

Catalog No. 4890328-02
Issued: April 1975

AG-440C
RECORDER/REPRODUCER

OPERATION AND MAINTENANCE

AMPEX CORPORATION
AUDIO-VIDEO SYSTEMS DIVISION

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CATALOG NO. 4890328-02

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**AG 445C
REPRODUCER**

OPERATION AND MAINTENANCE

**AMPEX CORPORATION
AUDIO-VIDEO SYSTEMS DIVISION**

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CATALOG NO. 4890355-01

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INTRODUCTION

This manual, Catalog No. 4890328-02, provides descriptive information, installation, operation, theory of operation, and maintenance instructions for the Ampex Model AG-440C Tape Recorder/Reproducer, Ampex Part numbers 4010202-01 through -42, 4010203-01 through -39, and 4010204-01 through -18.

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SECTION I

DESCRIPTION

The AG-440C Tape Recorder/Reproducer is available mounted in an Ampex console, mounted in portable cases, or unmounted for vertical or horizontal installation in a rack or custom console. The basic system consists of a tape transport, a head assembly, and one record/reproduce electronic unit for each channel.

The AG-440C Recorder/Reproducer can be configured for use with 1/4-inch or 1/2-inch width magnetic tape. Available head assemblies permit one, two, or four channel recording or reproduction.

Each record/reproduce unit contains a built-in Sel-Sync* circuit for recording added channels in

perfect synchronization with previously recorded channels. Plug-in accessories, such as a microphone preamplifier, a matching transformer (600-ohm impedance), and a remote control unit are available as optional equipment.

TAPE TRANSPORT

All components of the tape transport (Figure 1-1) are mounted on a rigid-casting base. Mechanical features allow changing from one tape width to the other in a few minutes.

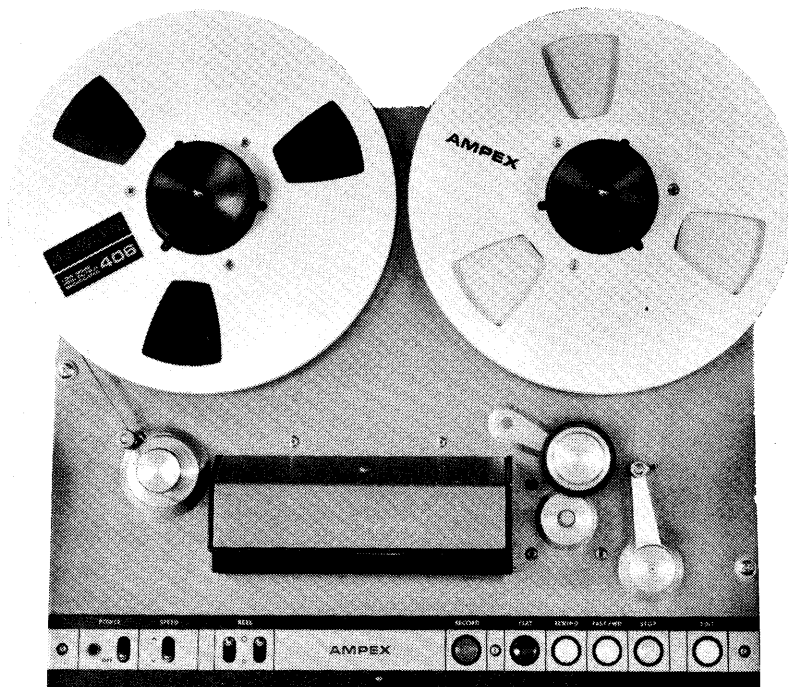


Figure 1-1. Tape Transport

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The tape transport consists mainly of sub-assemblies which may be removed without unsoldering connections. The heads plug into receptacles inside the head housing for easy removal and installation. Most relays and electronic circuits are the plug-in type.

Three standard tape speed pairs are available: 3-3/4 or 7-1/2 in/s (inches per second), 7-1/2 or 15 in/s, and 15 or 30 in/s. Speed selection is made by a toggle switch, and electronic equalization is automatically switched according to the speed selected.

The transport, as delivered, will accommodate tape reels 10-1/2 inches, 8 inches, 7 inches, and 5 inches in diameter. Any combination of a large NAB hub and small EIA hub may be used by setting the REEL (tension) switches accordingly. Also, the turntables can be easily repositioned for use with an 11-1/2 inch IEC reel.

Tape scrape-flutter is minimized by a scrape-flutter idler that is mounted on jeweled bearings and located between the record and reproduce head stacks. An optional second idler may be installed to the left of the record head.

Two solenoid-actuated arms automatically move the tape from contact with the heads during the fast forward or rewind modes. For editing and cueing operations, electronic override of the tape lifter is provided by pressing the EDIT pushbutton.

A plug-in printed circuit card containing the power supply regulator and master bias and erase oscillator is mounted in a power supply box on the underside of the tape transport.

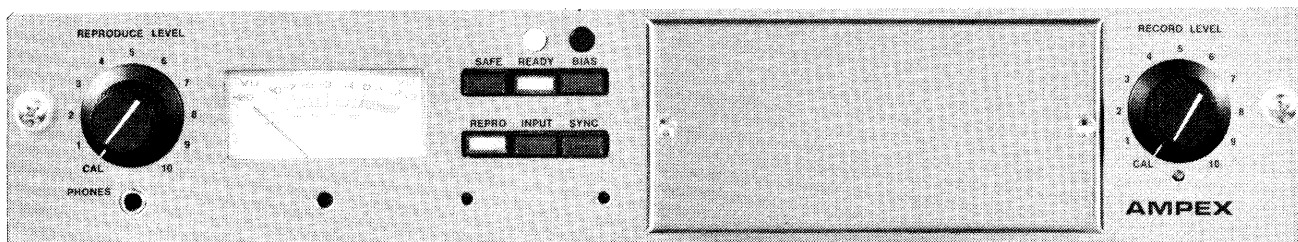
Pushbutton controls at the transport lower right edge select operation modes: RECORD, PLAY, REWIND, FAST FWD, STOP, and EDIT. These switches are on the front of the tape transport control box. The control box has externally-mounted main fuses, cable receptacles for transport sub-assemblies, and plug-in relays for the play, rewind, fast forward, and edit functions.

RECORD/REPRODUCE ELECTRONIC UNIT

One record/reproduce electronic unit (Figure 1-2) is required for each recorder/reproducer channel. The record/reproduce unit consists of an electronic chassis with three plug-in modules (Figure 1-3). The modules, removable through a front panel cut-out, are guided to printed circuit board receptacles when inserted in the chassis.

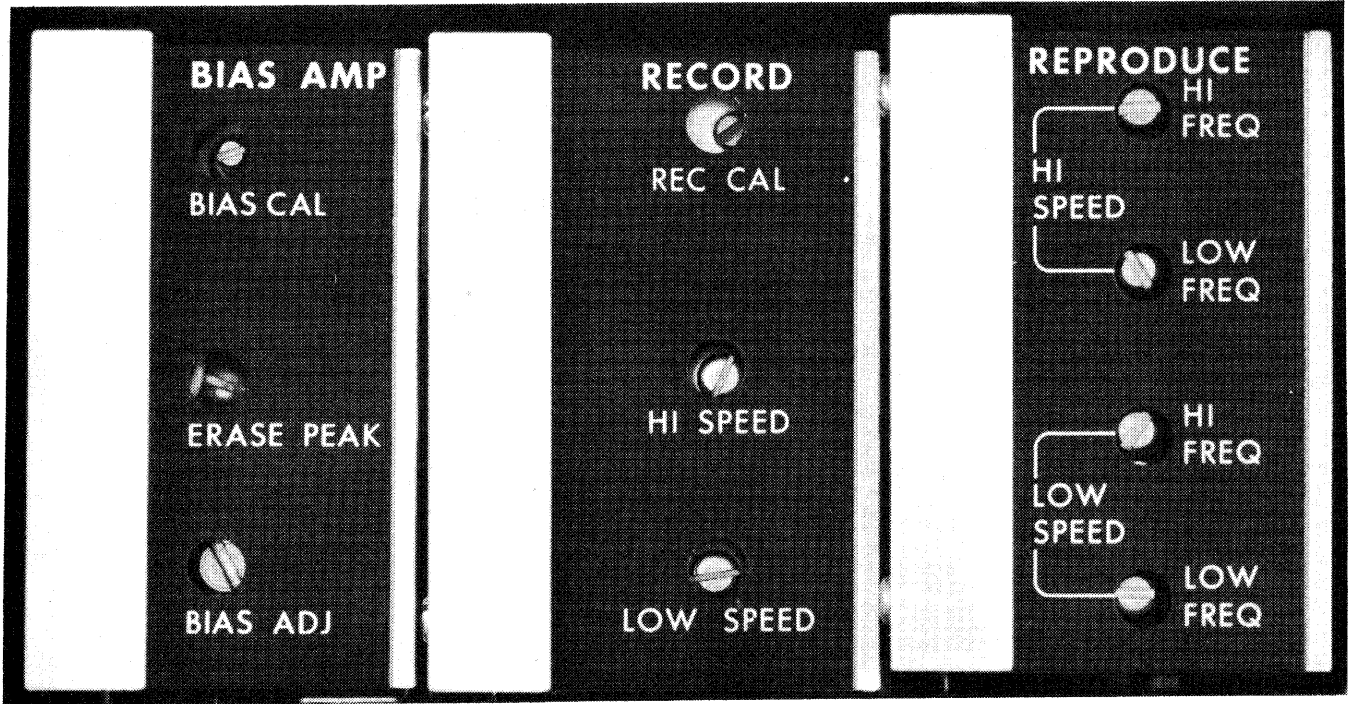
The three removable modules provide amplification for record, reproduce, and bias. The record and reproduce modules each contain plug-in equalization circuitry mounted at right angles to the main boards, so electronic alignment controls are accessible through the front panel cutout. Equalization is automatically switched (according to the tape speed selected) by solid-state switching circuits.

Receptacles for interconnect cables, accessories, and input/output-signal cables are on the back panel of the chassis (Figure 1-4). Also accessible from the rear of the unit are: a line-termination switch (to select correct termination resistance



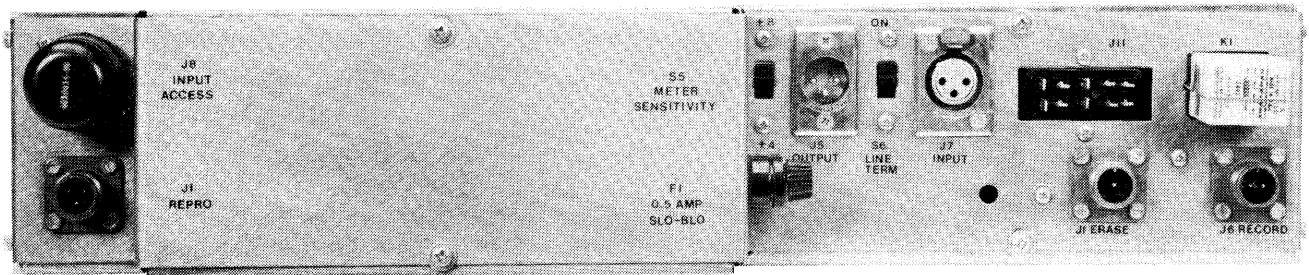
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Figure 1-2. Record/Reproduce Unit (Front Panel)



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Figure 1-3. Removable Modules



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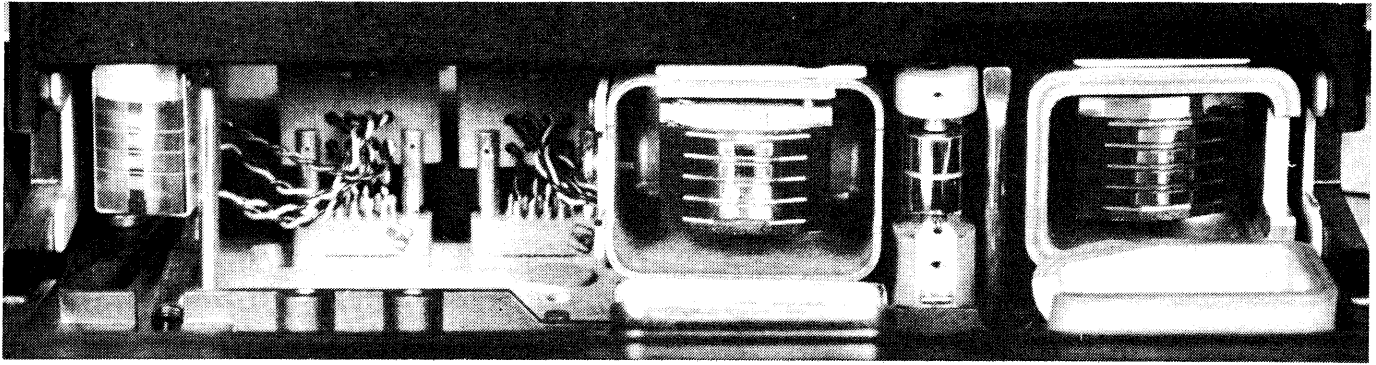
Figure 1-4. Record/Reproduce Unit (Rear View)

during maintenance procedures), a meter sensitivity switch (to permit selecting +8 dBm or +4 dBm output level), a switch for selecting output impedance (150 ohm or 600 ohm), a plug-in record relay, and a power fuse. The recorder/reproducer is shipped from the factory with a dummy plug inserted in the INPUT ACCESSory socket. With the dummy plug installed, an unbalanced-line input is provided (input impedance is 100,000 ohms). A supplied bridging transformer is inserted in the INPUT ACCESSory socket when a balanced-line

input is desired. Input impedance with the bridging transformer installed is 20,000 ohms.

HEAD ASSEMBLY

The erase, record, and reproduce head stacks are usually mounted in head mounting positions 1, 3, and 4, respectively (Figure 1-5) but other combinations are possible.



13037-18

Figure 1-5. Head Assembly

EQUIPMENT CONFIGURATIONS

Many configurations of the AG-440C Recorder/Reproducer are possible. Either one-channel, two-channel, or four-channel versions can be console, portable, or rack mounted. Two console mounted versions are illustrated (Figures 1-6 and 1-7).

motor, any two of the four tape speeds listed in Table 1-1 are possible.

Six different types of head assemblies are available (Table 1-2). Two types of head assemblies are available for one-channel machines, two types for two-channel machines, and two types for four-channel machines.

Tape transports may be equipped with either a two-speed AC capstan drive motor or a servo controlled DC motor. With the servo capstan

Record and reproduce equalizers (Figure 1-3) required for different tape speeds are listed in Table 1-3.

Table 1-1. Tape Transports

CAPSTAN MOTOR	TAPE SPEED (IN/S)				TRANSPORT ASSEMBLY PART NUMBER
	3-3/4	7-1/2	15	30	
AC (60 Hz)	X	X			4020271-32
AC (60 Hz)		X	X		4020271-30
AC (50 Hz)	X	X			4020271-33
AC (50 Hz)		X	X		4020271-31
DC Servo	X	X	X	X	4020271-34



Figure 1-6. One-Channel (1/4-Inch Tape Width) Recorder/Reproducer



Figure 1-7. Four-Channel (1/2-Inch Tape Width) Recorder/Reproducer

Table 1-2. Head Assemblies

CHANNELS	TYPE	TAPE WIDTH (INCHES)	PART NO.
1	Full Track	1/4	4020355-01
1	Half Track	1/4	4020355-02
2	Two Track	1/4	4020355-02
2	Two Track Playback and Two-Channel Four-Track Playback*	1/4	4020355-03
4	Four Track	1/4	4020282-01
4	Four Track	1/2	4020356-01

*This head assembly contains four head stacks in head positions as follows: two-track erase (position 1), two-track record (position 2), two-channel four-track reproduce (position 3), and a two-track reproduce (position 4). A switch on the head assembly permits selection of either the two-channel four-track (2-Ch 4-Tr) or the two-track reproduce head.

Table 1-3. Standard Equalizers

FUNCTION	TAPE SPEED (IN/S)	PART NO.
Record	7-1/2 NAB – 15 NAB	4020269-01
Record	3-3/4 NAB – 7-1/2 NAB	4020269-02
Record	15 NAB – 30 AES	4020269-07
Reproduce	3-3/4, 7-1/2, 15 NAB (or IEC)	4020270-01
Reproduce	15 NAB (or IEC) – 30 AES	4020270-02

OPTIONAL EQUIPMENT

Available optional equipment is listed in Table 1-4. If a balanced-line or microphone input is to be used, the dummy plug (in the INPUT ACCESS socket) must be replaced with one of the following:

1. A bridging-input transformer (providing unity gain with an input impedance of 20,000 ohms). This transformer (Catalog No. 4580200-01) is supplied with the AG-440C Recorder/Reproducer.
2. A 600-ohm input impedance matching transformer (providing a gain of approximately 14 dB).

3. A microphone preamplifier (for recording with a microphone).

This preamplifier is a two-stage solid-state unit with the RECORD LEVEL control located after the input stage; making the preamplifier a low-noise variable-gain device that is usable with a wide range of microphones.

SPECIFICATIONS

Specifications for significant parameters and features of the AG-440C Recorder/Reproducer are given in Table 1-5.

Table 1-4. Accessories

DESCRIPTION	AMPEX PART NO.
Microphone Preamplifier	4010066
Remote Control Unit	4010080
Matching Transformer (600 ohms input impedance)	4580200-02
Pickup Recording Kit	4850180
Erase Head Kit	
Mounting 1/4-inch heads in position 2	4850178-01
Mounting 1/2-inch heads in position 2	4850178-02
Multivolt Transformer (permits operation from 220-Vac line voltage)	4010186
Console Rear Cover	4040984
Electronics Assembly Cover	4040982
Console Rear Cover Set	
Contains 4040982 and 4040984	4010076-01
Contains 4040982 and two 4040984	4010076-02
Contains 4040982 and three 4040984	4010076-03
Contains 4040982 and four 4040984	4010076-04
Scrape-Flutter Idler (not interchangeable with furnished idler)	4010069
Extender Boards for Circuit Boards:	
Reproduce	4020151
Record	4020152
Bias Amplifier	4020153
Power Supply	4020154
Capstan Servo	4050695-02
IEC (CCIR) Record Equalizer	
7-1/2 in/s (70 μ s) – 15 in/s (35 μ s)	4020269-03
3-3/4 in/s (90 μ s) – 7-1/2 in/s (70 μ s)	4020269-04
15 in/s (35 μ s) – 30 in/s (17.5 μ s)	4020269-06
Portable Case (for two electronic units)	4150330
Portable Case (for three or four electronic units)	4150331
Blank Panel (for unused case spaces)	4290620
Support, Electronic Unit (used in pairs)	4260404
Reel, 10-1/2 Inch Diameter	
1/4-inch tape (identical to reel supplied)	4690003-10
1/2-inch tape	4690003-20

Table 1-5. Specifications

Track Width:

1/4-inch (6.3 mm) tape:

- Full-track: 0.234 inch (5.94 mm)
- Half-track 2 channel: 0.075 inch (1.9 mm)
- 4 channel: 0.040 inch (1.0 mm)

1/2-inch (12.6 mm) tape:

- 4 channel: 0.070 inch (1.8 mm)

Tape Speeds:

With AC capstan motor:

TRANSPORT PART NO.	LINE POWER FREQUENCY	SPEED	
		(LOW)	(HIGH)
4020271-32	60 Hz	3-3/4 in/s	7-1/2 in/s
4020271-33	50 Hz	(9.5 cm/sec)	(19 cm/sec)
4020271-30	60 Hz	7-1/2 in/s	15 in/s
4020271-31	50 Hz	(19 cm/sec)	(38 cm/sec)

With DC servo capstan motor:

Choice of three low/high speed combinations, depending upon pin strapping of servo printed wiring assembly:

- a. 3-3/4 in/s and 7-1/2 in/s
- b. 7-1/2 in/s and 15 in/s
- c. 15 in/s and 30 in/s

Variable speed operation is also possible.

Reel Size:

5-inch, 7-inch, 8-inch, 10-1/2-inch, EIA or NAB. Can accept 11-1/2-inch (29 cm) IEC (CCIR) reel with adaptors. Reel switches provide correct tension for large or small reel hubs.

Line Input:

100,000 ohms unbalanced; convertible to 20,000 ohms balanced, with supplied bridging transformer. Accepts line levels from -17 dBm, to produce recommended operating level. Record amplifier mid-frequency clip level 28 dB or more above operating level.

Line Output:

Balanced or unbalanced.

Nominal Impedance: 600 ohms or 150 ohms (selected by switch)

Internal Impedance: 130 ohms or 33 ohms respectively.

Clip Level: +28 dBm or 10 Vrms respectively.

Output Level: Meter sensitivity is selectable by switch for +4 dBm or +8 dBm.

Table 1-5. Specifications (Continued)

Equalization:

NAB standard for 3-3/4, 7-1/2, and 15 in/s; AES standard for 30 in/s; IEC (CCIR) available for 3-3/4, 7-1/2, and 15 in/s.

Equalization automatically switched by transport speed selector.

Overall Frequency Response:

Specification referred to a 700-Hz zero reference when recording with Ampex 406 tape or equivalent high-output, low-noise tape. Zero reference is operating level for 15 in/s and 30 in/s, at least 14 dB below operating level for 3-3/4 in/s and 7-1/2 in/s.

3-3/4 in/s NAB:	+1, -2 dB	30 Hz to 7,500 Hz
7-1/2 in/s NAB:	±1 dB	50 Hz to 10,000 Hz
	+1, -2 dB	30 Hz to 15,000 Hz
15 in/s NAB:	±1 dB	100 Hz to 15,000 Hz
	±2 dB	30 Hz to 25,000 Hz
30 in/s AES:	±2 dB	50 Hz to 20,000 Hz

SEL-SYNC Response:

Specification referred to a 700-Hz zero reference in the SEL-SYNC mode of operation where the record head is used for reproducing. The specification does not apply to full-track recorders.

15 in/s:	±2 dB	30 to 12,000 Hz
30 in/s AES:	±2 dB	50 to 12,000 Hz

Signal-to-Noise Ratio:

Measured with respect to a record level of 520 nWb/m to biased-tape noise when using Ampex 406 or equivalent high-output, low-noise tape.

UNWEIGHTED

(Using a 30-Hz to 18-kHz RC filter to attenuate noise outside the audio spectrum)

TAPE SPEED	FULL TRACK	HALF TRACK OR 2 TRACK	4 TRACK 1/2 INCH	4 TRACK 1/4 INCH
3-3/4 in/s NAB	67 dB	62 dB	—	59 dB
7-1/2 in/s NAB	69 dB	64 dB	64 dB	61 dB
15 in/s NAB	68 dB	63 dB	63 dB	60 dB
30 in/s AES	70 dB	65 dB	65 dB	—

Table 1-5. Specifications (Continued)

Signal-to-Noise Ratio (continued):

WEIGHTED

(Using an NAB or ASA "A" weighting filter and a 1,000-Hz reference)

TAPE SPEED	FULL TRACK	HALF TRACK OR 2 TRACK	4 TRACK 1/2 INCH	4 TRACK 1/4 INCH
3-3/4 in/s NAB	71 dB	66 dB	—	63 dB
7-1/2 in/s NAB	73 dB	68 dB	68 dB	65 dB
15 in/s NAB	71 dB	66 dB	66 dB	63 dB
30 in/s AES	74 dB	69 dB	69 dB	—

Bias and Erase Frequency:

150 kHz

Erase Efficiency:

75 dB or greater at 1 kHz

Crosstalk:

Measured by recording a 1,000-Hz signal on a track of an erased tape and reproducing from an adjacent channel.

Two-track, 1/4-inch tape, and four-track 1/2-inch tape: Better than 65 dB

Four-track, 1/4-inch tape: Better than 60 dB

Even-Order Distortion:

Second-harmonic distortion of a 500-Hz signal recorder at 520 nWb/m (6 dB above high output tape operating level) is less than 0.4%.

Flutter and Wow:

Measured per ANSI S4.3 or DIN 45507 using a prerecorded flutter tape.

TAPE SPEED	SERVO MOTOR			7-1/2-15 AC MOTOR			3-3/4 – 7-1/2 AC MOTOR		
	PEAK WTD	PEAK UNWTD	RMS UNWTD	PEAK WTD	PEAK UNWTD	RMS UNWTD	PEAK WTD	PEAK UNWTD	RMS UNWTD
3-3/4 in/s	0.10%	0.18%	0.12	—	—	—	0.12%	0.22%	0.15
7-1/2 in/s	0.06%	0.12%	0.08	0.10%	0.14%	0.1	0.10%	0.16%	0.1
15 in/s	0.06%	0.10%	0.06	0.07%	0.12%	0.08	—	—	—
30 in/s	0.04%	0.08%	0.05	—	—	—	—	—	—

Table 1-5. Specifications (Continued)

Speed Accuracy:

Speed measured per NAB Standard on Magnetic Tape Recording and Reproduction 1965 Section 2.02.01 with the pulley tachometer located between the capstan and the reel idler.

Absolute Speed:

Measured in the beginning portion of a reel using a tape whose thickness is 0.0019 inch \pm 0.00005 inch (1.5 mil tape).

Servo Motor: Nominal \pm 0.08%

AC Motor: Nominal \pm 0.20%

Speed Variation Beginning to End of Reel: Using 10-1/2-inch NAB or 7-inch EIA.

Servo Motor: Less than 0.08%

AC Motor: 15 in/s Less than 0.10%
7-1/2 in/s Less than 0.14%

Start Time:

At 3-3/4, 7-1/2, and 15 in/s, the average speed is typically* within \pm 1/2% of the nominal speed in 300 milliseconds throughout a reel of tape. This specification does not apply to 3-3/4 – 7-1/2 in/s recorders equipped with AC capstan motors if the supply tape pack is less than 1 inch from the reel hub. At 30 in/s, \pm 1/2% of nominal speed is reached in 3 seconds.

With capstan servo motors, the flutter components below 20 Hz will be less than \pm 0.3% peak in 1 second. At 30 in/s, in 3 seconds. With AC capstan motors, the flutter components below 20 Hz will be less than \pm 0.3% peak in 3-1/2 seconds.

Stop Time:

At 15 in/s, the tape moves less than 3 inches after pressing the stop button.

Rewind Time:

Approximately 1 minute for a 2,400-foot NAB reel.

Power Requirement:

105 to 125 Vac, 60 Hz.

SYSTEM	AMPS (APPROXIMATELY)
1 Channel	2.3
2 Channel	2.5
3 Channel	2.7
4 Channel	2.9

Recorders with capstan servo motors operate at either 60 Hz or 50 Hz. Recorders with an AC capstan motor are available for 50 Hz operation.

*Varies with tape.

SECTION II

INSTALLATION

This section contains information about unpacking and inspection, equipment connectors and cabling, mounting configurations, accessory installation, initial adjustments and lubrication, and conversion for use with different tape widths and reel sizes.

UNPACKING AND INSPECTION

Upon receipt, examine shipping crate for any signs of damage. Unpack the equipment and inspect for physical damage. Using packing list, verify that all items have been received.

NOTE

The plug-in electronic modules and associated equalizer printed wiring assemblies (PWA's) are mounted behind a cover on the front panel of the record/reproduce units. The power supply/bias oscillator PWA is mounted in the power supply assembly, which is located on the underside of the tape transport.

Immediately report any equipment damage and/or missing items to the transportation company and local Ampex distributor. Remove all materials (adhesive tape, rubber bands, etc.) used to secure certain movable components of the recorder/reproducer during shipment.

CONSOLE-MOUNTED EQUIPMENT

Equipment ordered with the console is mounted and interconnected at the factory. The console is shipped lying on its back with the tape transport

located 90° to a horizontal position. To unpack the recorder/reproducer proceed as follows:

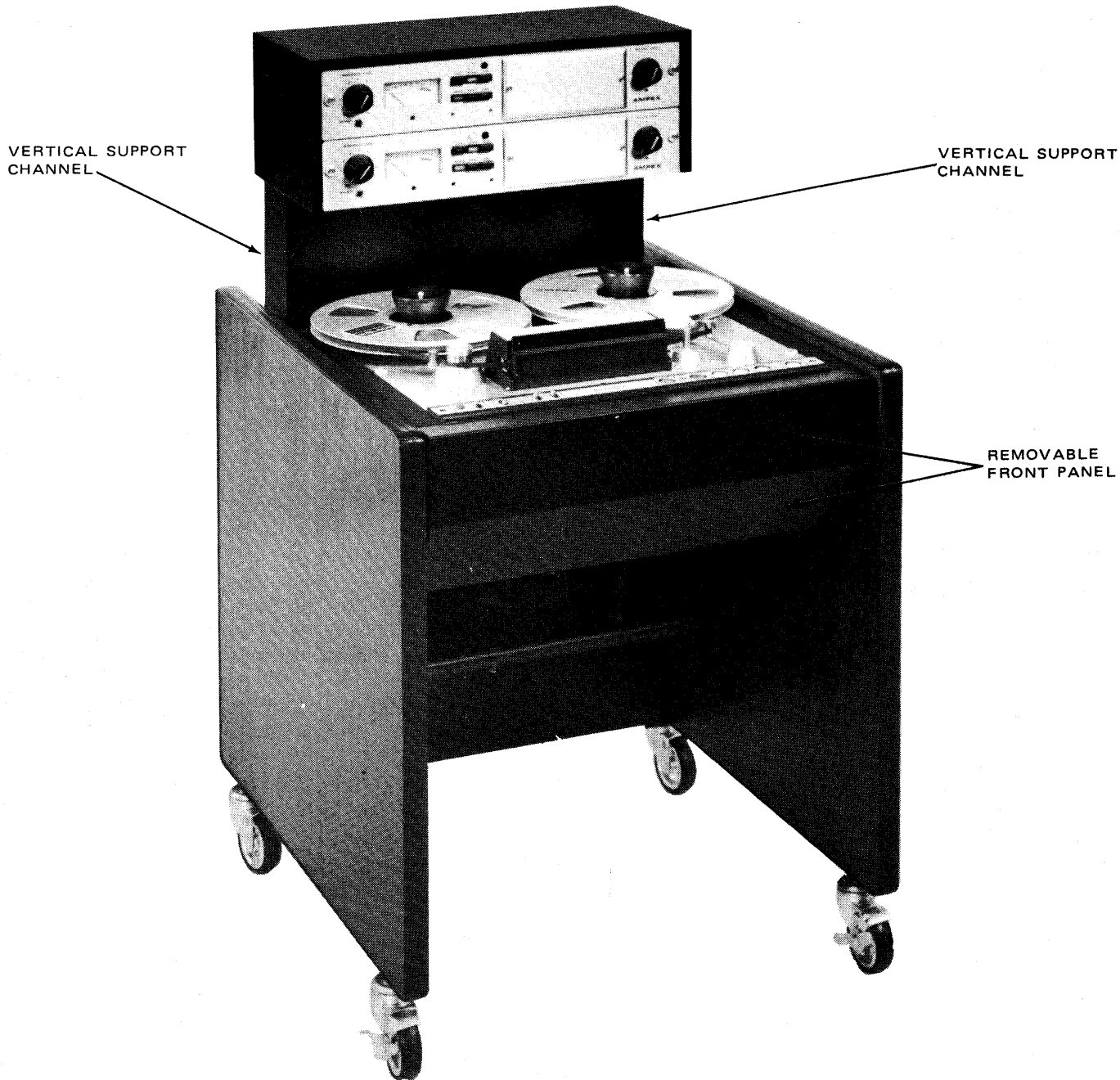
1. Open shipping container completely.
2. Check that all casters are fully inserted in the bottom of the console. Any caster that is not fully inserted might have its shaft bent when the console is set upright.
3. Place a board in front of the two rear casters of the console.
4. Grasp console vertical-support channels (Figure 2-1) and tilt console up and forward until it rests on all four casters.
5. Facing front of console, manually stabilize transport, loosen knurled knob on left inner side (facing console) of console base, rotate transport to the horizontal position, and retighten knob to secure transport in position.

UNMOUNTED AND PORTABLE EQUIPMENT

Unmounted equipment or equipment mounted in portable cases is shipped packaged separately. Use special care in unpacking unmounted equipment to prevent damage to such critical components as the capstan, head assembly, and takeup tension arm.

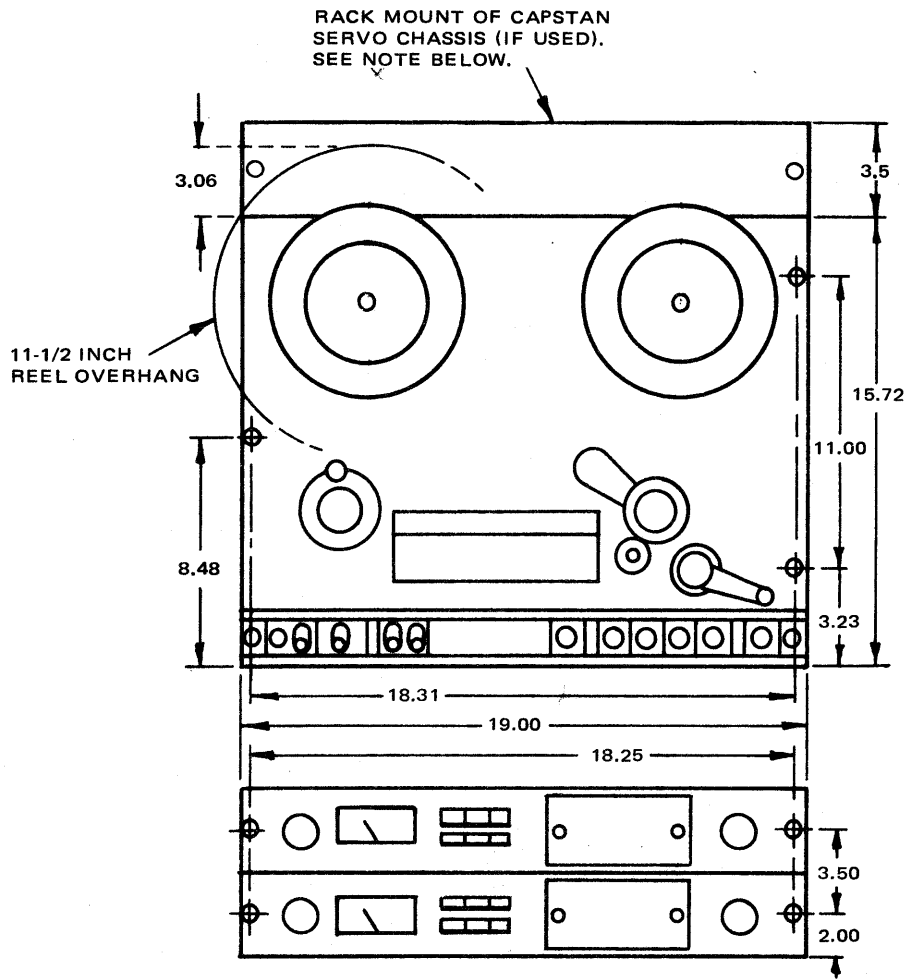
MOUNTING UNITS

Equipment ordered with the console or with portable cases is mounted in position at the factory. Unmounted equipment can be mounted in a standard 19-inch rack or in a custom cabinet. Mounting dimensions are shown in Figure 2-2. Ensure that adequate ventilation space is provided between units.



13037-3

Figure 2-1. Console-Mounted Recorder/Reproducer



ALL DIMENSIONS IN INCHES

SPACE REQUIRED BEHIND MOUNTING (INCLUDING CONNECTORS):

TRANSPORT:	10.50 INCHES
ELECTRONICS:	9.50 INCHES

NOTE: IN A RACK MOUNT INSTALLATION, THE CAPSTAN SERVO MAY BE MOUNTED IN ANY CONVENIENT POSITION IN THE RACK. HOWEVER, BECAUSE OF HUM RADIATION FROM THE SERVO POWER TRANSFORMER, THE SERVO CHASSIS SHOULD BE MOUNTED A MINIMUM OF 3-1/2 INCHES AWAY FROM THE ELECTRONICS CHASSIS.

Figure 2-2. Mounting Dimensions

CONSOLE FRONT-PANEL REMOVAL AND INSTALLATION

The console has a front panel (Figure 2-3) that extends down and around the bottom of the control panel. This panel must be removed to perform some installation procedures.

To remove the panel, proceed as follows:

1. Release the two captive thumbscrews at the far corners of the panel (under transport).
2. Press up on the angled portion of the panel to remove the cover lip from the transport frame slot.
3. Move the panel clear of the transport frame. Then lower the panel until the duct clears the fan (AC capstan drive motors only).

To install panel:

1. Position the duct around the drive motor fan (if equipped).
2. Insert the lip of the panel into the slot of the transport.
3. Press the lip firmly into position. Then engage and tighten the two captive thumbscrews.

INTERCONNECTING CABLES

Equipment in a console is intercabled at the factory. However, always ensure that cable connectors are firmly seated and cables are undamaged. (Refer to paragraph on *Checking Cables and Components*.)

Portable equipment must be intercabled each time the recorder is set up in the field. Always route power and control cables as far as possible from the input/output cables and head cables to avoid electrical interference. To intercab a portable unit, proceed as follows:

1. Open rear covers of electronics case and the side panel of the transport case.
2. Remove all of the cables from the transport cable storage area.
3. Connect one of the electronic power cables (10 pin connectors) to J11 of each of the record/reproduce electronic units (Figure 1-4). Any of the power cables may be connected to any of the record/reproduce electronic units.
4. Connect the head cables (captive) to the corresponding receptacles (RECORD, ERASE, REPRO) of the record/reproduce unit(s).

NOTE

On multi-channel equipment, the head cables are marked with the track number. The top track is designated as track 1.

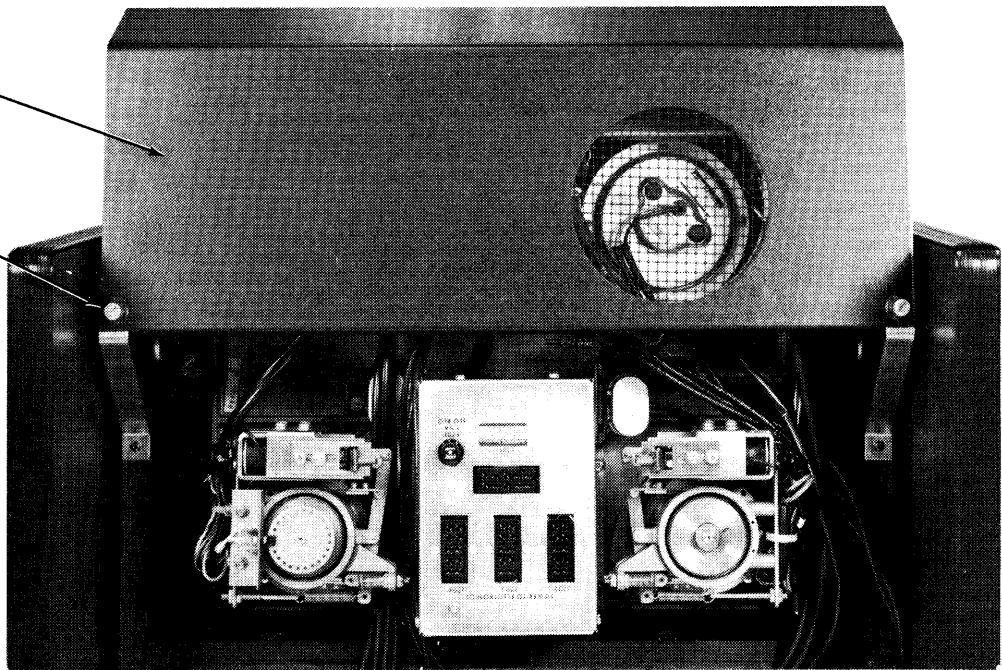
CHECKING CABLES AND COMPONENTS

Connectors on the tape transport control box are shown in Figure 2-4. Before attempting to operate the AG-440C Recorder/Reproducer, check the following cables and components for security and proper installation:

1. Captive cable from takeup motor to connector J603S on tape transport control box.
2. Captive cable from rewind motor to connector J607S on tape transport control box.
3. Captive cable from capstan drive motor to J602S on tape transport control box.
4. Captive cable from 39-Vdc power supply box on tape transport to J606S on tape transport control box.

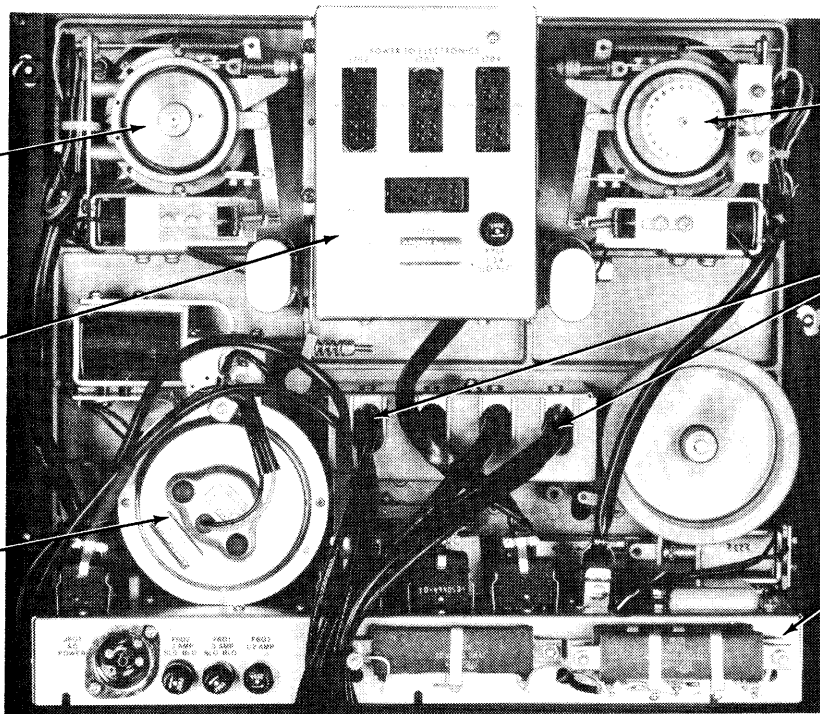
REMOVABLE
PANEL

CAPTIVE
THUMB SCREW



13079-2

Figure 2-3. Tape Transport Removable Panel



13037-19

Figure 2-4. Tape Transport (Underside View)

5. Plug-in equalizer PWA in each record amplifier module and reproduce amplifier module (Figure 2-5). Ensure that these PWA's are firmly seated in their connectors.

6. Plug-in assemblies of record/reproduce unit(s). Check that the bias amplifier, record amplifier, and reproduce amplifier modules are firmly seated in their connectors.

7. Three fuses on tape transport control box, one fuse on 39-Vdc power supply box, one fuse on rear panel of each record/reproduce unit. Verify that correct fuses are installed and serviceable.

8. Four plug-in relays on tape transport control box and one on rear panel of each record/reproduce unit.

9. 39-Vdc regulator/bias oscillator PWA (in 39-Vdc power supply box). Ensure that this PWA is firmly seated in its connector.

10. Interconnect cables from power supply box to each record/reproduce unit.

11. Head cables at each record/reproduce unit.

NOTE

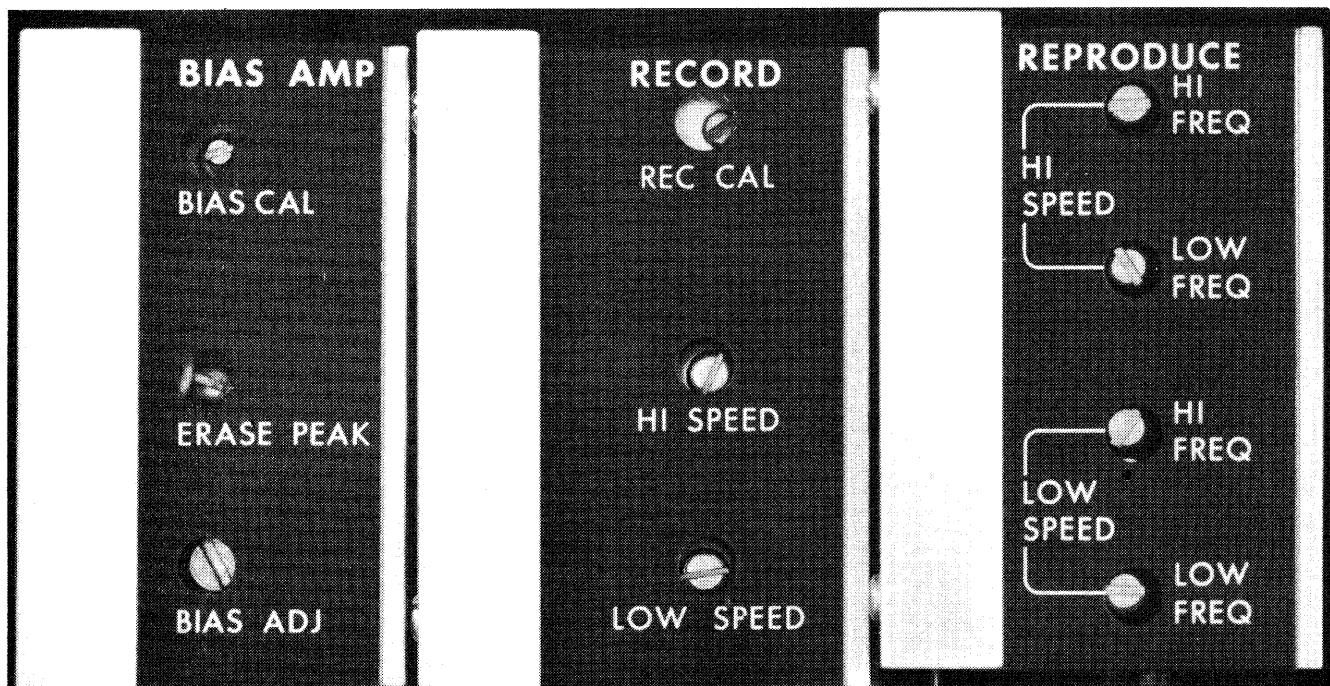
The power-supply cover (Figure 2-4) must be opened to gain access to regulator/bias oscillator PWA.

INITIAL LUBRICATION

When the reproducer is first received, the AC capstan motor and the capstan idler may require lubrication. (The servo controlled DC capstan motor is permanently lubricated.)

AC CAPSTAN MOTOR

The AC capstan motor sleeve bearing might be dry even though there is oil in the wick reservoir. To



13037-15

Figure 2-5. Bias, Record, and Reproduce Modules

prevent possible damage, lubricate the bearing as follows:

1. Using a knife blade or similar tool, gently pry up the metal dust cover from around the capstan shaft (Figure 2-6).
2. Manually rotate the capstan while applying four or five drops of oil around the capstan shaft where it enters the motor. Use Ampex Lubricating Oil, Catalog No. 4010825 or 087-579. (Equivalent oils are Esso Standard Oil Co., Teresso No. 47; and Socony Mobil Co., Mobiloil DTE Medium.)
3. Wipe oil off the capstan shaft and surrounding parts. Then replace the metal dust cover.

CAUTION

BE CERTAIN TO CLEAN CAPSTAN SHAFT THOROUGHLY. THE LUBRICATING OIL MAY DAMAGE THE CAPSTAN IDLER AND MAGNETIC TAPE.

CAPSTAN IDLER

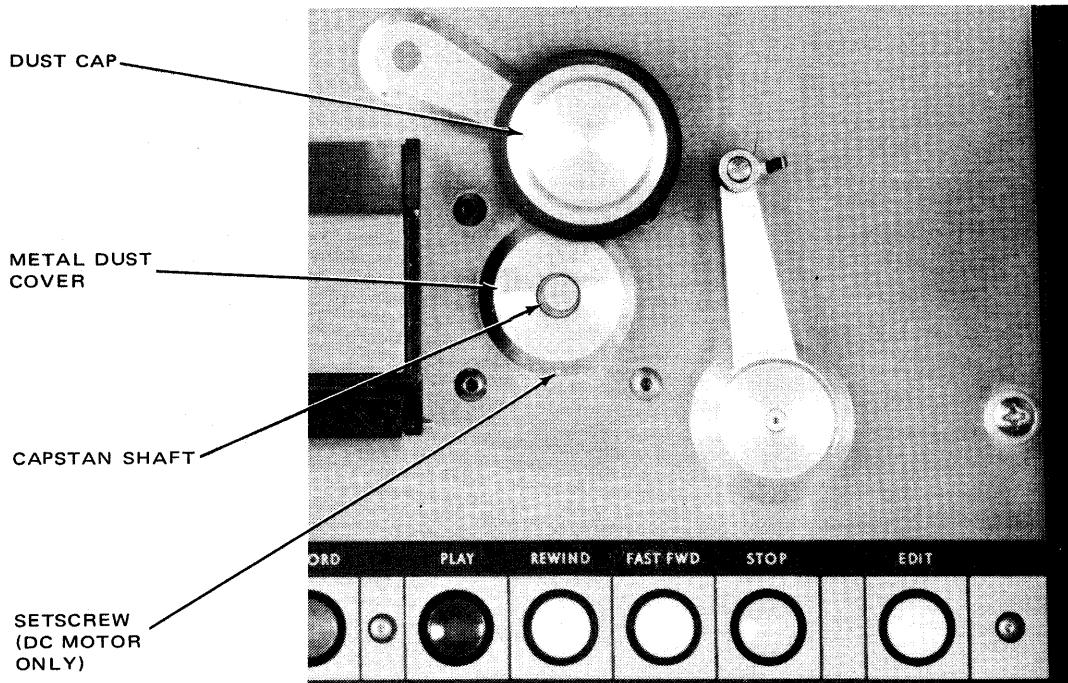
Check that the capstan idler has sufficient lubrication as follows:

1. Using a knife blade or similar tool, gently pry up the dust cap (Figure 2-6) from the hub of the capstan idler to expose the felt washer.
2. Apply sufficient oil to *just* saturate the felt washer. Use the same type of oil used for the AC capstan motor lubrication.

CAUTION

REMOVE ANY EXCESS OIL FROM THE HUB OR THE CAPSTAN IDLER. IF NECESSARY, CLEAN THE IDLER WITH ISOPROPYL ALCOHOL.

3. Replace the dust cap.



13037-16

Figure 2-6. Capstan and Associated Parts

CONNECTING AC POWER

The power requirements of the AG-440C Recorder/Reproducer are listed in Table 1-5. To supply power to the recorder/reproducer, connect power cable between appropriate facility power source and the AC POWER connector on the tape transport control box.

AUDIO SIGNAL CONNECTIONS

INPUT/OUTPUT CONNECTORS

The audio signal INPUT and OUTPUT connectors of the recorder/reproducer are located on the rear panel of each record/reproduce unit. The INPUT connector is a standard female XL connector, and the OUTPUT connector is a standard male XL connector. Mating XL connectors for both the INPUT and OUTPUT rear-panel connectors are supplied with the recorder/reproducer.

Input-Connector Wiring

For balanced inputs, wire male XL connector as follows:

1. Connect signal leads of two-conductor shielded cable to pin 3 (high) and pin 2 (low) of connector.
2. Connect cable shield to pin 1.

For unbalanced inputs, wire male XL connector as follows:

1. Connect center conductor of single-conductor shielded cable to pin 3 of connector.
2. Connect cable shield to pins 2 and 1.

Output-Connector Wiring

For balanced outputs, wire female XL connector as follows:

1. Connect signal leads of two-conductor shielded cable to pin 3 (high) and pin 2 (low) of connector.

2. Connect cable shield to pin 1.

For unbalanced outputs using two-conductor shielded cable, wire female XL connector as follows:

1. Connect signal leads of cable to pin 3 (high) and pin 2 (low) of connector.
2. Connect cable shield to pin 1 of connector.
3. Connect jumper from pin 1 to pin 2 of connector.

For unbalanced outputs using single-conductor shielded cable, wire female XL connector as follows:

1. Connect center conductor cable to pin 3 of connector.
2. Connect cable shield to pin 2 of connector.
3. Connector jumper between pins 1 and 2 of connector.

INPUT SIGNAL SETUP

The AG-440C Recorder/Reproducer is shipped with a dummy plug in the INPUT ACCESS receptacle on the back panel of each record/reproduce unit. This plug provides input impedance for an unbalanced line with a nominal impedance of 100,000 ohms. An accessory plug-in transformer must be used for balanced-line inputs. Input impedance of a record/reproduce unit using a bridging transformer is 20,000 ohms. Input impedance using a matching transformer is 600 ohms, and the voltage step up is 14 dB. A microphone preamplifier must be plugged into the INPUT ACCESS receptacle when the input signal comes from a microphone.

Balanced Line Inputs

Prepare recorder/reproducer for balanced-line inputs as follows:

1. Install appropriate accessory plug-in transformer in INPUT ACCESS socket on rear

panel of each record/reproduce unit requiring a balanced input.

2. Connect male connector of two-conductor shielded cable to INPUT connector on rear panel of each record/reproduce unit requiring a balanced input.

Unbalanced Line Inputs

Prepare recorder/reproducer for unbalanced-line inputs as follows:

1. Install dummy plug-in INPUT ACCESS socket on rear panel of each record/reproduce unit requiring an unbalanced input.
2. Connect male connector of single-conductor shielded cable to INPUT connector on rear panel of each record/reproduce unit requiring an unbalanced input.

Microphone Inputs

Prepare recorder/reproducer for microphone inputs as follows:

1. Install accessory microphone preamplifier in INPUT ACCESS socket on rear panel of each record/reproduce unit requiring a microphone input.
2. Connect microphone cable to INPUT connector on rear panel of each record/reproduce unit requiring a microphone input.

OUTPUT SIGNAL SETUP

Prepare recorder/reproducer for balanced-line or unbalanced-line output(s) as follows:

1. Connect appropriate output cable assembly to OUTPUT connector on rear panel of each record/reproduce unit requiring an output. Refer to *Output-Connector Wiring* paragraph for information about output cables.
2. Set the LINE TERM switch of each record/reproduce unit to appropriate position. This switch should be set to OFF when the record/reproduce unit is driving loads of

600 ohms or less. Set the switch to ON for all other loads.

ACCESSORIES

INPUT TRANSFORMER OR MICROPHONE PREAMPLIFIER

A 600-ohm matching input transformer and a microphone preamplifier are available as optional accessories. Installation and application of these accessories are discussed in the *Input Signal Setup* paragraphs.

REMOTE CONTROL UNIT

Except for the stop/edit and play/edit modes, all operational modes of the AG-440C Recorder/Reproducer can be controlled from a remote location with an accessory remote control unit (Catalog No. 4010080). To use this accessory, remove the dummy plug from the REMOTE CONT connector of the tape transport control box and plug the connector of the remote control unit in its place. The recorder/reproducer will not operate without a dummy plug or a remote control unit plugged into the REMOTE CONTROL connector on the tape transport control box.

CONSOLE REAR COVERS

Rear covers for console-mounted equipment consist of a cover for the console base and individual covers for each record/reproduce unit. The optional rear covers are secured to the console back uprights by captive spring-loaded thumbscrews, which mate with threaded holes in the uprights.

SCRAPE-FLUTTER IDLER

The scrape-flutter idler accessory (Catalog No. 4010069-02) mounts between head positions 2 and 3. This accessory is larger in diameter than the idler furnished with the recorder/reproducer and, therefore, is not interchangeable with the furnished idler. Installation instructions for the scrape-flutter idler are presented in this section.

INITIAL ADJUSTMENTS

The AG-440C Recorder/Reproducer is set up at the factory to have the operational configuration given in Table 2-1.

Table 2-1. Factory-Shipped Operational Configuration

ITEM	SETTING
Output Impedance	600 ohms
Line Output Level	+8 dBm
LINE TERM Switch	ON
Operating Level	260 nWb/m (0 on vu meter), which is 3 dB higher than the 185 nWb/m operating level of Ampex Standard Tapes, Catalog No. 01-31325-01 for 7-1/2 in/s and 01-3135-01 for 15 in/s.
Bias and Equalization	Biased and equalized using Ampex 406 high-output, low-noise tape, Catalog No. 173111.

Some applications of the AG-440C Recorder/Reproducer require operational adjustments that differ from those established at the factory. For example, the use of conventional tape requires change of operating level, change of bias, and changing of record equalization. These changes can be accomplished using alignment procedures provided in the Maintenance section. However, if it is known that the recorder/reproducer is correctly aligned for a given set of conditions, these conditions may be changed by using the short-cut adjustment procedures presented in subsequent paragraphs.

TEST EQUIPMENT

The only test items required to perform any of the conversion procedures presented in the following paragraphs are a sine wave signal generator (Hewlett-Packard, Model 204C or equivalent) and a suitable roll of blank tape. Refer to Table 5-1 in the Maintenance section for a complete list of required test equipment and test equipment characteristics.

If the blank recording tape to be used is a high-output, low-noise tape, a 260 nWb/m operating level is recommended. For conventional

tapes, an operating level of 185 nWb/m should be used. If the operating level adjustment of the AG-440C is in doubt, a quick verification can be made using a standard alignment tape. Simply reproduce the 185 nWb/m operating level tone, with the REPRODUCE LEVEL control set to the CAL position. If the VU meter indicates -3, the operating level is adjusted for 260 nWb/m. If the VU meter reading is 0 (zero), the operating level is 185 nWb/m.

BIASING FOR DIFFERENT TAPE

To change the recording bias level adjustments proceed as follows:

1. Perform bias adjustment as presented in the Maintenance section of this manual (see heading *Bias Adjustment*).
2. Perform bias metering calibration adjustment as presented in the Maintenance section (see heading *Bias Metering Calibration* in Section V).

EQUALIZING FOR A DIFFERENT TAPE

Perform the record high-frequency equalization adjustment as presented in the Maintenance section (see heading *Record High Frequency Equalization* in Section V). Readjustment of low frequency equalization is not required when changing tapes.

NOTE

In the short cut procedures that follow, make adjustments at the tape speed that is most commonly used.

SHORT CUT PROCEDURES

Changing From 260 nWb/m To 185 nWb/m (At +8 VU Line Level)

To change operating level proceed as follows:

1. Rotate the RECORD LEVEL and REPRODUCE LEVEL controls fully counter-clockwise to CAL.
2. Press READY and INPUT pushbuttons.

3. Adjust the level of the signal generator output signal (700 Hz signal) for a 0 indication on VU meter.
4. Press READY and REPRO pushbuttons.
5. Press PLAY and then RECORD pushbuttons.
6. Use screwdriver to adjust the input level calibrate control (under RECORD LEVEL control) for a -3 indication on VU meter.
7. Use screwdriver to adjust reproduce-level calibrate control (under REPRO pushbutton) for a 0 indication on VU meter.
8. Press READY and INPUT pushbuttons.
9. Use screwdriver to adjust record calibrate control (on record plug-in module) for a 0 indication on VU meter.

Changing From +8 VU To +4 VU Line Level (At 260 nWb/m Operating Level)

To change line levels, proceed as follows:

1. Rotate the RECORD LEVEL and REPRODUCE LEVEL controls fully counter-clockwise to CAL.
2. Set METER SENSITIVITY switch to +4.
3. Press READY and INPUT pushbuttons.
4. Adjust the level of signal generator output signal (700 Hz) for a 0 indication on VU meter.
5. Press READY and REPRO pushbuttons.
6. Press PLAY and then RECORD pushbuttons.
7. Adjust RECORD LEVEL control for a 0 indication on VU meter.
8. Use screwdriver to adjust reproduce-level calibrate control (under REPRO pushbutton) for a -4 indication on VU meter.
9. Return RECORD LEVEL control to CAL position.

10. Use screwdriver to adjust the input calibrate adjustment (under RECORD LEVEL control) for a 0 indication on VU meter.
11. Press READY and INPUT pushbuttons.
12. Use screwdriver to adjust record-level calibrate control (on record plug-in module) for a 0 indication on VU meter.

Changing From +8 VU To +4 VU Line Level and From 260 nWb/m To 185 nWb/m Operating Level

To change levels, proceed as follows:

1. Rotate the RECORD LEVEL and REPRODUCE LEVEL controls fully counter-clockwise to CAL.
2. Set METER SENSITIVITY switch to +4.
3. Press READY and INPUT pushbuttons.
4. Adjust the level of signal generator output signal (700 Hz) for a 0 indication on VU meter.
5. Press READY and REPRO pushbuttons.
6. Press PLAY and then RECORD pushbuttons.
7. Adjust RECORD LEVEL control to obtain a 0 indication on VU meter.
8. Use screwdriver to adjust reproduce-level calibrate control (under REPRO pushbutton) to obtain a -1 indication on VU meter.
9. Return the RECORD LEVEL control to CAL position.
10. Use screwdriver to adjust the input level calibrate control (under RECORD LEVEL control) for a 0 indication on VU meter.
11. Press READY and INPUT pushbuttons.
12. Use screwdriver to adjust record calibration control (on record plug-in module) for a 0 indication on VU meter.

Changing From Nominal (600-Ohm To 150-Ohm) Output Impedance

To change output impedance proceed as follows:

1. Rotate the RECORD LEVEL and REPRODUCE LEVEL controls fully counter-clockwise to CAL.
2. Connect the load that will normally be used with the recorder/reproducer to the audio OUTPUT connector of desired record/reproduce unit.

NOTE

The LINE TERM switch on each record/reproduce unit can be used to connect a 680-ohm load across the audio output of the unit. To connect the 680-ohm load, set the LINE TERM switch to ON.

3. Press READY and REPRO pushbuttons.
4. Press PLAY and RECORD pushbuttons.
5. Adjust the level of signal generator output signal (700 Hz) for a 0 indication on VU meter.
6. Set OUTPUT impedance switch to 150.
7. Use screwdriver to adjust reproduce-level calibrate control (under REPRO pushbutton) for a 0 indication on the VU meter.
8. Press READY and INPUT pushbuttons.
9. Use screwdriver to adjust record calibrate control (on record plug-in module) for a 0 indication on VU meter.

VERIFICATION OF OPERATING LEVEL USING TAPE SATURATION

Tape-saturation testing may be used to check the results of the procedures concerned with changing the operating levels. For a conventional tape, the maximum level of a 700-Hz signal at 15 in/s is

about 12 to 14 dB above the normal 185 nWb/m output. For a high output tape, the saturation normally occurs 12 to 14 dB above the 260 nWb/m output. The 20% index on the VU meter may be used as a rough indication of a signal 14 dB below 0 VU.

To verify operating level, proceed as follows:

1. Rotate the RECORD LEVEL and REPRODUCE LEVEL controls fully counter-clockwise to CAL.
2. Press READY and REPRO pushbuttons.
3. Press PLAY and then RECORD pushbuttons.
4. Adjust output signal level of signal generator to obtain a 0-VU indication on VU meter (at 700 Hz for 15 in/s or 350 Hz for 7-1/2 in/s).
5. Adjust REPRODUCE LEVEL control to obtain a 20% indication on VU meter.
6. Turn RECORD LEVEL control clockwise until a maximum VU indication is obtained. There is no gross operating-level error if the VU indication is between -3 and 0. If the zero-adjust setting of the VU meter is inaccurate, the 20% mark can be in error.

CONVERSION

TURNTABLE REPOSITIONING FOR DIFFERENT REEL SIZE

The takeup and rewind assemblies, including turntables, are secured to the reel guards through slots in the top plate. These slots permit the takeup and rewind assemblies to be adjusted to accommodate different size reels. Before the AG-440C Recorder/Reproducer is shipped from the factory, the takeup and rewind assemblies are positioned as close together near the center of the transport as possible. This position of the assemblies allows the use of reels up to 10-1/2 inches in diameter. If 11-1/2 inch CCIR reels are to be used, the assemblies can be repositioned as follows.

NOTE

When the takeup and rewind assemblies are positioned to accommodate 11-1/2 inch CCIR reels, transports cannot be mounted side-by-side on standard 19-inch racks because the reels protrude beyond the edges of the racks.

1. At the rear of the transport, loosen the three self-locking nuts that secure the takeup assembly to the reel guard. Then, loosen the three self-locking nuts that secure the supply assembly to the reel guard.
2. Slide the takeup and rewind assemblies as far as possible from the center of the transport.
3. Verify that the reel-guard flats are parallel to the top edge of the transport and that the turntables are centered in the guards. Then, tighten the six nuts loosened in step 1.

TAPE-WIDTH CONVERSION

Setting up the tape transport to accommodate 1/2-inch or 1/4-inch tape is accomplished by rotating two tape guides in their mountings and changing head assemblies. One guide is located on the reel idler and the other is located on the takeup tension arm. Head alignment of the replacement head assembly must be performed (see Maintenance section).

Rotating Tape Guides

To rotate the tape guides to accommodate different tape widths, proceed as follows:

1. Lift the reel-idler guide against the spring pressure and turn it until the desired-size guide is in the tape path.
2. While supporting the takeup tension arm to prevent bending, lift the tension arm guide against the spring pressure and turn the guide to the desired guide width in the tape path.

NOTE

The guides snap down into position when correctly aligned.

Changing Heads

To remove head assembly, proceed as follows:

1. Loosen the captive screw on the slanted rear surface of the head assembly. Then, remove the stainless steel head cover.

NOTE

For a four-position head, the switching knob must be unscrewed to free the cover. The switching knob is located at the center of the head cover.

2. Disconnect all head connectors carefully (Figure 2-7).

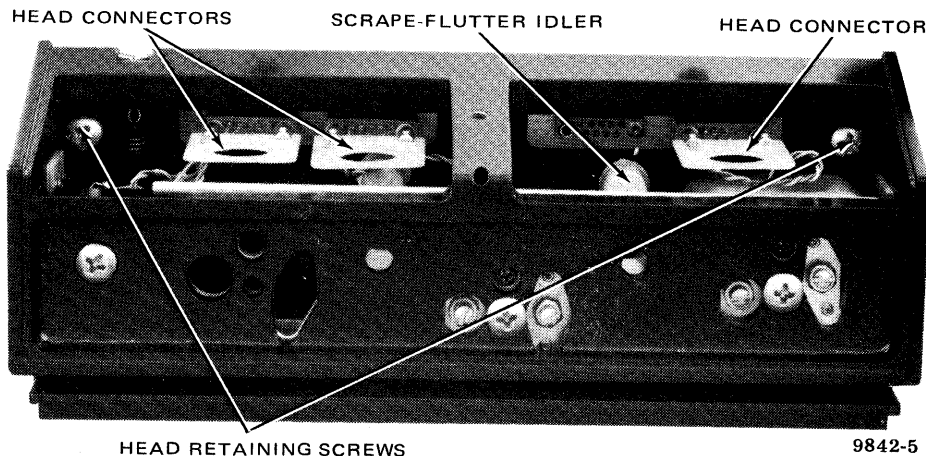


Figure 2-7. Head Assembly (Top View)

3. Remove the two screws holding the head to the top plate.
4. Being careful to avoid bumping or scratching the scrape-flutter idler, lift head assembly up and off.

To install head assembly, proceed as follows:

1. If the head cable box is to be changed, change it before reinstalling the head assembly. (Refer to the following section.)
2. Being careful to avoid bumping or scratching the scrape-flutter idler, mount desired head assembly in place.
3. Install two screws that retain head assembly to top plate.
4. Connect all head connectors.
5. Install stainless steel head cover. Tighten captive screw on slanted rear surface of head assembly.
6. For a four-position head, install switching knob at the center of the head cover.

Changing Head Cable Box

The head cable box must be changed when adding channels (if the existing box is not adequate) or when adding a two-channel four-track (2-Ch 4-Tr) head. Ampex catalog numbers of various head cable boxes are contained in the Parts Lists section of this manual.

To remove head cable box, proceed as follows:

1. Remove head assembly. (Refer to *Changing Heads* text.)
2. Disconnect all head cables from the rear of the record/reproduce electronics unit(s).
3. Manually support head cable box (Figure 2-4) and remove the screws located behind the head assembly. Then remove the box.

To install head cable box, proceed as follows:

1. Situate head cable box in its mounting position. While manually supporting it, secure box with two retaining screws.
2. Install head assembly. (Refer to *Changing Heads* text.)
3. Connect all head cables to the record/reproduce electronics unit(s).

SCRAPE-FLUTTER IDLER ADDITION

The optional tape scrape-flutter idler kit (Catalog No. 4010069) contains the idler, a mounting screw, and a lockwasher. The standard-equipment idler with 3/8-inch roller is mounted between head positions 3 and 4 at the factory. The optional idler with 15/32-inch roller mounts between head positions 2 and 3. Install the optional idler as follows:

1. Remove head assembly. (Refer to *Changing Heads* paragraph.)
2. Mount optional idler on locating pin and boss. Then, secure idler with screw and washer.
3. Replace head assembly. (Refer to *Changing Heads* paragraph.)

CHANNEL ADDITION

The AG-440C Recorder/Reproducer can accommodate up to four record/reproduce channels. To add channels, change the head assembly and head cable box if required. (Refer to *Changing Heads* and *Changing Head Cable Box* paragraphs.) Then, add one record/reproduce unit for each added channel as follows:

NOTE

One interconnecting cable (Catalog No. 4050442) must be connected to each added record/reproduce unit. Optional plug-in input units such as a balanced-line transformer, microphone preamplifier, etc., may be added.

1. For mounting in portable cases, secure unit(s) in each case with two 12-24 X 3/4 oval-head Phillips screws. Place white nylon cup-washers under the head of each screw.

NOTE

Two types of portable cases are available for record/reproduce units. One type is a two-unit case (Catalog No. 4150330) and the other is a four-unit case (Catalog No. 4150331). Two two-unit cases, stacked on top of each other, may be used for four-channel portable systems. For one-channel systems, a blank panel (Catalog No. 4290620) is available to fill the empty space.

2. For mounting in racks or custom consoles, mount the added record/reproduce unit(s) above or below the existing record/reproduce unit(s). (Mounting dimensions are shown in Figure 2-2.) Each additional record/reproduce unit mounted in an Ampex console requires two riser-support castings (Catalog No. 4260404), which are installed as follows:

a. Remove the top cover from over the uppermost installed record/reproduce unit(s). Then remove the unit.

b. Using two 6-32 X 5/8 pan-head screws, two flat washers, two lockwashers, and two 6-32 hex nuts, secure new support castings to the existing supports.

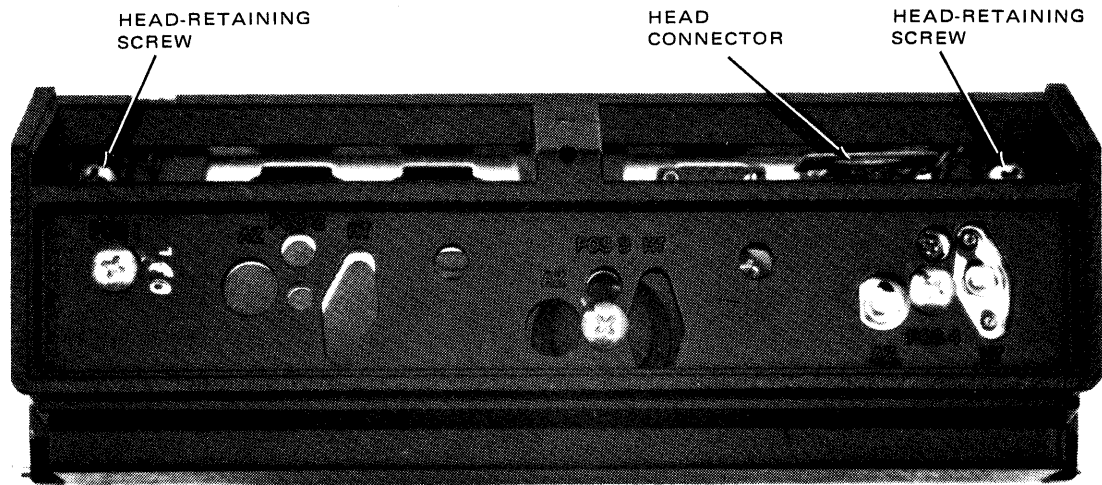
c. Install top cover and unit removed in step a.

d. Mount each added record/reproduce unit between the new support castings and secure with two 12-24 X 3/4 oval-head Phillips screws. Place white nylon cup-washers under the head of each screw.

e. Interconnect the record/reproduce units to the tape transport. (Refer to *Interconnecting Cables* earlier in this section.)

