHITE CLIP fully clockwise; adjust R75004 LOCAL PEDESTAL HEIGHT, fully counterclockwise. Place the following potentiometers in the center of their ranges: R75005 LOCAL VIDEO GAIN, R75007 OUTPUT 1 LEVEL, R75008 OUTPUT 2 LEVEL, R75009 OUTPUT 1 Z ADJUST, R75011 LOCAL SYNC GAIN, and R75012 OUTPUT 2 Z ADJUST.

Step 4: Synchronize the oscilloscope externally from TP75006 INPUT. Place the oscilloscope probe at TP75017 COMPOSITE GATING. Adjust the oscilloscope for a display of three horizontal gating pulses. Remove V75019, sync amplifier, and adjust control C75001 (horizontal) OSC FREQ ADJUST until horizontal gating pulses on the scope drift slowly. Replace V75019; the horizontal oscillator will lock and the horizontal gating pulses will remain stationary on the scope.

Step 5: Place the oscilloscope probe at TP75009 CLIPPED VIDEO. Rotate R75004 LOCAL PEDESTAL HEIGHT throughout its range to determine that clipping can be accomplished from sync tip to 50% of video level. Adjust R75004 for 10% set-up, resulting in a waveform of approximately 5 volts peak-to-peak amplitude.

Step 6: With the oscilloscope probe at the same test point, rotate R75002 WHITE CLIP throughout its range to determine that clipping can be accomplished from white peaks to beyond 50% of video level. Leave R75002 in the maximum clockwise position.

Step 7: Place the oscilloscope probe in TP75004 VIDEO ONLY. Rotate R75005 LOCAL VIDEO GAIN throughout its range to determine that a minimum 1 volt peak-to-peak signal is available at TP75004. Adjust R75005 for a 0.7 volt peak-to-peak at TP75004.

Step 8: Place the oscilloscope probe at TP75005 COMPOSITE VIDEO. Rotate R75011 LOCAL SYNC GAIN throughout its range to determine that a composite signal of 8 volts peak-to-peak minimum is available at TP75005. Adjust R75011 for a sync amplitude representing 25% of the composite signal level.

Step 9: Place the oscilloscope probe at TP75007 VIDEO OUTPUT 1. Leave J75004s VIDEO OUTPUT 1 connector unterminated. Adjust R75007 OUTPUT 1 LEVEL for a 2.8 volt peak-to-peak composite waveform at TP75007. Terminate J75004s with a 75 ohm dummy plug or a 75 ohm terminated coaxial cable, and adjust R75009 OUTPUT 1 Z ADJUST for a 1.4 volt peak-to-peak video signal as measured at TP75007.

Step 10: Place the oscilloscope probe at TP75010 VIDEO OUTPUT 2. Leave J75005s VIDEO OUTPUT 2 connector unterminated. Adjust R75008 OUTPUT 2 LEVEL for a 2.8 volt peak-to-peak composite waveform at TP75010. Terminate J75005s with a 75 ohm dummy plug or a 75 ohm terminated coaxial cable, and adjust R75012 OUTPUT 2 Z ADJUST for a 1.4 volt peak-to-peak video signal as measured at TP75010.

Step 11 Rotate R75014 HORIZONTAL BLANKING WIDTH fully counterclockwise. Adjust the following controls to their mid-range R75013 HOR GATING WIDTH, R75015 VERTICAL BLANKING POSITION, R75016 VERTICAL BLANKING WIDTH, and R75017 GATE PHASE. Adjust the oscilloscope for a display at the horizontal sync rate. Adjust R75004 LOCAL PEDESTAL HEIGHT for 50% set-up.

Step 12: Adjust R75017 GATE PHASE to the point where the trailing edge of sync begins to narrow. Back-off R75017 approximately 45 degrees from this point.

Step 13. Adjust R75013 HOR GATING WIDTH to the point where the front porch begins to lengthen Re-check step 12 and repeat if necessary. If step 12 is repeated, repeat 13.

Step 14: Adjust R75014 HORIZONTAL BLANKING WIDTH fully clockwise At this setting, blanking will extend approximately 3 microseconds into the active picture area. Re-adjust R75014 to the point where the back porch barely begins to lengthen.

Step 5: Place the oscilloscope on line sync and adjust it for display at the vertical sync rate. Use expanded sweep so that the vertical blanking interval occupies approximately one-half of the sweep width. Adjust R75015 VERTICAL BLANKING POSITION until the back porch blanks out one more horizontal line of video information than normal.

Step 16: Adjust R75016 VERTICAL BLANKING WIDTH until the front porch blanks out one more horizontal line of video information than normal.

Step 17: Re-adjust R75004 LOCAL PEDESTAL HEIGHT, which was adjusted in step 11 above for 50% set-up, for a normal set-up of 10%.

Step 18: Check the following test points for output waveforms and amplitudes listed:

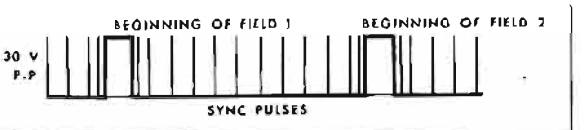
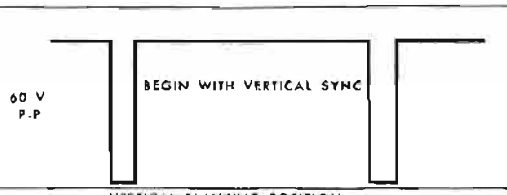
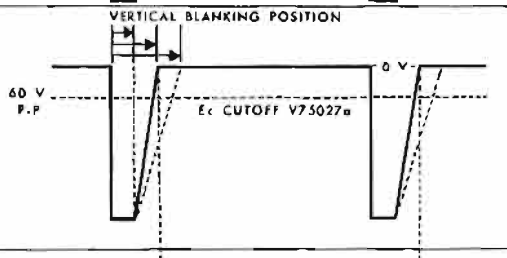
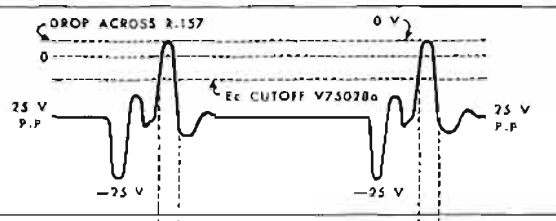
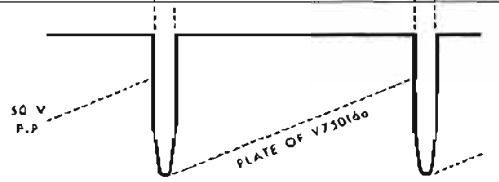
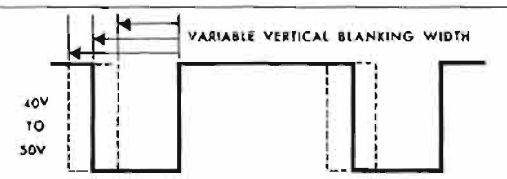
TP75011 KEYING PULSE for 15 volts peak-to-peak, with 1 microsecond delay between leading edge of keying pulse and trailing edge of sync.

TP75015 SYNC IN for 35 volts peak-to-peak, ±5 volts.

TP75016 SYNC OUT for 10 volts peak-to-peak, minimum.

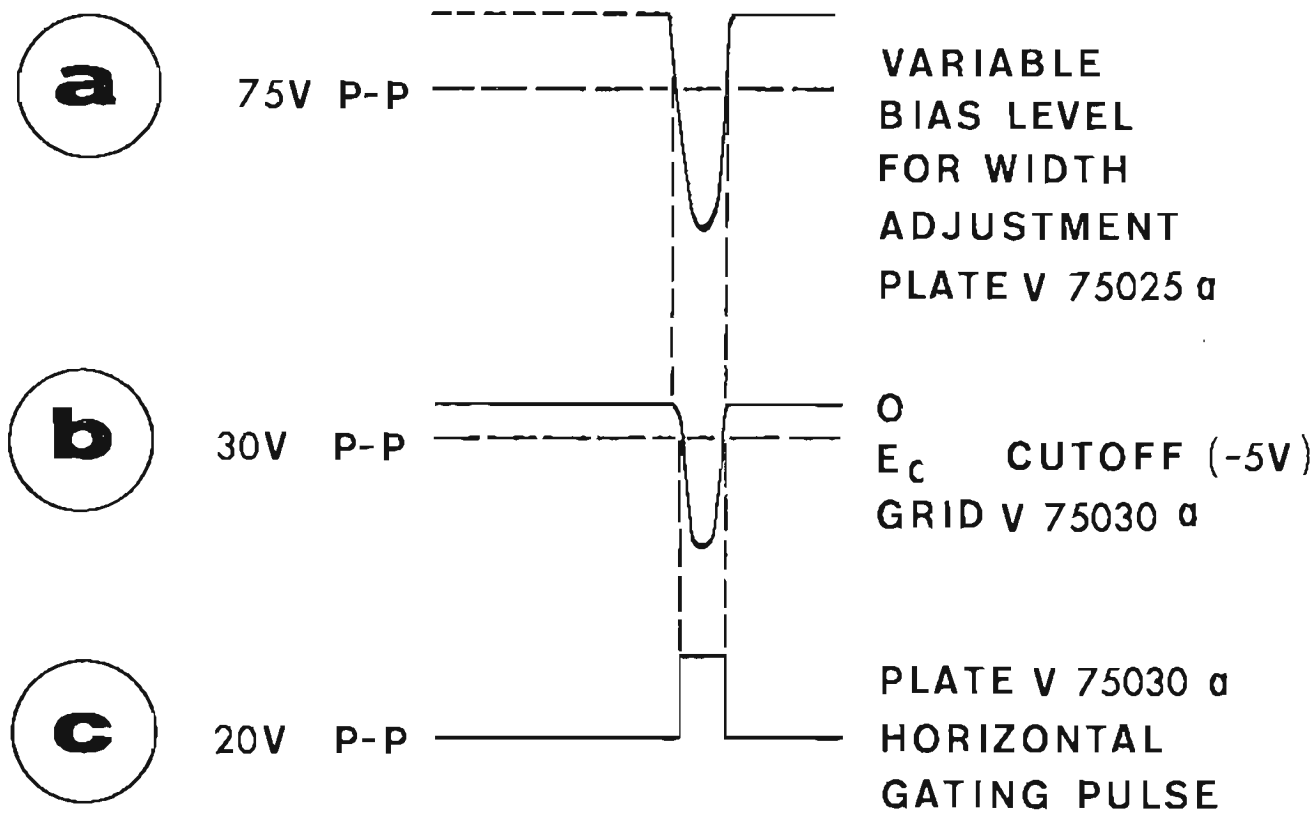
TP75018 SYSTEM SYNC for 2 volts peak-to-peak minimum.

SEE VOLUME 2 FOR PIN VOLTAGES, WAVEFORMS AND PARTS LIST.

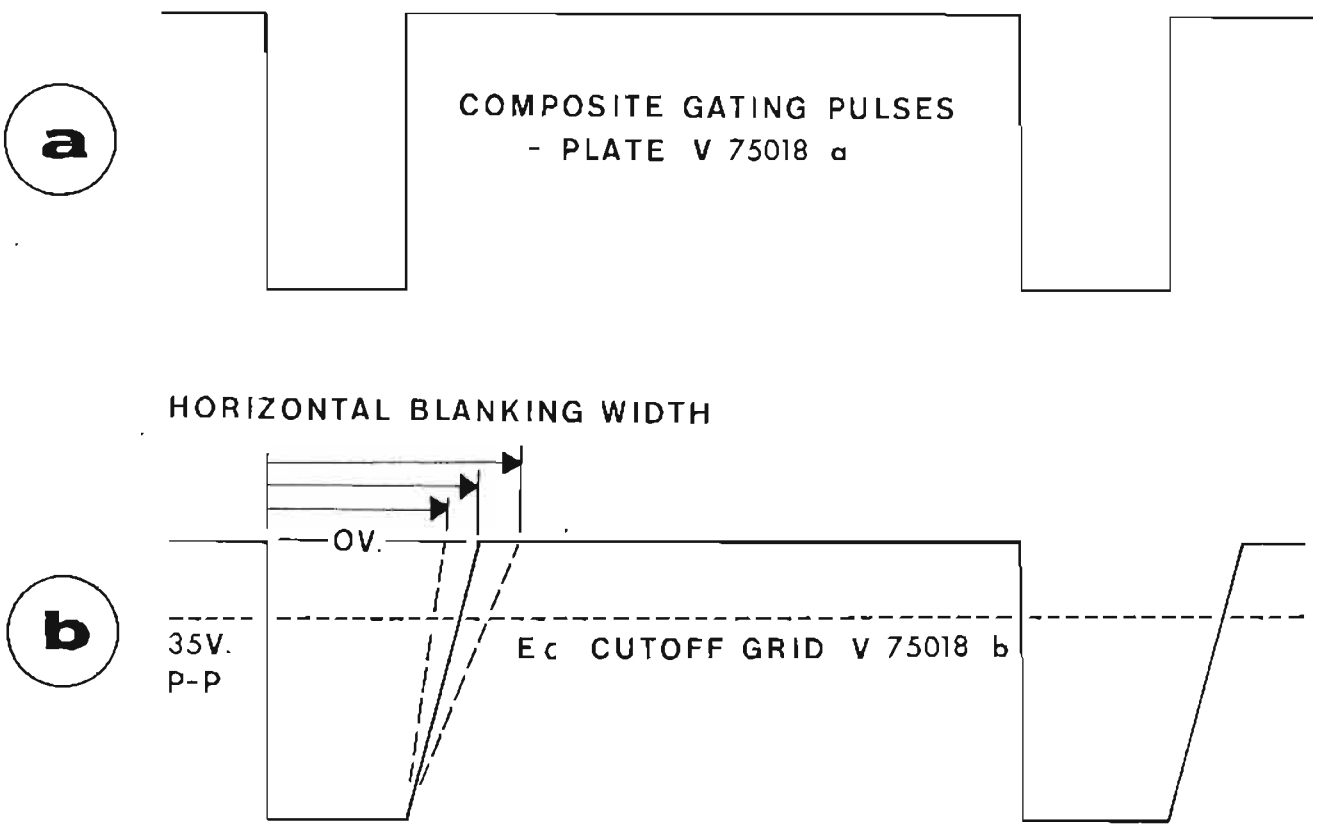
a	PLATE V73020a	
b	GRID V73026b INTEGRATED VERT SYNC	
c	PLATE V73026b	
d	GRID V73027a	
e	PLATE V73027a	
f	GRID OF V73028a	
g	PLATE OF V73028a	
h	SCREEN OF V73024b	
i	GRID OF V75029a	
j	PLATE OF V75029a	

VERTICAL GATING AND BLANKING

VRB/PRC 1



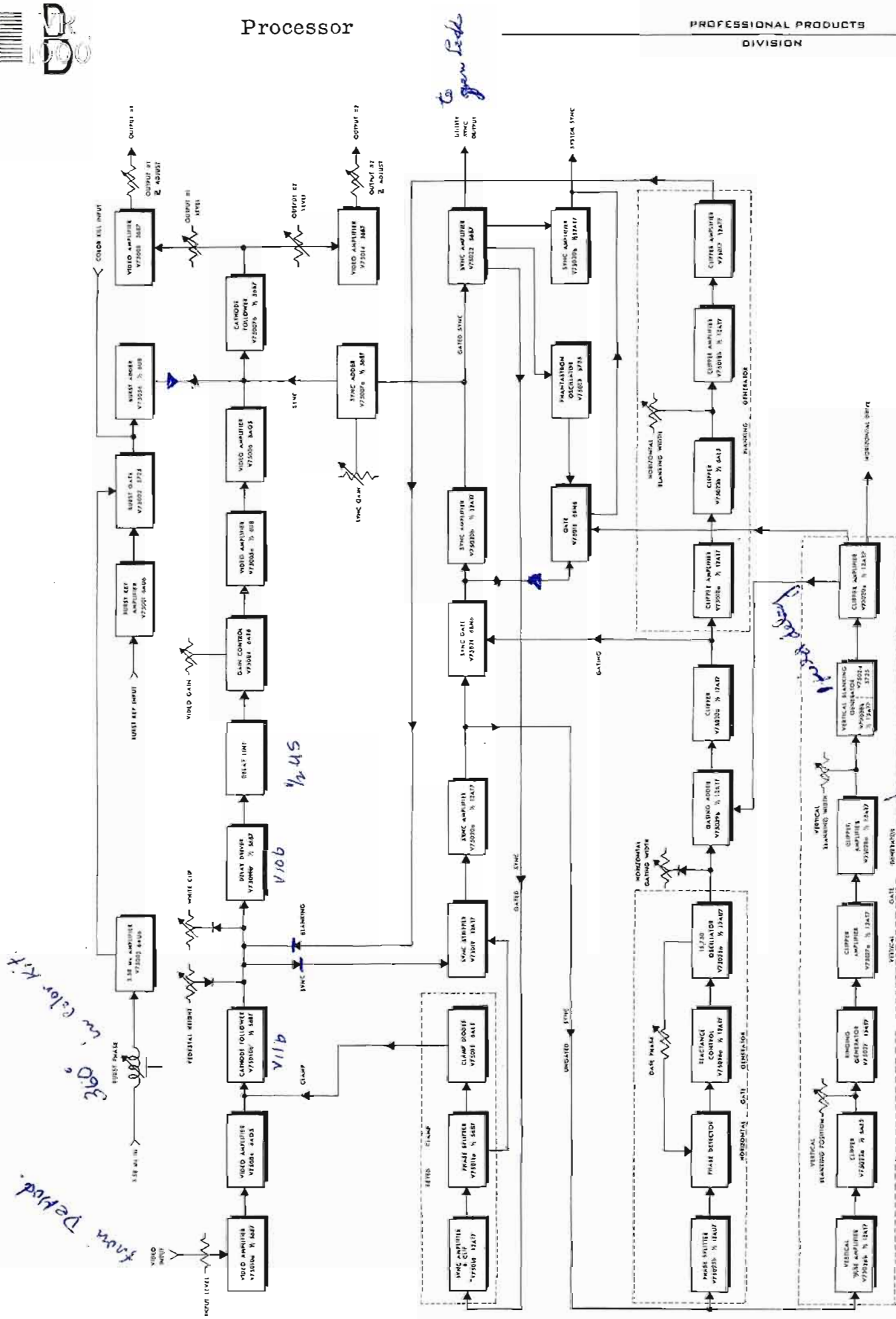
HORIZONTAL GATING WAVEFORM

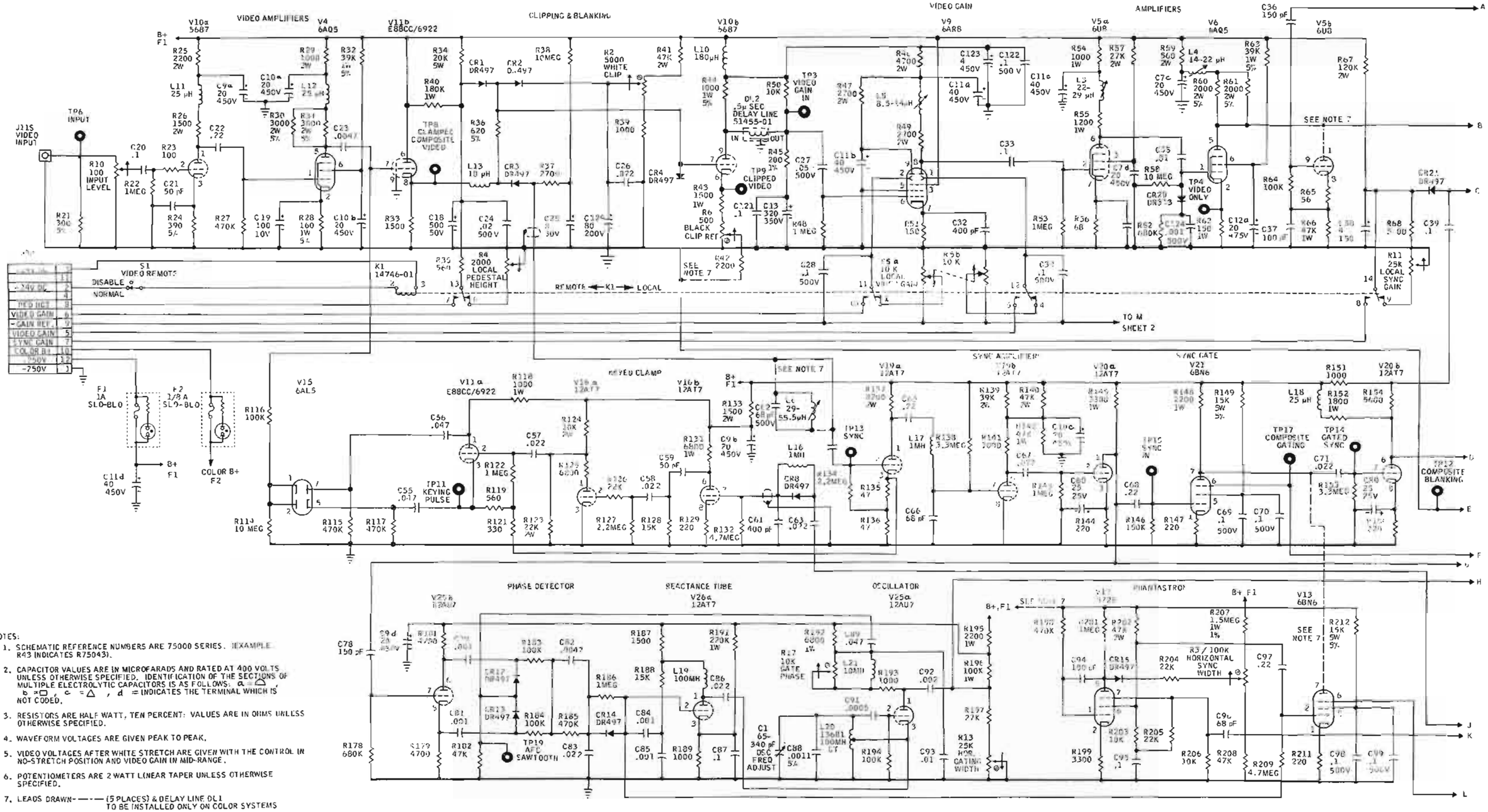


HORIZONTAL BLANKING WAVEFORM

VRB/PRC 3

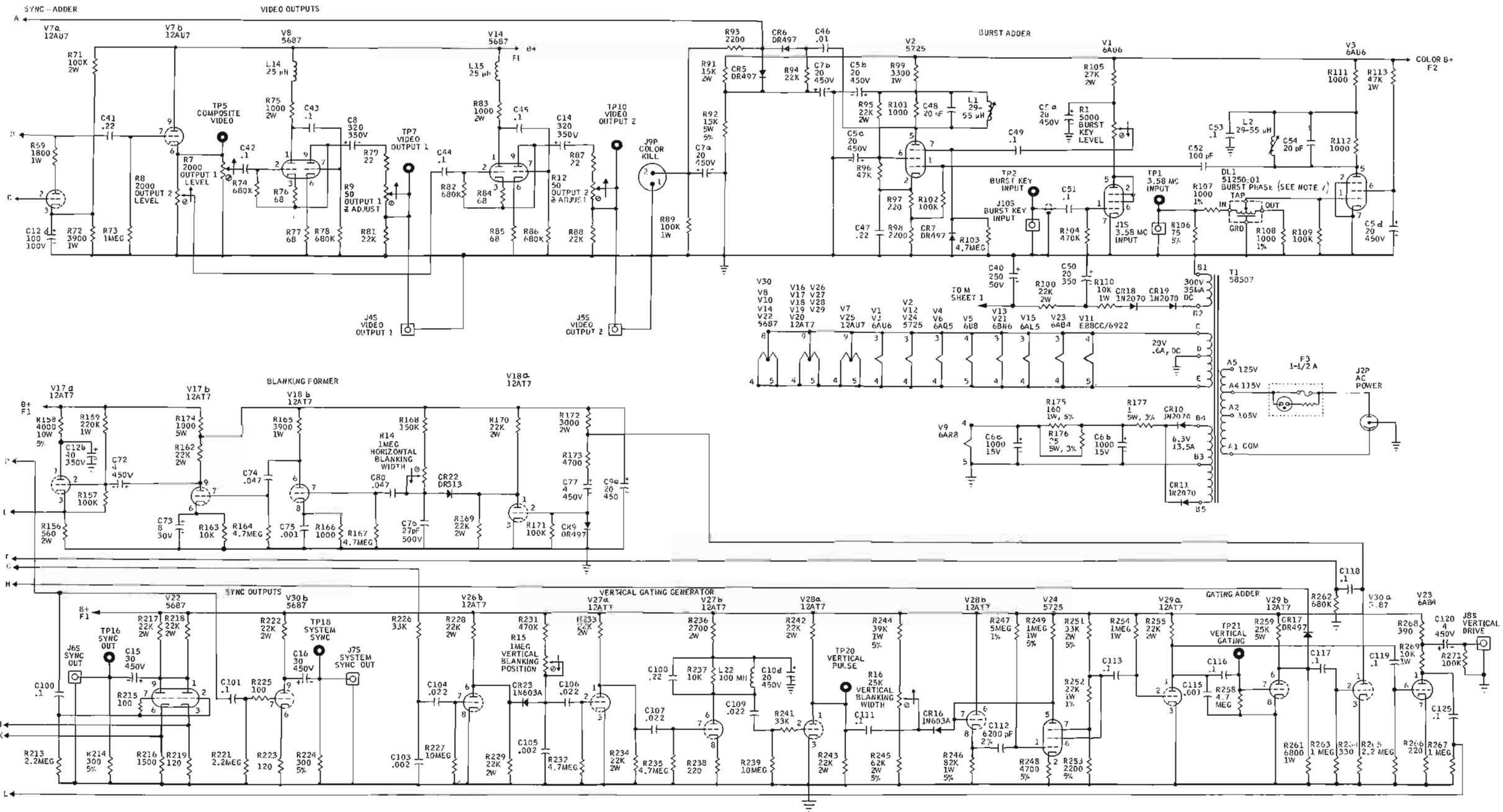
PROCESSOR BLOCK DIAGRAM





NOTES:

1. SCHEMATIC REFERENCE NUMBERS ARE 75000 SERIES. (EXAMPLE R43 INDICATES R75043).
2. CAPACITOR VALUES ARE IN MICROFARADS AND RATED AT 400 VOLTS UNLESS OTHERWISE SPECIFIED. IDENTIFICATION OF THE SECTIONS OF MULTIPLE ELECTROLYTIC CAPACITORS IS AS FOLLOWS: a = △, b = □, c = △, d = INDICATES THE TERMINAL WHICH IS NOT CODED.
3. RESISTORS ARE HALF WATT, TEN PERCENT: VALUES ARE IN OHMS UNLESS OTHERWISE SPECIFIED.
4. WAVEFORM VOLTAGES ARE GIVEN PEAK TO PEAK.
5. VIDEO VOLTAGES AFTER WHITE STRETCH ARE GIVEN WITH THE CONTROL IN NO-STRETCH POSITION AND VIDEO GAIN IN MID-RANGE.
6. POTENTIOMETERS ARE 2 WATT LINEAR TAPER UNLESS OTHERWISE SPECIFIED.
7. LEADS DRAWN- — — — (5 PLACES) & DELAY LINE DL1 TO BE INSTALLED ONLY ON COLOR SYSTEMS
8. PERFORMANCE PER A.E.S. 12-292.



POWER SUPPLIES

GENERAL

Two power supply types are required by the system to provide +250 volts dc and 24 volts dc.

One Ampere 250 Volt Power Supplies

Three identical regulated power supplies are furnished, each capable of delivering 1 ampere at a regulated +250 volts dc. A meter makes possible direct readings of output voltage, output current, and the current through each section of each series regulator tube (for routine checks on tube aging).

For convenience of identification, the power supplies are designated as A, B, and C, each occupying 7 inches of vertical space in a standard rack mounting. The single adjustment control is a screwdriver adjustment for output voltage located at the front of the unit as it is mounted in the rack. Ac line fusing is accomplished by fuse F66001 and dc output is fused by F6602, both of which are also located at the front of the unit.

Power supplies A and B are mounted on Rack 2; and power supply C is mounted in the console cabinet Components of the system receiving power from these power supplies are as follows:

Power Supply	Components Fed
A	Modulator/Demodulator, Switcher
B	Drum Servo Control Unit, Capstan Signal Generator, Guide Position Sensor, Processor
C	Head Channel Assembly, Record Driver, Left Control Panel, Right Control Panel, Erase and Cue Unit

Vacuum Tube Complement (Each Unit)

Type	Qty.	Schematic Ref. No.
5651	1	V66007
12AT7	1	V66006
6080	5	V66001, V66002, V66003, V66004, V66005

THEORY OF OPERATION

Power line frequency (60 cps) enters the unit at J66002P and is routed to power transformer T66001 through fuse F66001, the fuse post of which has a fuse failure indicator.

Power transformer T66001 provides high voltage to the rectifier of the regulating circuit, and also heater power to the vacuum tubes within the power supply.

The conventional bridge rectifier circuit employs silicon diodes, 2 in each leg to provide ample peak inverse voltage rating, feeding a choke input filter. The choke has an inductance of 0.6 henry at 1 ampere dc current and 120 cycle ripple frequency. Across the filter is a bleeder resistor network consisting of two 10,000 ohm 25 watt resistors in parallel to prevent the no load voltage from exceeding the rating of the filter capacitors.

The regulator section of the power supply employs conventional circuitry throughout. High gain feedback is obtained by using both sections of V66006 to control the voltage drop across V66001 through V66005 to provide an essentially constant output. Stabilized cathode voltage for V66006a is obtained through voltage reference tube V66007.

UNIT SET-UP

When setting potentiometer R66001 VOLTAGE ADJUST, the unit must be under normal load conditions, the tap on the power transformer T66001 appropriate to the line voltage available must be connected, and the meter switch S66001 must be placed in the SET VOLTS position. Set the potentiometer for a reading of 125 at the red line on the meter.

This corresponds to +250 volts dc. The trimpot R66002 mounted on the etched board is factory adjusted for the OUTPUT reading so that the meter reads 100 with one ampere output. It should require no field adjustment.

Twenty-Four Volt Power Supply

GENERAL

The twenty-four volt relay power supply, located at the left rear of the console cabinet (when facing the back of the console), furnishes 24 volt dc relay actuating power to other components in the system, and it can deliver 5 amperes of current at 24 volts dc.

It occupies 5-1/4 inches of vertical space. There are no adjustments and no vacuum tubes. The fuse is mounted on the front of the chassis in a fuse post containing a failure indicator.

THEORY OF OPERATION

The 60 cps, ac, power enters the unit at J69001P, and is routed -- through 3 ampere fuse F69001 -- to the primary of step-down power transformer T69001. A conventional full-wave selenium rectifier, with an associated filter circuit, provides 24 volts dc to output connector J69002S.

The 60 cycle power is also jumpered from J69001P to J69002S. The 60 cycle power available at J69002S is NOT fused by fuse F69001.

UNIT SET-UP

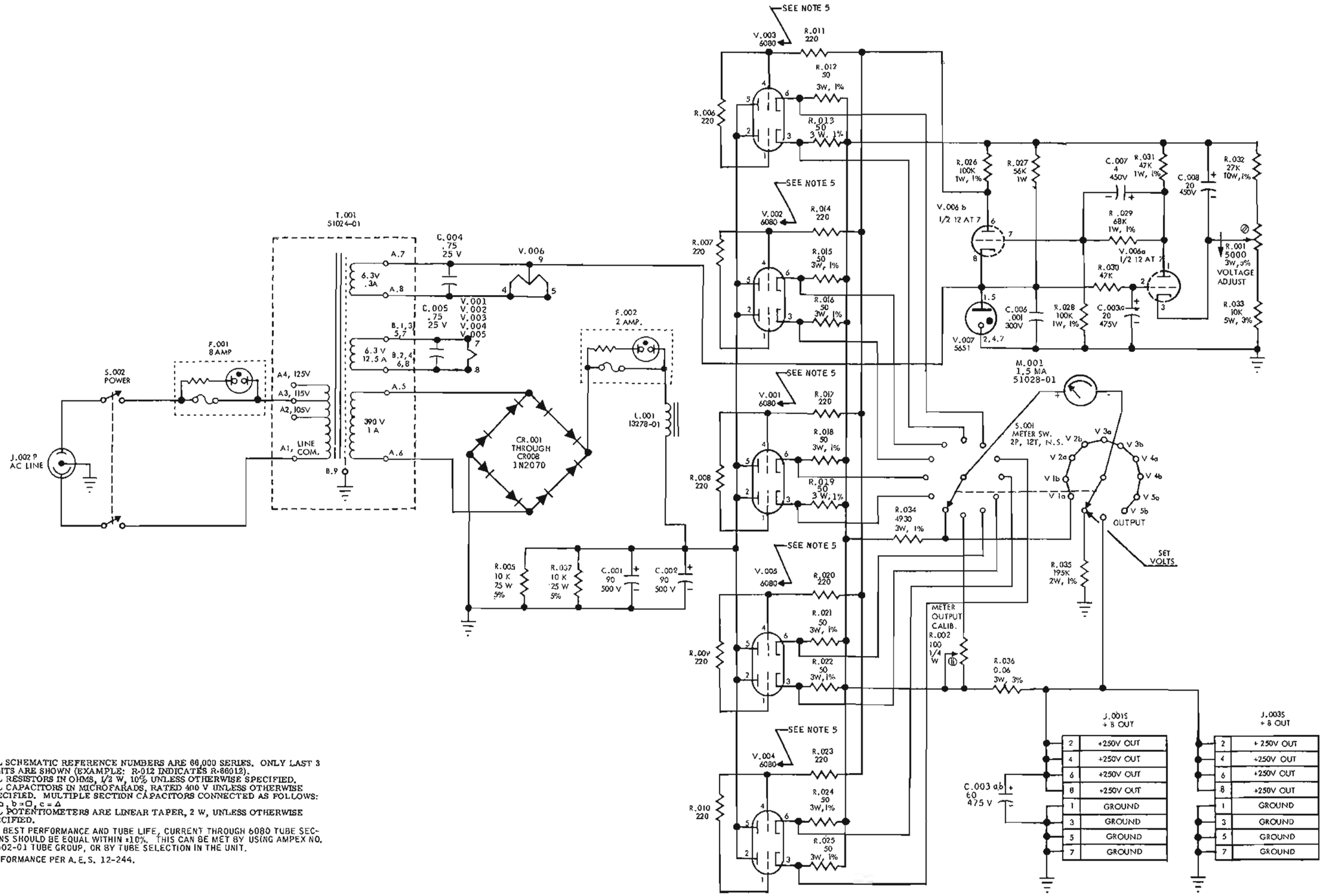
No set-up is required.

SEE VOLUME 2 FOR PARTS LISTS AND PIN VOLTAGES

SCHEMATIC —
250V, 1 AMP. POWER SUPPLY

CAT. NO. 50800

AMPEX CORPORATION



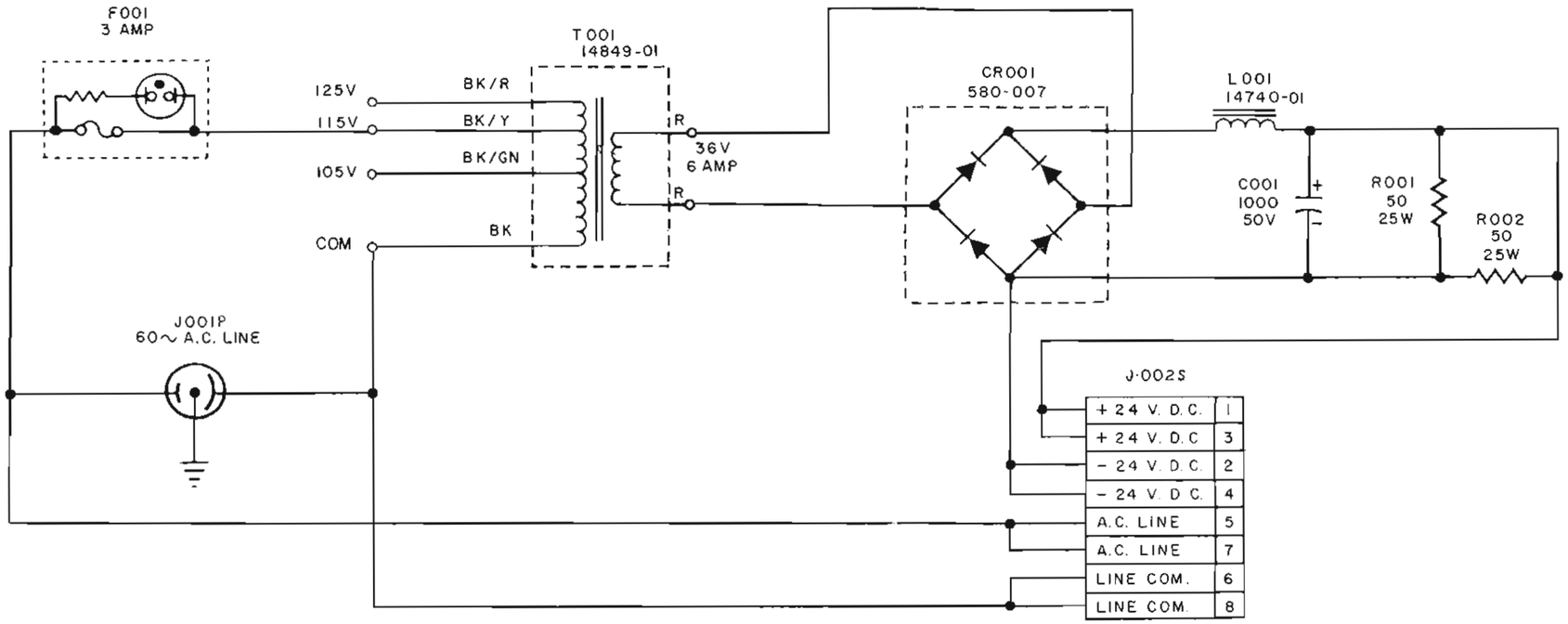
NOTES:

1. ALL SCHEMATIC REFERENCE NUMBERS ARE 86,000 SERIES. ONLY LAST 3 DIGITS ARE SHOWN (EXAMPLE: R-012 INDICATES R-86012).
2. ALL RESISTORS IN OHMS, 1/2 W, 10% UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITORS IN MICROFARADS, RATED 400 V UNLESS OTHERWISE SPECIFIED. MULTIPLE SECTION CAPACITORS CONNECTED AS FOLLOWS: a = ○, b = □, c = △
4. ALL POTENTIOMETERS ARE LINEAR TAPER, 2 W, UNLESS OTHERWISE SPECIFIED.
5. FOR BEST PERFORMANCE AND TUBE LIFE, CURRENT THROUGH 6080 TUBE SECTIONS SHOULD BE EQUAL WITHIN ±10%. THIS CAN BE MET BY USING AMPEX NO. 51502-01 TUBE GROUP, OR BY TUBE SELECTION IN THE UNIT.
6. PERFORMANCE PER A.E.S. 12-244.

SCHEMATIC
24 VOLT POWER SUPPLY

CAT. NO. 50933

AMPEX CORPORATION



NOTES:

1. ALL SCHEMATIC REFERENCE NUMBERS ARE 69000 SERIES. ONLY LAST 3 DIGITS ARE SHOWN (EXAMPLE: R-012 INDICATES R-69012).
2. ALL RESISTORS IN OHMS, 1/2W., 10% UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITORS IN MICROFARADS, RATED 400V. UNLESS OTHERWISE SPECIFIED. MULTIPLE ELECTROLYTIC CAPACITORS CODED AS FOLLOWS: a=⌓, b=□, c=△, d=UNCODED TERMINAL.
4. ALL POTENTIOMETERS ARE LINEAR TAPER, 2W., UNLESS OTHERWISE SPECIFIED.
5. WAVEFORM VOLTAGES ARE PEAK TO PEAK.
6. PERFORMANCE PER A.E.S NO. 12-234.

SYSTEM CONTROL

GENERAL

During the following discussion, refer to the complete dc system control foldout diagram at the back of this section. One of the major components of the dc system control is the System Control Unit chassis which contains eight conventional relays and 1 time delay relay, and is located behind the left rear door of the console. All modes of system operation are controlled by this unit in conjunction with additional relays, solenoids, switches and pushbuttons located elsewhere in this system. Such items as variable wirewound resistors, which govern supply and takeup motor torques, dictated by the mode of operation employed, are also part of the dc control system. Location of individual components can be determined by their schematic reference numbers.

THEORY OF OPERATION

To understand the operation of the various relays an overall view of the equipment must be considered, including operating controls, related relays and solenoids, indicators, etc. The complete action is described as each operating control is actuated or changed. To facilitate the location of relay contacts coded abbreviations are used on the schematic diagram of the overall ac and dc control system.

Remote and Local Circuits

Pushbuttons S46012 REMOTE and S46005 LOCAL, located on the console right control panel transfer control between this panel and the remote control unit. Contacts of relays K70008 REM 1 and K68002 REM 2 determine the transfer function. When relay coil K70008 REM 1 is de-energized, the control is local at the right control panel; conversely, when the relay coil is energized, control remains at the remote control unit. No remote/local pushbuttons are furnished at the remote unit.

The REMOTE pushbutton switch is normally open and the LOCAL pushbutton switch is normally closed. Both switches are connected in series with relays REM 1 and REM 2 across the 24 volt dc supply through section A of the NORMAL/DUB switch S68001, and consequently the relays are energized by the REMOTE pushbutton, and then de-energized by the LOCAL pushbutton whenever the NORMAL/DUB switch is in the NORMAL position.

In the de-energized positions, contacts REM 1A, REM 1E, REM 2A and REM 1B are selected by the local FAST FWD, REWIND and STOP pushbuttons. Contact REM 1C is selected by the local PLAY pushbutton; and contacts REM 2B and REM 1D are selected by the local RECORD and TONE pushbuttons.

In the energized positions, local circuits listed above are broken and their corresponding circuits are completed at the remote control unit. In addition, contact REM 1A closes during remote operation, applying 24 volts to the REMOTE DISABLE SWITCH S45001 in series with the processor relay K75001 PROC.

When the REMOTE DISABLE SWITCH is in the NORMAL closed position, the processor relay K75001 PROC is energized, transferring control of PEDESTAL HEIGHT, VIDEO GAIN AND SYNC GAIN to the remote unit. With this switch in the open DISABLE position the PROC relay cannot be energized and control of these functions remains at the processor.

Depressing the PLAY pushbutton opens normally closed contact PLAY B and extinguishes the STOP lamp.

Mode indicating lights are connected in parallel and indicate the operational modes at both locations. REMOTE and LOCAL lights at the right control panel indicate the unit from which control is derived, a REMOTE light on the remote control unit indicates switching of control to that unit.

Reproduce Circuit (During the following discussion, consider control in the LOCAL position).

The reproduce circuit is actuated when the PLAY pushbutton is pressed. Play relay K70004 is energized through the path from +24 volt dc, normally closed relay contact sets RW A, FF C, REM 1C through the PLAY pushbutton contacts; normally closed relay contact sets REM 2B, REC C, through the relay coil; normally closed contact sets STOP A and STOP B in parallel; and finally through the tape tension safety switch S34001 which is closed when tape is threaded correctly to -24 volts.

Relay contact PLAY A in its energized position forms a holding circuit for the play relay and also completes a path to the record, tone, audio override and cue override circuits which can now be actuated. (Audio override and cue override are discussed in detail at the end of this Section.)

Energized relay contact PLAY B in series with RW A and FF C completes the 24 volt dc paths to the capstan idler solenoid (CIS L43003) which actuates and moves the idler against the capstan through normally closed head override contact HOR B and to the capstan servo standby relay (CSS K48002) and the standby relay in the capstan servo generator which energizes and then starts the capstan motor.

Energized relay contact PLAY E completes the 24 volt dc path to the brake solenoids L34001 and L34002 on each reel assembly which actuate and release the brakes. Through normally closed relay contact HOR C, the STANDBY RELAY K68001 is actuated, starting the head drum motor, the head blower relay K70001 closes, completing the 117 volt ac path to the head fan assembly. After a 4 second delay introduced by relay contact TD B, the tape guide solenoid L23001 is actuated and the concave tape guide moves toward the video head assembly to a position dictated by the tape guide amplifier.

Energized relay contact PLAY C completes the 117 volt ac path to the takeup and supply motors, through adjusting resistors and normally closed contacts FF A and RW C.

Energized relay contact PLAY D completes the 117 volt ac path for the time delay relay K70009, and the elapsed time meter M56001. Contact TD A closes 1-1/2 seconds later, shorting out part of the supply motor's starting resistance and bringing the supply motor up to full speed.

Record Control Circuit

To record the reproduce circuit must be actuated meaning that all reproduce control circuit conditions have occurred, or are occurring, before the RECORD pushbutton will be effective

When play relay K70004 is energized and the RECORD pushbutton S46002 is pressed, record relay K70005 is energized. The energizing path consists of +24 volts dc through normally closed relay contacts RW A and FF C relay contact PLAY A in its energized position. normally closed contact REM 1D, the record pushbutton contacts, normally closed contact REM 2C, the record relay coil K70005, normally closed contacts STOP A and STOP B in parallel, and the tape tension safety switch to -24 volts dc.

Energized contacts PLAY B and REC A in series form the record relay holding circuit.

When contact REC B closes, +24 volts is applied through contacts RW A, FF C, and PLAY B to the following twelve relays:

1. record monitor relay - REC MON K46001
2. record/reproduce relay - REC/PB K46003
3. oscillator supply relay - OSC K46005 through contact - REC/PB now closed, through normally closed contact AOR A
4. left control panel relay LCP K56001
5. head channel assembly relay HCA K32001
6. record driver relay RDR K33001
7. drum servo relay DSC K65002
8. capstan record relay CSG K48001

9. demodulator relay MDM K62001, relay MDM is energized only when the NORMAL/DUB, switch S68001 is in the normal position
10. normal-or stop relay NC K59002
11. video erase relay VE K59003
12. record/reproduce RPB K59001

Fast Forward Control Circuit

When the FAST FWD pushbutton S46010 is pressed, fast forward relay FF K70002 is energized through contact REM 1A, contacts of the fast forward pushbutton switch, REM 1E, through the relay coil to contacts STOP A and STOP B connected in parallel, and the tape tension safety switch which will be closed when tape is properly threaded.

Contact FF C breaks the circuit to the reproduce and record circuits, de-energizing those circuits if the fast forward mode is instigated from the reproduce or record modes. Contact FF C completes a holding circuit for the fast forward relay coil through normally closed contact RW A.

Contact FF A breaks the torque motor circuit used in the reproduce or record modes, and completes the fast forward torque motor circuit. In this circuit the full 117 volt ac line voltage is connected across the takeup motor; and adjustable resistor R70001 is inserted in series with the supply motor dropping the voltage applied to that motor. The takeup motor thus operates at full torque and the supply motor at reduced torque.

Contact FF B opens the rewind relay holding circuit, making rewind operation impossible while the fast forward operation is in progress. Contact FF B also completes the circuit to the brake solenoids, energizing those solenoids, releasing the brakes, and also, through normally closed contact set HOR C, energizing K70001 the head blower relay and the drum servo standby relay K68001. The head blower and the head drum motor thus operate.

Rewind Control Circuit

When the REWIND pushbutton S46009 is pressed, rewind relay RW K70003 is energized through: normally closed contact REM 1A, contacts of the rewind pushbutton switch, normally closed contact REM 2A, the relay coil, normally closed contacts STOP A and STOP B connected in parallel, and the tape tension safety switch which will be closed when tape is properly threaded.

Contact RW B forms a holding circuit, in series with normally closed contact set FF B.

Contact set RW C breaks the torque motor circuit in the record or reproduce modes and completes the rewind torque motor circuit. The full 117 volt ac line voltage is applied to the supply motor; adjustable resistor R70001 is inserted in series with the takeup motor, dropping the voltage applied with the result that the supply motor operates at full torque and the takeup motor at reduced torque.

Normally closed contact RW A opens, preventing operation of the FF relay while rewind operation is in progress. RW A also opens the +24 path to the PLAY bus during rewind preventing operation of any of the reproduce or record circuits.

Normally opened contact RW A closes, completing the circuit to the brake solenoid relays and, through contact HOR C, the head blower and drum servo standby relays. Thus the brakes are released and the head blower and head drum motors operated during rewind.

Head Override Control Circuit

When the head override switch is closed, the coil circuit of head override relay HOR K70007 is completed. If the tape is not in motion when the head override switch is closed (play and/or record relays de-energized), the following circuits are completed: capstan servo standby relay CSG 1 K48002 through contact HOR B, and drum servo standby relay DSS K68001, in parallel with the head blower relay HBL K70001 through contact HOR C In this manner the head blower motor and the head drive motor are activated while the tape remains at rest

If the head override switch is closed while the tape is in motion (play and/or record relays energized), equipment operation is not effected. Normally closed contacts HOR B and HOR C which complete the CSG 1, DSS and HBL relay coil circuits open, but their normally open contacts which are returned directly to +24 volts close and hold these relays energized. If the STOP pushbutton is then pressed, the head drive and head blower motors continue to rotate because their coil circuits are not completed through the play circuits as in normal operation. The head override switch must be opened to stop the head blower and drive motors.

The head override circuit provides fast start for the reproduce modes, permitting reproducing to begin one second after the PLAY and/or RECORD pushbuttons are depressed instead of the 4 second interval in normal operation. This is accomplished by closing the head override switch before depressing the PLAY and/or RECORD pushbuttons. This completes the CSG 1, DSS and HBL relay circuits. In addition contact HOR A closes. This contact is in series with contact TD D of the time delay relay. This contact closes 1 second after the time delay coil picks up. The time delay coil picks up whenever the PLAY pushbutton is pressed. In this manner the guide solenoid is energized 1 second after the PLAY button is depressed, moving the tape against the head to start the reproduce or record processes. After reproduce or record operation has begun, the head override switch can be returned to its open position without effecting the operation in progress.

NOTE

Although only 1 second elapses from the time the PLAY pushbutton is depressed and the guide solenoid becomes energized in fast start and 4 seconds in normal operation, the actual time before a signal appears at the output of the demodulator is 2 seconds in fast start and 5 seconds in normal operation. The additional second has been introduced deliberately by placing a large capacitor across the demodulator relay MDM K62001 holding it closed for one second after its coil circuit is opened, permitting the servo circuits to stabilize for one second on the incoming signal from the tape before the demodulator output is made available.

EE-Tape and Preset Monitor Control Circuits

When the EE-TAPE switch is in the TAPE position, the equipment operates normally in all modes. When the EE-TAPE switch is in the EE position and the tape transport is at rest (PLAY and/or RECORD relays not energized), the coil circuits of the demodulator relay MDM K62001 and the PRE-SET MON relay PSM K46006 are completed through the normally closed contacts HOR A and TD C in parallel with PLAY E. The closing of the MDM contacts causes incoming composite video to be fed to the modulator. The modulator output, an fm/rf signal, is fed to the demodulator. The demodulator output, a composite am video signal, is fed to the processor and is available at the processor output for monitoring. This provides a check of the major portion of the electronics used in both record and reproduce operation.

The PSM relay contacts transfer the incoming audio line from the audio record input circuits to the console metering circuits so that the audio level can be set properly before recording begins. There contacts also feed the incoming audio to the reproduce amplifier to permit monitoring.

When the PLAY pushbutton is depressed, relays MDM and PSM drop out, either at the one or the four second interval depending on whether fast start or normal start is in use. Depressing the RECORD pushbutton starts normal record operation.

If the EE-TAPE switch is placed in the EE position while the equipment is in the reproduce or (play record modes), normal operation is not effected because all possible return paths for the PSM and MDM coils to +24 volts are opened.

A-B Switch Control Circuits

The A-B switch permits comparison between the video from a tape being reproduced and a local video source such as a monoscope pattern.

CAUTION

NEVER PLACE THIS SWITCH IN THE B POSITION WHEN A TAPE IS BEING REPRODUCED FOR PROGRAMMING PURPOSES.

During the time the A-B switch is in the B position and the equipment is in the reproduce mode, the video from the tape is not being fed through the demodulator and is not available at the output. During this period, local video is fed through the modulator/demodulator, and processor, and is available instead of the taped video at the output. The switch is intended for maintenance and set-up only. Closing it completes the demodulator relay MDM K62001 coil circuit (provided the NORM/DUB switch is in the NORM position) and opens the guide position sensor relay GPS 3 K67001 coil circuit to prevent automatic operation of the tape guide servo system during the test period. When the A-B switch is returned to the A position, normal reproduce operation is restored. Note that the switching from A to B operation does not entail the 1 second delay in demodulator relay MDM dropout as in normal operation, because the capacitor is removed from across the MDM coil when the A-B switch is in the B position.

Guide Position Sensor Control Circuit

The guide position sensor control circuit permits manual or automatic positioning of the female tape guide. When the AUTO COMP switch S56003 is in the MANUAL position, guide position sensor relay GPS K67001 is de-energized and the AUTO COMPENSATION sensor lamp is shorted. Normally closed contact GPS 3A inserts a resistor in series with the lamp bus to the -24 volt line. Normally closed contacts GPS 3C and GPS 3D connect a resistive bridge circuit to the input of the tape guide servo amplifier. This bridge circuit consists of a manually adjustable potentiometer located on the left control panel, labelled TIP PROJECTION ADJ when this control is adjusted a voltage is fed to the tape guide servo amplifier which in turn drives the tape guide motor. The other side of the bridge, a helipot, is coupled mechanically to the tape guide motor shaft, which continues to rotate until the bridge is balanced and the output of the bridge is zero. Manual adjustment of the TIP PROJECTION ADJ control is accomplished with the equipment in the reproduce mode and during reproduction of a standard test tape. The control is set at the red arrowhead (0.5 mil) and the tape guide shaft adjusted for minimum skewing. The control is then rotated counterclockwise until signal dropout takes place. The dial reading where dropout takes place indicates TIP PROJECTION.

For example, if dropout occurs at 3.0 on the TIP PROJECTION ADJ dial, the actual tip projection is 3.0 mils. As the tip wears down, dropout occurs sooner as the control is rotated counterclockwise and a correspondingly lower reading is obtained.

When the AUTO COMP switch is placed in the AUTO position, relay GPS 3 is energized closing contact GPS 3A in series with the normally closed contact GPS 2C and completing the auto compensation sensor lamp circuit. The lamp glows brightly. Normally open contacts GPS 3C and GPS 3D also close, connecting the error signal from the guide position sensor unit to the input of the tape guide servo amplifier. The normally closed sections of these contacts open, removing the input from the bridge circuit used during MANUAL operation. Relay GPS 2 K67002 remains de-energized until loss of video and sync or noisy video and sync cause tube V49001B in the guide position sensor unit to conduct sufficiently to energize relay GPS 1 in its plate circuit. When GPS 1 is energized, the coil circuit for relay GPS 2 is completed and GPS 2 is energized, breaking the direct lamp circuit to -24 volts inserting a dropping resistor in series with the lamp, causing the lamp to glow dimly. In addition, previously closed contact GPS 2A in parallel with contact GPS 3B opens. Because contact GPS 3B opened when relay GPS 3 became energized, the tape guide servo amplifier output is removed from the tape guide motor which remains inoperative until such time as a restoration of acceptable video and sync takes place, causing GPS 1 to become de-energized. When this happens GPS 2 drops out, the lamp glows brightly, and the tape guide servo amplifier output connection to the tape guide motor is restored and normal automatic tracking operation resumes.