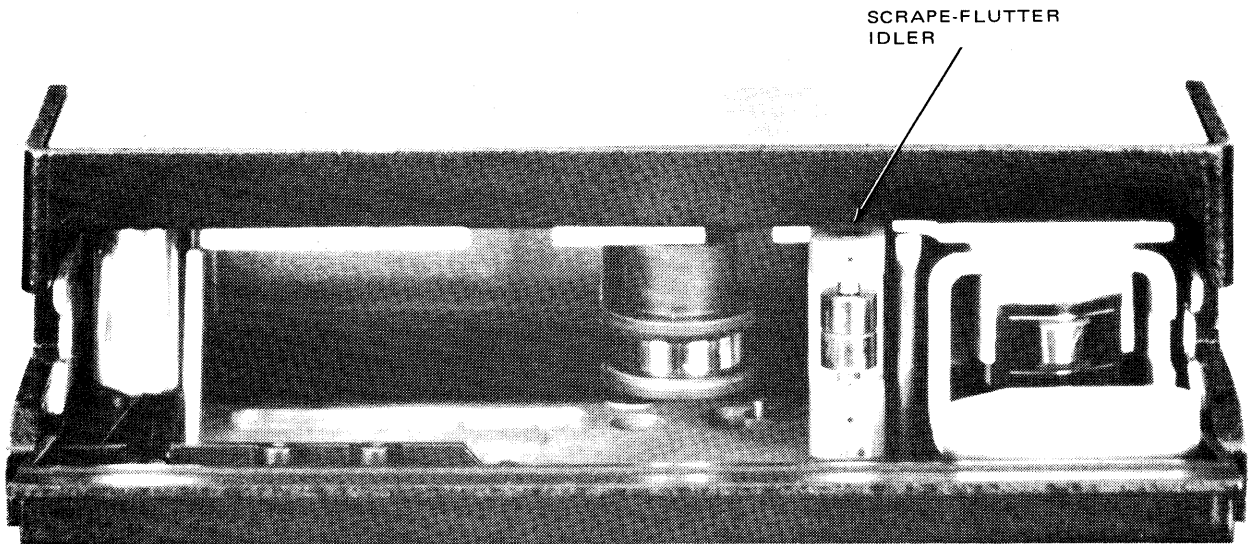
NOTE

If the console is equipped with optional rear covers, individual covers (Catalog No. 4040984) should be ordered for each additional record/reproduce unit.



TOP VIEW

13161-7



FRONT VIEW

13161-12

Figure 2-6. Reproduce Head Assembly

To install the head-cable box, proceed as follows:

1. Situate the head-cable box in its mounting position. While manually supporting the head-cable box, secure the box with the two retaining screws.
2. Install the head assembly.
3. Connect all head cables to the reproduce electronics unit.

Channel Addition

The reproducer can accommodate up to four reproduce channels. To add channels, change the head assembly and head-cable box if required. (Refer to *Changing Heads* and *Changing Head Cable Box* paragraphs.) Then, add one reproduce unit for each added channel.

SECTION III OPERATION

GENERAL

This section contains the following information: location and function of the operating controls and indicators, operating instructions for the various operating modes, and the tape speed capabilities of servo system equipped tape transports.

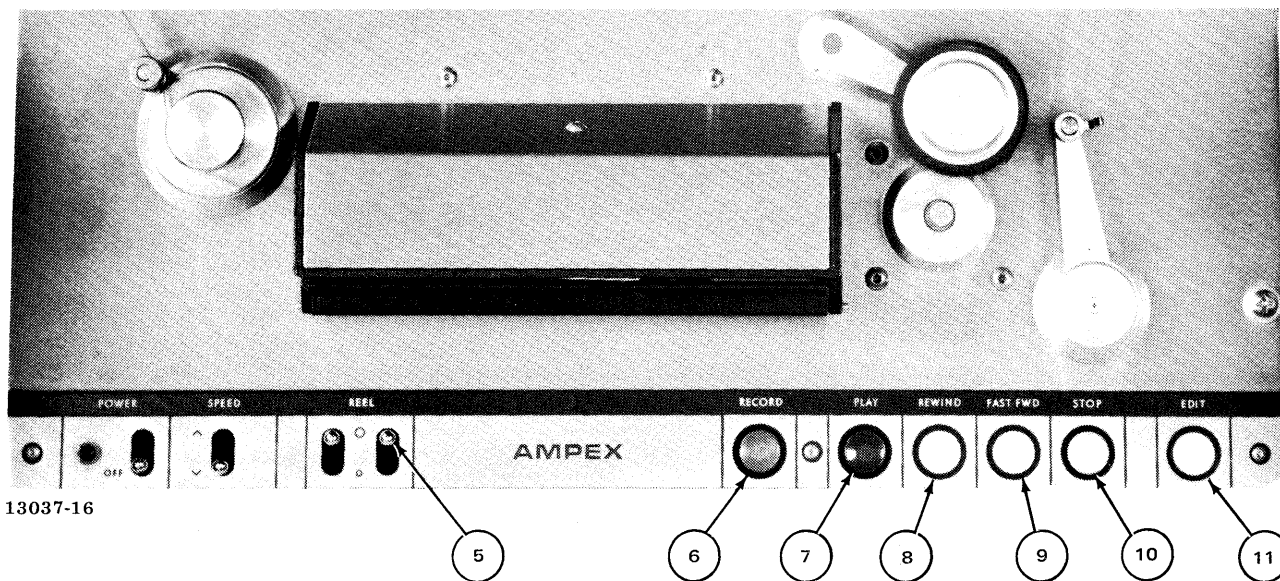
CONTROLS AND INDICATORS

Operator controls and indicators are located on the tape transport and record/reproduce unit. Table 3-1 shows the location and function of each control and indicator on the tape transport, and Table 3-2 shows those on the record/reproduce unit.

Table 3-1. Tape Transport, Controls and Indicators

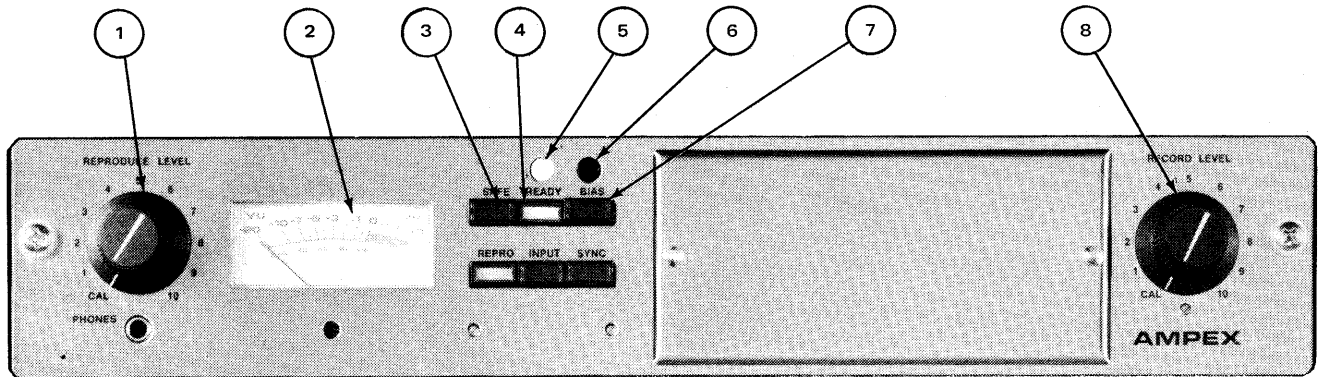
INDEX NO.	NAME	FUNCTION
1	POWER indicator	Lights when AC power is applied.
2	POWER toggle switch	Turns power to the tape recorder on and off.
3	SPEED toggle switch	Selects low (V) or high (^) tape speed. (Equalization is automatically switched in accordance with speed selection.)
4	Supply REEL toggle switch	Used to select appropriate tape tension for large (O) or small (o) supply-reel hubs.

Table 3-1. Tape Transport, Controls and Indicators (Continued)



INDEX NO.	NAME	FUNCTION
5	Takeup REEL toggle switch	Used to select appropriate tape tension for large (O) or small (o) takeup reel hubs.
6	RECORD pushbutton	Used in conjunction with PLAY (index No. 7, this table) and READY pushbuttons (index No. 4, Table 3-2). With READY pushbutton depressed, pressing PLAY pushbutton and then RECORD pushbutton initiates record mode.
7	PLAY pushbutton	Used to select play mode or used with RECORD (index No. 6, this table) and READY pushbuttons (index No. 4, Table 3-2) to select record mode. Pressing PLAY pushbutton during a fast-wind mode stops the tape and then automatically starts play mode.
8	REWIND pushbutton	Used to select rewind mode. Rewind can be initiated during any mode except record and play/edit modes.
9	FAST FWD pushbutton	Used to select fast forward mode. Fast forward can be initiated during any mode except record and play/edit modes.
10	STOP pushbutton	Used to stop the tape transport and cancel existing mode of operation.
11	EDIT pushbutton	<p>Used to initiate one of the following edit modes:</p> <p>Stop/Edit. If tape is stopped or not threaded, pressing EDIT pushbutton reduces braking force for easier tape threading or manual tape movement.</p> <p>Play/Edit. If play or record mode is active, pressing EDIT pushbutton removes power to takeup reel, causing tape to be spilled at takeup side of transport. Play/edit mode can be entered from stop mode by holding down EDIT pushbutton, pressing PLAY pushbutton, and then releasing EDIT pushbutton.</p> <p>Fast/Edit. If rewind or fast-forward mode is active, pressing EDIT pushbutton causes tape lifters to lower tape onto head to permit audio monitoring.</p>

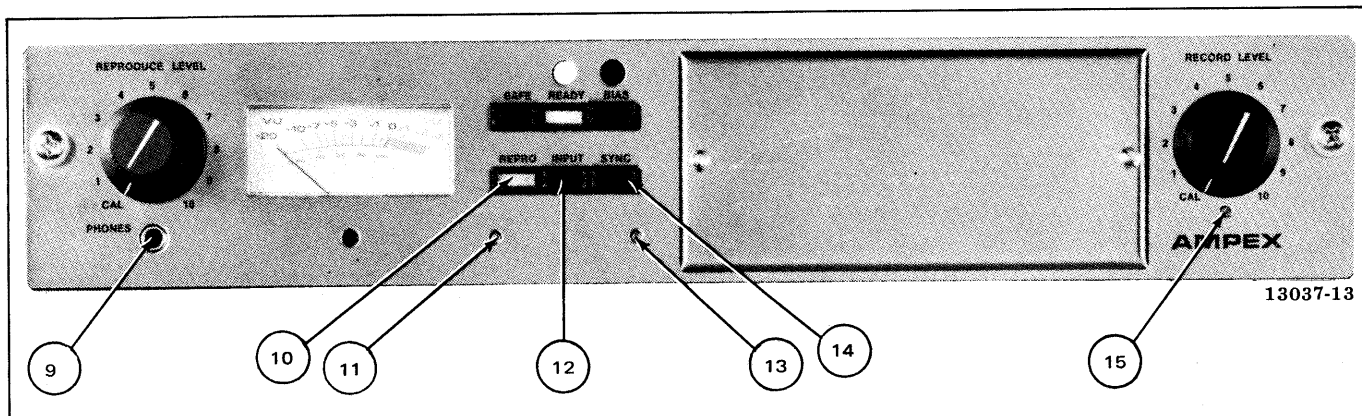
Table 3-2. Record/Reproduce Unit, Controls and Indicators



13037-13

INDEX NO.	NAME	FUNCTION
1	REPRODUCE LEVEL rotary control	REPRODUCE-LEVEL range of control used to vary normal or Sel-Sync reproduce level of associated channel. CAL position switches level-adjustment function to reproduce calibrate potentiometer (index No. 11, this table).
2	VU meter	Indicates signal level present at audio output of associated channel except when BIAS pushbutton (index No. 7, this table) is depressed while recording. Meter lights when recorder/reproducer is turned on.
3	SAFE latching pushbutton	In depressed position, prevents selection of record mode.
4	READY latching pushbutton	In depressed position, allows selection of record mode.
5	READY indicator (yellow)	Lights when READY pushbutton is depressed.
6	RECORD indicator (red)	Lights when record mode is selected.
7	BIAS latching pushbutton	In record mode, depressing BIAS pushbutton causes VU meter (index No. 2, this table) to indicate bias-signal level of associated channel. In other modes, depressing BIAS pushbutton disconnects VU meter from audio output.
8	RECORD LEVEL rotary control	RECORD-LEVEL range of control used to adjust gain of record amplifier of associated channel. CAL position switches gain-adjustment function to input calibrate potentiometer (index No. 15, this table).

Table 3-2. Record/Reproduce Unit, Controls and Indicators (Continued)



INDEX NO.	NAME	FUNCTION
9	PHONES jack	Receptacle for headphones plug. Reproduced audio of associated channel can be heard on headphones.
10	REPRO pushbutton switch	In depressed position, connects signal reproduced by reproduce head of associated channel to audio output, PHONES jack, and VU metering circuit of that channel.
11	Reproduce calibrate adjustment	Used to set operating level. (See <i>Operating Level Adjustment</i> in Maintenance section.)
12	INPUT pushbutton switch	In depressed position, connects signal to be recorded on associated channel to audio output, PHONES jack, and VU metering circuit of that channel.
13	Sync calibrate adjustment	Used to set Sel-Sync signal level.
14	SYNC pushbutton switch	Used to initiate Sel-Sync function. In reproduce mode, depressing SYNC pushbutton connects signal reproduced by record head of associated channel to audio output, PHONES jack, and VU metering circuit of that channel. If SYNC pushbutton is depressed during record mode, input signal being recorded is connected to audio output, PHONES jack, and VU metering circuit of associated channel.
15	Input calibrate adjustment	Used to adjust input level.

OPERATING INFORMATION

NOTE

In order to ensure optimum equipment performance and maximum service life, routine maintenance (refer to *Preventive Maintenance* in Section V) must be faithfully performed.

PRE-OPERATING PROCEDURES

Proceed as follows:

1. Set the transport POWER switch to on position. POWER indicator on tape transport and VU meter on record/reproduce unit will light.

2. Set transport SPEED switch to high-speed (\wedge) or low-speed (\vee) position as required. Tape speeds of 3-3/4 (\vee) and 7-1/2 (\wedge) in/s, 7-1/2 (\vee) and 15 (\wedge) in/s, or 15 (\vee) and 30 (\wedge) in/s are available. Appropriate record and playback equalizations are automatically selected to agree with the setting of the SPEED switch.

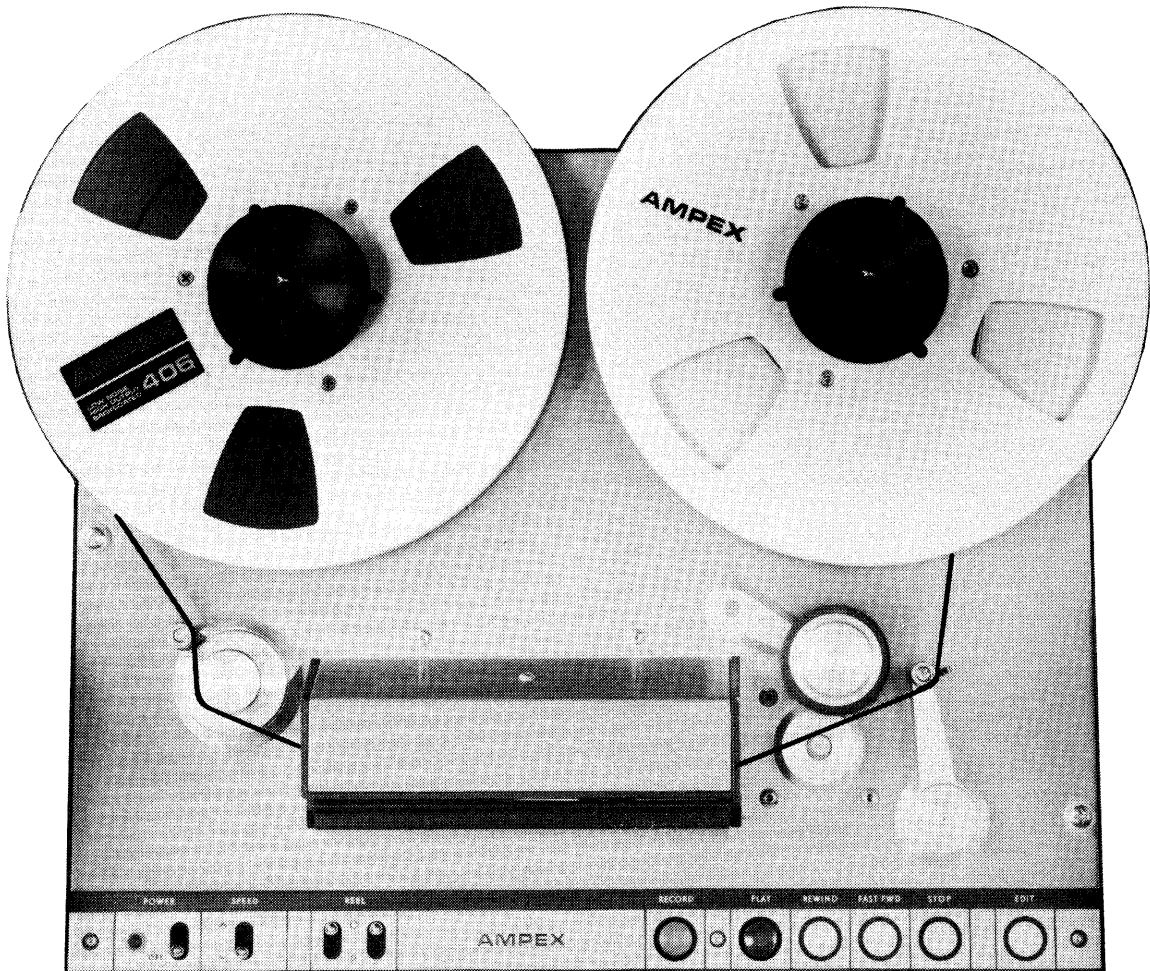
3. Set supply and takeup REEL switches to conform with the size of the hubs of the reels being used. For NAB hubs (4-1/2 inch diameter), set appropriate REEL switch to O. For EIA hubs (2-1/4 inch diameter), set appropriate switch to o. If desired, an NAB hub can be used on one turntable and an EIA hub on the other.

NOTE

When using a recorder/reproducer having 3-3/4 in/s and 7-1/2 in/s tape speeds, an AC capstan motor, and an NAB supply reel, set supply REEL switch to o (small reel position) if a fast start is to be made with less than a one-inch tape pack on supply reel. Fast starts may not be possible with an EIA reel on the supply turntable when the supply pack is less than 3/4 inch.

4. Install reel of tape on supply turntable and empty reel on takeup turntable.

5. Thread tape as shown in Figure 3-1. To facilitate tape threading, turn on recorder/reproducer and depress EDIT pushbutton,



13037-16

Figure 3-1. Tape Path

which reduces turntable braking force so the reels can be easily turned by hand.

6. Anchor tape to hub of takeup reel and turn takeup reel by hand until supply reel moves. This technique removes all tape slack, which causes the tape-tension arm to close the safety switch.

7. If desired, a headset or speaker can be connected to the PHONES jack on a record/reproduce unit of the recorder/reproducer.

RECORDING

Proceed as follows:

1. Perform all steps of pre-operating procedures.
2. Depress READY pushbutton of record/reproduce unit for each channel to be recorded. The associated READY indicator(s) (yellow) will light.
3. Depress SAFE pushbutton of record/reproduce unit for each channel that is not to be recorded.
4. Depress INPUT pushbutton.
5. Connect signal(s) to be recorded to appropriate rear-panel INPUT connector(s).
6. Adjust RECORD LEVEL control so that VU meter indicates 0 for most audio peaks. (Extreme peaks may reach +2 or +3 VU.)
7. Depress PLAY pushbutton to start tape in motion. Then depress RECORD pushbutton to begin recording on selected channel(s). Record indicator (red) will light.

NOTE

While recording, the input signal of each channel can be compared with the recorded signal on that channel by alternately depressing the associated INPUT and REPRO pushbuttons.

8. When recording is complete, depress STOP pushbutton to stop tape motion and deactivate record mode.

NOTE

The recorder/reproducer automatically stops tape motion and deactivates the record mode if the tape runs completely off the supply reel.

REPRODUCING

Proceed as follows:

1. Perform all steps of pre-operating procedures.
2. Depress SAFE pushbutton of record/reproduce units.
3. For two-channel recorder/reproducers having a two-track head and a 2-Ch 4-Tr head, push the knob on head assembly down to select the two-track head or up to select the 2-Ch 4-Tr head.
4. Depress REPRO pushbutton.
5. Depress PLAY pushbutton to begin reproducing recorded material.
6. When desired material has been reproduced, depress STOP pushbutton to stop tape motion and deactivate play mode.

NOTE

If the tape runs completely off the supply reel the recorder/reproducer automatically stops tape motion and deactivates the play mode.

SEL-SYNC FUNCTION

The Sel-Sync function of a given channel can be selected by depressing the SYNC pushbutton on the record/reproduce unit for that channel. Selecting the Sel-Sync function in conjunction with reproduce mode causes the reproduced audio to be derived from the record head rather than the

reproduce head. This combination of the Sel-Sync function with the reproduce mode is used in three ways.

1. Sel-Sync recording
2. Over-dubbing
3. Ping ponging

In Sel-Sync recording, a performer listens to one or more previously recorded tape tracks using the Sel-Sync/reproduce mode while recording material on another track. For example, assume a four-channel recorder/reproducer is equipped with a tape having two prerecorded tracks and two blank tracks. Typically, the two prerecorded tracks are reproduced (using two of the record heads for pickup), mixed together using studio equipment, and fed to a performer's earphones. The performer then listens to the prerecorded material while recording material on one of the blank-track channels. Thus, the new material is recorded in synchronism with the prerecorded material.

In overdubbing, a performer listens to material that he previously recorded on one or more tape tracks using the Sel-Sync/reproduce mode. The performer can repeat his previous performance (but not record it) and get into proper timing with the original material. At the point where the overdub is desired, the track(s) to be overdubbed is (are) switched to the record mode. The audio that the performer hears is automatically switched from the off-tape audio to the input audio the performer is recording when the record mode is selected.

Ping ponging is a process of reproducing two or more tracks of previously recorded material using the Sel-Sync/reproduce mode, mixing the reproduced signals together, and simultaneously rerecording the mixed signals on another track.

CAUTION

OFTEN IT IS NOT POSSIBLE TO RERECORD THE MIXED SIGNALS ON A TRACK ADJACENT TO THE HOME TRACK OF EITHER OF THE MIXED SIGNALS. THIS RECORDING PROBLEM IS CAUSED BY THE CROSSTALK BETWEEN THE HIGH-LEVEL SIGNAL BEING RECORDED ON ONE CHANNEL AND THE LOW-LEVEL SIGNAL BEING REPRODUCED FROM THE ADJACENT

CHANNEL. THE CROSSTALK CAUSES A FEEDBACK CONDITION THAT CAUSES THE CIRCUITS TO OSCILLATE. THEREFORE, IT MAY NOT BE POSSIBLE TO PING PONG ON A TWO-TRACK RECORDER/REPRODUCER. USING A FOUR-TRACK RECORDER/REPRODUCER, THE POSSIBILITIES FOR PING PONGING ARE RECORDING CHANNELS 1 AND 2 ON CHANNEL 4 OR CHANNELS 3 AND 4 ON CHANNEL 1.

FAST-WINDING

For fast-winding operations press either the REWIND or FAST FWD pushbutton. For editing and cueing operations, these pushbuttons can be pressed alternately without having to press STOP between fast-winding selections. Either fast-winding mode can be entered from the stop or play mode but is locked-out when in record or play/edit mode. To enter the play mode from either fast-winding mode, simply press the PLAY pushbutton.

Two automatic tape-lifter arms, which move the tape away from the heads, are automatically actuated in both fast-winding modes. To monitor audio in either fast-winding mode, press EDIT pushbutton, which overrides tape lifters and allows the tape to move across the heads. When manual override is desired, open head gate and push back either tape lifter.

NOTE

If the tape runs completely off the supply reel the recorder/reproducer automatically stops tape motion and deactivates the play mode.

EDITING

Three edit modes are available; they are: stop/edit, play/edit, and fast/edit. These modes are selected as specified in Table 3-1.

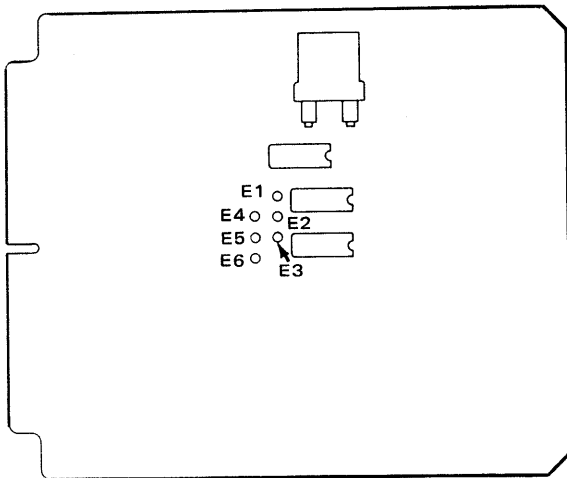
SERVO EQUIPPED TRANSPORT

Speed Pair Selection

The front panel SPEED switch on the AG-440C permits the selection of the high or low operating

speed. The assignment of high or low operating speed is determined by a strapping arrangement on the servo printed wiring assembly. Selected operating speeds may be any two of the following: 30 in/s, 15 in/s, 7-1/2 in/s and 3-3/4 in/s. Strap the speed pair as follows:

1. On the transport control panel, set the POWER switch to OFF.
2. Remove the servo printed wiring assembly (Figure 3-2) from the servo chassis (Figure 3-3).
3. Connect a jumper from the terminal associated with the low position of the SPEED switch, designated E2, to the terminal associated with the desired low tape speed (E1, E3 or E4). Refer to Figure 3-2.
4. Connect a jumper from the terminal associated with the high position of the SPEED switch, designated E5, to the terminal associated with the desired high tape speed (E3, E4 or E6).



SPEED STRAPPING				
RANGE		30/15	15/7½	7½/3¾
HI	E5 TO	E6	E3	E4
LO	E2 TO	E3	E4	E1

Figure 3-2. Tape Speed Pin Strapping

5. Replace the servo printed wiring assembly in the servo chassis, component side rearward (i.e., facing away from the AG-440C).

Variable Speed Mode

The use of the dummy plug in J4 of the servo chassis (Figure 3-3) causes the capstan servo to operate with a fixed reference frequency of 9.6 kHz. To operate the system at variable speeds, remove the dummy plug from J4 and connect a sine or square wave generator having an output of 3 to 30 Vrms across pins 2 and 3 (ground) of a similar plug. Refer to Figure 3-4.

Insert the new plug into J4 on the servo chassis. If a similar plug is not available, the dummy plug can be modified by removing the existing jumper between pins 1 and 2 and connecting the generator as described above. Once connected, the frequency of the generator can be used to control the speed of the tape in accordance with the values given in Table 3-3.

Table 3-3. Tape Speeds for Various Reference Frequency Inputs

TAPE SPEED (IN/S)	INPUT FREQUENCY
3-3/4	1200
7-1/2	2400
15	4800
30	9600

NOTE

The values given in Table 3-3 are with the SPEED switch in the "high" position and jumper set for 30 in/s.

Capstan Operational Options

Three capstan operational options are available; they are:

1. Capstan rotates at selected speed whenever tape is threaded and recorder/reproducer

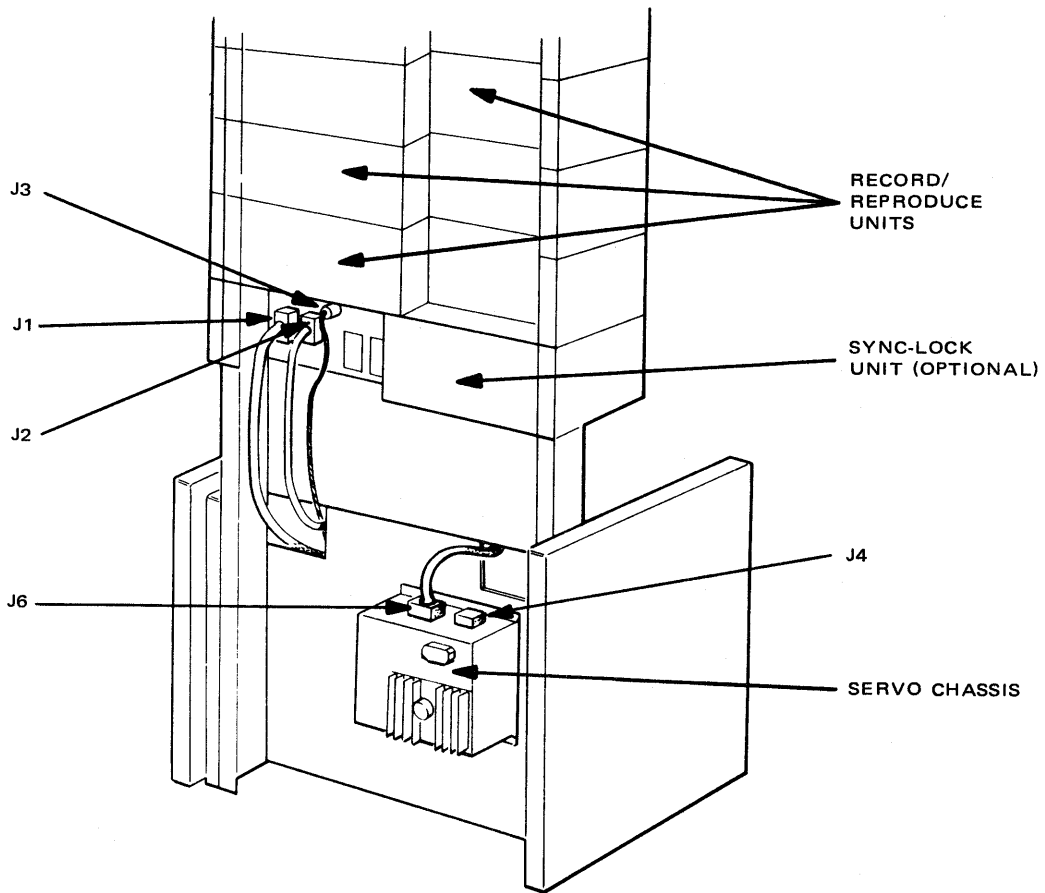


Figure 3-3. Servo Chassis Location

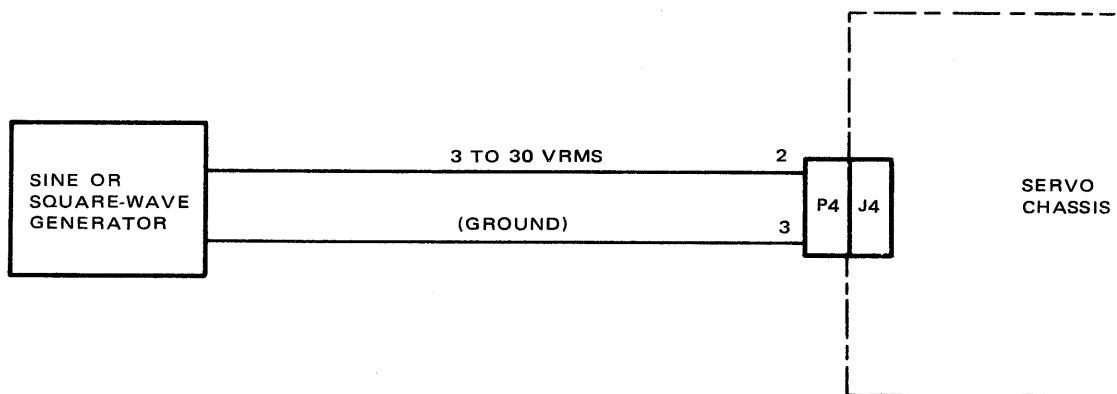


Figure 3-4. Variable Speed Operation

is turned on. To select this option, remove relay K1 from its socket on the servo electronics chassis (located at rear of console). This option may be used at 3-3/4 in/s, 7-1/2 in/s, and 15 in/s tape speeds but not at 30 in/s tape speed because a tape loop is normally thrown that opens the safety switch. Opening the safety switch stops the tape and cancels the current mode of operation.

2. Capstan rotates when tape is threaded, recorder/reproducer is turned on, and low tape speed is selected; however, for high tape speed, capstan only rotates after the play or record mode is initiated. This option is used for 15 in/s and 30 in/s recorder/reproducers when fast starts are to be made at 15 in/s tape speed. To select this option, set the CAPSTAN STOP switch on the servo chassis to HIGH SPEED.

3. Capstan only rotates when in play or record mode at both speeds. To select this option, place the capstan stop switch on the servo chassis in the BOTH SPEED position. If a fast start is desired in this mode, press and

hold STOP pushbutton and then PLAY pushbutton. The capstan motor will start and lock up in less than two seconds. When fast start is desired, release STOP and then PLAY pushbuttons. The tape will start moving the instant the STOP pushbutton is released.

REMOTE CONTROL OPERATION

Transport operation from the Ampex Remote Control Unit (Part No. 4010080) duplicates the record, play, rewind, fast forward and stop controls on the tape transport. On the remote control box, the EDIT pushbutton only performs the fast wind/edit function of defeating the tape lifters.

The standby lamp (located between the STOP and EDIT pushbuttons) indicates that the tape is threaded and the remote controls may be operated. If the transport is left in the stop/edit mode, with the tape threaded, the standby lamp will not light. To operate the transport under this condition, press the remote STOP pushbutton to cancel the stop/edit mode; the standby lamp will come on and the remainder of the remote controls will function.

SECTION IV

THEORY OF OPERATION

This section provides a block diagram oriented discussion of the functional capability and theory of operation of various configurations of the AG-440C Recorder/Reproducer. The general block diagram discussion is followed by a detailed description of the recorder/reproducer circuits.

GENERAL SYSTEM DESCRIPTION

TAPE TRANSPORT

Tape motion is controlled by the tape transport mechanism for all operation modes. The transport consists basically of a tape supply system, a tape drive system, a tape takeup system, and a control system. These systems provide smooth and positive tape motion across the magnetic heads, and maintain correct tape tension.

A separate motor drives the supply and the takeup assembly. These two motors are connected so that if power is applied with no tape threaded, the turntables will rotate in opposite directions; the supply turntable clockwise and the takeup turntable counterclockwise.

In the play or record modes of operation, the capstan controls tape speed; it pulls tape from the supply reel and delivers it to the takeup reel. The motor torque, and therefore tape tension, is adjusted by means of adjustable resistors, one for the supply and the other for takeup. Each of these resistors has two sliders to permit tape tension adjustment for any combination of large and small reels.

During fast-forward or rewind operation, the capstan is disengaged from the tape. The power of one of the motors is reduced by switching an adjustable resistor in series with the appropriate motor, while the other motor continues to operate at full power. The turntable under full power pulls the tape

against the torque of the other turntable, which provides the required tape tension.

A brake controlled by two solenoids is mounted on each of the two torque motors. The main-brake solenoid on each motor is energized (brakes released) whenever tape is placed in motion in any mode. The edit-brake solenoid on each motor is energized in the stop/edit and play/edit modes to control the braking force at each turntable.

The capstan drive is provided by either a servo-controlled DC capstan motor or an AC capstan motor, depending on the tape transport selected. The capstan is at the end of the capstan motor shaft and is precision machined and hardened. AC motors have a flywheel and fan mounted on the shaft at the other end of the motor. A solenoid-controlled capstan idler presses the tape against the capstan to provide the driving friction against the tape.

The AC capstan drive motor has separate windings for each of the two tape speeds. A speed toggle switch selects the desired tape speed, and also automatically switches in the correct equalization circuit for each speed. Speed control of the servo type capstan motor is discussed in the Operation section (Section III) of this manual.

When the recorder/reproducer is in the play or record mode, the capstan idler solenoid is energized. When the capstan idler solenoid energizes, the capstan idler moves and presses the tape against the rotating capstan. The main brake solenoids are also energized, releasing the brakes, and the capstan drives the tape across the head assembly at the selected speed.

A reel idler assembly on the left side of the transport minimizes any tape motion transients caused by the supply assembly. The reel idler arm minimizes initial strain when tape motion starts (to

avoid stretching or breaking the tape) and prevents formation of a tape loop between the supply reel and the heads. The reel idler flywheel serves to dampen transients in tape speed that could result from torque motor cogging (not moving smoothly) and uneven tape pack on the supply reel.

The tape takeup tension arm has two functions; it tensions the small tape loop that is formed while the takeup reel is achieving normal speed during start, and it actuates the safety switch to stop operation if a large tape loop forms, or if the tape breaks. The tension arm also actuates the safety switch if either reel runs out of tape. The guide for the tape is similar to that on the reel idler. A tape hook holds tape on the guide during threading and when the tape becomes slack.

A solenoid-operated tape lifter assembly raises the tape from contact with the heads during fast-forward or rewind operation. When either mode starts, the tape lifter solenoid energizes and moves the tape lifter mechanism. The tape lifter is defeated as long as the edit pushbutton is pressed.

BLOCK DIAGRAM FUNCTIONAL DESCRIPTION

Figure 4-1 shows a general block diagram of the AG-440C Recorder/Reproducer. As shown in the figure, the AG-440C can be configured to record and reproduce up to four audio channels. Each audio input may come from a microphone or another audio source, such as another tape reproducer. A microphone amplifier input accessory is used when the audio input comes from a microphone.

Reproducing

With the recorder/reproducer turned on and the tape properly threaded, selecting the reproduce mode causes the control circuitry to release the main reel brakes and to enable the reel motors, the capstan motor, and the capstan idler. As a result, the recorded tape is pulled past the heads at a constant speed. The signal sensed by the record (Sel-Sync operation) or reproduce head is equalized and amplified.

Recording

In the record mode the tape is moved as in the play mode. During recording an erase signal from an internal oscillator is fed to the erase head(s), which clear(s) any previously recorded signals from the tape before it reaches the record head(s). Information to be recorded is amplified, mixed with a bias signal, and applied to the record head(s). The information is recorded on the tape as it is pulled past the record head(s).

Fast Forward/Rewind

With the recorder/reproducer turned on and the tape properly threaded, selecting the fast forward mode locally or remotely causes the control circuitry to release the main reel brakes and apply full power to the takeup reel motor and hold-back power to the supply reel motor. The control circuitry also causes the tape to be lifted away from the heads. Tape is then rapidly wound onto the takeup reel. The rewind mode is similar to the fast-forward mode except that full power is applied to the supply reel motor, and the tape is rapidly wound onto the supply reel.

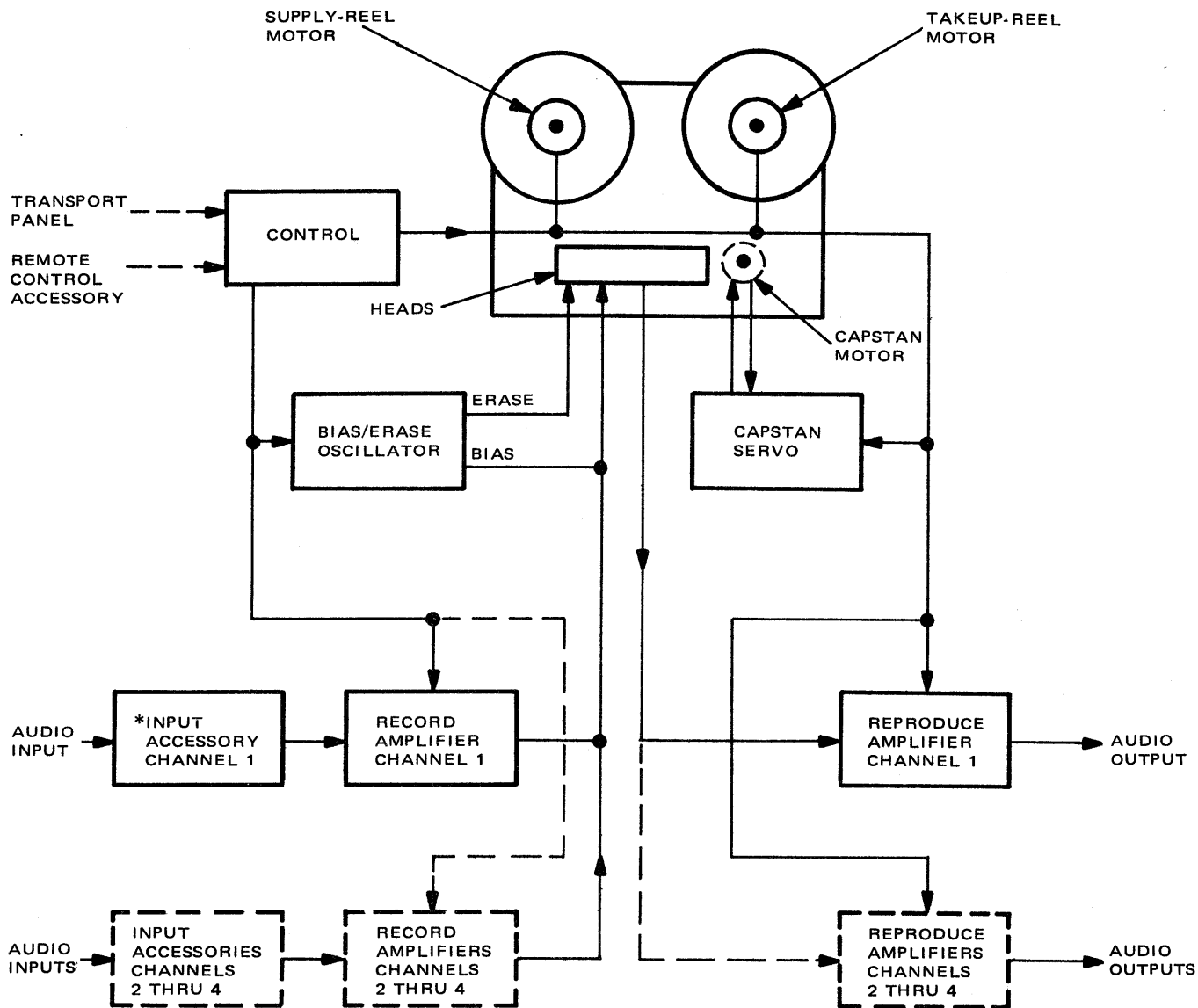
Edit

Three edit modes are selectable at the front panel of the recorder/reproducer: stop/edit, fast wind/edit, and play/edit. Selecting the stop/edit mode sets only the edit brakes of the tape-reel motors, thus facilitating manual cueing and threading of the tape. Selecting the play/edit mode causes the tape to be pulled past the heads and spilled off the right side of the transport. This mode is typically used when unwanted tape is to be cut off. The fast-wind/edit mode brings the tape into contact with the heads while the tape is being moved in the fast-forward or rewind modes, making the recorded portions audible for high speed search.

DETAILED CIRCUIT DESCRIPTION

CONTROL CIRCUITRY

The control circuitry is principally located on the tape transport and the transport control printed wiring assembly (PWA). Figures 4-2 through 4-7



*BRIDGING TRANSFORMER, MATCHING TRANSFORMER, OR MICROPHONE PREAMPLIFIER.

Figure 4-1. AG-440C Recorder/Reproducer, System Block Diagram

provide simplified functional versions of the complete schematic diagrams found in Section VI of this manual.

The transport control circuits utilize three DC power supplies: 130 Vdc (CR602 through CR605) to operate the solenoids, 24 Vdc (CR113 through CR116) to operate the relays and logic circuitry,

and the 39 Vdc electronics power supply which supplies logic power when the 24V power supply is deactivated by the safety switch.

Four relays are associated with transport functions: Play (K602), Edit (K603), Fast Forward (K604), and Rewind (K601). These relays control the power to the solenoids and motors in addition

to performing logic functions. The transistor logic located on the plug-in printed wiring board coupled with the logic of the relays, control energizing of these relays.

The general functions of transistors on the logic board are described below:

- Q101 } Fast wind motion sense.
- Q102 }
- Q103 }
- Q104 } Stopping the play and edit modes (de-
- Q107 } activation of the play and edit relays).
- Q105 } Record stop delay which delays the stop-
- Q106 } ping of the transport until the bias decays.
- Q106 } Record detector that senses when any
- Q108 } electronics is recording.
- Q108 } Fast wind stopping, when the PLAY
- Q109 } pushbutton is pressed.
- Q109 } Play memory circuit which remembers
- Q110 } that the PLAY button was pressed during
- Q111 } a fast wind mode.

Play Mode

The tape transport will enter the play mode whenever the play relay (K602) is energized. Relay K602 is energized by application of a positive voltage to relay pin 14 if Q107, in the ground leg of the relay, is in a conducting state. The play mode is terminated by turning off Q107. Transistor Q107 also controls the turn off, or inhibiting, of the edit relay (K603).

Positive voltage can be applied to the play relay via three paths: PLAY pushbutton S608, remote control PLAY pushbutton, and the play memory circuit (Q109, Q110 and Q111). The play memory circuit remembers that the PLAY pushbutton was pushed during a fast wind mode and when the tape comes to a stop, the play relay is energized. Detailed operation of the play memory circuit is explained after the turn-off action of Q107 is discussed.

In the standby condition, Q107 is held in a conducting state by two means: application of +24V to the base of Q107 through CR111, R116 and CR112, or application of +39V to the base of

Q107 through CR110, VR102, R116 and CR112. Q107 can be turned off or inhibited by several means. If Q104 conducts, the base drive to Q107 is shunted to ground through the collector of Q104 and R110. If the FAST FWD or REWIND push-buttons are pressed, Q104 is turned on by application of a positive voltage through the normally open pushbutton contacts CR107 or CR106, and R109. Transistor Q104 will also conduct when the local or remote STOP pushbutton is pressed. Pressing STOP removes a ground from the junction of R113 and CR109 and turns on Q104 by delivering base drive through R113, CR109 and R109. If Q106 (the record detector explained in the *Control Circuitry/Record Mode* text) is turned on, the ability of Q104 to turn off Q107 is overridden, since Q106 applies additional positive current to the base of Q107 through R118 and CR112. Therefore, pressing FAST FWD or REWIND will not stop the play mode if the recording process is active.

Q107 will also be turned off whenever the fast motion circuit (Q101, Q102, and Q103) is active (discussed in *Control Circuitry/Fast-Forward* text). Base drive is removed from Q107 by conduction of Q103 through CR104. Operation of the play memory circuit is described in the following paragraph.

Whenever fast wind motion is present, the junction of CR121 and CR120 is held positive; either through Q108, K604-11/7 or K601-11/7 and CR117, or through R105, Q101, and CR101 (during fast-wind deceleration). However, this positive voltage will not turn on Q109, Q110 or Q111 and they will remain off until the PLAY button is pressed. At this time Q108 turns off since CR119 back-biases the emitter-base junction of Q108 and the fast forward or rewind relay de-energizes. The positive edge of the pulse created when the PLAY button is pressed passes through C109, R122 and CR122 to the base of Q111. This causes Q111 to conduct, which causes Q110 to conduct. Q110 now supplies the base drive to Q111 through R124 and CR120. Transistors Q110 and Q111 latch into the conducting state and remain latched as long as the CR120/CR121 junction is high or a charge is present on C108. When the junction of CR120 and CR121 is high, CR120 acts as a forward-biased diode to charge C108. When this junction falls to ground potential, after fast wind tape motion has

stopped, CR120 acts as a zener diode to remove most of the charge from C108.

Even though Q111 is conducting, Q109 (which supplies positive voltage to the play relay) cannot conduct because its base circuit is back-biased by CR121. When tape motion finally stops, the positive voltage is removed from the junction of CR121 and CR120. However, the Q110/Q111 latch remains conducting due to the charge on capacitor C108. The base of Q109 will now conduct through VR103, R121, Q111, CR123 and STOP button S606 to ground. Therefore, Q109 will supply a positive pulse to the play relay and the tape transport will enter the play mode, since Q107 has also returned to its normal conducting state.

Contact set K602-9/5 supplies +24 Vdc via CR609 to the coil of relay K602 to keep it energized after the positive levels from the local PLAY pushbutton, remote PLAY pushbutton, or play memory circuit are gone. In addition, the positive level supplied through contact set K602-9/5 keeps the capstan servo (if used) enabled.

Contact set K602-10/6 (Figure 4-2, Sheet 2), supplies 80 Vac to the takeup tension (R606) and holdback tension (R607) resistors. Each of these variable resistors has two movable contacts. One of the movable sliders on R606, R607 is used to adjust tape tension when using a small tape reel, and the other movable slider of R606 and R607 is used for large reel tape tension adjustment. A REEL switch for each resistor (R606 and R607) is used to select the appropriate movable contact. The output of R606 is routed through contact set K604-2/10 to the takeup motor (B602). The opposite side of the takeup motor (B602) is connected to the AC neutral line through contact set K603-4/12 of the edit relay and the safety switch (S603) of the tension arm. The output of R607 is routed through contact set K601-2/10 to the rewind motor. The opposite side of the rewind motor (B603) is connected to AC neutral through the safety switch (S603) of the tension arm. Resistor R602 and capacitor C611, resistor R605 and capacitor C613 and capacitor C610 minimize contact arcing.

Contact set K602-8/12 connects +130 Vdc to the rewind main brake solenoid (K607) and to the

takeup main brake solenoid (K605) through contact set K603-3/11 of the edit relay. Capacitor C615 shunts inductive transients to ground.

Contact set K602-7/11 connects +130 Vdc to the capstan solenoid (K610). Diode CR615 dampens the inductive kick when the solenoid is de-energized.

With the reel motors energized, the main reel brakes disengaged by the main brake solenoids, the capstan servo enabled (if applicable), and the capstan pinch roller pulled in by the capstan solenoid, the tape is pulled forward at the correct speed and tension for the play mode.

Record Mode

The record mode is initiated by pressing the local or remote RECORD and PLAY pushbuttons. Pressing either PLAY pushbutton initiates the circuit action described in the *Control Circuitry/Play Mode* text. Pressing either RECORD pushbutton connects the +24 Vdc present at pin 9 of relay K602 to the base circuit of transistor 9Q1. (See Figure 4-3.) Providing the local or remote STOP pushbutton is not depressed and the SAFE/READY switch is set to READY, the positive level at the base of transistor 9Q1 turns on the transistor. The collector current of transistor 9Q1 is supplied to the bases of transistors 9Q2 and 9Q3. The collector current of transistor 9Q2 keeps transistor 9Q1 conducting. The emitter current of transistor 9Q2 is routed through diode 9CR1 and resistor 9R5 to the base of transistor Q106 (Figure 4-2), which turns on Q106. The current supplied to the base of transistor 9Q3 (Figure 4-3) turns it on. In turn, the collector current of transistor 9Q3 turns on transistor 9Q4 and, after a delay caused by capacitor 8C1, 9Q3 turns on the bias/erase amplifier. Turning on transistor 9Q4 causes relay 4K1 to energize and the RECORD lamp to light. In addition, turning on transistor 9Q4 provides another path for base current of transistor Q106 (Figure 4-2).

With transistor Q106 turned on, the resulting high level at its collector forward biases the base/emitter junction of transistor Q105. Transistor Q105 and capacitor C105 form a stop-memory circuit that is only active in the record mode. When either the local or remote STOP pushbutton is pressed,

capacitor C105 charges through diode CR109 and resistor R113 (Figure 4-2). Also, the emitter circuit of transistor 9Q1 is opened (Figure 4-3).

Opening the emitter circuit of 9Q1 turns off transistor 9Q1, 9Q2, and 9Q3. Transistor 9Q4 is held on by the charge on capacitor 8C1, which keeps record relay 4K1 energized and transistor Q106 conducting (via 9R6 and 9CR2). (See Figures 4-2 and 4-3.) Consequently, transistor Q107 is held on by the collector current of Q106, which keeps play relay K602 energized. As soon as 9Q3 turns off, the voltage on 8C1 starts to decay, causing the bias and erase voltage to decay.

The time constant associated with capacitor C105 (Figure 4-2) is longer than that associated with 8C1 (Figure 4-3). As a result, transistor Q104 is still conducting when the charge on 8C1 becomes low enough to turn off the bias/erase amplifier and transistor 9Q4. Turning off 9Q4 turns off the record relay 4K1, the RECORD lamp, and transistor Q106. Turning off Q106 allows Q104 to turn off Q107, which turns off play relay K602, thus causing the tape to be stopped. When C105 has discharged enough to turn off Q104, transistor Q107 is turned on again by the current flowing through R116, CR112, and the base/emitter junction of Q107 returning the circuit to the standby condition. The technique of slowly turning off the bias/erase oscillator before the tape is stopped prevents switching transients from being recorded.

Fast-Forward Mode

The fast-forward mode is initiated by pressing the local or remote FAST FWD pushbutton. In either case, a nominal +24-volt level is applied through diode CR107 (Figure 4-4) to the base circuit of transistor Q104 (Figure 4-2) and through diode CR108 (Figure 4-4) to relay K604.

If the play mode is in operation, the positive level applied to the base circuit of Q104 (Figure 4-2) immediately turns it on. Turning on Q104 turns off Q107, which de-energizes play relay K602. As a result, the play mode is terminated before fast-forward becomes active.

If the record mode is in operation when fast-forward is pressed, transistor Q106 prevents Q104 from turning off Q107 as described in the *Control*

Circuitry/Record Mode. This prevents the tape transport from entering a fast mode during recording.

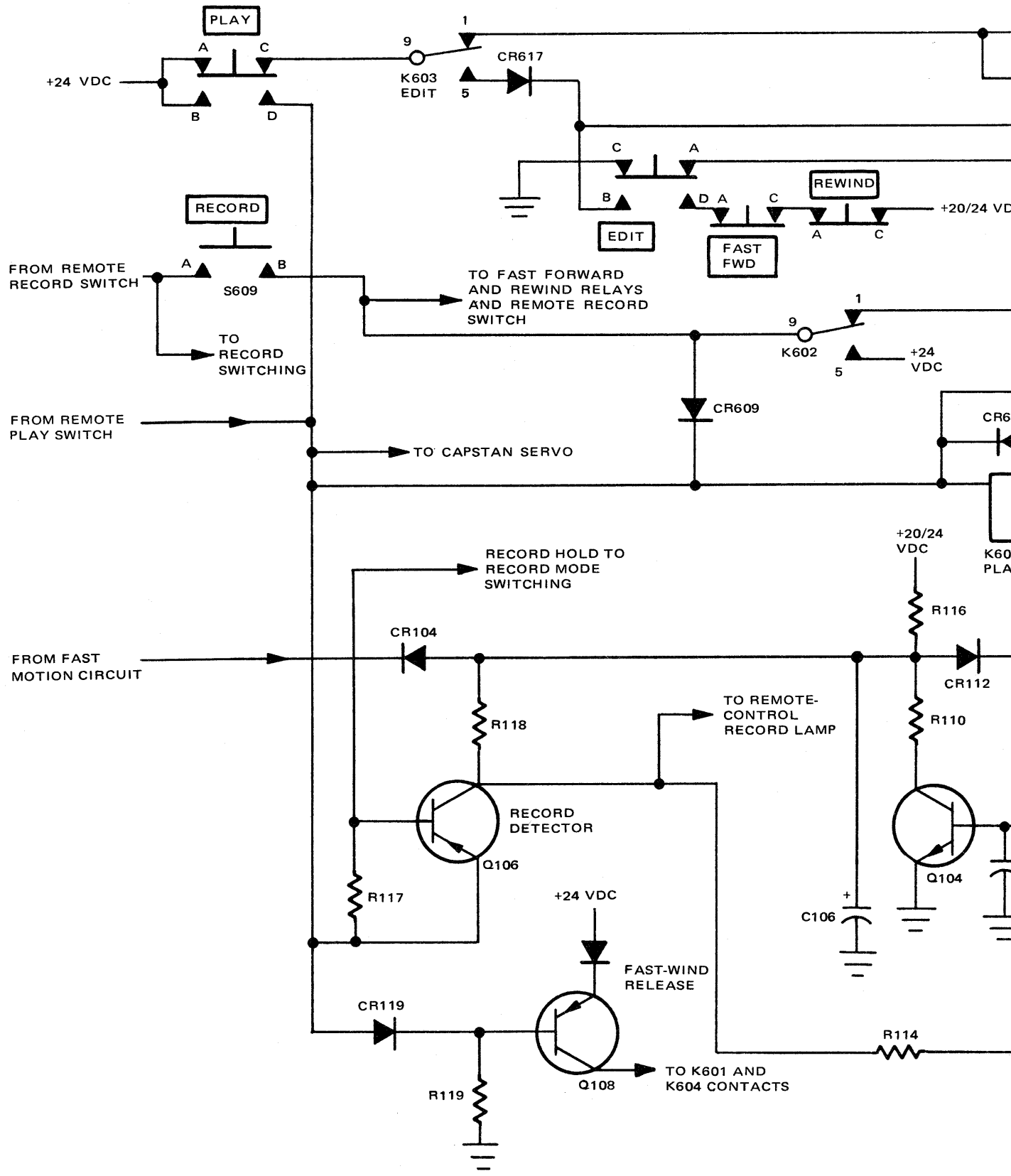
Providing the local or remote STOP pushbutton is not depressed (Figure 4-4) and play relay K602 is not energized, the coil of relay K604 is energized when the local or remote FAST FWD pushbutton is pressed. Energizing the coil of relay K604 transfers its associated contact sets, causing the circuit action described in the following paragraphs.

Contact set K604-5/9 and K601-3/11 connects a nominal +24-volt level from the collector of normally on transistor Q108 to the coil of relay K604 to keep it energized. The return path for the relay current is through play relay contacts K602-9/1, CR610 and STOP pushbutton S606 to ground. Thus, the recorder/reproducer is held in the fast-forward mode after the FAST FWD pushbutton is released.

Contact set K604-7/11 connects a nominal +24-volt level from the collector of transistor Q108 to the coil of relay K101. As a result, relay K101 is energized; and its closed contact set connects +130 Vdc to the tape-lifter solenoid (K609), which energizes the solenoid. Diodes CR102 and CR616 dampen the inductive transient produced when the coils of K101 and K609, respectively, are de-energized.

Contact set K604-6/10 connects either 80 Vac or 117 Vac (depending on setting of the REEL switch) to the takeup motor (B602) and variable resistor R603 (fast motion holdback). The output of R603 is applied to the supply motor (B603). The takeup motor is connected through contact set K603-4/12 to the safety switch (S603) on the tension arm, and the supply motor is connected directly to the safety switch. With the tape properly threaded, the safety switch is closed, and the AC circuits for the takeup and supply motors are completed. Resistor R605 and capacitor C613 and capacitor C610 minimize contact arcing.

Contact set K604-8/12 connects +130 Vdc to the supply main brake solenoid (K607) and to the takeup main brake solenoid (K605) through contact set K603-3/11 of the edit relay. Capacitor C615 suppresses inductive transients.



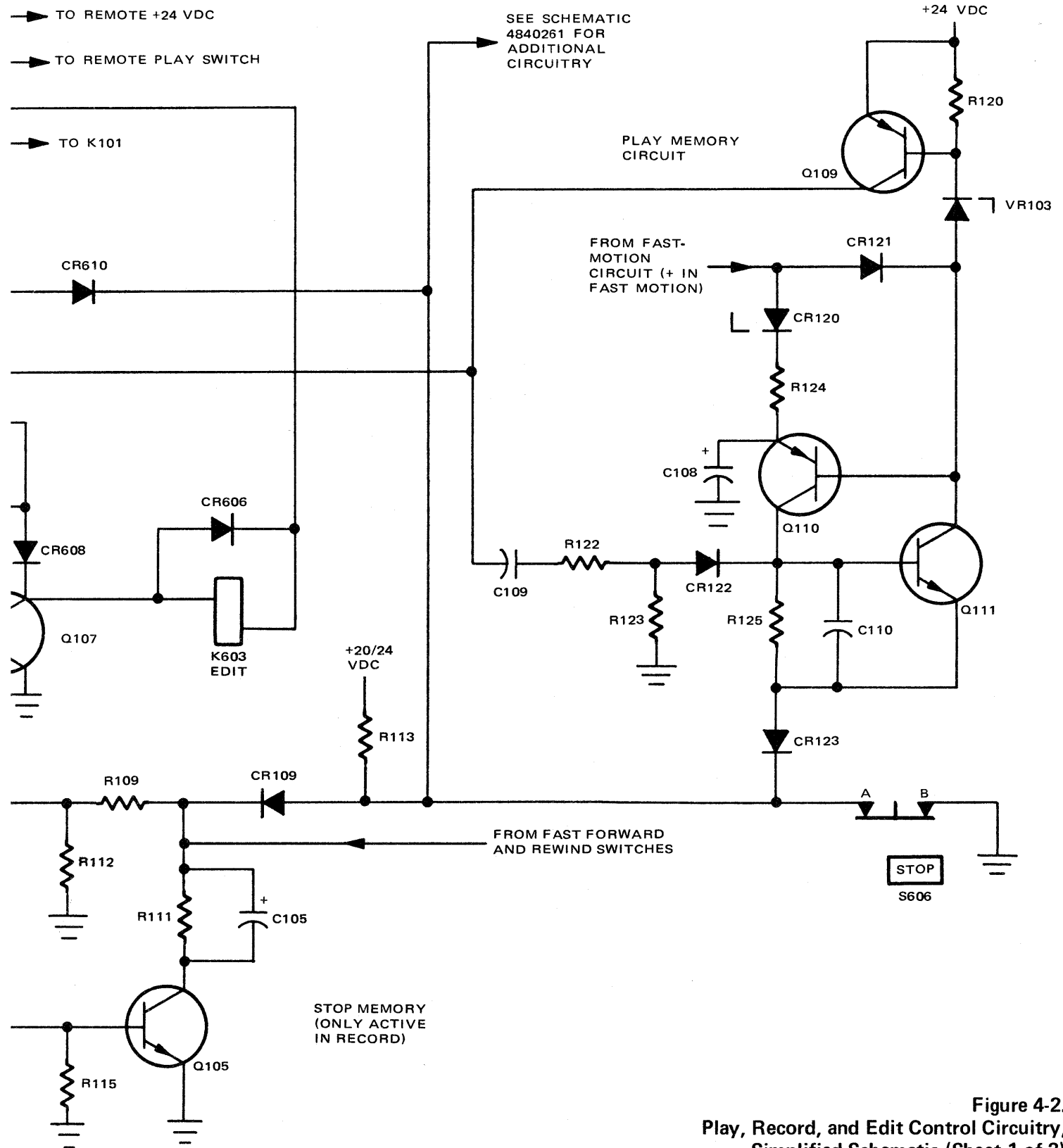
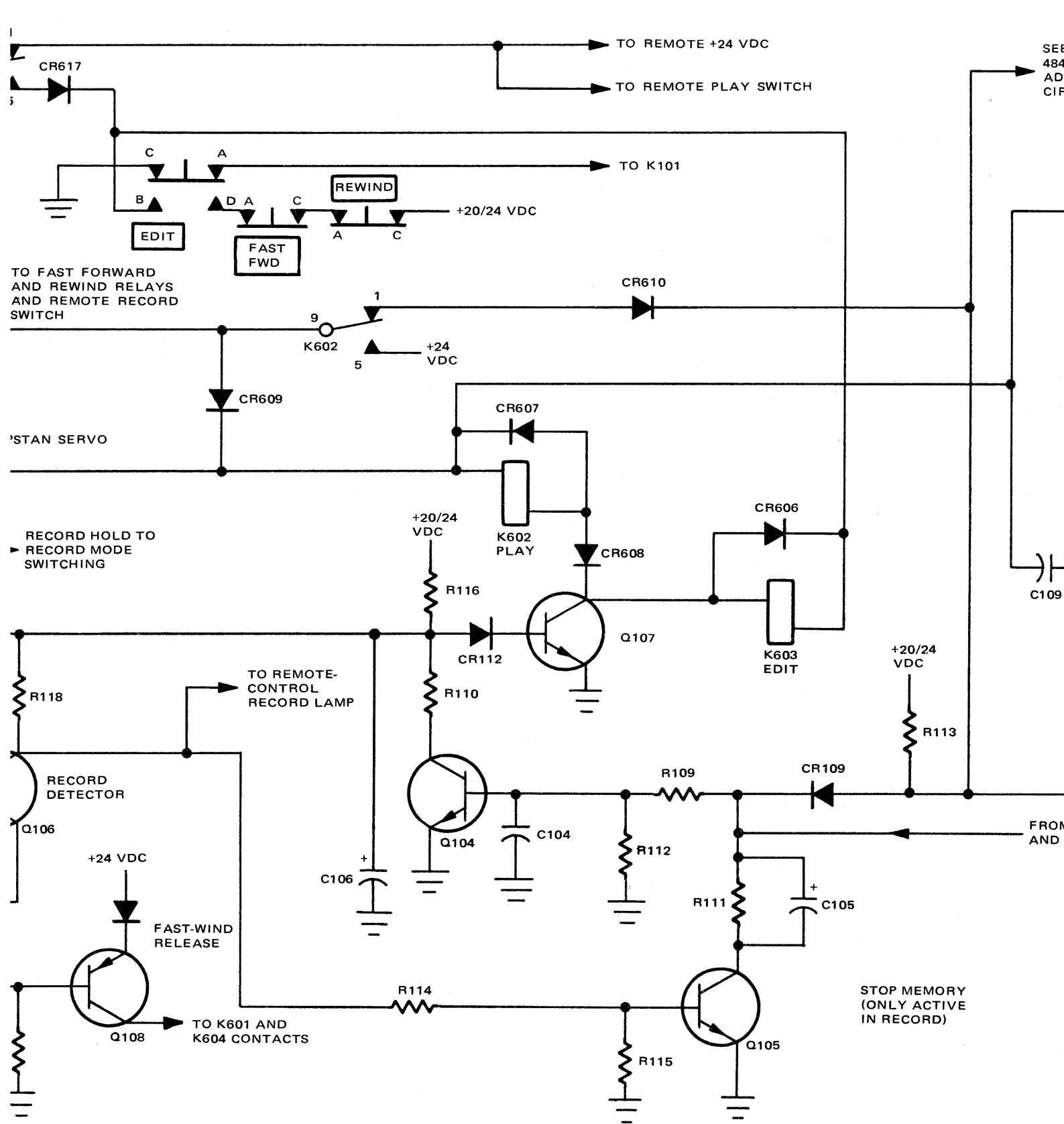
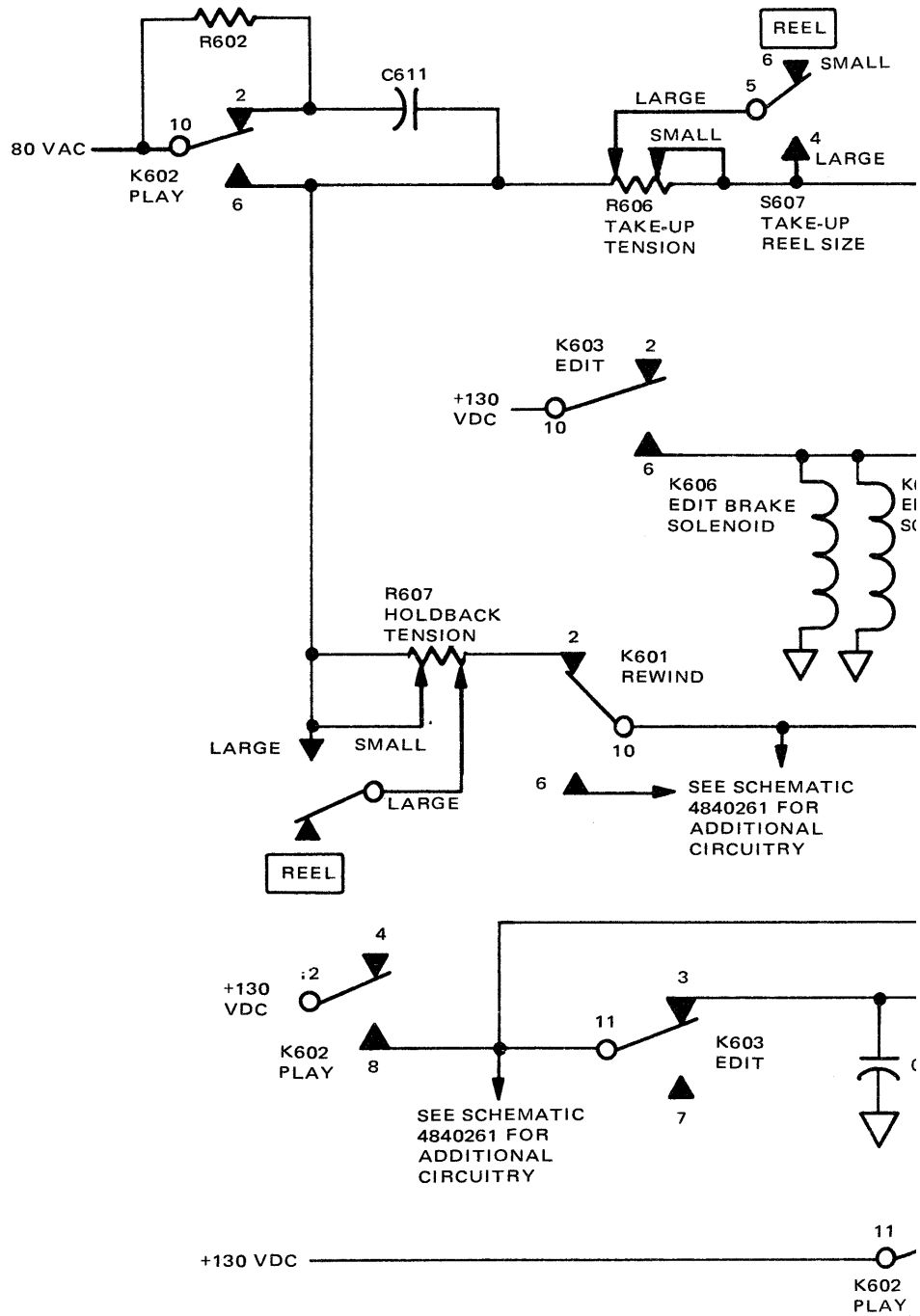
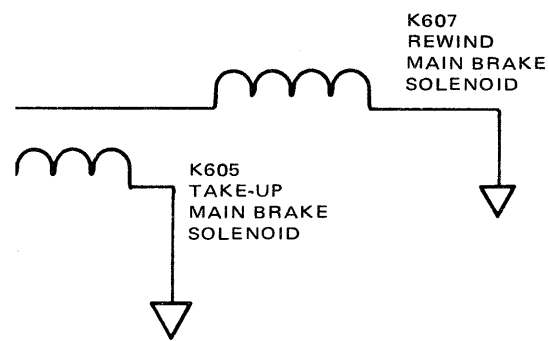
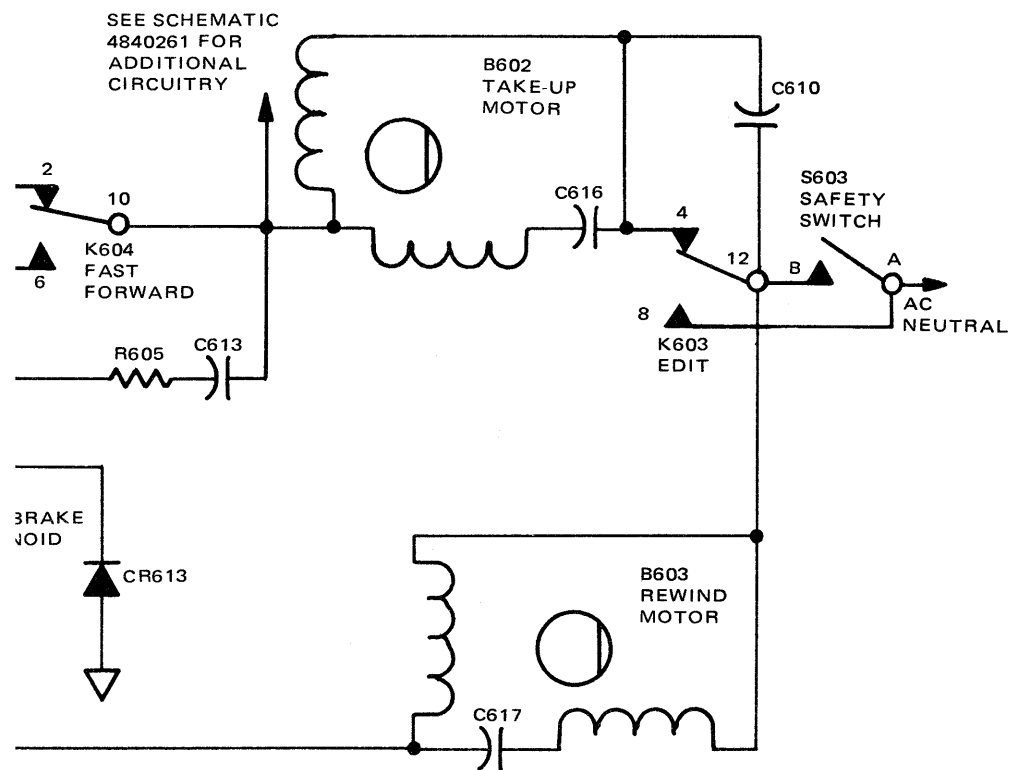