Dubbing Control Circuits

When the NORM/DUB switch S68001 is placed in the DUB position dubbing of the video and/or audio from another VR1000B is made possible. This can only be done with the equipment in LOCAL operation because with the switch in the DUB position the +24 volt circuit to the remote relays in broken. Placing the switch in DUB completes the coil circuits of relays DUB 1 and DUB 2 and opens the coil circuit of the Demodulator Relay MDM. When DUB 1 and DUB 2 energize the output of the demodulator limiters (an fm/rf signal) of the companion VR1000B operating in the reproduce mode is fed to the input of the dubbing VR1000B operating in the record mode. The actual circuitry is covered in detail under the Theory of Operation of the Modulator and Demodulator section of this manual.

Audio Record Only - Audio Normal Control Circuits

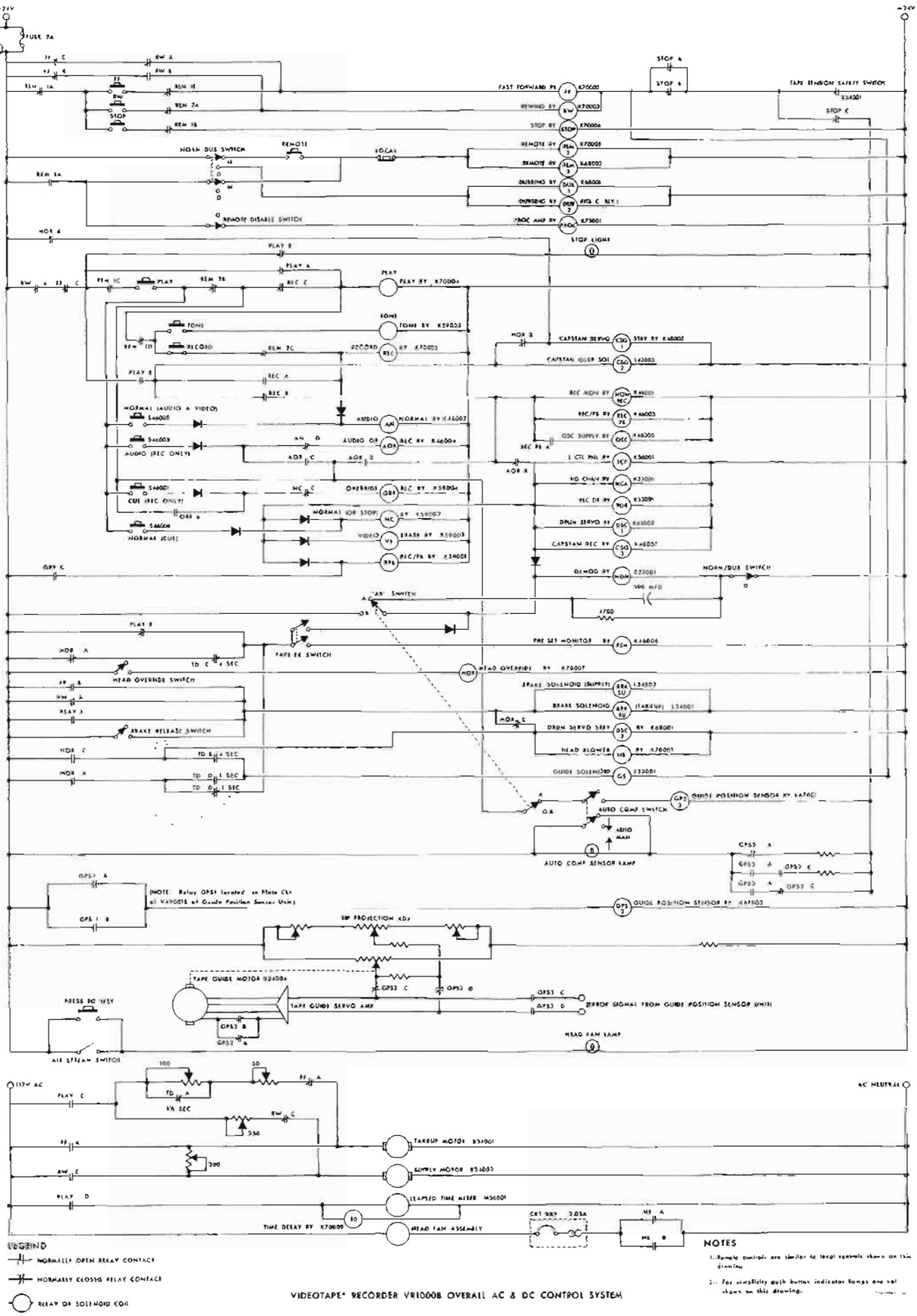
When it is desired to record audio only, press the AUDIO ONLY pushbutton S46003 after pressing the PLAY button. The audio override record relay AOR K46004 is energized through the following path: +24 volts, RW A, FF C, PLAY A, REC C, REM 2B, the AUDIO ONLY pushbutton S46003V AN D, the AOR coil, parallel contacts STOP A STOP B and tape tension safety switch S34001 to -24 volts. The holding circuit for relay AOR is established through contact AOR C and the normally closed contact AN D. When relay

AOR is energized, formerly closed contact AOR B opens de-energizing all the video and record relays: LCP, HCA, RDR, DSC 1, CSG 3, MDM, NC, VE and RPB. Only relays REC MON, REC PB and OSC are energized through formerly opened contact AOR B. Normal operation can be restored by pressing the NORMAL pushbutton S46008 located directly under the AUDIO ONLY button on the right control panel. This causes relay AN to energize, breaking the AOR coil circuit. If the RECORD pushbutton is pressed during audio only operation, relay AN is energized and the AOR coil circuit is also broken. In summary, audio only recording can be accomplished after pressing the PLAY pushbutton, and normal operation can be restored by pressing the NORMAL pushbutton which places the system in the reproduce mode, or by pressing the RECORD pushbutton which places the system in the record mode.

Cue Normal - Cue Record Only Control Circuits

When it is desired to cue information only, audio or tone, press the PLAY pushbutton and the CUE ONLY button S46001. The override record relay ORR K59004 is energized through the following path: +24 volts, RW A, FF C, PLAY A, REC C, REM 2B, CUE ONLY pushbutton S46001, NC C, the ORR coil, parallel contacts STOP A and STOP B, the tape tension switch S34001 to -24 volts. The holding circuit for relay ORR is established through contact ORR B and the normally closed contact NC C. When relay ORR is energized, formerly open contact ORR C closes, completing the coil circuit of RPB If tone is desired on the cue channel, press the TONE button. Normal operation can be restored by pressing the CUE NORMAL or the RECORD pushbutton. The operation is similar to that described under Audio Record Only - Audio Normal Control Circuits.

Because the audio only and cue only circuits are completed through a contact of the remote relay REM 2, these operations can be performed only at the local position.



VIDEOTAPE® RECORDER VR1000B OVERALL AC & DC CONTROL SYSTEM

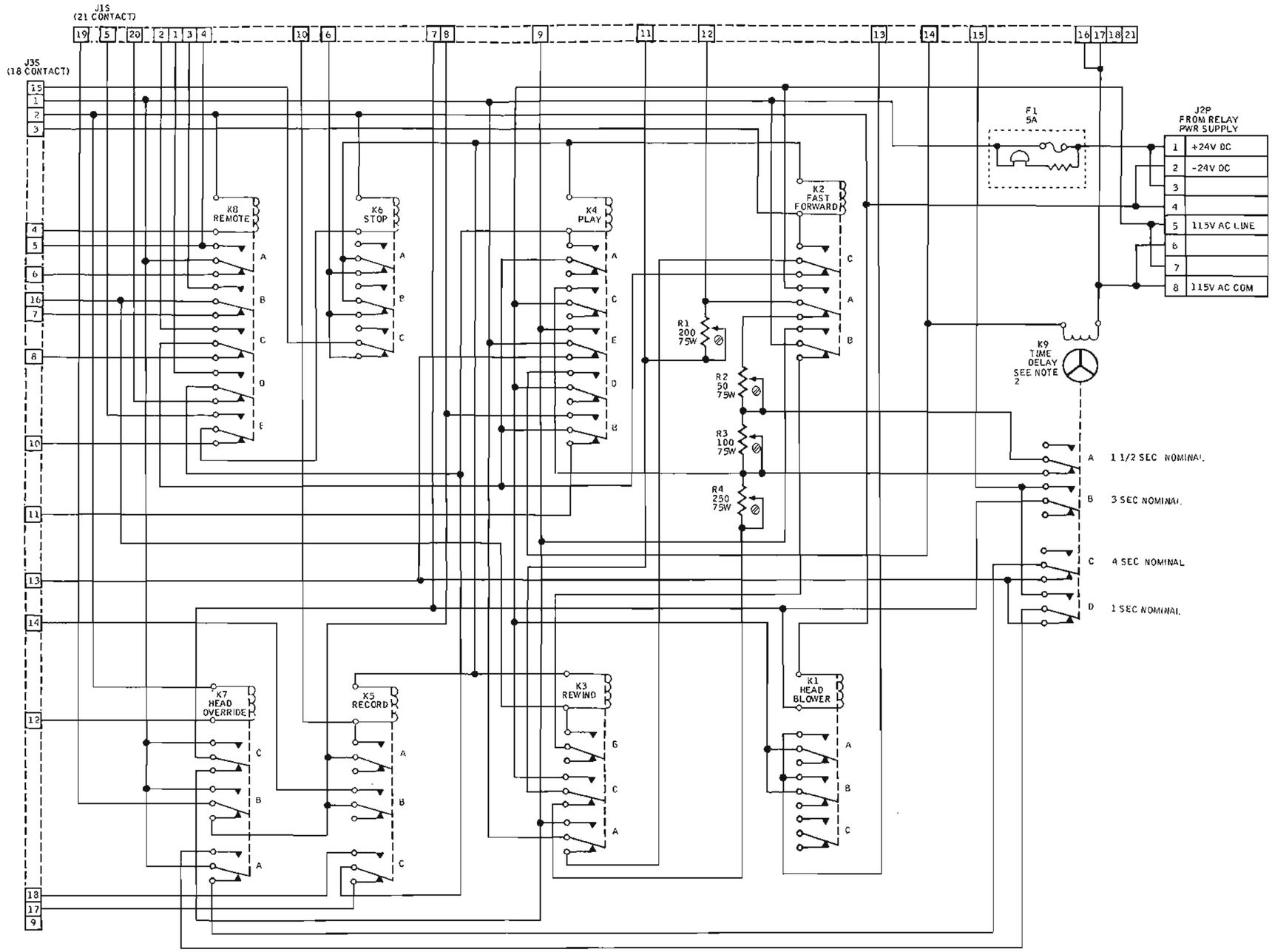
VRB / SYC 1

SCHEMATIC
SYSTEM CTL UNIT

CAT. NO. 51470

AMPEX CORPORATION

MODEL CAT. NO.	NEXT ASSY.	SYSTEM LINE SCHEM (SEE NOTES 3 & 4)	WIRE DIAGRAM (SEE NOTE 3.)
57020	57023	57026	57025



NOTES:

1. RELAY SECTIONS LETTERED FROM LEFT TO RIGHT LOOKING AT TOP FROM CONNECTOR LUG SIDE.
2. B & D CAM SECTIONS SHALL RETURN TO REST (WHEN K9 IS DE-ENERGIZED) WITHIN 1/2 SEC + 0, -1/2 SEC.
3. ANY CHANGES IN THIS SCHEMATIC TO BE REFLECTED IN WIRE DIAGRAMS AND SYSTEM LINE SCHEMATICS INCORPORATING THIS UNIT.
4. SEE TABLE FOR DRAWING NUMBERS OF SYSTEM SCHEMATICS. SHEET 2 & 3 OF THESE DRAWINGS WILL SHOW THE CONTROL CIRCUITRY CONNECTIONS TO THIS UNIT. (51470)
5. SCHEMATIC REF NUMBERS ARE 70000 SERIES. ONLY LAST DIGITS ARE SHOWN. (EXAMPLE: K2 INDICATES K70002).

MOTOR POWER AMPLIFIERS

GENERAL

Two motor power amplifiers are provided with the system. These units amplify the frequencies applied to the input -- 240 cps for the head drum motor, 60 cps for the capstan motor -- and furnish power to drive those motors. The head drum motor requires 240 cps, 3 phase power; the capstan motor requires 60 cps, 2 phase power. Appropriate strapping of Jones plug J60002P, as indicated on the schematic diagram, enables identical power amplifiers to supply both requirements. These units are amplifiers: they DO NOT ORIGINATE THE FREQUENCIES APPLIED TO THE MOTORS.

Each amplifier can deliver 160 watts, (80 watts each channel) of output power at 115 volts. The 3 phase output is obtained by connecting the two channels, which are 90 degrees out of phase, through a Scott "T" type circuit. Strapping is accomplished on the mating plug of J60002S.

The two power amplifiers are mounted on Rack 2, each occupying 12-1/4 inches of vertical rack space. Available on the front panel is a meter with a 9 position selector switch which permits metering any of the phase voltages, the line voltage, or the dc through each output tube. Also located on the front panel is a master GAIN control for setting the output voltage. A power ON-OFF switch, normally left in the ON position, and an ac line fuse are mounted on a bracket at the right side of the chassis. The cable connectors are located at the rear of the unit.

Vacuum Tube Complement (Each Unit)

Type	Qty.	Schematic Ref. No.
12AU7	(1)	V60003
6AU6	(4)	V60001, V60004, V60007, V60009
6550	(4)	V60002, V60005, V60008, V60010
OA2	(1)	V60006

THEORY OF OPERATION

The signal frequency to be amplified enters the unit at INPUT connector J60001P. Input circuitry consists of resistor R60011, isolating capacitor C60011, and linear taper potentiometer R60001 VOLTAGE LEVEL which acts as the master gain control.

From the gain control the signal is fed to the grid of a single stage triode amplifier V60003b. The output of this amplifier splits into 2 paths, one shifted in phase +45 degrees, the other -45 degrees, providing dual amplifier circuit inputs that are 90 degrees apart. Phase shift for 60 cps operation is accomplished by strapping in J60002S, providing appropriate connections of the series capacitors C60014 and C60024; no strapping is used for 240 cps operation.

Both amplifier circuits are identical, each containing a floating paraphase type phase inverter V60001-V60004 and V60007-V60009 and a push-pull output stage V60002-V60005 and V60008-V60010 feeding an output transformer, T60001 and T60003. Feedback voltage is derived from the secondaries of the output transformers and fed through AC BALANCE potentiometers R60002 and R60003, which are located on the chassis front and permit screwdriver adjustment for each amplifier circuit.

The output transformers are arranged to provide either 2-phase or 3-phase output, depending on the strapping of the mating plug for output connector J60002S.

A self contained power supply provides B+, heater, and bias voltages for the vacuum tubes in the unit. The B+ supply uses silicon rectifiers in a 2 voltage output, full wave bridge circuit with V60006 regulating the plate voltage for input stage V60003b. The 125 volt negative grid bias is developed in a separate, full wave rectifier circuit, also using silicon rectifiers. Protective bias for the push-pull stage tubes during heater warm-up is provided by V60003a. At the first application of power, V60003a, connected as a diode, provides an open circuit to ground in a bias divider network, and the full -125 volt dc bias voltage is applied to the grids of all 6550 type vacuum tubes. As the tube heaters warm up, V60003a starts to conduct, providing paths to ground through resistors R60027 and R60047. When full operating condition is attained these divider networks drop the fixed bias to the normal 32 0 volts dc operating value. There is also some self-bias due to the metering and balance resistors.

UNIT SET-UP

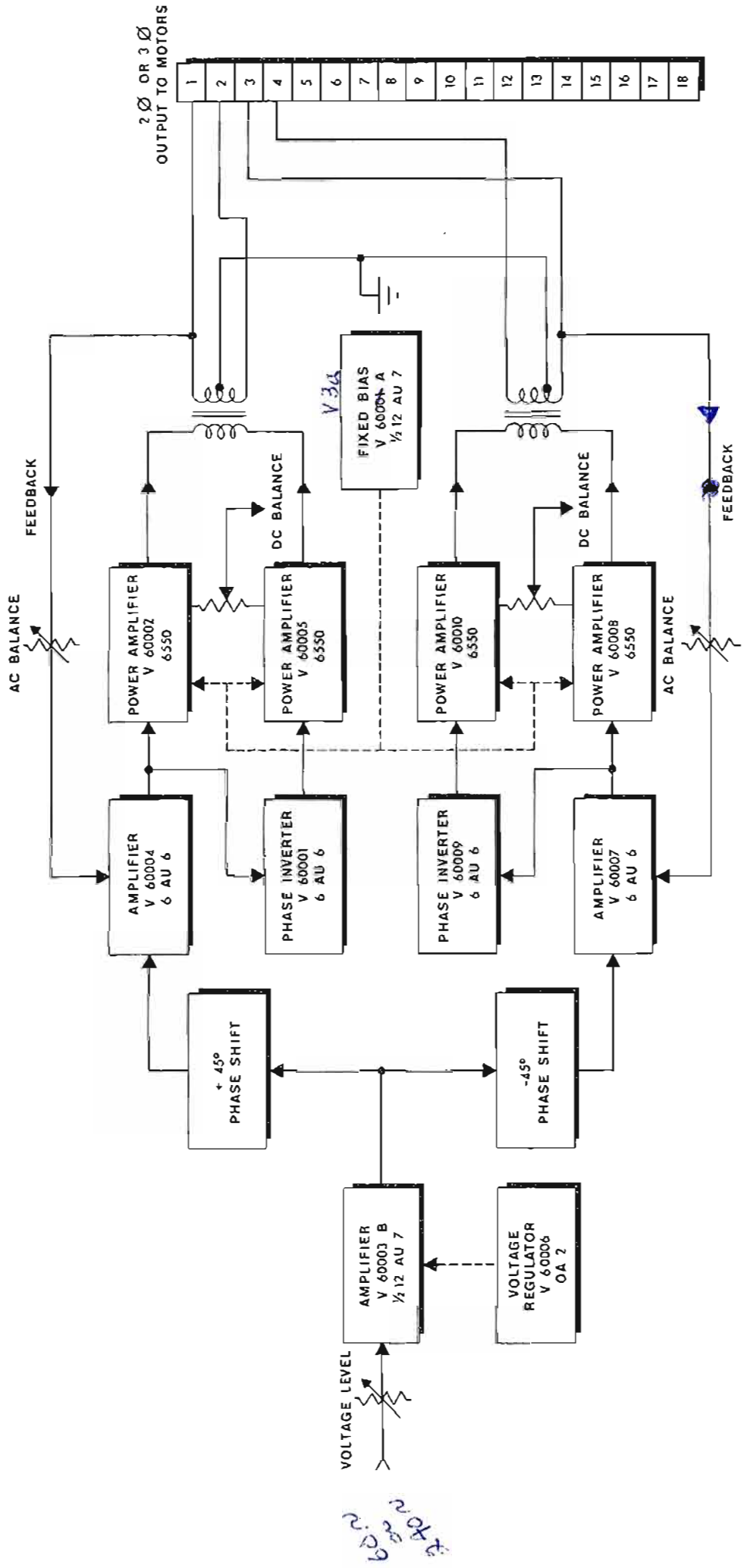
When setting up the equipment, place the AC BALANCE potentiometers in the full counter-clockwise positions for maximum feedback (minimum voltage output for a given input). Set the DC BALANCE potentiometers R60003 and R60005 to achieve equal current readings through each half of the output tube pairs. Tube current can be determined by using the meter on the front panel, switching to the identifier for the desired tube.

For two phase operation (the capstan motor must be operating), after placing the AC BALANCE potentiometers in the full counterclockwise positions, set the input gain control VOLTAGE LEVEL R60001 so that the higher of the two phase positions on the meter reads 120 volts. Switch to the other phase position and obtain a 120 volt reading by adjusting the AC BALANCE control for that side. Now check the first position to be certain the reading remains 120 volts.

In general, set-up procedure for three phase operation (the drum motor must be operating) is the same as for two phase operation, except that more interaction among phases will be noted. Always maintain one AC BALANCE potentiometer in the maximum feedback, counterclockwise position, selecting the phase position showing the highest voltage reading, and use this for a reference phase, continuing adjustment until the other two phase readings correspond to the reference phase as closely as possible. Small differences of phase relative to one another (maximum 4%) may remain due to normal transformer and motor variations

SEE VOLUME 2 FOR PIN VOLTAGES AND PARTS LIST.

MOTOR POWER AMPLIFIER BLOCK DIAGRAM



13330 A

SCHEMATIC
MOTOR POWER AMP.

CAT. NO. 50750-01

AMPEX CORPORATION

NOTE
CONNECTIONS FOR CABLE CONNECTOR J.002P. LEFT COLUMN FOR 2 PHASE 60 CYCLE OPERATION; RIGHT FOR 3 PHASE 240 CYCLE.

J.002P (60 CY) (CAPSTAN MOTOR DRIVE)
1. CONNECTS AMPLIFIERS FOR 2 PHASE CAPSTAN MOTOR.
2. CONNECTS M.001 METER FOR 2 PHASE READINGS.
3. POWER FACTOR CORRECTION IS LOCATED AT CAPSTAN MOTOR

J.002P (240 CY) (HEAD MOTOR DRIVE)
1. SCOTT CONNECTS AMPLIFIERS FOR 3 PHASE HEAD MOTOR.
2. CONNECTS M.001 METER FOR 3 PHASE READINGS.
3. CONNECTS POWER FACTOR CORRECTION FOR HEAD MOTOR.

AC LINE CONNECTIONS

125 VOLTS - A1 AND A9
120 VOLTS - A3 AND A9
115 VOLTS - A1 AND A7
110 VOLTS - A3 AND A7
105 VOLTS - A1 AND A5
100 VOLTS - A3 AND A5

NOTES
1. RESISTOR VALUES ARE IN OHMS WITH TEN PERCENT TOLERANCE AND RATED AT HALF WATT, UNLESS OTHERWISE SPECIFIED.
2. CAPACITOR VALUES ARE IN MICROFARADS WITH TWENTY PERCENT TOLERANCE AND RATED AT 600 VOLTS, UNLESS OTHERWISE SPECIFIED.
3. SECTIONS OF MULTIPLE ELECTROLYTIC CAPACITORS ARE IDENTIFIED AS FOLLOWS: a= ⌓ b= □ c= △ d INDICATES THE FOURTH TERMINAL, WHICH IS NOT CODED.
4. ALL SCHEMATIC REFERENCE NUMBERS ARE 60,000 SERIES, ONLY THE LAST 3 DIGITS ARE SHOWN. (EXAMPLE: R.012 INDICATES R 60012).
5. POTENTIOMETERS ARE 2 WATT, LINEAR TAPER, UNLESS OTHERWISE SPECIFIED.
6. PERFORMANCE PER A.E.S. 12-282

VRB
MPA 2

B57020

DRUM SERVO CONTROL UNIT

GENERAL

The basic function of the drum servo control unit is to control the speed and the position of the video head drum motor in accordance with incoming video vertical sync pulses (or power line frequency). During the record mode the drum motor provides the drive signal (through the photoelectric cell) to the capstan motor; during the reproduce mode the photoelectric cell signal is the reference timing signal for the capstan motor. The signal from the photoelectric cell is processed in the drum servo control unit before performing these functions, and also furnishes signals for the recorded control track, the switcher, and the oscilloscope on the left hand control panel.

The drum servo control unit is mounted on Rack 2, where it occupies 15 inches of vertical rack space. All connections to the unit are made at the rear of the rack. Power for the unit is derived from regulated power supply "B" in Rack 2.

Vacuum Tube Complement

Type	Qty.	Schematic Ref. No.
12AU7	3	V65001, V65006, V65009
5963	7	V65002, V65003, V65004, V65010, V65014, V65016, V65025
ECC81/12AT7	7	V65005, V65007, V65013, V65018, V65019, V65020, V65027
6AU6	4	V65011, V65012, V65024, V65028
6AL5	1	V65021
6AN8	1	V65015
OA2	1	V65022
OB2	1	V65017
6AW8	1	V65026
5725	2	V65008, V65023

THEORY OF OPERATION

The system can be referred to any of 4 timing signals -- external sync, video vertical sync, color vertical sync, or the 60 cycle power line frequency. The video signal enters the unit at J65010S VIDEO IN and is connected to SYNC SELECTOR switch S65001 COLOR-VIDEO-LINE-EXTERNAL, and J65011S VIDEO OUT where it leaves the unit. The COLOR SYNC enters the unit at J65012S and external sync at EXTERNAL SYNC IN J65013S, both of which are connected to SYNC SELECTOR switch S65001. The 60-cycle signal is taken from the 115 volt ac winding of transformer T65001.

Selector switch S65001 is a 4-section switch which connects the video or color signal to the first 3 stages in the unit, and to bypass these stages when the 60-cycle line frequency is selected as the reference. It also controls indicator lights DS65001 through DS65004.

We will first follow the video or color sync through the first 3 stages. The pentode V65026b is a conventional video amplifier. Partial stripping of the sync pulses from the video signal is accomplished in V65026a, the triode section of the same vacuum tube, by driving it to plate current cut-off during most of the period between sync pulses. Further stripping is furnished by grid current rectification in V65027a, with clipping provided by the CR65001 diode in this circuit. Both horizontal and vertical sync pulses appear at the plate of V65027a, with the horizontal pulses being filtered out by the action of an rc integrating circuit which couples the plate to the second section of the selector switch and to relay K65002. Normally, the selector switch will be left in the VIDEO position; during the record mode this selects video sync as a reference, during the reproduce mode relay K65002 is de-energized and its contacts select the 60 cycle line reference. (The switch may be set in the LINE position, so the system at all times is referred to the 60 cycle line, or in the COLOR SYNC position, so the system at all times is referred to the color sync generator, or in the EXTERNAL SYNC IN position so that the system at all times is referred to any other external sync source that may be connected to the connected input.)

The 60-cycle line pulse forming circuit consists of filament transformer T65001 with the 115 volt winding connected across a neon bulb (VR65001) circuit. The voltage pulse which occurs when the neon bulb reaches its striking potential is separated from the 60-cycle component by differentiation, and a diode (CR65011) clips off the negative pulse. The resulting positive pulse is delivered to the second section of the selector switch and to relay K65002.

Whichever positive pulse (video, color, 60-cycle line or external source) is selected, it is amplified in V65027b, and further amplified and clipped in V65020b. In the plate of V65020, a 240 cycle resonant circuit is energized every 4th cycle, and from the resulting train of decaying sine waves nearly symmetrical square waves are obtained by clipping and amplifying in V65013. These square waves are fed to V65014a, a phase splitting circuit which provides a push-pull signal to the head position sensor bridge circuit. This bridge circuit is the phase comparator in which the push-pull reference signal is compared with the 240 cycle photoelectric cell signal.

Let us now examine the other input to this bridge. The 240 cycle photoelectric cell signal enters the unit at J65001S and is clipped to an amplitude of 1 volt by diodes CR65021 and CR65022. The signal is amplified by V65005b, with the resultant 240 cycle square wave triggering the bi-stable multivibrator circuit of V65004. The multivibrator output is a 240 cycle square wave of approximately 150 volts peak-to-peak amplitude, which is fed to several circuits. The circuits in which we are interested presently goes through the phase splitting circuit of V65014b to produce a push-pull signal to the other two legs of the head position sensor bridge circuit.

We now have two push-pull inputs to the head position sensor bridge -- one derived from the reference source and one derived from the rotation of the video head drum (by the action of the photoelectric cell). At the connection at the center of the bridge circuit (common to all diodes in the bridge) a square wave with a fundamental 480 cycle frequency is developed; one edge of this square wave coincides with the rise (or fall) of the reference signal while the other edge coincides with the rise (or fall) of the signal from the head drum. As long as these 2 signals are 90° apart the output signal from the bridge is symmetrical and there is no dc component. However, if the 90° relationship is disturbed the output will become a non-symmetrical rectangular wave with a dc component present.