Figure 4-2.
Play, Record, and Edit Control Circuitry,
Simplified Schematic (Sheet 1 of 2)







NOTE:
= 130-VDC
RETURN

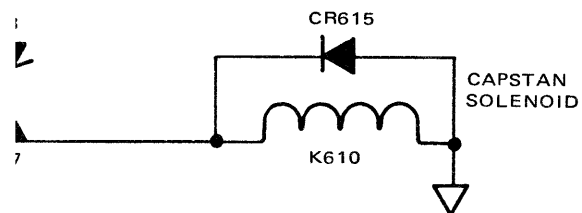
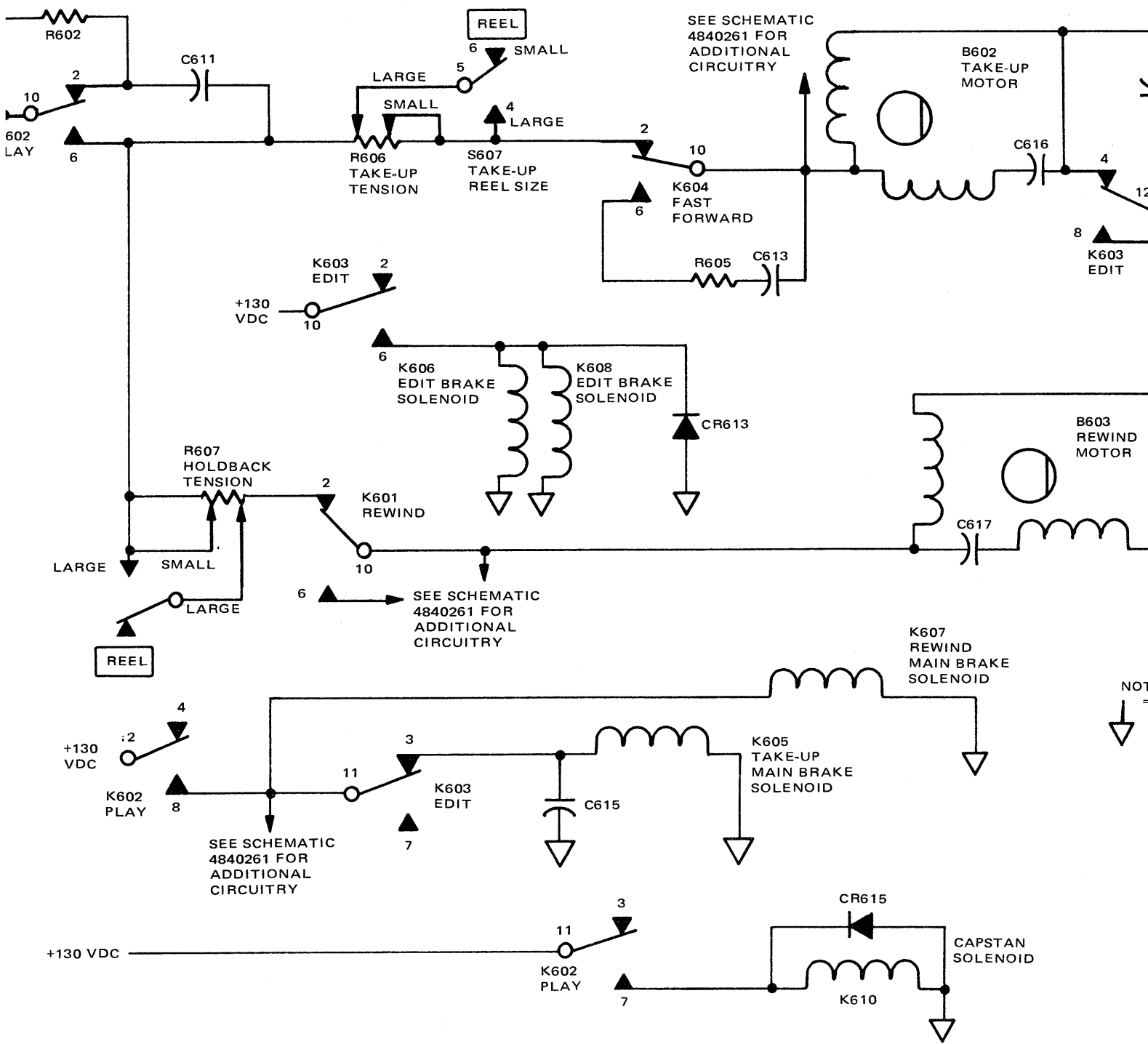
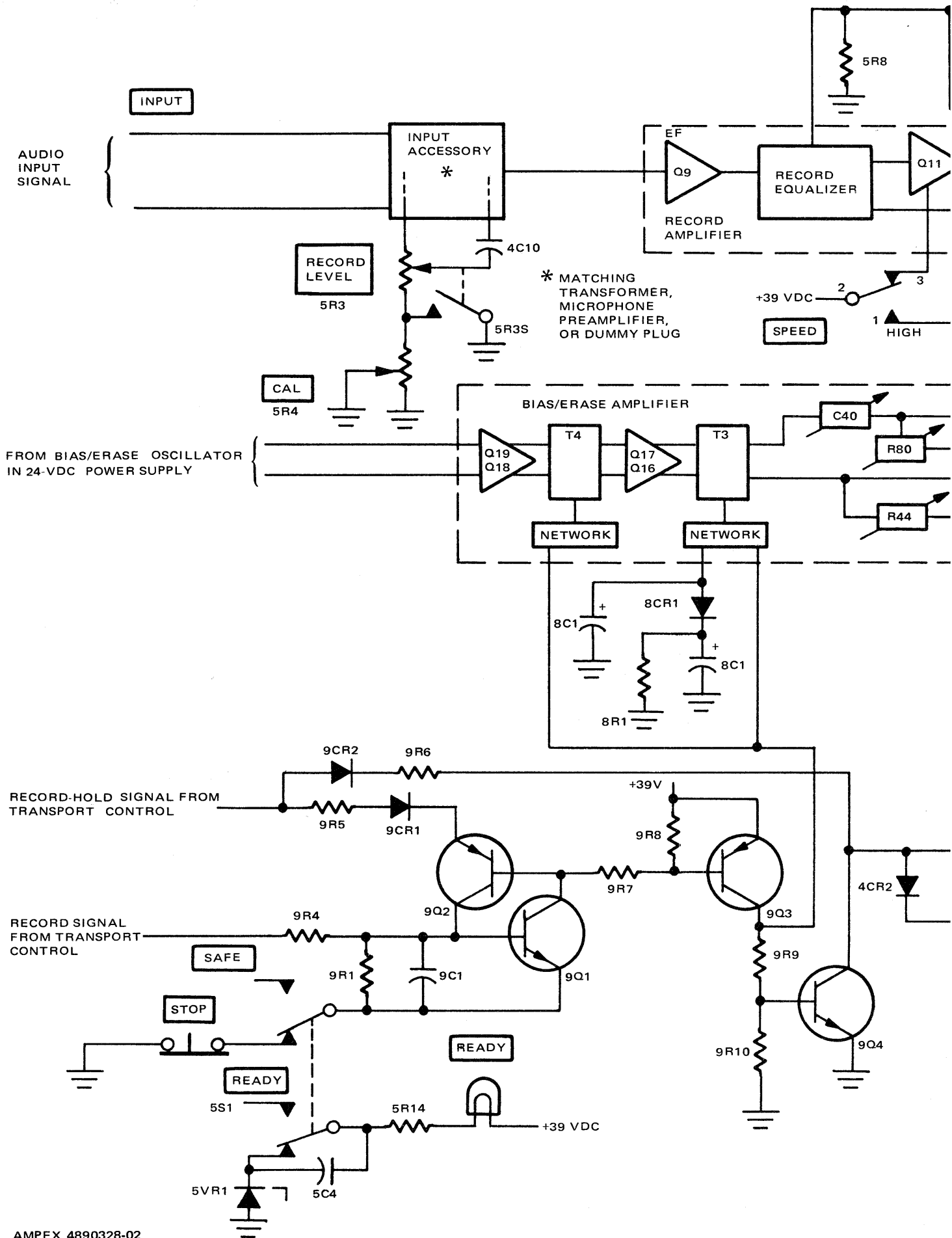
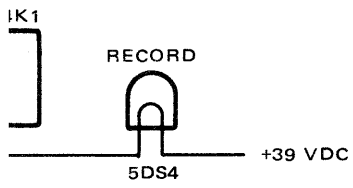
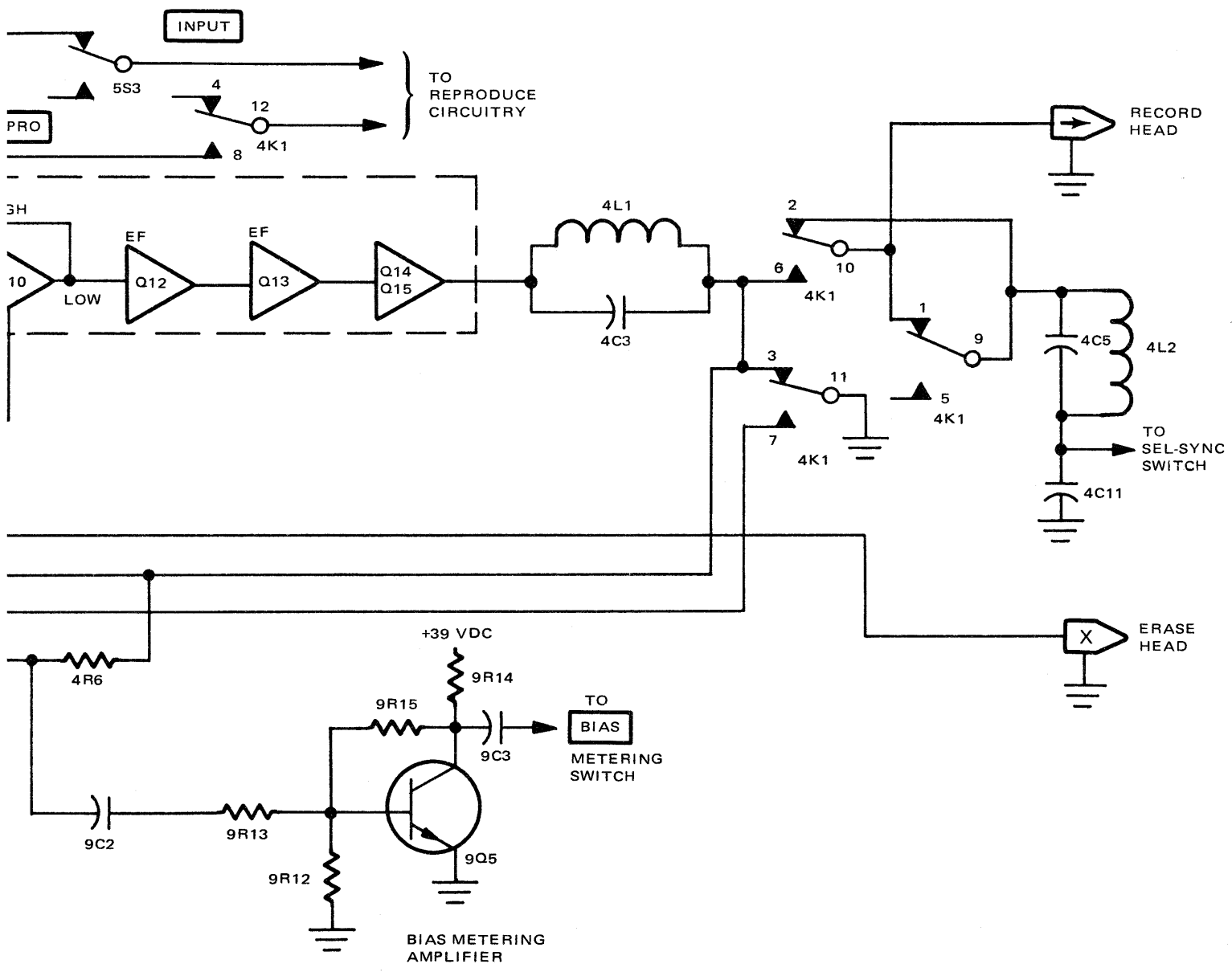


Figure 4-2.
Play, Record, and Edit Control Circuitry,
Simplified Schematic (Sheet 2 of 2)



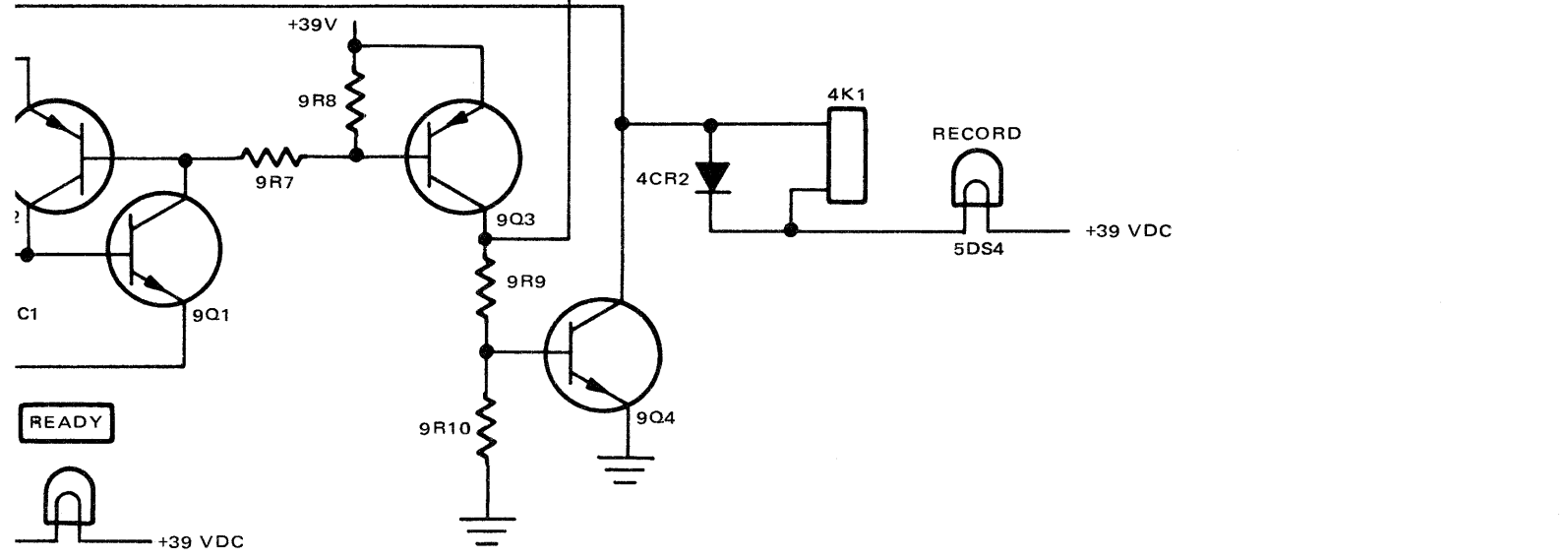
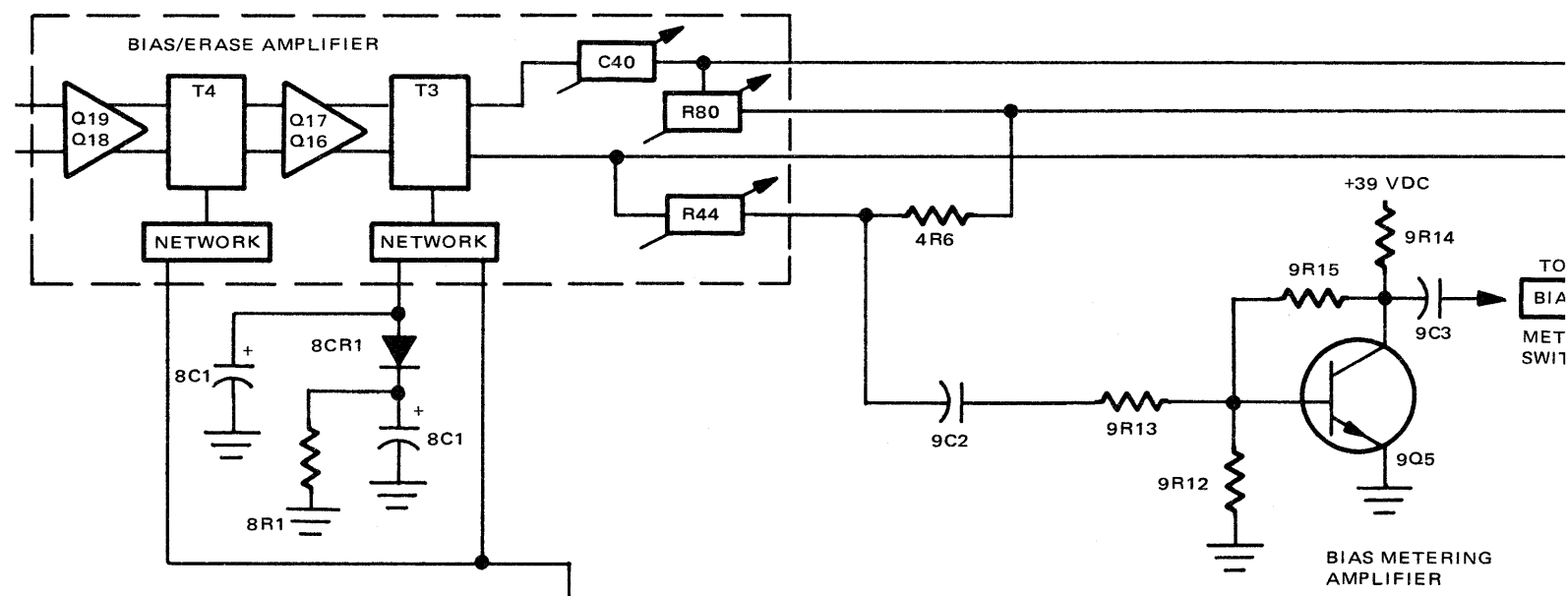
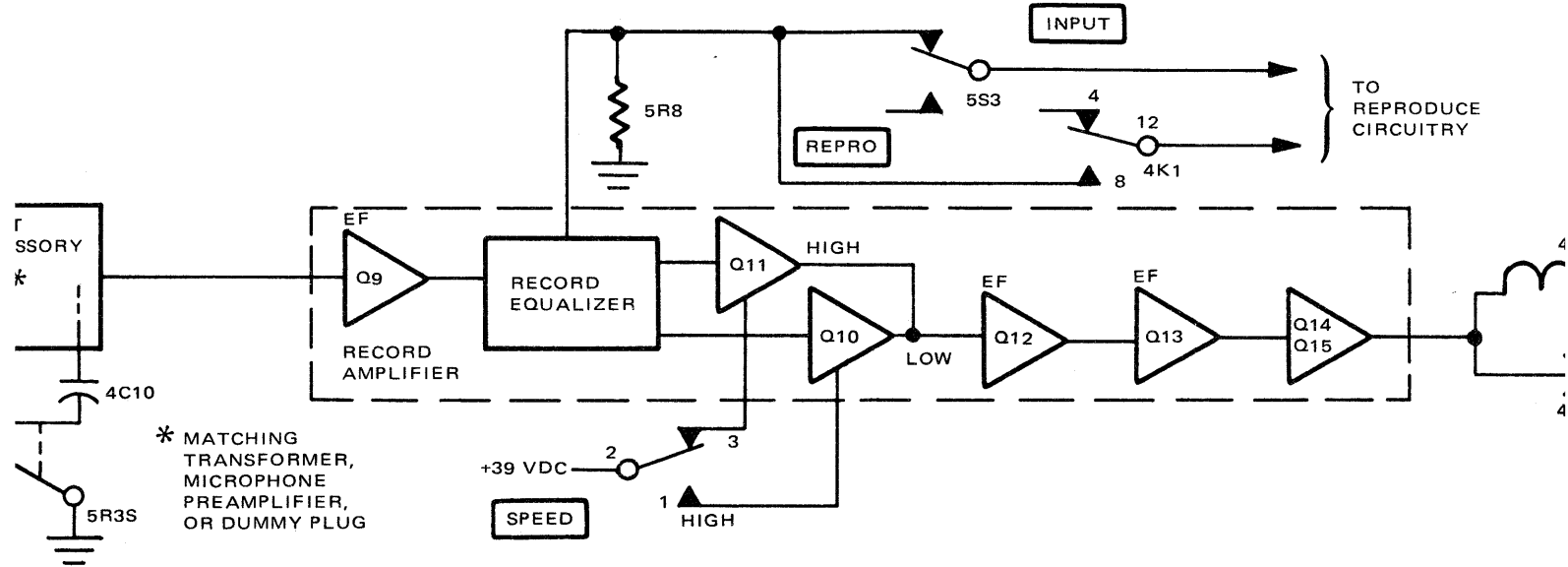
NOT

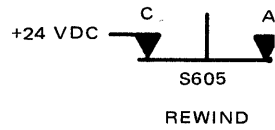




REFERENCE DESIGNATOR PREFIX CODE:
 4 BACK PANEL
 5 FRONT PANEL
 8 SIDE PANELS
 9 RECORD CONTROL BOARD

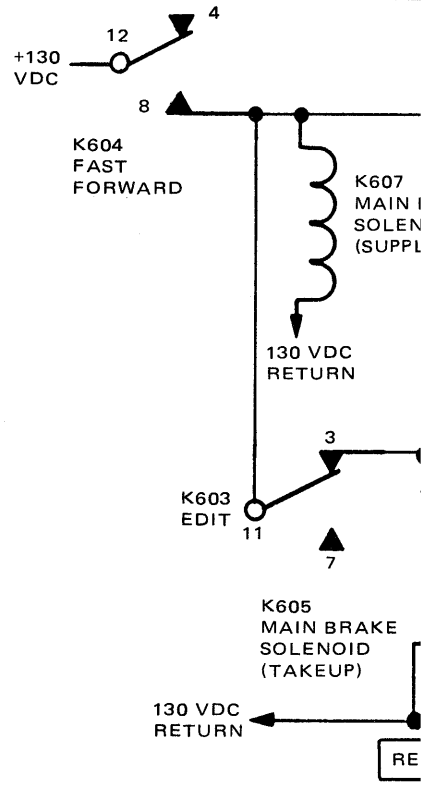
Figure 4-3.
 Record Mode Signal Path and Control Circuitry,
 Simplified Schematic





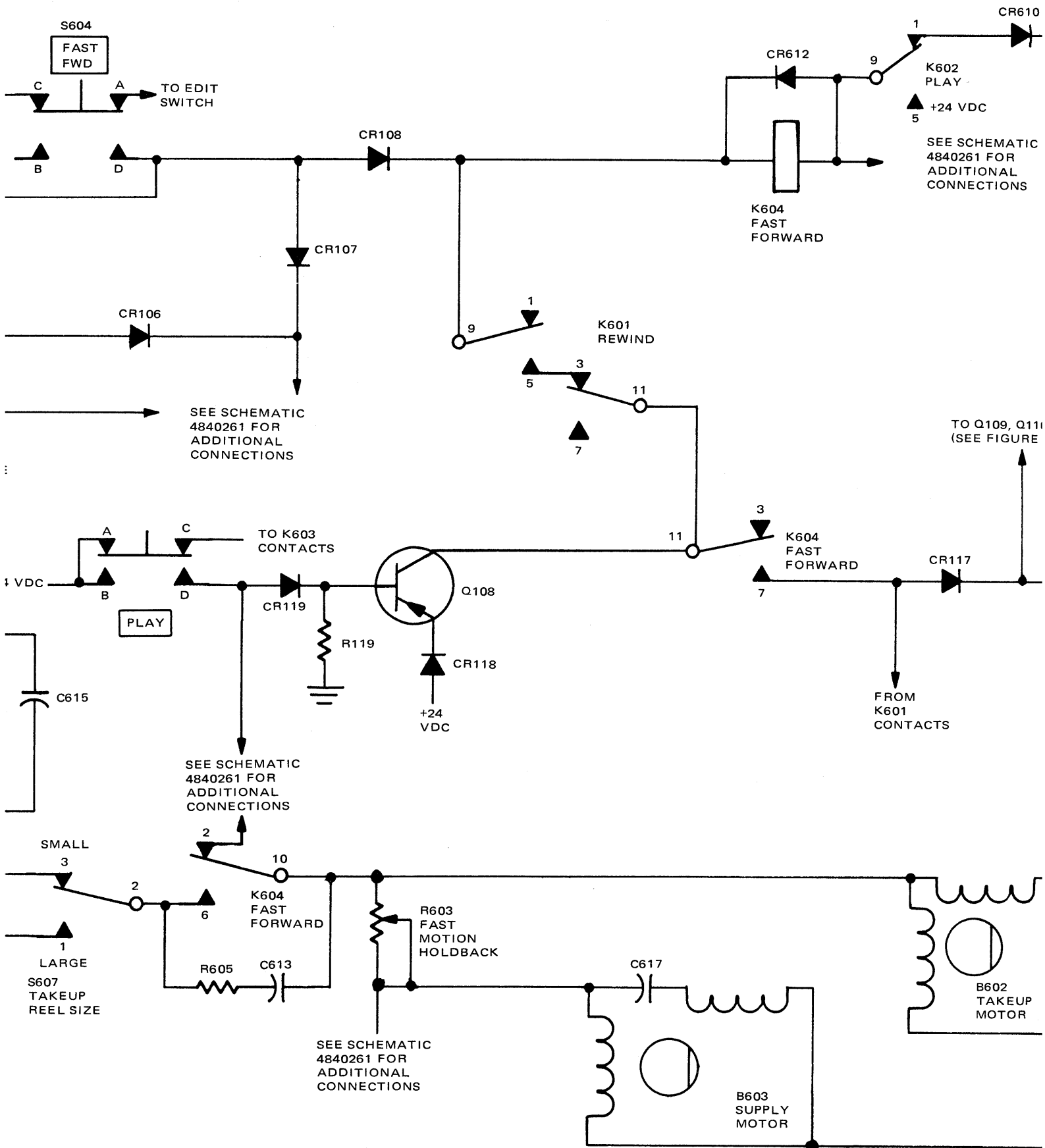
FROM REMOTE
FAST FORWARD
SWITCH

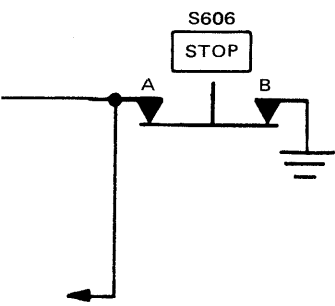
FROM REMOTE
AND LOCAL
REWIND SWITCHES



80

117





Q111
2)

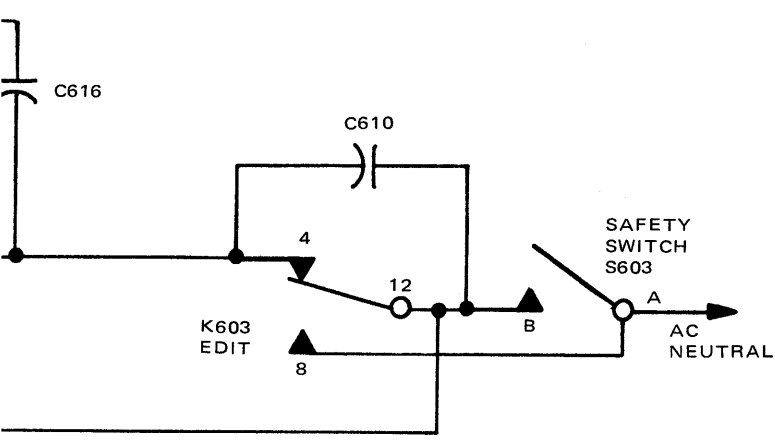
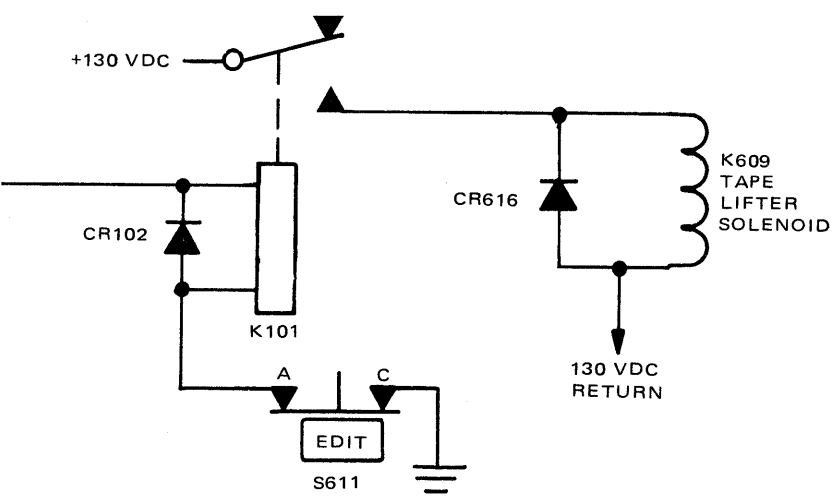
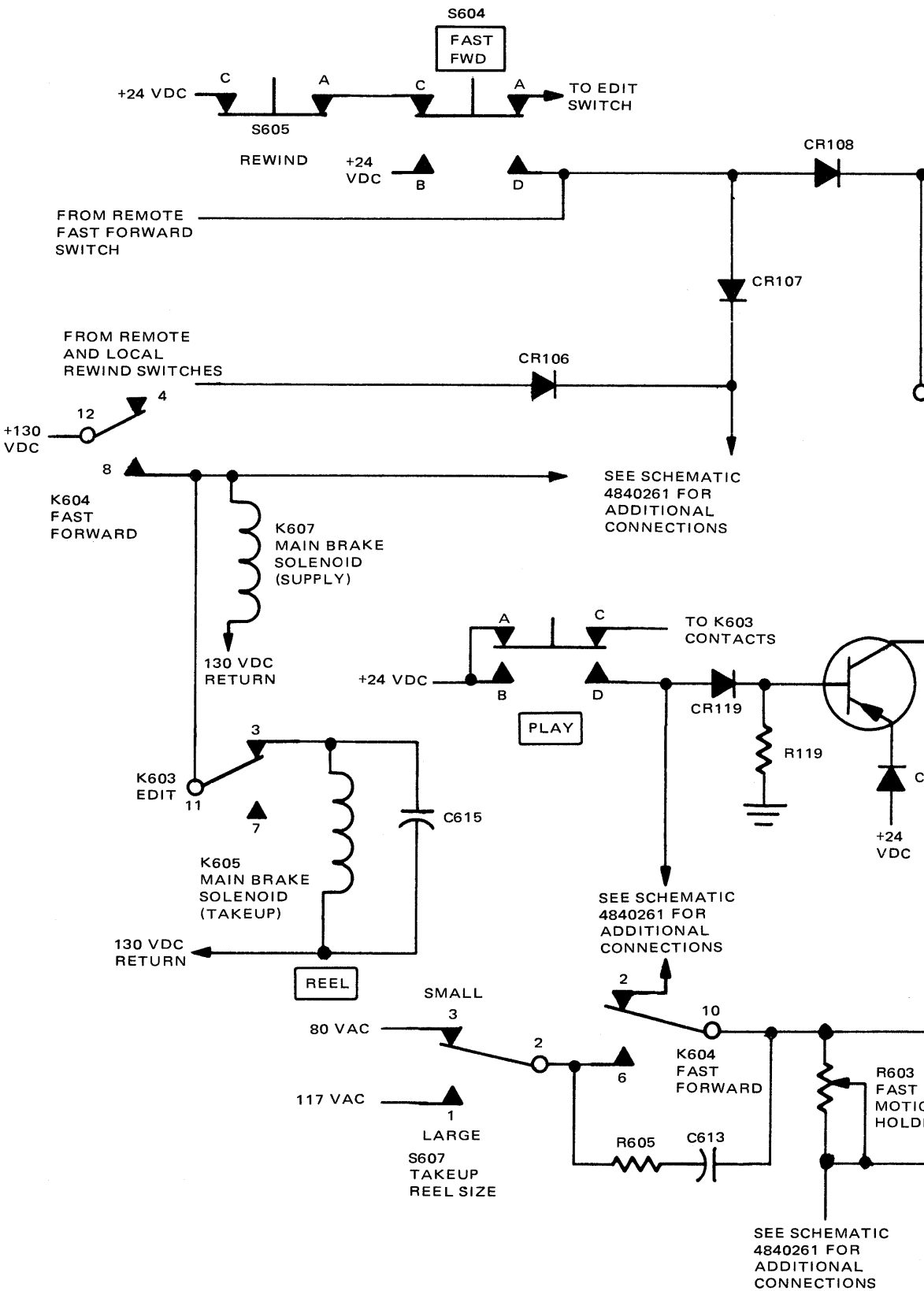
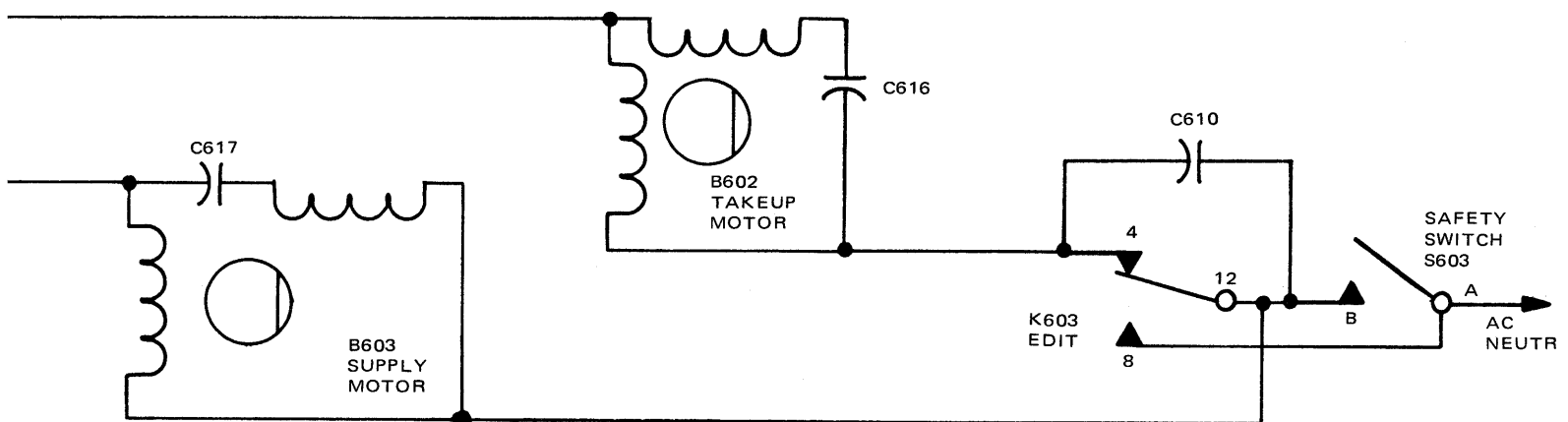
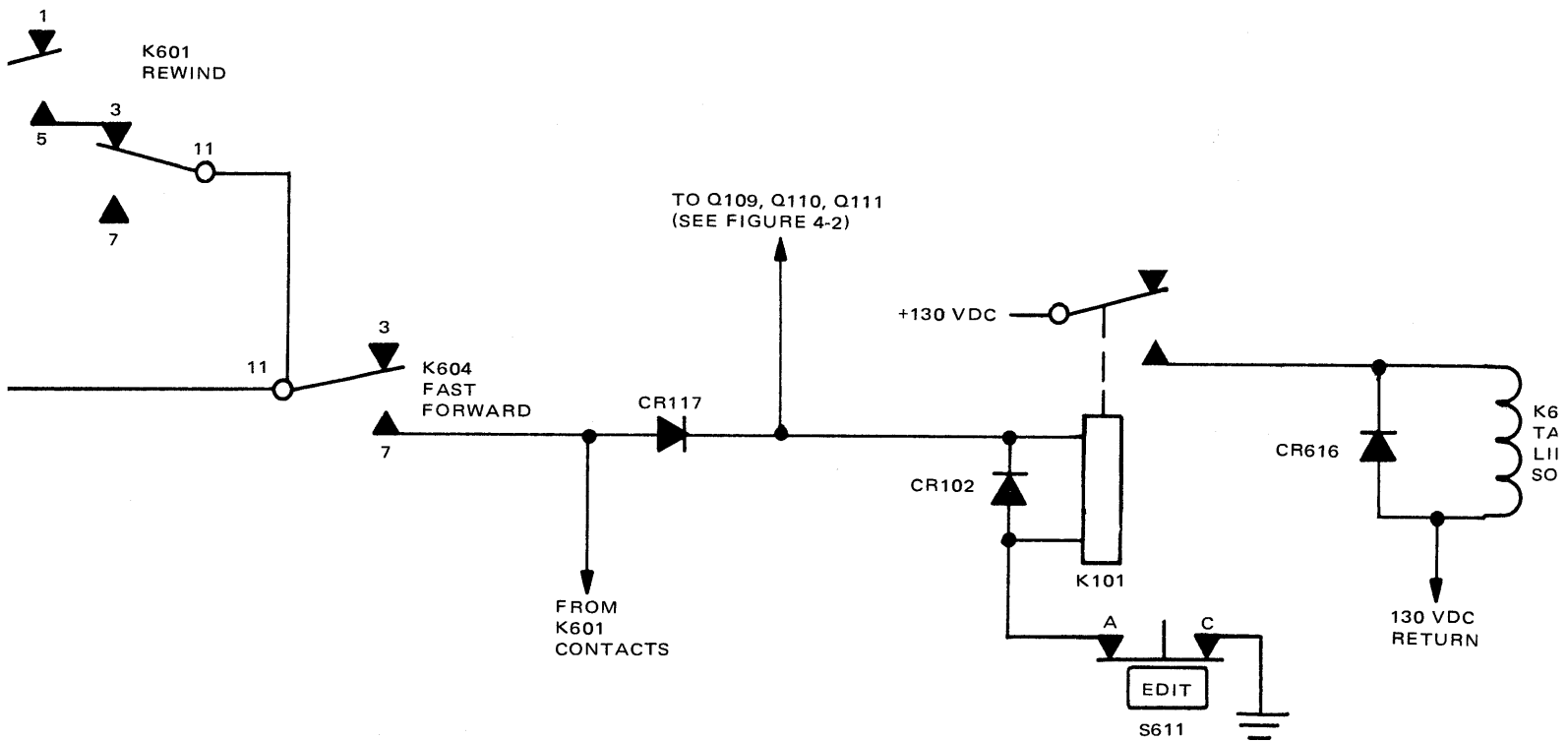
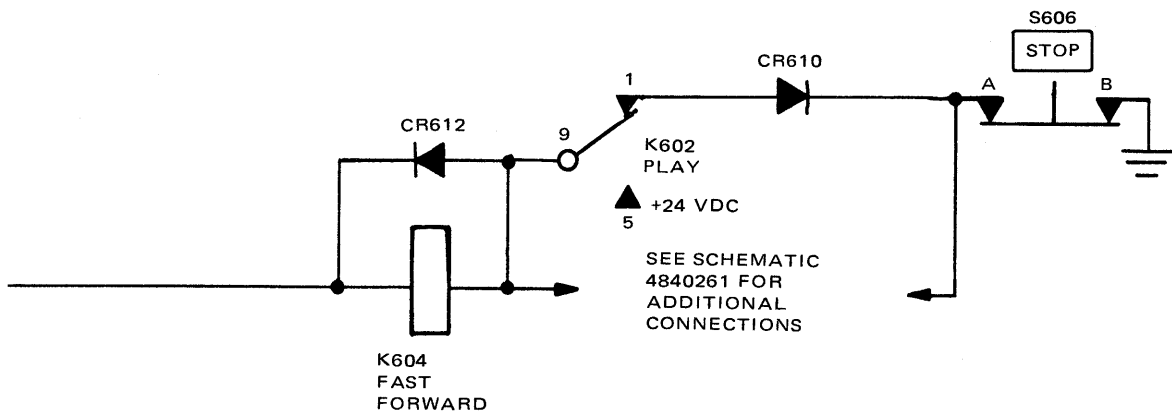


Figure 4-4.
Fast Forward Mode,
Simplified Schematic





With the reel motors energized, the main reel brakes disengaged by the main brake solenoids, and the tape lifted from the heads by the tape-lifter solenoid, and tape is rapidly wound onto the takeup reel. Fast-forward is terminated by pressing the STOP pushbutton to interrupt the current in relay K604. Fast-forward is also terminated when the PLAY pushbutton is pressed. PLAY pushbutton S608 connects the nominal 24 volts through CR119 to the base of Q108. This back-biases the base-emitter junction of Q108, and the turn-off of Q108 removes the 24-volt holding voltage to K604.

Rewind Mode

The rewind mode is similar to fast-forward and is initiated by pressing the local or remote REWIND pushbutton. In either case, a nominal +24-volt level is applied through diode CR106 (Figure 4-5) to the base circuit of transistor Q104 (Figure 4-2) and through diode CR105 (Figure 4-5) to relay K601. The application of the positive level to transistor Q104 produces the same circuit action described in the fast-forward text.

Providing the local or remote STOP pushbutton is not depressed and relay K602 is not energized, the coil of relay K601 is energized when the local or remote REWIND pushbutton is pressed. Energizing the coil of relay K601 transfers its associated contact sets, causing the circuit action described in the following paragraphs.

Contact set K601-5/9 and K604-3/11 connects a nominal +24-volt level from the collector of normally on transistor Q108 to the coil of relay K601 to keep it energized. The relay current return path is the same as for the fast-forward relay. Thus, the recorder/reproducer is held in the rewind mode after the REWIND pushbutton is released.

Contact set K601-7/11 connects a nominal +24-volt level from the collector of transistor Q108 to the coil of relay K101. Consequently, relay K101 is energized; and its closed contact set connects +130 Vdc to the tape-lifter solenoid (K609), which energizes the solenoid. Diodes CR102 and CR616 dampen the inductive transient produced when the coils of K101 and K609, respectively, are de-energized.

Contact set K601-6/10 connects either 80 Vac or 117 Vac (depending on setting of the REEL switch) to the supply motor (B603) and variable resistor R603 (fast motion holdback). The output of R603 is applied to the takeup motor (B602).

Contact set K601-8/12 connects +130 Vdc to the supply main brake solenoid (K607) and to the takeup main brake solenoid (K605) through contact set K603-3/11 of the edit relay. Capacitor C615 suppresses inductive transients.

With the reel motors energized, the main reel brakes disengaged by the main brake solenoids, and the tape lifted from the heads by the tape lifter solenoid, the tape is rapidly wound onto the supply reel.

Edit Mode

In play/edit and stop/edit, the edit relay (K603) is energized, but in fast-wind/edit K603 remains de-energized. As discussed in the previous text, transistor Q107 (Figure 4-2) is turned on in the play and stop modes and turned off in the fast-wind modes (via CR104). Thus, a low level is present on one side of the edit relay coil (K603) in the play and stop modes and a nominal open circuit in the fast-wind mode.

During the stop, play, or record mode, pressing the EDIT pushbutton energizes the coil of edit relay K603, causing its associated contact sets to transfer. Only contact sets K603-5/9 and K603-6/10 of the edit relay have any effect in the stop mode. Closing contact set K603-5/9 establishes a holding circuit for the edit relay. Closing contact set K603-6/10 (Figure 4-2) energizes the edit brake solenoids (K606, K608), which release the edit brakes. Energizing the edit brake solenoid allows the tape reels to be easily moved by hand. Thus, the stop/edit mode facilitates manual cueing and tape threading. The stop/edit mode is terminated by pressing the REWIND, FAST FWD, STOP, or PLAY pushbuttons. Pressing the REWIND, FAST FWD or STOP pushbuttons causes transistor Q104 to conduct, which reverse biases transistor Q107 and de-energizes the edit relay. Pressing the PLAY pushbutton (S608) removes the positive holding voltage from edit relay K603, through the normally closed contacts of S608. Diode CR613 dampens

the inductive transient produced by the edit brake solenoids when they are de-energized.

Pressing the EDIT pushbutton after selecting the play mode places the recorder/reproducer in the play/edit mode. As in the stop/edit mode, pressing the EDIT pushbutton establishes a holding circuit for the edit relay. In addition, contact set K603-7/11 breaks the circuit to the takeup main brake solenoid, which engages the takeup reel brake. Further, contact set K603-4/8/12 breaks the takeup motor circuit and disables the safety switch (S603). Consequently, the tape is pulled forward by the capstan and spilled off the right side of the transport because the takeup reel does not move. This mode is mainly used when unwanted tape is to be cut off. The play/edit mode is terminated by pressing the STOP, PLAY, FAST FWD, or RE-WIND pushbuttons.

The fast-wind/edit mode is selected by first selecting the fast-forward or rewind mode and then pressing the EDIT pushbutton. During the fast-wind modes, the fast-motion circuit furnishes a low level to the anode of diode CR112, back-biasing the diode and transistor Q107. Consequently, transistor Q107 is turned off; and the edit relay (K603) cannot be energized. Thus, the edit relay cannot modify fast-wind operation. However, relay K101 is de-energized through normally closed contacts of S611, as long as the EDIT pushbutton is depressed (Figure 4-4). As a result, the tape-lifter solenoid is de-energized, the tape remains in contact with the heads, and any audio material on the tape is reproduced. This mode is primarily used for quickly reaching a desired portion of the recorded material.

Stop Mode

Pressing the STOP pushbutton deactivates any mode of operation. If the fast-forward mode is active, pressing the STOP pushbutton de-energizes fast-forward relay K604. (See Figure 4-4.) De-energizing K604 transfers its associated contact sets, which de-energizes the reel motors, applies the main reel brakes, and relaxes the tape-lifter mechanism. Similar shut-down action occurs if the STOP pushbutton is pressed during the rewind mode.

Pressing the STOP pushbutton also removes the ground from the junction of CR109 and R113 (Figure 4-2). Transistor Q104 turns on when the ground is removed and shunts current around the base/emitter circuit of Q107, which turns off Q107. Turning off Q107 turns off play relay K602 and/or edit relay K603. Consequently, the reel motors, capstan solenoid, and brake solenoids are de-energized; and the tape is brought to rest.

If the record mode is active, pressing the STOP pushbutton causes the events described in *Control Circuitry/Record Mode* text. As a result, the tape is ultimately brought to rest.

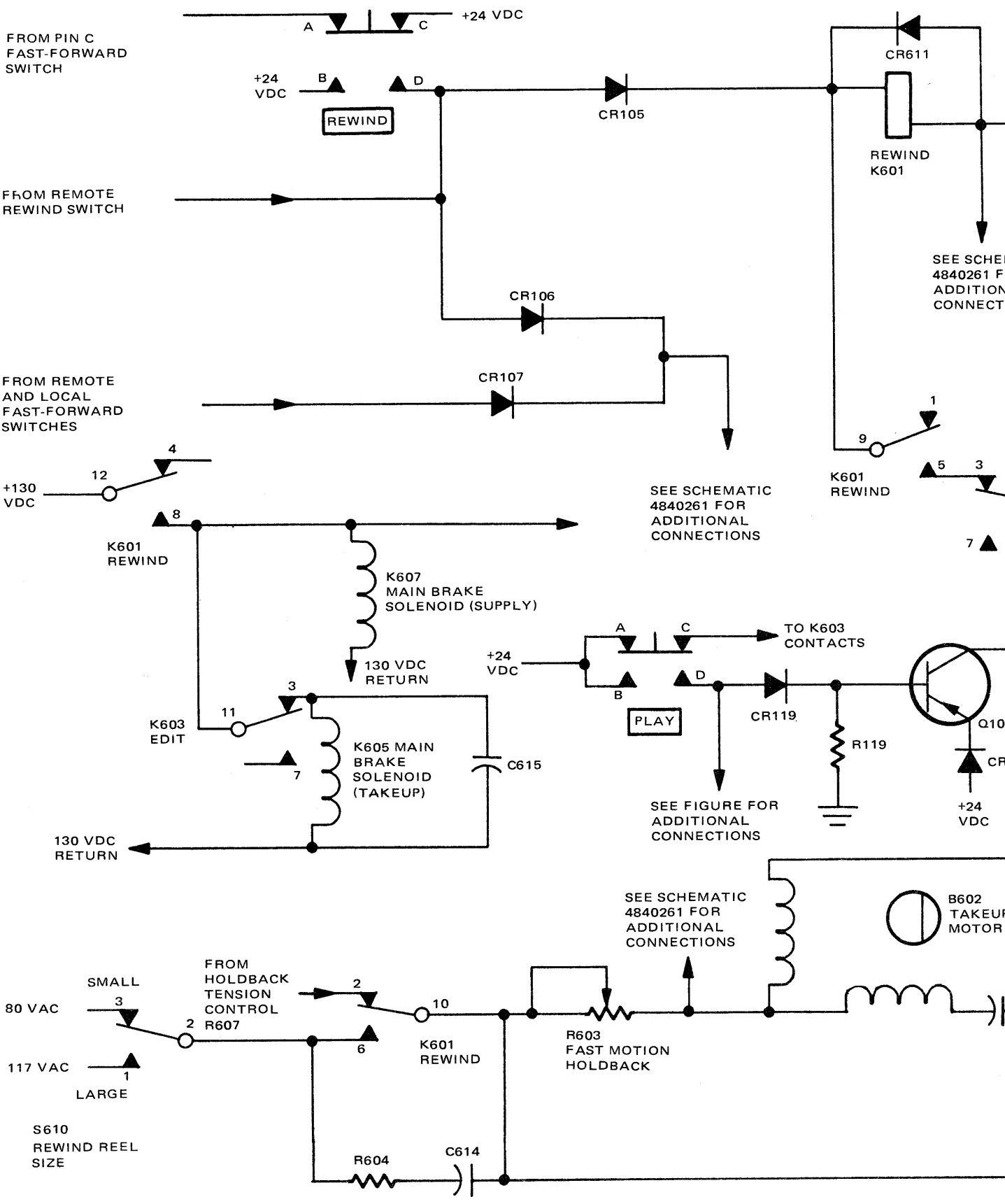
End-Of-Tape/Broken Tape

When the tape supply is exhausted or the tape breaks, the tension arm is spring-returned to its rest position, which opens the safety switch (S603). In all modes except edit, the safety switch removes AC power from the reel motors, capstan motor or capstan servo, 130 Vdc power supply, and the 24 Vdc power supply. Thus, the reel motors and capstan motor are de-energized, the capstan pinch roller is allowed to retract, and the main reel brakes are applied.

Fast-Motion Sensor

A motion-sensing device is mounted on the rewind motor. This device consists of a light-emitting diode, a phototransistor, and a perforated tachometer disk fixed to the shaft of the motor (see Figure 4-6). When the shaft is turning, the light path between the diode and phototransistor is periodically broken by the disk. The transistor conducts each time the light shines on its base and cuts off when the base is shielded from the light. Thus, an AC signal is developed that is coupled through capacitor C103 to the base of transistor Q102. Diode CR103 protects the base/emitter junction of transistor Q102 from high amplitude negative-going voltage spikes.

With either the fast-forward or rewind mode selected, either contact set K601-7/11 or K604-7/11 connects the positive collector voltage of normally on transistor Q108, to relay K101 and the base circuit of transistor Q103. Relay K101 is



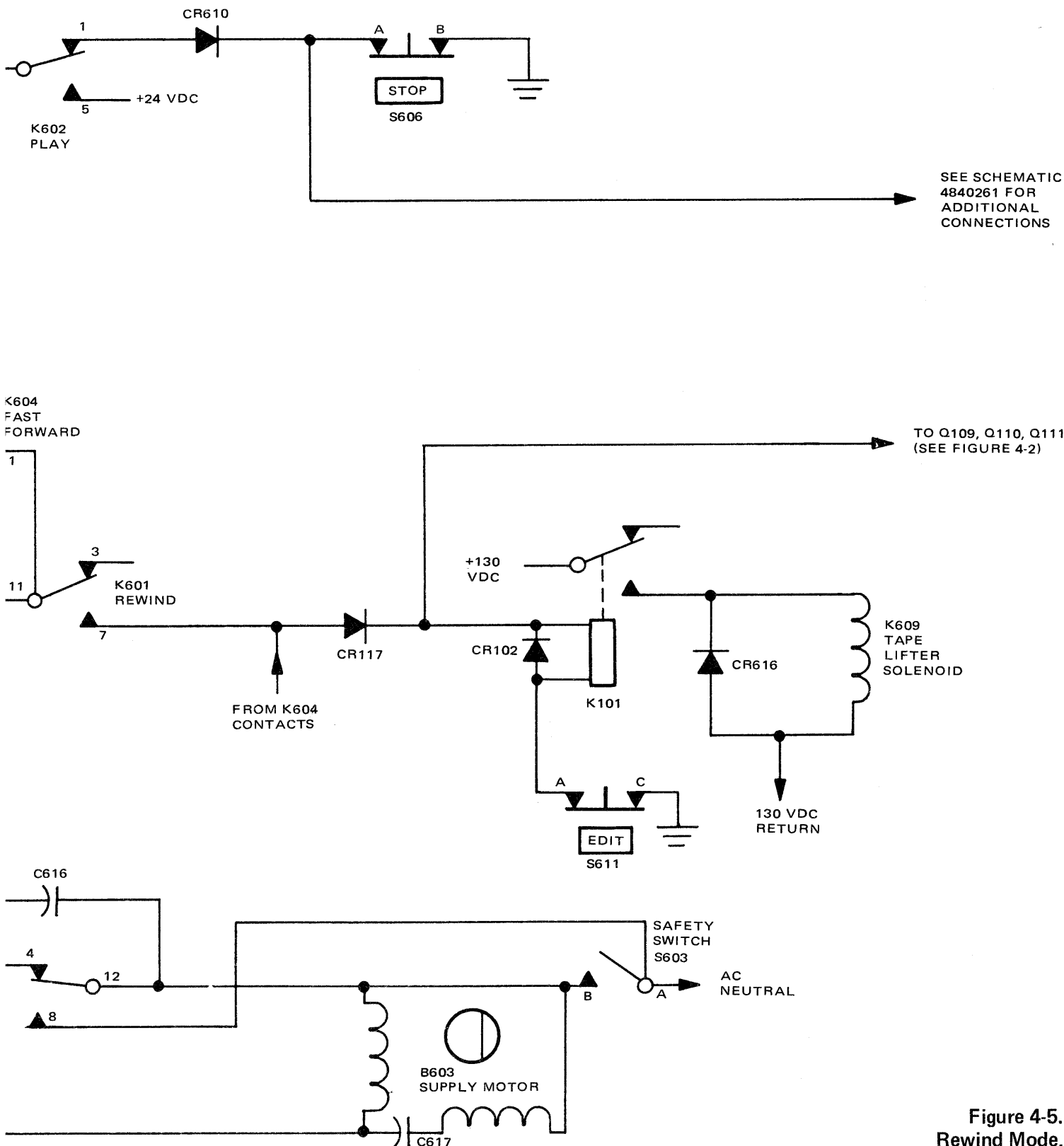


Figure 4-5.
Rewind Mode,
Simplified Schematic

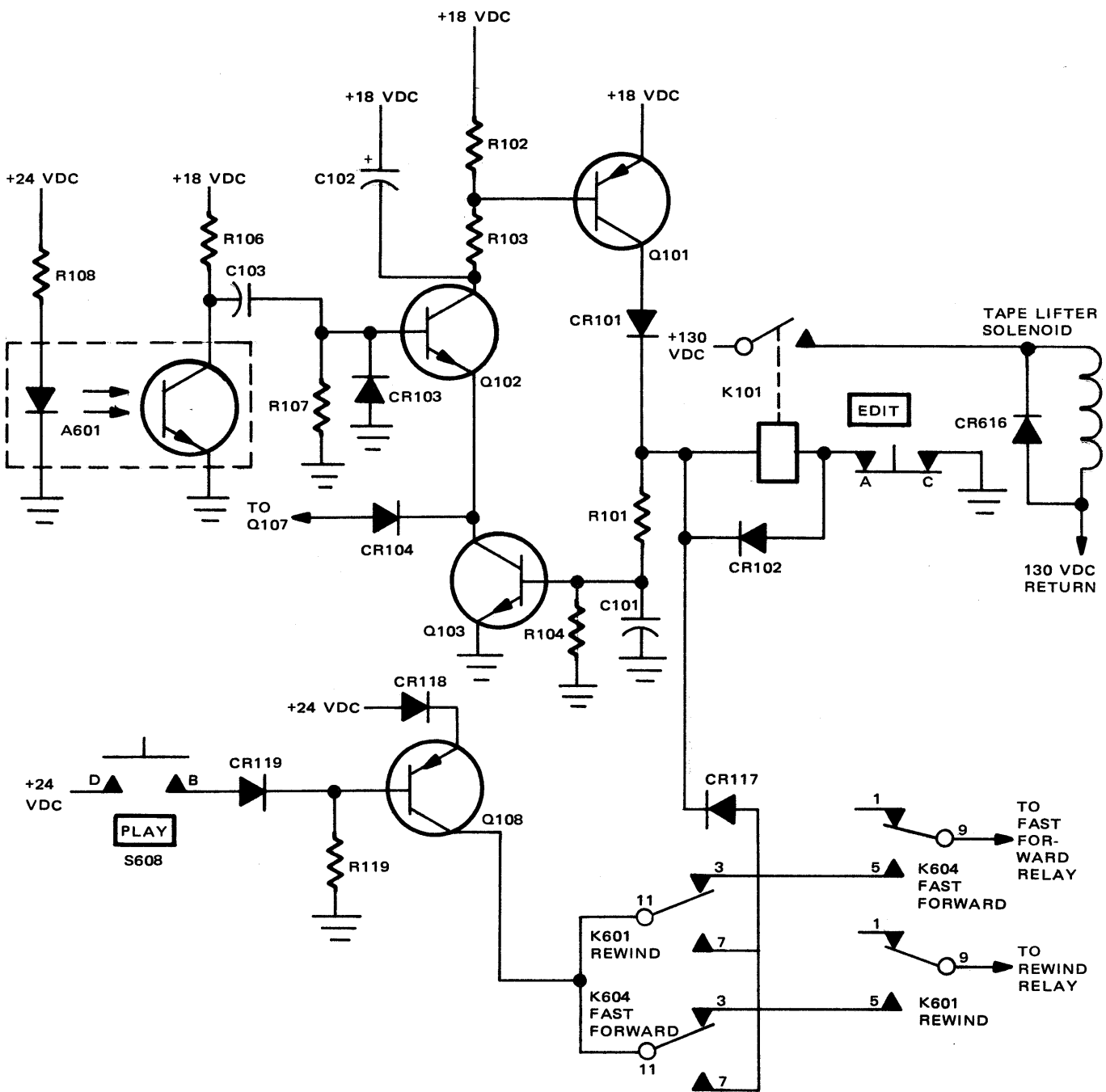


Figure 4-6. Fast Motion Circuitry, Simplified Schematic

energized by the positive voltage, which causes the tape to be lifted from the heads. In addition, transistor Q103 is turned on inhibiting Q107 through CR104. The low collector voltage of Q103

allows transistor Q102 to conduct and the time-varying signal at the base of Q102 is reproduced at the collector. Capacitor C102 filters the collector signal of Q102, and the DC voltage developed

across R102 turns on transistor Q101. Turning on Q101 establishes alternate current paths for K101 and the base circuit of Q103.

When another mode is selected, either contact set K601-3/7/11 (Figure 4-6) or K604-3/7/11 disconnects the positive voltage from K101 and the base of Q103. However, because the tape is still in motion, the circuit composed of Q101, Q102, and Q103 and associated components remains latched. That is, Q102 continues to drive Q101, which drives Q103; and, in turn, Q103 furnishes emitter current to Q102. Relay K101 is kept energized by Q101. When tape motion stops, Q102 stops conducting, causing Q101 and Q103 to stop conducting. Consequently, relay K101 is de-energized, which allows the tape to be lowered onto the heads and also allows play mode to be entered, since Q107 is no longer held off by Q103.

SIGNAL CIRCUITRY

Signal circuitry is located on the reproduce amplifier PWA, record amplifier PWA, bias/erase amplifier PWA, record control PWA, back panel, front panel, side panels, and power supply. Figure 4-3 shows a simplified schematic of the circuits involved in the record mode, and Figure 4-7 shows the signal circuits used in the reproduce mode of operation. The VU meter and its associated circuits shown in Figure 4-7 are used in both the record and reproduce modes. See schematics 4840248, 4840249, and 4840168 for details of the amplifier circuits shown in Figures 4-3 and 4-7.

Record Mode

Electronic audio signals to be recorded are applied to the back-panel INPUT connector (Figure 4-3). These signals are then coupled through the input accessory socket to the RECORD LEVEL/INPUT CAL control.

With the RECORD LEVEL control set fully counterclockwise, switch 5R3S is open; and the setting of the Input Calibration adjustment (5R4) determines the attenuation of the input signal. Turning the RECORD LEVEL control clockwise closes switch 5R3S and allows the RECORD LEVEL control to be used for input-signal attenuation.

Capacitor 4C10 couples the signal from the RECORD LEVEL control to the input accessory, and from there the signal is routed to the record amplifier assembly. (Refer to the *Circuit Description/Record Amplifier* text for a detailed discussion of the record amplifier assembly.) Emitter-follower (EF) Q9 amplifies the signal and drives the circuits of the record equalizer. The record equalizer supplies an unequalized signal to resistor 5R8, a high-speed equalized signal to amplifier Q11, and a low-speed equalized signal to amplifier Q10.

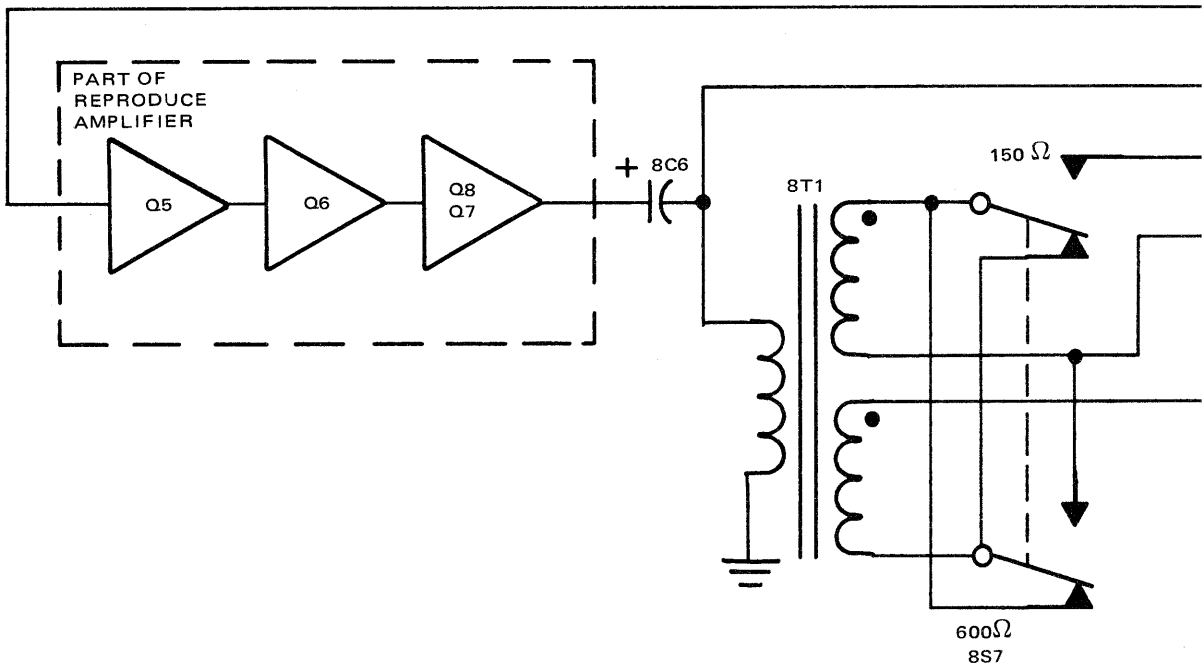
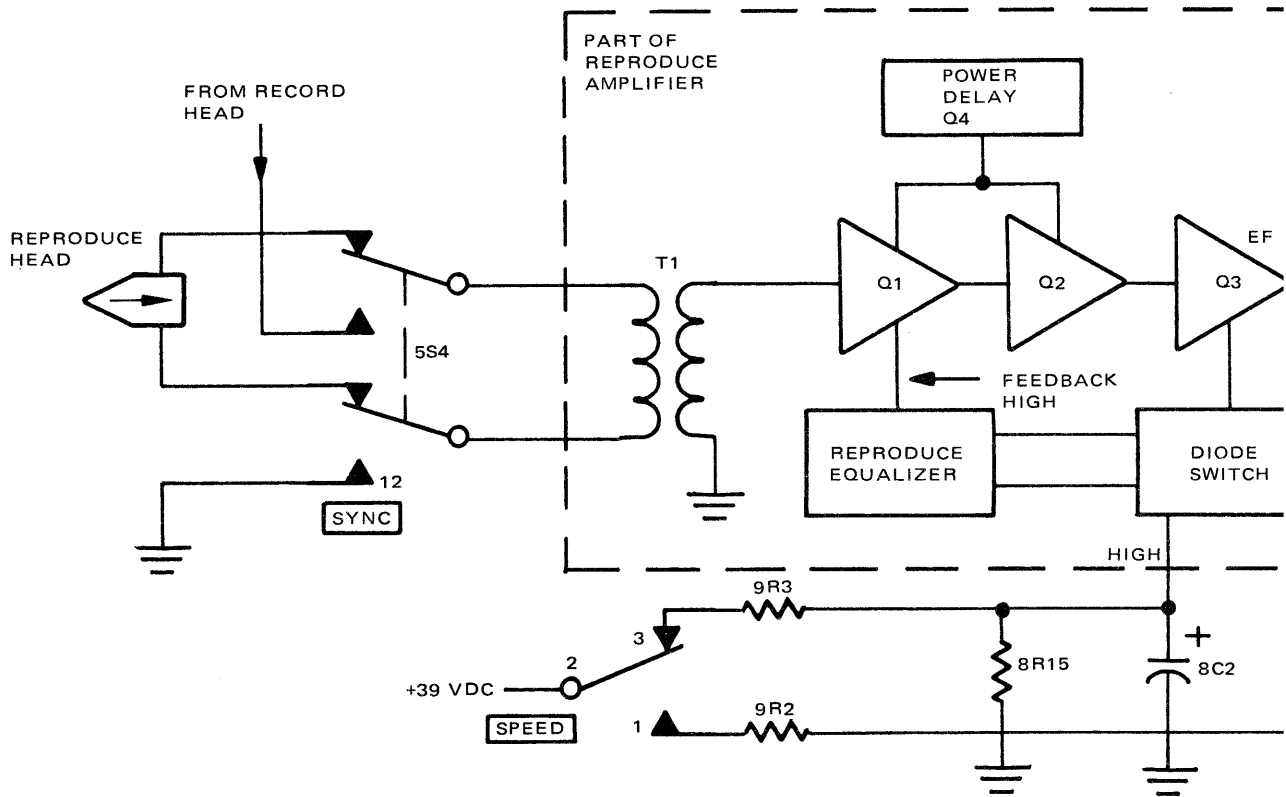
With the SPEED switch set to the low-speed position, amplifier Q11 is disabled; and amplifier Q10 is enabled. Enabling Q10 allows the low-speed equalized signal to be amplified and sent to the record head via bias trap 4L1-4C3 and contact set 4K1-6/10. Conversely, setting the SPEED switch to the high-speed position enables amplifier Q11 and disables Q10, allowing the high-speed equalized signal to be sent to the record head.

As stated in the *Control Circuitry/Record Mode* text, the bias/erase amplifier is furnished a positive voltage (referenced to ground) from the collector of transistor 9Q3 during the record mode. Reference ground is furnished to the bias/erase amplifier through contact set 4K1-7/11. The bias/erase amplifier is enabled by the applied voltage, and the 150-kHz signal from the bias/erase amplifier is delivered to the record head (via 4K1-6/10), the erase head, and the bias metering amplifier. Potentiometer R80 is used to set the level of the bias signal applied to the record head, and capacitor C40 is adjusted to resonate with the erase head to obtain maximum erase current.

Transistor 9Q5 and associated components form the bias metering amplifier. With switch 5S2 (Figure 4-7) set to BIAS, the bias signal is applied to the front panel VU meter for bias-signal monitoring. Potentiometer R44 (Figure 4-3) is used when calibrating the VU meter.

Play Mode

Recorded material can be reproduced using either the reproduce or record head. Reproduction using the record head is termed Sel-Sync operation, which is explained in the Operation section of this manual. When using the reproduce head, the audio



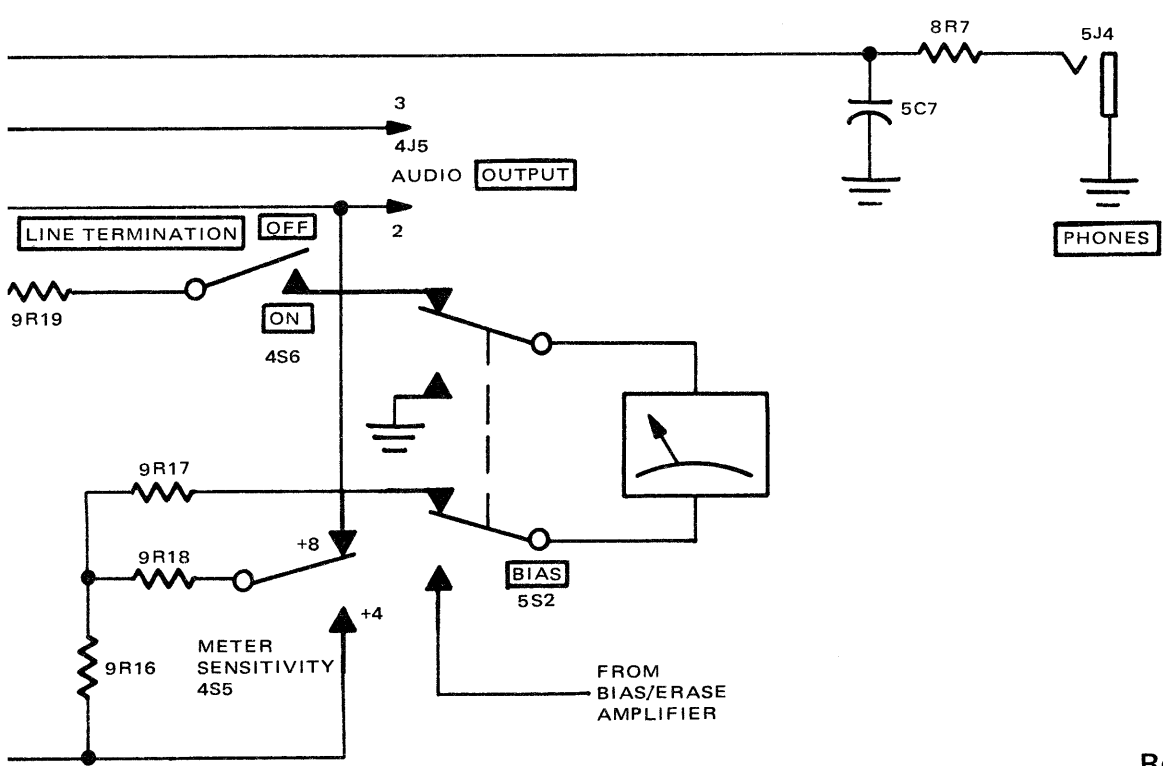
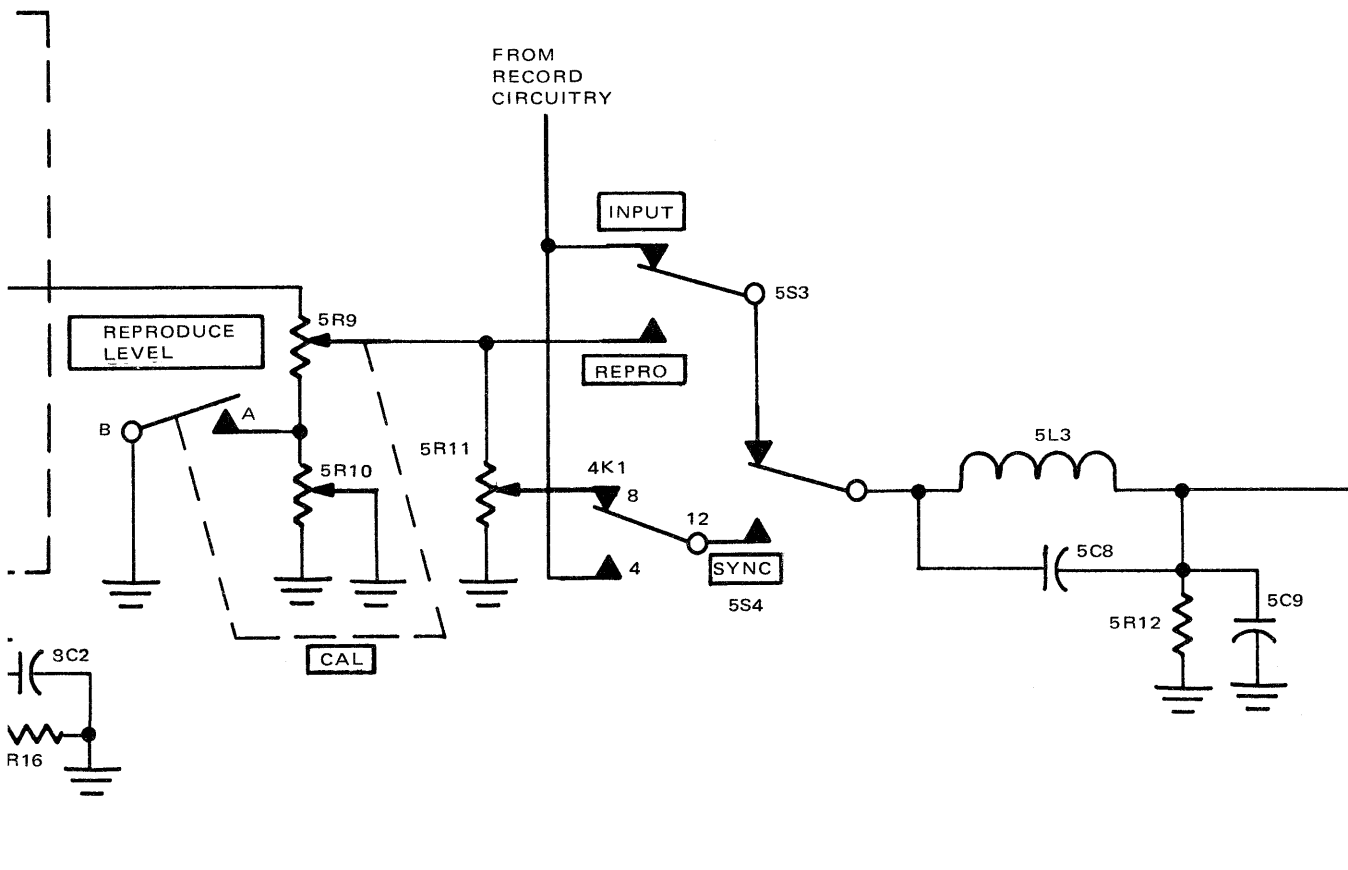
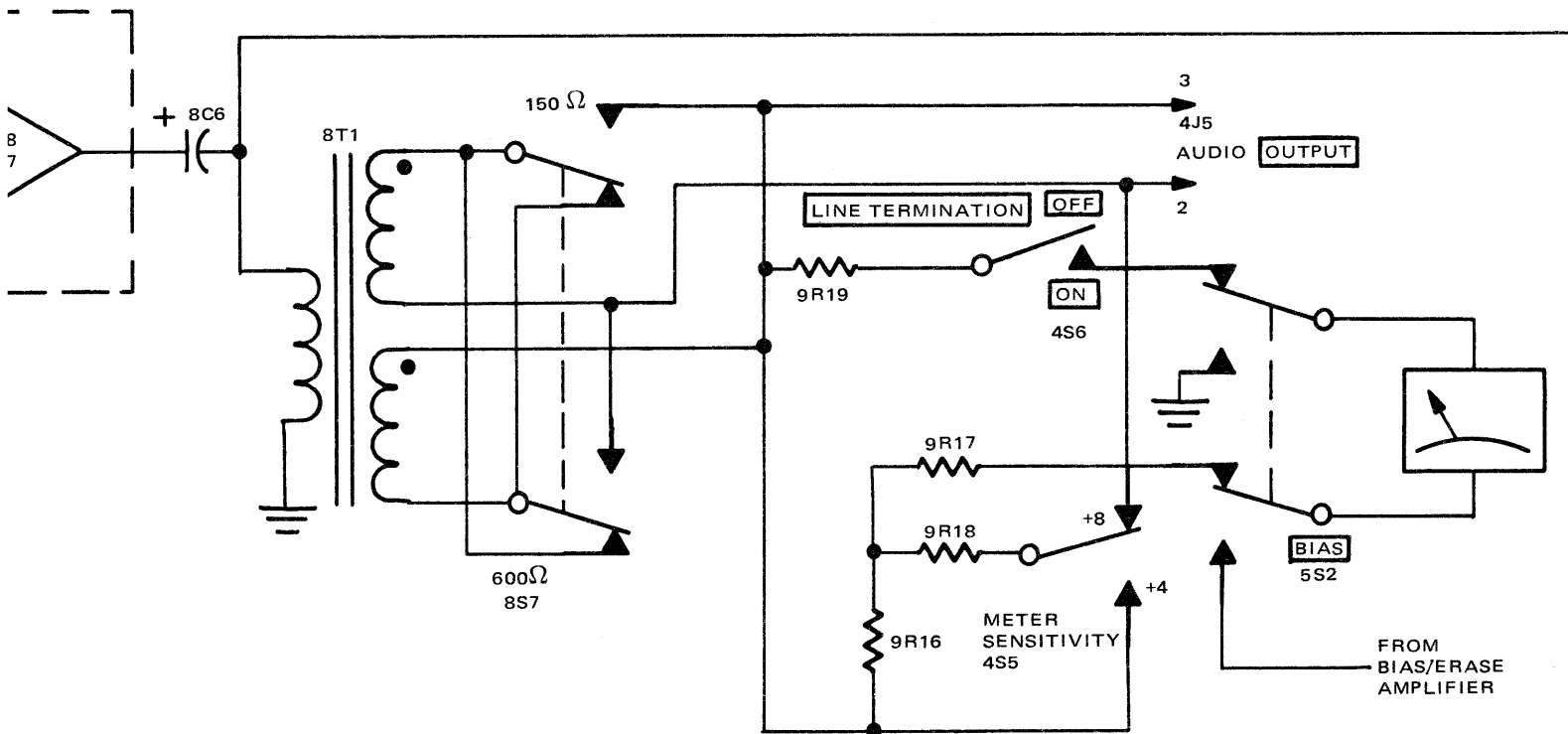
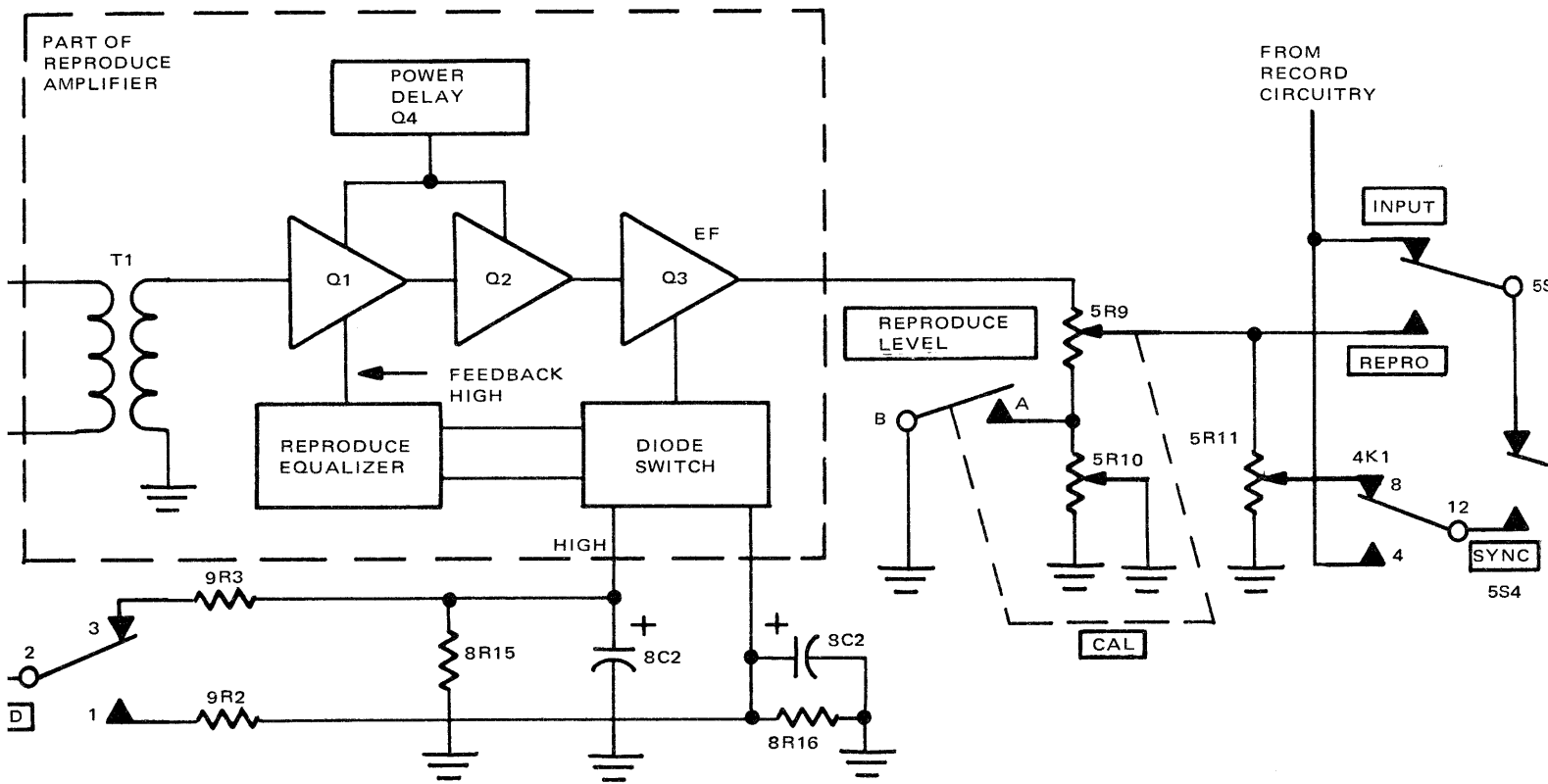


Figure 4-7.
Reproduce Mode Signal Path,
Simplified Block Diagram



signal developed across the head is connected through contacts of switch 5S4 to the primary of transformer T1 of the reproduce amplifier PWA. (See Figure 4-7.) In Sel-Sync operation, the signal developed across the record head is routed through a bias trap (4L2, 4C5, 4C11) and contacts of switch 5S4 to the primary of T1. (See Figures 4-3 and 4-7.)

Transformer T1 couples the reproduced audio signal to amplifier Q1. Amplifier Q2 further amplifies the signal and drives emitter-follower (EF) Q3. In turn, amplifier Q3 drives the REPRODUCE LEVEL control and the reproduce equalizer. The equalizer is situated in a feedback path between amplifiers Q3 and Q1. A diode switch controlled by the tape transport SPEED switch routes the feedback signal from emitter-follower Q3 to either the high-speed or low-speed section of the reproduce equalizer, depending on the setting of the SPEED switch. Therefore, the signal developed across the REPRODUCE LEVEL control is equalized in accordance with the tape speed being used.

With the REPRODUCE LEVEL control set fully counterclockwise, the switch associated with potentiometer 5R10 is open. Therefore, the setting of potentiometer 5R10 determines the attenuation of the reproduced signal. Turning this control clockwise closes the switch associated with potentiometer 5R10, which bypasses 5R10 and allows potentiometer 5R9 to be used for reproduce-signal attenuation. In either case, the signal appearing at the movable contact of potentiometer 5R9 is applied to one contact of REPRO switch 5S3 and to potentiometer 5R11.

For normal reproduction (not Sel-Sync), the INPUT/REPRO switch (5S3) is set to REPRO; and the SEL SYNC switch (5S4) is set to the normal (out) position (not SEL SYNC). Therefore, the signal appearing at the movable contact of potentiometer 5R9 is connected to the bias trap (5L3, C8, R12, C9). Alternately, in Sel-Sync operation, switch 5S4 is set to the SYNC position. This switch position forces the REPRO switch out, disconnects the movable contact 5R9 from the bias trap and connects the trap to the movable contact of potentiometer 5R11 (via contact set 4K1-8/12). Potentiometer 5R11 is used to compensate for the higher level of the signal developed across the

record head compared to that developed across the reproduce head.

Contact set 4K1-8/12 of the record relay remains closed in the reproduce mode. However, in the record mode, the record relay is energized; and contact set 4K1-4/12 connects the unequalized output of the record equalizer (Figure 4-3) to the bias trap (5L3, C8, C9, R12; Figure 4-7). Thus when the SYNC pushbutton is depressed, the audio signal to be recorded is connected to the reproduce circuitry for monitoring purposes.

The output of the bias trap is amplified by stages Q5, Q6, and Q7/Q8 of the reproduce line amplifier. Capacitor 8C6 couples the output of the reproduce line amplifier to the PHONES jack (5J4) and to the primary of output transformer 8T1. The secondary of 8T1 is connected through an output-impedance switch (8S7) to the audio OUTPUT jack (4J5) and the metering circuitry.

The output signal level is indicated on the front-panel VU meter when the BIAS pushbutton is in its out position (not depressed). A meter-sensitivity switch and its associated resistive network (9R16, R17, R18) is used to calibrate the VU meter for either +4-dBm or +8-dBm output-signal levels. The output line can be terminated internally by setting the LINE TERM switch (4S6) to ON, which connects resistor 9R19 across the audio-output line.

BIAS/ERASE AMPLIFIER

Schematic 4840249 shows the circuitry of the bias/erase amplifier. This amplifier receives a 150-kHz push-pull bias/erase signal from the bias/erase oscillator whenever the recorder/reproducer is turned on.

Essentially, the bias/erase amplifier consists of two cascaded push-pull amplifiers and three adjustments. During the record mode, operating power for the amplifier is received via transistor switch 9Q3 on the record control PWA. An external network connected to pin 6 of the amplifier PWA causes a short turn-on delay of the operating power and a longer turn-off delay. These delays cause the bias and erase signals to rise and decay slowly to minimize imperfections in the recorded material

caused by turning the bias/erase amplifier on and off.

The push-pull signal from the bias/erase oscillator is applied to the bases of transistors Q18 and Q19. Each transistor drives one half of the primary winding of transformer T4. The push-pull signal taken from the center tapped secondary of T4 is used to drive a second push-pull transistor/transformer stage (Q16, Q17, T3). Both amplifier stages operate at clipping level.

The single-ended signal taken from the secondary of T3 is routed through capacitor C40 (ERASE ADJ) to the erase head (schematic 4840248) and potentiometer R80. The signal taken from potentiometer R80 is routed through contacts of external relay 4K1 to the record head and through external resistor 4R6, potentiometer R44 (BIAS CAL), and contacts of relay 4K1-7/11 to ground. Capacitor 9C2 couples the signal developed across potentiometer R44 to the bias metering amplifier.

Capacitor C40 is adjusted to resonate with the inductance of the erase-head winding to provide maximum sinusoidal current through the winding. Potentiometer R80 is used to adjust the level of bias current, and potentiometer R44 is used to calibrate the front panel VU meter for bias-signal monitoring.

Resistors R83 and R87 are biasing resistors, and capacitors C42 and C45 are tuning capacitors. Capacitors C41, C43, and C44 are signal decouplers for the input power line.

RECORD AMPLIFIER

Schematic 4840249 shows the circuitry of the record amplifier. Capacitor C24 couples the input audio signal to the base of transistor Q9. Transistor Q9 and associated components form an emitter-follower circuit that provides high input impedance for the input circuit of the record amplifier and low-impedance drive to the record-equalizer circuit. Capacitor C52 couples the signal taken from the emitter of Q9 to potentiometer R108. The signal taken from the movable contact of R108 is

routed to the output stages of the reproduce amplifier in the record and input-monitoring modes of operation.

The signal from Q9 is also connected to the plug-in, high- and low-speed record equalizer PWA. As shown by schematic 4840249, there are several plug-in record equalizer circuits available to suit different record-equalization requirements. The output of the low-speed equalizer is applied to the base of transistor Q10, and the high-speed equalized signal is applied to the base of transistor Q11.

Transistors Q10 and Q11 and associated components form the low- and high-speed equalizer amplifiers, respectively. The setting of the SPEED switch determines which of these amplifiers is enabled and which is inhibited. To inhibit amplifier Q10, a high positive level is applied to pin 5 of the record amplifier PWA. Resistor R57 and capacitor C26 delay the voltage rise at the junction of resistors R55 and R56. Delaying the voltage rise causes transistor Q10 to turn off slowly and, thus, avoids switching transients. Conversely, amplifier Q10 is enabled when a low level is applied to pin 5. Amplifier Q11 is turned off and on in a similar manner.

Capacitor C25 provides low-frequency boost for amplifier Q10, and C27 provides low-frequency boost for amplifier Q11. Capacitors C55 and C56 defeat the low-frequency boost when it is not desired.

Capacitor C30 couples the output of amplifier Q10 or Q11 to the base of transistor Q12. Transistors Q12 and Q13 and associated components form two cascaded emitter-follower circuits. These circuits provide high-signal current for the output amplifier stage.

The output driver stage consists of transistors Q14 and Q15 and associated components. Transistor Q15 is an active collector resistance for Q14, thus allowing high recording current to be obtained. Capacitor C31 keeps signals at the base and emitter of Q15 in phase (i.e., bootstrapped), which causes the amplifier to have a high output impedance in the audio-frequency range. This high output impedance minimizes the effects of a variable load caused by changes in the record-head impedance over the audio spectrum.

REPRODUCE AMPLIFIER

Schematic 4840249 shows the details of the reproduce amplifier. Transformer T1 couples the audio output of the reproduce head or record head (Sel-Sync operation) to the base of transistor Q1. Transistor Q1 and associated components form a common-emitter amplifier. Base bias for Q1 is derived from the DC voltage developed across resistor R4, and capacitor C1 prevents signal degeneration. Transistor Q2 and associated components form another common-emitter amplifier. This amplifier receives its signal input from the collector of Q1 and, in turn, drives the base of transistor Q3. DC feedback is coupled from the collector of Q2 through resistors R2 and R3 to the base circuit of Q2. Capacitor C2 decouples the junction of R3 and R2 to signal ground, C4 prevents high-frequency oscillation of stage Q2, and C5 minimizes signal degeneration in the emitter circuit of Q2.

Collector voltage for Q1 and Q2 is supplied by transistor stage Q4. The turn on of Q4 is delayed by R38 and C8 when power is applied to the reproduce amplifier PWA, minimizing turn on transients.

Transistor Q3 and associated components form an emitter-follower circuit. This circuit provides the low-impedance drive for the reproduce equalizer and the base circuit of transistor Q5. The reproduce equalizer is situated in a feedback path that interconnects the emitter of Q3 with the emitter of Q1.

High-speed or low-speed equalization is selected by control voltages that are applied to diodes CR1 and CR2. These voltages are controlled by the SPEED switch. When a high voltage is applied to pin M and a low voltage to pin N, diode CR1 is forward biased and CR2 is reverse biased. Thus, the audio signal taken from the emitter of Q3 is routed through C6, CR1, C3, R104, R103, R102, C50, and R101 to the emitter of Q1. Conversely, when CR1 is turned off and CR2 is turned on, the feedback path is via C6, CR2, C17, R107, R106, C51, R105, and R101. Potentiometers R104 and R102 are used to adjust the high-speed frequency response, and R107 and R105 are adjustments for the low-speed frequency response.

The output of emitter-follower Q3 is coupled through capacitor C7, circuitry on the front and back panels, and capacitor C11 to the base of transistor Q5. Capacitor C10 attenuates unwanted high frequencies, and C12 decouples the base-bias network of Q5.

Transistor Q5 and associated components form a common-emitter amplifier. The output of stage Q5 is directly coupled to common-emitter amplifier Q6, which drives complementary-amplifier Q7-Q8. Capacitor C14 enhances the DC voltage (hence current) available to the base circuit of transistor Q8 and, therefore, allows the output signal at pin 5 to swing almost to 39 volts without clipping. Resistor R25 couples feedback from the signal output line to the emitter of Q5. Resistors R26 and R25 set the overall AC gain of the amplifier formed by transistors Q5 through Q8 and associated components.

AC CAPSTAN DRIVE MOTOR

Schematic 4840261 shows the details of the capstan motor circuit. The circuit essentially consists of a two-speed, AC-powered, capstan motor and switching circuitry. The motor (B601) has one set of field windings for high speed and another set for low speed. Switch S602 (SPEED) is used to select the desired speed by connecting 117-Vac, single-phase power to either the high-speed or low-speed field windings. Notice that one section of the SPEED switch connects a phase-shifting capacitor (C601) in series with one of the field windings for each speed. Capacitors C602 through C605 minimize contact arcing of the SPEED switch.

SERVO CAPSTAN DRIVE MOTOR

The closed-loop capstan servo system consists of the capstan servo PWA; a reference generator, a frequency/phase comparator, and a servo amplifier on the capstan servo chassis; and a high torque, tachometer-equipped, DC motor. The tape is driven directly by the shaft of the motor.

SERVO SYSTEM BLOCK DIAGRAM

Figure 4-8 shows a block diagram of the capstan servo system. During operation, tachometer pulses are provided at a rate proportional to capstan speed. These pulses are amplified and fed to one input of a digital phase comparator. The other input to the phase comparator is a reference signal. This signal is derived from a reference oscillator and divider circuit on the capstan servo PWA or an external reference-frequency source. A pulse shaper converts the input reference signal into a train of steep-sided pulses. This pulse train is then appropriately divided to obtain one pulse train for high-speed operation and one for low-speed operation. The setting of the SPEED switch determines

which pulse train is applied to the overspeed limiter. In turn, the limiter drives the reference input to the phase comparator.

The phase comparator compares the tachometer signal with the selected reference signal and produces an output that is proportional to the phase difference between the two signals. The phase-comparator output can vary from a DC level for an extreme underspeed or overspeed condition to a symmetrical square wave for an on-speed condition. During the record or reproduce mode, this speed-proportional output is integrated to form an error signal, which is amplified by the capstan motor drive amplifier (MDA) and used to drive the capstan motor. If the capstan motor slows, the

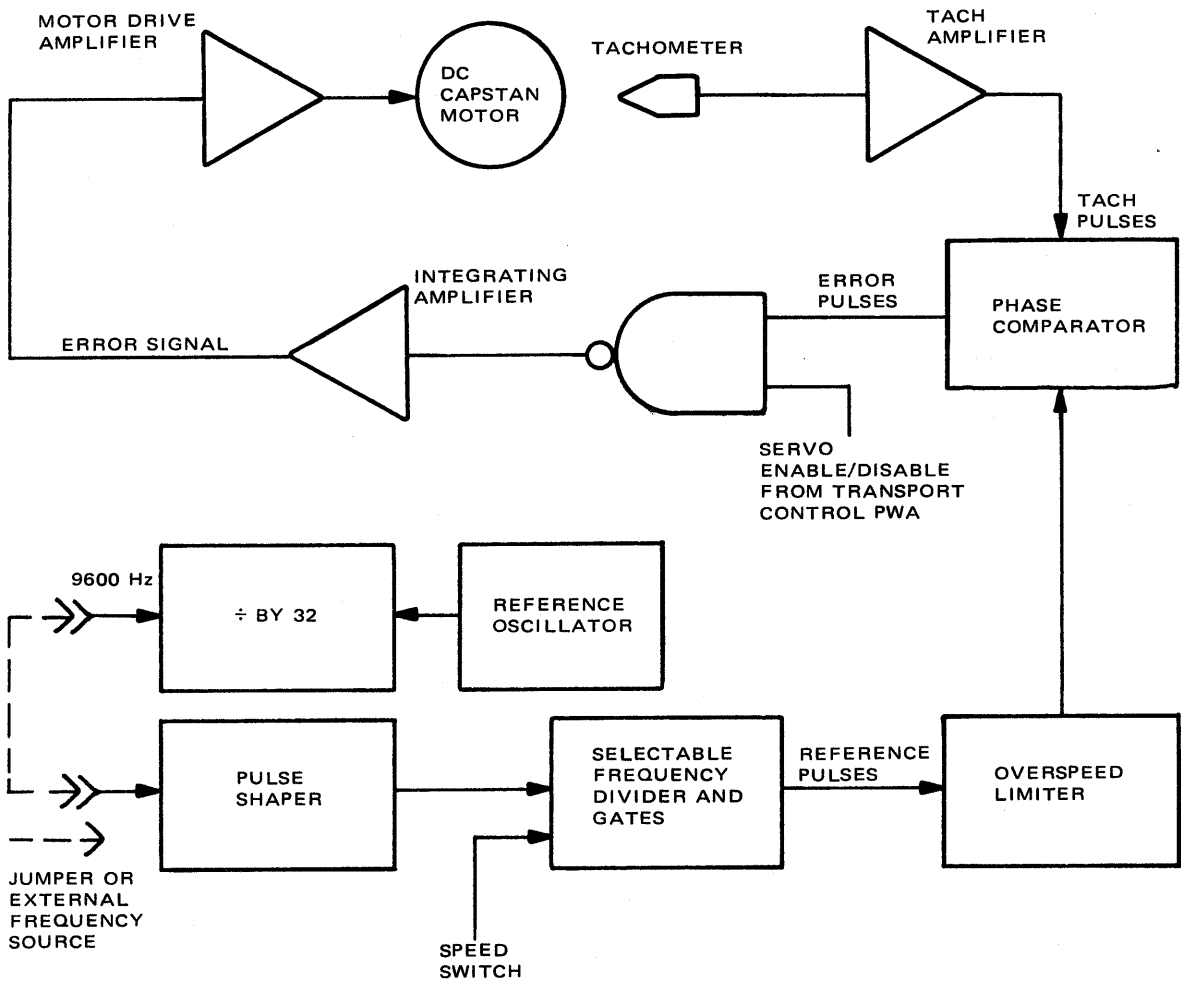


Figure 4-8. Capstan Servo Block Diagram

error signal causes the MDA to provide more current to the capstan motor to increase its speed. Conversely, if the capstan motor overspeeds, the MDA supplies less current to the motor, causing it to slow.

The overspeed limiter prevents severe overspeeding of the capstan motor if the frequency of the external reference oscillator (when used) is set too high. If the reference frequency increases to a preset limit, the output of the limiter becomes a high level. This level causes the phase comparator to produce an output that stops the capstan motor.

SERVO SYSTEM CIRCUIT DESCRIPTION

Stage A5, crystal Y1, and associated components comprise the internal reference oscillator (schematic 4840356). Crystal Y1 is situated in the feedback path of stage A5 and is series resonant at 307.2 kHz. Consequently, only a 307.2-kHz signal is fed back with minimum attenuation, causing the stage to oscillate at 307.2-kHz. This 307.2-kHz signal is fed to stage A2.

Stage A1 is an integrated circuit that is strapped to divide the oscillator signal by 16. In turn, the 19.2-kHz output of stage A1 is halved in frequency by flip-flop A3-8/9. Normally, either the 9600-Hz output of flip-flop A3-8/9 or an external 9600-Hz signal is applied to pin 9 of the capstan servo PWA.

Diode CR1 protects the base/emitter junction of transistor Q6 from large-amplitude negative-going spikes. Transistor Q6 and associated components amplify and clip the signal and drive Schmidt trigger A11. The Schmidt trigger delivers a clearly shaped pulse train to flip-flop A3-1.

Flip-flops A3 and A2 form a divider chain. This divider chain is connected to strapping points E1, E4, E3, and E6 such that division by one, two, four or eight is possible. Accordingly, certain of these strapping points are interconnected at the factory to obtain the proper frequency division for the customer-specified tape speeds.

Strapping point E2 is connected to pin 13 of NAND gate A7 and E5 is connected to pin 10 of NAND gate A7. Both NAND gates are also connected to the SPEED switch. Setting the

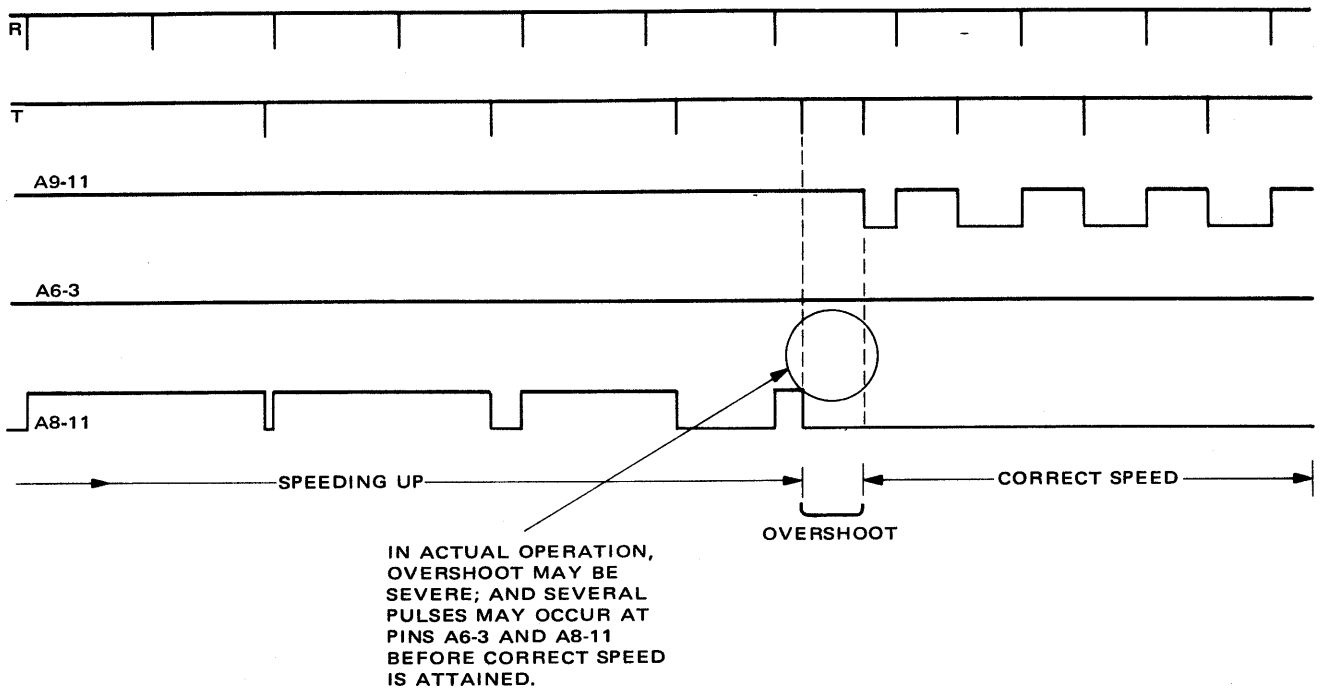
SPEED switch to the low-speed position enables gate A7-11 and disables gate A7-8. Conversely, setting the SPEED switch to the high-speed position enables gate A7-8 and disables gate A7-11. Therefore, the appropriate pulse train is delivered to pin 1 of retriggerable one-shot A10 (overspeed limiter).

In normal operation, one-shot A10 delivers a train of negative-going pulses to pin 6 of flip-flops A8, A9, and A6 (phase comparator). If the repetition rate of the pulse train applied to pin 1 of retriggerable one-shot A10 exceeds approximately 12,000 pps, the output of A10 becomes a high level. This high level will cause the phase comparator to stop the capstan motor, thus preventing the motor from overspeeding.

Tach pulses from the capstan-motor tachometer are applied to the base of transistor Q8. Transistors Q8 and Q7 form a high-gain, non-inverting amplifier. Resistors R29, R32, R35, R36, R38 and R39 are biasing resistors; and resistor R37 provides a DC feedback path. The amplified tach signal taken from the collector of Q7 is shaped by Schmidt trigger A11-6, inverted at A7-6 and applied to pin 5 of flip-flops A8, A9, and A6 (phase comparator).

Figure 4-9 shows a typical set of waveforms for the capstan phase comparator while increasing speed to synchronous speed and a table listing the signal conditions at pins A8-11, A9-11, and A6-3 for each motor-speed condition. The waveforms of this figure depict a situation similar to the time when the capstan motor is accelerating to operating speed after starting. Notice that when the tach-signal (T) frequency reaches and then exceeds the reference-signal (R) frequency, two T pulses occur between adjacent R pulses. At this point, flip-flop A9-3/11 begins changing state; and a square wave that contains phase information appears at pin A9-11.

When the capstan motor reaches the correct speed (synchronized operation), the R and T pulses alternate; and a rectangular wave is produced at pin A9-11. Notice that while the motor is increasing speed and when it is synchronized, pin 3 of flip-flop A6-3/11 is low. Further notice that during the same time interval, each T pulse causes the signal at pin A8-11 to go low, but the following R pulse returns the signal to a high level. After the



MOTOR SPEED	A8-11	A9-11	A6-3
INCREASING	PULSES	HIGH*	LOW*
SYNCHRONIZED	LOW*	SYNCHRONIZED SQUARE WAVES	LOW*
DECREASING	LOW*	LOW*	PULSES

*THERE MAY BE A BURST OF PULSES PRESENT AT THE INSTANT MOTOR ENTERS BY SYNCHRONISM DUE TO OVERSHOOT OR UNDERSHOOT.

Figure 4-9. Capstan Phase Comparator, Typical Operation

instant that the tach-signal frequency exceeds the reference-signal frequency (termed overshoot), flip-flop A8-3/11 stops changing state; and the signal at pin A8-11 stays low during synchronized operation. In actual operation, although Figure 4-9 does not show it, the overshoot may be enough to cause a burst of pulses at pins A6-3 and A8-11.

When the motor is slowing, pin A9-11 remains low until the capstan is turning (for an instant) below the correct speed (undershoot). During the undershoot interval, two T pulses occur between adjacent R pulses. Subsequently, a rectangular wave at the correct frequency is again produced at pin A9-11.

(The motor-slowng sequence is not shown in Figure 4-9.) The signal at pin A6-3 is normally high and is forced low by each R pulse when the motor is slowing. At the instant of undershoot, the signal at pin A6-3 goes low and stays low. Further, the signal at pin A8-11 remains low (as the signal at pin A6-3 does when the motor is coming up to speed). However, a few pulses may appear at pin A8-11 at the instant of undershoot because of inertia.

The output of the phase comparator is applied to NAND gate A7-2. During the record or reproduce mode, this gate is enabled by a high level coupled through resistor R27 when the coil of relay K1 of the capstan servo is energized. The coil of relay K1 is energized when transistor Q8 of the capstan-servo chassis (schematic 4840279) is turned on by the play signal from the transport-control circuitry or by a high level from the capstan-stop circuitry. (The capstan-stop circuitry is discussed in a subsequent paragraph.) Enabling NAND gate A7-3 allows the phase-comparator output to be applied to the base of transistor Q1.

The signal developed at the collector of Q1 is coupled to the base of transistor Q2. Transistor Q2 and associated components form a double-integrating active filter. Resistors R16 and R17 and capacitors C10 and C11 form the integrating network, and transistor Q2 multiplies the effect of the network. The output signal taken from the emitter of Q2 is again integrated by another double-integrating active filter (A3 and associated components). The signal taken from the emitter of Q3 is routed through a lead/lag network (R21, R22, R23, C14) to pin 5 of integrated circuit A4. The lead/lag network supplies required phase shift to keep the capstan servo system from oscillating.

Integrated circuit A4 is a differential amplifier that compares the output of the lead/lag network with the feedback signal from the capstan motor drive amplifier. The difference signal developed at the output of A4 is coupled through an attenuator (R25, R26) to the base of Q4.

Transistor Q4 supplies the base-drive current for the capstan motor drive amplifier (Q6, R28) located on the capstan-servo chassis. The capstan-motor circuit forms the collector load for transistor Q6. Potentiometer R19 on the capstan servo

PWA is used to adjust the gain for best DC stability.

The capstan-servo circuitry is shown in schematic 4840279. With the CAPSTAN STOP switch set to BOTH SPEED, the junction of resistors R29 and R30 is grounded holding Q8 off and K1 de-energized. During the play or record modes, a high level from the play circuitry is applied to the base of transistor Q8, turning transistor Q8 on, and energizing the coil (K1A) of relay K1. Transferring contact sets K1B-1/9 and K1B-2/10 removes a shunt from the capstan motor, which enables the motor. Transferring contact set K1C-4/12 enables NAND gate A7-3 of the capstan servo (schematic 4840356), which enables the servo. Consequently, the capstan motor starts turning and is servo controlled.

With the CAPSTAN STOP switch set to HIGH SPEED and the tape SPEED switch set to the low-speed position, the junction of R29 and R30 is connected to an open circuit. As a result, the +5 Vdc level at pin J3-4 causes transistor Q8 to be turned on in all modes. Thus, the capstan motor is turning and under servo control in all modes.

With the CAPSTAN STOP switch set to HIGH SPEED and the tape-speed switch set to the high-speed position, the junction of R29 and R30 is connected to ground through the tape transport speed switch. Thus, the capstan servo and motor only operate in the play and record modes as previously described. This arrangement is used to start the tape at a 30-in/s speed when the play or record mode is selected.

BIAS/ERASE OSCILLATOR

The bias/erase oscillator is mounted on the 39-Vdc regulator PWA and supplies a 150-kHz push-pull signal to the bias/erase amplifier of the audio electronics. Schematic 4840168 shows the details of the oscillator.

Transistors Q701 and Q702 and associated components comprise the circuitry of the oscillator, which is a variation of a standard stable multivibrator. Capacitors C702 and C703 and resistors R703 and R704 are the basic timing elements of

the multivibrator. Capacitor C701 prevents the bases of Q701 and Q702 from swinging excessively negative and removes unwanted transients. The collectors of Q701 and Q702 are connected to opposite ends of the center-tapped primary of transformer T701. This primary and capacitor C704 form a tuned circuit that is shock excited by the push-pull drive from the collectors of Q701 and Q702. With the slug of T701 appropriately set, a 150-kHz, push-pull sine wave signal is obtained across the center-tapped secondary of T701. This signal is routed to the bias/erase amplifier.

Operating power for the oscillator is taken from the 39-Vdc regulator. Resistor R705 and voltage regulator VR701 reduce the 39 Vdc to 13 Vdc. Capacitor C705 prevents AC signals from the oscillator from entering the 39 Vdc power line via resistor R705.

POWER SUPPLIES

There are four power supplies in the tape machine. The +5/12/20 Vdc power supply (capstan servo chassis), a 24 Vdc supply, and a 130 Vdc supply are located in the tape transport control box and a 39 Vdc supply is contained in the bias/erase oscillator and power supply chassis. Each of these power supplies is described in detail in the following paragraphs.

+5/12/20 Vdc Power Supply

The +5/12/20 Vdc power supply (schematic 4840279) receives 117 Vac power from the AC power-distribution circuitry of the recorder/reproducer. Transformer T1 steps down the 117 Vac power and drives bridge-rectifier CR1. The 20-volt level developed across filter capacitor C17 is applied to the capstan-motor circuit and to a series-regulator circuit. The series regulator is composed of transistor Q7, capacitor C16, resistor R27, and voltage-regulator diode VR1. Diode CR1, resistor R27, and capacitor C16 function together to hold the base of Q7 at about 13 Vdc. The regulated 12-volt level appearing at the emitter of Q7 is applied to stages Q1, Q2, Q3, and Q4 and to a +5 volt regulator, which are located on the capstan servo PWA (schematic 4840356).

The +5 volt regulator consists of filter capacitors C4 and C5, resistor R6, voltage-regulator diode

VR1, and transistor Q5. Resistor R6 and diode VR1 function together to hold the emitter voltage of Q5 at +5 Vdc.

24 Vdc Power Supply

Schematic 4840261 shows the details of the 24 Vdc power supply. This supply receives 117 Vac power supply from the AC power-distribution circuitry of the recorder/reproducer. Transformer T601 steps down the 117 Vac power and drives a bridge rectifier composed of diodes CR113 through CR116. The 24-volt level developed across filter capacitor C107 is then distributed to the transport-control circuitry.

130 Vdc Power Supply

Schematic 4840261 shows the details of the 130 Vdc power supply. This supply receives a nominal 117 Vac power from the AC power-distribution circuitry of the recorder/reproducer. A bridge rectifier (CR602, CR603, CR604, CR605) and filter capacitor (C609) convert the input AC power into an unregulated 130 volt level that is applied to the circuitry of the tape transport. Bleeder resistor R601 dissipates the charge on capacitor C609 when the power is turned off.

39 Vdc Power Supply

Schematic 4840168 shows the details of the 39 Vdc power supply. This supply receives 117 Vac power from the power-distribution circuitry of the recorder/reproducer. Transformer T702 steps down the 117 Vac power and drives a bridge rectifier composed of diodes CR701 through CR704. Fuse F701 protects the primary of T702 from excessive current. The voltage level developed across filter capacitor C707 is applied to the regulator circuitry of the power supply. Bleeder resistor R706 dissipates the charge on capacitor C707 when the power is turned off.

Transistors Q703 through Q706 and associated circuitry form a conventional series regulator equipped with an overcurrent protection circuit. The divider network composed of resistor R707 and diodes CR705 and CR706 maintain transistor Q703 base/emitter voltage constant. Consequently, during normal operation, the collector current of transistor Q703 is constant. This current is shared

by the base/emitter circuits of transistors Q704 and Q705 and the collector/emitter circuit of transistor Q706.

Transistor Q705 is the series pass transistor of the regulator and operates in a Darlington configuration with driver transistor Q704. Transistor Q706, voltage-regulator diode VR702, and resistor R710 form a voltage-comparator stage. This stage compares a sample of the output voltage of the regulator with the voltage drop across diode VR702 and conducts in proportion to the voltage difference. For example, if the output voltage tends to become more positive, Q706 conducts more heavily, which shunts a portion of the current available to the base circuit of Q704. Therefore, Q704 and Q705 conduct less, causing the output voltage to be restored to the desired level (nominally +39 Vdc). Conversely, if the output voltage tends to become more negative, Q706 conducts less, which allows more of the constant collector current of Q703 to flow in the base circuits of Q704 and Q705. As a result, Q704 and Q705 conduct more to restore the output voltage to the desired level. The output voltage can be adjusted slightly to compensate for circuit variations using potentiometer R712, which is part of the output-voltage sensing network (R711, R712, R713).

Current furnished to the load is sensed by resistor R709. The value of this resistor is chosen such that if the current load tends to become excessive, the voltage drop across R709 turns on diode CR707. Turning on CR707 allows a low level to be applied to the emitter of transistor Q703, which turns off Q703. Turning off Q703 cuts off the base current of transistors Q704 and Q705, which causes them to stop conducting. Therefore, the power supply is protected until the current overload is removed.

POWER DISTRIBUTION

AC Distribution

Input 117 Vac power is routed through fuses F601 and F602 (Figure 4-10) to POWER switch S601. With safety switch S603 (on tension arm) open,

closing switch S601 applies 117 Vac power to the power ON indicator (DS601), the contacts of relay K603, the 39 Vdc power supply, and safety switch S603. Thus, power is available to operate the stop/edit mode so that tape can be threaded and/or manually cued. Once the tape is properly threaded, safety switch S603 is closed and power is available for all modes of operation.

Capacitor C608 minimizes contact arcing when switch S603 is opened and closed. Any high-frequency noise present in the input AC power is shunted to ground by capacitors C606 and C607. Fuses F601 and F602 protect the entire AC distribution from damaging currents, and fuse F603 does the same for the 130 Vdc power supply.

DC Distribution

Except for a portion of the 24 Vdc and 39 Vdc power distribution, DC power distribution is straightforward. As mentioned previously, DC power is available to operate the stop/edit mode even when the safety switch (S603) is open. This DC power comes from the 39 Vdc power supply through CR110 and CR102. When the safety switch is closed, the 24 Vdc power supply is enabled. Enabling the 24 Vdc supply turns off diode VR102 on the transport-control PWA, which disconnects the 39 Vdc supply from certain circuits. These circuits are then powered by the 24 Vdc supply.

Diode CR111 disconnects the 24 Vdc supply from the 39 Vdc supply when the 24 Vdc supply is not active (schematic 4840261). Diode CR110 disconnects the 39 Vdc supply from the 24 Vdc supply if the 39 Vdc supply should fail while the 24 Vdc supply is active.

The 39 volt power supply ground is connected to the 24 volt power supply ground via the electronics (schematic 4840248). Ground is carried by the playback cable outer shield to 4J1 (electronics chassis), to 4J11-5, and then back to the 39 volt power supply. If the electronics is disconnected, the edit functions will not operate when the safety switch is open.

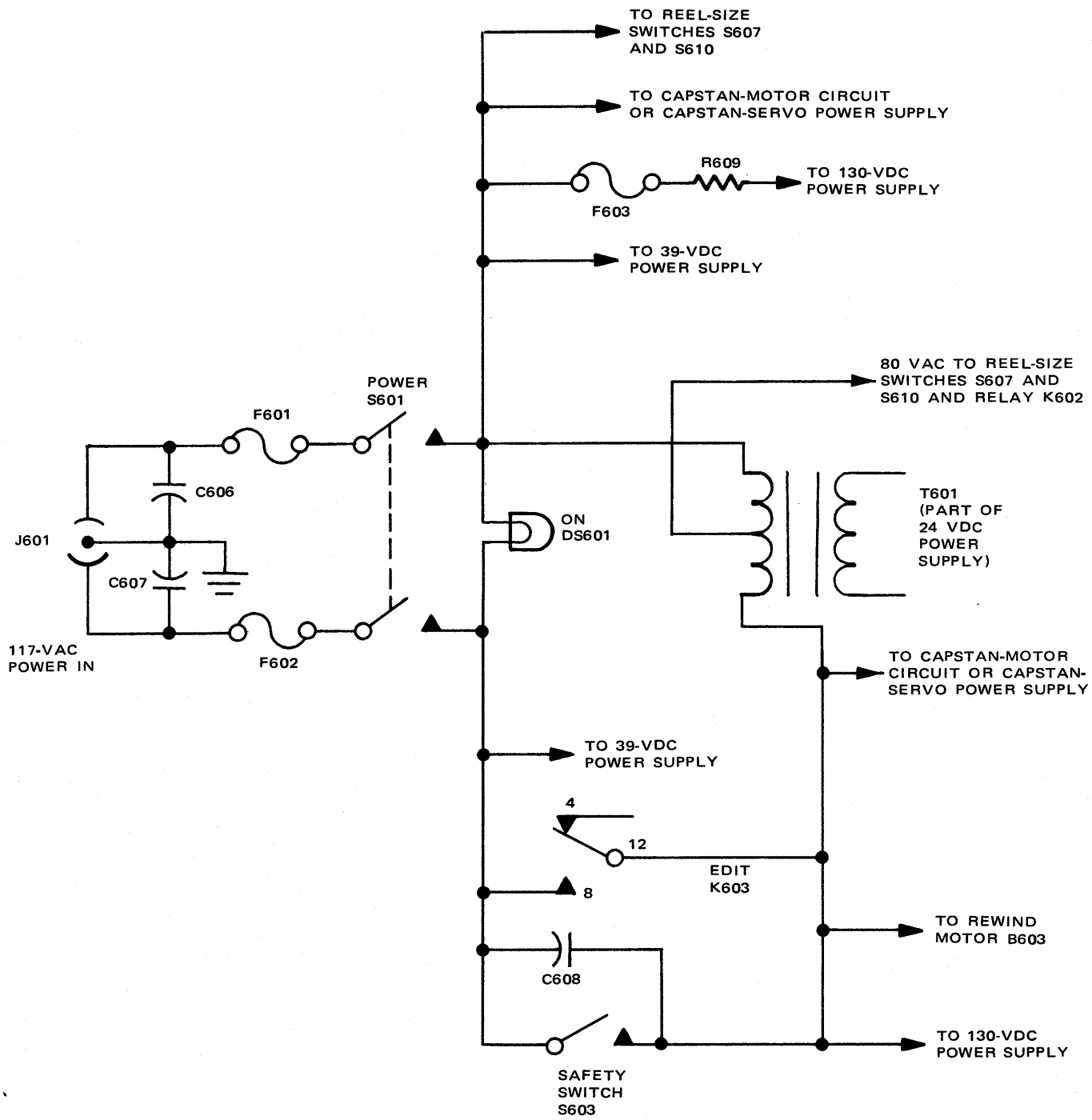


Figure 4-10. AC Power Distribution, Simplified Schematic

SECTION V

MAINTENANCE

GENERAL

This section provides maintenance information for the AG-440C Recorder/Reproducer. Maintenance information, following this general discussion, is grouped under nine main headings: *Overall Test Equipment Requirements, Preventive Maintenance, Performance Tests, Tape Transport Adjustments, Electronic Alignment, Head Maintenance, Transport Maintenance, Removal of Electronic Assemblies and Components, and Troubleshooting.*

Under the heading *Overall Test Equipment Requirements*, Table 5-1 gives suitable test equipment (mechanical and electronic) for testing, adjustment, and maintenance of the AG-440C.

Preventive Maintenance includes procedures for cleaning, demagnetizing, and lubrication. Information under *Performance Tests* includes overall performance checkout for frequency response, signal-to-noise ratio, distortion, flutter, and speed accuracy. *Tape Transport Adjustments* provides procedures for adjusting tape tension, brakes, and the capstan idler. *Electronic Alignment* covers

adjustment of power supply voltages, bias oscillator frequency, and calibration adjustments of record/reproduce electronic circuitry. *Head Maintenance* covers mechanical adjustments of the head assembly and provides head removal and installation procedures. *Transport Maintenance* provides servicing hints for the tape transport and provides detailed procedures for removal and replacement of tape transport components and assemblies. *Troubleshooting* discusses a number of the most common problems (electronic and mechanical) and provides suggestions for correcting these problems.

OVERALL TEST EQUIPMENT

All electronic and mechanical test equipment required during testing, alignment, adjustment, or maintenance of the recorder/reproducer is listed in Table 5-1. In Table 5-1 items 1 through 8 are used during Performance Tests, items 1 through 11 during Electronic Alignment, and items 12 through 15 are required for Tape Transport Adjustments. Equivalent equipment can be substituted for the equipment suggested in the table.

Table 5-1. Overall Test Equipment Requirements

ITEM NUMBER	EQUIPMENT TYPE	SUGGESTED MODEL	USED FOR
1	Audio Oscillator	Hewlett-Packard, Model 204C or 209D	Response and distortion tests
2	AC Vacuum Tube Voltmeter (VTVM)	Hewlett-Packard, Model 400D	Noise Test
3	Wave Analyzer	Hewlett-Packard, Model 302A	Distortion Test
4	Flutter Meter	Micom (Bahrs) Model B8100 or B100W	Flutter Test
5	Tape-Speed Strobe	Dubbings Electronics Model Deluxe AA for 7-1/2, 15, or 30 in/s	Speed Test

Table 5-1. Overall Test Equipment Requirements (Continued)

ITEM NUMBER	EQUIPMENT TYPE	SUGGESTED MODEL	USED FOR
6	Standard Alignment Tape	Refer to Table 5-2	Reproduce head azimuth, reproduce response, and operating level adjustment
7	Noise Filter 30 Hz to 18 kHz or ASA "A" weighted filter	See Figures 5-2 and 5-3	Noise Measurement
8	Flutter Test Tapes	Refer to Table 5-5	Flutter Test
9	DC Voltmeter (20,000-ohm/volt)	Any	Test and adjustment of power supply voltages
10	Frequency Counter or Oscilloscope	Hewlett-Packard 5221A or Tektronix 453	Bias Frequency Measurement
11	Flux Loop	Ampex 4050238-02	Reproduce Equalization
12	Spring Scales	Chatillon, 0-16 oz. and 0-10 lbs.	Tape Transport Adjustments
13	Cord or twine, about 30 in. long, with small loop at one end		
14	Empty reel, NAB hub		
15	Technician Tools		

PREVENTIVE MAINTENANCE

It is important that routine maintenance be performed at the recommended intervals. Cleaning and demagnetization procedures should be performed after each eight hours of operation.

The AC capstan drive motor requires lubrication initially (when the recorder/reproducer is installed), and at three month intervals thereafter. The capstan drive motor of tape transports equipped with the servo version drive motor, does not require initial or periodic lubrication.

Lubrication required at three month and annual intervals is discussed later in this section under the head *Lubrication*.

CLEANING

Oxide particles from the magnetic tape tend to collect on components in the tape path. These oxide accumulations degrade the performance of the recorder/reproducer. The heads and all other

components in the tape path must be cleaned after each eight hours of operation, or more frequently if visual inspection indicates cleaning is needed.

Clean each head thoroughly with a cotton-tipped applicator dampened with Ampex Head Cleaner (Catalog No. 4010823 or 087-007).

CAUTION

WHEN CLEANING THE HEADS, USE ONLY THE RECOMMENDED SOLVENT TO AVOID DAMAGING THE HEADS. KEEP SOLVENT OFF OF PLASTIC FINISHES AND THE CAPSTAN IDLER TIRE. DO NOT USE METAL TOOLS THAT COULD SCRATCH THE HEADS.

Use isopropyl alcohol to clean all tape-guiding components, the capstan, and the capstan idler.

CAUTION

DO NOT USE AMPEX HEAD CLEANER ON TAPE-GUIDING COMPONENTS, THE CAPSTAN, OR THE CAPSTAN IDLER.

Clean scrape-flutter idlers with a dry cotton-tipped applicator. Be sure to remove all oxide from the top and bottom of the roller holder assemblies.

DEMAGNETIZING

The head should be demagnetized after each eight hours of operation. Heads and other components in the tape path can acquire permanent magnetization that increases signal noise and distortion and partially erases high frequencies on recorded tapes. Use an Ampex Head Demagnetizer (Catalog No. 4010820) or equivalent to demagnetize components in the tape path.

NOTE

Remove recorded tape from the vicinity of the demagnetizer to prevent accidental tape erasure.

Proceed as follows:

1. Turn equipment power off and remove any recorded tape that is near the transport.
2. Cover the demagnetizer tips with an adhesive tape.
3. Connect the demagnetizer to a 110-120 Vac power source.
4. Lightly touch the demagnetizer tips simultaneously to the faces of one head stack.
5. Using a slow even motion, move the demagnetizer tips up and down the stack several times. Then, slowly withdraw the demagnetizer.
6. Repeat steps 4 and 5 at each head stack.
7. Move the demagnetizer at least two feet from the recorder/reproducer and then unplug the demagnetizer.

LUBRICATION

The only parts of the AG-440C Recorder/Reproducer that require lubrication are the bearings in

the AC capstan drive motor (if applicable), the capstan idler, and the scrape-flutter idler. Ampex Lubricating Oil (Catalog No. 4010825 or 087-579) is recommended for the capstan motor and capstan idler. (Equivalent oils are Esso Standard Oil Co., Teresso No. 47 and Socony Mobil Oil Co., Mobiloil DTE, Medium.) Scrape-flutter idlers require the special equipment and oil described in the paragraph headed *Scrape-Flutter Idler Lubrication*.

AC Capstan Motor, Initial Lubrication

A procedure for the initial lubrication of an AC capstan motor is presented in the Installation section of this manual under the heading *Initial Lubrication*. (The servo-controlled DC capstan motor does not require lubrication.)

AC Capstan Motor and Capstan Idler, 3-Month Lubrication

The AC Capstan motor and the capstan idler should be lubricated every 3 months or after each 1,000 hours of operation.

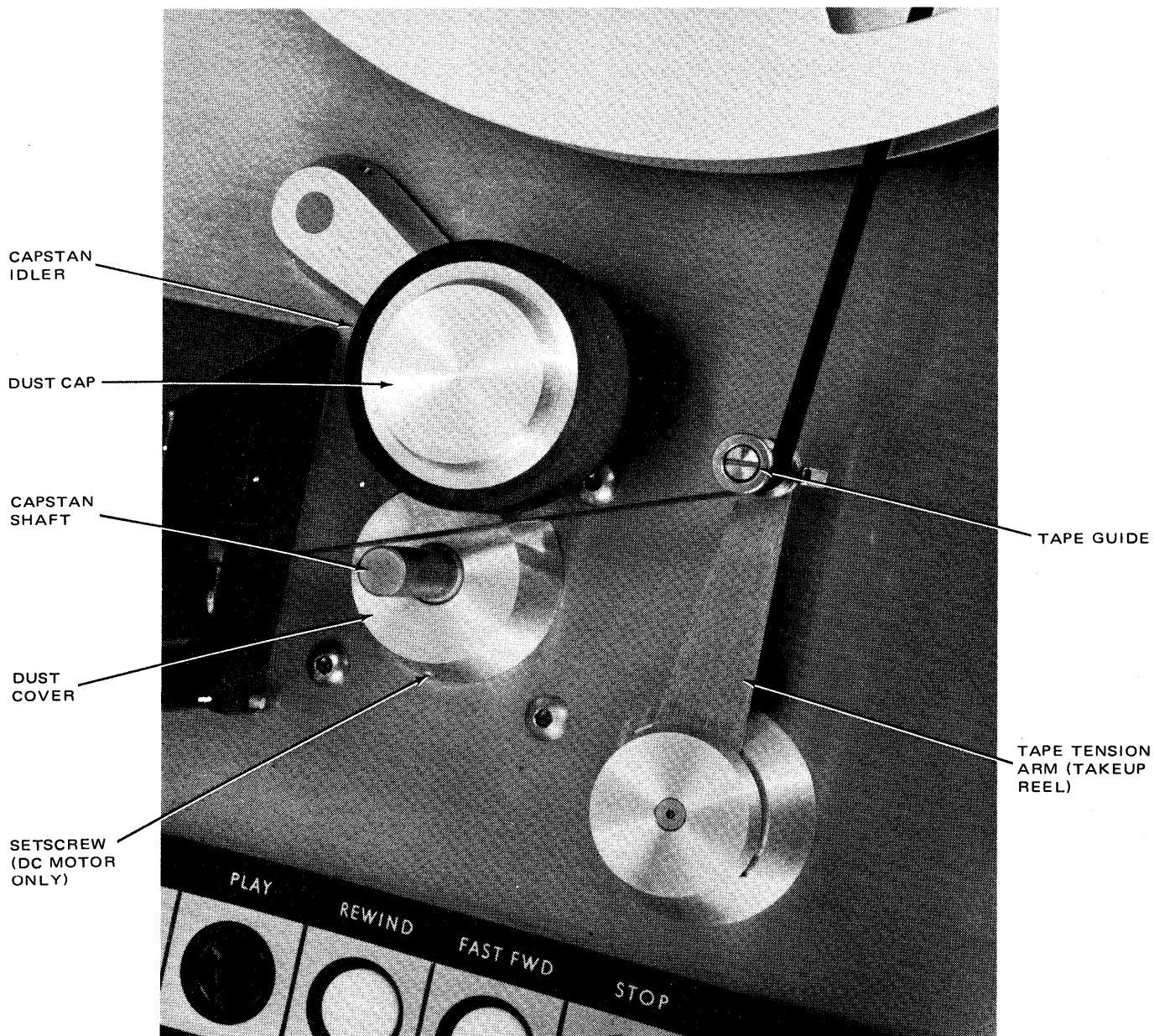
AC Capstan Motor. Proceed as follows:

1. Use a knife blade or similar tool and gently pry up the metal dust cover from around the capstan shaft (Figure 5-1).
2. For motors that have an oil hole in the end bell, fill oil reservoir through the oil hole. For motors without an oil hole, lubricate motor bearings by applying ten drops of oil around the base of the capstan shaft while manually rotating the shaft.

CAUTION

BE CERTAIN TO CLEAN CAPSTAN SHAFT THOROUGHLY AS THE LUBRICATING OIL CAN RUIN THE CAPSTAN IDLER AND MAGNETIC TAPE. IF NECESSARY, CLEAN THE CAPSTAN IDLER WITH ISOPROPYL ALCOHOL.

3. Wipe oil off capstan shaft and surrounding parts. Then replace metal dust cap.



13037-17

Figure 5-1. Tape Drive and Takeup Tensioning Components

Capstan Idler. Proceed as follows:

1. Use a knife blade or similar tool and gently pry up the dust cover from the hub of the capstan idler to expose the felt washer.
2. Apply sufficient oil to *just* saturate the felt washer.
3. Remove any excess oil from the hub of

the capstan idler. Refer to the previous CAUTION.

4. Replace the dust cap.

Scrape-Flutter Idler Lubrication

Ultrasonically clean and then lubricate the scrape-flutter idlers once a year or after each 2,000 hours

of operation. This cleaning and lubrication can possibly be done by a local jeweler or watchmaker, who would usually have the ultrasonic cleaner and special jewel oil required. Otherwise, clean and lubricate the idler as follows:

1. Remove head assembly. (Refer to heading *Changing Heads*, in Section II.)
2. Remove idler assembly retaining screw and lockwasher. Then lift idler assembly off locating pin.
3. Ultrasonically clean the complete scrape-flutter idler assembly.
4. Lubricate each jewel bearing with one drop of jewel oil (or Ampex precision instrument oil No. 087-239). Use a No. 21 gauge hypodermic needle to apply oil to bearing.
5. Mount idler assembly on locating pin and secure, using screw and lockwasher.

PERFORMANCE TESTS

Performance tests should be performed at regularly scheduled intervals, to ensure that the recorder/reproducer is performing in accordance with the specifications given in Table 1-5. Performance tests should also be performed whenever the equipment

appears to be malfunctioning and following repairs to the equipment that may affect performance.

TEST EQUIPMENT

The equipment listed in Table 5-1, items 1 through 8 (or equivalent) is required for completion of the performance tests. Included in the test equipment listed in Table 5-1 are: Alignment tapes (Table 5-2), flutter test tapes (Table 5-5), and filters used during noise measurement tests (Figures 5-2 and 5-3).

Standard test tapes (Table 5-2) are precisely recorded in an Ampex laboratory and must be correctly handled and stored to retain their accuracy. The following requirements should especially be followed.

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

After extensive use, high-frequency tones may drop as much as 2 dB, and flutter indications may rise even though actual flutter remains unchanged.

Table 5-2. Full Track Standard Alignment Tapes

SPEED	TYPE OF EQUALIZATION	TAPE WIDTH	
		1/4 INCH TAPE	1/2 INCH TAPE
3-3/4	NAB (90 μ s and 3180 μ s)	4690037-01	—
	EIA (120 μ s and 3180 μ s)	01-31331-01	—
7-1/2	NAB (50 μ s and 3180 μ s)	01-31321-01	01-31321-05
	IEC (CCIR) (70 ms and ∞)	4690014-01	4690015-01
15	NAB (50 μ s and 3180 μ s)	01-31311-01	01-31311-05
	IEC (CCIR) (35 μ s and ∞)	01-31313-01	01-31313-05
30	AES (17.5 μ s and ∞)	4690093-01	4690085-01

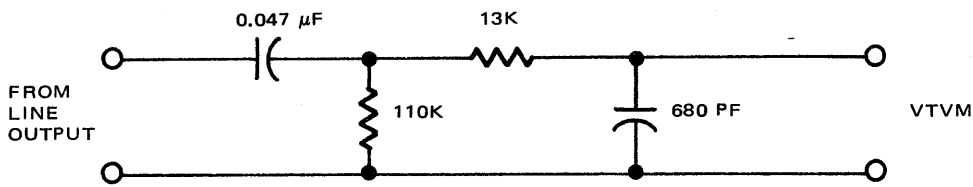


Figure 5-2. 30 Hz to 18 kHz Noise Filter

NOTE:
INSERTION LOSS AT
1 kHz = 4 dB (SUBTRACT
4 dB FROM VTVM READING)

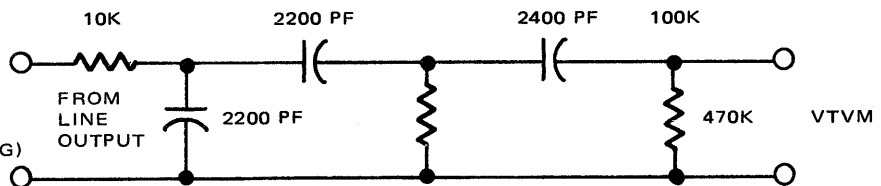


Figure 5-3. ASA "A" Weighted Filter

Flutter increase is caused by: demagnetization of the recorded signal from repeated runs; tape deformation due to tape tension, changes in temperature and humidity; and increased dropouts resulting from tape wear.

The test tape is threaded in the normal tape path (from the supply to takeup turntable). During the alignment procedures, the rewind and fast forward modes may be used as necessary. After alignment, wind the tape completely on the takeup reel, interchange reels, thread the tape, and place the equipment in the reproduce mode to wind the tape back on its original reel.

All tones on 15-in/s or 30-in/s standard alignment tapes are recorded at operating level. On slower speed tapes, all tones are recorded 10 dB below operating level, except for the last tone.

OPERATING-LEVEL CHECK

The specifications presented in Table 1-5 apply to an AG-440C Recorder/Reproducer using Ampex 406 high-output, low-noise tape (or equivalent) at a 260 nWb/m operating level. Some of these specifications may not be achievable using other

tapes or operating levels. If in doubt about the existing level, proceed as follows:

1. Place a standard alignment tape (Table 5-2) on the supply reel. Thread tape according to Figure 3-1.
2. Set controls of the record/reproduce unit for each channel to be checked as follows:
 - a. Set REPRODUCE LEVEL control to CAL.
 - b. Press SAFE pushbutton.
3. Set SPEED switch to appropriate position.
4. Set REEL switches to appropriate positions.
5. Press PLAY pushbutton. The 185 nWb/m, 700-Hz operating level tone should produce a -3 VU indication on the VU meter if the recorder/reproducer is adjusted for a 260-nWb/m operating level. It will produce a 0 VU indication when adjusted for 185 nWb/m operating level.

TEST CONDITIONS

The test conditions specified in steps 1 through 8 below are to be set up prior to continuing with the performance test. After these test conditions are set up, continue with the procedures that follow for checking Overall Frequency Response, Overall Signal-To-Noise, and the Overall Distortion Check.

1. Externally terminate each line output and set LINE TERM switch(es) to off position(s) (down); or, if no external load(s) is (are) to be used (or impedance of external load is more than 2,000 ohms), set LINE TERM switch(es) to ON.
2. Install dummy plug(s) or appropriate input accessory unit(s) into INPUT ACCESS connector(s).
3. Clean and demagnetize heads and other tape-path components. (Refer to *Preventive Maintenance* portion of this section.)
4. Install a reel of blank tape on the recorder/reproducer and thread the tape according to Figure 3-1.
5. Set SPEED switch to appropriate position.
6. Set REEL switches to appropriate positions.
7. Set REPRODUCE LEVEL and RECORD LEVEL controls to CAL.
8. Switch recorder/reproducer POWER switch to ON.

OVERALL FREQUENCY RESPONSE

Either the VU meters of the recorder/reproducer or an external VTVM can be used to measure signal level during the overall frequency response test. The recommended signal level for checking frequency response is 14 dB below operating level for 3-3/4-in/s and 7-1/2-in/s tape speed. Proceed as follows:

1. Connect a signal generator to the INPUT connector of the record/reproduce unit of the channel to be tested.
2. Adjust the signal generator output frequency to 700 Hz.
3. If desired, connect a VTVM to the OUTPUT connector of the record/reproduce unit of the channel to be tested. Otherwise, use the front-panel VU meter.
4. Press the READY and INPUT push-buttons and set RECORD LEVEL and REPRODUCE LEVEL controls to CAL.
5. If the VU meter is being used for response measurements, set the signal generator to the reading given in Table 5-3 (column 4) for the tape speed being used. When using an external VTVM, set the signal generator to the reading given in column 3 of Table 5-3 for the tape speed and line level being used.
6. Start the tape in the record mode of operation.
7. Depress the reproduce pushbutton. If a VTVM is being used, readjust the signal

Table 5-3. Recommended Signal Levels for Checking Frequency Response

METER SENSITIVITY (LINE LEVEL)	TAPE SPEED	VTVM READING MONITORING INPUT OR REPRO.	VU METER READING MONITORING INPUT
+8	3-3/4 or 7-1/2	-6 dBm	20% mark
+8	15 or 30	+8 dBm	0
+4	3-3/4 or 7-1/2	-10 dBm	20% mark
+4	15 or 30	+4 dBm	0

generator level if necessary to give the VTVM reading shown in column 3 of Table 5-3. If VU meters are being used, adjust the reproduce level control for a 0 meter reading.

8. While simultaneously recording and reproducing, vary the oscillator frequency and check the response on either the VU meter or VTVM.

9. Repeat this procedure on other channels or at the other tape speed.

OVERALL SIGNAL-TO-NOISE

The overall signal-to-noise test requires either a 30-Hz to 18-kHz noise filter (Figure 5-2) or an ASA "A" weighted filter (Figure 5-3) to attenuate noise outside of the audible-frequency band. However, since each of these filters attenuates frequencies above its bandpass at 6 dB per octave, neither filter completely removes inaudible high-frequency noise. Therefore, the overall signal-to-noise test should not be performed while simultaneously recording and reproducing a test signal because high-frequency bias-signal pickup may affect the test results.

The signal-to-noise ratio specified in the following test procedure is referenced to a peak record level that is 6 dB above operating level (520 nWb/m) when using Ampex 406 tape. If conventional tapes are used at a peak record level of 370 nWb/m, the signal-to-noise ratio will be degraded depending upon the actual tape used. To convert a VTVM measurement to peak signal-to-noise ratio, change the sign of the VTVM indication and add the number listed in Table 5-4. The result of the addition is a peak record-level signal-to-noise ratio expressed in dB. For example, if the recorder was adjusted with a +4 VU meter sensitivity and ASA,

"A" weighted noise is being measured, a VTVM reading of -62.5 dBm indicates a peak signal-to-noise ratio of 62.5 +6, or 68.5 dB.

Perform signal-to-noise test on desired record/reproduce unit as follows:

1. Perform all steps of test setup procedure.
2. Connect either the 30-Hz to 18-kHz noise filter or an ASA "A" weighted filter to the OUTPUT connector.
3. Connect VTVM to filter output.

CAUTION

DO NOT CONNECT ANY OTHER LOADS TO THE INPUT OF THE VTVM BECAUSE THE ADDITIONAL LOADING MAY CHANGE THE CHARACTERISTICS OF THE FILTER.