Any dc component in the output of the bridge is filtered and delivered to the grid of oscillator control tube V65015b. The triode section of this tube (V65015a) is connected in a conventional Colpitts oscillator circuit, the frequency of which is controlled by electronically inserting a capacitor across part of the tank circuit during a portion of the oscillation cycle. Series connected diodes CR65019 and CR65020 provide the electronic switch for this capacitor, placing it in the tank circuit whenever the voltage developed at terminal 4 of the tank circuit drops below 150 volts (This is a regulated voltage determined by voltage regulator V65022). The fraction of a cycle during which the diodes conduct (placing the capacitor in the circuit) is determined by the charge placed on the capacitor during the non-conducting period, which is in turn controlled by the plate current of oscillator control stage V65015b through a 220K resistor. During the time that the diodes are NOT conducting plate voltage for V65015b is supplied by the oscillator tank circuit. Thus, frequency of oscillation of V65015a is determined by the length of time that the .0051 microfarad capacitor is inserted across the tank circuit. This duration is controlled by the plate current of V65015b, and V65015b is controlled by any error signal developed by the head position bridge.

Without an error signal, the frequency of oscillation of V65015b is 240 cycles per second. The maximum frequency shift from this center frequency is approximately ± 12 cycles, corresponding to error signals of approximately ± 1 volt. While this sensitivity is necessary for positioning the drum motor accurately with respect to sync when everything is running smoothly, a sudden shift in drum motor speed (which would occur if the sync signal phase were suddenly changed) might exceed the ability of the capstan motor to follow, might exceed the limits of the processing amplifier, and would result in a relatively large sync frequency error during the reproduce function. A clamping circuit is thus used

in the plate of V65015b. The bias voltages on V65021 (a dual diode) are adjusted at R65003 MIN FREQ and R65004 MAX FREQ and limit the excursion of the plate of V65015b to the range between the bias voltages. This has the effect of limiting the minimum and maximum charging current to the frequency determining capacitor and at the same time retaining the 12 cycles-per-volt sensitivity in the operating range between the clamp voltages.

If the incoming sync differs from 60 cps by an amount which would cause the oscillator control to reach the clamping level and attempt to exceed it, the plate of V65015b will assume a new average dc voltage level. The grid of cathode follower stage V65019b gradually will assume this new potential (gradually because of the action of 4.7 meg resistor R65117 and 1.0 microfarad capacitor C65054). The cathode voltage of V65019b will follow the grid, and this action will (again gradually) recenter the clamping potentials around the new point.

Sudden, sharp, changes in the system are thus avoided, but if the change persists the system will gradually change to the potentials dictated by the forces which originated the condition.

The output of oscillator V65015a triggers a 240 cycle monostable multivibrator V65016. The square wave output of this stage is differentiated, and the resultant positive pulses cause V65019a to discharge the .1 uf condenser from plate to ground. The result is a sawtooth voltage which is ac coupled to the third grid of V65023. Before tracing the origin of the signal to the first grid of this stage it is advisable to consider several circuits not yet discussed.

Besides providing a signal to the head position sensor bridge, the circuits of V65013 and V65020 furnish a 240 cycle square wave signal to V65001b. This square wave is converted to a sine wave in the 240 cycle bandpass filter in the grid circuit of cathode follower V65001b. The output of the cathode follower is delivered to J65009S TO SCOPE from whence it may be selected for connection to the Y axis of the oscilloscope on the left control panel.

The output of the head position sensor bridge, in addition to being fed to the oscillator control tube, is fed to a vacuum tube voltmeter circuit of V65009. This indicates any error in the position of the head drum with respect to the selected sync source.

Besides feeding the head position sensor bridge, the output of multivibrator V65004 is fed to cathode follower V65006b. This cathode follower output in turn is delivered to J65002P TO CAPSTAN SERVO GEN which is connected to the capstan motor servo generator (where it acts as a reproduce timing reference signal), and to J65003S TO CONTROL TRACK which is connected to the left control panel (where the signal is used to record the control track and to trigger the oscilloscope sweep generator).

Another output of multivibrator V65004 is fed to a 240 cycle bandpass filter L65003 240 CY TO SWITCHER in the grid circuit of cathode follower V65006a. This filter converts the 240 cycle square waves to sine waves, and the output of the cathode follower is delivered to J65008P which is connected to the switcher unit and to J65009S TO SCOPE for the X axis of the oscilloscope on the left control panel. (A circular Lissajous pattern formed by the 240 cycles from V65001b on the Y axis and this signal on the X axis will now be displayed on the oscilloscope when the system is operating under stable conditions and the SYSTEM STABILITY display is selected at the left control pane.)

The 60 cycle output of binary count down stage V65002 is fed to a bandpass filter L65001, where it is converted to a sine wave, and thence to the grid of cathode follower V65001a. The output of the cathode follower is fed to J65007S, TO CAPSTAN AMP which is connected to the capstan signal generator to supply the capstan motor drive during record.

Regarding the signal path to the first grid of V65023, as previously explained, a nominal 240 cycle sawtooth wave, whose frequency deviates in accordance with the error signal generated in the head position sensor bridge is applied to the third grid of this tube.

Another output of bi-stable multivibrator V65005 (controlled by the photoelectric cell input) is delivered to a junction point from one path leads to the grid of V65010b and another path to the grid of V65012. V65010b is a phase splitter, delivering a push-pull 240 cycle square wave signal to two terminals of the velocity sensor bridge.

The square wave output of V65005 is differentiated in the grid circuit of tube V65012, the plate circuit of which has a 240 cycle parallel resonant tank circuit. The differentiated square wave signal provides pulses of energy to sustain oscillation in the resonant circuit, with a diode clipper circuit slicing a 1 volt portion from the center portion of the waveform. The resulting signal is again an approximate 240 cycle square wave; however, the phase of this signal is displaced from that delivered by V65005 by 90°, plus or minus an amount proportional to the difference between the actual photoelectric cell output and 240 cps (this additional phase shift occurs as a result of feeding any signal not of resonant frequency through a resonant circuit.

This square wave is amplified by V65011 to an approximate 140 volt peak-to-peak level and delivered to the grid of phase splitter V65010a. The push-pull signal from the phase splitter is connected to the other two terminals of the velocity sensor bridge. With the system operating in a steady state condition, the output of the bridge would be a symmetrical 480 cycle square wave approximately 10 volts peak-to-peak if the load were resistive. If the output of the photoelectric cell is other than 240 cycles, the bridge output would change to a non-symmetrical rectangular waveform having a dc component proportional to the difference between the actual photoelectric cell frequency and 240 cps. Actually, the bridge is connected to a 180 cps cutoff, low pass filter. The input impedance of the filter is reactive at 480 cps, so the output waveform of the bridge circuit is partially integrated. The filter attenuates to a high degree any signals of 240 cps, 480 cps, or higher, and will have output components from dc to 180 cycles. The instantaneous output

voltage is proportional to any instantaneous difference between the actual frequency from the photoelectric cell and 240 cps. (This is, in effect, a frequency discriminator circuit.) This output signal is dc coupled to the first grid of V65023.

The signal at the plate of V65023 would be a 240 cps sawtooth with an average dc axis of approximately 130 volts positive if clipping diodes CR65023 and CR65024 were not present. Because the voltage on the first grid is proportional to any instantaneous error in motor speed, the dc reference level at the plate is also proportional to any such error. The dc clipper circuit, CR65023 and CR65024, slices 1 volt out of the plate signal at approximately the 130 volt level. Only that portion of the wave between +129 volts and +130 volts (these are typical values) will thus show through the clipper "window" to the grid of V65023. By differentiating, clipping and amplifying, we emerge with an output signal having a linear phase shifting characteristic directly proportional to the error frequency detected in the discriminator circuitry. Thus the slicing action of the clipping circuit will occur at different levels on the wave, and the sloping edge of the sawtooth slice will move with respect to the steep edge, in accordance with the error signal.

The sliced waveform is amplified in V65028, and again clipped to shorten the rise time of the sloping edge -- the important edge of the signal. A final amplification of the signal is provided by V65024. In the plate circuit of this stage the signal is differentiated, and the positive pulse which is coincident with the steep edge of the sawtooth slice is shunted to ground by diode CR65027.

The negative pulse, coincident with the sloping edge of the sawtooth slice, triggers 240 cycle monostable multivibrator V65025. It should be apparent that the phase shift of the square wave output of this stage from that of the oscillator output appearing at TP65015 OSC OUT is proportional to any error signal developed by the frequency discriminator (plus a constant). This square wave drives V65018b, a cathode follower stage, and then is passed through a low pass filter, which removes harmonics of the 240 cps signal.

After passing through contacts of standby relay K65001, the signal is delivered to J65004P TO DRUM AMP which is connected to the drum motor drive amplifier. The motor will thus be brought gradually into synchronism with any change in sync phase or frequency, but will be rapidly corrected for transient shifts in motor speed (hunting).

Field pulses are derived by taking the 240 cycle square waves from V65005 differentiating them at C65083 to form pulses which are applied to grid number 3 of V65008. V65008 is biased to cutoff by grid number 1 at all times except when the amplified vertical sync pulse from V65020 is present, resulting in a coincidence gate circuit which passes every fourth positive pulse formed from the 240 cycle square waves at V65005, provided it is coincident with the video vertical sync pulse. After inverting the phase in V65007a and going through cathode follower V65007b, the pulse goes to J65003S TO CONTROL TRACK and thence to the control track record amplifier in the left control panel.

UNIT SET-UP

Make the following checks with tape threaded on the tape transport and while feeding a video signal to the system.

Step 1: Place the drum servo control unit selector switch S65001 in the VIDEO position.

Step 2: Adjust controls on the unit as follows:

R65002	OSC CONT SENSITIVITY	Full clockwise
R65003	MIN FREQ	Full counterclockwise
R65004	MAX FREQ	Full clockwise
R65006	DAMPING GAIN	Full counterclockwise

Step 3: Sync the oscilloscope to line and insert the probe in TP65015 OSC OUT; ground TP65014 OSC CONTROL to the chassis (leave grounded until otherwise indicated). The frequency of the waveform displayed should be 240 cps; if not, adjust R65005 to achieve this display as closely as possible (a slight drift may be present).

Step 4: Insert the oscilloscope probe in TP65017 PHASE SHIFTER. Sync the oscilloscope to internal. Adjust R65007 SYMMETRY for a symmetrical 240 cycle square wave.

Step 5: Insert the oscilloscope probe in TP65018 240 CY SYM and adjust 240 cycle symmetry control R65 240 CY SYM for a precisely symmetrical (±2%) 240 cycle square wave of 140 volts (±20 volts) peak-to-peak amplitude.

Step 6: Insert the oscilloscope probe in TP65004 P.E. CELL IN, sync the oscilloscope to line. Adjust L65006 240 CY TO DRUM for a maximum amplitude (approximately 30 volts peak-to-peak) 240 cycle sine wave. Then turn L65006 240 CY TO DRUM counterclockwise until this signal is reduced by 5 volts peak-to-peak.

Step 7: Insert the oscilloscope probe in TP65013 240 CY REF. Adjust L65005 240 CY to obtain a recurring train of decaying sinusoidal oscillations, four to a group, re-energized at the negative peak of each fourth cycle. The resulting waveform should be predominately 240 cps.

Step 8: Actuate the HEAD OVERRIDE switch above the right hand control panel; this will start the video head in rotation. Check, and if necessary, adjust the voltage for each of the 3 phases on the head motor drive amplifier (as explained under CHECK OF VIDEO HEAD AND PHOTOELECTRIC CELL OPERATION in SYSTEM CHECKOUT AND ADJUSTMENT).

Step 9: Insert the oscilloscope probe in TP65004 P.E. CELL IN of the drum servo control unit. Check for a 240 cycle signal of approximately 10 volts peak-to-peak amplitude. (This signal is from the photoelectric cell amplifier.)

Step 10: Insert the oscilloscope probe in TP65012 PHASE COMP and check for a 480 cycle square wave (perhaps with a varying symmetry) approximately 12 volts peak-to-peak in amplitude. Remove the test probe.

Step 11: Remove the ground from TP65014 OSC CONTROL. Ground TP65012 PHASE COMP to the chassis, and if necessary adjust R65001 METER CAL to zero the self-contained meter (meter indicator centered). Remove the ground from TP65012 PHASE COMP.

Step 12: Insert the oscilloscope probe into TP65008 FIELD PULSE and adjust L65005 240 CY till edit pulse appears, or if visible, for maximum width.

Step 13: Insert the oscilloscope probe in TP65005 240 CY SQUARE WAVE OUT and check for a 240 cycle square wave approximately 15 volts peak-to-peak in amplitude.

Step 14: Insert the oscilloscopr probe in TP65007 240 CY SINE WAVE OUT. Check for a 240 cycle sine wave approximately 35 volts peak-to-peak in amplitude. If necessary, adjust L65003 240 CY TO SWITCHER to achieve maximum amplitude of this waveform.

Step 15: Insert the probe of the oscilloscope in TP65001 60 CY TO CAPSTAN and check for a 60 cycle sine wave approximately 18 volts peak-to-peak in amplitude. If necessary adjust L65001 60 CY TO CAPSTAN for maximum amplitude of the waveform. Remove the oscilloscopr probe.

Step 16: Insert the oscilloscope probe in TP65002 240 CY TO SCOPE and check for a 240 cycle sine wave approximately 4 volts peak-to-peak in amplitude. If necessary adjust L65002 240 CY TO SCOPE to obtain maximum amplitude of the waveform. Remove the test probe.

Step 17: Insert the oscilloscopr probe in TP65011 REF PHASE. Adjust L65004 REF PHASE for maximum amplitude of the 240 cycle waveform. This amplitude should be 35-45 volts peak-to-peak.

Step 18: Insert the oscilloscope probe in TP65017 PHASE SHIFTER. Observe the position of the positive slope of the waveform displayed with respect to the negative slope. Rotate R65006 DAMPING GAIN to extreme clockwise position. Positive slope of the waveform with respect to the negative slope should be within ten microseconds of its previous position. If it has changed more than this, adjust L65004 REF PHASE to correct it. Turn R65006 DAMPING GAIN full clockwise, and leave it in that position.

Step 19: At the console de-actuate the head override switch.

Step 20: Repeat Step 3 except do not ground TP65014 OSC CONTROL.

Step 21: If necessary readjust R65002 METER BAL to bring self contained meter to center without grounding TP65012 PHASE COMP.

Step 22: Connect a stable video sync signal to J65012S EXTERNAL SYNC IN. (May be composite video.)

Step 23: Set sync selector switch, S65001 to EXTERNAL position

Step 24: At the console, actuate the head override switch. Insert one probe of a dual-trace oscilloscope in TP65009 FIELD PULSE GATE and the other probe in TP65008 FIELD PULSE. The oscilloscope sweeps should be adjusted to trigger from the positive slope of the pulse at TP65009 FIELD PULSE GATE. A pulse of 80 ±30 microseconds width and approximately 15 volts amplitude should appear at TP65008 FIELD PULSE. If the leading edge of this pulse at TP65008 does not occur 60 ±10 microseconds after the leading edge of the gating pulse at TP65009 FIELD PULSE GATE, adjust L65005 240 CY a small amount to achieve this condition.

Step 25: Trigger the oscilloscope sweep externally from the positive slope of the signal at TP65009 FIELD PULSE GATE. Insert the oscilloscope probe in TP65004 P.E. CELL IN and thus observe the stability of the photo cell signal with respect to the stable sync signal. Hunting oscillations of the photo cell signal should not exceed 2 microseconds peak-to-peak at a rate of about 5 cycles per second. (Allowable hunting amplitude is inversely proportional to the square of the hunting frequency A random drift at a slow rate of as much as plus or minus 30 microseconds is allowable and normal.) Oscillations induced by lightly touching the periphery of the rotating head drum should be damped out within two cycles. If system passes above checks, servo may be assumed to be performing normally.

Step 26: Return sync selector switch S65001 to VIDEO position.

Step 27: At the console de-actuate the head override switch.

NOTE

The following steps accomplish a compromise between quickly synchronizing the head motor to a new sync source, and limiting the rate of change to the new sync source, to a rate which the other circuits of the recorder can follow. These adjustments should be made after the other units of the machine have been adjusted to reproduce satisfactory pictures. Either of two methods may be used: 1. A test recording is made with switches between two video signal sources of slightly different sync frequencies. 2. A test recording is made from one video signal source, but the head motor is alternately allowed to "run free" and then synchronized to the video sync signal.

METHOD 1. (Two video signal sources with slightly different sync frequencies.)

Step 1: Put the equipment in the record mode by pressing the PLAY button and then the RECORD button.

Step 2: Insert the oscilloscope probe in TP65012 PHASE COMP. Observing the 480 cycle square wave, turn R65003 MIN FREQ fully clockwise and R65004 MAX FREQ fully counterclockwise. The system should remain locked. Leave the controls in these positions temporarily.

Step 3: Switch the video sync source and observe the rate at which the system synchronizes to the new sync. This will be shown by the changing symmetry of the 480 cycle rectangular wave.

NOTE

The head motor will synchronize to the new sync by either speeding up or slowing down, whichever phase change is shorter. R65003 MIN FREQ limits the amount the motor may slow down. R65004 MAX FREQ limits the amount the motor may speed up. The objective is to get the system to stabilize as quickly as possible from either direction without getting a break-up of the picture due to inability of other circuits to follow the change.

Step 4: Adjust R65003 MIN FREQ counterclockwise in small increments and R65004 MAX FREQ clockwise in small increments, until the system stabilizes in about 2 seconds from the most extreme phase changes in each direction.

Step 5: Rewind the recorded test section of tape and reproduce it. Observe the effect on the reproduced picture of the changes in sync phase. Continue making test recordings and adjusting R65003 MIN FREQ and R65004 MAX FREQ until stabilization following a sync change is as rapid as possible without danger of picture break-up on even the most extreme phase changes.

Step 6: Press the STOP button.

METHOD 2. (One video signal source.)

Step 1: Put the equipment in the record mode by pressing the PLAY button and then the RECORD button.

Step 2: Insert the oscilloscopr probe in TP65012 PHASE COMP. Observing the 480 cycle square wave, turn R65003 MIN FREQ fully clockwise and R65004 MAX FREQ fully counterclockwise. The system should remain locked. Leave the controls in these positions temporarily.

Step 3: Ground the input at EXTERNAL SYNC IN J65012S. Turn the selector switch to EXTERNAL. The waveform at TP65012 PHASE COMP will disappear. Wait a few seconds for the motor to drift out of phase with the video sync, then return the selector switch to VIDEO and observe the rate at which the system synchronizes to the sync. This will be shown by the changing symmetry of the 480 cycle rectangular wave.

NOTE

The head motor will synchronize to the sync by either speeding up or slowing down -- whichever phase change is shorter. R65003 MIN FREQ limits the amount the motor may slow down. R65004 MAX FREQ limits the amount the motor may speed up. The objective is to get the system to stabilize as quickly as possible from either direction without getting a break-up of the picture due to inability of other circuits to follow the change.

Step 4: Adjust R65003 MIN FREQ counterclockwise in small increments and R65004 MAX FREQ clockwise in small increments, repeating Step 3 after each adjustment until the system stabilizes in about 2 seconds from the most extreme phase changes in each direction.

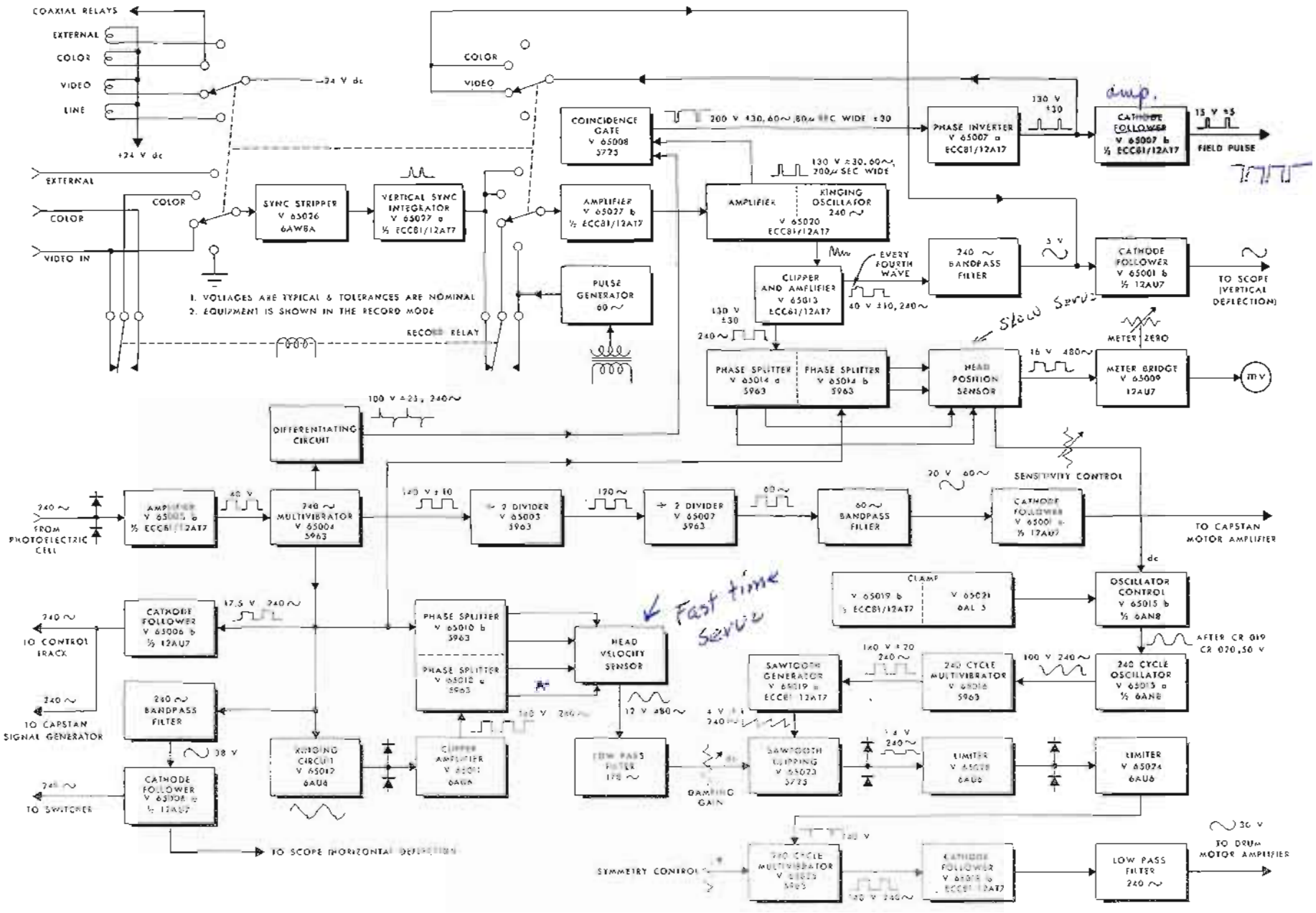
Step 5: Rewind the recorded test section of tape and reproduce it. Observe the effect on the reproduced picture, of the motor pulling into synchronism with the sync signal. Continue to adjust R65003 and R65004 while recording, until stabilization after applying the sync signal is as rapid as possible without danger of picture break-up on even the most extreme phase changes.

Step 6: Press the STOP button.

NOTE

The OSC CONT SENSITIVITY control, R65002 in most cases will be kept at maximum clockwise rotation at all times because this position gives the greatest control sensitivity. If video signals of widely varying sync frequencies are encountered during any one recording, it will be found that the servo control will shift from one frequency to another more readily when the sensitivity control is in the counterclockwise position. However, when this is done, some loss in accuracy of head motor positioning with respect to the vertical sync pulse will occur.

SEE VOLUME 2 FOR PIN VOLTAGES WAVEFORMS AND PARTS LIST.



DRUM SERVO CONTROL UNIT BLOCK DIAGRAM

SCHEMATIC-
DRUM SERVO CONTROL
CAT. NO. 50803

AMPEX

N/A TABLE
N/A
57021

J 004P POWER	
+250 V DC	8
RH CONTROL PANEL	7
CONT RLY PANEL	6
-24 V DC	5
COAX RLYS	4
GROUND	3
+24 V DC	2
-250 V DC	1

NOTES
1. ALL SCHEMATIC REFERENCE NUMBERS ARE 65000 SERIES. ONLY LAST 3 DIGITS ARE SHOWN (EXAMPLE R 016 INDICATES R 65016)
2. ALL RESISTORS IN OHMS, 1/2W, 10% UNLESS OTHERWISE SPECIFIED
3. ALL CAPACITORS IN MICROFARADS, RATED 400V UNLESS OTHERWISE SPECIFIED. MULTIPLE ELECTROLYTIC CAPACITORS CODED AS FOLLOWS a-b-c, a-b-c, a-b, a-b UNCODED TERMINAL
4. ALL POTENTIOMETERS ARE LINEAR TAPER, 2W, UNLESS OTHERWISE SPECIFIED
5. WAVEFORM VOLTAGES ARE PEAK TO PEAK
6. PERFORMANCE PER A.E.S. NO. 10-1960
7. FOR 250V OPERATION REMOVE C-072 (.0015 mf) FROM TERMINALS 1 & 3 OF OSCILLATOR ASS'Y. 57001

CAPSTAN SIGNAL GENERATOR

GENERAL

The purpose of the capstan signal generator is to compare the 240 cps reference frequency from the photo electric cell with the 240 cps signal reproduced from the control track, and to supply a resultant frequency, nominally 60 cps, to the capstan motor drive amplifier. This provides instantaneous control of tape position during the reproduce function so that proper tracking of the reproduce heads is maintained.

Mounted in Rack 2, the unit occupies 8-3/4 inches of rack space. All interconnecting connectors are at the rear, as the equipment is mounted on the rack, and all adjustment points are available from the front of the rack.

Six basic circuits are employed in the unit -- a control frequency circuit, a reference frequency circuit, a phase sensing circuit, a frequency control circuit, a Wien bridge oscillator circuit, and a tape speed override circuit.

Vacuum Tube Complement

Type	Qty.	Schematic Ref. No.
6AU6	3	V48002, V48006, V48008
12AU7	1	V48009
5750	1	V48003
OB2	1	V48004
6AQ5	1	V48001
6AW8	1	V48005
5963	1	V48007
3TFV4	1	V48010

THEORY OF OPERATION

Control Frequency Circuit

The 240 cps signal reproduced from the control track on the magnetic tape, after being processed by circuitry contained in the left control panel, enters the capstan signal generator at LINE IN connector J48001S. It is fed, across limiting diodes CR48001 and CR48002, to the grid of limiter amplifier V48005b. The signal is amplified in this stage, then limited again by the action of diodes CR48003 and CR48004. The resultant square wave is amplified in V48006 and fed to phase splitter tube V48007b which delivers push-pull outputs to opposite legs of the phase sensing bridge circuit.

The control frequency circuit also includes a voltage doubler circuit, CR48017, CR48014 and C48038 and a relay circuit, K48003 and V48005a.

A control track signal passing through the voltage doubler circuit will cut off V48005a thus de-energizing K48003. The SENSITIVITY control (R48001) is normally shorted out by K48003 to insure zero error voltage during start time. Therefore, when the control track signal is received in the reproduce mode a minimum of time is required to synchronize the capstan with the rotation of the head drum.

Reference Frequency Circuit

The reference frequency, originally derived from the head drum motor as its rotation is scanned by the photoelectric cell, is amplified and shaped in the drum servo control unit, then routed to connector J48001S. Circuitry of the reference frequency circuit V48008 and V48007a is identical to that of V48006 and V48007b in the control frequency circuit, with a resultant push-pull square wave output to the opposite two legs of the phase sensing bridge circuit.