4. Disconnect any cable that may be connected to the INPUT connector.
5. Set RECORD LEVEL control to the off position (slightly clockwise from CAL position).
6. Set REPRODUCE LEVEL control to CAL position.
7. Press READY and REPRO pushbuttons on all record/reproduce units.
8. Press PLAY and then RECORD pushbuttons.

NOTE

Steps 7 and 8 place all channels of the recorder/reproducer in the record mode.

Table 5-4. Signal-to-Noise Conversion Numbers

METER SENSITIVITY (LINE LEVEL)	30-Hz TO 18-kHz FILTER CONVERSION NUMBER	ASA "A" WEIGHTED FILTER CONVERSION NUMBER*
+8	14	10
+4	10	6

*This number applies to a filter with 4-dB attenuation at 1 kHz.

Placing all channels in the record mode prevents the possibility of a previous recording on an adjacent track cross-talking into the channel under test.

9. Press STOP and then REWIND push-buttons, allow tape to rewind to beginning of recording made in step 8, then press STOP pushbutton.

10. Press PLAY pushbutton.

11. Note indication of VTVM. Calculate the signal-to-noise ratio using the technique described in the test associated with Table 5-4.

OVERALL DISTORTION CHECK

For accurately checking distortion use a wave analyzer which measures individual distortion products. Instruments that measure total harmonic distortion are inadequate because they will measure modulation noise and tape noise in addition to the distortion products. Also, to avoid error, use a signal generator with less than 0.2% distortion products.

To check distortion, record a 500-Hz signal at normal operating level. The second harmonic distortion should be below 0.4%. The third harmonic

distortion will normally be between 0.6% and 1.1% and is dependent on the type of tape, bias adjustment and the accuracy of the "normal operating level" adjustment.

FLUTTER CHECK

It is recommended that these checks be made with Ampex standard flutter test tapes (see Table 5-5) which are recorded on precise equipment and have less than 0.03% rms flutter. If flutter tapes are not available, it is possible to record a 3000-Hz or 3150-Hz signal to be used for a flutter measurement. After recording a section of tape, rewind to the beginning and start the tape in the reproduce mode. Since it is possible for the record mode flutter to either add or subtract from the reproduce mode flutter depending upon the phase relationship, it is necessary to make several passes over the recorded section of tape and average the flutter meter readings.

Flutter meters are sensitive to amplitude modulation that results from poor head-to-tape contact or from signal dropouts. Therefore, clean the heads before making flutter tests. The following procedure applies to the use of a Micom (Bahrs) Model 8100 flutter meter. If a different flutter meter is used, the manufacturer's instructions should be followed.

Table 5-5. Flutter Test Tapes

TAPE WIDTH (INCHES)	SPEED (IN/S)	FREQUENCY (HZ)	AMPEX CATALOG NO.
1/4	3-3/4	3000	01-31336-01
1/4	3-3/4	3150	4690013-01
1/4	7-1/2	3000	01-31326-01
1/4	7-1/2	3150	4690012-01
1/4	15	3000	01-31316-01
1/4	15	3150	4690011-01
1/4	30	3000	4690099-01
1/2	7-1/2	3000	01-31326-05
1/2	7-1/2	3150	4690012-05
1/2	15	3000	01-31316-05
1/2	15	3150	4690011-05
1/2	30	3000	4690099-05

Perform the flutter check as follows:

1. Set pushbuttons at SAFE and REPRO, reproduce level control in CAL.
2. Connect the output receptacle to the flutter meter signal input connector.
3. Set the flutter meter controls as follows:
 - a. Set the Demod. Input Select to line or 100 MV -5V.
 - b. Set the Meter Select to Demod.
 - c. Set the Weighting Control to DIN (unweighted or weighted, depending upon which flutter reading is desired).
 - d. Set the % Full Scale Selector to 0.3 or 0.1 depending on the reading anticipated.
4. Apply power to the recorder and flutter meter.
5. Thread a flutter test tape on the transport with the tape reel on the takeup turntable. Rewind the tape to a reel on the supply turntable. Set the tape speed to conform to the test tape. Set reel switches to the reel hub sizes in use.
6. Start the test tape in motion in the reproduce mode. The Normal lamp on the flutter meter should light showing that the reproduce output is at the correct level for the flutter meter.
7. Read the indication on the flutter meter, repositioning the % Full Scale Selector on the flutter meter as required. The flutter should meet the specifications given in Section I.
8. Allow the flutter test tape to completely unwind from the supply reel.

MEASURING TAPE SPEED

The recommended method of measuring tape speed is to use an NAB speed measuring pulley

similar to that manufactured by Dubbing Electronics. The speed measuring pulley incorporates a strobe disc so that the strobe bars will be stationary when illuminated from 60-Hz lamps (flashing at a 120-Hz rate). When held against a tape whose thickness is 0.0019 inch (1.5 mil tape), the strobe bars will remain stationary when the tape is traveling at nominal speed. The NAB speed measuring pulley is 1.4305/1.4307 diameter and contains 18 bars for 30 in/s, 36 bars for 15 in/s, etc. To calculate speed error; count the number of bars that drift past a fixed reference point in a measured period of time. The speed error in percent can be calculated by dividing the bars passing the point-per-minute by 72.

Measure tape speed as follows:

1. Apply power and thread a blank tape 0.0019 inch thick (1.5 mil tape) on the transport. Set tape speed and set reel switches for the reel hub size in use.
2. Start the tape and hold the speed measuring pulley lightly against the tape between the capstan and the head assembly.

NOTE

The speed of the tape at the capstan is not the same as at other places in the tape path. The elastic magnetic tape is subjected to different tensions in different portions of the tape path. Portions of the tape stretched by a high tension must travel faster than portions of the tape subjected to a lower tension.

3. Count the bars that move past a given point in a particular time. Be sure to count the bars in the pattern that agree with the tape speed selected. Calculate the speed error from the formula; bars per minute divided by 72 equals the speed error in percent.

TAPE TRANSPORT ADJUSTMENTS

When a failure is noted during the performance test given earlier in this section, adjustment, alignment, or troubleshooting is required.

TEST EQUIPMENT

Test equipment required for tape transport adjustments is given in Table 5-1 (items 12 through 15 or equivalent).

TAPE TENSION

The tape transport may be used under three conditions of tape width: 1/4 inch only, 1/2 inch only, or combined 1/4 inch and 1/2 inch. In Table 5-6 the tensions listed for 1/2 inch only are identical to those needed for combined 1/4 and 1/2-inch operation. Therefore, machines shipped from the factory with 1/2-inch head assemblies may be used with 1/4-inch tape without readjustment. Machines shipped with 1/4-inch head assemblies are adjusted with the 1/4 inch only tensions. If the 1/4-inch head is replaced with a head having a 1/2-inch tape width capability, the tape tension should be reset.

Tape tension is determined indirectly by measuring the torque of both tape reel motors. Required tension adjustments are made by positioning sliders on the resistors under the cover of the transport control box (Figure 5-4).

CAUTION

WHEN TRANSPORT POWER SWITCH IS ON, FULL LINE VOLTAGE IS PRESENT AT THE RESISTORS. TURN POWER OFF WHEN ADJUSTING THESE RESISTORS.

In the following steps, an empty NAB (4-1/2 inch hub) reel is used, and the cord (or twine) is wrapped on the reel being checked in the same direction as recording tape is pulled onto that reel. The spring scale is hooked onto a small loop formed in the free end of the cord and is held stationary, with little or no slack in the cord, so that it will indicate cord tension when PLAY or a FAST WIND button is pushed.

NOTE

An empty EIA (2-1/4 inch hub) reel may be used, but in this event, all of the scale readings of Table 5-6 must be doubled in value.

1. In adjusting resistors during the following steps, loosen contact screws just enough to slide the contacts, then tighten screws just enough to make good electrical contact.

Table 5-6. Tape Tension Adjustment

TAPE WIDTH	PLAY HOLDBACK TENSION		PLAY TAKEUP TENSION		FAST WIND HOLDBACK
	LARGE REEL	SMALL REEL	LARGE REEL	SMALL REEL	LARGE REEL
1/4 inch only	6 ± 1/2 oz. (155 to 185g)	3 ± 1/2 oz. (70 to 100g)	7 ± 1/2 oz. (185 to 215g)	4 ± 1/2 oz. (100 to 130g)	1 ± 1/4 oz. ² (20 to 35g)
1/2 inch only or 1/4 inch and 1/2 inch	8 to 10 oz. ¹ (225 to 285g)	3 ± 1/2 oz. (70 to 100g)	8 to 10 oz. ¹ (225 to 285g)	4 ± 1/2 oz. (100 to 130g)	1 ± 1/4 oz. ² (20 to 35g)

¹ Large reel sliders in extreme right position.

² Machines equipped with DC servo motors may be set for 1-1/2 to 2 ounce (40 to 55g) tension to minimize tape contact with capstan shaft during fast modes.

TAPE WIDTH	MAIN BRAKE FORCE ³	
	SUPPLY REEL CCW MOTION	TAKEUP REEL CW MOTION
Any ⁴	15 to 17 oz. (425 to 480g)	15 to 17 oz. (425 to 480g)

³ Brake force is affected by humidity and temperature extremes.

⁴ If only 1/2-inch tape is to be used, the main brake force can be increased up to 21 oz. (525g) to shorten fast wind stopping time.

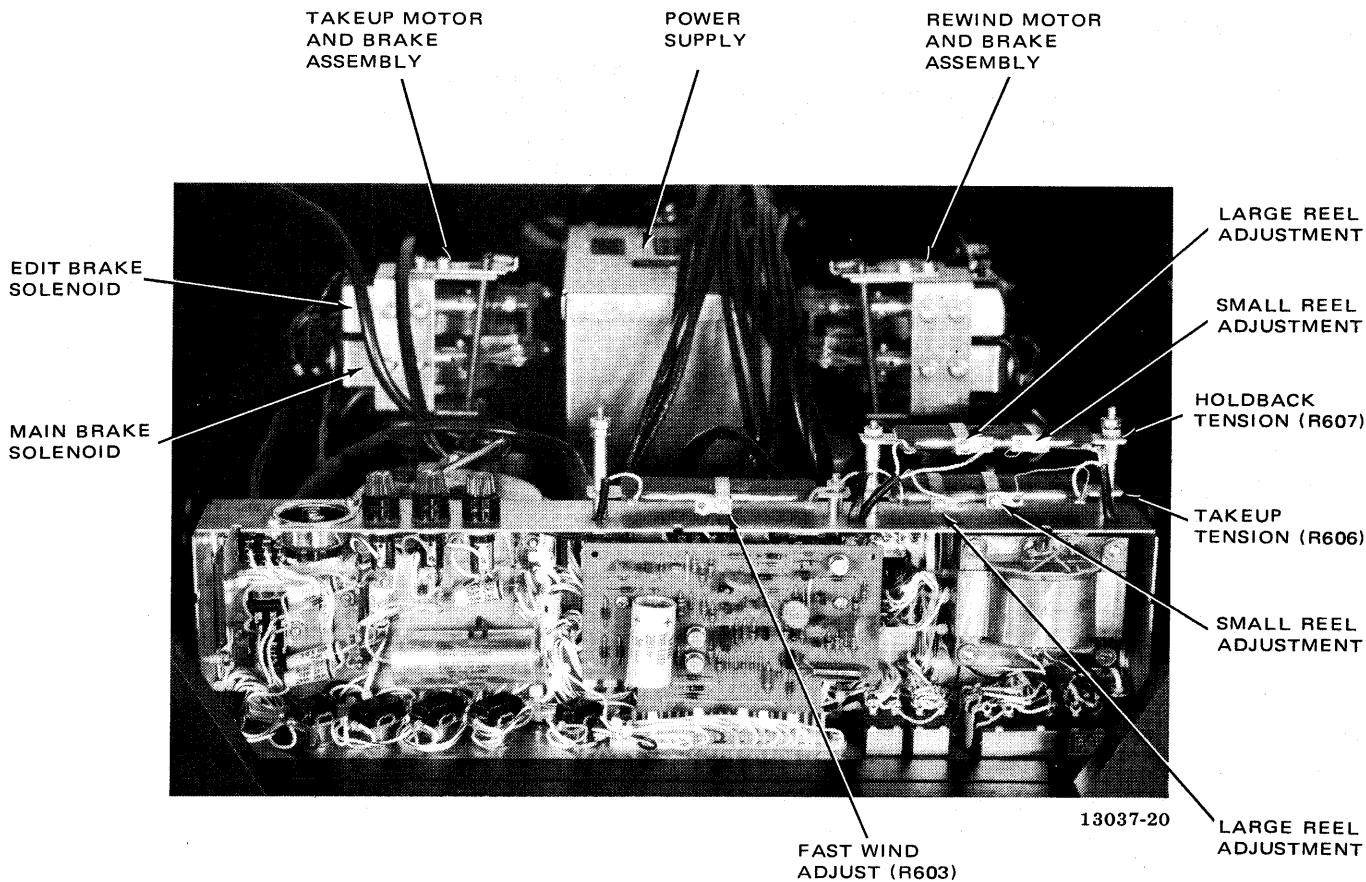


Figure 5-4. Tape Transport Control Box

2. Turn power ON and set SPEED to high or low.

3. Use tape, or a rubber band, to hold the takeup tension arm away from the safety switch.

4. Install the empty NAB reel on the takeup turntable and set the REEL hub switches in the large reel position. Press the PLAY button and adjust the inboard slider on R606 (resistor nearest chassis) for the large reel takeup tension in Table 5-6.

5. Change both REEL switches to the small reel position and adjust the outboard slider of R606 for the small reel takeup tension in Table 5-6.

6. Press STOP and change reel to the supply turntable. Place both REEL switches

in the large reel position; press PLAY and adjust the inboard slider of R607 (farthest from chassis) for the large reel holdback tension in Table 5-6.

7. Change both REEL switches to small reel position and adjust the outboard slider of R607 for the small reel holdback tension in Table 5-6.

8. Press STOP and change REEL switches to the large reel position. Press FAST FWD and adjust the single slider on R603 for the tension in Table 5-6.

BRAKES

The main brake system on each reel stops reel rotation and maintains tape tension. An edit brake

note: mounting holes for the brake and edit solenoids enable adjustment; their positions relative to each other and the the strike plate interactively affect the operation of brake and edit modes

system partially releases the brake bands to reduce braking force when the stop/edit mode is selected.

Torrington clutches on both brake drums eliminate clockwise braking of the supply reel and counterclockwise braking of the takeup reel. Braking is applied only to the reel supplying the tape at the time stop mode is initiated.

These clutches ensure proper stopping with mixtures of reel sizes. The disadvantage is that if the tape runs off the reel during a fast wind, the reel will spin for an appreciable length of time. If only one size reel will be used, the clutches may be defeated. (See heading *Rewind and Takeup Clutch Defeat.*) (page 5-34)

Required brake adjustments are made with the nuts shown in Figure 5-5. When adjusting the main braking force, the two nuts for the main brake adjustment must be turned equally. Proceed with the following steps:

1. Apply power to equipment. Place the NAB reel on the supply turntable.

2. Wrap the cord or twine on reel hub counterclockwise with the loop at the cord free end.

3. Insert the spring scale hook in cord loop. Pull the scale to rotate the reel and check the scale indication while the reel is moving slowly and steadily. Required braking force is given in Table 5-6. Adjust brake nuts as necessary (screw in to increase force, and out to decrease force).

NOTE

The force required to start reel rotation will be much higher than that required when the reel is rotating slowly and steadily.

4. Rewind the cord on the reel hub, counterclockwise. Press the EDIT pushbutton.

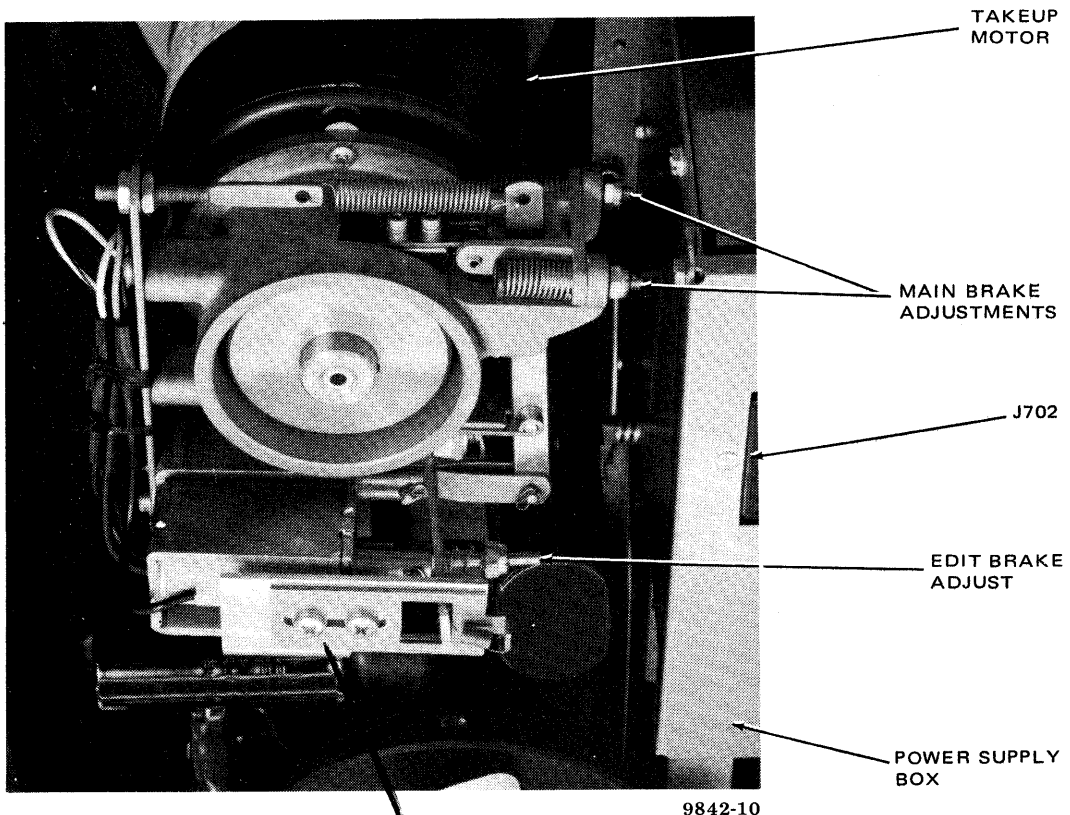


Figure 5-5. Brake Adjustments

limit-of-travel adjustment for solenoids' strike plate: enables edit

NOTE

In the following steps, edit brake force can be set as preferred by each operator. The minimum tension specified ensures holding the takeup tension arm away from the safety switch.

5. Insert the spring scale hook in the cord loop. Pull the scale to rotate the reel and check the scale indication while the reel is moving slowly and steadily. The scale reading will vary as the reel is rotated. The minimum braking force should be between 1-1/2 and 2-1/2 oz. (40 to 70g).

NOTE

Adjust edit-brake nut as necessary (screw in to decrease force, and out to increase force).

6. Press the STOP pushbutton.
7. Move the empty reel to the takeup

turntable. Wind the cord on the hub clockwise. Measure and adjust brake nuts per step 3.

8. Rewind the cord on the reel hub clockwise. Press EDIT pushbutton. Measure and adjust the edit braking force per step 5.

9. Press the STOP pushbutton.

CAPSTAN IDLER

The capstan idler force against the moving capstan is determined by the capstan idler solenoid spring. The force is adjusted by a lock nut on the capstan idler solenoid spade bolt shown in Figure 5-6.

As the solenoid temperature rises, its resistance also rises. When power line regulation is poor, allow 30 minutes or more for warmup (operating in the reproduce mode) before adjusting the capstan idler force. At the factory, the solenoid is checked to be sure it will bottom at line voltages of

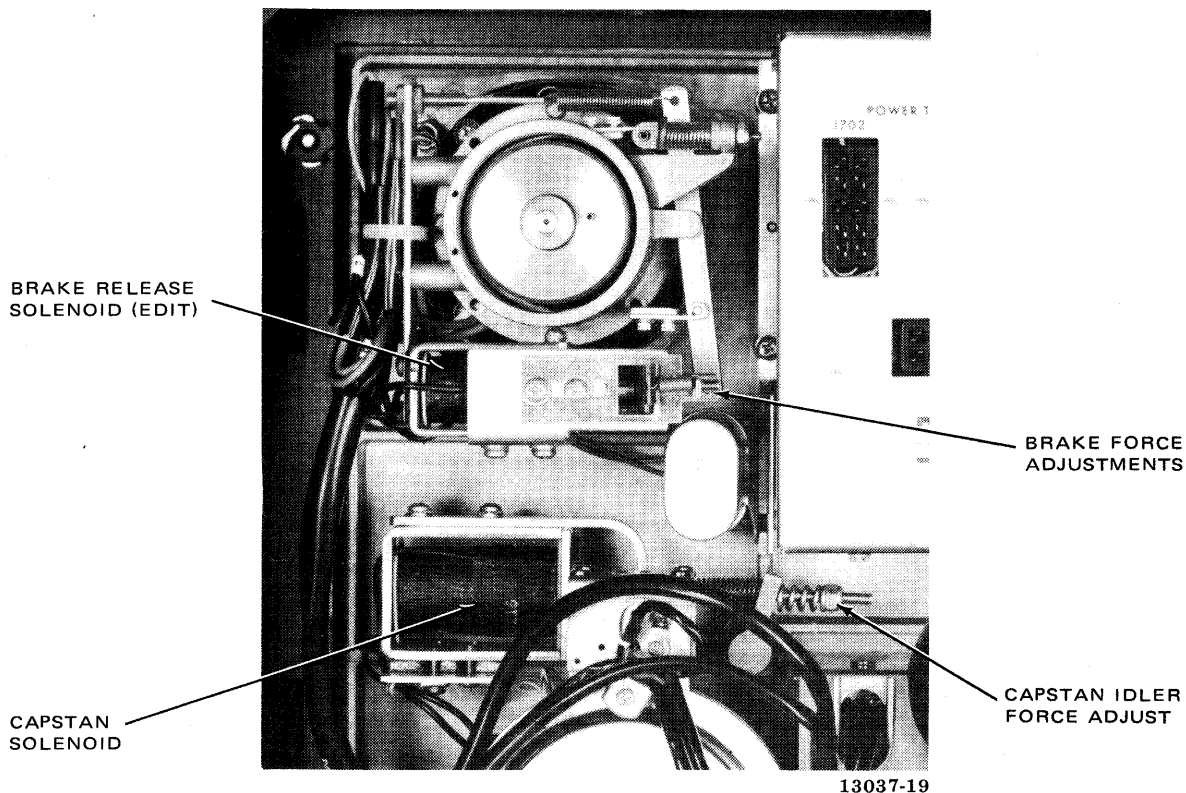


Figure 5-6. Capstan Idler Adjustment

95 volts (cold) and 105 volts (hot). Proceed with the following steps:

1. Apply power to equipment. Use pressure-sensitive tape or a rubber band to hold takeup tension arm (Figure 5-7) away from the safety switch.
2. Tie the cord together to form a continuous loop. Place the loop around the capstan idler shaft as shown in Figure 5-7.
3. Press PLAY pushbutton (the idler moves to contact the capstan, and then both rotate).
4. Insert the spring scale hook through the loop, then pull the cord taut at a 90° angle to the idler arm. Do not let the cord contact the rotating idler.

NOTE

It may be necessary to temporarily increase the clearance between the capstan idler and the capstan idler arm (to prevent the cord from touching the idler). If necessary, loosen the setscrew

(that retains the idler shaft in the idler arm) and increase the clearance. After completing step 6 of this procedure, readjust clearance to normal.

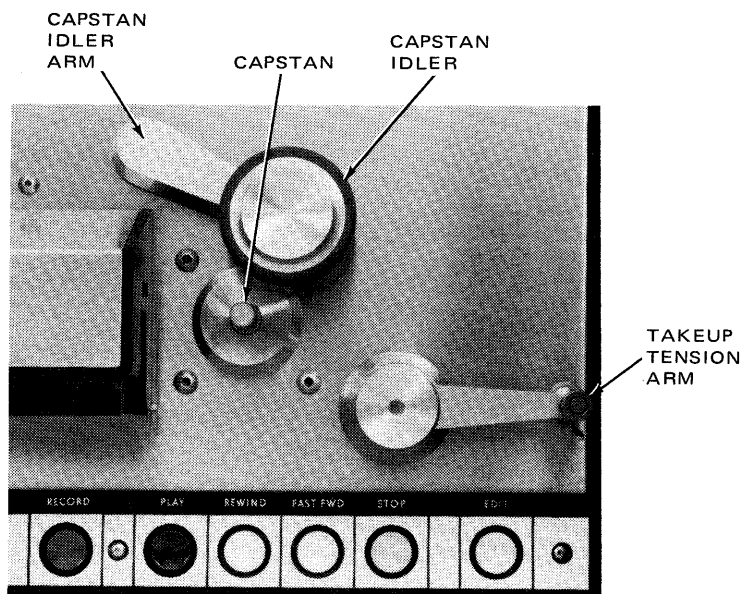
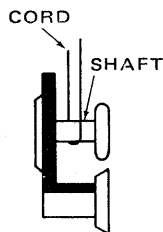
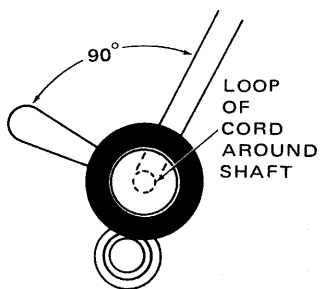
5. Pull on the scale, and note the scale indication when the idler just loses contact with the capstan (the idler stops rotating).
6. Adjust the spring tension nut (Capstan Idler Force Adjust of Figure 5-6) for 9 lbs $\pm 1/2$ lb (3.9 to 4.3 kg).

ELECTRONIC ALIGNMENT

Complete electronic alignment consists of adjustment of power supply voltage, bias oscillator frequency, reproduce adjustments, and record adjustments. Procedures for complete electronic alignment of the AG-440C Recorder/Reproducer are provided below.

TEST EQUIPMENT

Test equipment required for electronic alignment is listed in Table 5-1 (items 1 through 11).



13161-6

Figure 5-7. Capstan Idler Tension Measurement

PRELIMINARY PROCEDURES

Check that the output line is terminated either externally or with the line termination switch. Also clean and demagnetize the heads.

Power Supply

The power supply (with the bias and erase oscillator) is mounted on a plug-in printed circuit board in the transport power supply box. Operation can be checked by connecting the DC voltmeter across pin 9 (positive) and pin 5 of any of the four receptacles (J701 through J704) on the power supply box cover. The voltmeter should indicate 39 (± 1) volts.

If adjustment is necessary, open the cover on the power supply box (see Figure 5-8).

WARNING

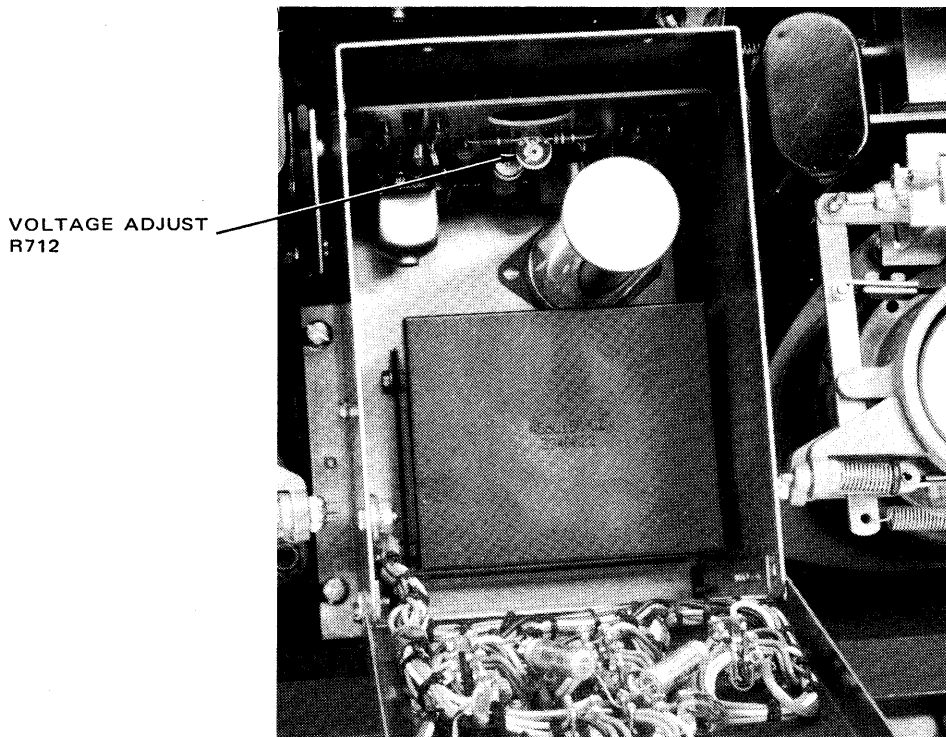
FULL LINE VOLTAGE IS PRESENT WITHIN THE POWER SUPPLY BOX. DO NOT TOUCH

THE FUSE POST OR TRANSFORMER LEADS WHILE THE SYSTEM IS ENERGIZED.

With the voltmeter connected as previously described, place the equipment in the reproduce mode, then adjust R712 (see Figure 5-8) for an indication of 39 (± 1) volts.

Bias Oscillator Frequency

The bias oscillator is mounted on the same plug-in printed circuit board as the 39-volt power supply. The frequency can be measured by connecting a counter or oscilloscope between pin 2 or 3 (positive) and pin 1 (or chassis ground) on any of the four receptacles (J701 through J704) on the power supply box. The counter should read 150 kHz ± 3 kHz. The oscilloscope should indicate a period of 6.53 to 6.80 microseconds. If the frequency needs adjustment, install an extender card and adjust the slug of coil T701 for 150 kHz or 6.66 microseconds.



9842-12

Figure 5-8. Power Supply Box Interior

REPRODUCE ALIGNMENT

High Frequency Equalization

One method for adjusting high frequency response is to utilize a flux loop. This is a device which will induce constant flux into the head when placed in contact with the head and fed a constant voltage from a signal generator. In the absence of equalization the reproduce electronics will produce a flat response from a constant flux signal.

When high frequency equalization is added, the response will rise with increasing frequency. In the absence of a flux loop a standard alignment tape may be used to set high frequency equalization. However, when using the standard tape the results will vary with the condition and accuracy of the tape.

Three controls are associated with the reproduce high frequency equalization: the low speed high frequency equalizer, the high speed high frequency equalizer and the head resonance control. The high frequency equalizers (Figure 1-3) set the turnover frequency established by NAB or IEC (CCIR) standard. This frequency is expressed in microseconds. For example at 15 in/s NAB specifies that the high frequency equalization is 50 microseconds. This gives a 6 dB per octave rising characteristic with a transition frequency (3 dB point) of 3183 Hz (the turnover frequency being the reciprocal of $2\pi RC$). The head resonance control affects both speeds equally and is used to make a compromise compensation for the loss due to a finite reproduce head gap length. It does this by changing the frequency where the head resonates with the input capacity. This resonance produces a rise above the curve generated by the high frequency equalizer. This control is located on the reproduce plug-in module. When turned clockwise viewed from the front it raises the resonant frequency and reduces the gap loss compensation.

Initial Test Steps. Connect the equipment and set controls as specified in steps 1 through 7 which follow.

1. Connect the flux loop to the signal generator and clip it on to the reproduce head.

2. Set the signal generator to deliver a maximum output 500-Hz signal.

3. Connect a VTVM, set to the -10 dBm scale, to the output receptacle.

4. Set the SAFE and REPRO pushbuttons.

5. Set the REPRODUCE LEVEL control to approximately 5.

6. Set the speed switch for the 7-1/2 in/s speed (15 in/s for 15-30 in/s machines).

7. Turn on equipment power.

NOTE

Be sure that the signal generator maintains a constant output voltage for output frequencies of 500 Hz to 15 kHz.

Final Test Steps. If equalization is simply being verified or trimmed, proceed with steps 8 through 11. If equalization is suspected to be completely wrong, omit steps 8 through 11 and complete steps 8A through 14A.

8. With the VTVM set on the -10 dBm scale, adjust the reproduce level control and/or the signal generator to produce the 500-Hz reading in Table 5-7 that agrees with the equalization being verified. The dB readings in Table 5-7 should be interpreted as dB with respect to a -10 dBm reference.

9. Switch to 5 kHz and check that response agrees with Table 5-7, and if necessary adjust the HI FREQ equalizer that corresponds with the SPEED switch setting (high or low).

10. Switch to 15 kHz and adjust head resonance control (R32) if necessary. This adjustment is most easily accomplished with the reproduce module plugged into an extender board.

11. Change to the other speed pair and repeat steps 8 and 9.

Table 5-7. High-Frequency Equalization Response

OPERATION	FREQ.	3-3/4 NAB 90 μ S	7-1/2 IEC 70 μ S	7-1/2 NAB 50 μ S	15 NAB 50 μ S	15 IEC 35 μ S	30 AES 17.5 μ S
Set Level	500	+0.35 dB	+0.2 dB	+0.1 dB	+0.1 dB	+0.05 dB	0 dB
Adjust High Frequency Equalization	5,000 10,000	+9.5 dB —	+7.7 dB —	+5.4 dB —	+5.4 dB —	+3.4 dB —	— +3.5 dB
Adjust Head (R32) Resonance for 3-3/4 – 7-1/2 Recorder	15,000	—	+19 dB ¹	+16 dB ¹	—	—	—
Adjust Head (R32) Resonance for 7-1/2 – 15 Recorder	15,000	—	+18 dB ¹	+15 dB ¹	—	—	—
Adjust Head (R32) Resonance for 15 – 30 Recorder	15,000	—	—	—	+14.5 dB ¹	+11.5 dB ¹	—

¹ Because of variation in head inductance, it may not be possible to reach these center values. Set as close as possible to these readings.

Complete the following steps in place of steps 8 through 11 when equalization appears to be completely wrong.

8A. When starting from unknown equalizer adjustments, begin by turning both low and high speed frequency equalizers to the extreme counterclockwise position. Set SPEED switch in position providing 7-1/2 in/s (15 in/s for 15-30-in/s machines).

9A. With the VTVM set on the -10 dBm scale adjust the reproduce level and/or signal generator to give exactly -10 dBm.

10A. Switch to 5 kHz and adjust the appropriate high frequency equalizer to give the reading in Table 5-7.

11A. Before adjusting head resonance, change to the other speed pair. Set 500 Hz to exactly -10 dBm. Switch to 5 kHz and set the other high frequency equalizer for the appropriate reading in Table 5-7.

12A. Return SPEED switch to original speed setting. Set signal generator output frequency to 500 Hz and adjust the REPRODUCE LEVEL control for the appropriate (Table 5-7) reading.

13A. Switch to 5 kHz and retrim the high frequency equalizer if necessary. This procedure is required because there is some interaction between the high speed and low speed equalizers.

14A. Switch to 15 kHz and adjust the head resonance control for the appropriate (Table 5-7) reading.

Reproduce Head Azimuth

It is recommended that the reproduce head azimuth be adjusted at 7-1/2 in/s for 3-3/4–7-1/2 or 7-1/2–15-in/s machines and at 15 in/s for 15–30-in/s machines. This adjustment may be made using the equipment VU meters. It is made by

adjusting the left-hand nut at the top of the reproduce head (see Figure 5-9).

CAUTION

DO NOT ADJUST ANY OF THE OTHER NUTS ON THE HEAD ASSEMBLY.

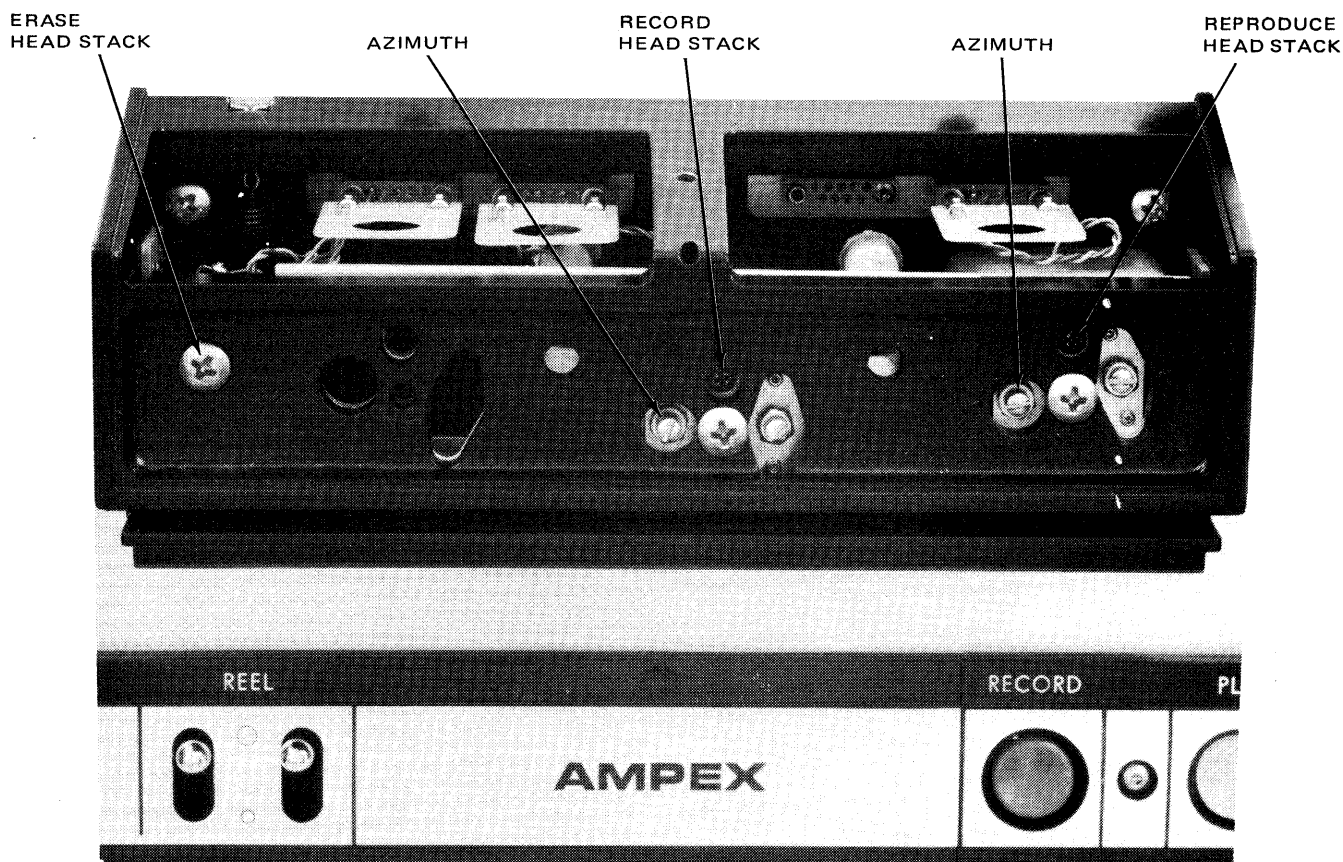
1. Remove the head cover by loosening captive screw on its angled back.
2. Apply power. Thread an appropriate standard alignment tape on the transport. Set the speed and reel size switches accordingly.
3. Set the pushbuttons at SAFE and REPRO. Connect head sets or a monitor amplifier speaker to the head phone jack or the

output receptacle so the voice announcements on the tape can be heard.

4. Start the tape in the reproduce mode and adjust the reproduce level control for a 0 VU meter reading on the 700-Hz tone.
5. On the 15-kHz tone, adjust the reproduce head azimuth adjustment nut (not the screw) for a maximum reading on the VU meters. On multi-channel equipment if all heads do not peak at the same setting, adjust for optimum output of all the heads.

NOTE

If the azimuth is far out of adjustment, minor peaks will appear on each side of the correct setting. Correct adjustment results in an output markedly higher than the minor peaks.



9842-5

Figure 5-9. Head Azimuth Adjustments

Reproduce Standard Tape Response

If the reproduce equalization has been adjusted with a flux loop, the standard tape response is a double check on this adjustment. If the standard tape plays back within ± 1 dB of the 700-Hz reference tone in the 2.5-kHz to 10-kHz region and ± 2 dB 12 kHz to 15 kHz, the previous adjustments are probably adequate. If it does not meet these requirements, look for the problem area:

1. Bad alignment tape.
2. Dirty heads.
3. Improper tape wrap on head (racking). Head gap not centered in the tape contact area.
4. Reproduce high frequency equalizers set improperly.

If the standard tape is to be used for reproduce equalizer adjustment, the reproduce high frequency equalizer should be adjusted on the 5-kHz or 7.5-kHz tone for flat response. Then rewind to the 15-kHz tone and adjust the head resonance control for desired 15-kHz response remembering that the head resonance affects both speeds equally. For example, if the 15-kHz response at 7-1/2 in/s is adjusted to 0, thus compensating for all gap loss, the response at 15-kHz 15 in/s (where the gap loss will be less) may be +1-1/2 to +2 dB above the 700-Hz reference.

NOTE

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

Operating Level Adjustment

This adjustment is made with the operating level 700-Hz signal from the standard alignment tape. It is important that this adjustment be accurate since it affects signal to noise ratio, distortion, and tape saturation level. On Ampex standard alignment tapes this level is 185 nWb/m and is the first tone for 15 in/s and 30 in/s tapes, the last tone for 7-1/2 in/s and 3-3/4 in/s tapes. It is suggested that operating level be set at the speed at which the equipment will usually run. If used equally, set at 15 in/s (7-1/2 in/s for 7-1/2–3-3/4 recorders). The adjustment is made with the reproduce calibrate potentiometer when the REPRODUCE LEVEL control is in the calibrate (CAL) position.

Adjusting for a 185 nWb/m Operating Level

Reproduce the 185 nWb/m 700-Hz operating level tone from the alignment tape. With the REPRODUCE LEVEL control in the CAL position, adjust the reproduce potentiometer (Table 3-2) for a 0 reading on the VU meter or a +4 or +8 dBm reading on the VTVM depending upon the line level selected.

Adjusting for a 260 nWb/m Operating Level

Reproduce the 185 nWb/m 700-Hz operating level tone from the alignment tape. With the REPRODUCE LEVEL control in the CAL position, adjust the reproduce calibrate potentiometer for a -3 reading on the VU meter or a +1 dBm reading on the VTVM if a +4 dBm line level is used, or +5 dBm reading if a +8 dBm line level is used.

NOTE

If an alignment tape with a 200 nWb/m operating level is used, add 0.7 dB to the readings called out above. For example, if the VU meter reading with a 185 nWb/m signal should be -3, it should be set to -2.3 with a 200 nWb/m signal.

Sel-Sync Level Adjustment

While reproducing the operating level signal, press the SYNC button. Adjust the sync calibration potentiometer (Table 3-2) for the same VU meter reading that the reproduce position indicates.

RECORD ALIGNMENT

Erase Peaking

The erase peaking consists of adjusting the erase adjust capacitor C40 (ERASE PEAK in Figure 1-3), and the slugs of coils T3 and T4 to produce the maximum erase voltage. An extender card is needed for adjustment of T3 and T4. The coils need adjustment if the bias frequency changes. For example, if a bias module were changed to another recorder, the slugs should be tuned. If the bias module is changed to another channel, only the erase adjust capacitor requires tuning to match it to the head. Proceed as follows:

1. Install the bias module on the extender card.
2. Press the BIAS pushbutton on the channel being adjusted (the remaining channels should be in SAFE).
3. With no input signal applied to the recorder, start the tape in record mode.
4. Adjust the bias calibrate potentiometer to provide an "on scale" reading of the VU meter. The bias reading on the VU meter changes when an extender card is used.
5. Adjust the erase adjust capacitor for maximum VU meter reading, then adjust the slugs on the coils. Since the three adjustments interact slightly, repeat the adjustment until the maximum reading is obtained.
6. If the bias amplifier is equipped with bias balance potentiometer R92, adjust R92 for minimum noise. An alternate method of adjustment of R92 is as follows.

- a. Connect an ASA "A" weighted filter (Figure 5-3) to the OUTPUT connector.
- b. Connect a VTVM to the filter output.
- c. Adjust R92 for minimum reading on the VTVM.

NOTE

For both methods of adjustment of R92, if a noise null cannot be found within range of the control, demagnetize the heads and readjust capacitor C40 and coils T3 and T4.

7. Stop the tape.
8. Press SAFE.
9. Reinstall the bias module and proceed to the next channel.

NOTE

The adjustment of erase adjust capacitor C40 is quite broad but does affect second-harmonic distortion. Usually any spot on the peak produces acceptable second-harmonic distortion. If the absolute minimum second-harmonic distortion is desired, C40 can be trimmed while measuring distortion. This distortion measurement should be made after the remaining steps in the record alignment are completed.

Bias Adjustment

The selection of bias point is an individual decision; some users prefer peak biasing, some overbiasing, or other bias setting. Two bias adjustment procedures will be described; peak biasing at a long wavelength (15 mils), and overbiasing at a medium wavelength (1.5 mils). The overbiasing procedure provides a more precise setting and is recommended when using Ampex 406 high-output, low-noise tape. Biasing should be done at the tape speed commonly used. If both are used equally, adjust at 15 in/s (7-1/2 in/s for 3-3/4-7-1/2 machines).

Long-Wavelength Peak Biasing. Proceed as follows:

1. Adjust the signal generator to 2,000 Hz at 30 in/s, 1,000 Hz at 15 in/s, 500 Hz at 7-1/2 in/s or 250 Hz at 3-3/4 in/s.
2. Select READY and REPRO.
3. Set REPRODUCE LEVEL control to CAL.
4. Start the tape in the record mode.
5. Adjust the RECORD LEVEL control for an on-scale reading of the VU meter.
6. Adjust the BIAS ADJ (Figure 1-3) for maximum reading on the VU meter.

Medium-Wavelength Overbiasing. Proceed as follows:

1. Adjust the signal generator to 20 kHz at 30 in/s, 10 kHz at 15 in/s, 5 kHz at 7-1/2 in/s, or 2.5 kHz at 3-3/4 in/s.
2. Select READY and REPRO.
3. Set REPRODUCE LEVEL control to CAL.
4. Start the tape in the record mode.

NOTE

This adjustment can be made at operating level at 15 in/s and 30 in/s but should be made at least 10 dB below operating level at 3-3/4 and 7-1/2 in/s.

5. Adjust the RECORD LEVEL control for an on-scale reading of the VU meter.
6. Adjust the BIAS ADJ for maximum reading on the VU meter.
7. Since the azimuth must be in approximate alignment to provide a signal at the 1-1/2 mil wavelength, it may be necessary to make a preliminary azimuth adjustment at this time. Place a nut-driver on the left-hand

nut of the record head (Figure 5-9) and adjust for a maximum reading on the VU meter.

8. At the 15 and 30 in/s speed, adjust the RECORD LEVEL control for a VU meter reading of +1. Check that this is still the maximum reading point by turning the bias adjust control, then overbias 1-1/2 dB by turning the control clockwise until the VU meter reads -1/2.
9. When adjusting at 3-3/4 or 7-1/2 in/s, after adjusting the bias adjust and record head azimuth for a maximum reading (steps 6 and 7), adjust the RECORD LEVEL so that the VU meter reads between the 20% mark and -10 VU.

- a. Adjust the REPRODUCE LEVEL control so the VU meter reads +1.
- b. Check that this is still the maximum reading point by turning the BIAS ADJ control, then overbias 1-1/2 dB by turning BIAS ADJ clockwise until the VU meter reads -1/2.

NOTE

When using Ampex 406 tape, 1-1/2 dB overbias at 1.5-mil wavelength falls within the range of peak bias at 15-mil wavelength.

Bias Metering Calibration

Immediately after adjusting the bias (see preceding paragraph) and while still recording, press the BIAS pushbutton. Adjust the bias calibration potentiometer so that the VU meter indicates 0.

Record Head Azimuth

This adjustment is similar to the reproduce head adjustment except that it is made while simultaneously recording and reproducing a short wavelength signal. This procedure ensures that the azimuth of both heads coincide. Proceed as follows.

1. Use a 15-kHz signal generator output at 7-1/2 in/s or a 25-kHz signal at 15 in/s.
2. Use pushbuttons to select READY and REPRO.
3. Set REPRODUCE LEVEL control to CAL.
4. Start the tape in the RECORD mode.
5. Adjust the RECORD LEVEL control for a VU meter reading near the 20% mark.
6. Adjust the REPRODUCE LEVEL control so that the VU meter indicates between 0 and -5.
7. Adjust the record head azimuth nut (not the screw) shown in Figure 5-9 for a maximum reading on the VU meters. On multi-channel equipment, if all heads do not peak at the same setting, adjust for optimum output of all the heads.

Record High Frequency Equalization

This adjustment can be made at operating level for 15 or 30 in/s, but should be made at least 14 dB below operating level for 3-3/4 and 7-1/2 in/s. Proceed as follows:

1. Select READY and REPRO.
2. Set REPRODUCE LEVEL control to CAL.
3. Set signal generator output frequency to 700 Hz.
4. Start the tape in the record mode.
5. For 15 or 30 in/s speeds, adjust the RECORD LEVEL control so the VU meter indicates 0.
- 5a. For 3-3/4 or 7-1/2 in/s speeds, adjust the RECORD LEVEL control so that the VU meter indicator is at the 20% mark. Adjust the REPRODUCE LEVEL control so the VU meter indicates 0.

6. Change the signal generator output frequency to 7 kHz.
7. As a preliminary setting, adjust the appropriate low or high speed record equalizer so that the VU meter indicates 0.
8. Check the response above and below 7 kHz and trim the record equalizer for the response desired. If the desired response cannot be obtained, the reason may be:
 - a. Heads are dirty.
 - b. Improper tape wrap on head (racking). Head gap not centered in the tape contact area.
 - c. Attempting to adjust 3-3/4 or 7-1/2 in/s response at operating level.
 - d. Forgetting to place the reproduce level in the CAL position when adjusting record level.
 - e. Bias set incorrectly. The bias adjustment can be used to improve response. However, remember that compensating for record deficiencies by underbiasing increases distortion.

Before repeating the Record High Frequency Equalization adjustments at the other tape speed, proceed with the Reproduce Low Frequency Equalization procedure given below. Then perform the High Frequency and Low Frequency Equalization procedures at the other tape speed.

Reproduce Low Frequency Equalization

This adjustment is made while simultaneously recording and reproducing to avoid fringing effects present if the adjustment is made with a full track standard tape. Proceed as follows:

1. Using the 700-Hz reference level noted during record high frequency equalization, sweep the signal generator frequency slowly from 700 Hz down to 30 Hz (note the magnitude of the peaks and dips).

2. Adjust the appropriate low or high speed reproduce low frequency equalizer for the flattest possible response. This is done by adjusting the head "bump" excursions for an equal magnitude above or below the 700-Hz reference level.

Input Calibration Adjustment

Adjust the input calibration as follows:

1. Select READY and REPRO.
2. Set RECORD LEVEL and REPRODUCE LEVEL controls to CAL.
3. Set signal generator frequency to 700 Hz and output level at +4 or +8 dBm, depending upon the line level used.
4. Start the tape in the record mode.
5. Adjust the input calibrate potentiometer (Table 3-2) for a 0 reading on the VU meter.

Record Calibrate Adjustment

After completing the Input Calibration Adjustment procedure above, proceed as follows:

1. Press the INPUT pushbutton.
2. Adjust the RECORD calibrate adjustment on the record plug-in module for a 0 indication on the VU meter.

SERVO GAIN ADJUSTMENT

NOTE

This adjustment should be made only when a major component of the servo system is changed. If 1200-Hz carrier whine is audible, reduce servo gain (turn R19 clockwise).

Proceed as follows:

1. Put the capstan servo PWA on extender board 4050695.

2. Attach a scope probe to test point number 2 of the capstan servo PWA.
3. Put recorder in PLAY.
4. Adjust R19 on capstan servo PWA for minimum signal jitter.
5. Remove extender board and re-install PWA.

HEAD MAINTENANCE

Head cleaning and demagnetizing was discussed in the *Preventive Maintenance* portion of this section, under headings *Cleaning* and *Demagnetizing*. Adjustment of head azimuth was discussed in the *Electronic Alignment* portion of this section, under the heading *Record Head Azimuth*. Changing the head assembly is explained in the Installation section (Section II), under the heading *Conversion*. The head and tape adjustment explanations follow. Head height is precisely set at the factory, therefore, height adjustment is seldom required except when a head stack is changed.

ADJUSTING HEAD HEIGHT

Record/Reproduce (All Except Two-Channel Four-Track)

Adjust head height as follows:

1. Remove the head housing cover by loosening the captive screw on the angled back surface.
2. Thread tape on transport, and initiate the play mode at the highest speed available.
3. Loosen the hex nut (Figure 5-10) approximately 1/4 turn.
4. Turn the two hex-socket setscrews (see Figure 5-10) clockwise the same number of turns, until the head laminations barely appear at the tape bottom edge. Keep relaxing

the hex nut and azimuth nut, as necessary to maintain tension and azimuth.

5. Carefully count the turns, while turning the two hex-socket setscrews counterclockwise (in exactly equal turns) until the head laminations barely appear above the tape top edge. Keep tightening the hex nut and azimuth nut as necessary to maintain tension and azimuth.

6. Turn the same two setscrews back (clockwise) half the number of turns counted in step 5. Again relax the hex-nut and azimuth nut as necessary to maintain tension and azimuth. Finally tighten the hex nut until it is snug.

7. Stop tape motion.

8. Check head azimuth and tape wrap. Check head azimuth as explained earlier in this section.

9. Replace head housing cover.

Record/Reproduce (Two-Channel Four-Track)

To set the height of a two-channel four-track record or reproduce head: repeat steps 1, 2, and 3, given in the paragraph above; then adjust the two hex-socket setscrews so that the mu-metal portion of the outermost head (head furthest from tape transport) is exactly even with the edge of the tape furthest from the tape transport.

Erase Heads

Erase head height is adjusted with shims (0.010, 0.002, 0.003, and 0.005 inch thick, Ampex Part Nos. 4350025-01, 4350025-02, 4350025-03, and 4350025-04 respectively). To change shims, the head must be removed by removing one cross-head screw (Figure 5-10).

Except for four-track 1/4-inch erase heads, shim the head until the ferrite portion of the outermost head (head furthest from tape transport) is just visible at the outermost edge of the tape. Add shims until the similar portion of the bottom head is barely visible below the tape bottom edge. Then

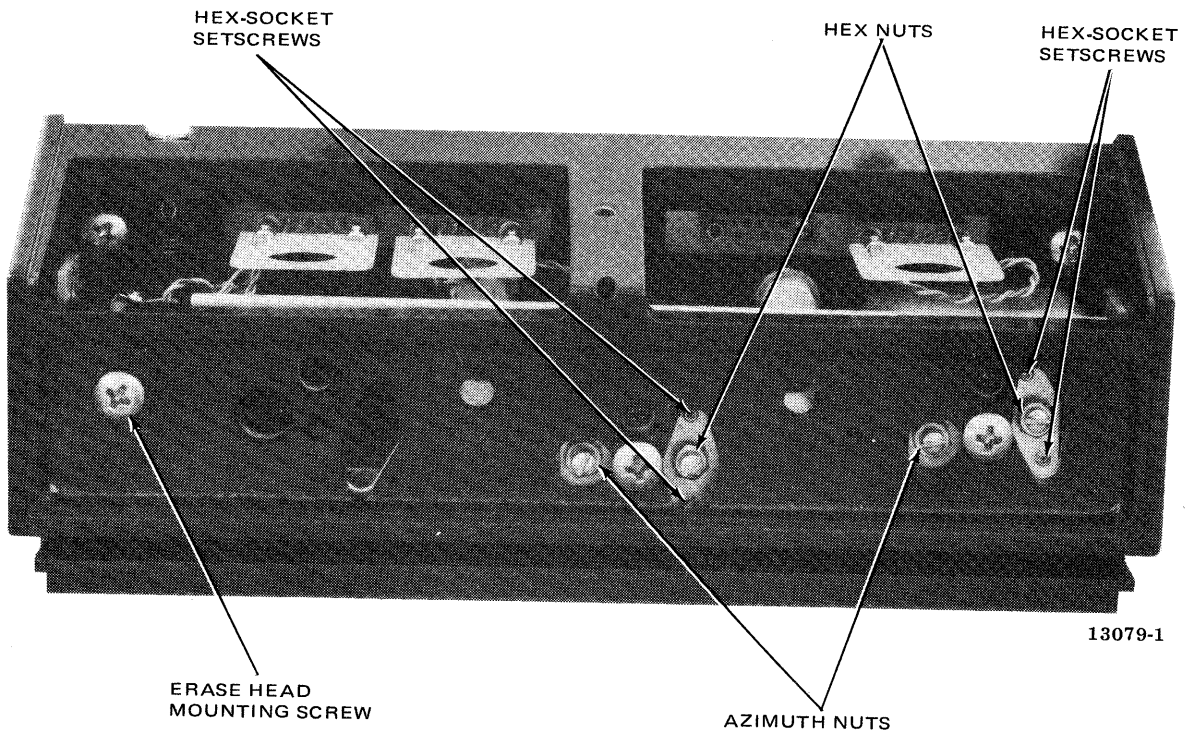


Figure 5-10. Head Height Adjustments

remove exactly half the shim thickness that was needed to move the head stack from the top to the bottom of the tape.

Adjust four-track 1/4-inch erase head height to dimension shown on drawing 4020355.

ADJUSTING TAPE WRAP AND ZENITH

The head gap must be centered in the tape contact area, and the tape must contact the head top and bottom equally.

To check tape wrap (racking) and head zenith (perpendicularity), lightly cover the head face with grease pencil or crayon. Thread tape on transport, initiate the high speed play mode, and stop it after ten seconds. Lift the tape from the head; the head area visibly cleaned by the tape should be centered on the head gap (this checks tape wrap). The head tape-contact area should also be equally clean at the top and bottom (this checks head zenith).

If tape wrap adjustment is indicated, remove the head housing cover by loosening the captive screw on the angled back surface. Loosen the large

cross-head screw (Figure 5-11). Adjacent to the large cross-head mounting screw there is a smaller cross-head screw in a hole. Loosen the small cross-head screw, and carefully use a screwdriver to pry at the side of the aluminum plate (through which the head stack mounting screws protrude) in the required direction. Check that the shield can is aligned with the head gate shield, then tighten the screws. Recheck the tape wrap per the preceding paragraph. Repeat the process until the tape wrap is correct. The erase head is adjusted for tape wrap by loosening the mounting screw, rotating the head as required, and tightening the screw.

To adjust the head zenith, loosen the hex nut and use the two hex-socket setscrews (also used for head height adjustment, see Figure 5-11). As the adjustment is being made, visually check the zenith by lining up the head (by viewing from the side) with the capstan or the scrape-flutter idler. Turn the outermost setscrew in and the innermost setscrew out, to move the stack bottom in (away from the tape). To move the bottom of the head out (toward the tape), reverse the procedure. Be sure both setscrews remain snug. When the zenith adjustment seems correct, recheck it with the

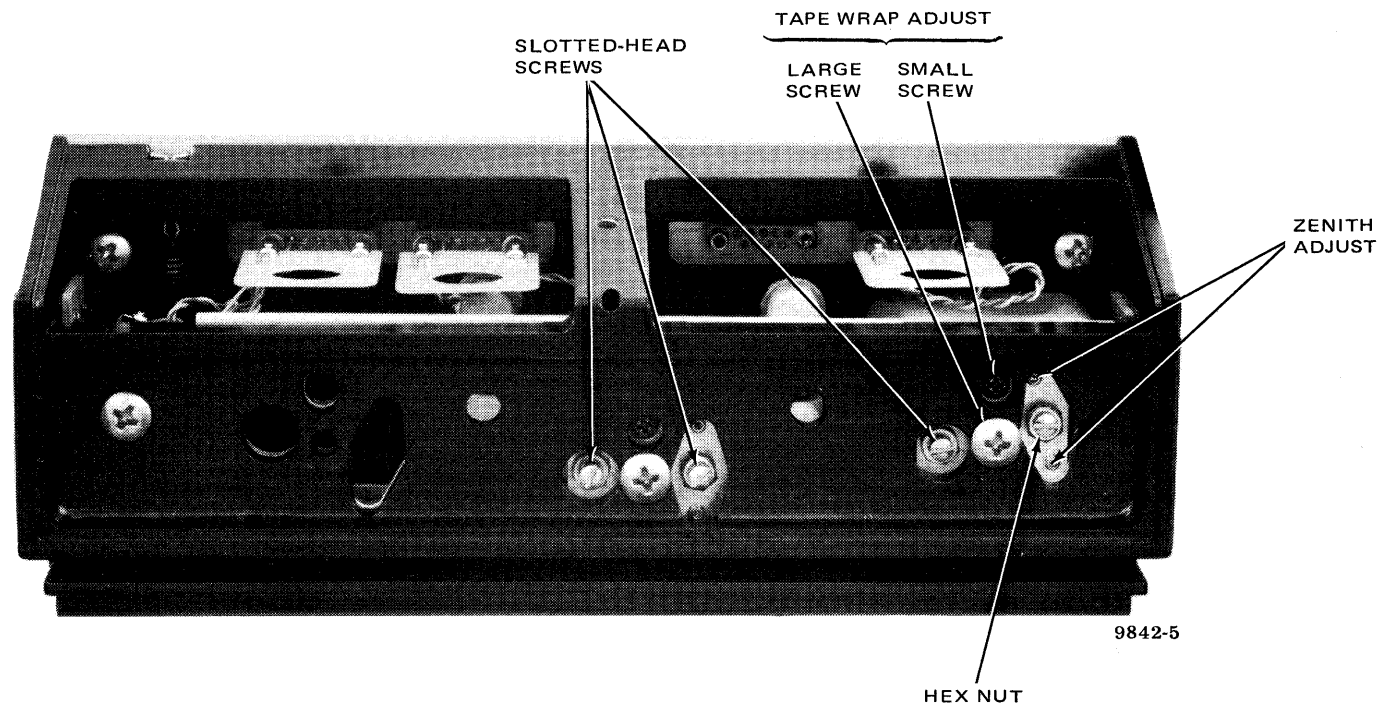


Figure 5-11. Tape Wrap and Zenith Adjustments

grease pencil method described above. Repeat the adjustment until the head zenith is correct (no zenith adjustment is required for the erase head).

Whenever head zenith or tape wrap is changed, check the head azimuth and height.

CHANGING HEAD STACKS

Record or Reproduce Stack

To change the record or reproduce head stack, proceed as follows:

1. Remove the complete head assembly. Head assembly drawings are provided in Section VI.

2. Remove the large cross-head screw (Figure 5-11) and then the shield can (containing the head stack).

3. If the replacement head stack is in a shield can, mount the shield can in position. Check (through the bottom of the casting) that the head stack shield can is aligned with the gate shield, and is parallel to the casting top front edge, then tighten the mounting screw.

4. If the head stack is not in a shield can, use a screwdriver to remove the two slot-head screws and the nuts (Figure 5-11) and remove the head stack from the shield can. Be careful not to lose the double-coil lockwasher. Remove head stack and two head springs from the shield can.

CAUTION

WHEN SOLDERING LEADS ON A HEAD STACK, USE A SMALL-WATTAGE PENCIL-TYPE SOLDERING IRON. EXCESSIVE HEAT CAN CAUSE IRREPARABLE INTERNAL DAMAGE TO THE HEAD STACK.

5. Unsolder the leads at the terminals of the old head stack and solder the leads to the terminals of the new head stack.

6. Turn the two hex-socket setscrews out until the ends are even with inside of the shield.

7. Obtain the two slot-head screws and the nuts removed in step 3. Turn the nuts tightly against the screw heads. Place the double-coil lockwasher over the end of the screw with the plain hex nut (the other screw has a self-locking nut).

8a. On heads for 1/4-inch tape, place the two head springs in the indentations in the top of the head stack. Slip the head stack into the shield can without displacing the springs.

8b. On heads for 1/2-inch tape, hold the shield can upside down, and place the two head springs in the indentation in the shield can (looking through the shield can open side, the indentations are at the right front and right rear). Without displacing the springs, slide the head stack (upside down) into the shield can.

9. Insert the two slot-head screws through the plate and shield can, along with the azimuth nut, plain hex nut, and double-coil lockwasher. Engage the two screws in the head stack holes, and tighten them firmly.

10. Secure the head stack and shield can in the head assembly with the large cross-head screw removed in step 2. Check (through the bottom of the casting) that the head stack shield can is aligned with the gate shield, and is parallel to the casting top front edge; then tighten the mounting screw.

11. Turn-in the two hex-socket-head setscrews to lower the head stack, until head height is approximately correct.

12. Turn the two nuts on the slot-head screws down against the plate, and use the azimuth-adjusting nut (see Figure 5-9) to set the head azimuth to the approximate correct position.

13. Install head assembly on the transport and mate the connectors with the correct receptacles.

14. Check and adjust head height, tape wrap, zenith, and head azimuth.

Erase Head Stack

To change an erase head stack, remove the complete head assembly from the transport. Remove the large cross-head screw, then remove the erase head stack, spacer, and shims. Place the spacer and shims on the new assembly and mount them on the casting with the mounting screw. Check erase head height and tape wrap.

REPLACING HEAD TAPE GUIDES

If any of the three sapphire tape guides on the head assembly are replaced or become misadjusted, the tape guide must be properly positioned. A special tool (4930512-01 for 1/4-inch guides and 4930512-02 for 1/2-inch guides) is used to ensure the positioning accuracy required for proper tape guidance. Use of this special tool is illustrated and explained in Figure 5-12.

SAPPHIRE GUIDE SET-UP

ARRANGE HEAD ASSEMBLY WITH TOOL 4930512-XX ON A FLAT SURFACE AS SHOWN BELOW.

1. LOOSEN BOTH 4-40 SCREWS.
2. PUSH THE TOOL FORWARD SLIGHTLY AND GENTLY UNTIL IT CONTACTS THE SAPPHIRE TAPE GUIDES ON BOTH UPPER AND LOWER EDGES.
3. TIGHTEN BOTH SCREWS.
4. PULL THE TOOL BACK OFF THE TAPE GUIDE, THEN PUSH IT FORWARD AGAIN GENTLY TO CHECK AND FEEL IF THE TAPE GUIDE HAS BEEN SET-UP TO THE PROPER LEVEL; IF NOT, REPEAT THE PROCEDURE.

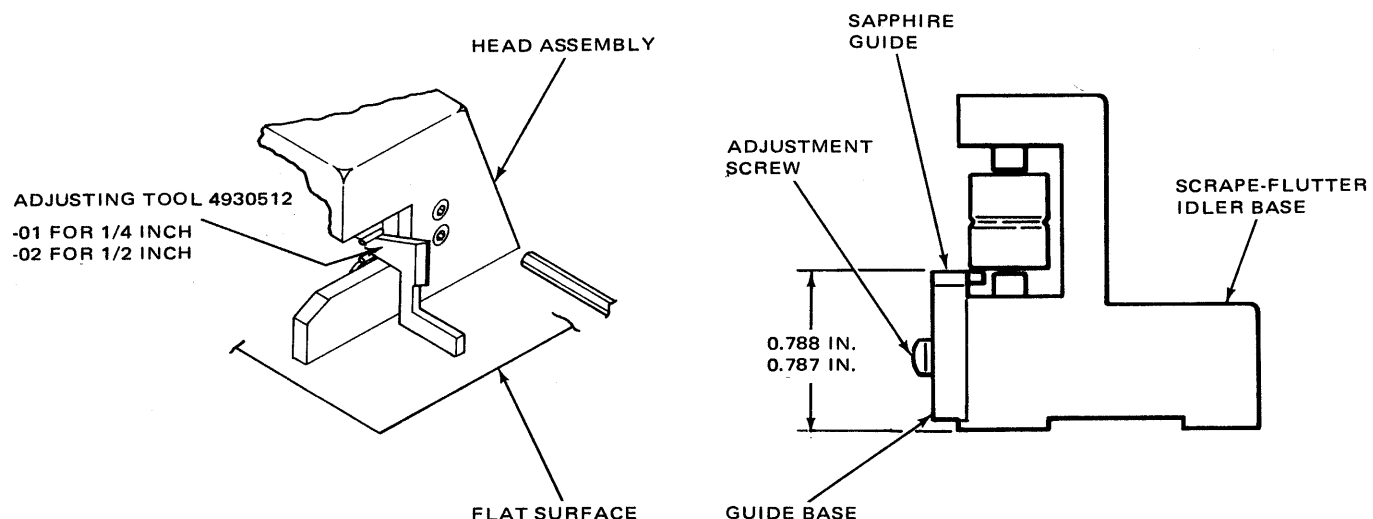


Figure 5-12. Sapphire Tape Guide Adjustment

If the sapphire guide on the scrape flutter idler requires replacement or is loose, adjust the guide to the dimension shown in Figure 5-12 (use a vernier caliper for measurement).

TRANSPORT MAINTENANCE

The following paragraphs contain transport corrective maintenance, parts replacement, instructions and the special adjustment procedures required thereafter. Most of these procedures require removal of the console front panel.

SERVICING HINTS

Brake Bands

Glazed brake bands that are not contaminated with oil can sometimes be renovated by abrading them

only with 600-grit sandpaper. (Do not use emery cloth or carborundum-coated paper.)

Solenoids

A corroded solenoid plunger, which does not slide freely, can be renovated by rotating it in a drill press while holding crocus cloth against it.

CAUTION

DO NOT LUBRICATE PLUNGERS, SINCE OIL CAN EVENTUALLY CAUSE STICKING.

Relays

To visually check if a relay is energizing, remove the snap-on cover with a thin-blade tool. Rub any

contaminated relay contacts clean with bond paper or a relay-contact burnishing tool.

The four control circuit relays are identical to the electronics record relay. In an emergency the record relay of a channel that will not be placed in record may be interchanged with a defective control circuit relay.

Capstan Idler

The capstan idler (Figure 5-13) is removed from the idler arm by loosening the retaining setscrew. Instructions for removing the idler wheel from the idler shaft are given later in this section under the heading *Idler Assembly Replacement*.

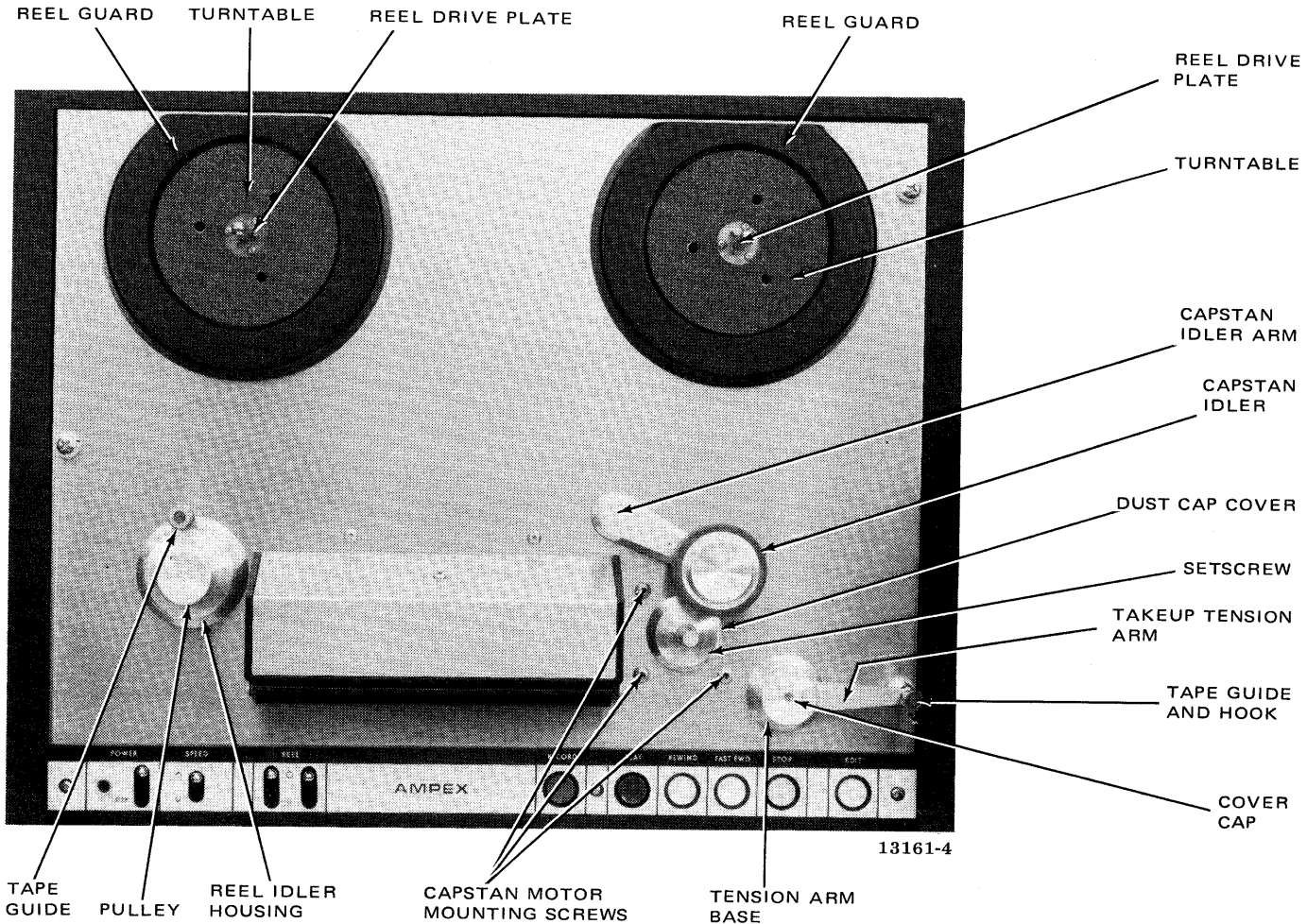


Figure 5-13. Tape Transport Components (Top View)

REPLACEMENT OF HEAD-CABLE BOX

Remove and install the head-cable box as explained under the heading *Changing Heads* (Section II of this manual).