Phase Sensing Circuit

Square waves from the control frequency circuit and the reference frequency circuit are equal in amplitude and are normally 90 degrees out of phase when tape speed and head rotation are exactly synchronized. The two square waves are mixed and detected by the diodes CR48007 through CR48010, and resistors R48045 through R48052, resulting in symmetrical step pulses of equal amplitude. This condition, which will remain static so long as the two square waves are 90 degrees out of phase, will introduce no error signal to the control circuit, and the oscillator will operate at its nominal frequency of 60 cps.

However, when the phase angle of the square waves from the control track and from the reference channel differs from 90 degrees -- which will occur when capstan rotation is not synchronized with head drum rotation, the output will become a non-symmetrical rectangular wave with a dc component present. The resultant, positive or negative, voltage is applied through a low pass filter across SENSITIVITY control R48001.

This error voltage controls the transconductance of V48003, a reactance tube modulator, which is connected as one of the frequency determining elements of the Wien bridge oscillator.

The phase sensing circuit thus creates a dc voltage proportional to any instantaneous deviation in phase relationship between the rotational position of the head drum and the position of the tape in respect to the recorded control track. This voltage then acts to correct the phase error by controlling the frequency of the oscillator the output of which drives the capstan motor.

A control range meter, M48001, indicates proper operation of the phase sensing circuit; correct operation is indicated when the meter pointer does not exceed the limits marked on the meter face in slow excursions from its center position.

Control Circuit

The control circuit consists of a reactance tube (V48003) and a voltage regulator tube, V48004 This is a conventional reactance tube circuit the effective output impedance of which is controlled by the dc voltage applied to grid No. 1. The phase of the reactive component in the output voltage is determined by a phase shift network between the plate and grid number 3. The amplitude is controlled by the transconductance of the tube, which in turn is a function of the voltage on grid number 1. The output is thus a function of any error signal emitted by the phase sensing circuit

The reactive component is added to the voltage already existing between the grid and the ground branch of the Wien bridge oscillator, thus permitting control of the oscillator frequency.

Wien Bridge Oscillator

As described previously, the output of the reactance tube is connected to one arm of the Wien bridge circuit, and its effect is to create a changing value in the reactance of that arm. The varying reactance, a function of any error signal generated in the phase sensing circuit, changes the nominal 60 cps frequency of the conventional Wien bridge oscillator in a manner which will synchronize the capstan speed with the rotation of the head drum.

In the absence of any error signal, the oscillator will operate at its normal frequency of 60 cps. Oscillator output is connected, during the reproduce mode of operation, through relay contacts of K48001 to J48003P from whence it is routed to the capstan motor drive amplifier.

Tape Speed Override Circuit

This circuit substitutes variable resistors for two of the fixed resistors in the Wien bridge circuit by means of a dual potentiometer and switch circuitry in the tape speed override assembly. The nominal 60 cps frequency of the conventional Wien bridge oscillator can thus be varied approximately ± 20% in a linear manner. A detent in the switch gives positive action in returning to the nominal 60 cps position.

Operation During the Record Process

When the equipment is in the record mode, relay K48001 is energized. A 60 cps frequency -- derived from the 240 cps signal, generated by the photo electric cell, which is shaped and divided by circuitry in the drum servo control unit -- is connected from J48004S to J48003P This bypasses all elements in the capstan signal generator and connects the signal to the capstan motor drive amplifier. The capstan signal generator thus has no effect in the record mode of operation.

UNIT SET UP

Step 1: Adjust CONTROL RANGE R48005 to mid position, sync the oscilloscope to the 60 cycle line and insert the probe in TP48001 OUTPUT. Observe a 20 volt peak-to-peak sine wave. Adjust BIAS control R48002 so that the 60 cycle sine wave drifts slowly.

Step 2: Connect the dc volt meter with a positive lead to TP48003 and the negative lead to ground. Voltage should be approximately 11 volts.

Step 3: Adjust the meter balance Potentiometer R49003 to achieve a zero deflection of the error signal meter M49001. Remove the volt meter.

Step 4: With tape threaded on the equipment press the PLAY pushbutton, then the RECORD pushbutton to place the equipment in the record mode. Check the 120-volt two phase voltage at the capstan motor drive amplifier, if necessary adjust as described under CHECK OF TAPE TRANSPORT MECHANISM. Continue recording for approximately three minutes, then press the STOP pushbutton.

Step 5: Rewind the tape to the beginning of the three minute recording made in step 4. Press the PLAY pushbutton to reproduce the recorded signal, and if necessary adjust output control R48004 to obtain a 120 volt indication on the meter at the capstan motor drive amplifier.

Step 6: Place the oscilloscope test probe in TP48002, turn SENSITIVITY control R48001 full counterclockwise. Adjust CONTROL RANGE control R48005 slowly, until meter M48001 shows some oscillation; continue to adjust R48005 CONTROL RANGE until the oscillations cease and the meter indicates zero error (the meter may still be slightly unstable). The oscilloscope should now display a step waveform approximately 16 volts peak-to-peak in amplitude, with some drift of this signal possible.

Step 7: Turn control R48001 SENSITIVITY slowly clockwise until meter oscillations completely stop. If the meter reads off center adjust control R48005 CONTROL RANGE to center it. The oscilloscope display should now be stabilized.

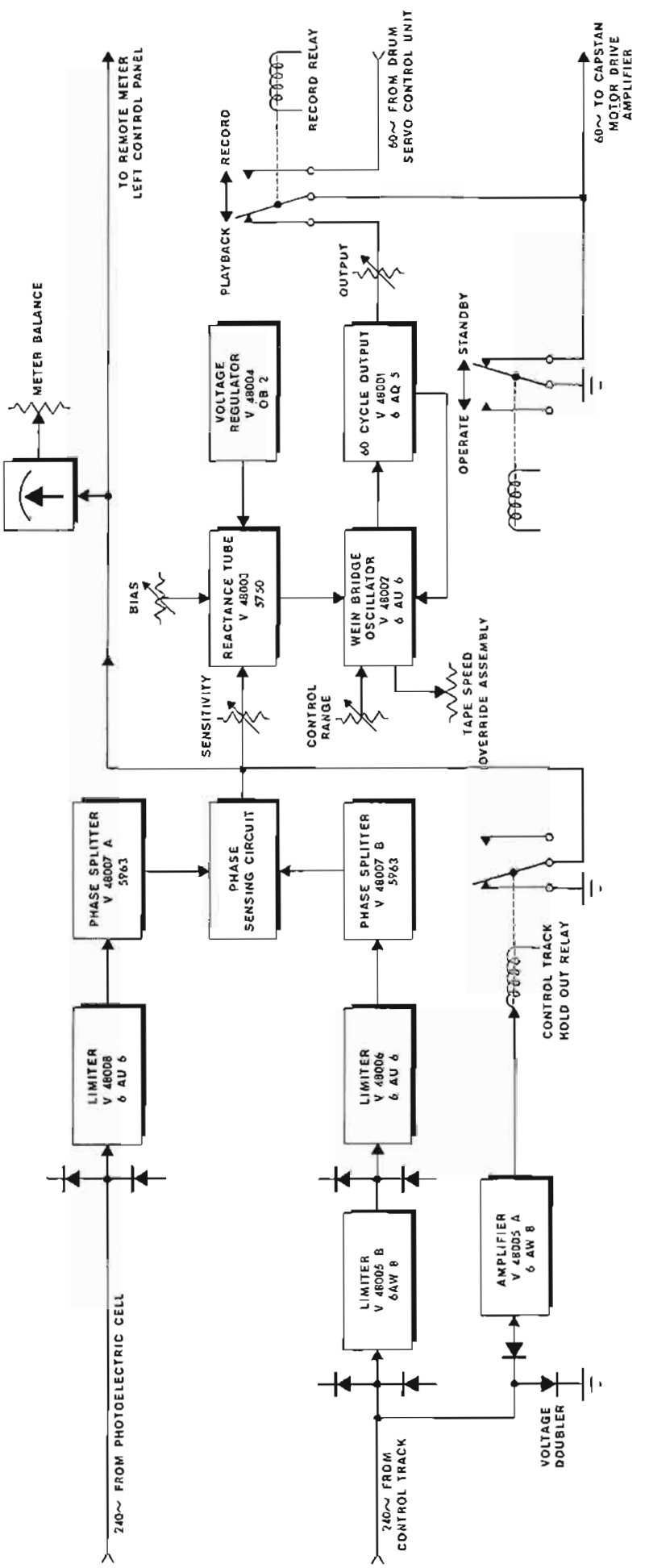
Step 8: Stop and start the reproduce mode several times, continuing to adjust R48001 SENSITIVITY until the system will stabilize before the female tape guide moves toward the video head assembly. (This may entail readjustment of R48005 CONTROL RANGE.)

Step 9 With the system reproducing the recorded signal, interrupt the speed of the rotating capstan by momentarily grasping it to slow it down, and observe that the system quickly recovers stability.

Step 10: Press the STOP pushbutton

SEE VOLUME 2 FOR PIN VOLTAGES, WAVEFORMS AND PARTS LIST.

CAPSTAN SIGNAL GENERATOR BLOCK DIAGRAM



SCHEMATIC — CAPSTAN SIGNAL GEN.

CATALOG NO. 13258

AMPEX

NOTES:

1. ALL SCHEMATIC REFERENCE NUMBERS ARE 48000 SERIES. (EXAMPLE: R12 INDICATES R48012).
2. ALL RESISTORS IN OHMS 1/2W, 10% UNLESS OTHERWISE SPECIFIED.
3. ALL POTENTIOMETERS ARE LINEAR TAPER, 2W, UNLESS OTHERWISE SPECIFIED.
4. WAVEFORM VOLTAGES ARE PEAK TO PEAK.
5. PERFORMANCE PER A.E.S. NO. 12-245.
6. COMPONENT VALUES SHOWN IN Y1 AND Z1 ARE FOR REFERENCE ONLY.
7. RELAY K1 HAS UNUSED CONTACTS 1, 11, 10; 6, 13, 7, 4, 14, 5.
8. RELAYS K2 AND K3 HAVE UNUSED CONTACTS 1, 11, 10; 9, 14, 8; 6, 13, 7.

LEFT CONTROL PANEL

GENERAL

The left control panel contains the control track reproduce circuitry, and controls and indicators for various other circuits in the system as follows:

An oscilloscope tube and selector switch to display SYSTEM STABILITY or SWITCHER OUTPUT indications. The field pulse can be observed on this oscilloscope during the record mode when the selector switch is in the SYSTEM STABILITY position.

A 4-position VIDEO RECORD CURRENT METERING switch which switches the video record current meter on the right hand meter panel to the individual video channels, from the head channel assembly.

An OPERATING HOURS indicator which operates when the equipment is in the record or reproduce modes, and indicates the total accumulated hours of such operation.

A TIP PROJECTION control which adjusts the position of the female guide.

An AUTOMATIC COMPENSATION push-pull type switch. This switch is illuminated brightly when the position of the female guide is being automatically controlled. It is illuminated (but dim) when the position of the guide is automatically changed from automatic to manual due to signal loss or deterioration and is not illuminated when the system is switched to manual.

A BLOWER indicating light of the push-to-test type which is illuminated when the air stream to the video head drum motor is operating normally.

A TRACKING control which centers the video heads on the recorded tracks.

A CAPSTAN SERVO meter which is in parallel with, and identical to, the meter on the CAPSTAN SIGNAL GENERATOR and indicates correct functioning of this unit.

Vacuum Tube Complement

Type	Qty.	Schematic Ref. No.
6485	3	V56001, V56002, V56003
12AT7	3	V56004, V56010, V56011
6J6	2	V56005, V56006
3RP1	1	V56008
OB2	1	V56007
12AU7	1	V56009
ECC83/12AX7	1	V56012

Power to the tubes in the left control panel is provided by the one ampere regulated power supply "C" in the console.

Circuitry in the panel includes an oscilloscope circuit, and a record and reproduce circuit for the control track.

THEORY OF OPERATION

Oscilloscope Circuit

When the SCOPE SELECTOR switch is placed in the SWITCHER OUTPUT position, the signal from output No. 2 of the switcher unit, entering the left control panel at J65002S SCOPE INPUT is amplified by V56001 and delivered to the vertical deflection plate of V56008, the cathode ray tube. The horizontal sweep generator and amplifier circuit consists of V56004, V56005, V56003, and V56002. The horizontal sweep is triggered by a 240 cycle square wave signal, originated by the photoelectric cell and processed in the drum servo control unit, entering the unit at pins 26-27 of J56004P. This signal is amplified and differentiated in V56004a, and used to trigger the monostable multivibrator circuits of V56005 and V56006. Input signals above 0.4 volts peak-to-peak are required to trigger the multivibrator circuits. The resultant 120 cycle square wave is used to key sawtooth generator V56004b and also to provide unblanking pulses to the cathode ray tube, the beam of which normally is cut off. The sawtooth output of V56004b is amplified and inverted by V56003 and connected to one horizontal deflection plate; it is again inverted by V56002 and delivered to the other

horizontal deflection plate to provide push-pull horizontal sweep. The horizontal and vertical positioning controls are in the circuit and positioning is possible. Thus the output of the four video heads on one revolution of the drum, as combined in the switcher and amplified in V56001, is displayed on one horizontal sweep of the oscilloscope. The 120 cycle sweep frequency coincides with the rpm of the drum motor. As alternate revolutions of the drum are blanked out, a clear display of the switcher output is assured. An input signal from the switcher of one volt peak-to-peak will produce a minimum vertical deflection of 1/2-inch at the maximum setting of R56001 SCOPE GAIN, the vertical amplifier gain control.

When the SCOPE SELECTOR switch is placed in the SYSTEM STABILITY position, B+ power to V56004a is removed, thus the horizontal sweep generator circuit of V56004a, V56005, V56006 and V56004b is rendered inoperative. A 240 cps signal originated by the photoelectric cell and processed in the drum servo control unit enters the left control panel at terminal 1 of J56003P and, through contacts of the selector switch is delivered by V56003. V56003 and V56002 amplify this signal and deliver it push-pull to the horizontal deflection plates. A 240 cps reference signal, originated by the sync source and processed in the drum servo control unit, enters the panel at terminal 4 of J56003P and is connected -- through contacts of the selector switch -- to V56001. The signal is amplified by V56001 and delivered to the vertical deflection plate. The cathode ray tube beam current is normally flowing as the selector switch changes cathode ray tube bias voltage, so a 1:1 Lissajous pattern is displayed. The horizontal component of this pattern is the 240 cps signal originated by the photoelectric cell, while the vertical component is the 240 cps signal originated by the sync source. The horizontal and vertical positioning controls are shorted to ground by contacts of the selector switch, and are inoperative.

Control Track Circuit

The record circuit of the control track consists of V56009 (a and b). A 240 cycle square wave signal originated by the photoelectric cell and processed in the drum servo control unit enters the panel at pins 26-27 of J56004P (this is the same signal used in the horizontal sweep circuit of the oscilloscope) and is impressed on the grid of V56009a through RECORD LEVEL control R56001. The circuits of V56009a and V56009b comprise a two stage amplifier using cathode follower output, with a 240 cps bandpass filter inserted between the stages to ensure a pure 240 cps output. The field reference pulse is delivered at pin 24 of J56004P from the drum servo control unit (originated by vertical sync) and mixed with the sine waves in the grid circuit of V56009b. In the record mode relay K56001 is energized and contact set 12-5 connects the amplifier output to the control track head.

the reproduce circuit for the control track consists of V56012 (a and b), V56011 (a and b), and V56010a. The output of the control track head is routed through contact set 6-13 of unenergized relay K56001 across the primary of transformer T56002. V56012 provides two stages of amplification. A 240 cps bandpass filter and the (reproduce) PLAYBACK LEVEL control are located between V56012 and V56011. The input level to V56011a thus is controlled by PLAYBACK LEVEL control, R56008 and peaked for 240 cps by the bandpass filter. There then follow two stages of amplification, with a cathode follower output stage. LOG TRACKING control R56013 provides a variable phase shift (with approximately 170° of range) so that the position of the recorded transverse video tracks can be centered on the video heads during reproduction. Approximately a 10 volt peak-to-peak signal is provided at the output, which is delivered to pins 22 and 23 of J56004P, and thence to the capstan signal generator.

Tube V56010b provides an isolating amplifier circuit for the control track meter on the left hand meter panel. During the record mode this stage is connecved in the return circuit of the control track head (through contacts of relay K56001). In the reproduce mode, V56010b is connected across the output stage. Calibration of the meter in the record and reproduce modes is adjustable at R56010 and R56007 respectively.

Controls and Indicators

Other controls and indicators not explained in the preceding discussions, do not employ electronic circuitry in the left control panel. An examination of the schematic diagram will clearly indicate the connections involved.

UNIT SET-UP

Step 1. Actuate the head override switch. Place the automatic compensation circuit (guide position sensor) in manual operation (illuminating light of AUTOMATIC COMPENSATION pushbutton not lit). Note the time indicated on the OPERATING HOURS meter. Tape must be threaded on the equipment.

Step 2 Turn the TIP PROJECTION control throughout its range, observing the action of the tape guide lever which should move the guide toward the video head assembly as the control is turned counterclockwise, and away from the video head assembly as the control is turned clockwise.

Step 3 Place the SCOPE SELECTOR switch in the SYSTEM STABILITY position. A one-to-one Lissajous pattern (formed by two 240 cycle signals from the drum servo control unit) should be displayed on the oscilloscope.

Step 4: Place the SCOPE SELECTOR switch in the SWITCHER OUTPUT position. A horizontal trace (formed by the output of the heads as combined in the switcher unit) should be displayed by the oscilloscope. If necessary adjust the positioning and astigmatic controls for the oscilloscope (these controls can be reached by removing the console front panel).

Step 5: De-actuate the head override switch. Press the PLAY pushbutton then the RECORD pushbutton to place the system in the record mode. The control track meter should indicate that the control track signal is present (this signal is from the control track generator whose adjustment procedure follows when making the complete system check).

Step 6: Insert the oscilloscope test probe in TP56002 CONTROL TRACK RECORD OUTPUT and if necessary adjust RECORD LEVEL control R56011 for a maximum undistorted sine wave, approximately 2.0 volts peak-to-peak.

Step 7: If necessary, adjust RECORD CALIB control R56010 for a zero indication on the control track meter. Continue recording for approximately 1 minute, then press the STOP pushbutton.

Step 8: Rewind the tape to the beginning of the 1 minute recording made in Step 7.

Step 9. Insert the oscilloscope test probe in TP56001 CONTROL TRACK PLAYBACK OUTPUT. Press the PLAY pushbutton to reproduce the signal recorded on the tape. If necessary, adjust playback level control R56008 PLAYBACK LEVEL for a 10 volt peak-to-peak sine wave as displayed on the oscilloscope. If necessary, adjust PLAYBACK CALIB control R56007 for a zero indication on the control track meter. Remove the oscilloscope test probe.

Step 10: Press the RECORD pushbutton and turn the VIDEO RECORD CURRENT METERING control through its 4 positions, checking that video record current is indicated on the meter at the right hand meter panel. (It may be necessary to adjust the gain controls on the record amplifier driver to achieve the indications.) Press the STOP pushbutton.

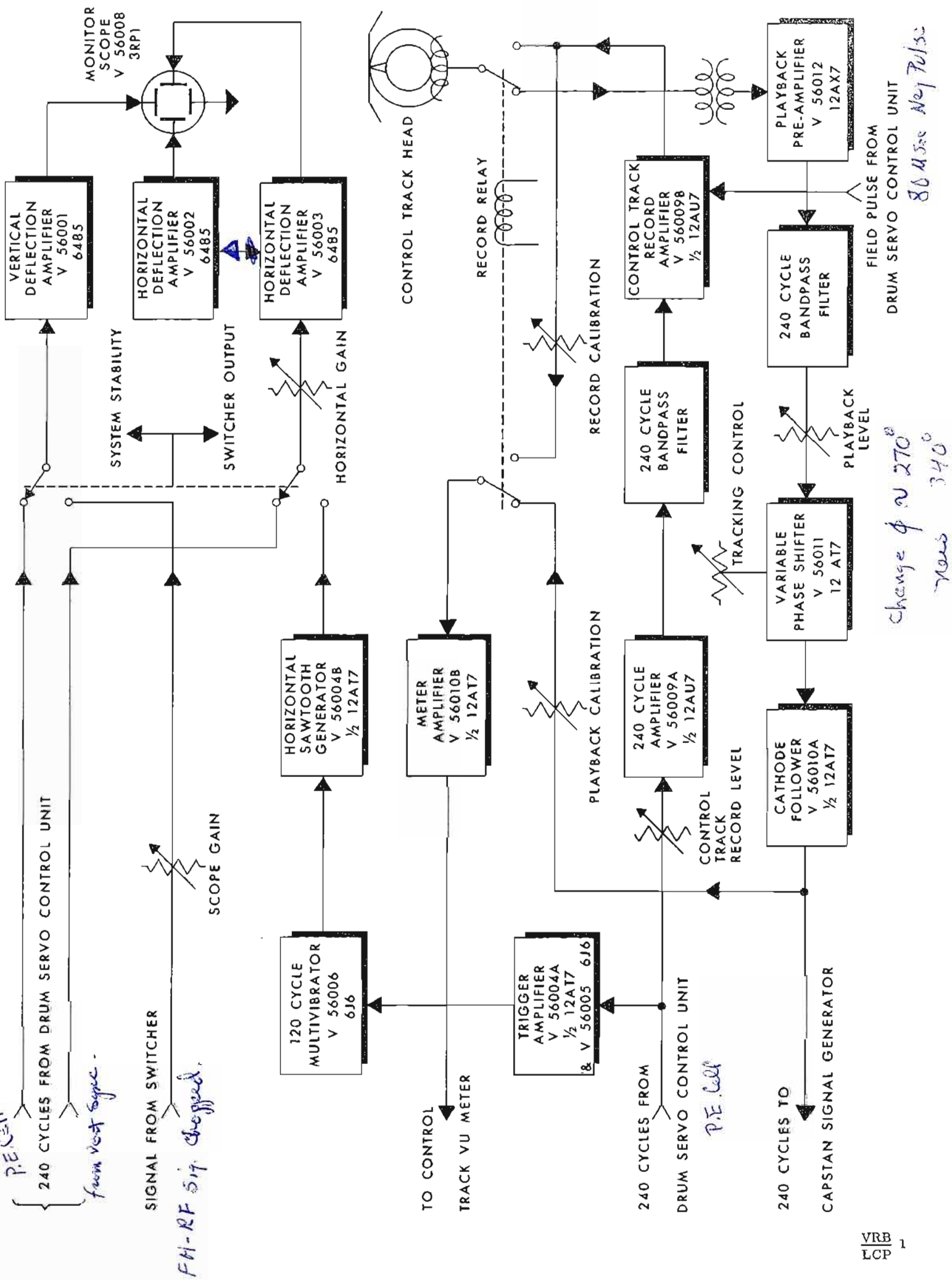
Step 11: Check that the OPERATING HOURS meter has operated during the adjustment process.

Step 12: Check that the SCOPE GAIN control R56001 is in mid position.

SEE VOLUME 2 FOR PIN VOLTAGES, WAVEFORMS AND PARTS LIST.

Left Control Panel

LEFT CONTROL PANEL BLOCK DIAGRAM



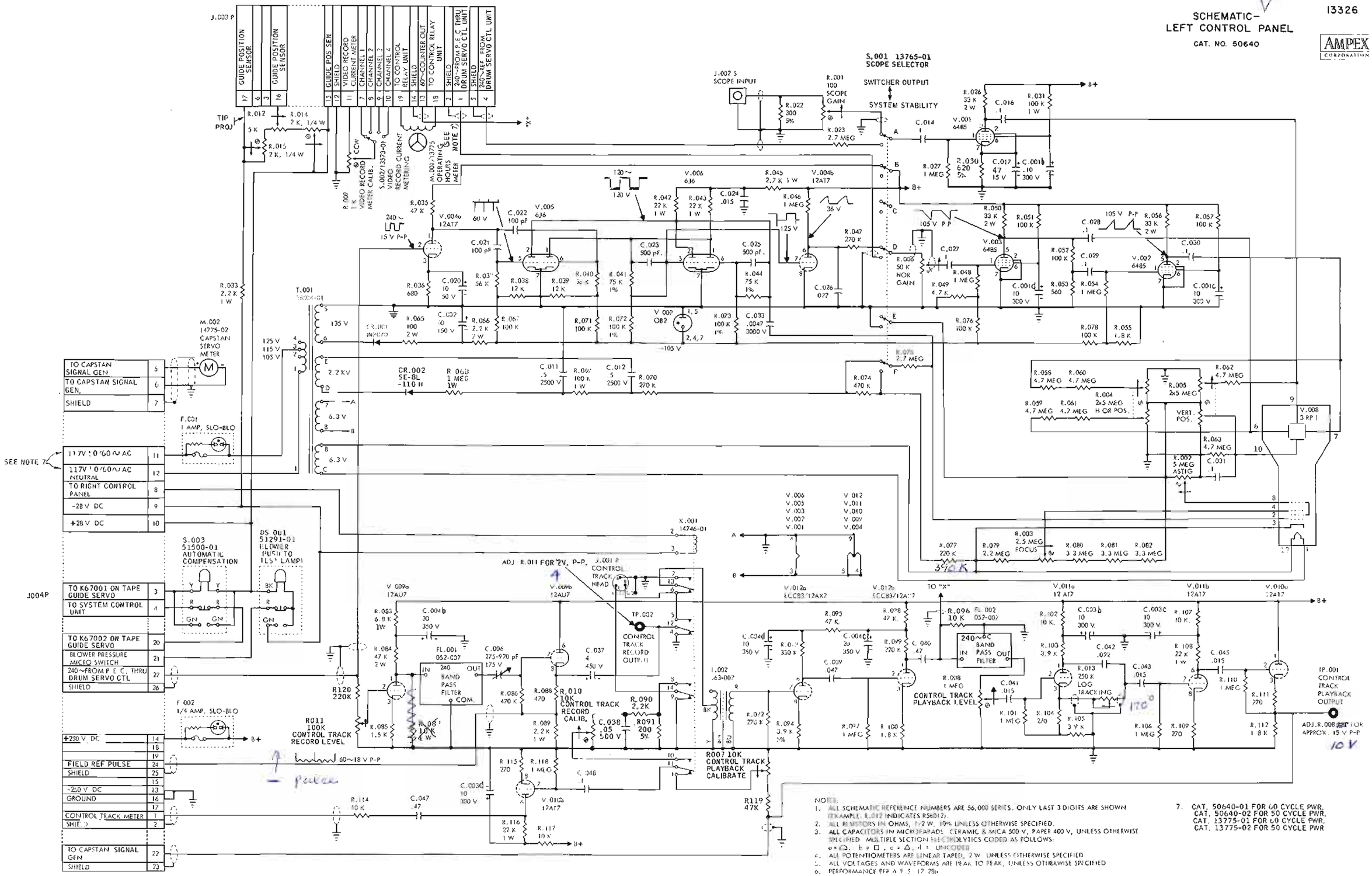
VRB / LCP 1

SCHEMATIC—
LEFT CONTROL PANEL

CAT. NO. 50640

13326

AMPEX CORPORATION



NOTES:
1. ALL SCHEMATIC REFERENCE NUMBERS ARE 56,000 SERIES. ONLY LAST 3 DIGITS ARE SHOWN (EXAMPLE: R.012 INDICATES R56012).
2. ALL RESISTORS IN OHMS, 1/2 W, 10% UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITORS IN MICROFARADS. CERAMIC & MICA 500 V, PAPER 400 V, UNLESS OTHERWISE SPECIFIED. MULTIPLE SECTION ELECTROLYTICS CODED AS FOLLOWS: a = ○, b = □, c = △, d = UNCODED
4. ALL POTENTIOMETERS ARE LINEAR TAPED, 2 W, UNLESS OTHERWISE SPECIFIED.
5. ALL VOLTAGES AND WAVEFORMS ARE PEAK TO PEAK, UNLESS OTHERWISE SPECIFIED
6. PERFORMANCE PER A.P.S. 17 29a.
7. CAT. 50640-01 FOR 60 CYCLE PWR.
   CAT. 50640-02 FOR 50 CYCLE PWR.
   CAT. 13775-01 FOR 60 CYCLE PWR.
   CAT. 13775-02 FOR 50 CYCLE PWR

VRB
LCP 2

IB57020

LCP-7

GUIDE POSITION SENSOR

GENERAL

The purpose of the guide position sensor is to provide an error signal during the reproduce mode when the tape guide is not positioned correctly. This error signal is fed to the tape guide servo, which will reposition the tape guide to remove the error signal.

The unit is mounted on Rack 1, where it occupies 3-1/2 inches of vertical rack space. All connectors are at the rear (as the equipment is mounted on the Rack), while all adjustment points are available from the front of the rack.

Vacuum Tube Complement

Type	Qty.	Schematic Ref. No.
12AU7	1	V49001
5725	1	V49002
5687	1	V49003
6AL5	1	V49004
12AT7	2	V49005, V49006

THEORY OF OPERATION

The error signal is derived from the reproduced video signal by sensing a time displacement error caused by incorrect horizontal positioning of the tape guide. If this timing error is not corrected a "venetian blind" effect occurs in the reproduced picture. Basically, the guide position sensor detects differences in the time interval between the horizontal sync pulses which immediately precede and follow a head switching operation as compared to the average time interval of the horizontal pulses during a head scanning period.

Sync pulses from the output of the Video Processing Unit enter at J49002S SYNC FROM PROCESSING AMPLIFIER, which is jumpered to J49003S, from whence the signal is routed to the channel switcher. The pulses are amplified in V49006a., differentiated, and then clipped by the action of V49004a. Thus positive pulses, corresponding to the leading edge of the horizontal sync pulses, are fed as trigger pulses to V49005.

Monostable multivibrator V49005 will be adjusted (by means of DELAY WIDTH control R49003) to produce a normal positive pulse of approximately 57.5 microseconds duration at each horizontal sync pulse. (As these pulses are spaced at 63.5 microsecond intervals, approximately 6 microseconds will elapse between the time that the multivibrator reverts to its stable condition and the occurrence of the next triggering pulse. As a consequence the waveform at TP49006 appears to be a negative, 6 microsecond pulse.) This pulse of approximately 100 volts, peak-to-peak amplitude, is coupled to the grid of V49003b.

During the positive pulse interval of 57.5 microseconds V49003b conducts heavily, and its plate potential drops to approximately 20 volts. During the 6 microsecond interval between pulses the tube is cut off, and C49005 starts to charge (through R49017) from 70 volts toward the 250 volt B+ supply. The time constant of R49017 and C49005 is such that for a 6 microsecond interval the slope of the charge curve of C49005 will be at its steepest (approximately 10 volts per microsecond). At the end of the 6 microsecond interval V49003b again will conduct heavily, providing a quick discharge path for C49005. The result is a series of sawtooth pulses, which occur at a rate corresponding to the horizontal sync pulses, and whose peak amplitude is constant as long as the time interval between the sync pulses is constant.

Now, assume that the tape guide is not positioned correctly, and that a timing error of 0.1 microsecond is produced each time the heads are switched (every 16 horizontal lines). This will result in a change of 0.1 microsecond in the charge time of C49005, which means an amplitude variation of approximately 1 volt in the tip of the sawtooth wave at the plate of V49003b.

Diode V49004b provides a charge path for C49006, which will charge to the peak of the sawtooth wave. The discharge path of C49006 is through R49018, and the capacitor charge will decay only about 5 volts in a horizontal line interval, so only the tips of the sawtooth wave are preserved. The high impedance at the cathode of V49004b requires cathode follower circuit V49003a for isolation and to provide a low impedance output. A high pass filter composed of C49007 and L49001 removes any low frequency microphonic effects generated in the circuit.

To control the position of the tape guide it is necessary to sample the sawtooth wave at a point where 0 volts indicates correct tape guide position, and negative or positive excursions from 0 volts indicate incorrect tape guide position. This is accomplished in the sampling circuit, which uses as a reference the 480 cycle square wave (from the channel switcher) which establishes the head switching time.

The 480 cycle square wave enters the unit at J49004S 480 CYCLE INPUT, is amplified by V49001a, differentiated, and clipped so that positive trigger pulses, corresponding to the leading edge of the square wave, are fed to the "Phantastron" delay circuit of V49002.

Tube V49002 is a pentode, grid 1 of which controls the total screen plate current, while Grid 3 controls the division of that current between the screen grid and the plate. The plate section may be considered as a normally "off" tube, while the screen grid section is a normally "on" tube. The control grid normally allows a large tube space current to flow from the cathode to the screen. This current, through R49030, places the cathode at a higher potential than Grid 3; thus a large screen grid current is allowed to flow, but no plate current flows.

Steady state plate voltage on the "Phantastron" stage is established by the setting of ZERO ADJ R49001 (in a voltage divider network between B+ and chassis ground), and diode CR49003 (in a parallel divider network to B+ from the swinger arm of R49004). When the positive trigger pulse from V49001a is applied to Grid 3, plate current is allowed to flow and a sudden drop in normal plate voltage occurs. This voltage drop is coupled to Grid 1, which causes the cathode current (and voltage) to drop and the screen grid voltage to rise. As the cathode potential goes in the negative direction, Grid 3 is going relatively in a positive direction in respect to the cathode and more plate current will flow. Plate voltage will drop further, cathode voltage will drop as a result, and screen grid voltage will increase. This action will continue until the plate voltage decreases to a point where plate current will not flow, at which point the tube returns to its static condition pending receipt of the next trigger pulse.

The output of the "Phantastron" circuit, taken from the screen grid, is a positive pulse, triggered by the leading edge of the 480 cycle square wave switching pulse, the width of which can be varied by R49001 ZERO ADJ. Sampling time, determined by the trailing edge, will thus occur at a 480 cycle rate, or at alternate head switching intervals corresponding to 32 lines of video information.

The output of the "Phantastron" is fed to V49001b, which acts as an isolating amplifier, and thence to T49001. This transformer circuit isolates the diode sampling circuit from ground, and differentiates the square wave from the "Phantastron" into negative and positive pulses. The negative pulses will have no effect on the diode circuit, as the polarity of these pulses is opposite to the conducting mode of the diodes. However, the positive pulses, corresponding to the trailing edge of the square waves, will cause the diodes to conduct through each branch of the bridge, and C49019 will soon charge to the peak value of the applied positive pulses. A back bias, which cannot leak off between pulses, is thus provided on the diode bridge.

Let us now return to our sawtooth waveform at TP49004. As large positive spikes of voltage could be caused by noise pulses in the circuit, and since these spikes could overcome the back bias on the diode bridge (producing erratic indications), CR49001 is provided in the circuit to clip the waveform at approximately +10 volts. This waveform is completely isolated from the output circuit by the action of the back bias on the diode bridge, except during the 2 microsecond period when the sampling pulse from V49001b is impressed on the bridge. During that period all four diodes in the bridge will conduct, acting as a closed switch between TP49004 and the output circuit and allowing C49020 to charge toward the instantaneous voltage at TP49004. This voltage will be zero during the 2 microsecond sampling time if the guide is correctly adjusted, or will be either a positive or negative value if the guide is misadjusted. Potentiometer R49002 SENSITIVITY allows overall adjustment of the error signal level which is fed to the tape guide servo.

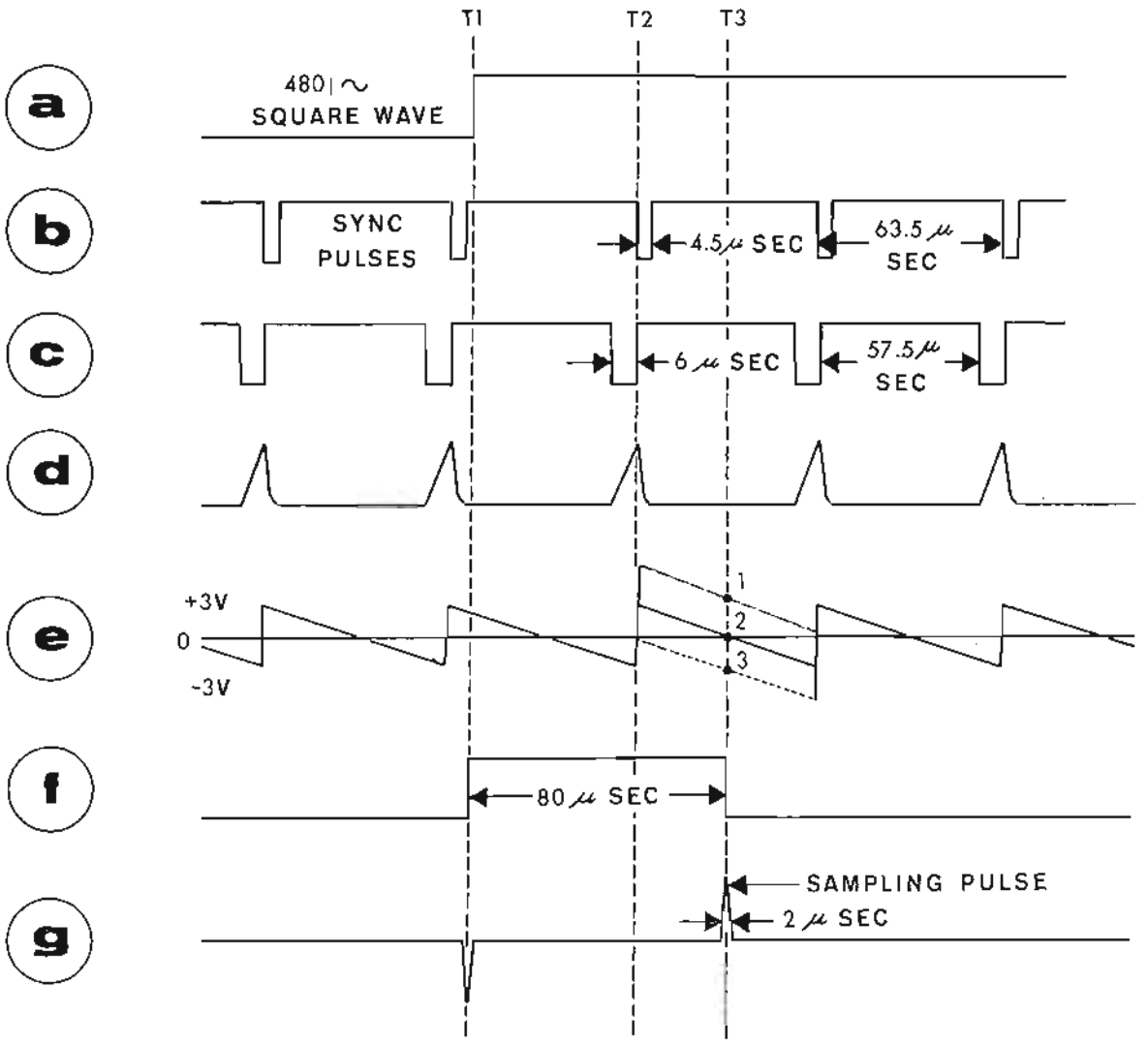
The operation of the circuit is shown in the timing diagram. Waveform A illustrates the 480 cycle square switching pulse, waveform B is that of the sync pulses, and waveform C is that of the output of delay multivibrator V49005. Waveform D is the sawtooth output of V49003b, whose peak amplitude will vary if timing differences exist between sync pulses. Waveform E is the sawtooth waveform appearing at TP49004, whose position will vary around a zero voltage reference relative to any error which exists. Waveform F is the square wave output of the phantastron delay circuit, with the trailing edge delayed approximately 80 microseconds from the start of the 480 cycle switching pulse to establish the sampling time. Waveform G is the sampling pulse formed by the differentiated trailing edge of the phantastron delay circuit square wave.

The circuit of V49006b is provided to automatically open the guide servo loop, thus holding the guide position, if the picture becomes badly degraded, or if the video signal ends. When a normal signal appears at TP49004, a negative bias is developed on the grid of V49006b (by the action of CR49004 in conjunction with C49021 and R49040). Thus only a few mils of current will flow through coil 1-8 of differential relay K49001. Potentiometer R49004 CUTOUT ADJ is adjusted to allow equal current flow through coil 2-3 of the relay, and the relay will remain in a balanced condition (no contacts closed) which allows automatic operation. If the video signal is interrupted, the bias on tube V49006b will be zero, more current will flow through coil 1-8 of the relay, and relay contacts 4-6 will close. If the video signal becomes excessively noisy (or if the video signal on the tape ends), the bias on the tube will increase, less current will flow through coil 1-8, and contacts 7-8 will close. Actuation of the relay in either direction will cause one leg of the guide motor to be opened through relay control in the tape guide servo.

UNIT SET UP

Guide position sensor performance checks depend upon the completed system checkout which includes adjustments for this unit. Any adjustment to the channel switcher subsequent to the completion of the guide position sensor sequence, for instance, will necessitate further adjustment of this unit. Therefore, no unit set up is included in this section.

SEE VOLUME 2 FOR PIN VOLTAGES, WAVEFORMS AND PARTS LIST.



a 480 ~ SWITCHING PULSE ——— TP-49001

b NEGATIVE SYNC FROM VIDEO PROCESSING UNIT ——— TP-49007

c DELAY MULTI OUTPUT (100 V P-P) ——— TP-49006

d SAWTOOTH OUTPUT (100 V P-P) ——— TP-49005

e SAWTOOTH OUTPUT (5 V P-P) ——— TP-49004

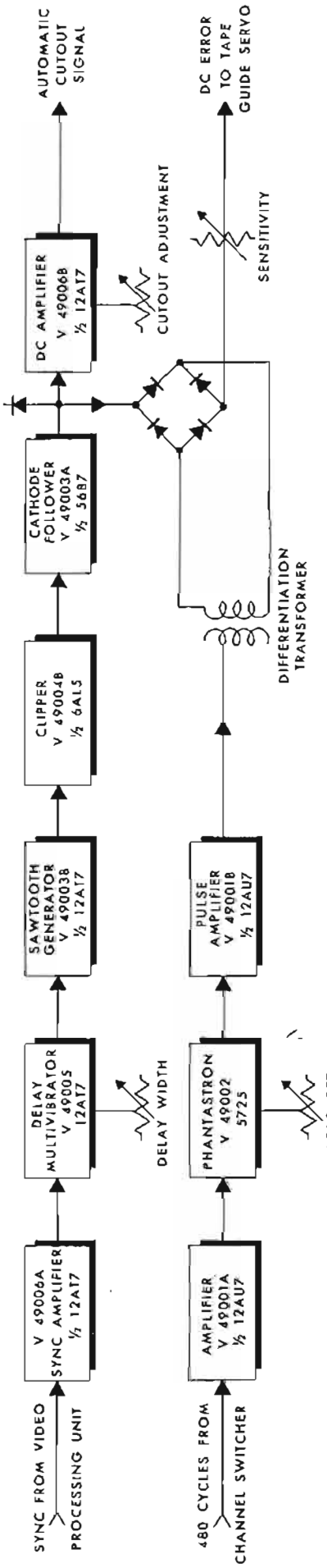
f PHANTASTRON DELAY (36 V P-P) ——— TP-49002

g SAMPLE PULSE (40 V PEAK) ACROSS ——— T-49001 SECONDARY

VRB/GPS 1

TIMING DIAGRAM

GUIDE POSITION SENSOR BLOCK DIAGRAM



SCHEMATIC –
GUIDE POSITION
SENSOR
CATALOG NO. 13259

13309

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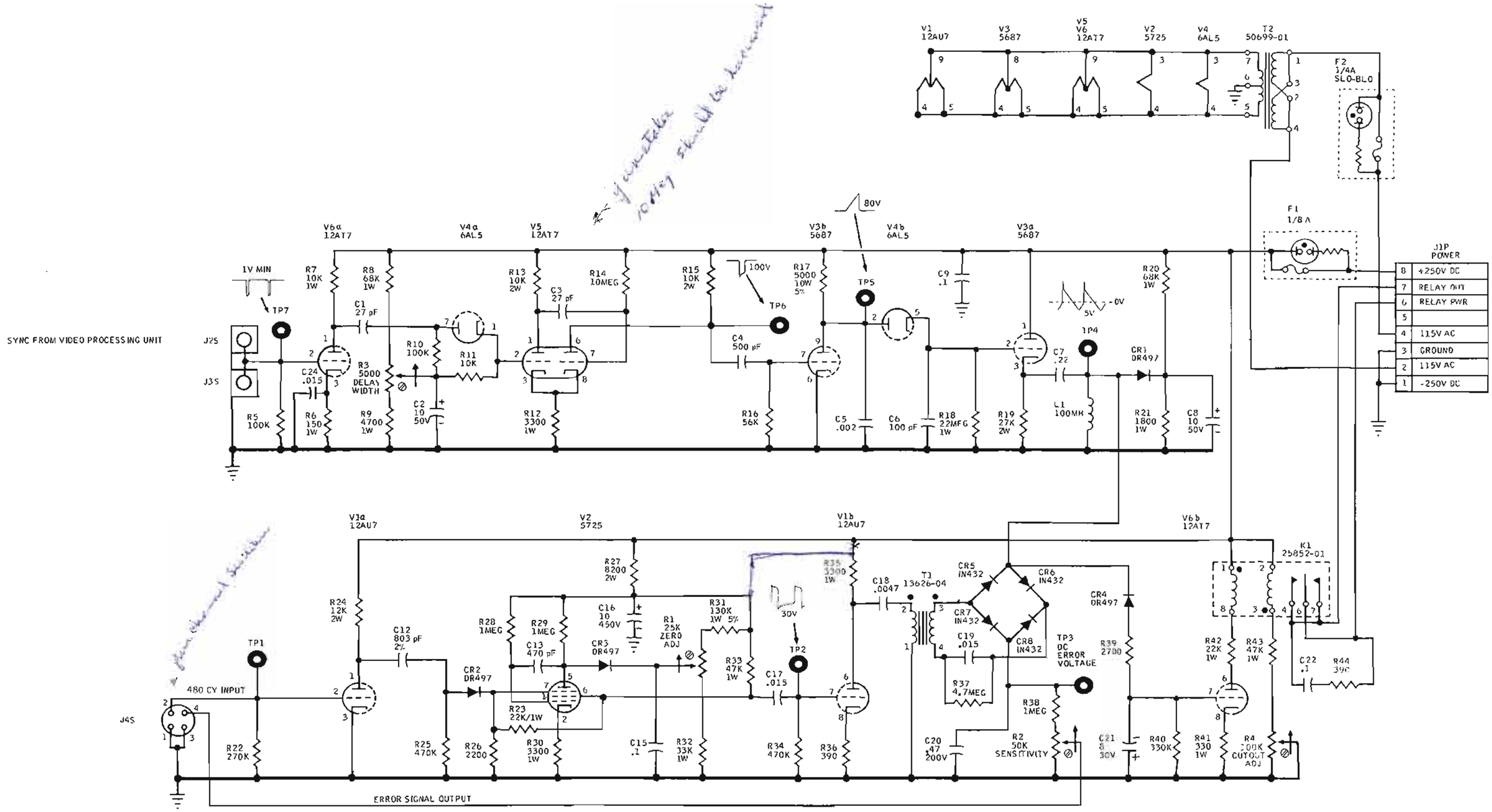


NOTES:

1. ALL SCHEMATIC REFERENCE NUMBERS ARE 49000 SERIES. ONLY LAST DIGITS ARE SHOWN. (EXAMPLE. R12 INDICATES R49012).
2. ALL RESISTORS IN OHMS, 1/2W, 10% UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITORS IN MICROFARADS, MICA 500V, 5%. OTHER TYPES 400V, 10% UNLESS OTHERWISE SPECIFIED.
4. ALL POTENTIOMETERS ARE LINEAR TAPER 2W, UNLESS OTHERWISE SPECIFIED.
5. WAVEFORM VOLTAGES ARE PEAK TO PEAK.
6. PERFORMANCE PER A.E.S. NO. 12-294.

TAPE GUIDE SERVO

GENERAL

The function of the tape guide servo is to develop a signal which can be used to control the tape guide motor in accordance with the amplitude and polarity of any dc error voltage developed in the guide position sensor unit or caused by the repositioning of the manual TAPE GUIDE POSITION potentiometer on the left control panel.

Mounted in the rear of the console, the unit is powered from the 60 cycle line. The single adjustment point is available to the operator when the left rear access door (facing the rear of the console) is opened. All connections are made from the back of the unit.

Vacuum Tube Complement

Type	Qty.	Schematic Ref. No.
12AX7	2	V67001, V67002
12AU7	2	V67003, V67004

THEORY OF OPERATION

Selection of input (either AUTOMATIC from the guide position sensor or MANUAL from the left control panel) is controlled by relay K67001; when this relay is energized the tape guide is positioned automatically.

The selected signal is routed through contacts of K67001 to the swinger arm of converter D67001. The "chopping" action of this converter is controlled by the 60 cycle power, so that the dc signal is routed first in one direction then the other through the primary of transformer T67002, and the reversals occur at a 120 cps rate. Thus at the secondary of T67002 there will be developed a 60 cps ac voltage whose amplitude is a function of the absolute value of the original dc input voltage, and whose phase with respect to the 60 cps power line (either in-phase or 180° out of phase) is determined by the polarity of the original dc input voltage.

This ac voltage is amplified in three conventional triode amplifier stages (V67001a, V67001b, and V67002a) which follow. GAIN CONTROL potentiometer R67008, in the grid circuit of V67002, provides an overall sensitivity adjustment for the unit. The amplified signal is next applied to the motor control circuit.

One winding of the tape guide motor is connected across the ac power line, through C67009b, at contacts 7-8 of J67003S. The other winding is connected across the full wave rectifier circuit consisting of V67003 and V67004. If no signal is applied to the grids of V67003 and V67004, the current through this second winding will be pulses, occurring at 120 pps, which are of constant amplitude and polarity. In conjunction with the motor winding which is connected across the power line, (whose current pulses reverse polarity at each half cycle) this will result in a zero net motor torque.

If, however, a 60 cycle signal is applied to the grids of V67003 and V67004 the rectified current waveform will contain a 60 cps component. This component in the motor winding connected to the rectifier, in conjunction with the ac current in the other winding, will result in torque being developed in the motor, and the motor will operate. The speed of motor rotation will depend on the amplitude of the 60 cps signal from V67002a, while the direction of the rotation will depend on the phase of this signal in respect to the 60 cycle line (as has already been explained, this phase is determined by the polarity of the dc input voltage). The motor rotation will continue until repositioning of the tape guide results in a reduction to zero of the dc input voltage, at which time rotation will stop.

Input selection, from either the automatic error signal of the guide position sensor (AUTOMATIC) or from the manual bridge circuit (MANUAL), is controlled through relay K65001 which in turn is controlled by the AUTOMATIC-MANUAL switch on the left control panel. When this relay is energized, the tape guide is positioned automatically. With K65001 in automatic position, protection relay K65002 provides a means for opening the servo loop by disconnecting one winding to the guide motor. This relay is actuated by a signal from the guide position sensor whenever the video signal is sufficiently degraded or ceases completely.

Power to the unit is supplied directly from the ac power line at J67002P. Fusing is provided by F67001. Tube V67002b is connected as a conventional, half wave, power rectifier and supplies B+ voltage to the amplifier stages.

Tape Guide Motor Assembly

The tape guide motor assembly is mounted underneath the tape transport and consists of a motor, coupled to a worm drive which positions the tape guide actuator arm. The motor operates with 115 volts, 50 or 60 cps power, and develops a 48 inch-ounce maximum torque.

A worm drive mechanical linkage controls a pivoted actuator arm. Positioning of this arm causes the guide to be moved closer to the heads or farther away from them. The actuator arm forms a STOP for the solenoid control of the tape guide. Coupling also is provided to the center arm of the helical potentiometer which forms one leg of the servo bridge used for manual control of the tape guide position.

UNIT SET-UP

Because all internal set-up adjustments of the tape guide servo are made by Ampex prior to shipment of the equipment, there are no set-up adjustments required.

OPERATING ADJUSTMENT CONTROLS

The AUTOMATIC COMPENSATION switch is a push button with integral light indicator. In the reproduce mode, the tape guide is under automatic control when the light is illuminated, and under manual control when the light is extinguished. In the record mode, the tape guide is always under manual control regardless of the light indication.

The TIP PROJECTION control knob adjusts a potentiometer. The knob position is determined by the position of the pointer on a calibrated scale. The extreme counterclockwise scale mark is number 5. Reading clockwise the scale marks are successively 4, 3, 2, 1, 0, and -1. In addition there is a red triangular shaped mark on the scale. When in the reproduce mode, the tip projection control knob pointer should be set at this mark.

NOTE

The tip projection scale numbers read the distance from the tape guide to the head drum in thousandths of an inch.

OPERATING ADJUSTMENTS

Step 1: Thread the standard video reference tape on the equipment.

Step 2: Adjust the pointer on the TIP PROJECTION CONTROL to the red mark.

Step 3: Adjust the AUTOMATIC COMPENSATION SWITCH to manual, (indicator light extinguished).

Step 4: Place the system in the reproduce mode.

Step 5: Watch the reproduced picture on the monitor while slowly rotating the tip projection control knob counterclockwise. The picture will eventually drop out by evidencing skewing. The proper setting of the tip projection control will be two and one-half scale divisions clockwise from the point of drop out.

NOTE

When the equipment is under proper adjustment, the tip projection control knob will point to the red mark at the conclusion of the above procedure.

Step 6: Remove the reference tape from the equipment.

ADJUSTMENTS REQUIRED FOLLOWING HEAD DRUM REPLACEMENT

Whenever the head drum is removed for adjustment or repair, and re-installed (or replaced,) the following procedure must be followed.

Step 1: Thread a standard video reference tape on the equipment.

Step 2: Turn the horizontal allen head set screw on the tape guide actuator arm clockwise until the screw head is flush with the arm surface.

Step 3: Adjust the AUTOMATIC COMPENSATION switch to manual, (indicator light extinguished).

Step 4: Place the equipment in the reproduce mode.

Step 5: Watch the reproduced picture on the monitor while slowly turning the allen head set screw counterclockwise until all picture skewing disappears and the picture is normal. This adjustment eliminates time displacement errors caused by improper tape guide positioning.