REPLACEMENT OF POWER SUPPLY BOX

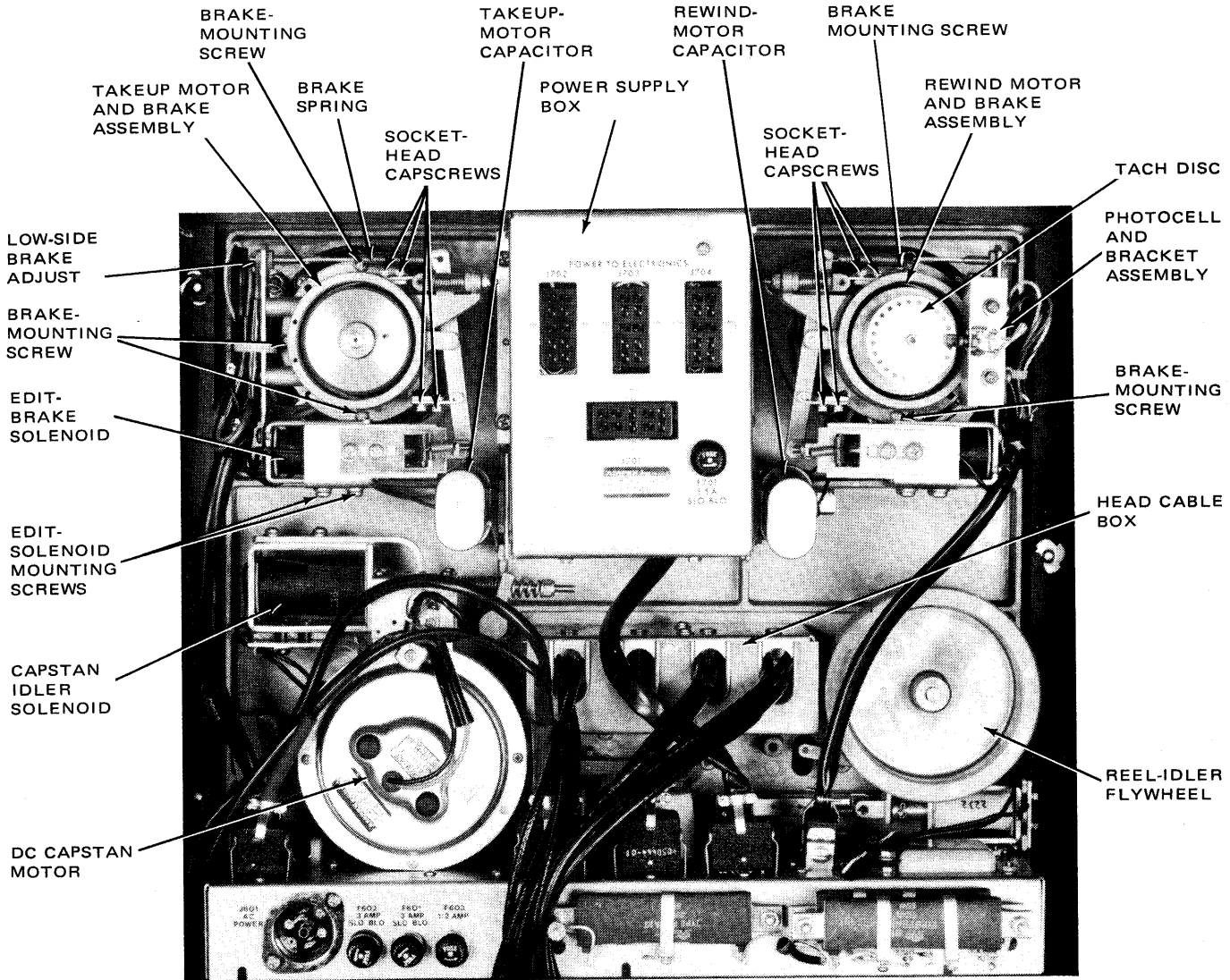
Power Supply Removal

To remove the power supply (Figure 5-14), disconnect cables from receptacles J701 through J704.

Disconnect the captive power-supply cable from the receptacle on the transport control box. Remove the four mounting screws and remove the power supply box.

CAUTION

A POWER TRANSISTOR IS MOUNTED ON THE SIDE OF THE POWER SUPPLY, NEXT TO THE TRANSPORT. USE CARE NOT TO DAMAGE THE TRANSISTOR WHILE REMOVING THE POWER SUPPLY.



13037-19

Figure 5-14. Tape Transport Components (Bottom View)

Power Supply Installation

Install the power supply in reverse order of removal procedures. (The captive cable is routed from under the power supply box, out of the side toward the transport control box.)

TAKEUP AND REWIND ASSEMBLIES

Major components in the takeup and rewind assemblies (Figure 5-14) are the torque motor and the brake. The turntable (fixed to the motor shafts) cannot be adjusted or individually replaced. The fixed position of the turntable also prevents removal of the motor flange. If any of these components are damaged beyond use, the complete motor assembly must be replaced.

Adjustment of tape tension (motor torques) and braking force are discussed earlier in this section (see *Tape Tensions and Brakes*).

Replacing Takeup or Rewind Assembly

The takeup and rewind assemblies are each secured, through slotted holes in the top plate, to the reel guards (for quick conversion to 11-1/2-inch CCIR reels). When either assembly is removed, the reel guard (Figure 5-13) will also be released.

To remove either assembly (Figure 5-14), disconnect the connector from the tape transport, slide the plastic sleeving from the capacitor solderless connectors and disconnect them. Manually support the assembly, and remove the three mounting nuts and washers (Figure 5-15).

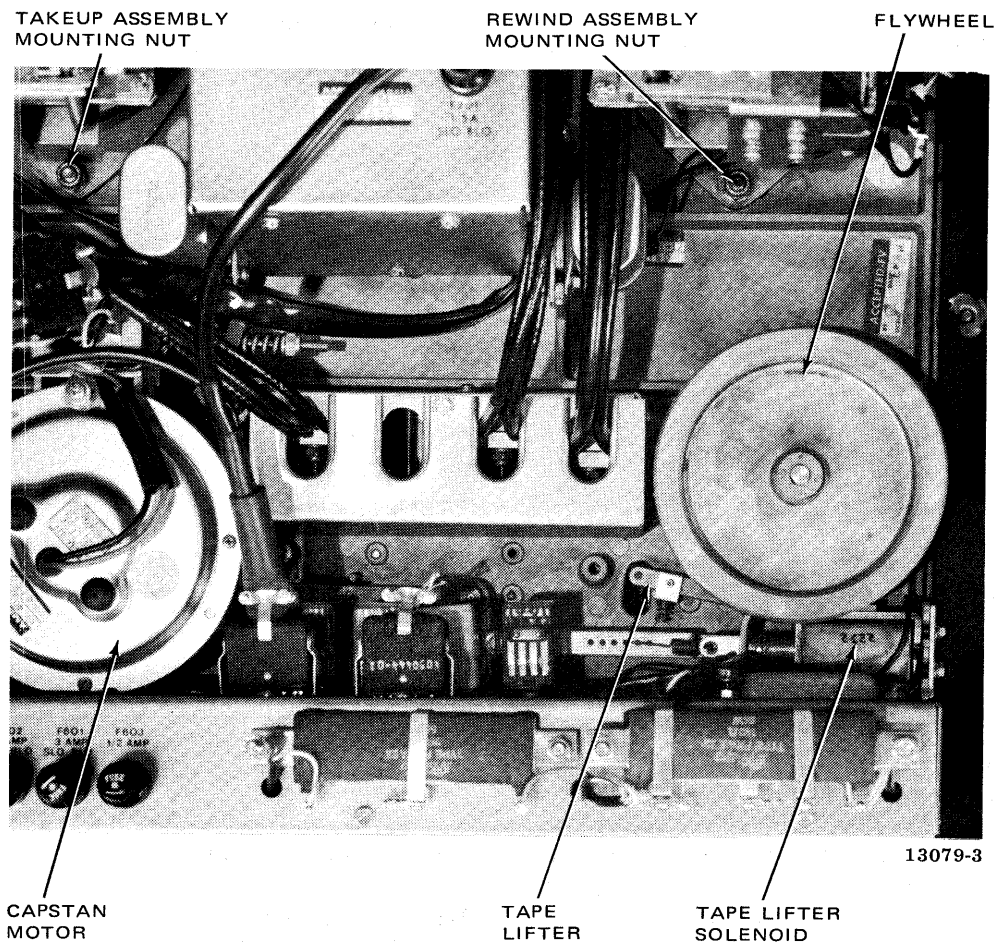


Figure 5-15. Takeup and Rewind Assembly Mounting Nuts

Reinstall the assembly in the reverse order of removal procedures. If the 10-1/2-inch NAB reel is the largest to be used, secure the assembly in the innermost position. If the 11-1/2-inch CCIR reel is to be used, secure the assembly in the outermost position. Before tightening the mounting nuts, check that the flat portion of the reel guard is parallel with the transport top edge and that the turntables are centered in the guard.

Reel Drive Plate Replacement

A reel drive plate (Figure 5-13) in the center of each turntable has three extrusions which mate with the EIA reel hubs. Three screws secure the plates to the turntable. To replace the drive plate, remove the three screws, lift the plate from the spindle, place the new drive plate in position, and reinstall the screws.

Turntable Pad Replacement

To replace the cork pad on the turntable top, use a putty knife (or similar tool) to lift one edge of the pad, then peel it off the turntable. Clean all adhesive from the turntable, with lacquer thinner, MEK, or similar solvent. Peel the backing from the new pad (exposing the adhesive surface) and carefully align the reel holddown holes in the pad with those in the turntable. Press the pad firmly in position.

Brake Assembly Removal

To remove the brake assembly proceed as follows:

1. Remove the cable clamp that secures the wires to the solenoid bracket.
2. Slide the plastic sleeving from the solderless connectors on the two solenoids.
3. If the brake is being removed from a rewind assembly, remove the photocell and bracket assembly (Figure 5-14). Loosen the two screws that hold the photocell mounting bracket to the solenoid bracket to expose the third brake assembly mounting screw.
4. Remove the three brake assembly mounting screws.

5. Manually actuate the main brake solenoid (the one closest to motor) and slide the entire assembly from the brake drum.

Brake Band Replacement

To replace the brake band, proceed as follows:

1. Remove the brake spring (Figure 5-14).
2. Remove the two socket-head cap-screws and washers which secure the brake band (at the end farthest from the solenoids). A band link clamp will also be released.
3. Loosen (do not remove) the two socket-head cap-screws at the other end of the brake band. Take care not to lose the leaf spring, then slide the brake band end from between the clamp and the screws, and remove the brake band.
4. Insert the new brake band through the holes in the housing, with the slotted end toward the solenoids.
5. Secure the brake band end farthest from the solenoids with the band link clamp, the two socket-head cap-screws, and the lock-washers removed in step 2.
6. Insert the brake band's slotted end between the band link and its clamp. Install the leaf spring between the brake band and the band-link clamp (so the spring is on the band inner side, which is on the same side as the lining). Tighten the two socket-head cap-screws snugly, but so the brake band will still slide in and out of the clamp.
7. Reinstall the brake spring removed in step 1.
8. Adjust the brake assembly (see *Brake Installation and Adjustment*).

Brake Solenoid Replacement

Remove cable clamp which secures the wires to the solenoid bracket. Slide the plastic sleeving from the solderless connectors on the two solenoids, and disconnect the wires.

To remove the edit brake solenoid (the solenoid farthest from the motor), remove the two screws and washers (Figure 5-14) from the edit solenoid and its bracket. The solenoid plunger will slide partly out. If the plunger must be removed, remove the self-locking nut (edit brake adjustment) and the spring beneath it (Figure 5-5), and slide the spade bolt out through the hole in the edit-solenoid stop-plate. Remove the plunger from the spade bolt by removing the cotter pin and clevis pin.

To remove the main brake solenoid, remove the two screws and washers from the end of the main brake solenoid and the solenoid bracket. Pivot the edit brake solenoid bracket for access, then remove the main brake solenoid (the plunger slides partly out of the solenoid). If the plunger must be removed, remove the cotter pin and clevis pin.

Replace the solenoids in the reverse order to removal procedures. Perform adjustment procedures given in the following paragraph.

Brake Installation and Adjustment

To install the complete brake assembly on the reel motor, manually actuate the main brake solenoid, insert the brake band over the brake drum on the motor shaft, and secure the assembly in position with the three brake assembly mounting screws.

After installing any item on the brake assembly, adjust the brakes as follows:

NOTE

Parts that are adjusted are illustrated in Figures 5-5 and 5-14.

1. Check that the edit-brake solenoid is flush with the edit solenoid bracket. Adjust the edit solenoid bracket so it is 1/16 inch above the inboard face of the main-brake solenoid.
2. Remove the end of the low side brake spring that goes to the adjusting bolt. This allows the brake solenoid to be easily operated manually.
3. Check that the brake band is correctly aligned to the drum. Slide the slotted end of

the band into its clamp (clamp nearest the solenoids). The brake band should be secured at a position that allows it to clear the brake drum when the solenoid is in the energized (seated) position yet does not cause the band to buckle. This buckling will be visible near the clamp when the solenoid is seated. The brakes should not drag on the drum with the solenoid seated. Tighten the two clamp screws.

4. Attach the low side brake spring to the adjusting bolt.
5. Position the edit solenoid spring anchor bracket so the edit solenoid stop plate is 1/16-inch to "just touching" the end of the main brake solenoid plunger.
6. Connect the solderless connectors to the solenoids and slide the plastic sleeving over the connectors.
7. Secure the wires to the solenoid bracket with the cable clamp.
8. Mount the photocell assembly on its bracket, if working with a rewind assembly. The photocell bracket should be vertically adjusted so that the photocell does not touch the tach disk.
9. Adjust the photocell horizontal alignment (see *Motion Sense Photocell Alignment*). Adjust the main brake tension and edit brake tension as explained earlier in this section.

Motion Sense Photocell Alignment

Align the motion sense photocell as follows:

1. Tape the takeup tension arm in a position so the safety switch is on.
2. Connect an AC VTVM or oscilloscope to the collector of the photocell assembly located on a tie point on the photocell bracket with a green/white wire attached.
3. Apply power. Place the transport in play mode, without tape, and allow the rewind

motor to turn freely. Do not attempt to make this adjustment in the fast wind mode since the circuitry clips the photocell output in fast forward or rewind.

4. Loosen the two screws holding the photocell/bracket assembly (Figure 5-14) to the photocell bracket and adjust this assembly with respect to the tach disk holes to give a maximum AC reading on the VTVM or oscilloscope. The maximum voltage should be between 2-1/2 and 8 volts rms. Tighten the mounting screws.

Rewind and Takeup Clutch Defeat

The clutch associated with the rewind and takeup assemblies ensures proper stopping with any combination of reel sizes. If only one reel size is to be used, the clutches may be defeated as follows:

1. Remove one of the setscrews that hold the brake drum to the motor shaft on both rewind and takeup assembly.
2. In place of the setscrew, insert a 4-40 X 3/8 long socket-head cap-screw. In absence of a cut-down Allen wrench, use a pliers to tighten this screw.
3. Check the low side braking tension with a NAB reel, twine and a spring scale. The tension should be 5 to 6 ounces with clockwise direction of the rewind turntable and counterclockwise direction of the takeup turntable. If the tension is incorrect, adjust the low side spring tension with the low side adjusting nuts (Figure 5-14).

Takeup and Rewind Motor Capacitor Replacement

To remove a takeup or rewind motor capacitor (Figure 5-14) remove the power supply (see *Power Supply Removal*). Slide the plastic sleeving from the solderless connectors on the capacitor leads, and disconnect the wires. Loosen the two screws on the mounting plate and slide the capacitor and plate from the casting. Remove the mounting plate and use the removed screws, nuts, and washers to secure the new capacitor on the plate (do not

tighten the screws). Slide the capacitor and plate into position, then tighten the screws. Connect the leads and reinstall the power supply.

AC AND SERVO CAPSTAN MOTOR

AC Capstan Motor Lubrication

Lubrication instructions for the AC capstan motor are provided earlier in this section under the heading *Lubrication*. (The servo controlled DC capstan motor does not require lubrication.)

AC Capstan Motor Fan and Flywheel Replacement

The fan and the flywheel are secured to the AC capstan motor shaft by setscrews. To remove the components, loosen the setscrews and slide the parts off the shaft.

To reinstall the components, slide the flywheel on the shaft until the hub is against the shaft shoulder (the hub setscrew portion should be away from the motor). Tighten the setscrew against the shaft flat. Slide the fan on the shaft (setscrew side toward the motor) and bottom it against the flywheel hub. Tighten the setscrew against the shaft flat.

Capstan Motor Replacement

Replace the capstan motor as follows:

CAUTION

DO NOT BUMP OR SCRAPE THE CAPSTAN AS THE MOTOR IS REMOVED OR INSTALLED.

1. Disconnect the motor cable at the control box (AC motor) or at the servo chassis (DC motor).
2. Remove the capstan dust cap cover from the DC motor by loosening the setscrew (Figure 5-13), pushing the capstan idler back, and lifting the dust cap from the capstan shaft. For an AC motor, use a knife blade or similar tool and gently pry the dust cap cover off from the top plate.

3. Manually support the motor and remove the four screws from the motor and top plate. The motor shield used with AC motors will also be released.

4. Install the capstan motor in the reverse order of removal. Be sure to install the motor shield removed with the AC motor.

Motor Capacitor Replacement

The AC capstan motor capacitor is fastened to the capstan-idler solenoid mounting plate by two screws (Figure 5-14). Unplug the capacitor from the transport control box. Use a short screwdriver (or offset screwdriver) to remove the two screws and washers, and remove the capacitor. Use the removed screws and washers to mount the new capacitor in position. Reconnect the capacitor to the transport control box.

REEL IDLER

Tape Guide Replacement

To remove the tape guide from the reel idler arm, unscrew the spring-loaded screw (Figure 5-13), then remove the guide, screw, spring, and flat washers (used as shims). To install the tape guide, insert the spring and screw in the top of the guide, and install all of the washers; seat the guide slot (in the bottom) over the spring pin on the arm, and tighten the screw.

Pulley Replacement

The pulley (Figure 5-13) is held in the reel idler housing by the reel idler flywheel (Figure 5-14), which is secured to the pulley shaft by a setscrew. The setscrew is in the side of the flywheel toward the transport, and must be found by touch. Rotate the flywheel so the pulley shaft flat is toward the outer edge of the rewind motor. Insert a 3/32 Allen wrench (with a handle and long-shaft) past the outer edge of the rewind motor, and then into the setscrew hole by touch. If the transport is face down, manually support the reel idler pulley while loosening the setscrew and removing the flywheel, then slide the pulley and pulley shaft out of the housing.

Install the pulley by sliding the pulley shaft back through the housing, and then remounting the flywheel. End play must be 0.003 to 0.005 inch to avoid damaging the ball bearings. Check the play by firmly holding the pulley down in the housing, and using a feeler gauge, measure the clearance between the pulley and the housing (at the side opposite the arm). To this measurement add 0.004 inch, and select the feeler gauge leaves equal to the total. Insert the gauge between the pulley and housing, at the side opposite the idler arm. Hold the pulley firmly down on the gauge, and push the flywheel (setscrew side in) so it firmly contacts the bottom of the housing. Tighten the flywheel setscrew, and remove the feeler gauge.

Idler Tension Adjustment

The idler tension is not critical; however, if it becomes too high, and cannot be correctly adjusted, it indicates that reel idler damage is causing binding.

Measure the tension with the transport in the horizontal position at the outer end of the arm with a spring scale. Between 1/3 and 1 ounce (10 to 30g) of pressure should be required to move the arm from its stop.

If adjustment is indicated, remove the pulley assembly (see *Pulley Replacement*), which reveals two screws. Loosen the screws, and rotate the bushing clockwise to increase tension, or counterclockwise to decrease tension. Tighten the two screws, and recheck the tension. Reinstall the pulley.

Arm Assembly Replacement

To remove the arm assembly, remove the pulley then remove the two screws that are revealed. Remove the arm, bushing, and idler mount from the housing. The arm is between the bushing and the mount; they are press-fit together to a very close tolerance and, therefore, cannot be ordered separately. Contact Ampex Audio Technical Support Department if replacement is required. The tension spring can easily be replaced by unhooking it from two pins, one on the arm and the other on the mount.

To install the arm assembly, insert it in the housing with the arm in the upper left slot. Install the two screws loosely, then check and adjust arm tension and replace the pulley.

Reel Idler Assembly Replacement

To remove the complete reel idler assembly, remove the pulley (Figure 5-13). Remove the two screws that secure the reel idler assembly to the casting (Figure 5-14), and remove the assembly from the transport.

Install the assembly in the reverse order of removal procedures. If the arm was removed from the housing, check and adjust the arm tension. Install the pulley and flywheel.

Ball Bearing Replacement

To replace the ball bearings in the reel idler, remove the idler assembly from the transport (see *Reel Idler Replacement*). Remove the arm from the housing. Insert a pencil (or similar object) up through the hole in the lower bearing to push the top bearing out.

To remove the lower ball bearing, use Truarc pliers to remove the lower retaining ring, then insert the pencil (or similar object) from the top of the housing to push the bearing out.

CAUTION

WHEN INSTALLING THE NEW BEARINGS, USE NO LUBRICATION. INSERT THE BEARINGS INTO THE HOUSING WITH FINGER PRESSURE ONLY, BEING VERY CAREFUL NOT TO COCK THE BEARINGS IN THE HOUSING.

Install the lower bearing, against the retaining ring, by pushing only the bearing outer race (not toward the inside) with equal pressure on opposite sides of the bearing. Install the lower retaining ring below the bearing, then push the other bearing into position.

Reinstall the reel idler assembly on the transport, and install the arm assembly. Check and adjust the arm tension. Reinstall the pulley and flywheel.

TAKEUP TENSION ARM

Arm Spring Adjustment

The only time the spring requires adjustment is when the arm is removed from the housing (Figure 5-13) for some reason. Remove the cover cap from the tension arm base (socket-head screw in cap must be removed) for access to the spring.

If the spring is completely loose, it should be wound approximately one turn around the hub and hooked over the drive pin in the housing. Usually the spring will not be completely loose but will be hooked on the pin associated with the arm assembly. In this case use a sharp pick to remove the spring from the pin and extend it to the drive pin. To check that the spring position is correct, the tension required to move the arm off of the stop can be measured at the tape guide. When in a horizontal position this tension should be between 0.4 and 0.9 ounce (12 to 25g).

Safety Switch Adjustment

To check the position where the takeup tension arm actuates the safety switch (to stop tape motion), move the arm to the tape threaded position. Allow the arm to return slowly toward the rest position, listening closely for the click when the safety switch actuates. At that point, the tape guide tape-contacting surface should be 3-1/2 to 4-3/8 inch from the transport edge.

Required adjustments are made from the transport back. Remove the connectors for capstan and takeup motors from the transport control box. Hold other wires aside so the safety switch (Figure 5-16) is accessible. Use long-nose pliers to bend the safety switch actuator out from the switch to actuate with the takeup tension arm at a higher position and toward the switch for a lower position. Reconnect the capstan motor and takeup motor connectors.

Tape Guide and Hook Replacement

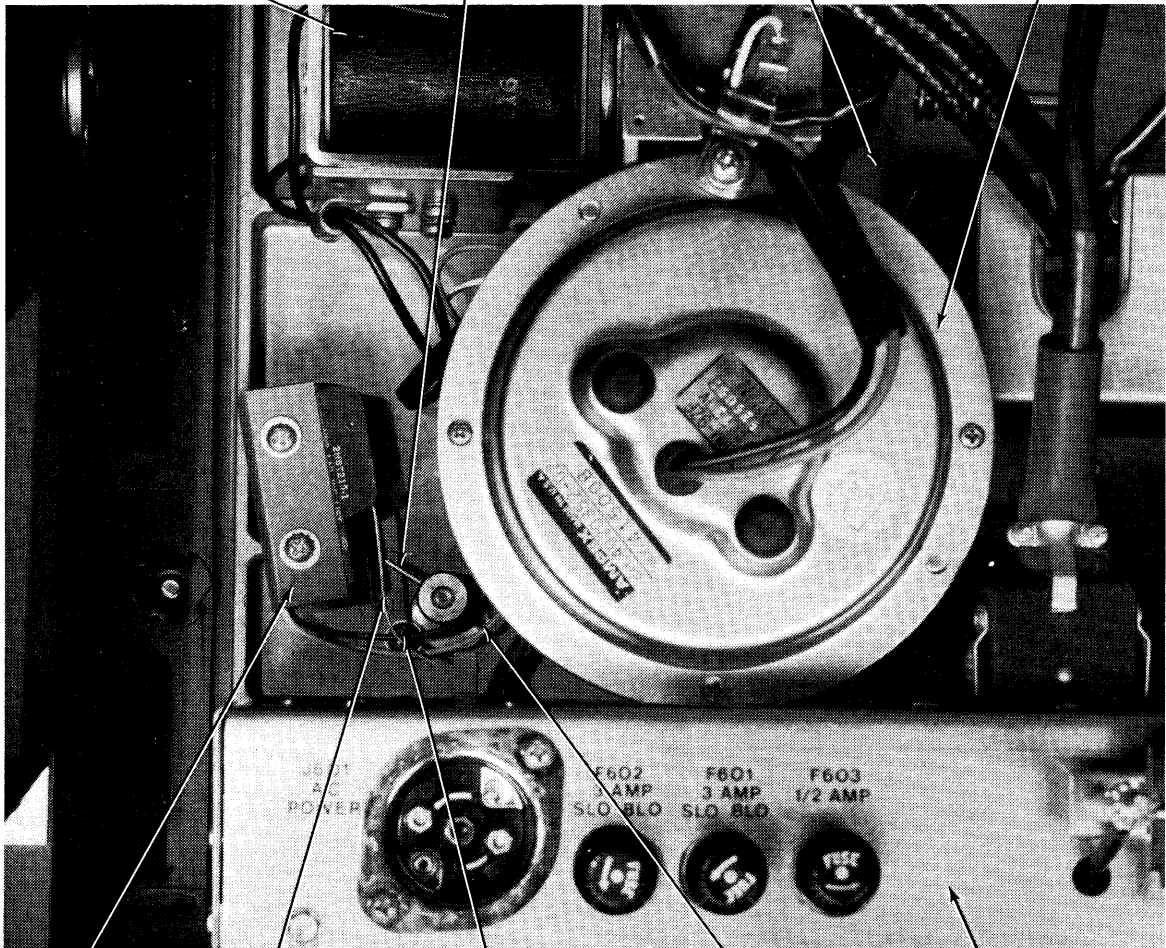
Remove and replace the tape guide and hook (Figure 5-13) from the takeup tension arm as follows.

CAPSTAN IDLER SOLENOID

ROLLPIN

IDLER ARM

CAPSTAN DRIVE MOTOR



13079-4

SAFETY SWITCH

SWITCH ACTUATOR

TAKEUP TENSION ASSEMBLY MOUNTING SCREW

SETSCREW

TRANSPORT CONTROL BOX

Figure 5-16. Takeup Tension Safety Switch

CAUTION

WHILE PERFORMING THE REPLACEMENT PROCEDURE, SUPPORT THE TAKEUP TENSION ARM TO PREVENT BENDING THE ARM.

Remove the spring-loaded screw from the top of the guide to remove the tape guide and hook.

To install the hook and guide, use the rollpin on the arm to align the locating hole in the hook and

the slot in the bottom of the guide. Insert the spring and screw in the guide, then tighten the screw.

Tape Tension Arm Replacement

To remove the takeup tension arm assembly, disconnect the capstan drive motor and takeup motor cables from the transport. Secure other wires aside for access to the tension arm base. Remove the screw and washer (Figure 5-16) and

lift the assembly off the transport while carefully guiding the protruding rollpin out through the top plate.

Remove the setscrew from the base, and install it in the new assembly so it protrudes 3/16 inch. Guide the end of the new assembly through the top plate hole and mate the setscrew with the upper left hole. Secure the assembly to the transport with the screw and washer previously removed.

CAPSTAN IDLER

Lubrication and Adjustment

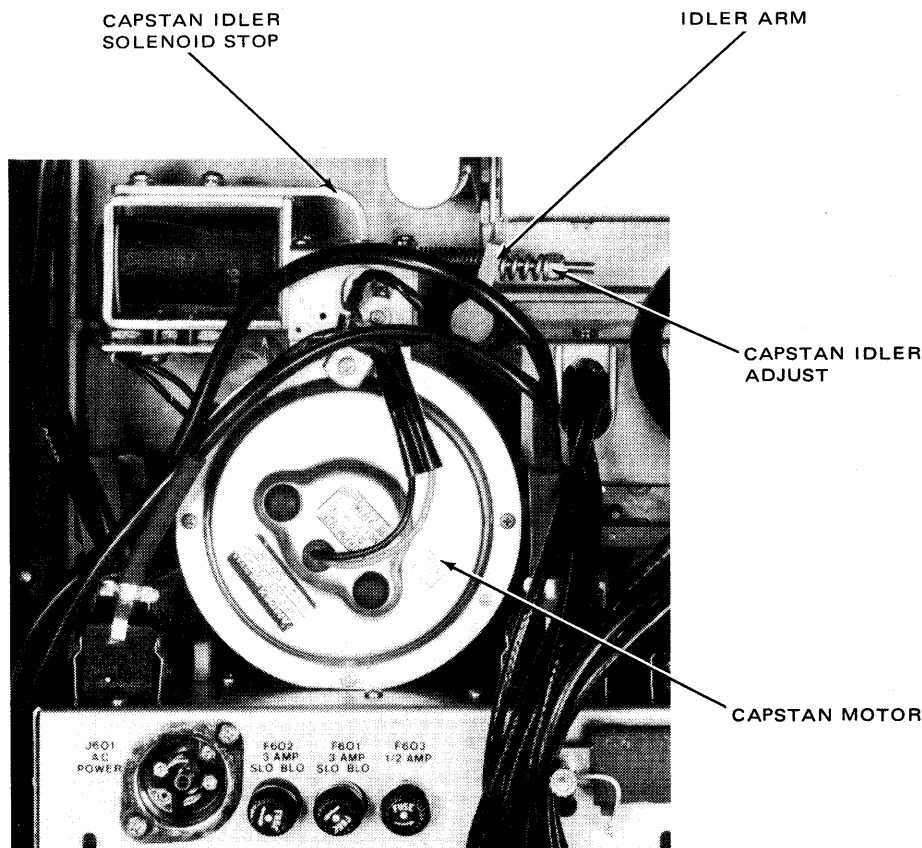
Lubrication of the capstan idler is discussed earlier in this section under the heading *Lubrication*. The adjustment of idler force against the capstan is given under the heading *Tape Tension (Capstan Idler)*.

Non-Removable Parts

The capstan idler arm (Figure 5-13) and associated components cannot be removed from the transport, because the solenoid arm (Figure 5-17) is secured to the idler arm shaft by a press-fit rollpin. Removing and installing this rollpin requires special tools. The solenoid arm will not pass through the hole in transport, so parts between the idler arm and the solenoid arm cannot normally be removed. If any of these parts should ever require replacement, the transport should be returned to the factory for repair.

CAUTION

DO NOT USE A DRIFT PIN AND HAMMER TO DRIVE THE ROLLPIN OUT OR IN, SINCE IRREPARABLE TRANSPORT DISTORTION CAN RESULT.



13079-19

Figure 5-17. Capstan and Capstan Idler Components

Idler Positioning

The normal clearance between the idler tire and the capstan (Figure 5-13) should be 0.460 ± 0.02 inch for AC capstan motors and 0.400 ± 0.02 inch for capstan servo motors. This clearance can be increased if low line voltages will not be experienced. Under low line voltage, the capstan idler solenoid may not pull in with increased clearance.

To adjust the clearance, tilt the transport to a vertical position with the pushbuttons on top. Loosen the two screws that hold the capstan idler solenoid stop to the capstan idler solenoid. Move the solenoid stop inboard so as to give maximum clearance. Place an appropriately dimensioned spacer between the capstan and the idler tire. For AC motors, this spacer could be a 15/32 drill bit; for servo motors, a 13/32 drill. Tape wound on a pencil to give the proper dimension will also work. While holding the spacer with the right hand, move the solenoid stop outboard with the left hand until the tire just touches the spacer. While holding the stop in position, remove the spacer and tighten the solenoid stop screws with the right hand. Place the transport in the normal operating position and recheck the dimension. If the tire is held too tightly against the spacer, the idler will shift position when the spacer is removed. Make sure the solenoid stop is not cocked so that the space bolt drags on the solenoid stop.

Idler Assembly Replacement

The rubber-tired idler assembly is held on the capstan idler arm (Figure 5-13) by a setscrew. To remove the idler assembly, loosen the setscrew and slide the idler shaft from the arm.

To remove the idler wheel from the idler shaft, use a knife blade or similar tool and gently pry up the dust cap from the hub of the idler assembly. Remove the retaining ring (with Truarc pliers) and the shims. Lift idler wheel from shaft. Transfer the felt wick and cap spring to the new idler wheel. Install the idler wheel in the reverse order using the shims to allow slight end play.

Install the idler assembly on the capstan idler arm so that the bottom surface of the idler is 0.66 inch ± 0.015 inch above the stainless steel overlay. For

3-3/4 and 7-1/2 in/s machines with AC capstan motors, this dimension should be 0.56 inch ± 0.015 inch.

Capstan Idler Solenoid Replacement

To remove the capstan solenoid (Figure 5-17), remove the drive motor (with capacitor). Disconnect the takeup motor cable from the transport control box. Remove the self-locking nut (capstan adjust) and spring from the end of the bolt in the solenoid arm. Slide the plastic sleeving from the solderless connectors on the solenoid leads, and disconnect them. Remove the mounting plate that clamps the solenoid to the transport by loosening the four mounting screws. Slide the plate and solenoid off, while guiding the bolt out of the idler arm.

To install the solenoid, loosely secure the mounting plate to the solenoid with the four removed screws and washers. (The solenoid leads are fastened in a cable clamp that is secured with one screw.) Place the idler return spring on the bolt, then insert the bolt end through the idler arm. Slide the plate and solenoid over the casting extrusions. Tighten the screws to clamp the solenoid in position. Install the idler adjusting spring, and then the self-locking nut on the bolt. Connect the leads to the solenoid. Install the drive motor and its capacitor. Reconnect the takeup motor cable. Check and adjust the capstan idler position. Check and adjust the capstan idler pressure.

TAPE LIFTER

During the play mode the tape lifter arms must not touch the tape. In the fast wind modes the lifter must remove the tape from head contact; however, the tape must not contact the head gate shield covers. Adjustment is usually required only when a tape lifter component or the solenoid is replaced.

Tape Lifter Adjustment

To adjust the tape lifter proceed as follows:

1. Remove the head assembly and the reel idler flywheel and pulley. Disconnect the capstan motor cable, the electronic power

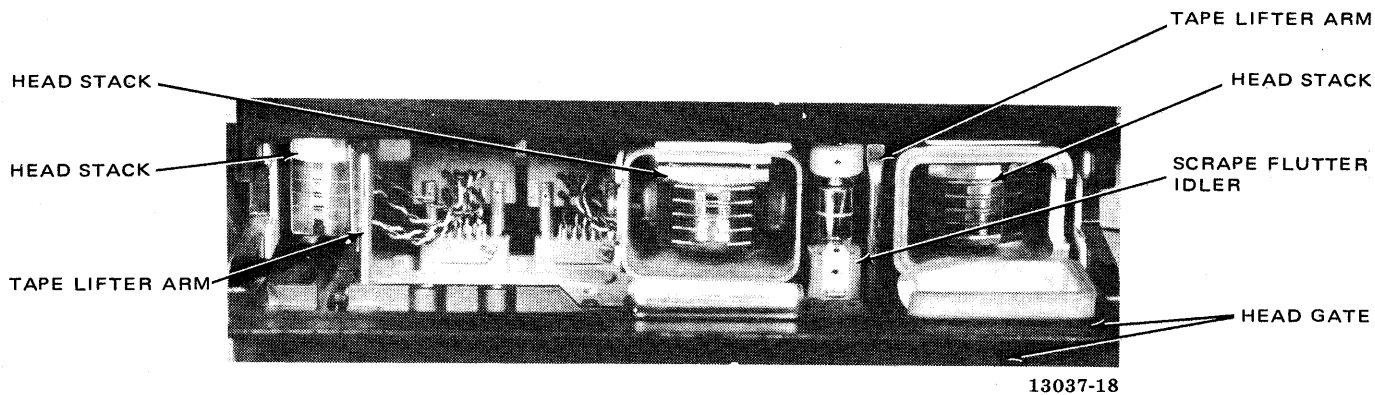
cable and the supply motor cable and the takeup motor cable. Use pressure sensitive tape to hold the takeup tension arm away from the safety switch. Loosen the two hex head screws at each end of the tape lifter bracket (Figure 5-18). Make sure the spring that connects the solenoid to the bracket is in the third hole.

2. Working from the top of the transport, stuff sponge rubber or some other resilient material into the left tape lifter opening in such a way so that the distance between the front surface of the right-hand lifter and the front surface of the scrape-flutter idler is $9/32$ to $5/16$ inch. This will not be the final dimension since approximately $1/32$ spring back can be anticipated. Energize the tape lifter solenoid by pressing one of the fast mode pushbuttons.

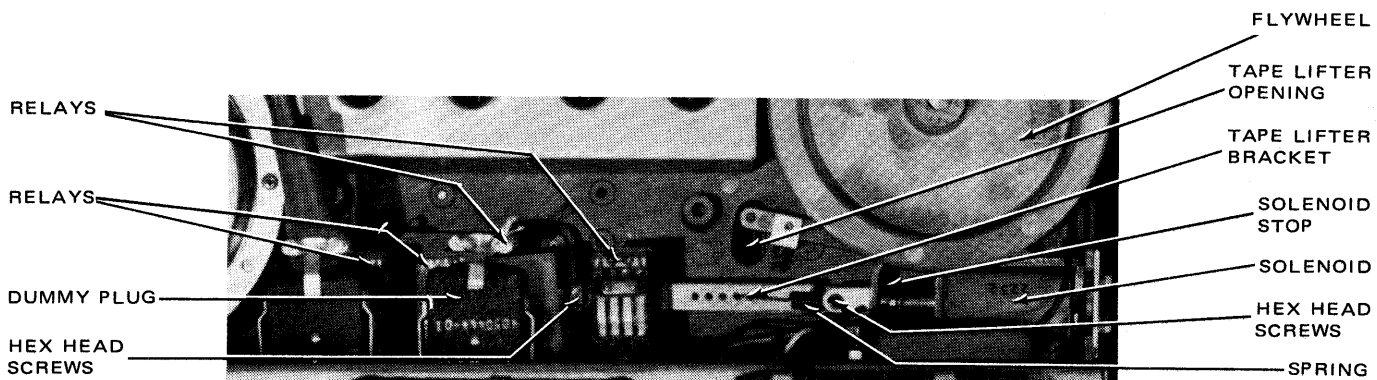
3. Working from the rear of the transport, pull the tape lifter bracket inboard until all the slack is removed from the spring connecting the bracket and solenoid. However, do not extend the spring. While holding the bracket in this position, tighten the inboard hex head screw; then tighten the hex head screw under the spring.

4. Working from the front of the transport, remove the resilient material and again check distance measured in step 2. It should be $1/4$ to $9/32$ of an inch. If not, repeat steps 2 and 3 using a different allowance for spring back.

5. Press the STOP button. Measure the distance between the front surface of the scrape-flutter idler and the front surface of the lifter in the retracted position. This should be $1/8 \pm 1/32$ inch. If not, loosen the two screws that hold the solenoid stop to the



13037-18



13079-3

Figure 5-18. Tape Lifter Components

solenoid. Move the stop to attain this dimension making sure that there is no slack in the solenoid-lifter bracket spring. Tighten these screws.

6. Replace the reel idler flywheel and pulley, and the head assembly. Reconnect the cables previously removed.

Solenoid Replacement

To remove the tape lifter solenoid (Figure 5-18), remove the reel idler pulley and flywheel. Disconnect the rewind-motor and electronic-power-supply cables from the transport control box. Remove tape lifter spring (refer to Figure 5-18). Slide the plastic sleeving from the solderless connectors on the solenoid leads and disconnect the wires. The solenoid is clamped to the transport casting by a mounting plate. Use an open-end wrench to loosen the two hex-head screws, then slide solenoid and plate off.

To install the solenoid, mount the plate on the solenoid end with the two removed screws, lock-washers, and flat washers. Slide the solenoid and plate onto the extrusions on the casting, and use an open-end wrench to tighten the two mounting screws. Connect the leads to the solenoid and reinstall the tape lifter spring in its original position. Adjust tape lifter action. Reinstall the reel idler pulley and flywheel, and reconnect cables.

Tape Lifter Replacement

To remove the tape lifter assembly, remove the reel idler pulley and flywheel. Disconnect the transport rewind-motor and power-supply cables, remove the dummy plugs (or cables) from the transport control box, and remove the four plug-in relays (Figure 5-18).

Remove the tape lifter solenoid. Remove the tape lifter return spring from between the tape lifter assembly and the transport post. Remove the two socket-head shoulder screws and remove the complete assembly (note that flat washers are between the tape lifter and the transport).

The tape lifter assembly drawing is provided in Section VI. Replaceable parts are listed in the tape transport parts list. The tape lifter return spring

takes up slack at the end of the clevis pins on the tape lifter arms to prevent backlash and rattle.

To install the tape lifter assembly, reverse the removal procedures. Be sure to install the washers between the assembly and the transport. Install the tape lifter solenoid. Adjust the tape lifter action. Reinstall the reel idler pulley and flywheel. Reinstall the connecting cables, dummy plugs, and relays.

SAFETY SWITCH REMOVAL

To remove the safety switch (Figure 5-16), disconnect the capstan motor and takeup motor cables from the transport control box. Move other wiring aside for access. Slide the plastic sleeving from the solderless connectors on the safety switch leads and disconnect the wires. The switch is secured to mounting posts on the transport casting by two screws and washers. Remove these screws and the switch, along with the shield.

To install the safety switch, place the shield over the switch, then use the two screws to secure the switch and shield. Connect the leads to the switch, check and adjust actuation of the switch, and reconnect cabling.

REMOVAL OF ELECTRONIC ASSEMBLIES AND COMPONENTS

CONTROL BOX COVER

The control box bottom cover must be removed for access to components inside. To remove the cover, turn power OFF, and remove the cover from over the tension-adjust resistors (Figure 2-3). Use an open-end wrench to loosen the seven hex-head screws (two at each end, and three on one side of the bottom cover). Use the access finger holes to pull the cover off (the screws slide out of the slots on the box).

WARNING

DANGEROUS VOLTAGES ARE PRESENT INSIDE THE CONTROL BOX AND ACROSS THE TENSION-ADJUST RESISTORS WHEN POWER IS CONNECTED TO THE RECORDER. ONLY THOROUGHLY EXPERIENCED PERSONNEL SHOULD SERVICE THE UNIT WITH POWER ON.

CONTROL BOX

To remove the control box, disconnect all cable connectors. Disconnect the solderless connectors from the tape lifter solenoid, the capstan idler solenoid, and the safety switch.

At the front of the transport, remove the two screws from the pushbutton escutcheon, and remove the released parts. Remove the two screws from the toggle switch escutcheon, and remove the escutcheon.

Manually support the control box, remove the three screws securing the front of the control box, and remove the control box.

Relay actuation and power distribution can be checked with: 1) control box removed, 2) dummy plugs in their receptacles, 3) the two safety switch leads joined and tape-insulated, 4) each solderless connector separately tape-insulated, and 5) cover reinstalled over the tension-adjust resistors. The power cord can then be connected, power applied, and circuits checked.

WARNING

DANGEROUS VOLTAGES ARE PRESENT INSIDE THE CONTROL BOX AND ACROSS THE TENSION-ADJUST RESISTORS. ONLY THOROUGHLY EXPERIENCED PERSONNEL SHOULD ATTEMPT SERVICING THE ENERGIZED UNIT WITH THE BOTTOM COVER OR THE RESISTOR COVER REMOVED.

To install the control box, reverse the removal procedures. Check for correct connection of leads to the solenoids, drive motor capacitor, and safety switch.

POWER LAMP

To replace the power lamp, remove the two screws securing the escutcheon over the pushbuttons and remove the released parts. Remove the two screws securing the escutcheon over the toggle switches, and remove the released parts. Remove the lamp from the socket with a lamp extracting tool; if the tool is not available, the lamp may be removed with the eraser end of a pencil onto which is

attached a piece of adhesive tape with the sticky side out.

CONTROL BOX SWITCHES

Remove the control box from the transport. When new pushbutton switches are installed, set the switch face to 19/32 ($\pm 1/32$) inch above the chassis. Set toggle switch handles 1-5/16 ($\pm 1/32$) inch above the chassis.

INDICATOR LAMP REMOVAL

The record and ready lamps may be replaced from the front by pulling the lamps from their sockets with pliers. When replacing the lamps, note that the terminals are not centered on the lamps.

The lamps should be replaced with the lamp terminals closest to the bottoms of the sockets. The easiest way to align the lamps is to do it under power. If a ready lamp is to be replaced, place the channel in ready. Insert the lamp in the socket until it lights, then push it home. When replacing a record lamp, press ready on that channel, then place the transport into the record mode of operation. Insert the lamp into the socket and push it home when it lights.

NOTE

If a record lamp burns out, that channel will not go into full record operation since the record relay will not energize. The tape will not be damaged even though the bias amplifier is energized. If a replacement lamp is not available, remove the ready lamp and install it in the record lamp socket.

To replace the meter lamp, it is necessary to remove the top cover of the electronics. Remove the screw holding the lamp socket to the meter bracket. Pull the lamp and socket outboard from behind the meter bracket. Replace the lamp and reinstall the socket.

CIRCUIT BOARD COMPONENTS

Required removal tools are:

1. 50-watt (maximum) pencil-type soldering iron.

TROUBLESHOOTING

2. Noncorrosive soldering flux with rosin-alcohol base.

3. Piece of small-diameter shielding braid.

Use a plunger-type solder remover if available instead of the soldering flux and shielding braid.

To remove a component, dip the shielding braid in the soldering flux. Heat the solder joint with the soldering pencil (never use a soldering gun or high-wattage iron), and dip the braid into the molten solder (the solder flows into the braid). Do not overheat soldering joints during this procedure, and especially avoid heating joints that are not to be desoldered. When solder has been removed from all component leads, the part should then be removed without exerting excessive force.

To install the replacement part, bend the leads to fit in the mounting holes. Insert the leads through the holes, then bend them flat against the foil path. Use the soldering pencil, and low-melting-point rosin-core solder to solder the joints. Do not overheat the junction or nearby junctions. Remove excess rosin from the joint with a clean lint-free cloth moistened with alcohol.

After replacing a diode or transistor, allow the board to cool approximately two minutes before reinstalling it.

CAUTION

RESIDUAL SOLDERING HEAT COULD CAUSE THERMAL RUNAWAY IF POWER IS APPLIED TO A SEMICONDUCTOR DEVICE DURING THE TWO-MINUTE COOLING PERIOD.

OTHER COMPONENTS

All other components are accessible when the top or bottom cover is removed. Component location on the schematic diagram is indicated by a number before the identification letter. A table on the diagram gives the prefixes used, and the component locations. The assembly drawings are helpful in locating parts.

Use standard audio troubleshooting techniques to isolate faults to a certain stage or component. The DC, signal, and bias voltages are given at many points on the schematic diagram, as an aid in locating malfunctions. Schematic diagrams for the recorder/reproducer circuits and power distribution are in Section VI.

POSSIBLE CORRECTIVE ACTIONS

Any of the following corrective actions (see Table of Contents for Section V) may be required to bring the equipment within specifications.

1. Clean the heads.
2. Demagnetize the heads.
3. Adjust signal generator for flat output over the frequency range in use.
4. Adjust head azimuth.
5. Adjust bias level.
6. Adjust reproduce equalization.
7. Adjust record calibration.
8. Adjust tape tensions.

Adjustment and alignment procedures that may be needed during maintenance or troubleshooting are given earlier in this section.

CAUSES OF TAPE SPEED ERROR

Some causes of tape speed errors are given below.

1. Incorrect tape thickness. If a 1-mil tape is run with the 7-1/2–15 in/s AC capstan motor, the actual tape speed will be approximately 0.15% slower than if 1.5-mil tape were used. The NAB pulley will measure this speed as 0.18% slow because the pulley, as well as the capstan, is designed to 1.5-mil tape.

2. Tape slippage at the capstan. This may be caused by any of the following:

- a. Slick or oily capstan or capstan idler.
 - b. Insufficient capstan idler pressure.
 - c. Capstan idler solenoid not bottoming.
 - d. Incorrect tape tensions.
 - e. Dragging brakes.
 - f. Improper position of reel hub size switches.
 - g. Reel idler dragging so that it does not come up to the tape speed.
 - h. Capstan surface is polished.
3. Defective capstan motor.
4. Defective AC capstan-motor capacitor.

CAUSES OF NOISE

NOTE

The signal-to-noise ratios listed in Table 1-2 apply to Ampex 406 tape referenced to a 520 nWb/m peak record level.

Some causes of excessive noise (a low signal-to-noise ratio) are listed below.

1. Incorrect setting of operating level (reproduce calibrate potentiometer).
2. Head gate open during noise check, causing hum.
3. External fields from nearby motor and transformers being introduced into heads, head cables or electronics, causing hum.
4. Heads need demagnetization, causing popping-type noise.

5. Erase peaking adjustment not at peak, causing unsymmetrical bias and popping-type noise.

6. Reproduce equalization incorrect, causing excessive high-frequency noise.

7. Reproduce head height incorrect, so that a portion of the head rides off of the recorded track.

CAUSES OF DISTORTION

Some causes of distortion, detected during performance tests, are given in the following paragraphs.

Second Harmonic Distortion

Excessive second harmonic distortion may be caused by:

1. Magnetized heads.
2. Erase peaking adjustment or erase transformers not at peak causing unsymmetrical bias and high distortion.
3. Malfunction in the bias oscillator or bias balance potentiometer R92 (if present on the bias module) is misadjusted, resulting in unsymmetrical output.
4. Malfunction of record or reproduce amplifiers.

Third Harmonic Distortion

Excessive third harmonic distortion may be caused by:

1. Reproduce calibration control incorrectly adjusted so that operating level is not correct.
2. A conventional tape used at a 260 nWb/m operating level will cause more than normal distortion and a high output tape used at 185 nWb/m operating level will produce less than normal distortion.

3. Bias setting incorrect.
4. Head height incorrect so that record and reproduce heads do not line up.
5. Malfunction of record or reproduce amplifiers.

6. Reel idler — bent shaft, flywheel not balanced, damaged bearing.
7. Head assembly — poor tape guiding.
8. Tape scrape, warped or damaged reels.

CAUSES OF FLUTTER

Excessive flutter can be caused by any component that affects the tape motion, but is usually caused by the following:

1. Oxide or dirt on components in the tape-handling path.
2. AC capstan motor — not in synchronism (too low line voltage), excessive tape tension, defective motor capacitor, bearings defective or need lubrication, or motor shaft bent.
3. Servo motor — servo gain incorrectly adjusted, loose or misadjusted rotor, loose or misadjusted tach probe, malfunction of servo electronics.
4. Supply motor — excessive or erratic holdback tension, dragging brakes, or bent shaft.
5. Capstan idler — defective rubber tire, bearing defective or needs lubrication, pressure incorrectly adjusted.

FLUTTER TROUBLESHOOTING HINTS

As an aid in troubleshooting, a sound-and-vibration analyzer (such as General Radio Type 1564-A) can be used to isolate flutter to certain frequencies by connecting the analyzer to the flutter meter output. Compare the results with the rotational rates in Table 5-8 for an indication of the cause of trouble.

If flutter is caused by the supply motor assembly, the frequency will vary, starting from low when the tape pack on the supply reel is large, and progressively increasing as the tape pack gets smaller. The takeup motor assembly seldom causes appreciable flutter because it is isolated from the heads by the capstan and capstan idler. If this is causing flutter, the frequency would vary inversely to that of the supply motor (high with a small tape pack on the takeup reel and decreasing as the pack increases).

EXTENDER BOARDS

Corrective maintenance procedures are greatly simplified by using the optional extender boards. The extender board, when installed between a circuit

Table 5-8. Rotational Rates (Hertz)

COMPONENT	TAPE SPEED			
	3-3/4 IN/S	7-1/2 IN/S	15 IN/S	30 IN/S
AC Capstan Motor	10	20 or 10	20	—
Servo Motor	3.125	6.25	12.5	25
Capstan Idler	0.6	1.2	2.4	4.8
Reel Idler	0.8	1.6	3.2	6.4
Scrape-Flutter Idler (Normal)	3.4	6.3	12.7	25.4
(Optional)	2.5	5.1	10.2	20.4

board and its receptacle, moves the circuit board outside the chassis so all components are accessible for testing/adjustment (the extended circuit boards must be mechanically supported).

Extender board catalog numbers are as follows: reproduce, 4020151; record, 4020152; bias amplifier, 4020153; power supply, 4020154; and capstan servo, 4050695.

TROUBLESHOOTING THE REPRODUCE AMPLIFIER

There are two methods of troubleshooting the reproduce amplifier:

1. Use of the flux loop to introduce a constant flux into the reproduce head thus introducing a constant current into the reproduce preamplifier.
2. Use of a resistor divider in place of the head to induce a constant voltage into the reproduce preamplifier.

The response curves expected when using a constant flux input are shown in Figures 5-19 and

5-20. The test set-up for inducing a constant voltage is shown in Figure 5-21. Typical response curves for the various speeds are shown in Figures 5-22 and 5-23.

TROUBLESHOOTING THE RECORD AMPLIFIER

There are also two methods of troubleshooting the record amplifier:

1. Use of a current probe to measure the current in the record head.
2. Measuring the voltage across a resistor substituted for the record head (see Figure 5-24).

In both methods, remove the bias amplifier module and place the channel into the record mode. The response expected is similar in both methods. Typical response curves are shown in Figure 5-25. The high-frequency response will vary with the high-frequency preemphasis used. Typical mid-frequency operating level signals will be approximately 1/2 mA with method 1 and 0.05V (-24 dBm) with method 2.

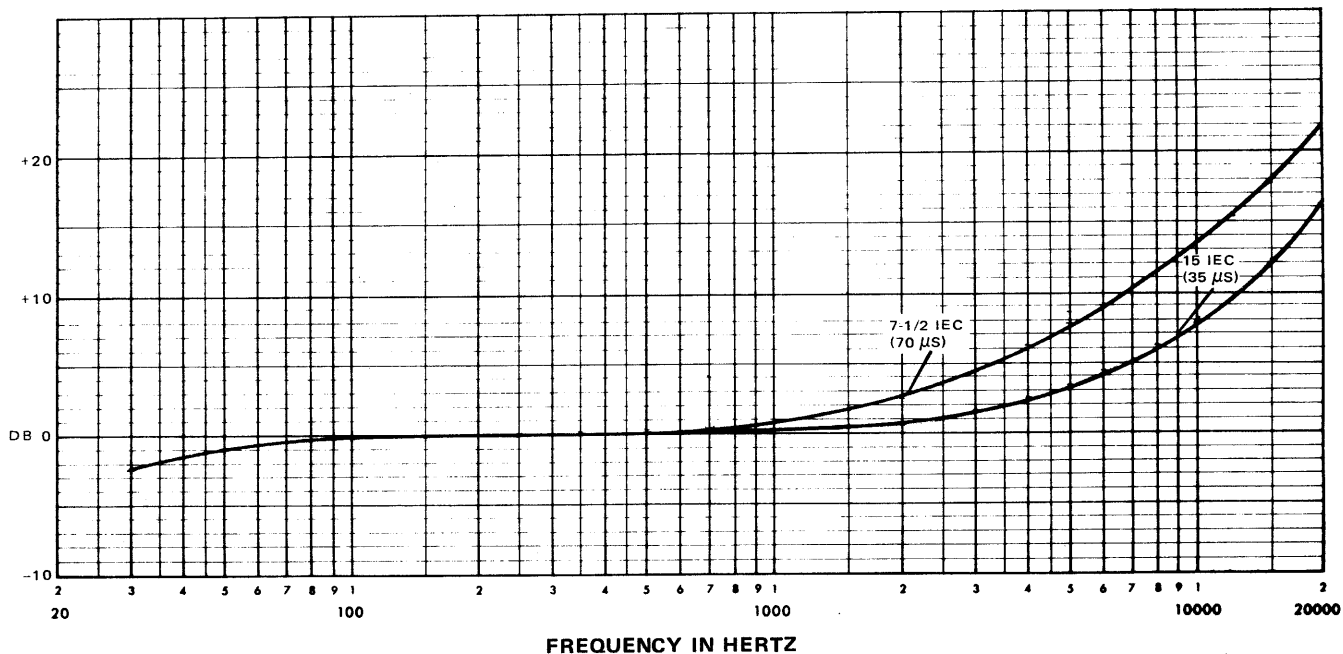


Figure 5-19. Reproduce Amplifier Response with Constant Flux to Head (IEC)

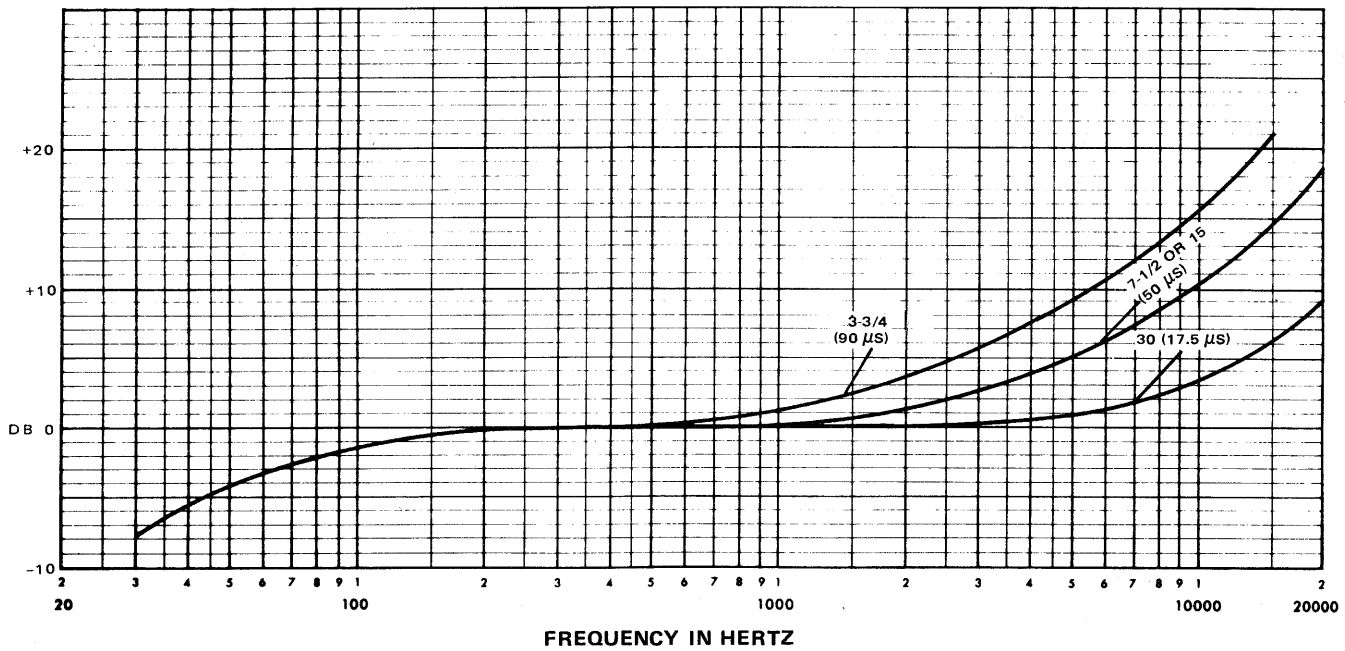


Figure 5-20. Reproduce Amplifier Response with Constant Flux to Head (NAB and AES)

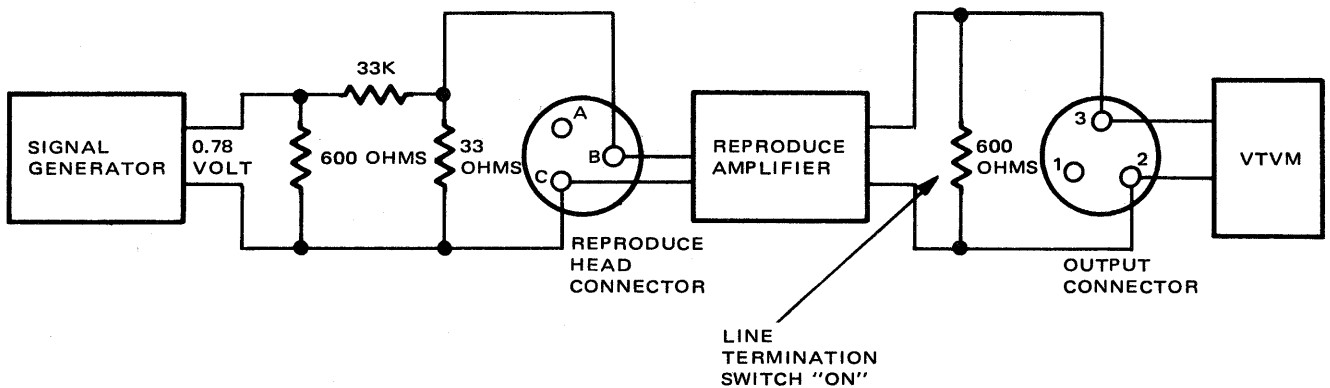


Figure 5-21. Troubleshooting Setup for Reproduce Amplifier

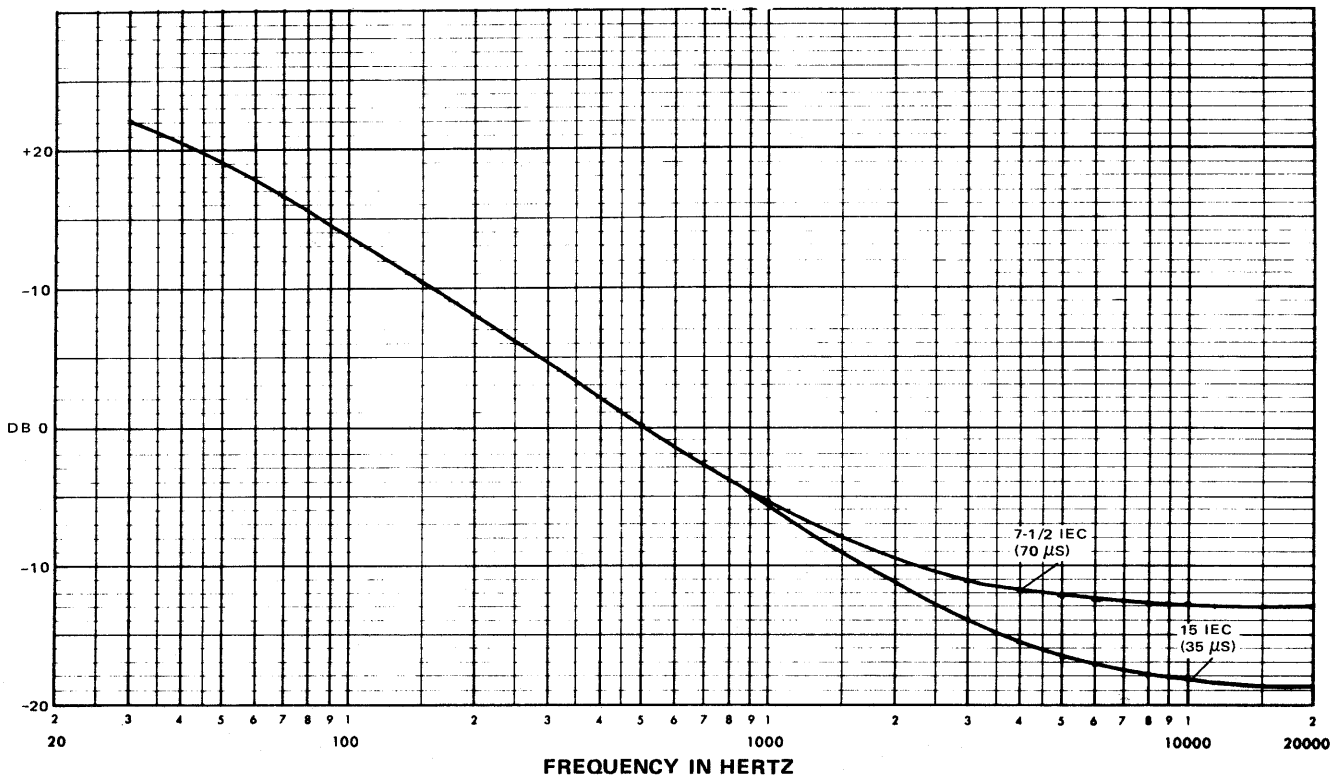


Figure 5-22. Reproduce Amplifier Response with Constant Voltage Input (IEC)

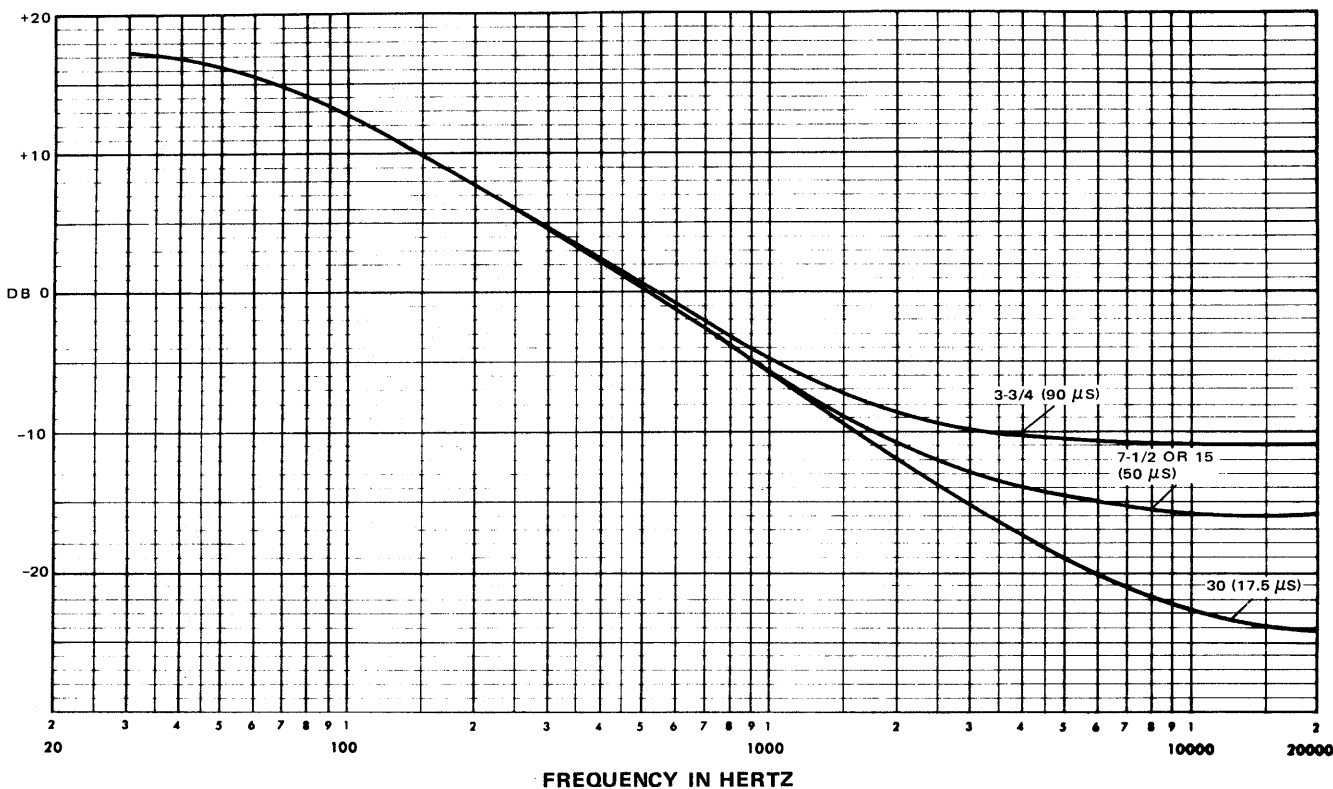


Figure 5-23. Reproduce Amplifier Response with Constant Voltage Input (NAB and AES)

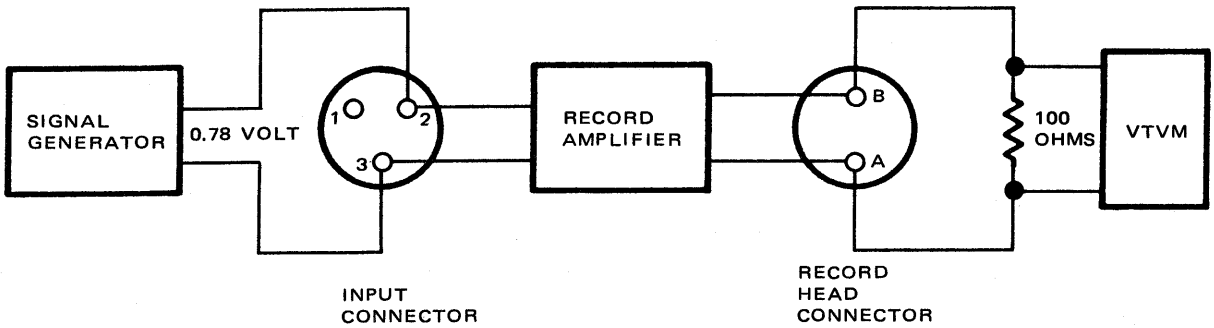


Figure 5-24. Troubleshooting Setup for Record Amplifier

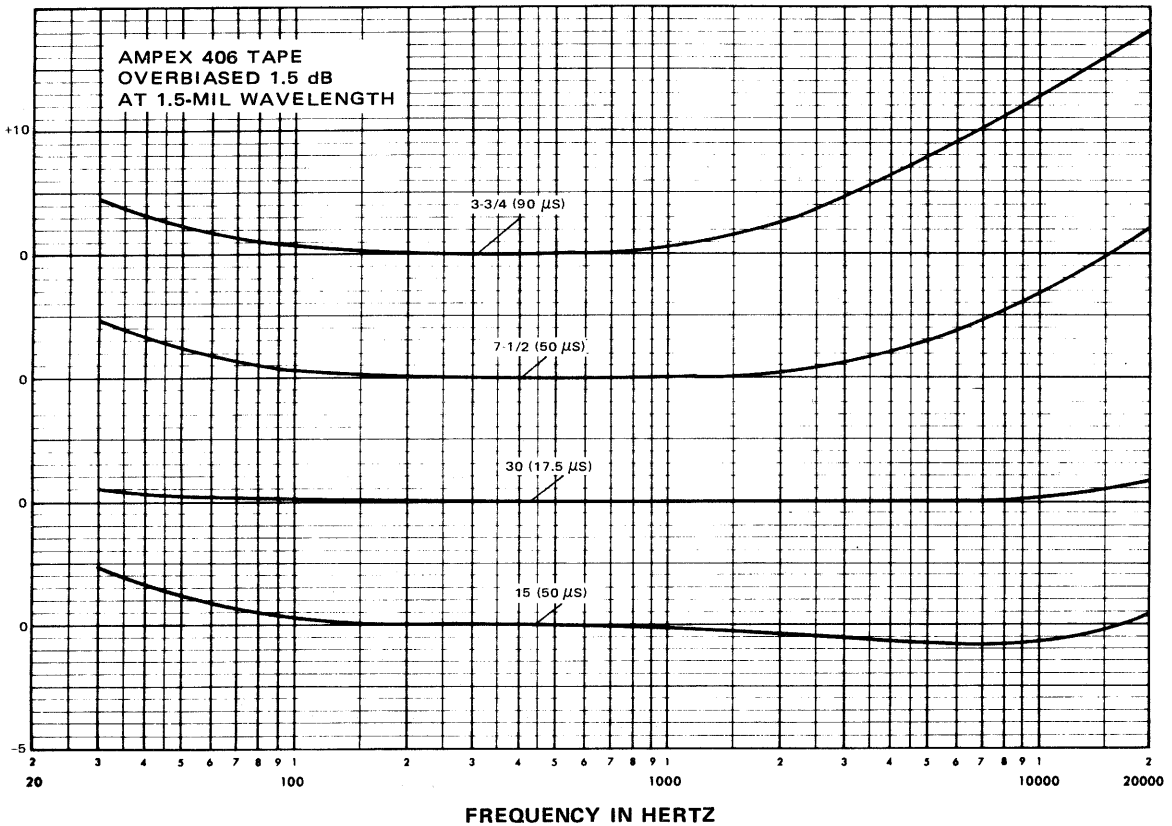


Figure 5-25. Record Current Response (Pre-Emphasis Set for Flat Response)

TROUBLESHOOTING HINTS

Electronic

Troubleshooting hints for electronic portions of the recorder/reproducer are given in Table 5-9.