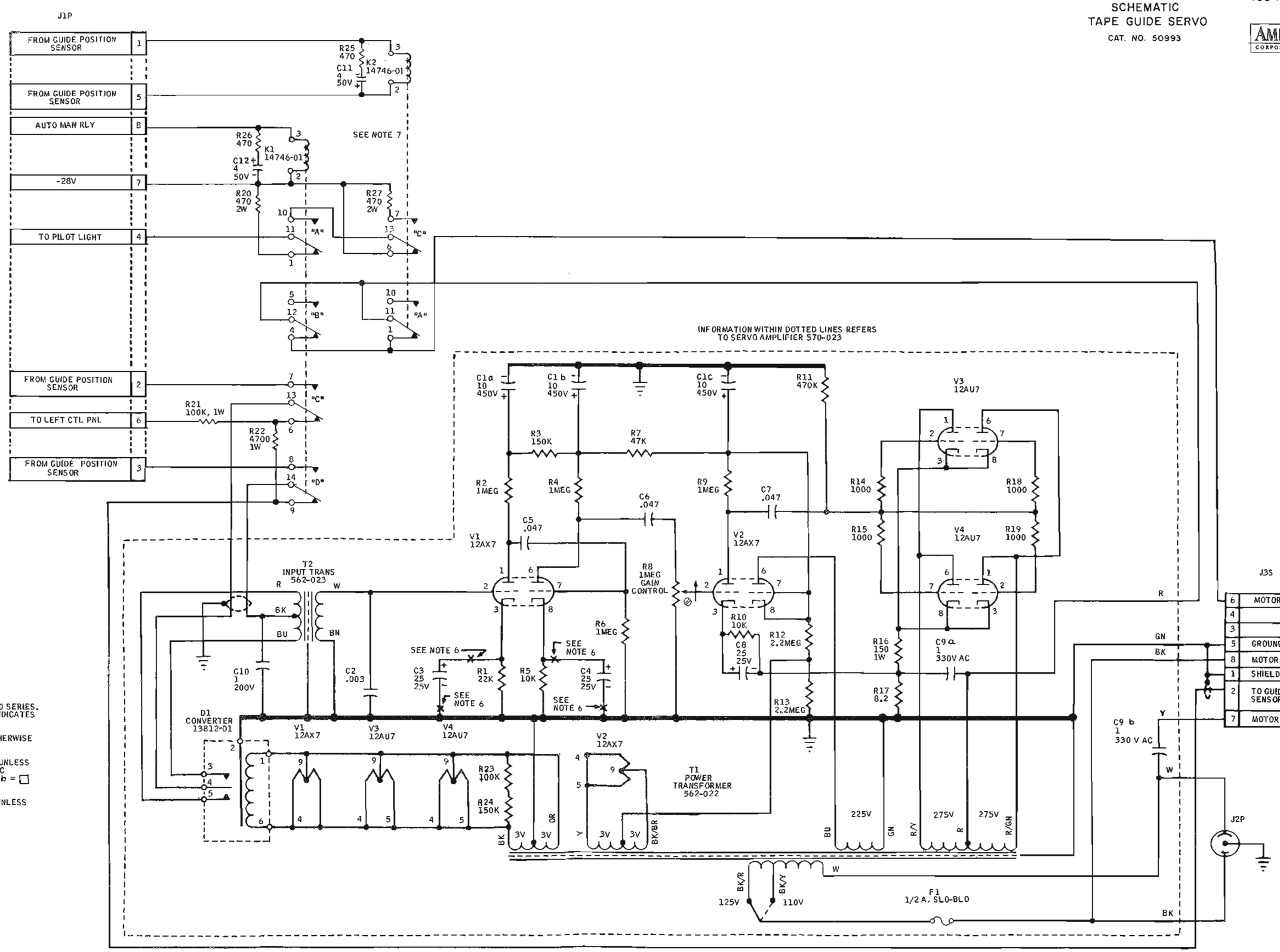
Step 6: Remove the reference tape from the equipment.

SEE VOLUME 2 FOR PIN VOLTAGES, WAVEFORMS AND PARTS LIST.

13346

SCHEMATIC
TAPE GUIDE SERVO
CAT. NO. 50993

AMPEX CORPORATION



NOTES:

1. ALL SCHEMATIC REFERENCE NUMBERS ARE 67000 SERIES. ONLY LAST DIGITS ARE SHOWN (EXAMPLE: R43 INDICATES R67043.
2. ALL RESISTORS IN OHMS, 1/2W, 10% UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITORS IN MICROFARADS, RATED 400V UNLESS OTHERWISE SPECIFIED. MULTIPLE ELECTROLYTIC CAPACITORS CODED AS FOLLOWS: a = ⌓ , b = □ c = △ , d = UNCODED TERMINAL.
4. ALL POTENTIOMETERS ARE LINEAR TAPER, 2W, UNLESS OTHERWISE SPECIFIED.
5. WAVEFORM VOLTAGES ARE PEAK TO PEAK.
6. REMOVE C3 & C4 WHEN ASSEMBLING 50993.
7. SECTIONS "B" & "D" OF K2 ARE NOT USED.
8. PERFORMANCE PER A.E.S. NO. 12-236.

VRB 2
TGS

IB57020

VIDEO ERASE AND CUEING UNIT

GENERAL

Several erase and cueing operations can be performed with this unit and its associated heads. The 2 inch wide video erase head, which is energized only during the record mode, provides the signal to erase all previously recorded video, audio, control track and cue track information from the tape, furnishing a means to remove unwanted takes and make the substitution of other takes. Such sequences can be closed by splicing. By means of the cueing head arrangement and circuitry, the audio track can be recorded as a separate operation; and routine cueing, program director notes, editing instructions and control tones can be recorded while programming or during reproduction. The cueing track, located at the lower portion of the tape just above the control track, is twenty mils wide, separated from the other information by guard bands ten mils in width on either side.

The video erase head is located on the left side of the tape transport adjacent to the tape supply reel, the cueing heads are situated in the lower section of the audio head assembly, and the electronics assembly for these erase and cueing heads is mounted in the console below the left control panel. All control for any phase of the erase or cueing operation is accomplished at the right control panel. The circuits controlled by these pushbuttons are described in the System Control Unit section of this manual.

Power for the video erase push-pull output stage is furnished by a self-contained power supply driven directly from the 60 cps power line. The cueing electronic circuitry consists of a record amplifier, a reproduce amplifier, a bias and erase oscillator, a buffer oscillator, a tone oscillator, and a metering circuit.

Vacuum Tube Transistor Complement

Type	Qty.	Schematic Ref. No.
EL34/6CA7	2	V59001, V59006
12AX7	2	V59002, V59004
12AU7	3	V59003, V59005, V59009
12AT7	2	V59007, V59010
6CL6	1	V59008
2N109	1	Q59001

THEORY OF OPERATION

Cue Record Amplifier

The audio signal (+8 dbm level) enters the unit at REC INPUT BRIDGE J59001S and is adjusted by RECORD LEVEL potentiometer R59004, which is part of the bridging input circuit.

The record channel consists of a conventional two stage resistance coupled amplifier V59005 a and b.

In the record mode relay, K59001 is energized and through contact set 7-13 the output of constant current stage V59005b is delivered to the record-reproduce cue head by means of REC/PB HEAD J59002P. In the reproduce mode, this relay is de-energized, and contact set 4-12 grounds the record amplifier output, minimizing the possibility of cross talk between the record and reproduce channels which might occur within relay K59001.

Cue Reproduce Amplifier

The audio reproduce channel consists of a 3 stage resistance coupled amplifier, V59004a, B59004a, V59003b and a transformer coupled output stage V59003a.

In the reproduce mode relay, K59001 is de-energized and contact set 6-13 connects the signal from the record-reproduce head through J59002P to transformer T59001 and thence to the grid of V59004a. All stages in the reproduce amplifier are conventional audio circuits.

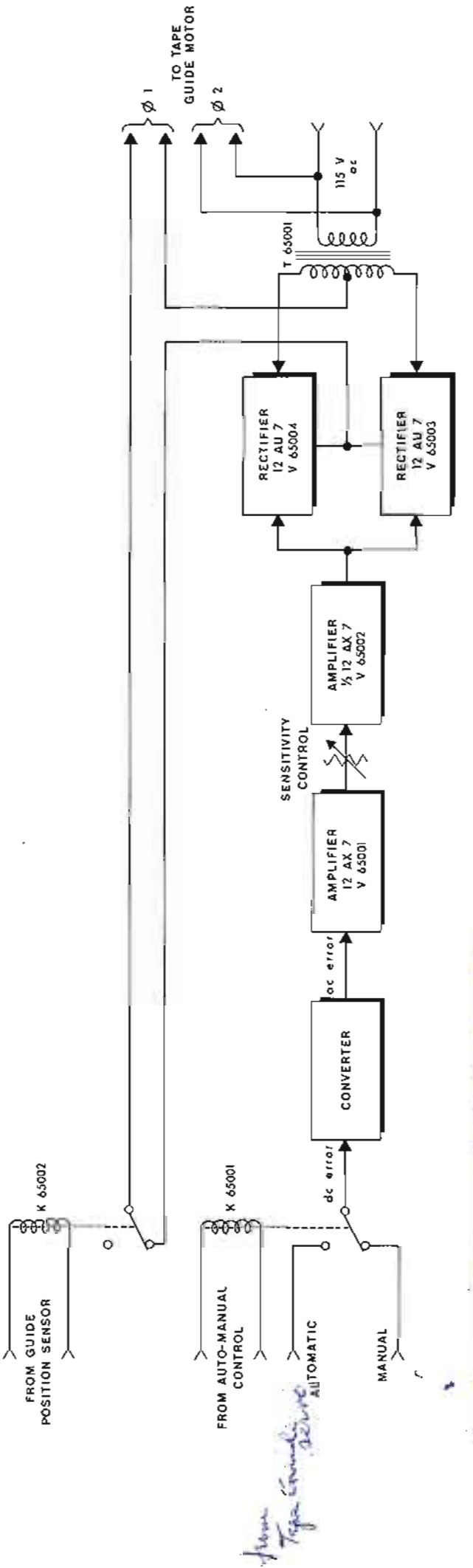
Output transformer T59002 is factory connected to feed a 600 ohm line, but can be strapped for a 150 ohm output. Approximately 6 db gain will be sacrificed if this connection is used.

Cue Bias and Erase Oscillator

The bias and erase oscillator is composed of dual triode tube V59009 connected in an lc push-pull circuit. The frequency is approximately 100 kc; the exact frequency is not critical. Plate voltage is applied to the oscillator in the cue only mode, through contact set 8-14 of relay K59002 in the energized position.

The oscillator output is taken from transformer T59004 and fed through variable capacitor C59002 ERASE, which adjusts the erase current in the cue only mode. From this point the signal is routed through contacts 10 and 11 of relay K59004 in the energized position, to J59005P CUE ERASE HEAD and thence to the erase head, and through adjustable capacitor C59003, which adjusts the bias current, to cue record amplifier output.

TAPE GUIDE SERVO BLOCK DIAGRAM



Buffer Oscillator Circuit

A buffer oscillator circuit is used to amplify and isolate the 100 kc signal fed from the right control panel during the record mode.

The 100 kc signal enters the unit at J59004P and feeds the cathode of a grounded grid amplifier V59007a. This amplifier drives the grid of a buffer oscillator through RECORD ERASE LEVEL potentiometer control R59005. The final stage of this buffer oscillator, V59008, is tuneable and is adjusted for maximum voltage at TP59003 by variable capacitor C59001.

From transformer T59003 the output is fed through contacts 1 and 11 of relay K59002 to J59005P CUE ERASE HEAD and thence to the erase head. Plate voltage is applied to this oscillator only in the record mode through contacts 10 and 11 of relay K59001 in the energized state.

Tone Oscillator

V59010, the tone oscillator, is a free running multivibrator operating at approximately 325 cycles. It is connected to the cue record amplifier input and can be energized by depressing the tone button at the right control panel. Plate voltage is applied through contacts 7 and 13 of relay K59005 in the energized position.

Video Erase Circuit

The 100 kc video erase signal is the same signal fed to the buffer oscillator circuit. One half of V59007 feeds the buffer oscillator and the other half of the dual triode acts as a grounded grid amplifier to isolate and amplify the 100 kc from the right control panel. The output of this amplifier is controlled by video erase level potentiometer R59002 which then feeds the grid of amplifier V59002a. The second half of this dual triode V59002b is used as a phase splitter to drive the push-pull output stage V59001 and V59006. These pentode amplifiers feed the video erase head through J59009S. Screen voltage to these tubes is fed through J59009S to protect them when the video erase head is disconnected.

A transformer and a single loop of copper ribbon constitutes the video erase head. The primary of the transformer is tuned to resonance by a variable capacitor.

Power Supply

Dc plate power for the push-pull video erase output circuits is provided by a conventional power supply consisting of a power transformer T59005, a bridge rectifier circuit using 8 diodes, CR59009 through CR59016, with an inductance input lc filter

All tubes in the unit derive heater power from the 6.3 volt windings of the filament transformer T59006.

The 60 cycle ac power line is connected to J59008P, and is fused at 2 amperes by F59003. The dc voltages are fused by F59001 and F59002. Fuse failure is indicated by lights on the fuse posts.

UNIT SET UP

Erase Level

Step 1: Insert an oscilloscope probe into TP59003, CUE ERASE. Place the equipment in the cue only mode and adjust C59003 ERASE LEVEL for approximately 80 volts peak-to-peak.

Step 2: With the equipment in the record mode, adjust C59001 RECORD ERASE control to achieve resonance (maximum voltage at TP59003). Adjust R59005 RECORD ERASE LEVEL for the same voltage as in step 1.

Cue Record Bias

This is an important adjustment because record bias will affect the high frequency response, distortion, and noise. Adjust the bias for the type of tape to be used, as tapes from different manufacturers require differing bias levels.

Step 1: Connect an audio oscillator to pins 2 and 3 of input connector J59001S REC INPUT and set it for 1000 cps at 1.95 volts rms. Terminate pins 2 and 3 of J59003P AUDIO OUT with a 600 ohm resistance, and connect a vtvm across this load.

Step 2: Thread the video head reference tape on the equipment and reproduce the signal on the tape. As the audio tone is reproduced, set R59003 PLAYBACK LEVEL control to achieve a +8 dbm indication on the vtvm. RETAIN THIS SETTING.

Step 3: Stop tape motion and remove the video head reference tape. Then thread along the prescribed path a tape on which no signal is recorded.

Step 4: Place the equipment in the cue only mode, and adjust C59003 BIAS LEVEL in steps, noting each setting, from full counterclockwise to full clockwise, then stop tape motion.

Step 5: Rewind the tape to the beginning of the recording made in Step 4, and reproduce the recorded signal. Determine which setting of C59003 resulted in the highest output indicated on the vtvm and adjust C59003 for this maximum setting.

Step 6: Record and reproduce as necessary to achieve the final setting of C59003 which will give maximum output during the reproduce mode.

Record and Reproduce (Playback)

Step 1: Connect an audio oscillator to pins 2 and 3 of input connector J59015S REC INPUT and set it for 1000 cps at 1.95 volts rms. Terminate pins 2 and 3 of J59003P in a 600 ohm resistance, connecting the vtvm across this load.

Step 2: Place the equipment in the cue only mode, and with the same audio level setting, record frequencies from 50 to 3000 cycles.

Step 3: Rewind the tape and reproduce these frequencies. Note that the level as indicated on the vtvm is within ±3 db.

Step 4: Stop the equipment and check the noise level on the vtvm. Signal-to-noise should be at least -45 db.

Step 5: Record the video and control track with no audio on the cue channel. Reproduce this signal, making certain that the signal-to-noise ratio is 30 db below the normal +8 dbm output.

Video Erase

Step 1: Place the equipment in the record mode and with an oscilloscope check the 100 kc signal at TP59001 VIDEO ERASE LEVEL for 0 to 1.5 volts peak-to-peak when adjusting R59002 VIDEO ERASE LEVEL.

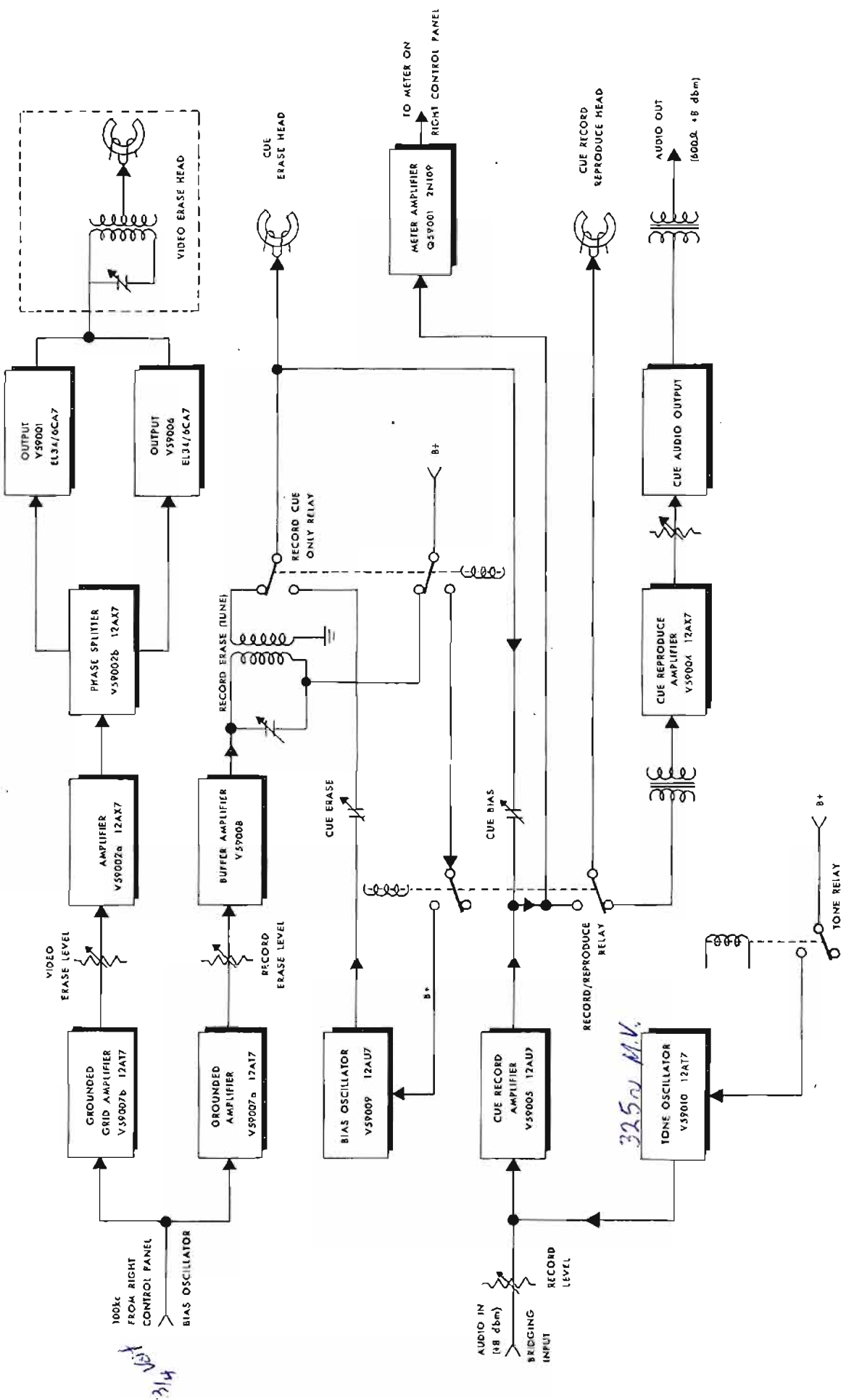
WARNING

HIGH VOLTAGES EXIST ON THE VIDEO ERASE HEAD. DO NOT TOUCH THE ERASE HEAD WHILE MAKING THE FOLLOWING ADJUSTMENTS.

Step 2: Stop the equipment and remove the video erase head cover. Place the equipment in the record mode and measure the voltage from one side of the erase head variable capacitor to ground. Tune the capacitor to resonance (maximum voltage) and adjust R59002 VIDEO ERASE LEVEL for 700 volts peak-to-peak, then tune the video erase head at BALANCE control R59001 for minimum distortion as indicated on the oscilloscope.

SEE VOLUME 2 FOR PIN VOLTAGES, WAVEFORMS AND PARTS LIST.

VIDEO ERASE & CUEING UNIT BLOCK DIAGRAM



VRB / EAC 1

SCHEMATIC - VIDEO ERASE & CUEING UNIT

CAT. NO. 50738

13328 D

AMPEX CORPORATION

NOTES:

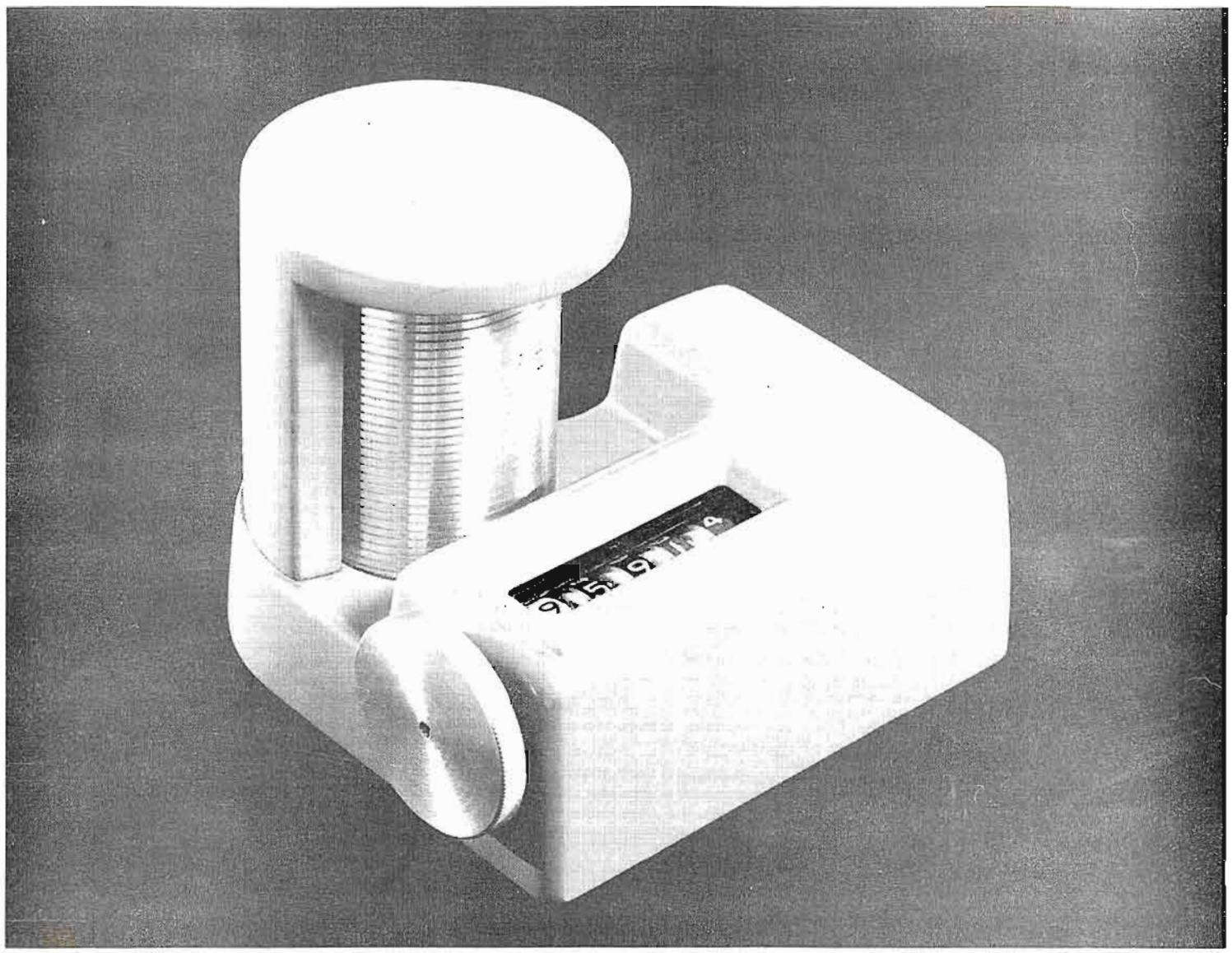
1. ALL SCHEMATIC REFERENCE NUMBERS ARE 59000 SERIES. ONLY LAST DIGITS ARE SHOWN (EXAMPLE: R-12 INDICATES R59012).
2. ALL RESISTORS IN OHMS, 1/2 W, 10% UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITORS IN MICROFARADS, RATED 500 V UNLESS OTHERWISE SPECIFIED. MULTIPLE ELECTROLYTIC CAPACITORS CODED AS FOLLOWS: a = ⌓, b = □, c = △, d = UNCODED TERMINAL
4. ALL POTENTIOMETERS ARE LINEAR TAPER, 2 W, UNLESS OTHERWISE SPECIFIED.
5. WAVEFORM VOLTAGES ARE PEAK TO PEAK.
6. PERFORMANCE PER A.E.S. NO 12-283.
7. ON RLY K 2 AND K 5 TERMINALS 8,14,9.5,12,4,10,11,1 NOT USED. ON K 3 TERMINALS 8,14,9 NOT USED.

J7P

8	-24 V THRU STOP RLY CTL RLY PANEL
12	REC BUS
15	-24V
5	LOCAL NORMAL STOP CKT
3	- 250 V DC
13	-24 V THRU STOP RLY CTL RLY PANEL
9	LOCAL REC SW
2	+ 24 V DC
1	TALLY LIGHT
7	TO LOCAL NORMAL LAMP
6	PLAY BUS
11	PLAY REMOTE BUS
4	+ 250 V DC
14	LOCAL TONE SW
10	LOCAL REC LAMP

J6S

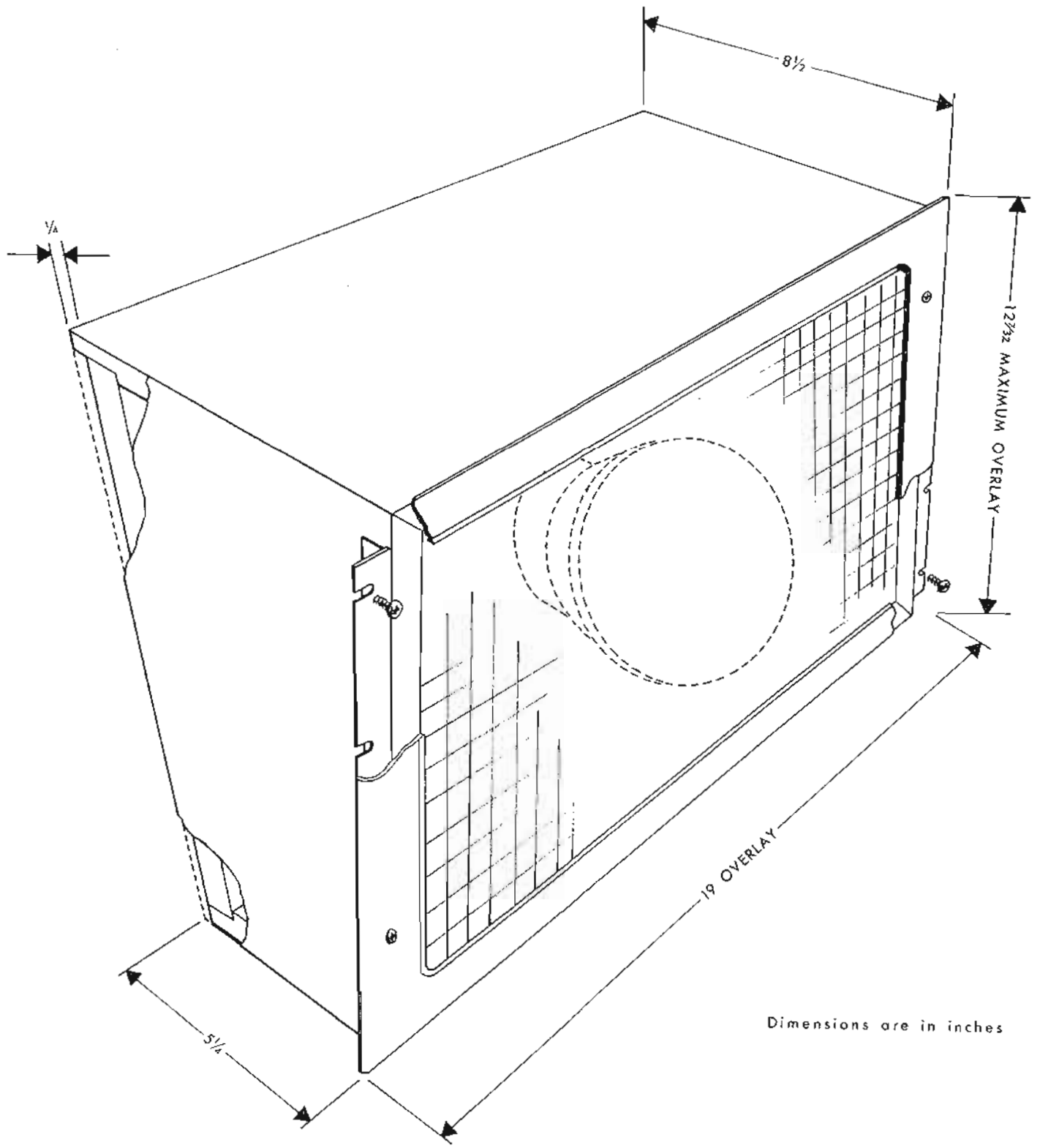
1	REM REC LAMP
2	REM REC SW
6	REM NORMAL SW
9	-24V
3	TO REM + 24 V
7	REM TONE SW
4	REM NORM LAMP
5	-24V THRU STOP RLY
12	
8	
10	
11	



TAPE TIMER ASSEMBLY

For accurate determination of program and recording length or any portion thereof, the tape timer is calibrated in hours, minutes and seconds. It is accurate to approximately 3 seconds for an hour long recording. The tape timer functions as an adding device in the forward modes and a subtractor in rewind condition.

The assembly consists of a mounting base, a rotary idler and shield, an indexed counter, a system of gears, a reset knob and a vernier knob for making fine manual corrections of the index reading. The unit is mounted on the takeup reel side of the tape transport.



Dimensions are in inches

PERFORMANCE CHARACTERISTICS

Acoustical response when this speaker is connected to Ampex Amplifier Catalog No. 51398-01: .5db on axis from 60 cycles to 10,000 cycles as measured in an anecoic chamber radiating into 180° solid angle.

1. Input Impedance: 12 ohms nominal
2. Power Output: 10 watts

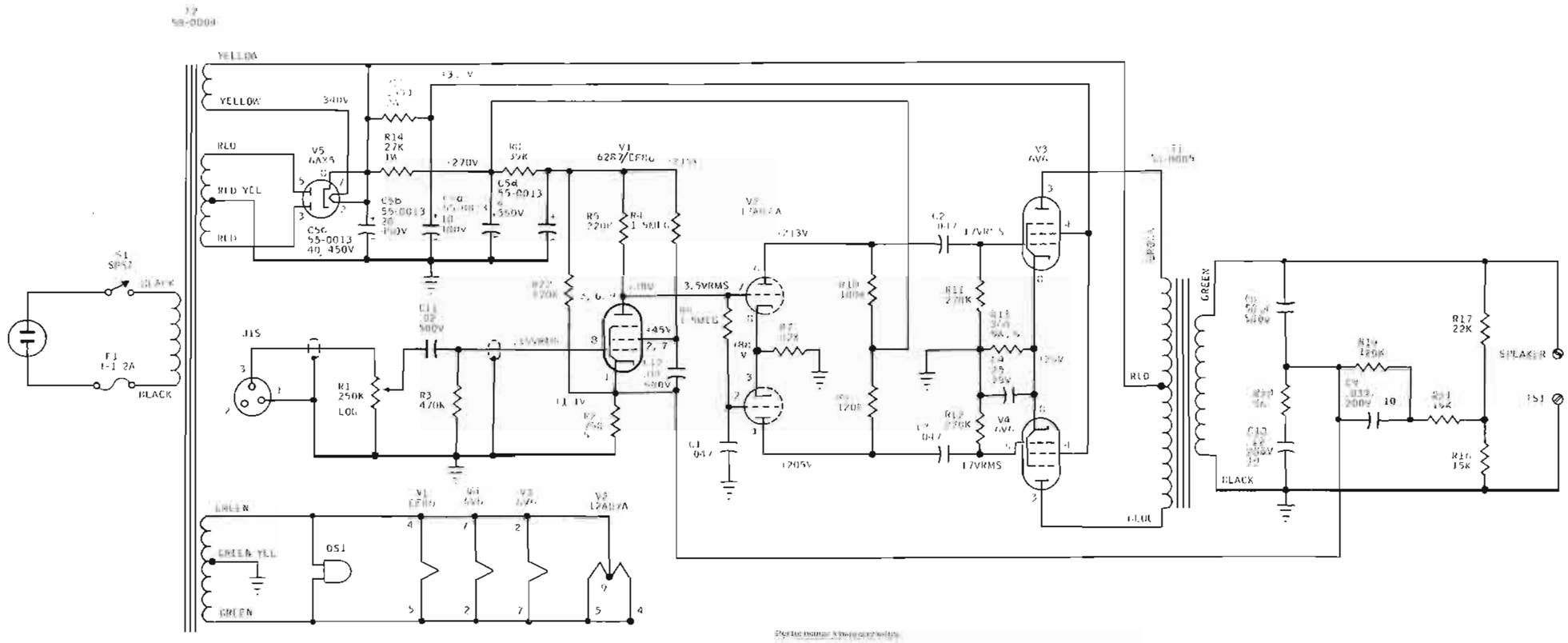
SPEAKER MONITOR

VRB 1
SPM

SCHEMATIC-
AUDIO MONITOR AMPL

CATALOG NO 51398

1336



NOTES:

1. ALL RESISTORS ARE IN OHMS, 1/2 WATT, 10% UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS ARE IN MICROFARADS, UNLESS OTHERWISE SPECIFIED. MULTIPLE SECTION ELECTROLYTICS CODED AS FOLLOWS: a - A, b - B, c - C, d - D, UNCODED.
3. AC SIGNAL VOLTAGE MEASURED AT 950 CY RELATIVE TO 10 WATTS ACROSS 12 OHM RESISTIVE LOAD.
4. SIMILAR TO AMPEX AUDIO DWG 84-0020.

1. Input impedance: 100,000 ohms unbalanced.
2. Reciprocal compensating network provided at secondary of output transformer to restore 2-ways Loudspeaker, Catalog Number 51397-01, intended for use with this amplifier.
3. Frequency response of amplifier as measured without reciprocal compensating network, ± 1 db from 25 cycles to 20,000 cycles at 1/2 power point.
4. Overall distortion less than 1% rms measured at rated 10 watt output.
5. Assembled response of amplifier with Ampex Loudspeaker, Catalog Number 51397-01, connected, ± 5 decibels from 60 cycles to 15,000 cycles as measured in an anechoic chamber utilizing four 120° cone angle.
6. Power requirements: 115 volts, single phase, 50 or 60 cycles, 3 amperes, 35 watts.
7. Fits standard 19 inch rack, occupies 5-1/4 inches of rack space.

VRB 1
AAM

357020

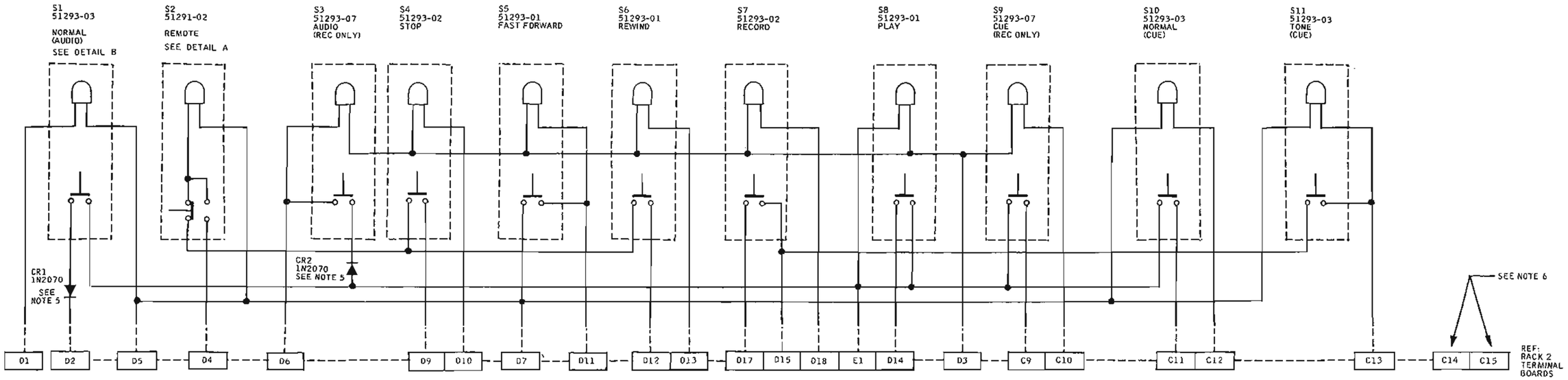
AA

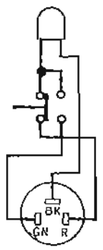
SCHEMATIC:
REMOTE CONTROL
FOR CAT. NO. 57020

13347

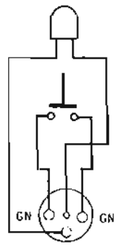
AMPEX

REMOTE TAPE TRANSPORT CONTROL





DETAIL A
REAR VIEW
51291-02 LIGHT-INDICATOR
PUSH TO TEST



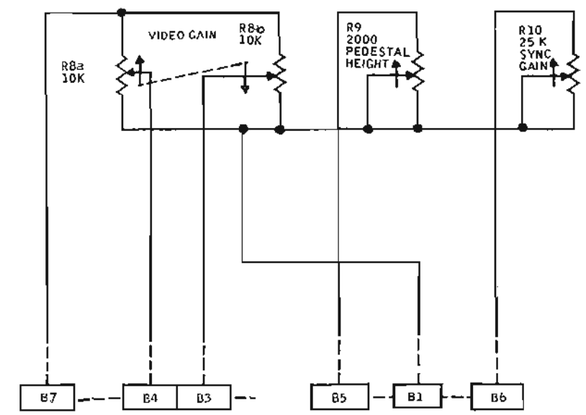
DETAIL B
REAR VIEW
51293 MOMENTARY CONTACT
NORMALLY OPEN

TYPICAL 10 PLACES

NOTES:

1. ALL SCHEMATIC REFERENCE NUMBERS ARE THE 74000 SERIES. ONLY THE LAST DIGITS ARE USED. EXAMPLE - R4 = R74004.
2. ALL RESISTORS ARE IN OHMS, ½W, 10%, UNLESS OTHERWISE NOTED.
3. ALL POTENTIOMETERS ARE IN OHMS, 2W, LINEAR TAPER.
4. ALL LAMPS ARE 24 V.
5. DIODES CR 1 & CR 2 EQUIVALENT TO AMPEX NO 582-036.
6. TERMINALS, RACK 2, C14 & C15 ARE CONNECTED ACROSS TALLY LAMP MOUNTED ON CONSOLE & CAN BE USED FOR REMOTE TALLY LAMP OR TIME METERING (24 V).
7. SEE SCHEMATIC SYSTEM LINE DIAGRAM FOR CAT NO 57020 (57026) FOR RELATED CIRCUITRY.

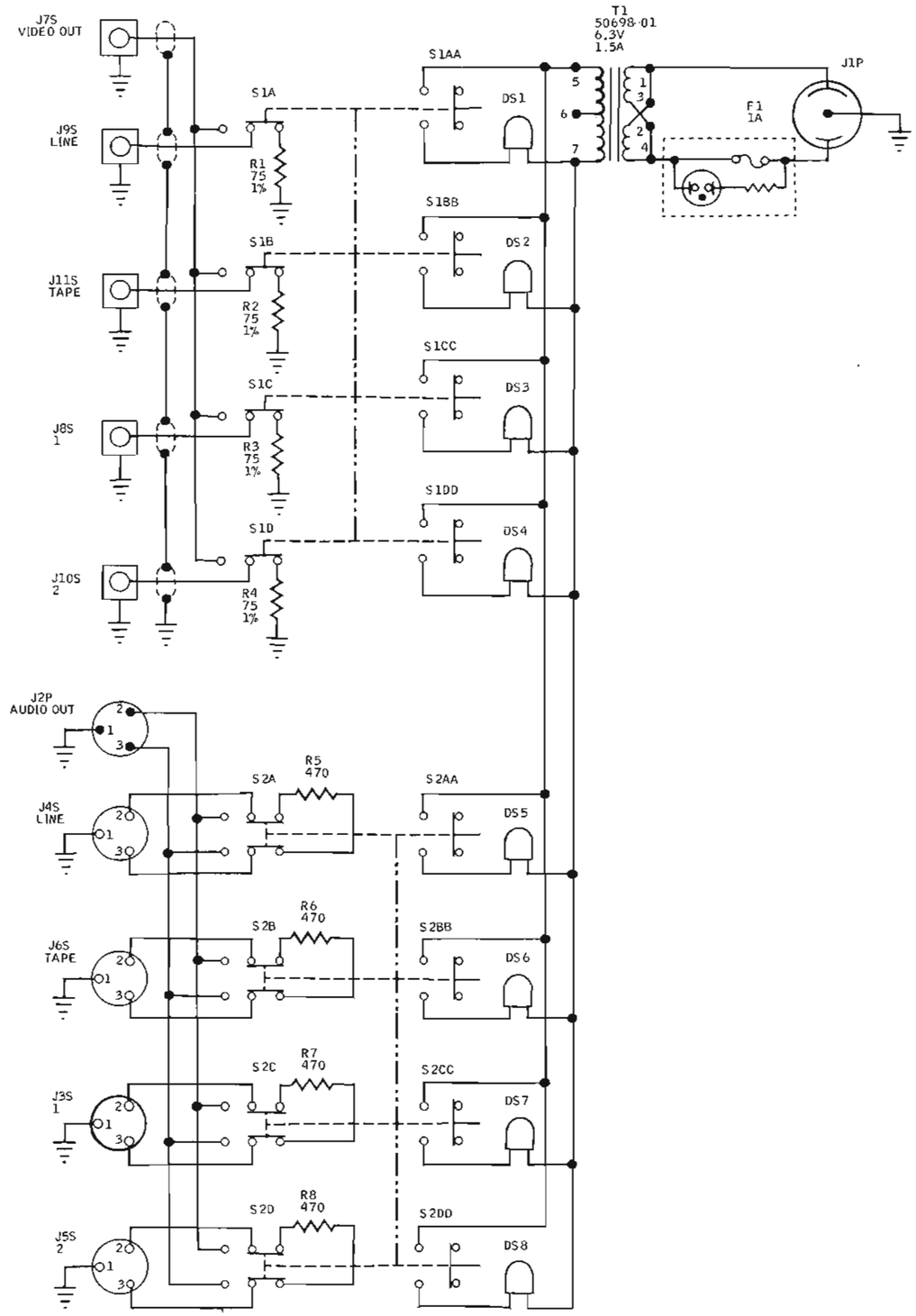
REMOTE CONTROL CIRCUIT
FOR PROCESSOR CATALOG NO. 51450



REF: RACK 1 TERMINAL BOARDS

SCHEMATIC DIAGRAM–
SWITCHING PANEL
CAT. NO. 51146

AMPEX CORPORATION



NOTES

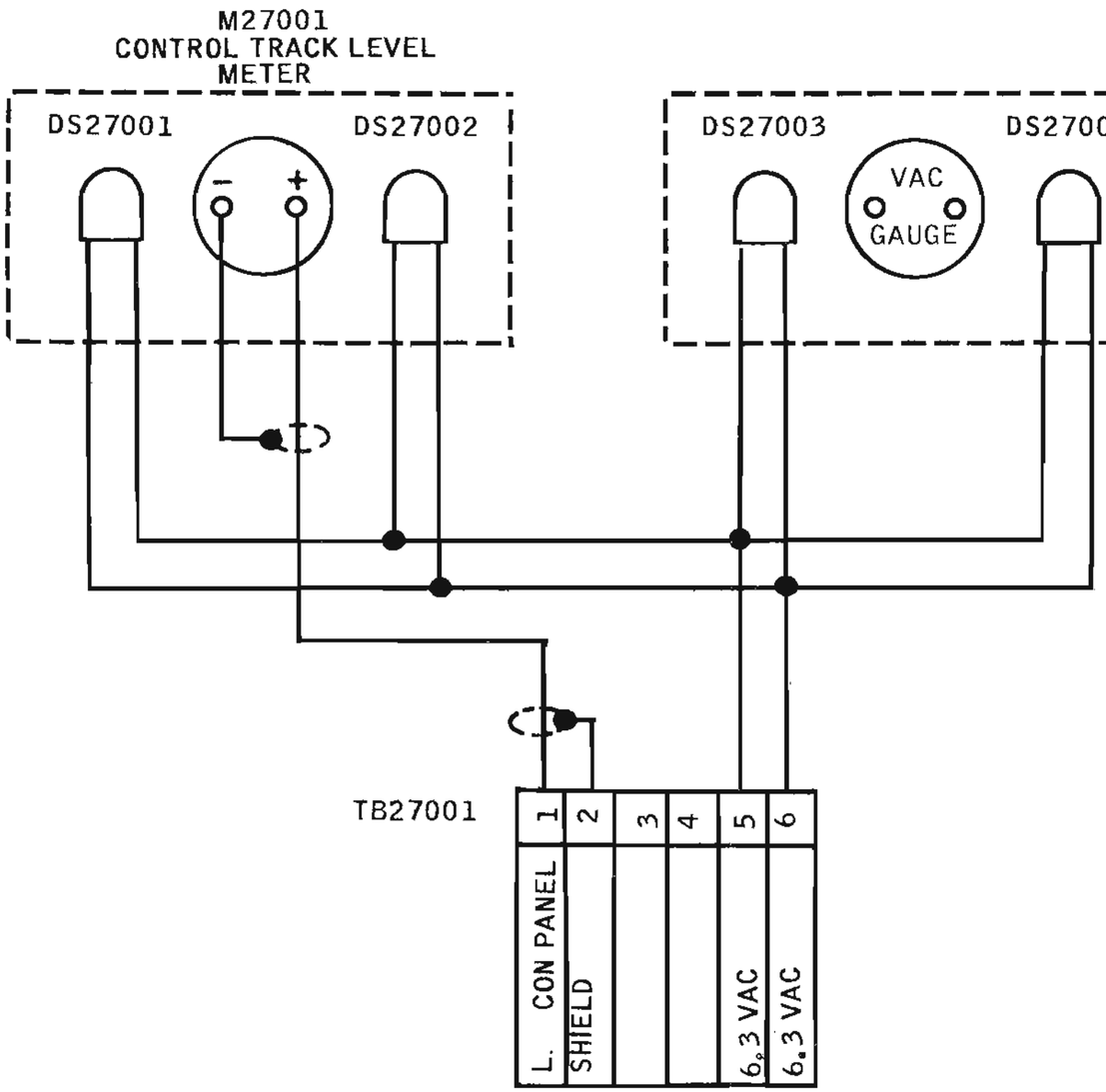
1. ALL SCHEMATIC REFERENCE NUMBERS ARE 72000 SERIES. ONLY THE LAST DIGITS ARE SHOWN. (EXAMPLE: R3 INDICATES R72003).
2. ALL RESISTORS IN OHMS, 1/2W, 10% UNLESS OTHERWISE SPECIFIED.
3. MECHANICAL LINKAGE IS INDICATED: - - - - - - - - -
   COMMON LATCH BAR IS INDICATED: — · · — · · —
4. ALL SWITCHES SHOWN IN OUT POSITION.

13923

SCHEMATIC—
LEFT METER PANEL

CATALOG NO. 14782

AMPEX CORPORATION



VRB
MSP 2

IB57020

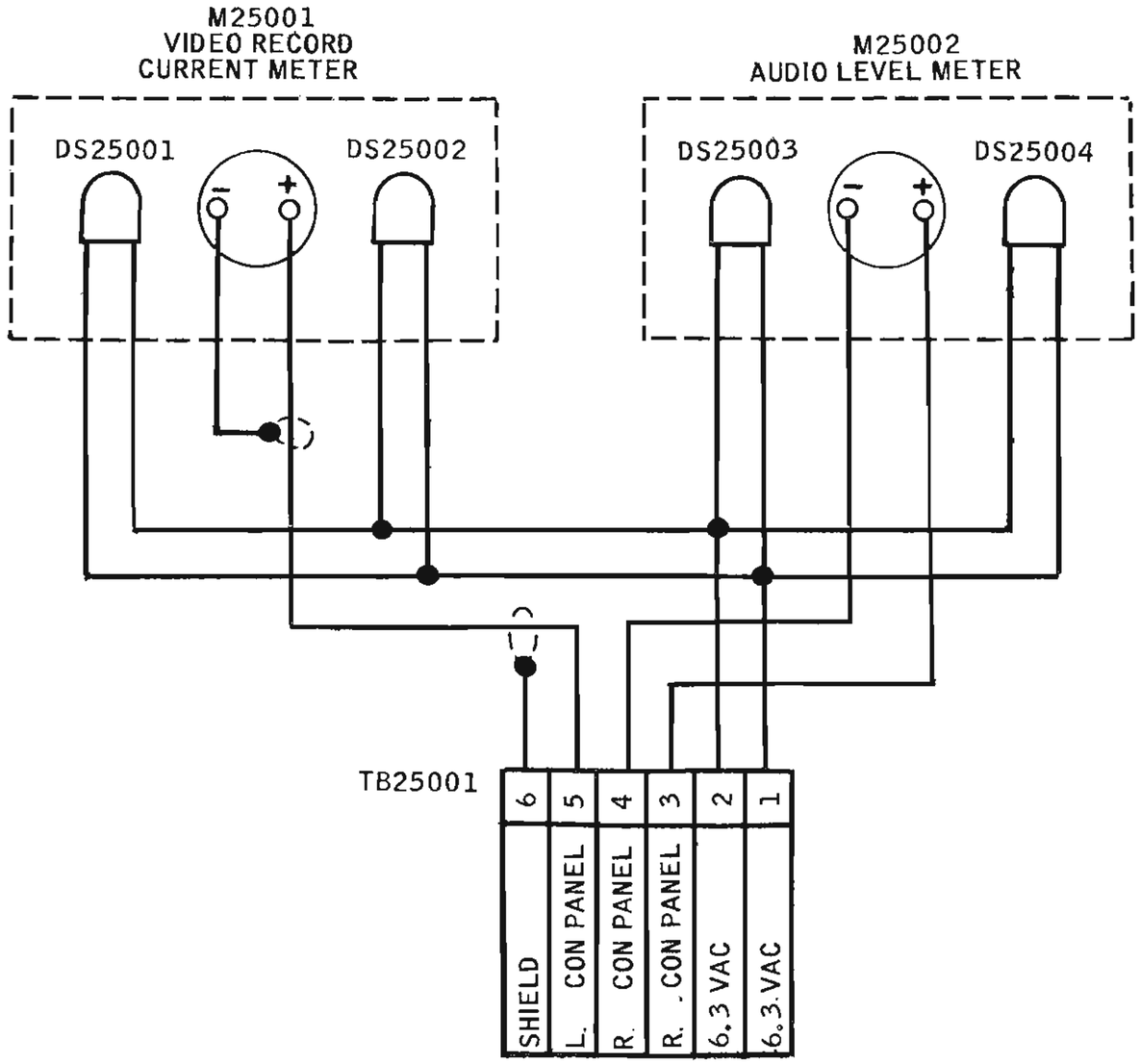
MSP

SCHEMATIC — RIGHT METER PANEL

13925

CATALOG NO. 14828

AMPEX CORPORATION



VRD
MSP 3

B57020

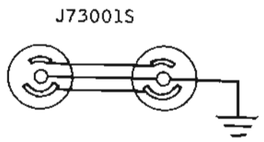
SCHEMATIC

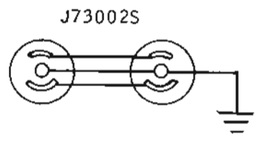
POWER CONTROL PANEL

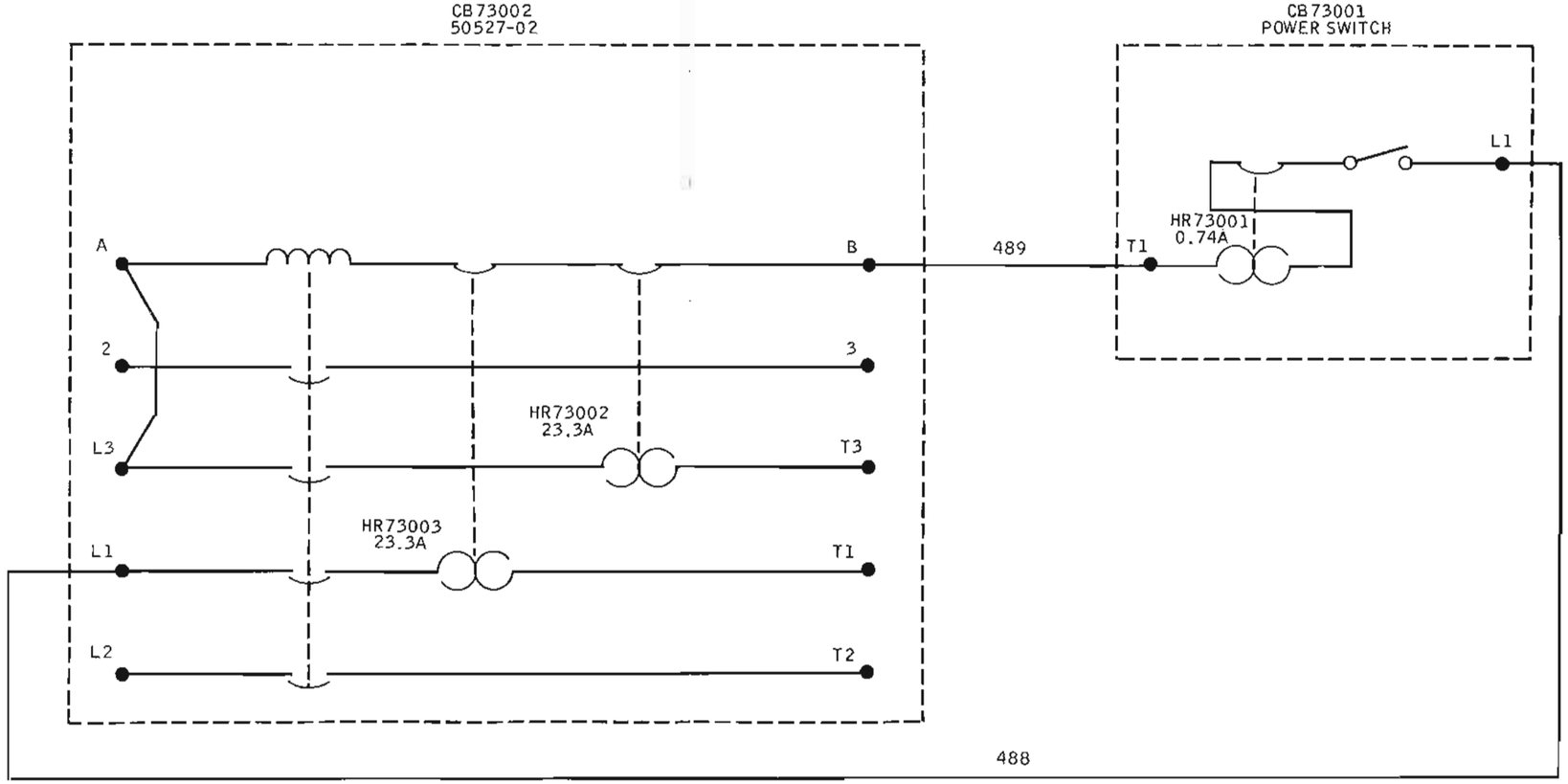
CATALOG ITEM 51296-01 ONLY

13359 B

AMPEX CORPORATION







NOTES:

1. J73001S & 2S TO BE ENERGIZED BY CUSTOMER.
2. FOR SYSTEM NUMBERS, SEE WIRE DIAGRAM FOR CAT. NO. 57020 (57025).

VRB 4
MSP

B57020

VIDEOTAPE™

AMPEX

CORPORATION

professional products division

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REDWOOD CITY
CALIFORNIA

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