Table 5-9. Troubleshooting Hints – Electronic

SYMPTOM	POSSIBLE CAUSE
Neither VU meter lamp or ready lamp lights.	+39V power supply disconnected or defective (F701 on power supply blown) or F1 on electronics blown.
No output indicated on VU meter or output line when monitoring input or reproduce.	Defective line amplifier or impedance switch set half way between 150 and 600 ohm position.
No output indicated on VU meter but output exists at line output.	Bias pushbutton pressed.
When placed in record, record lamp will not light and metering of bias indicates excessive bias.	Failure of record light, record relay or 9Q4 on record control board.
When placed in record, record lamp lights and metering of bias is correct but will not record. Signal present when monitoring input and when reproducing a pre-recorded tape.	Open record head or record cable, or open circuit in record relay contacts, or defective record amplifier.
Record light lights when record pushbutton is pressed but will not stay on.	9Q2 on record control board open or open circuit between 9Q2 and transport control box.
Record lights come on when power is turned on and ready switch is in Safe.	9Q3 or 9Q4 on record control board shorted.
Record light comes on when ready switch is placed in ready.	9Q1 on record control board shorted.

Tape Transport

Troubleshooting hints for the tape transport are given in Table 5-10.

Table 5-10. Troubleshooting Hints – Transport

SYMPTOM	POSSIBLE CAUSE
Neither transport pilot lamp nor VU meter lamp lights.	F601 or F602 on control box blown. Lamp defective.
No action when play, RW or FF buttons are pressed but edit operates and latches.	Safety switch inoperable.
No action when play, RW or FF button are pressed and edit operates when button is pressed.	Failure in 24V power supply.
Relays click when play, RW or FF are pressed but tape will not move.	Dummy plug missing in the remote receptacle J605 or failure in 120V power supply (F603 on control box blown).
Edit function fails to operate with safety switch "off."	Reproduce head cables disconnected (ground carried through outer shield) or +39V power supply inoperative or cables disconnected.
Servo motor fails to start when tape is threaded and safety switch is activated.	Capstan stop option selected in error.
Servo motor fails to start when play mode selected.	Dummy plug missing in servo chassis accessory socket J4.
AC motor fails to start when tape is threaded.	Dummy plug missing in transport control box socket J604.

SECTION VI

PARTS LISTS AND SCHEMATICS

This section contains assembly parts lists and schematic diagrams. The assemblies are separated in the manual into five groups: system, transport, head assemblies, electronics, and miscellaneous.

Three indexes list the drawings as follows:

- **Indented List of Assemblies** — List of assemblies in sequence of appearance in the manual.
- **Numerical List of Assemblies** — List of assemblies in numeric sequence.
- **Numerical List of Schematics** — List of schematics in numeric sequence.

Four illustrations follow the indexes to aid in the identification and location of major components and assemblies.

CATALOG/PART NUMBER IDENTIFICATION

The catalog/part number of a particular unit is determined by its features. This number is found on the identification plate at the rear of the unit, see Figure 6-1. Tables 6-1, 6-2, and 6-3 list the version numbers and features for one, two, and four channel recorders, respectively.

For example, if the number on the identification plate is 4010202-23, the first group of digits, 4010202, means the unit is a one channel recorder. Using Table 6-1, the version number -23 indicates that the recorder operates on 60 Hz and is portable, that it has two tracks, a 3-3/4 and a 7-1/2 in/s speed combination, and an AC motor.



Figure 6-1. Location of Parts, Top of Transport

Table 6-1. Version Numbers for One Channel Recorders (4010202)

VERSION NO.	POWER FREQ. (IN HZ)	TYPE OF ENCLOSURE	NUMBER OF TRACKS	TAPE SPEED IN/S	CAPSTAN DRIVE
-01	60	Rack	1	7-1/2 – 15	AC
-02	50				
-03	60	Console			
-04	50				
-05	60	Portable	2		
-06	50				
-07	60	Rack			
-08	50				
-09	60	Console	1		
-10	50				
-11	60	Portable			
-12	50				
-13	60	Rack	2	3-3/4 – 7-1/2	
-14	50				
-15	60	Console			
-16	50				
-17	60	Portable	1		
-18	50				
-19	60	Rack			
-20	50				
-21	60	Console	2		
-22	50				
-23	60	Portable			
-24	50				
-25	60/50	Rack	1	7-1/2 – 15	Servo
-26		Console			
-27		Portable			
-28					
-29		Rack	2		
-30		Console			
-31		Portable			
-32					
-33		Rack	1	3-3/4 – 7-1/2	
-34		Console			
-35		Portable			
-36					
-37		Rack	2	15 – 30	
-38		Console			
-39	Portable				
-40					
-41	Rack	1			
-42	Console				
		Portable			

Table 6-2. Version Numbers for Two Channel Recorders (4010203)

VERSION NO.	POWER FREQ. (IN HZ)	TYPE OF ENCLOSURE	TAPE SPEED IN/S	NUMBER OF TRACKS	CAPSTAN DRIVE	
-01	60	Rack	7-1/2 – 15	2	AC	
-02	50	Rack				
-03	60	Console				
-04	50	Console				
-05	60	Portable				
-06	50	Portable				
-07	60	Rack	3-3/4 – 7-1/2			
-08	50	Rack				
-09	60	Console				
-10	50	Console				
-11	60	Portable				
-12	50	Portable				
-13	60	Rack	7-1/2 – 15	2 – 4		
-14	50	Rack				
-15	60	Console				
-16	50	Console				
-17	60	Portable				
-18	50	Portable				
-19	60	Rack	3-3/4 – 7-1/2			
-20	50	Rack				
-21	60	Console				
-22	50	Console				
-23	60	Portable				
-24	50	Portable				
-25	50/60	Rack	7-1/2 – 15	2	Servo	
-26		Console				
-27		Portable				
-28		Rack	3-3/4 – 7-1/2			
-29		Console				
-30		Portable				
-31		Rack	15 – 30			
-32		Console				
-33		Portable				
-34		Rack	7-1/2 – 15			2 – 4
-35		Console				
-36		Portable				
-37		Rack	3-3/4 – 7-1/2			
-38		Console				
-39	Portable					

Table 6-3. Version Numbers for Four Channel Recorders (4020204)

VERSION NO.	POWER FREQ. (IN HZ)	TYPE OF ENCLOSURE	TAPE SPEED IN/S	CAPSTAN DRIVE	TAPE SIZE
-01	60	Rack	7-1/2 – 15	AC	1/2 inch
-02	50	Rack			
-03	60	Console			
-04	50	Console			
-05	60	Portable			
-06	50	Portable			
-07	50/60	Rack	15 – 30	Servo	
-08		Console			
-09		Portable			
-10		Rack			
-11		Console			
-12		Portable			
-13	50/60	Rack	7-1/2 – 15	Servo	1/4 inch
-14		Console			
-15		Portable			
-16		Rack			
-17		Console			
-18		Portable			

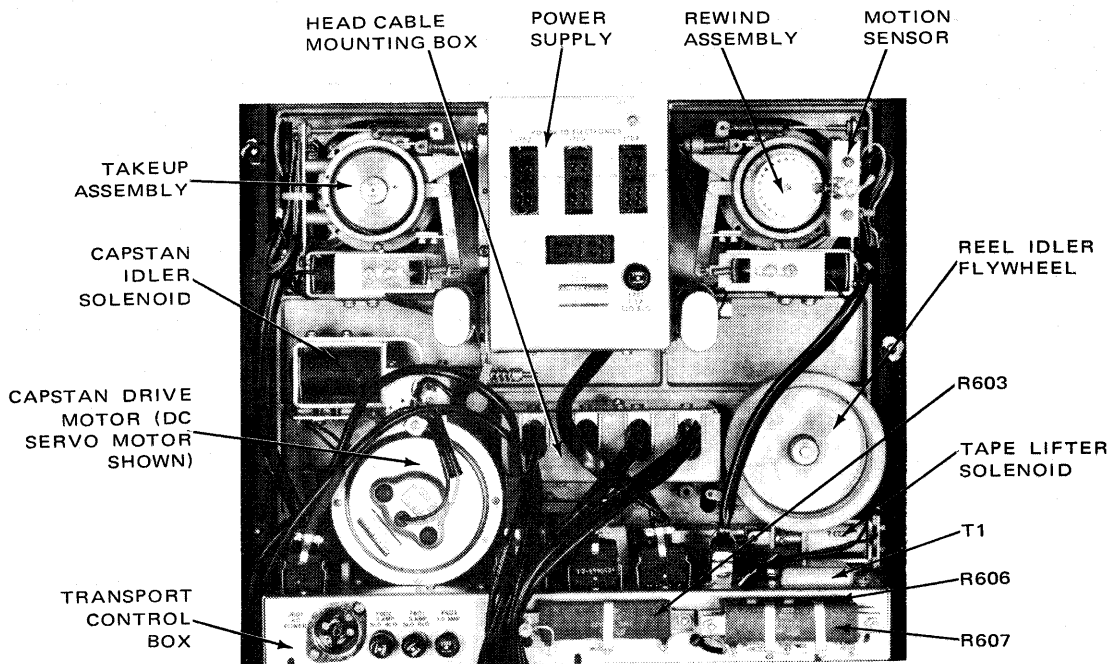


Figure 6-2. Location of Parts, Bottom of Transport

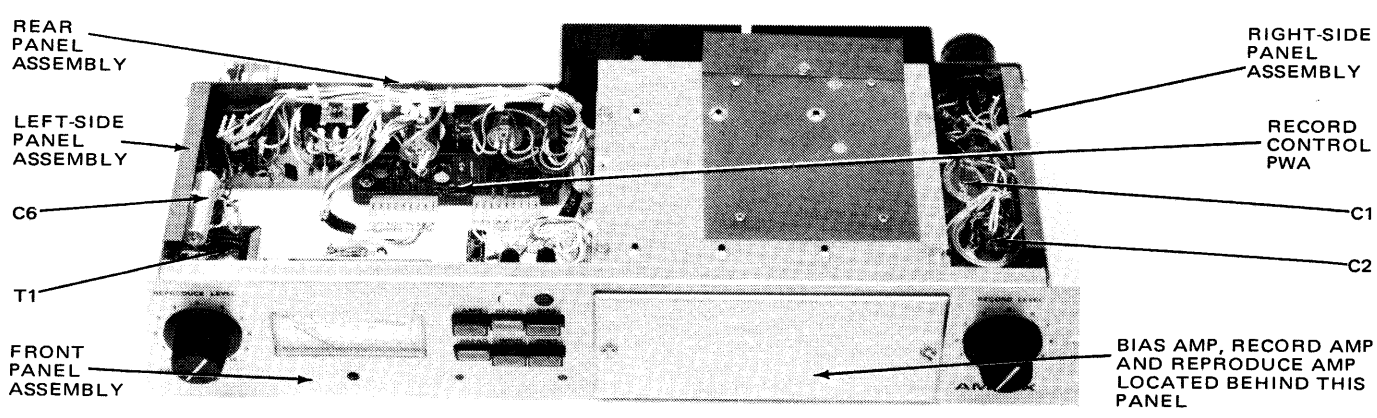


Figure 6-3. Location of Components, Record/Reproduce Unit

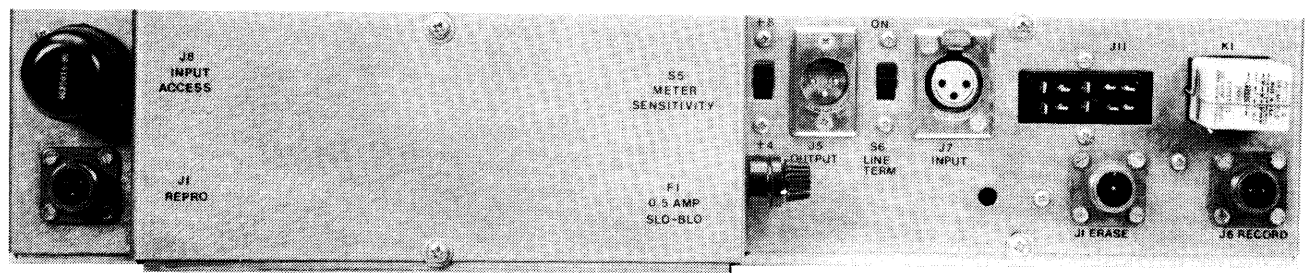


Figure 6-4. Rear Panel of Record/Reproduce Unit

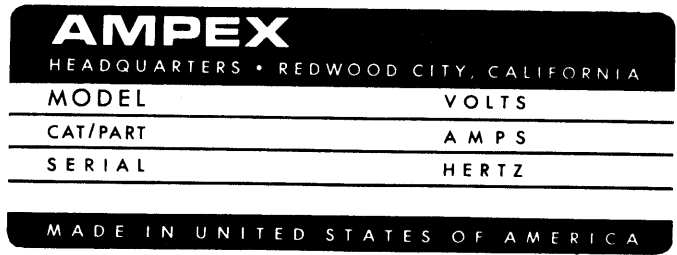


Figure 6-5. Identification Plate

INDENTURED LIST OF ASSEMBLIES

TITLE	ASSEMBLY NO.	PAGE NO.
SYSTEM		
One Channel Tape Recorder	4010202	6-13
Two Channel Tape Recorder	4010203	6-15
Four Channel Tape Recorder	4010204	6-17

TRANSPORT

Tape Transport Assembly	4020271	6-19
Scrape Flutter Idler and Guide Assembly	4041150	6-27
Tape Lifter Assembly	4030259	6-28
Tape Lifter Solenoid Assembly	4030273	6-29
Capstan Idler Assembly	4030279	6-30
Capstan Idler Solenoid Assembly	4030272	6-31
Takeup Tension Arm Assembly	4030322	6-32
Reel Idler Assembly	4040970	6-33
Takeup Assembly	4030297	6-34
Takeup and Rewind Brake Assemblies	4030264	6-36
Rewind Assembly	4030333	6-38
Takeup and Rewind Brake Assemblies (See Page 6-36).	4030264	
Motion Sensor Assembly	4050587	6-41
Drive Motor Assembly	4040993	6-42
Servo Motor Assembly	4020361	6-44
Transport Control Box Assembly	4020338	6-45
Transport Control Chassis Assembly	4041149	6-49
Transport Control PWA	4050656	6-50
Transport Control Harness Assembly	4050635	6-52
Capstan Servo Chassis Assembly	4020353	6-53
Capstan Servo PWA	4050692	6-57
Servo Power Cable	4050585	6-63

HEAD ASSEMBLIES

1 Track, 2 Track, and 2-4 Track Head Assemblies for 1/4-Inch Tape	4020355	6-65
Record Shield Can Assembly, 2-4 Track	4350021	6-69
Record Shield Can Assembly; 1 Track, 2 Track and 4 Track	4350022	6-70
Playback Shield Can Assembly, 2-4 Track	4350023	6-71
Playback Shield Can Assembly (All Head Assemblies).	4350024	6-72
Head Gate Assembly (All Head Assemblies).	4350029	6-73

INDENTURED LIST OF ASSEMBLIES (Continued)

TITLE	ASSEMBLY NO.	PAGE NO.
HEAD ASSEMBLIES (Continued)		
4 Track Head Assembly for 1/2-Inch Tape	4020356	6-74
Record Shield Can Assembly; 1 Track, 2 Track, and 4 Track (See Page 6-70).	4350022	
Playback Shield Can Assembly, (All Head Assemblies) (See Page 6-72).	4350024	
Head Gate Assembly, (All Head Assemblies) (See Page 6-73).	4350029	
4 Track Head Assembly for 1/4-Inch Tape	4020359	6-76
Record Shield Can Assembly; 1 Track, 2 Track, and 4 Track (See Page 6-70).	4350022	
Playback Shield Can Assembly, (All Head Assemblies) (See Page 6-72).	4350024	
Head Gate Assembly, (All Head Assemblies) (See Page 6-73)	4350029	
Head Cable Mounting Box Assembly	4050653	6-78
ELECTRONICS		
Power Supply Assembly	4020274	6-81
Regulator and Oscillator PWA	4050432	6-85
Power Supply Connector Panel	4040968	6-89
Record/Reproduce Electronics Assembly	4020337	6-90
Bias Amplifier PWA	4050433	6-91
Record Amplifier PWA	4050434	6-95
Record Equalizer PWA	4020269	6-98
Reproduce Amplifier PWA	4050435	6-100
Reproduce Equalizer PWA	4020270	6-102
Record Control PWA	4050564	6-103
Left Side Panel Assembly	4050593	6-107
Rear Panel Assembly	4050601	6-108
Rear Panel	4041183	6-110
Front Panel Assembly	4050616	6-112
Control Cluster Assembly	4050617	6-115
Right Side Panel Assembly	4050621	6-116
Record/Reproduce Unit (Electronics) Harness Assembly.	4050632	6-117
Enclosure Assembly	4050639	6-118
Record/Reproduce Unit (Electronics) Interconnect Cable Assembly	4050442	6-119
CONSOLE		
Console Assembly	4020084	6-121
Console Base Assembly	4040979	6-125
MISCELLANEOUS		
Remote Control Assembly (Optional Accessory)	4010080	6-127
Transistor Microphone Preamplifier Assembly (Optional Accessory)	4010066	6-130
Transistor Microphone Preamplifier PWA	4050409	6-132

NUMERICAL LIST OF ASSEMBLIES

ASSEMBLY NO.	REV.	TITLE	PAGE NO.
4010066	B	Transistor Microphone Preamp Assembly (Optional Accessory)	6-130
4010080	E	Remote Control Assembly (Optional Accessory)	6-127
4010202	D	One Channel Tape Recorder	6-13
4010203	D	Two Channel Tape Recorder	6-15
4010204	E	Four Channel Tape Recorder	6-17
4020084	S	Console Assembly	6-121
4020269	J	Record Equalizer PWA	6-98
4020270	D	Reproduce Equalizer PWA	6-102
4020271	AT	Tape Transport Assembly	6-19
4020274	P	Power Supply Assembly	6-81
4020337	B	Record/Reproduce Electronics Assembly	6-90
4020338	F	Transport Control Box Assembly	6-45
4020353	E	Capstan Servo Chassis Assembly	6-53
4020355	E	1 Track, 2 Track, and 2-4 Track Head Assemblies for 1/4-Inch Tape	6-65
4020356	D	4 Track Head Assembly for 1/2-Inch Tape	6-74
4020359	A	4 Track Head Assembly for 1/4-Inch Tape	6-76
4020361	C	Servo Motor Assembly	6-44
4030259	E	Tape Lifter Assembly	6-28
4030264	G	Takeup and Rewind Brake Assemblies	6-36
4030272	J	Capstan Idler Solenoid Assembly	6-31
4030273	F	Tape Lifter Solenoid Assembly	6-29
4030279	G	Capstan Idler Assembly	6-30
4030297	D	Takeup Assembly	6-34
4030322	D	Takeup Tension Arm Assembly	6-32
4030333	C	Rewind Assembly	6-38
4040968	E	Power Supply Connector Panel	6-89
4040970	K	Reel Idler Assembly	6-33
4040979	H	Console Base Assembly	6-125
4040993	F	Drive Motor Assembly	6-42
4041149	—	Transport Control Chassis Assembly	6-49
4041150	B	Scrape Flutter Idler and Guide Assembly	6-27
4041183	—	Rear Panel (Record/Reproduce Unit)	6-110
4050409	B	Transistor Microphone Preamplifier PWA	6-132
4050432	M	Regulator and Oscillator PWA	6-85
4050433	L	Bias Amplifier PWA	6-91
4050434	J	Record Amplifier PWA	6-95
4050435	AB	Reproduce Amplifier PWA	6-100
4050442	B	Record/Reproduce Unit (Electronics) Interconnect Cable Assembly	6-119
4050564	B	Record Control PWA	6-103
4050585	—	Servo Power Cable	6-63
4050587	A	Motion Sensor Assembly	6-41

NUMERICAL LIST OF ASSEMBLIES (Continued)

ASSEMBLY NO.	REV.	TITLE	PAGE NO.
4050593	—	Left Side Panel Assembly (Record/Reproduce Unit)	6-107
4050601	A	Rear Panel Assembly (Record/Reproduce Unit)	6-108
4050616	A	Front Panel Assembly (Record/Reproduce Unit).	6-112
4050617	C	Control Cluster Assembly (Record/Reproduce Unit)	6-115
4050621	C	Right Side Panel Assembly (Record/Reproduce Unit)	6-116
4050632	C	Record/Reproduce Unit (Electronics) Harness Assembly.	6-117
4050635	D	Transport Control Harness Assembly	6-52
4050639	C	Enclosure Assembly (Record/Reproduce Unit).	6-118
4050653	B	Head Cable Mounting Box Assembly	6-78
4050656	C	Transport Control PWA	6-50
4050692	G	Capstan Servo PWA	6-57
4350021	—	Record Shield Can Assembly, 2-4 Track	6-69
4350022	E	Record Shield Can Assembly; 1 Track, 2 Track, and 4 Track	6-70
4350023	C	Playback Shield Can Assembly, 2-4 Track	6-71
4350024	—	Playback Shield Can Assembly, (All Head Assemblies)	6-72
4350029	C	Head Gate Assembly, (All Head Assemblies)	6-73

NUMERICAL LIST OF SCHEMATIC DIAGRAMS

SCHEMATIC NO.	REV.	TITLE	PAGE NO.
4840153	A	Transistor Microphone Preamplifier PWA	6-133
4840168	J	Power Supply	6-87
		Regulator and Oscillator PWA	6-87
4840248	D	Record/Reproduce Electronics	6-105
		Record Control PWA	6-105
4840249	D	Bias Amplifier PWA	6-93
		Record Amplifier PWA.	6-93
		Record Equalizer PWA.	6-93
		Reproduce Amplifier PWA	6-93
		Reproduce Equalizer PWA	6-93
4840261	D	Tape Transport Assembly.	6-25
4840279	A	Capstan Servo Chassis	6-55
4840356	E	Capstan Servo PWA	6-61

NEXT HIGHER ASSEMBLY NO. CATALOG

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4020084-06		CONSOLE ASSY	
2	4020269-01		RECORD EQUALIZER ASSY, 7-1/2 - 15 IPS NAB	
3	4020269-02		RECORD EQUALIZER ASSY, 3-3/4 - 7-1/2 IPS NAB	
4	4020269-07		RECORD EQUALIZER ASSY, 15-30 IPS	
5	4020270-01		RECORD EQUALIZER ASSY, 15-30 IPS	
6	4020270-02		REPRODUCE EQUALIZER ASSY, 15-30 IPS	
7	4020271-30		TRANSPORT ASSY, 7-1/2-15 IPS, 60 HZ, W/AC MOTOR	
8	4020271-31		TRANSPORT ASSY, 7-1/2-15 IPS, 50 HZ, W/AC MOTOR	
9	4020271-33		TRANSPORT ASSY, 3-3/4-7-1/2 IPS, 60 HZ, W/AC MOTOR	
10	4020271-33		TRANSPORT ASSY, 3-3/4-7-1/2 IPS, 50 HZ, W/AC MOTOR	
11	4020271-34		TRANSPORT ASSY, W/SERVO MOTOR	
12	4020355-01		HEAD ASSY, 1 TRACK	
13	4020355-02		HEAD ASSY, 2 TRACK	
15	4020274-05		POWER SUPPLY ASSY	
17	4020337-01		RECORD/REPRODUCE UNIT ELECTRONICS ASSY W/OUT EQUALIZERS	
18	4020353-01		CAPSTAN SERVO CHASSIS ASSY	
20	4030145-10		KNOB ASSY, EDITING, FOR CONSOLE UNITS	
21	4040492-10		KNOB ASSY, REEL, FOR PORTABLE AND RACK MOUNT UNITS	
22	4040945-01		PANEL ASSY, BACKING, PORTABLE UNITS ONLY	
23	4041150-01		SCRAPE FLUTTER IDLER AND GUIDE ASSY	
24	4040992-02		PANEL, DECORATIVE COVER	
25	4050416-02		CABLE ASSY, POWER	
26	4050442-01		RECORD/REPRODUCE ELECTRONICS' INTERCONNECT CABLE	
27	4050653-01		HEAD CABLE BOX ASSY	
31	4100137-10		KNOB, REEL HOLD DOWN	
36	4110139-01		OVERLAY, ELECTRONICS	
37	4150329-01		TRANSPORT CASE ASSY, PORTABLE UNIT ONLY	
38	4150330-02		SINGLE AND DUAL ELECT, 7" CABLE ASSY, PORTABLE UNIT ONLY	
41	4290620-01		PANEL, FRONT FACING (BLANK), PORTABLE UNIT ONLY	
42	4290643-01		SHIELD, RESISTOR (CONTROL BOX, CONSOLE W/AC MOTOR)	
43	4290659-01		SHIELD, RESISTOR, CONTROL BOX	
44	4290928-01		PANEL, FRONT BACKING	
45	4290929-02		TRAY, CAPSTAN SERVO SUPPLY	
48	4580200-01		TRANSFORMER, BRIDGING	
49	4600008-10		SHIELD, P/B HEAD CONNECTOR	

NEXT HIGHER ASSEMBLY NO.

CATALOG

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
50	4690003-10		REEL ASSY	
58	4930504-01		NUTDRIVER, MODIFIED	
68	144-003		CONNECTOR, PLUG, FEMALE, 3 PIN	
69	145-009		CONNECTOR, PLUG, MALE, 3 PIN	
71	430-016		RING, RETAINER, 7/8	
72	470-384		SCREW, BUTTON HD, SOC, NO. 8-32 X 1/2	
73	471-073		SCREW, PN HD, 6-32 X 3/4 LG	
74	471-084		SCREW, PN HD, XRED, NO. 8-32 X 1 LG	
75	471-357		SCREW, FL HD, 10-32 X 5/8 LG	
76	471-470		SCREW, PN HD, 6-32 X 1-1/2 LG	
77	471-109		SCREW, PN HD, NO. 4-40 X 0.19 LG	
78	471-865		SCREW, PN HD, XREC, NO. 10-24 X .625 LG	
79	472-578		SCREW, OVAL HD, XRED, 10-32 X 3/4 LG	
80	472-889		SCREW, OVAL HD, XREC, NO. 12-24 X 3/4 LG	
81	472-922		SCREW, FL HD, 12-24 X 5/8 LG	
82	472-967		SCREW, OVAL HD, XREC, NO. 12-24 X 1-1/4 LG	
85	475-119		SCREW, PN HD, XREC, SEM NO. 10-24 X 1/2 LG	
86	496-005		NUT, KEP, 6-32	
87	496-006		NUT, KEP, 8-32	
89	501-009		WASHER, PLAIN, NO. 6	
90	501-010		WASHER, FLAT, NO. 8	
91	501-011		WASHER, FLAT, NO. 10	
92	502-004		WASHER, LOCK, NO. 8	
93	502-005		WASHER, LOCK, NO. 10	
94	503-061		WASHER, NO. 10, WHITE	
95	503-087		WASHER, NO. 12, WHITE	
			VERSIONS: 4010202-01 THRU 42	
			SEE TABLE 6-2	

NEXT HIGHER ASSEMBLY NO. CATALOG

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4020084-07		CONSOLE ASSY	
2	4020269-01		RECORD EQUALIZER ASSY, 7-1/2-15 IPS, NAB	
3	4020269-02		RECORD EQUALIZER ASSY, 3-3/4-7-1/2 IPS, NAB	
4	4020269-07		RECORD EQUALIZER ASSY, 15-30 IPS	
5	4020270-01		REPRODUCE EQUALIZER ASSY, NAB	
6	4020270-02		REPRODUCE EQUALIZER ASSY, 15-30 IPS, NAB	
7	4020271-30		TRANSPORT ASSY, 7-1/2-15 IPS, 60 HZ, W/AC MOTOR	
8	4020271-31		TRANSPORT ASSY, 7-1/2-15 IPS, 50 HZ, W/AC MOTOR	
9	4020271-32		TRANSPORT ASSY, 3-3/4-7-1/2 IPS, 60 HZ, W/AC MOTOR	
10	4020271-33		TRANSPORT ASSY, 3-3/4-7-1/2 IPS, 50 HZ, W/AC MOTOR	
11	4020271-34		TRANSPORT ASSY, W/SERVO MOTOR	
12	4020355-02		HEAD ASSY, 2 TRACK	
13	4020355-03		HEAD ASSY, 4 POSITION	
14	4020274-05		POWER SUPPLY ASSY	
15	4020337-01		RECORD/REPRODUCE UNIT ELECTRONICS ASSY, W/OUT EQUALIZERS	
16	4020353-01		CAPSTAN SERVO CHASSIS ASSY	
19	4030145-10		KNOB ASSY, EDITING, FOR CONSOLE UNITS	
22	4040492-10		KNOB ASSY, REEL, RACK MOUNT AND PORTABLE UNITS	
23	4041150-01		SCRAPE FLUTTER IDLER AND GUIDE ASSY	
24	4040992-02		PANEL, DECORATIVE COVER	
25	4050416-02		CABLE ASSY, POWER	
26	4050442-01		RECORD/REPRODUCE ELECTRONICS INTERCONNECT CABLE	
27	4050653-02		HEAD CABLE BOX ASSY, 2 TRACK UNITS	
28	4050653-05		HEAD CABLE BOX ASSY, 2-4 TRACK UNITS	
32	4100137-10		KNOB, REEL HOLD DOWN	
35	4110139-01		OVERLAY, ELECTRONICS	
43	4150329-01		CASE ASSY, TRANSPORT, PORTABLE UNIT ONLY	
44	4150330-02		CASE ASSY, SINGLE AND DUAL ELECT. 7", PORTABLE UNIT ONLY	
46	4290620-01		PANEL, FRONT FACING, BLANK, RACK MOUNT UNITS W/SERVO MOTOR	
47	4290643-01		SHIELD, RESISTOR ON CONTROL BOX OF CONSOLE W/AC MOTOR	
48	4290659-01		SHIELD, RESISTOR ON CONTROL BOX OF PORTABLE AND RACK MOUNT UNITS HAVING AC MOTOR	
49	4290928-01		PANEL, FRONT BACKING	
50	4290929-01		CAPSTAN SERVO SUPPLY TRAY, RACK MOUNT UNIT W/SERVO MOTOR	
52	4580200-01		TRANSFORMER, BRIDGING	
53	4600008-10		SHIELD, P/B HEAD CONNECTOR	

NEXT HIGHER ASSEMBLY NO. CATALOG

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
54	4690003-10		REEL ASSY	
56	4930504-01		NUTDRIVER, MODIFIED	
63	144-003		CONNECTOR, PLUG, FEMALE, 3 PIN	
64	145-009		CONNECTOR, PLUG, MALE, 3 PIN	
65	430-106		RING, RETAINER, 7/8	
66	470-384		SCREW, BUTTON HD, SOC, NO. 8-32 X 1/2	
67	471-073		SCREW, PN HD, 6-32 X 3/4 LG	
68	471-084		SCREW, PN HD, XREC, NO. 8-32 X 1 LG	
69	471-357		SCREW, FL HD, 10-32 X 5/8 LG	
70	471-470		SCREW, PN HD, 6-32 X 1-1/2 LG	
71	471-865		SCREW, PN HD, XREC, NO. 10-24 X .625	
72	472-578		SCREW, OVAL HD, XREC, NO. 10-32 X 3/4 LG	
73	472-889		SCREW, OVAL HD, XREC, NO. 12-24 X 3/4	
74	472-922		SCREW, FL HD, 12-24 X 5/8 LG	
75	472-967		SCREW, OVAL HD, XREC, NO. 12-24 X 1-1/4	
76	475-119		SCREW, PN HD, XREC, SEM, NO. 10-24 X 1/2	
77	496-005		NUT, KEP, 6-32	
78	496-006		NUT, KEP, NO. 8-32	
79	471-109		SCREW, PN HD, XREC, NO. 4-40 X 0.19 LG	
81	501-009		WASHER, PLAIN, NO. 6	
82	501-010		WASHER, FLAT, NO. 8	
83	501-011		WASHER, FLAT, NO. 10	
85	502-004		WASHER, LOCK, NO. 8	
86	502-005		WASHER, LOCK, NO. 10	
88	503-061		WASHER, WHITE, NO. 12	
89	503-087		WASHER, WHITE, NO. 10	
			VERSIONS: 4010203-01 THRU 39 SEE TABLE 6-2	

NEXT HIGHER ASSEMBLY NO. CATALOG

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4020084-09		CONSOLE ASSY	
2	4020269-01		RECORD EQUALIZER ASSY, 7-1/2-15 IPS, NAB	
3	4020269-02		RECORD EQUALIZER ASSY, 3-3/4-7-1/2 IPS	
4	4020269-07		RECORD EQUALIZER ASSY, 15-30 IPS	
5	4020270-01		REPRODUCE EQUALIZER ASSY, NAB	
6	4020270-02		REPRODUCE EQUALIZER, 15-30 IPS	
7	4020271-30		TRANSPORT ASSY, 7-1/2-15 IPS, 60 HZ, W/AC MOTOR	
8	4020271-31		TRANSPORT ASSY, 7-1/2-15 IPS, 50 HZ, W/AC MOTOR	
9	4020271-34		TRANSPORT ASSY, W/SERVO MOTOR	
10	4020356-01		HEAD ASSY, 4 TRACK 1/2"	
11	4020274-05		POWER SUPPLY ASSY	
12	4020359-01		HEAD ASSY, 4 TRACK 1/4"	
13	4020337-01		RECORD/REPRODUCE UNIT ELECTRONICS ASSY, W/OUT EQUALIZERS, 1/2" TAPE	
14	4020353-01		CAPSTAN SERVO CHASSIS ASSY	
15	4020337-02		RECORD/REPRODUCE UNIT ELECTRONICS ASSY, W/OUT EQUALIZERS, 1/4" TAPE	
17	4030145-10		KNOB ASSY, EDITING, FOR CONSOLE UNITS	
20	4040492-10		KNOB ASSY, REEL, FOR PORTABLE AND RACK MOUNT UNITS	
21	4040992-02		PANEL, DECORATIVE COVER	
22	4041150-01		SCRAPE FLUTTER IDLER AND GUIDE ASSY	
25	4050416-02		CABLE ASSY, POWER	
26	4050442-01		RECORD/REPRODUCE ELECTRONICS INTERCONNECT CABLE	
27	4050653-04		HEAD CABLE BOX ASSY	
30	4110139-01		OVERLAY, ELECTRONICS	
39	4150329-01		CASE ASSY, TRANSPORT, PORTABLE UNITS	
40	4150331-01		CASE ASSY, 3 & 4 ELECTRONICS, 14", PORTABLE UNITS	
42	4290620-01		PANEL, BLANK, FRONT FACING	
43	4290643-01		SHIELD, RESISTOR ON CONTROL BOX OF CONSOLE W/AC MOTOR	
44	4290659-01		SHIELD, RESISTOR ON CONTROL BOX OF PORTABLE AND RACK MOUNT UNITS HAVING AC/MOTOR	
45	4290928-01		PANEL, FRONT BACKING	
46	4290929-01		TRAY, CAPSTAN SERVO SUPPLY	
48	4580200-01		TRANSFORMER, BRIDGING	
50	4600008-10		SHIELD, P/B HEAD CONNECTOR	
52	4690003-10		REEL ASSY, 1/4"	
53	4690003-20		REEL ASSY, 1/2"	
62	4930504-01		NUTDRIVER, MODIFIED	

NEXT HIGHER ASSEMBLY NO. CATALOG

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
70	144-003		CONNECTOR, PLUG, FEMALE, 3 SOC	
71	145-009		CONNECTOR, PLUG, MALE, 3 PIN	
73	430-016		RING, RETAINER, 7/8"	
74	470-384		SCREW, BUTTON HD, SOC, NO. 8-32 X 1/2	
75	471-073		SCREW, PN HD, 6-32 X 3/4 LG	
76	471-084		SCREW, PN HD, XREC, NO. 8-32 X 1 LG	
77	471-357		SCREW, FL HD, 10-32 X 5/8 LG	
78	471-470		SCREW, PN HD, 6-32 X 1-1/2 LG	
79	471-865		SCREW, PN HD, XREC, NO. 10-24 X .625 LG	
80	472-578		SCREW, OVAL HD, XREC, 10-32 X 3/4 LG	
81	472-889		SCREW, OVAL HD, XREC, NO. 12-24 X 3/4	
82	472-922		SCREW, FL HD, 12-24 X 5/8 LG	
83	472-967		SCREW, OVAL HD, XREC, NO. 12-24 X 1-1/4	
84	475-119		SCREW, SEM, PN HD, XREC, NO. 10-24 X 1/2	
85	496-005		NUTS, KEP, 6-32	
86	496-006		NUT, KEP, 8-32	
87	471-109		SCREW, PN HD, XREC, NO. 4-40 X 0.19 LG	
88	501-010		WASHER, FLAT, NO. 8	
89	501-009		WASHER, PLAIN, NO. 6	
90	501-011		WASHER, FLAT, NO. 10	
91	502-004		WASHER, LOCK, NO. 8	
92	502-005		WASHER, LOCK, NO. 10	
93	503-061		WASHER, WHITE, NO. 10	
94	503-087		WASHER, WHITE, NO. 12	
VERSION: 4010204-01 THRU 18 SEE TABLE 6-2				

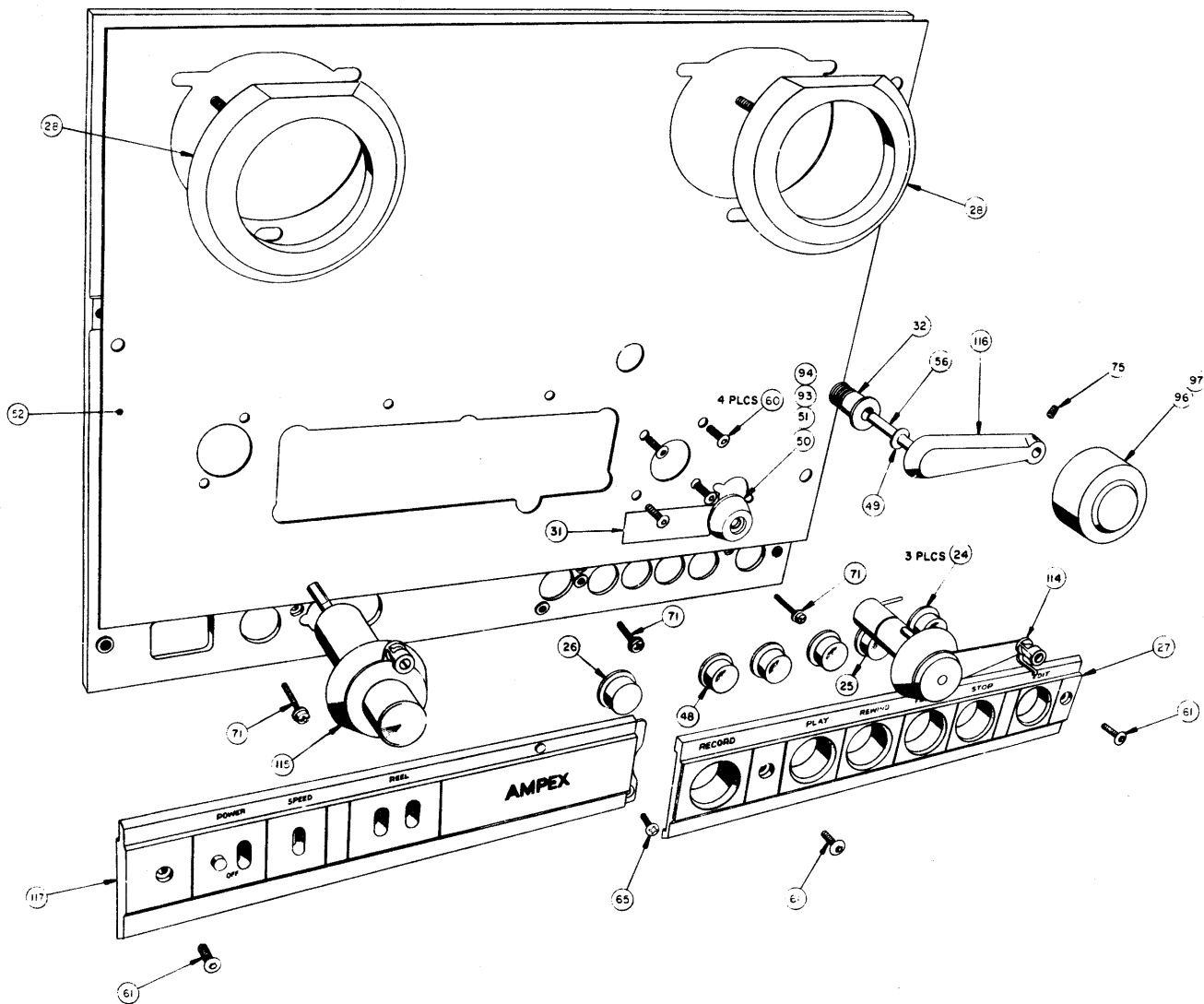
NEXT HIGHER ASSEMBLY NO. 4010202, 4010203, 4010204

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
6	4030259-03		TAPE LIFTER ASSY	
18	4040993-07		DRIVE MOTOR ASSY, 7-1/2 - 15 IPS, 60 HZ	
19	4040993-08		DRIVE MOTOR ASSY, 3-3/4 - 7-1/2 IPS, 60 HZ	
20	4040993-09		DRIVE MOTOR ASSY, 7-1/2 - 15 IPS, 50 HZ	
21	4040993-10		DRIVE MOTOR ASSY, 3-3/4 - 7-1/2 IPS, 50 HZ	
23	4050436-01		SAFETY SWITCH ASSY	
24	4100182-01		BUTTON, PUSH, WHITE	
25	4100182-02		BUTTON, PUSH, YELLOW	
26	4100182-03		BUTTON, PUSH, RED	
27	4110266-02		ESCUTCHEON, BUTTON, PUSH, RIGHT	
28	4110267-02		GUARD, REEL	
29	4130103-01		PAD, TOGGLE SWITCH	
30	4170184-01		SHIELD, SWITCH	
32	4200175-02		BUSHING, CAPSTAN IDLER	
33	4230160-10		ARM, SOLENOID	
34	4250202-01		FLYWHEEL, REEL IDLER	
36	4270117-01		SPRING, TAPE LIFTER SOLENOID	
37	4290641-01		SHIELD, DRIVE MOTOR, W/AC MOTOR	
38	4270252-02		SPRING, TAPE LIFTER RETURN	
41	4330255-01		PLATE, TAPE LIFTER SOLENOID MOUNTING	
42	4330256-01		PLATE, MOTOR CAPACITOR MOUNTING	
43	4330257-01		PLATE, CAPSTAN SOLENOID MOUNTING	
44	4400594-01		SCREW, MODIFIED	
45	4440113-10		WASHER, 0.315 X 0.005 THK	
46	4440113-20		WASHER, 0.315 X 0.010 THK	
47	4440113-50		WASHER, 0.315 X 0.003 THK	
48	4100182-04		BUTTON, PUSH, GREEN	
49	4440025-30		WASHER, LAMICOID, 0.015 THK	
50	4041143-01		DUST CAP ASSY, CAPSTAN, 7-1/2 - 15 IPS	
51	4041143-04		DUST CAP ASSY, CAPSTAN, 3-3/4 - 7-1/2 IPS	
52	4330254-02		FACING, TOP PLATE	
54	302-403		CLAMP, CABLE	
55	506-106		WASHER, "D", NO. 8	
58	302-007		CLAMP, CABLE, 1/4 ID	
59	406-005		PIN, "ROLLPIN", 0.028 WALL, 0.125 DIA X 0.75 LG	
60	470-423		SCREW, CAP, HEX SOC, BUTTON HD, NO. 10-24 X 5/8 LG	
61	470-427		SCREW, CAP, HEX SOC, BUTTON HD, NO. 6-32 X 3/8 LG	
62	473-123		SCREW, HEX HD, NO. 8-32 X 1/2 LG	
63	471-080		SCREW, PAN HD, XREC, NO. 8-32 X 1/2 LG	
64	471-081		SCREW, PAN HD, SREC, NO. 8-32 X 5/8 LG	

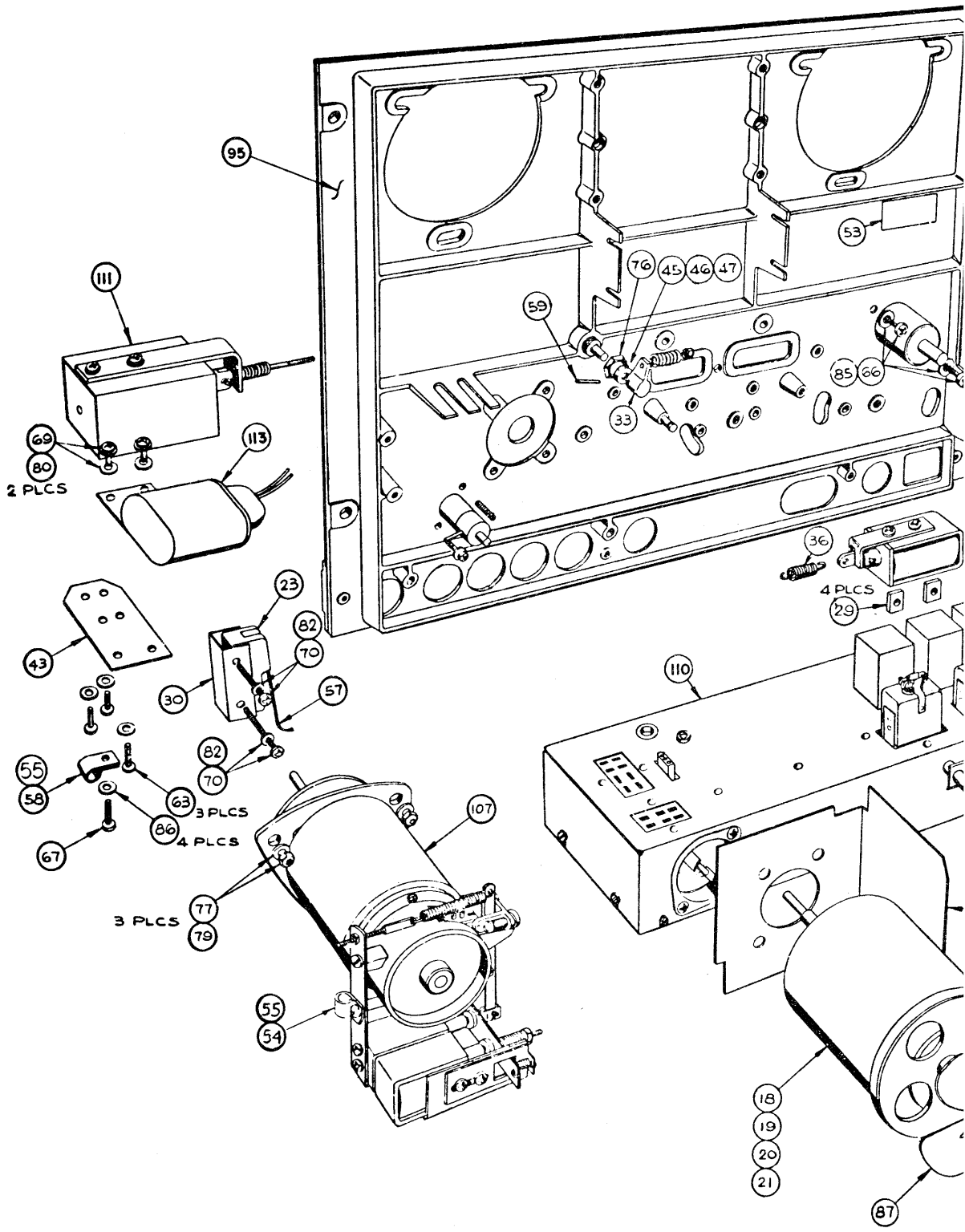
NEXT HIGHER ASSEMBLY NO. 4010202, 4010203, 4010204

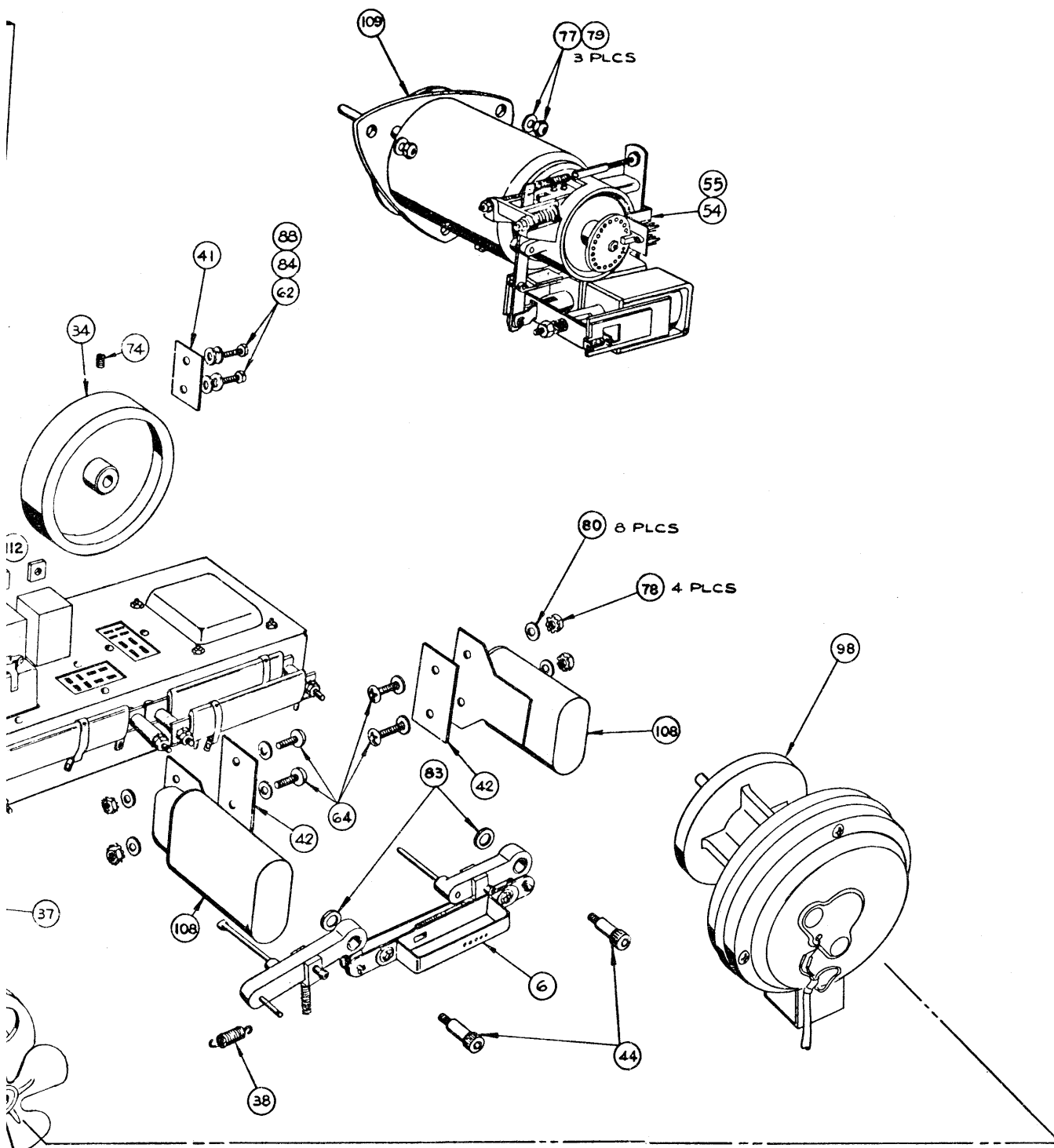
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
65	471-334		SCREW, FL HD, XREC, NO. 6-32 X 1/4 LG	
66	471-865		SCREW, PN HD, XREC, NO. 10-24 X 5/8 LG	
67	473-122		SCREW, PN HD, XREC, NO. 8-32 X 9/16 LG	
69	475-072		SCREW, PN HD, XREC, NO. 8-32 X 1/4 LG	
70	475-080		SCREW, PN HD, XREC, NO. 6-32 X 1-1/8 LG	
71	475-095		SCREW, PN HD, XREC, NO. 6-32 X 7/8 LG	
74	477-047		SCREW, SET, CUPPOINT, HEX SOC, NO. 10-32 X 1/4 LG	
75	477-115		SCREW, SET, CUPPOINT, HEX SOC, NO. 8-32 X 1/8 LG	
76	492-451		NUT, SELF-LOCKING, HEX, 5/8-18	
77	493-012		NUT, SELF-LOCKING, HEX, 1/4-20	
78	496-006		NUT, KEP, NO. 8-32	
79	501-006		WASHER, FLAT, 1/4	
80	501-010		WASHER, FLAT, NO. 8	
82	501-021		WASHER, FLAT, NO. 6	
83	501-908		WASHER, FLAT, NO. 10, 0.062 THK	
84	502-133		WASHER, LOCK SPRING, NO. 8	
85	502-016		WASHER, LOCK, FLAT, EXT TOOTH, NO. 10	
86	502-026		WASHER, LOCK, FLAT, INT TOOTH, NO. 8	
87	591-001		FAN, 5" DIA	
88	501-040		WASHER, FLAT, 0.171 ID X 0.375 OD X 0.062 THK	
93	4100198-02		DUST CAP, CAPSTAN, W/SERVO MOTOR	
94	477-426		SCREW, SET, CUP PT, HEX SOC, 4-40 X 3/32 LG	
95	4040990-04		TOP PLATE ASSEMBLY	
96	4030279-22		CAPSTAN IDLER ASSY, 7-1/2 - 15 IPS	
97	4030279-23		CAPSTAN IDLER ASSY, 3-3/4 - 7-1/2 IPS	
98	4020361-01		SERVO MOTOR ASSEMBLY, 3-3/4-30	
107	4030297-01		TAKEUP ASSY, GE MOTOR	
	4030297-02		TAKEUP ASSY, ASHLAND MOTOR	
	4030297-03		TAKEUP ASSY, TAKANAWA MOTOR	
108	4050361-10		CAPACITOR ASSY, 10 MFD	
	4050540-02		CAPACITOR ASSY, 5 MFD	
109	4030333-05		REWIND ASSY, GE MOTOR	
	4030333-06		REWIND ASSY, ASHLAND MOTOR	
	4030333-07		REWIND ASSY, TAKANAWA MOTOR	
110	4020338-03		CONTROL BOX ASSY	
111	4030272-04		SOLENOID ASSY, CAPSTAN IDLER	
112	4030273-03		SOLENOID ASSY, TAPE LIFTER	
113	4050586-01		CAPACITOR ASSY, CAPSTAN MOTOR, W/AC MOTOR	
114	4030322-01		TAKEUP TENSION ARM ASSY	
115	4040970-07		REEL IDLER ASSY	
116	4230131-01		ARM, CAPSTAN IDLER	
117	4040991-03		ESCUTCHEON ASSY	
119	4840261		SCHEMATIC, TRANSPORT	

VERSIONS: 4020271-13 THRU -17

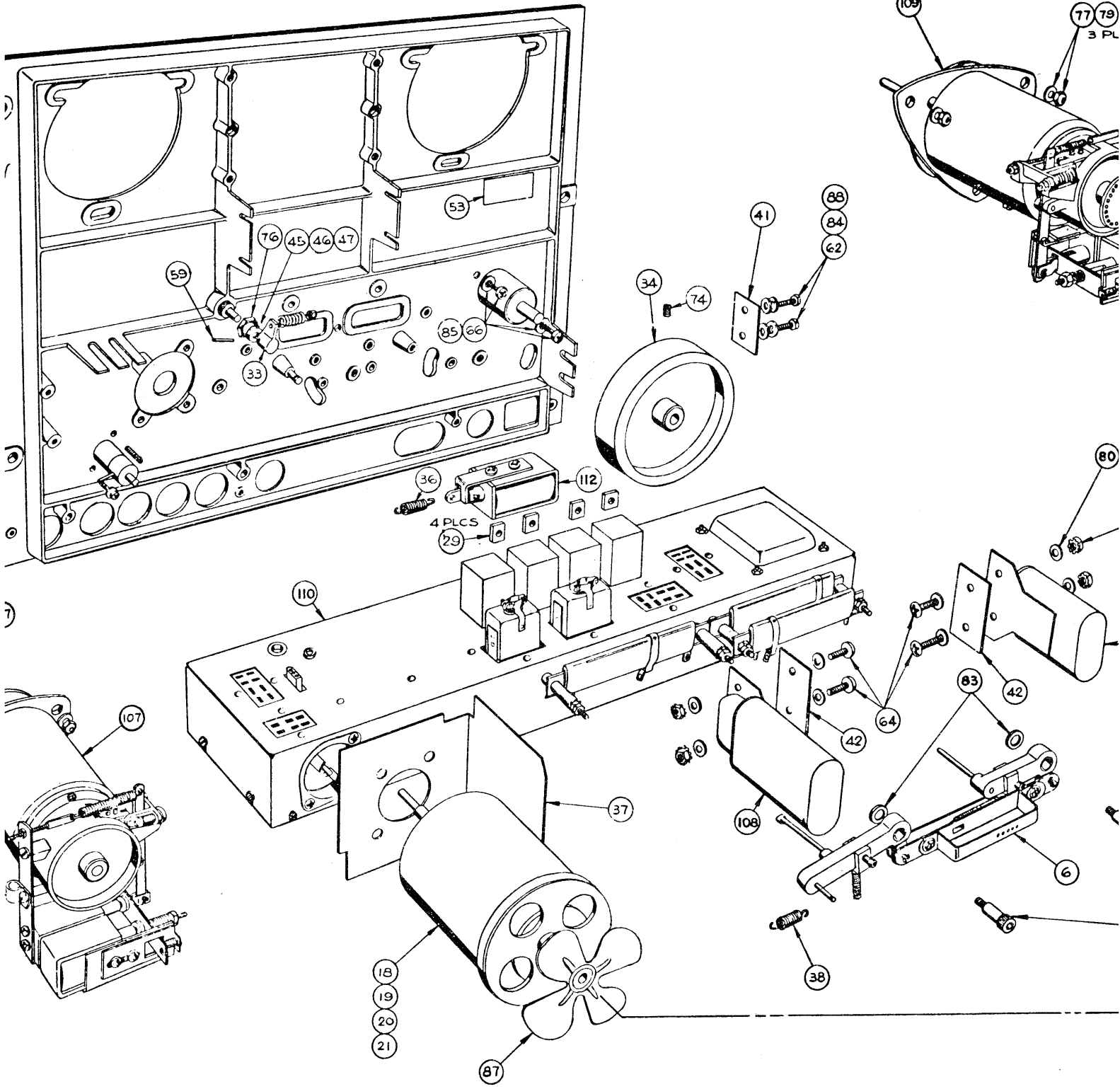


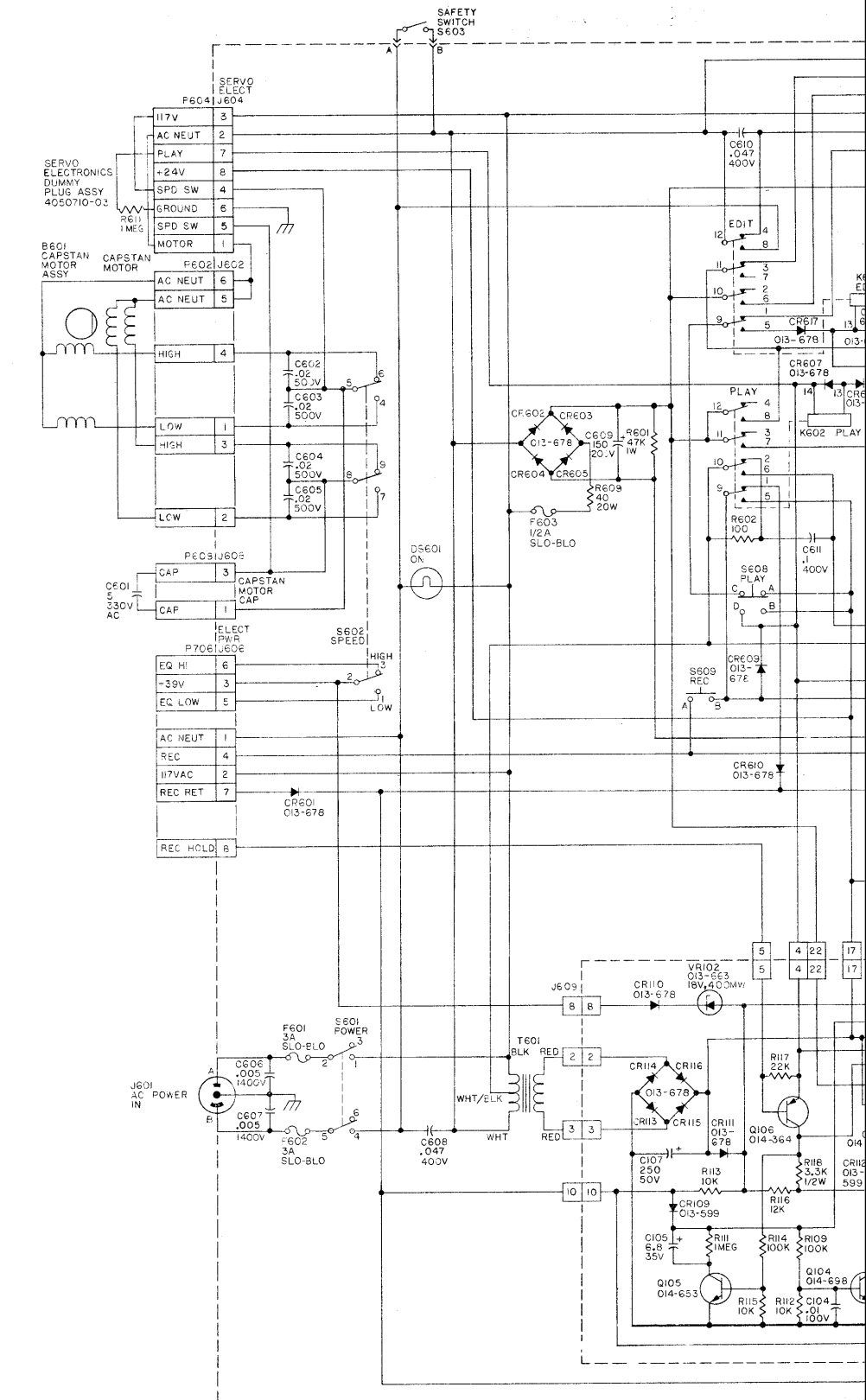
Assembly No. 4020271 (1 of 2), Tape Transport Assembly



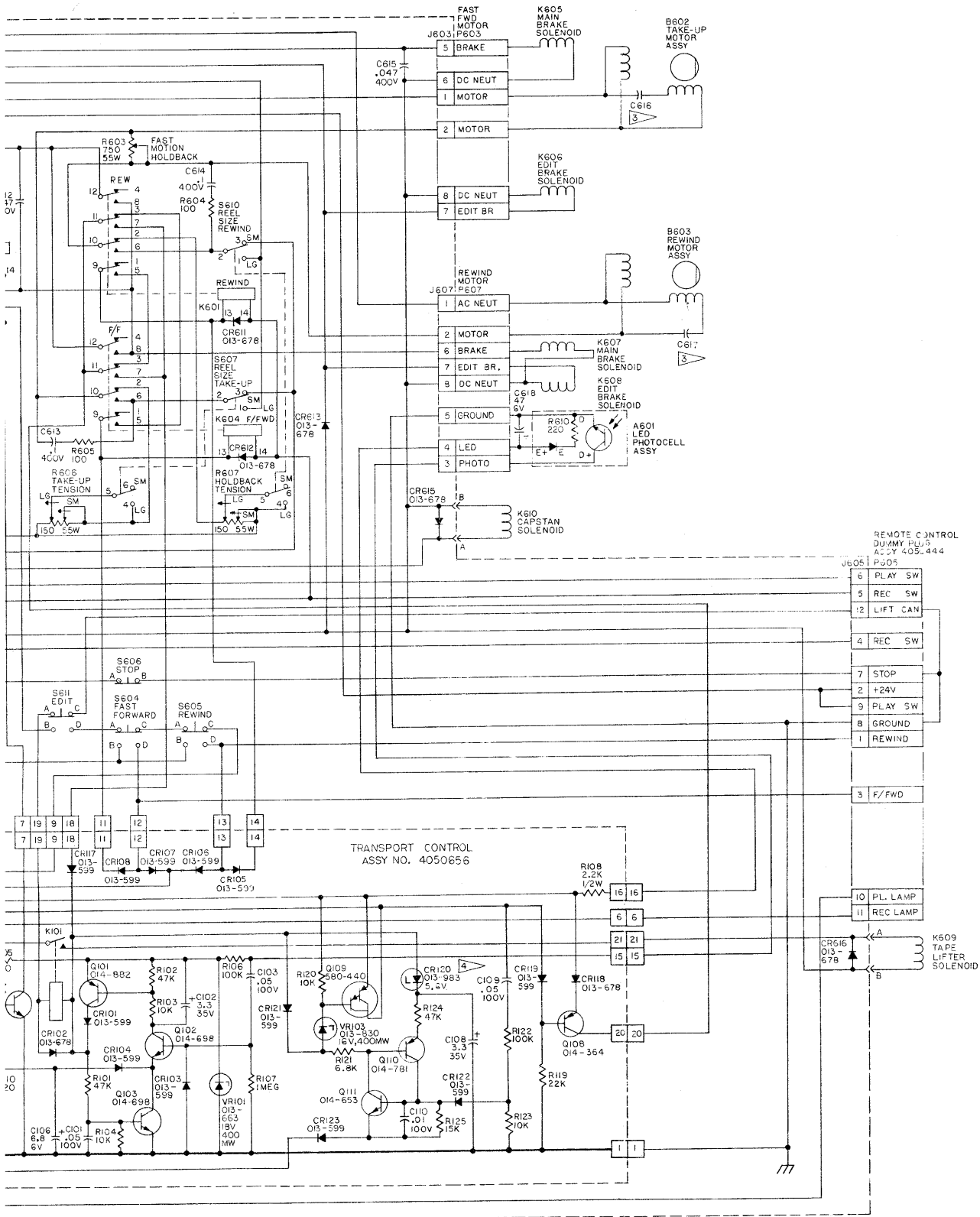


Assembly No. 4020271 (2 of 2)
 Tape Transport Assembly



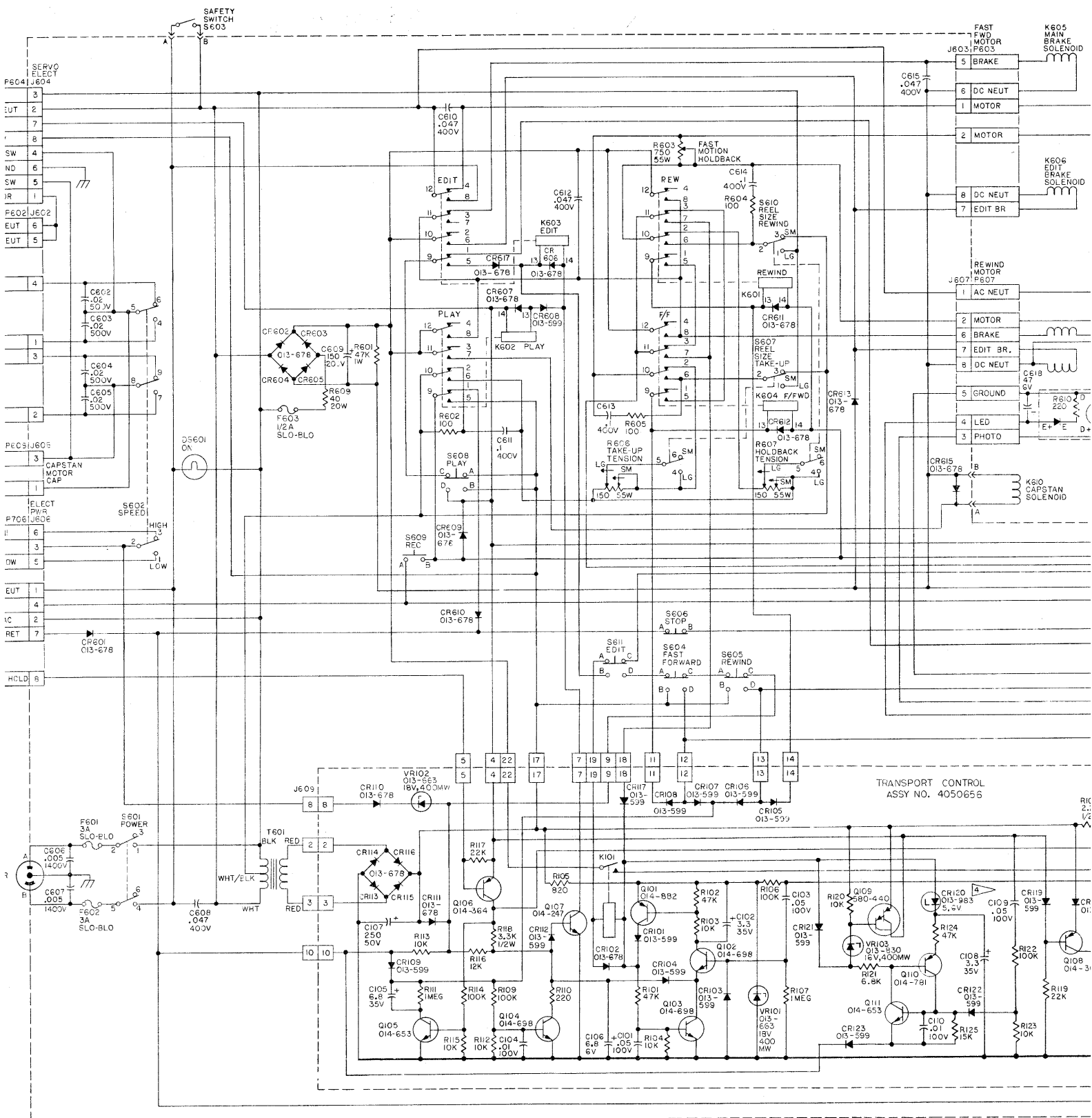


NOTES: UNLESS OTHERWISE SPECIFIED
 1 ALL RESISTOR VALUES ARE IN OHMS, 1/4W.
 2 ALL CAPACITOR VALUES ARE IN MICROFARADS.
 3 10MFD 236VAC EXCEPT 5MFD 300VAC WITH 4550107-30 MOTOR.
 4 FUNCTIONS AS A FORWARD BIASED DIODE



FIELD SERVICE REPLACEMENT LIST	REF. DES.	LAST REFERENCE	
AMPEX P/N	NEAREST COM'L EQUIV	NOT USED	DES. USED
O14-781	MPS 6518	R608	CR617
O14-247	2N2219	CR614	P608
O14-364	2N2905A	P601, 6	R603
O14-653	2N3904	P701-5	C101
O14-698	2N3565		J609
O14-882	2N3638A		S611
O13-678	IN 4385		C618
O13-653	IN 957B		DS601
O13-599	IN 914		T601
O13-983	IN 752		F603
O13-830	IN 956B		R611
580-440	MPS-A 65		K610
			A601
			P706

Schematic No. 4840261
Tape Transport Assembly



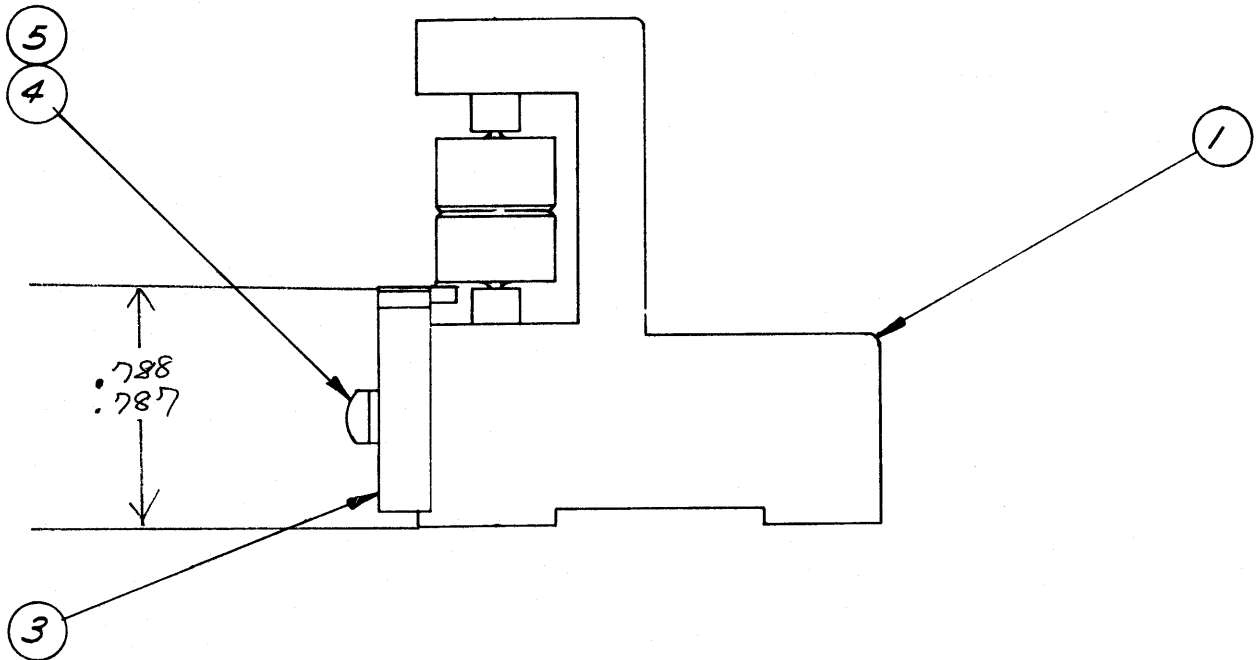
UNSPECIFIED
 ARE IN OHMS, 1/4 W.
 ARE IN MICROFARADS.
 5MFD 300VAC WITH

DI BIASED DIODE

FIELD SERVICE REPLACEMENT LIST	REF. DES. NOT USED	DES. USED	LAST REFERENCE
AMPLEX P/N	NEAREST COML. EQUIV.		
014-781	MPS 6518	R608	CR617
014-247	2N2219	CR614	P608
014-364	2N2905A	P601, 6	R125
014-653	2N3904	P701-5	R125
014-698	2N3565		J609
014-882	2N3638A		Q111
013-678	IN 4385		K101
013-663	IN 967B		C618
013-599	IN 914		D5601
013-983	IN 752		T601
013-830	IN 966B		F603
580-440	MPS-A65		R611
			K610
			A601
			P706

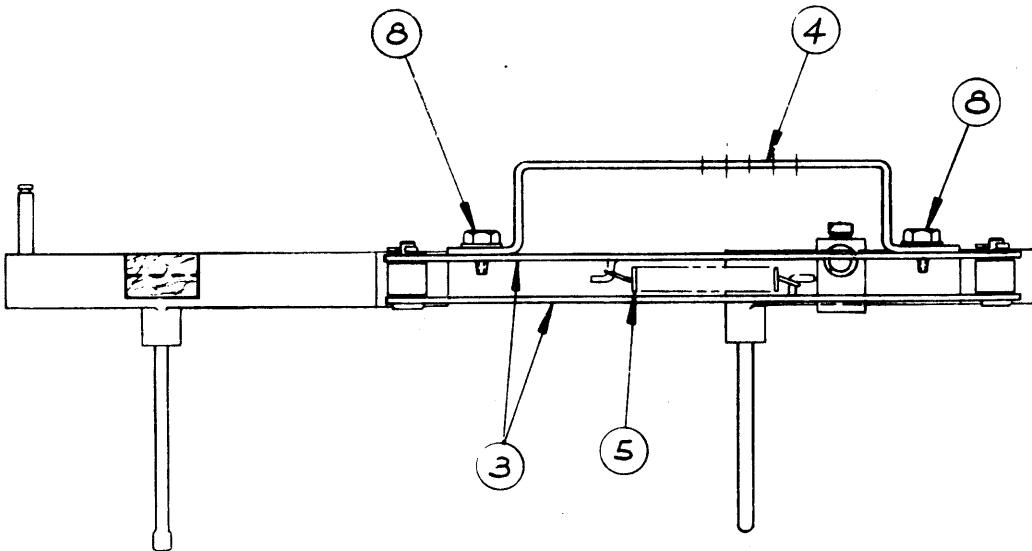
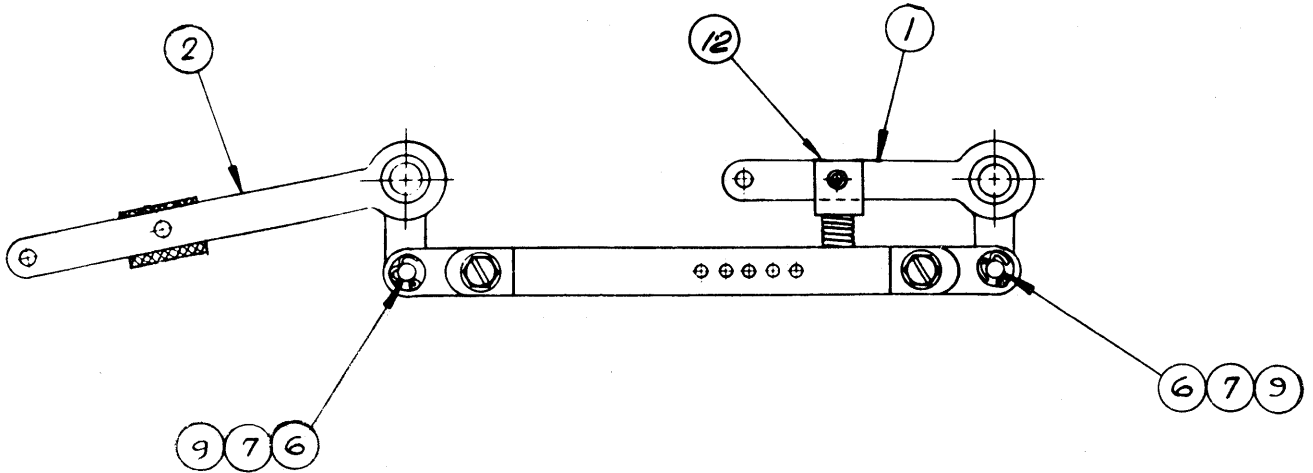
NEXT HIGHER ASSEMBLY NO. 4010202, 4010203, 4010204

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4040955-03		IDLER ASSY, SCRAPE FLUTTER GUIDE ASSY, BOTTOM SCREW, MACH, PN HD, XREC, 2-56 X 0.25 LG WASHER, LOCK, SPRING, NO. 2 VERSION: 4041150-01	
3	4041156-01			
4	472-113			
5	502-001			



NEXT HIGHER ASSEMBLY NO. 4020271

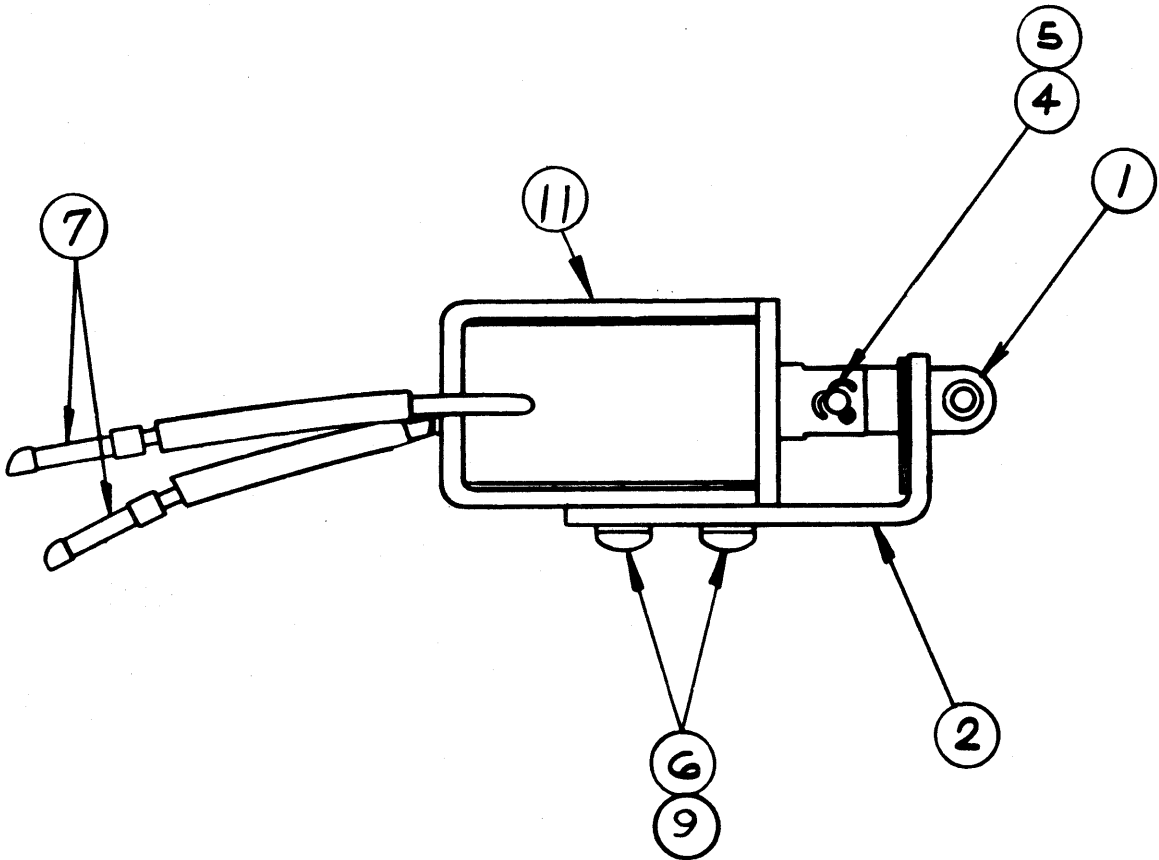
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4040965-03		TAPE LIFTER, LEFT HAND	
2	4040966-03		TAPE LIFTER, RIGHT HAND	
3	4230244-01		LINK	
4	4260384-01		BRACKET	
5	4270254-01		SPRING	
6	400-005		PIN, STRAIGHT, HEADED, CLEVIS, 1/8 DIA	
7	401-005		PIN, COTTER, 1/16 DIA, 1/2 LG	
8	476-011		SCREW, SELF TAPPING, HEX HD, NO. 6 X 1/4	
9	501-008		WASHER, FLAT, NO. 4	
12	4030278-01		SPRING CLIP ASSY	



NEXT HIGHER ASSEMBLY NO. 4020271

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4230242-01		LINK	
2	4260184-10		STOP	
4	400-007		PIN, STRAIGHT HEADED, 1/8 DIA	
5	401-005		PIN, COTTER, 1/16 DIA, 1/2 LG	
6	475-107		SCREW, PN HD, XREC, NO. 8-32 X 5/16	
7	171-008		CONNECTOR, SOLDERLESS	
9	501-010		WASHER, FLAT, NO. 8	
11	4590043-01		SOLENOID	

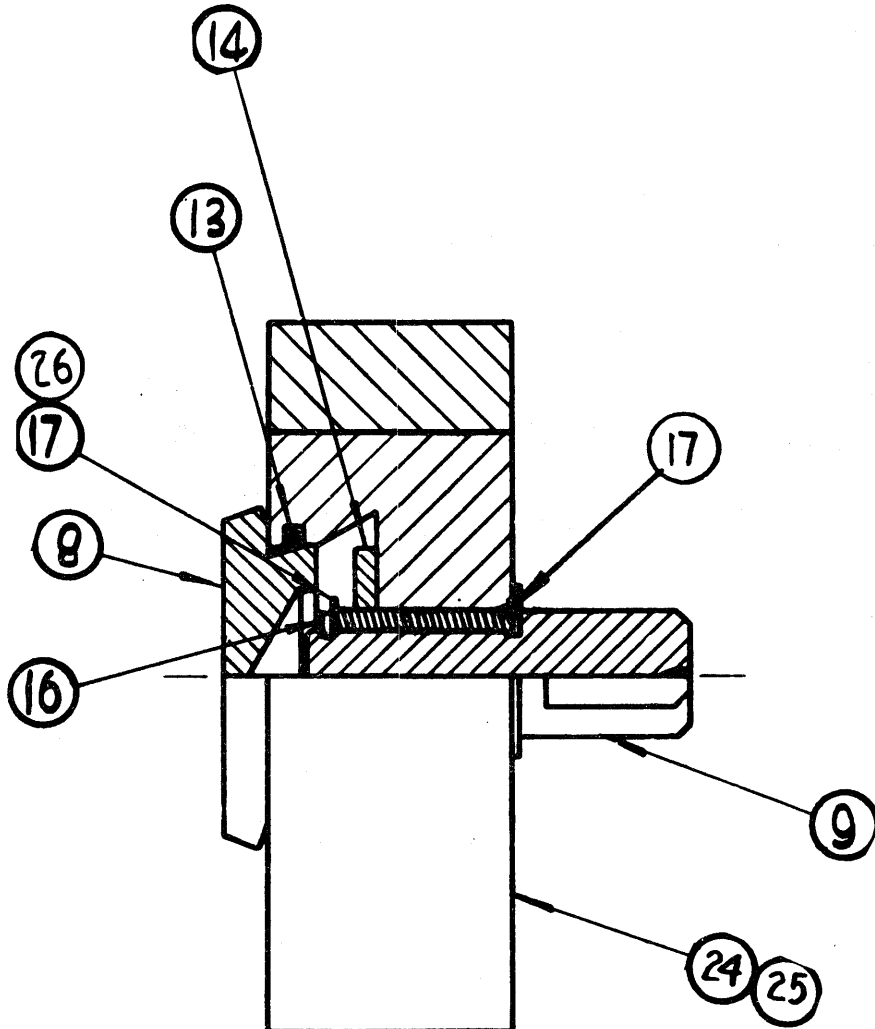
VERSION: 4030273-03



NEXT HIGHER ASSEMBLY NO. 4020271

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
8	4100166-10		CAP	
9	4210189-10		SHAFT, 1/4"	
13	4320112-10		RING, LOCK	
14	4440239-10		WASHER, FELT	
16	430-004		RING, RETAINING, 250 ID	
17	501-049		WASHER, FLAT, 0.002 THK	
24	4250198-02		PUCK ASSY, 7-1/2 - 15 IPS	
25	4250082-02		PUCK ASSY, 3-3/4 - 7-1/2 IPS	
26	501-689		WASHER, FLAT	

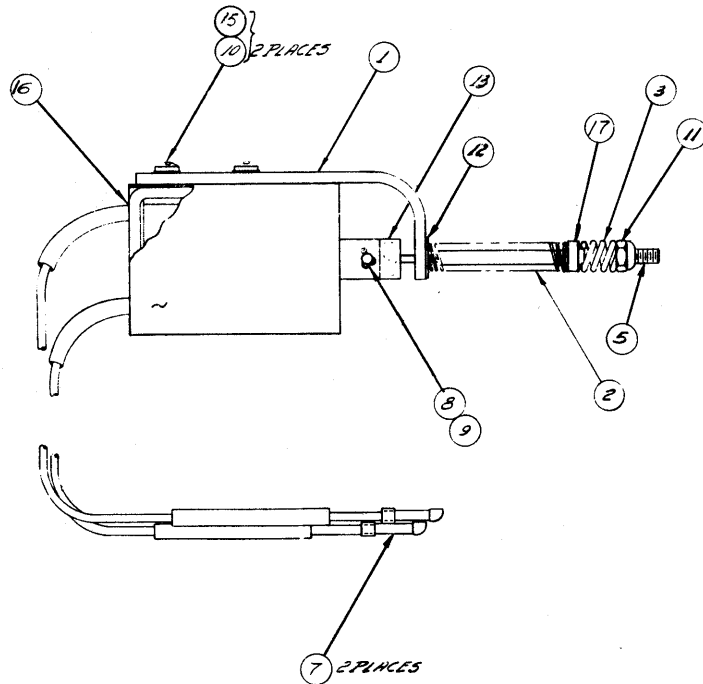
VERSION: 4030279-22 - 7-1/2 - 15 IPS
 4030279-23 - 3-3/4 - 7-1/2 IPS



NEXT HIGHER ASSEMBLY NO. 4020271

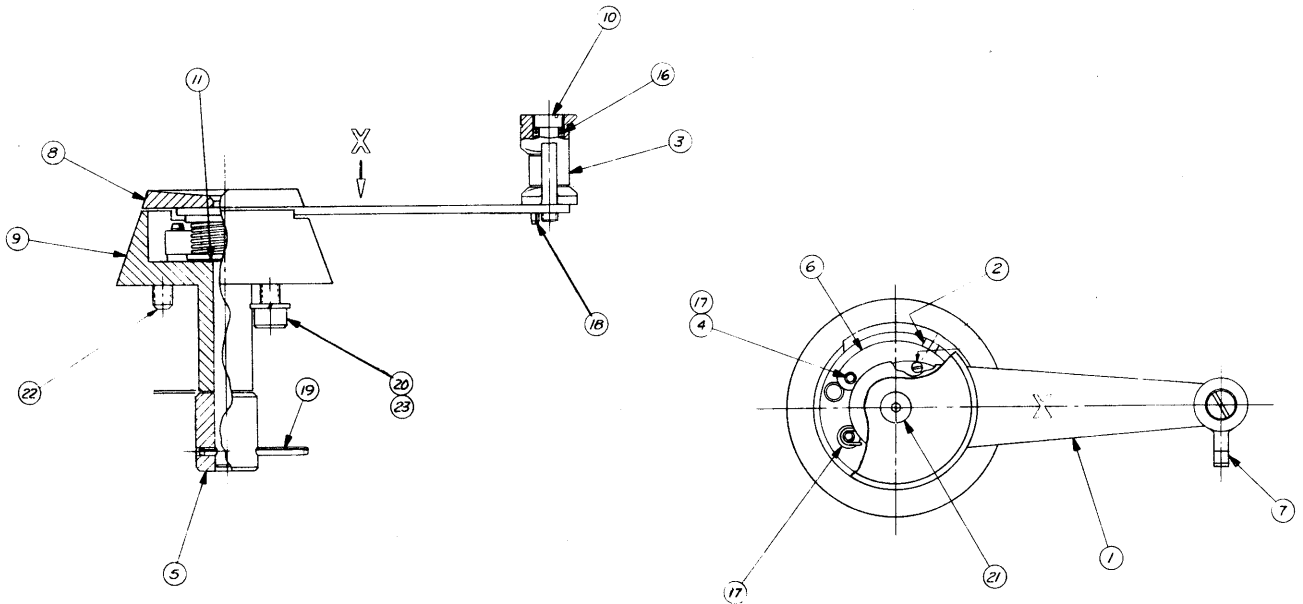
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4220139-20		STOP, SOLENOID	
2	4270161-10		SPRING, SOLENOID RETURN	
3	4270118-01		SPRING, SOLENOID RETURN	
5	4400604-20		BOLT, EYE	
7	171-008		CONNECTOR, SOLDERLESS	
8	400-009		PIN, CLEVIS, 125 DIS X 17/32 LG	
9	401-005		PIN, COTTER, 0.062 DIA X 1/2 LG	
10	475-092		SCREW, NO. 8-32 X 3/8 LG	
11	493-008		NUT, SELF-LOCKING, NO. 10-32	
12	501-037		WASHER, FLAT, NO. 1/4	
13	503-015		WASHER, FELT, NO. 1/4 ID X 1/4 THK	
15	501-010		WASHER, FLAT, NO. 8	
16	4041071-02		SOLENOID ASSY	
17	4440316-01		WASHER, SPRING CENTERING	

VERSION: 4030272-04



ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4040973-04		ARM ASSY, TAKEUP TENSION	
2	4210161-03		PIN, DAMPER	
3	4210310-03		TAPE GUIDE, TENSION ARM	
4	4220097-01		SPACER, TENSION ARM	
5	4220138-10		COLLAR, SHAFT	
6	4220138-01		CAM, TAKE-UP TENSION ARM	
7	4230158-20		HOOK, TAPE GUIDE	
8	4250193-01		CAP, TAKEUP TENSION ARM	
9	4330288-01		BASE, TAKEUP TENSION ARM	
10	4400593-02		SCREW, TAPE GUIDE MOUNTING	
11	4440235-10		SHIM, BRASS, TAKEUP TENSION ARM	
16	352-084		SPRING, COMPRESSION	
17	406-026		PIN, SPRING, .094 DIA X .500 LG	
18	406-058		PIN, SPRING, 0.062 DIA X 0.250 LG	
19	408-071		PIN, SPRING, 0.062 DIA X 0.875 LG	
20	470-028		SCREW, CAP, HEX SOCKET, 8-32 X 0.438 LG	
21	471-598		SCREW, CAP, FL HD, HEX SOCKET, 4-40 X 0.250 LG	
22	477-478		SCREW, SET, HEX SOCKET, FLAT PT, 8-32 X 0.38 LG	
23	502-004		WASHER, LOCK, HELICAL SPRING, NO. 8	

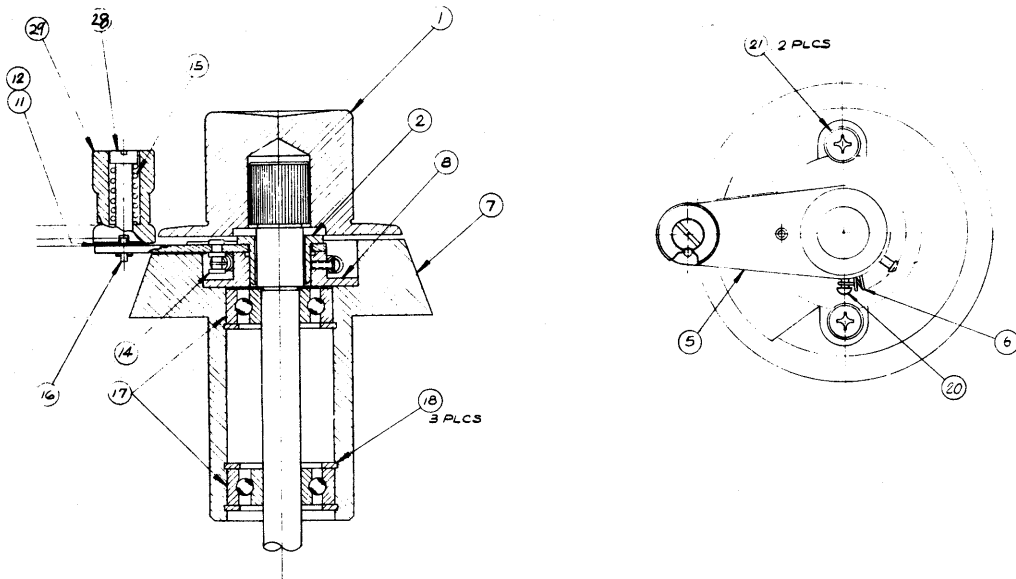
VERSION: 4030322-01



NEXT HIGHER ASSEMBLY NO. 4020271

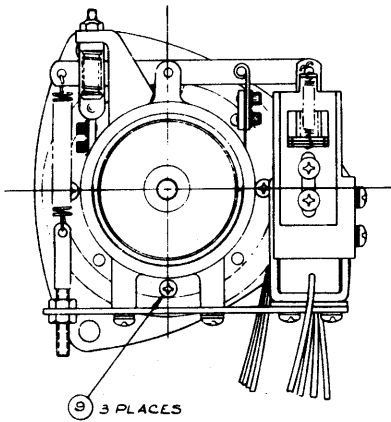
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4040408-80		PULLEY ASSY	
2	4200121-10		BUSHING	
5	4230245-01		ARM, REEL IDLER	
6	4270160-20		SPRING, TENSION ARM	
7	4290272-10		HOUSING, REEL IDLER	
8	4290273-10		MOUNT, REEL IDLER	
11	4440282-01		WASHER, 0.008 THK	
12	4440282-02		WASHER, 0.025 THK	
14	173-251		TERMINAL, TURRET	
15	352-084		SPRING, COMPRESSION	
16	406-272		PIN, SPRING, 0.012 WALL, 0.062 DIA	
17	421-116		BEARING, BALL, 0.3150 BORE X 8661 OD	
18	430-027		RING, RETRAINING, INTERNAL, 0.866"	
20	474-004		SCREW, DRIVE "U" ROUND HD, NO. 0 X 3/16	
21	475-081		SCREW, PN HD, PHILL, NO. 6-32 X 1/4	
28	4400593-02		SCREW, TAPE GUIDE, MOUNTING	
29	4210311-02		TAPE GUIDE, REEL IDLER	

VERSION: 4040970-07

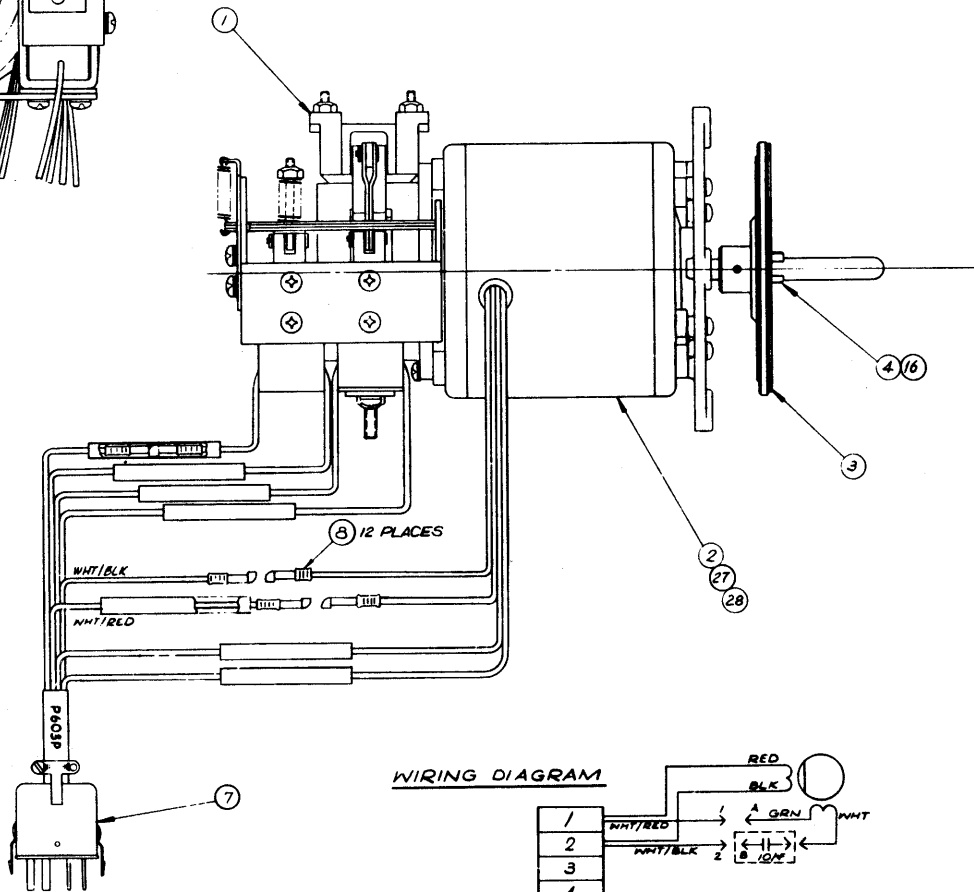


NEXT HIGHER ASSEMBLY NO. 4020271

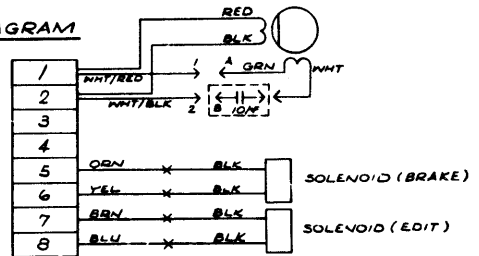
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4030264-03		BRAKE ASSY	
2	4040768-02		MOTOR ASSY, GE	
3	4130163-02		PAD, TURNTABLE	
4	4320128-10		PLATE, DRIVE	
7	145-013		CONNECTOR, RECT, PLUG, 8 PINS	
8	171-008		CONNECTOR, SOLDERLESS, KNIFE	
9	475-098		SCREW, PN HD, XREC, NO. 6-32 X 1/2 LG	
16	470-382		SCREW, BUTTON HD, NO. 4-40 X 3/16	
27	4040768-04		MOTOR ASSY, ASHLAND	
28	4040768-08		MOTOR ASSY, TAKANAWA	
<p>VERSIONS: 4030297-01 GENERAL ELECTRIC 4030297-02 ASHLAND 4030297-03 TAKANAWA</p>				



3 PLACES



WIRING DIAGRAM



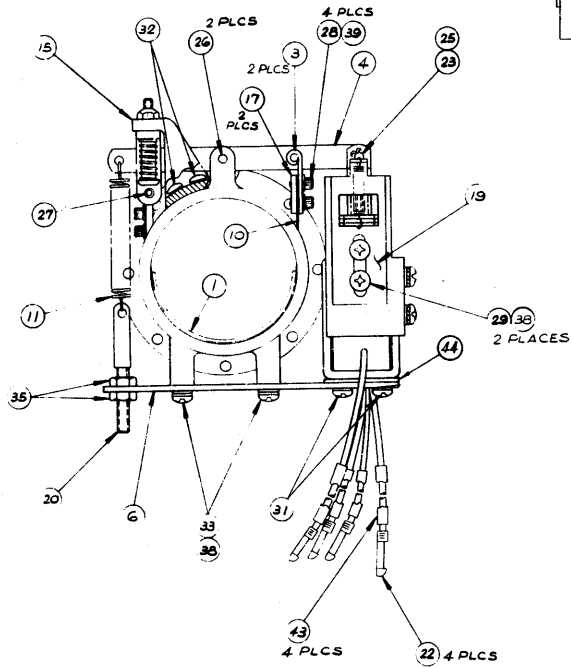
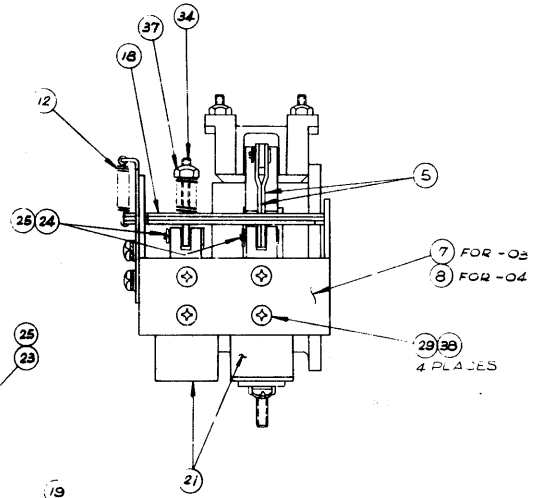
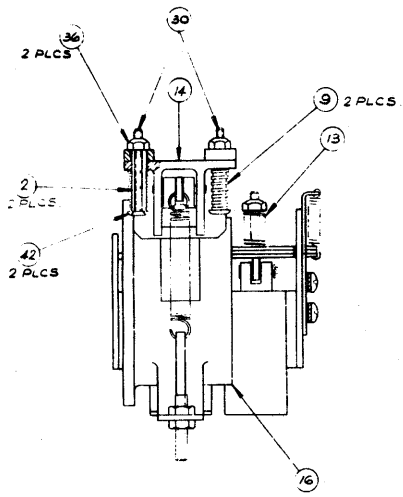
TAKE-UP CONNECTIONS
CONNECT KNIFE CONNECTOR (ITEM 8)
1 TO B
2 TO A

Assembly No. 4030297, Takeup Assembly

NEXT HIGHER ASSEMBLY NO. 4030297, 4030333

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4040414-10		BAND ASSY	
2	4220141-10		SPACER	
3	4230161-10		LINK, BRAKE BAND	
4	4230162-10		LEVER, BRAKE	
5	4230163-10		LINK, SOLENOID	
6	4260183-10		BRACKET, SOLENOID	
7	4260386-03		BRACKET, EDIT SOLENOID, TAKEUP	
8	4260386-04		BRACKET, EDIT SOLENOID, REWIND	
9	4270163-10		SPRING, COMPRESSION	
10	4270164-10		SPRING, LEAF	
11	4270178-10		SPRING, BRAKE	
12	4270251-01		SPRING, EDIT BRAKE RETURN	
13	352-085		SPRING, COMPRESSION	
14	4330109-10		CROSS HEAD, BRAKE	
15	4330110-10		ANCHOR BRAKE	
16	4330112-30		HOUSING, BRAKE	
17	4330113-10		CLAMP, BAND LINK	
18	4041068-01		STOP, PLATE ASSY	
19	4330260-01		ANCHOR, SPRING EDIT SOLENOID	
20	4400496-60		BOLT, SPADE	
21	4041070-01		SOLENOID ASSY	
22	171-008		CONNECTOR, SOLDERLESS KNIFE DISCONNECT	
23	400-002		PIN, STRAIGHT HEADED CLEVIS, 1/8 DIS X 9/32	
24	400-007		PIN, STRAIGHT HEADED, 1/8 DIS X 15/32	
25	401-005		PIN, COTTER, 1/16 DIA X 1/2 LG	
26	403-008		PIN, "DRIVE-LOK", TYPE C, 1/8 DIA X 1/2 LG	
27	406-042		PIN, "ROLLPIN", 1/8 DIA X 7/8 LG	
28	470-007		SCREW, CAP, HEX SOCKET, NO. 4-40 X 3/16	
29	475-088		SCREW, SEMS, PN HD, PHILL, NO. 8-32 X 5/16	
30	472-890		SCREW, MACH, FL HD, PHILL, NO. 6-32 X 1-3/8	
31	475-072		SCREW, PN HD, PHILL, INT TOOTH, NO. 8-32 X 1/4	
32	475-085		SCREW, PN HD, PHILL, INT TOOTH, NO. 6-32 X 5/16	
33	475-102		SCREW, PN HD, PHILL, EXT TOOTH, NO. 8-32 X 1/2	
34	480-010		BOLT, SPADE, NO. 8-32 X 1	
35	492-011		NUT, PLAIN, HEX, NO. 10-32	
36	493-006		NUT, SELF-LOCKING, HEX, 6-32	
37	493-007		NUT, SELF-LOCKING, HEX, 8-32	
38	501-010		WASHER, FLAT, NO. 8	
39	502-002		WASHER, LOCK SPRING, NO. 4	
42	506-001		WASHER, FINISHING, COUNTERSUNK, NO. 6	
44	4130051-01		PAD, DAMPER	

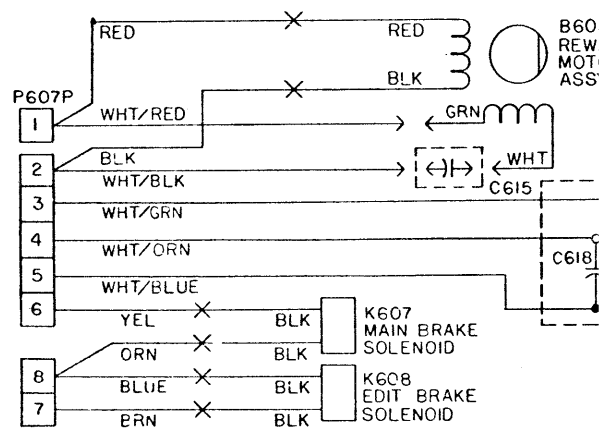
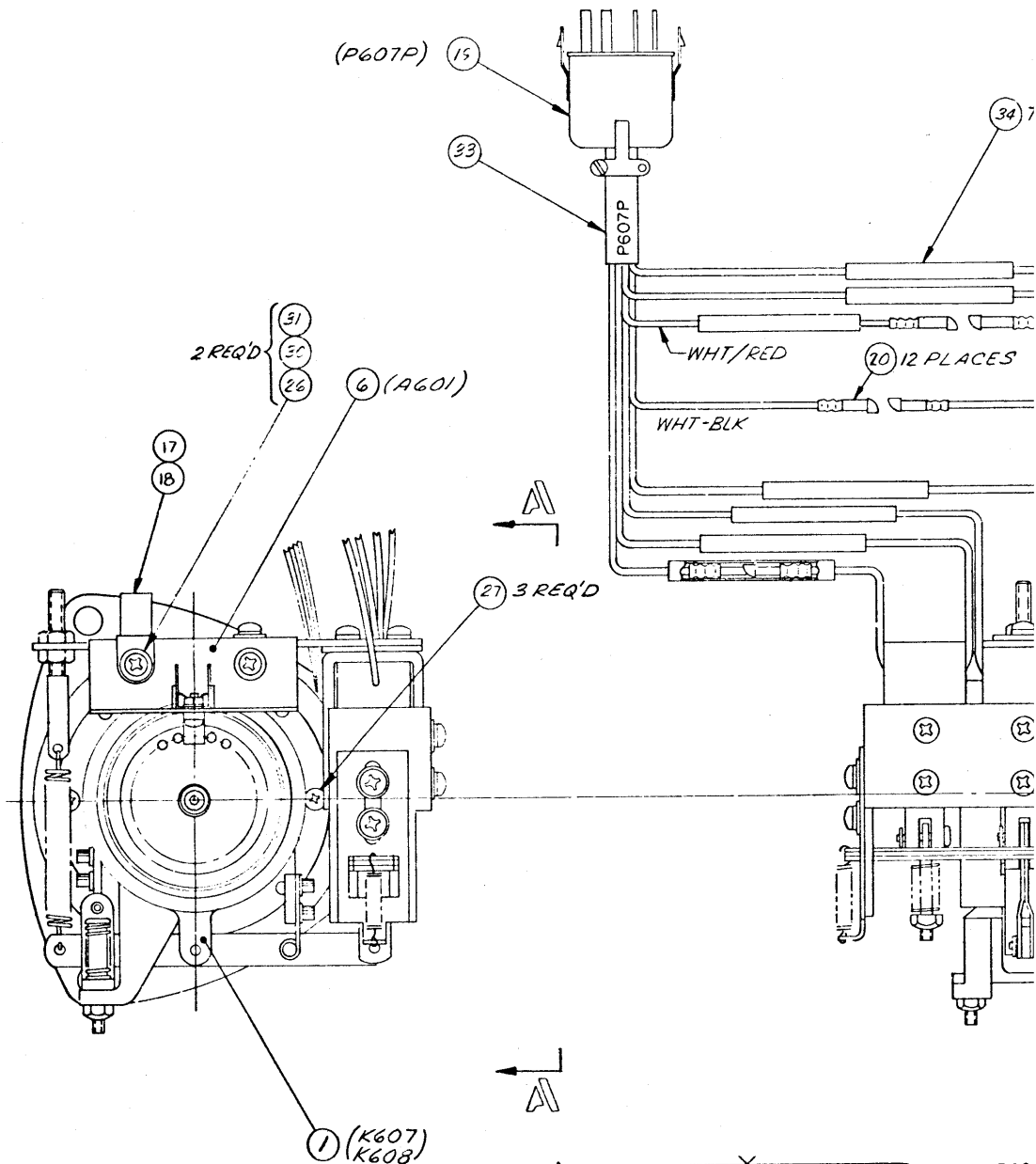
VERSION: 4030264-03 TAKEUP
4030264-04 REWIND



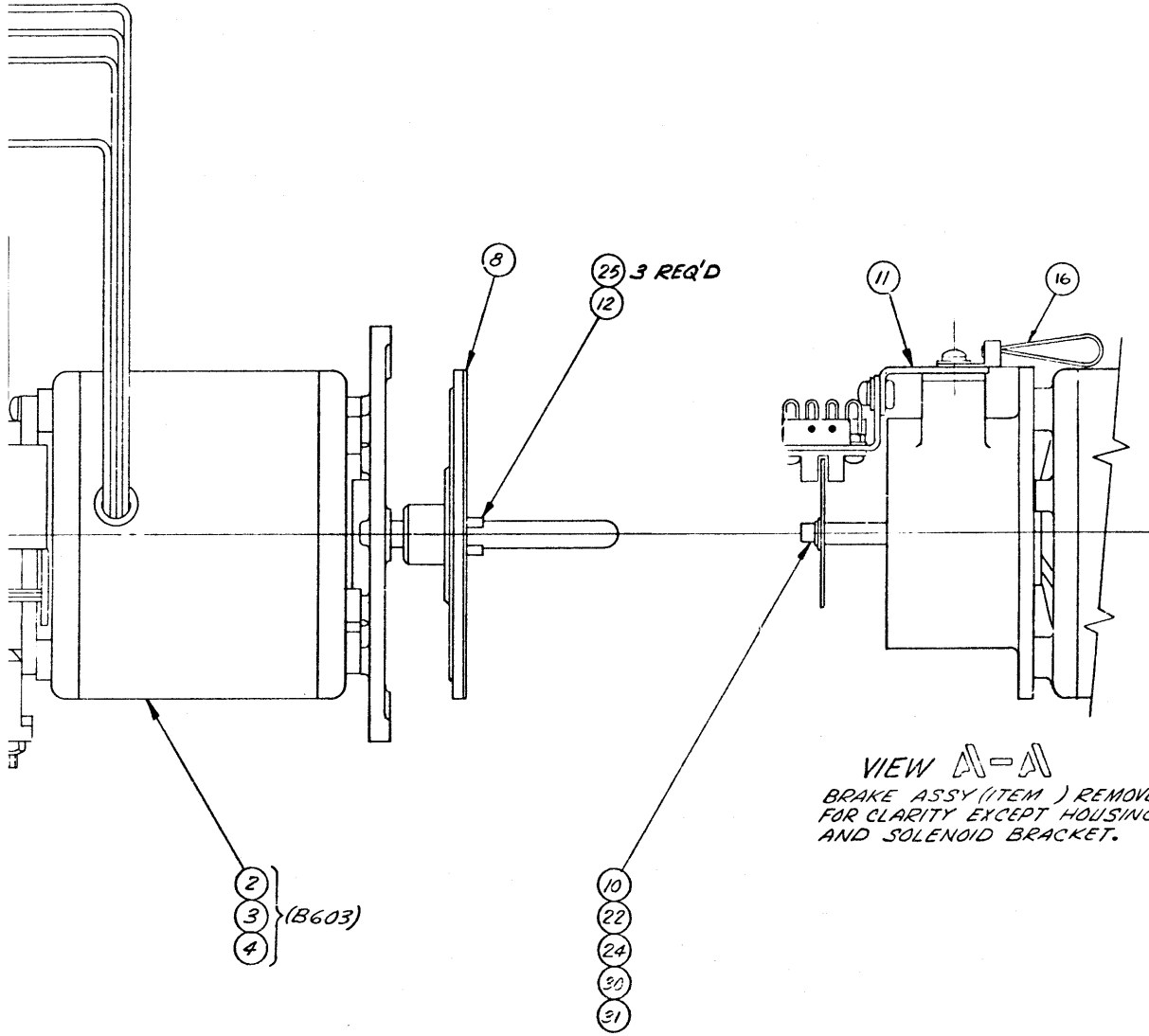
Assembly No. 4030264, Takeup and Rewind Brake Assemblies

NEXT HIGHER ASSEMBLY NO. 4020271

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4030264-04	K607, K608	BRAKE ASSY	
2	4041166-01	B603	MOTOR ASSY, REWIND, GE MOTOR	
3	4041166-02	B603	MOTOR ASSY, REWIND, ASHLAND MOTOR	
4	4041166-03	B603	MOTOR ASSY, REWIND, TAKANAWA MOTOR	
6	4050587-02	A601	MOTION SENSOR ASSY	
8	4130163-02		PAD, TURNTABLE	
10	4250081-01		DISC, MOTION SENSOR	
11	4260433-01		BRACKET, MOTION SENSOR	
12	4320128-10		PLATE, DRIVE	
16	302-365		STRAP, CABLE	
17	302-007		CLAMP, LOOP, OFFSET	
18	506-013		WASHER, "D"	
19	145-013	P607P	CONNECTOR, RECT PLUG, 8 PINS	
20	171-008		TERMINAL, QUICK DISCONNECT, SPLICE	
22	280-040		SPACER, THD, PLAIN, 6-32 X 0.75 LG, 0.250 AF	
24	470-024		SCREW, CAP, HEX SOC, 6-32 X 1.00 LG	
25	470-382		SCREW, CAP, BUTTON HD, 4-40 X 0.19 LG	
26	471-069		SCREW, MACH, PN HD, XREC, 6-32 X 0.38 LG	
27	473-331		SCREW, MACH ASSY WASHER, PN HD, XREC, 6-32 X 0.50 LG	
30	501-009		WASHER, PLAIN, 0.156 ID	
31	502-003		WASHER, LOCK, SPRING, 0.141 ID	
			VERSION: 4030333-05 GENERAL ELECTRIC	
			4030333-06 ASHLAND	
			4030333-07 TAKANAWA	

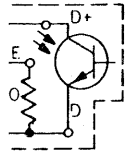


WIRING DIAGRAM

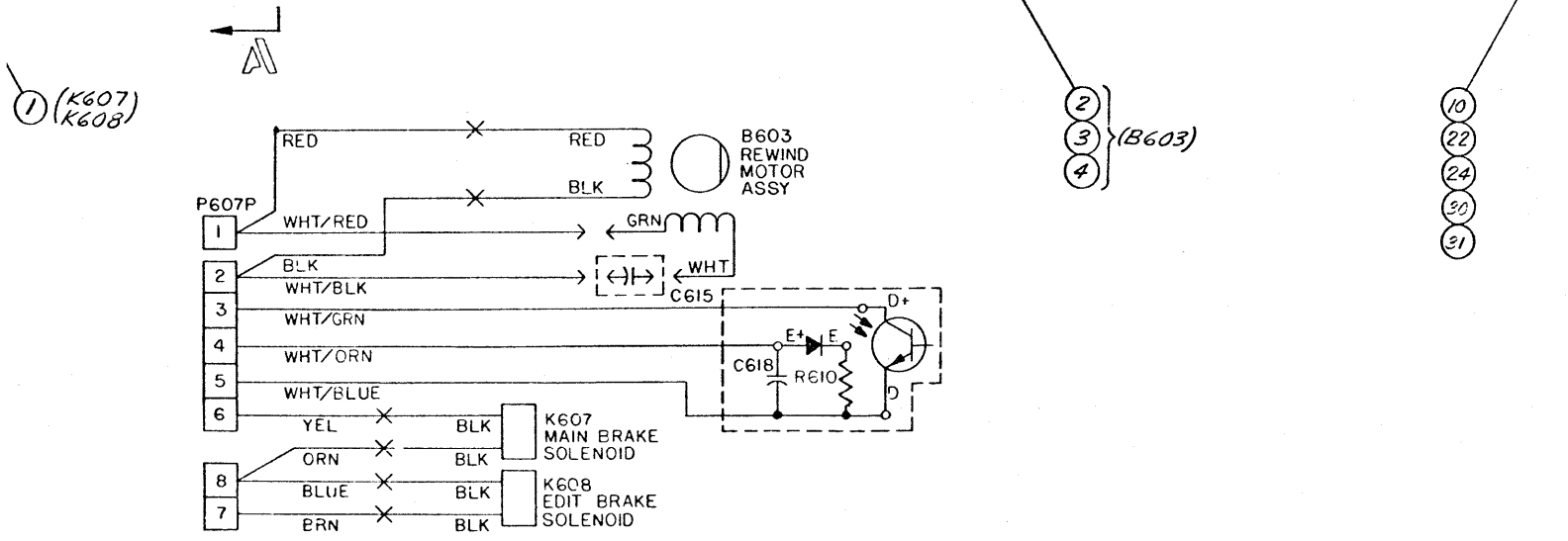
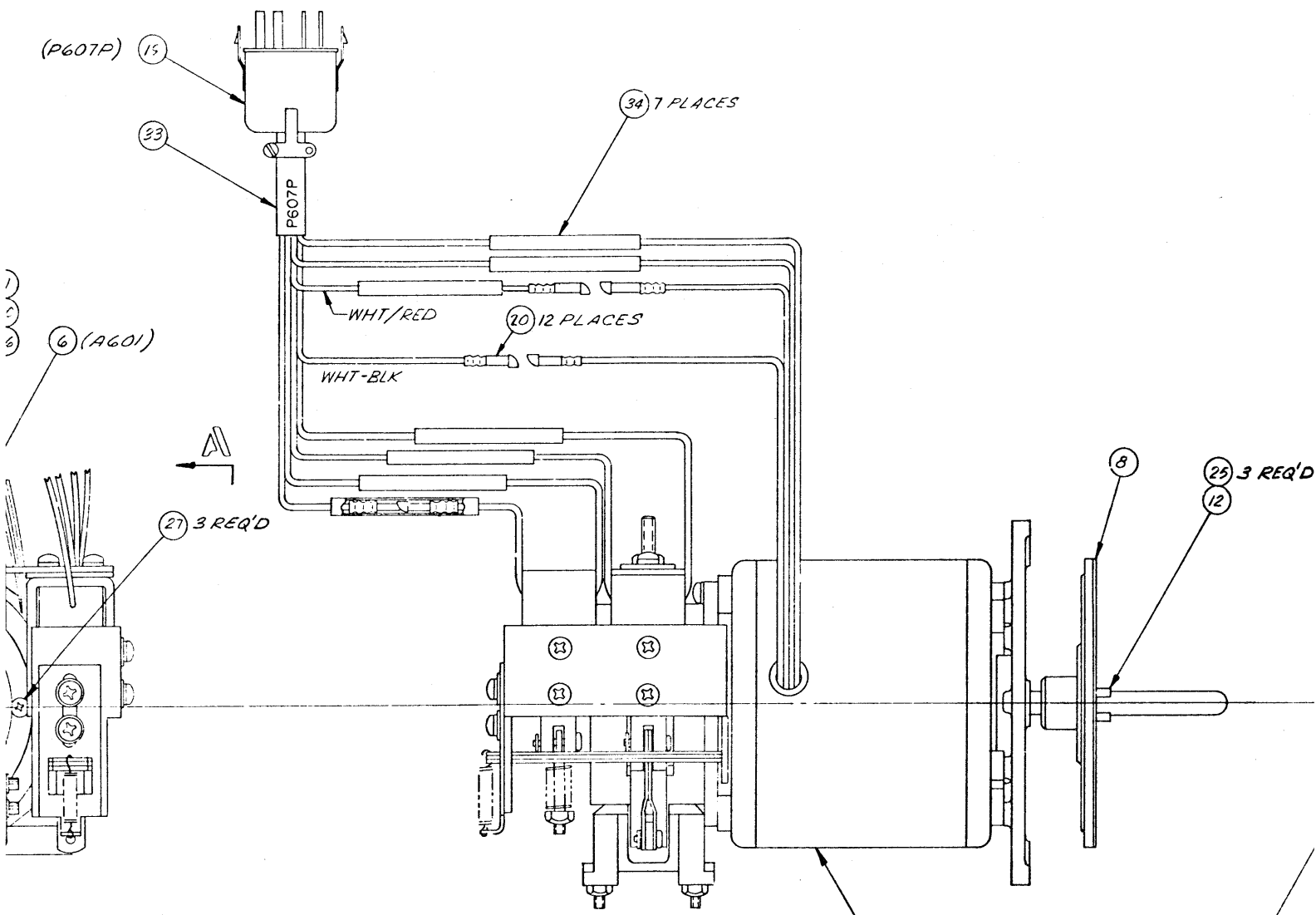


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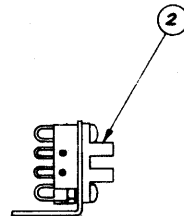
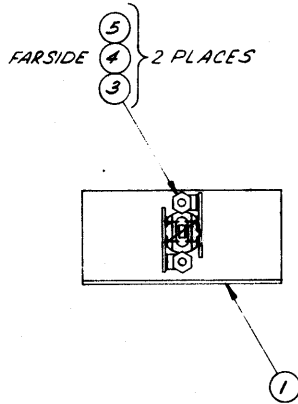
Assembly No. 4030333
Rewind Assembly



WIRING DIAGRAM

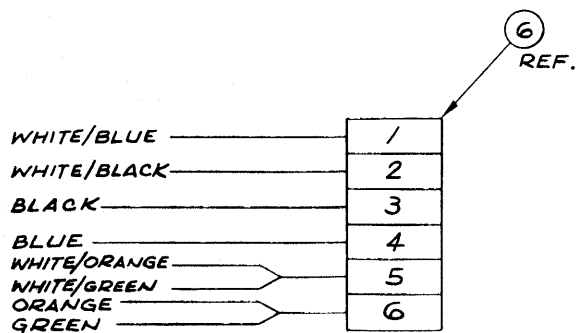
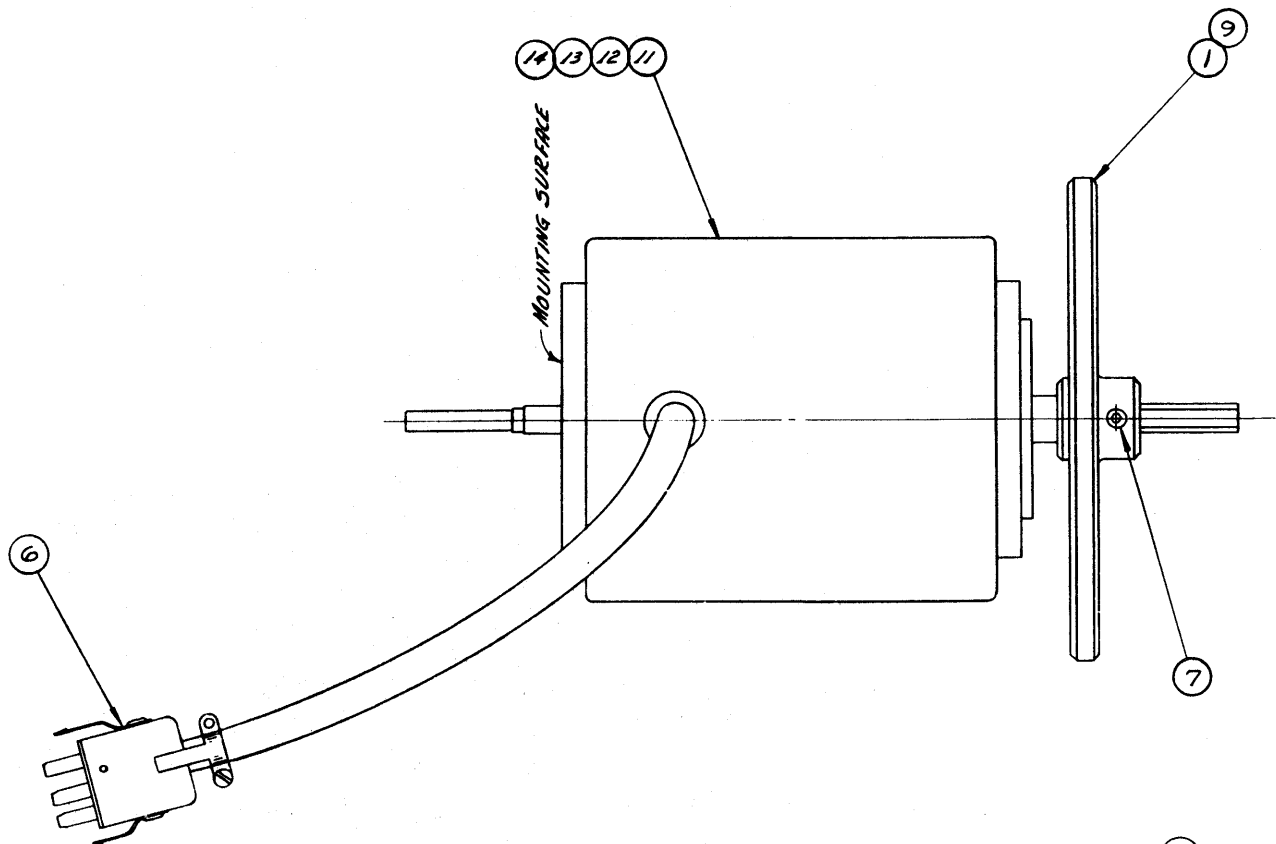
NEXT HIGHER ASSEMBLY NO. 4030333

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4330287-01		BASE, MOUNTING PHOTOCELL	
2	581-264		ISOLATOR, OPTICALLY COUPLED	
3	180-272		STRIP, TERMINAL	
4	471-062		SCREW, MACH, PN HD, 4-40 X 0.38 LG	
5	496-004		NUT, LOCKING, HEX, NO. 4	
7	037-298	C618	CAPACITOR, ELECT, 47 MFD, 6V	
8	495-517	R610	RESISTOR, COMP, 220 OHM, 1/4W, 10%	
VERSION: 4050587-02				



NEXT HIGHER ASSEMBLY NO. 4020271

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4250113-10		FLYWHEEL, 60 HZ	
6	145-012		CONNECTOR, RECT PLUG, 6 PIN	
7	477-336		SCREW, HEX SOC, CUP PT SET, NO. 10-32 X 1/4 LG	
9	4250114-10		FLYWHEEL, 50 HZ	
11	4590120-03		MOTOR, DRIVE, 60 HZ, 7-1/2 - 15 IPS	
12	4590120-04		MOTOR, DRIVE, 60 HZ, 3-3/4 - 7-1/2 IPS	
13	4590121-03		MOTOR, DRIVE, 50 HZ, 7-1/2 - 15 IPS	
14	4590121-04		MOTOR, DRIVE, 50 HZ, 3-3/4 - 7-1/2 IPS	
			<p>VERSION: 4040993-07 7-1/2 - 15 IPS, 60 HZ 4040993-08 3-3/4 - 7-1/2 IPS, 60 HZ 4040993-09 7-1/2 - 15 IPS, 50 HZ 4040993-10 3-3/4 - 7-1/2 IPS, 50 HZ</p>	



WIRING DIAGRAM

Assembly No. 4040993, Drive Motor Assembly

NEXT HIGHER ASSEMBLY NO. 4020271

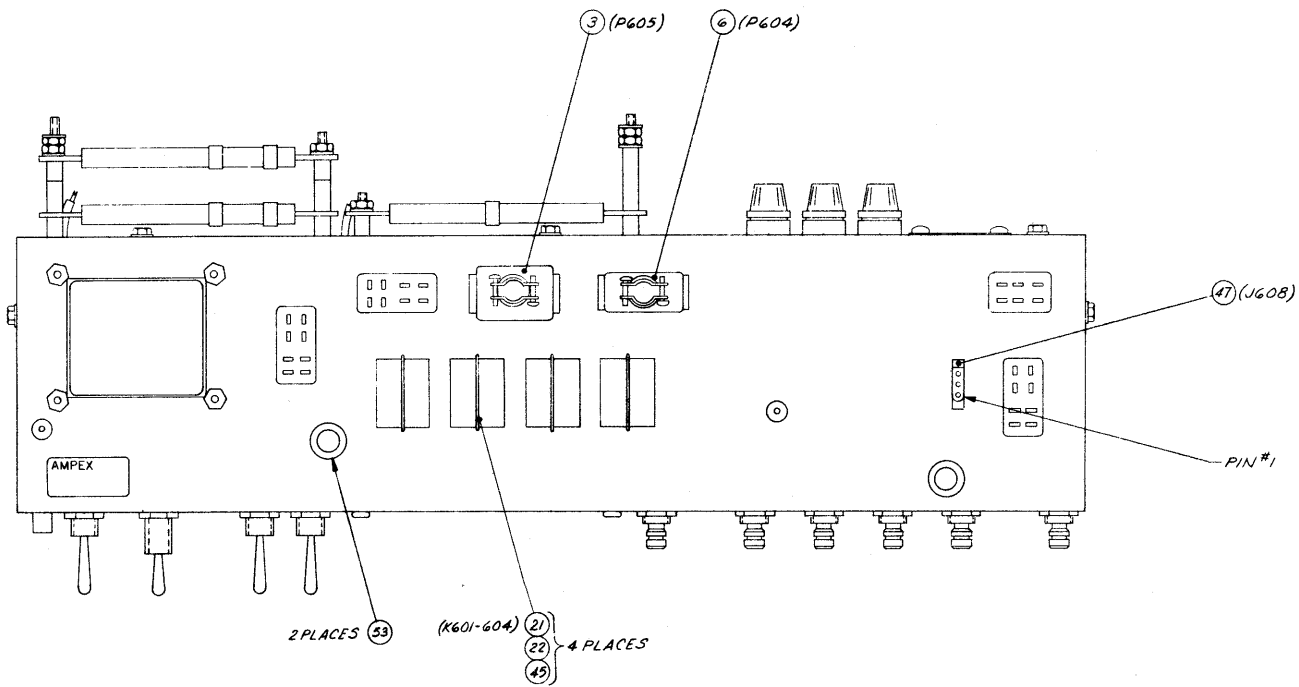
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4030347-01		MAGNET ASSY	
5	4041195-01		SHAFT ASSY	
6	4050665-03		CABLE ASSY, MOTOR TACH	
8	4220272-01		SPACER, TACHOMETER	
9	4210327-01		CORE, TACH COIL	
10	4220261-01		SPACER, TACH PREAMP	
11	4220273-01		FLANGE, SERVO MOTOR	
13	4250087-01		TACHOMETER	
15	4280030-01		SEAL, BEARING	
16	4290715-01		HOUSING	
17				
17	4290759-02		COVER, PICKUP COIL	
18	4330311-02		PLATE, COVER	
19	4330088-01		PLATE, NYLON	
20	4580059-01		COIL, TACH PICKUP	
25	171-009		TERMINAL, QUICK DISCONNECT	
26	172-004		LUG, SOLDER, NO. 4, INT TOOTH	
28	251-105		CAP, BUTTON	
29	280-006		SPACER, UNTHD, NO. 6, .375 LG	
31	302-365		TIE, CABLE	
32	471-060		SCREW, PAN HD, XREC 4-40 X .25 LG	
33	471-068		SCREW, PAN HD, XREC 6-32 X .31 LG	
34	471-074		SCREW, PAN HD, XREC 6-32 X .88 LG	
35	471-327		SCREW, FLAT HD, 4-40 X .31 LG	
36	471-345		SCREW, FLAT HD, 3-32 X .38 LG	
37	471-389		SCREW, FLAT HD, 6-32 X .50 LG	
39	477-497		SCREW, SET, No. 6-32 X .19 LG, CUP POINT	
40	473-348		SCREW, PAN HD, 8-32 X .31 LG NYLON	
41	475-070		SCREW, PAN HD, XREC, 6-32 X .44 LG	
44	501-008		WASHER, FLAT, NO. 4	
45	501-009		WASHER, FLAT, NO. 6	
46	501-650		WASHER, BELLEVILLE	
47	501-702		WASHER, FINISHING, NYLON, BLACK, NO. 10	
48	502-002		WASHER, LOCK, SPRING, NO. 4	
49	502-003		WASHER, LOCK, SPRING, NO. 6	
53	430-085		RING, RETAINING, INTERNAL	
54	432-072		O-RING, SEAL, .437 I.D., .625 O.D.	
58	4041197-01		HUB & ARMATURE ASSY	
	4041196-01		BACK PLATE ASSY PMI	
	4041196-02		BACK PLATE ASSY PMI	
	4041200-01		HUB & ARMATURE ASSY, HUB COLOR GOLD	
	4041200-02		HUB & ARMATURE ASSY, HUB COLOR BLUE	
	4041144-01		BACK PLATE ASSY	

NEXT HIGHER ASSEMBLY NO. 4020271

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4041015-02		COVER ASSY, CONTROL BOX	
2	4041149-01		TRANSPORT CONTROL CHASSIS ASSY	
3	4050444-01	P605	DUMMY PLUG, REMOTE CONTROL	
6	4050710-03	P604	DUMMY PLUG, SERVO ELECTRONICS	
7	4050656-02		TRANSPORT CONTROL PWA	
8	4050635-02		CONTROL BOX HARNESS ASSY	
9	4580056-01	T601	TRANSFORMER, POWER	
10	4610083-01		HOLDER, LAMP, PILOT LIGHT	
11	4620053-01	S602	SWITCH, SPDT TOGGLE, SPEED	
12	4620064-01	S604, 605, 608, 611	SWITCH, PUSHBUTTON	
13	4620144-20	S606	SWITCH, PUSHBUTTON, NO	
14	4620144-30	S609	SWITCH, PUSHBUTTON, NO	
19	013-599	CR608	DIODE	
20	013-678	CR601-7, 609-13, 615, 616, 617	DIODE	1N914 1N4385
21	020-144	K601, 602, 603, 604	RELAY, SPDT	
22	020-492		SPRING, RELAY HOLD DOWN	
24	030-001	C602-605	CAPACITOR, CERAMIC, 0.02 MFD, 500V	
25	030-465	C606, 607	CAPACITOR, CERAMIC, 0.005 MFD, 1400V	
26	031-624	C609	CAPACITOR, ELEC, 150 MFD, 200V	
27	035-985	C608, 610, 612, 615	CAPACITOR, MYLAR, 0.047 MFD, 400V, 20%	
28	035-999	C611, 613, 614	CAPACITOR, MYLAR, 0.1 MFD, 400V, 10%	
30	041-166	R601	RESISTOR, COMP, 47K, 1W, 10%	
31	049-333	R602, 604, 605	RESISTOR, 100 OHM, 1/4W, 10%	
33	059-013	R603	RESISTOR, 750 OHM, 55W, ADJ	
34	059-014	R606, 607	RESISTOR, 150 OHM, 55W, ADJ	
35	059-236	R609	RESISTOR, WW, 40 OHM, 20W	
36	060-323	DS601	LAMP, 120V, 0.025A	
39	070-002	F601, 602	FUSE, SLO-BLO, 3 AMP	
40	070-026	F603	FUSE, SLO-BLO, 1/2 AMP	
42	085-001		FUSEHOLDER, SHORT BODY	
43	119-249	S601, 607, 610	SWITCH, DPDT, TOGGLE	
44	145-501	J601	CONNECTOR, POWER, MALE, 3 CONTACTS	
45	150-992		SOCKET, RELAY	
47	166-079	J608	CONNECTOR, RECT, 3 PIN, MOLEX	
48	167-042	J609	CONNECTOR, RECT, 22 PIN, MOLEX	
49	172-003		LUG, SOLDER, LOCK, NO. 6	

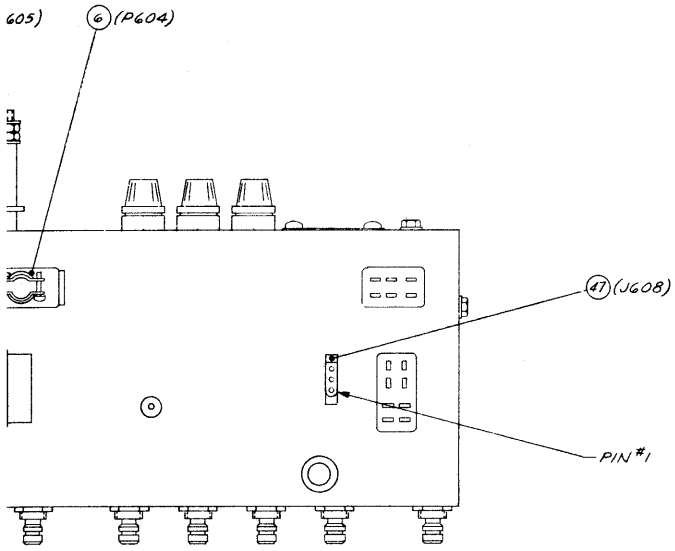
NEXT HIGHER ASSEMBLY NO. 4020271

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
49	172-003		LUG, SOLDER, LOCK, NO. 6	
50	172-010		LUG, SOLDER, PLAIN, NO. 6	
51	175-005		BAND, ADJUSTABLE, POWER RESISTOR	
53	260-017		GROMMET, 3/8 ID X 5/8 OD X 1/4 THK	
54	280-026		SPACER, PLAIN, NO. 8 X 1/2 LG	
55	280-612		SPACER, PLAIN, NO. 8 X 1 LG	
57	301-011		CLAMP, CAPACITOR	
59	471-064		SCREW, PN HD, XREC, NO. 4-40 X 1/2 LG	
60	471-069		SCREW, PN HD, XREC, NO. 6-32 X 3/8 LG	
61	471-082		SCREW, PN HD, XREC, NO. 8-32 X 3/4 LG	
63	472-408		SCREW, PN HD, XREC, NO. 8-32 X 1-3/4 LG	
64	472-409		SCREW, PN HD, XREC, NO. 8-32 X 2 LG	
66	475-085		SCREW, PN HD, XREC, NO. 6-32 X 5/16 LG	
67	476-200		SCREW, HEX WASHER HD, SELF-TAPPING, NO. 6 X 3/16 LG	
69	496-004		NUT, KEP, NO. 4-40	
70	496-005		NUT, KEP, NO. 6-32	
71	496-006		NUT, KEP, NO. 8-32	
73	501-009		WASHER, PLAIN, NO. 6	
74	502-347		WASHER, LOCK, INT TOOTH	
76	4840261		SCHEMATIC, TRANSPORT	
VERSION: 4020338-03				

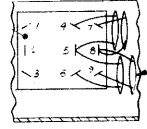


5 REQ'D 67

(T601) 9
 4 REQ'D 70
 FAR SIDE



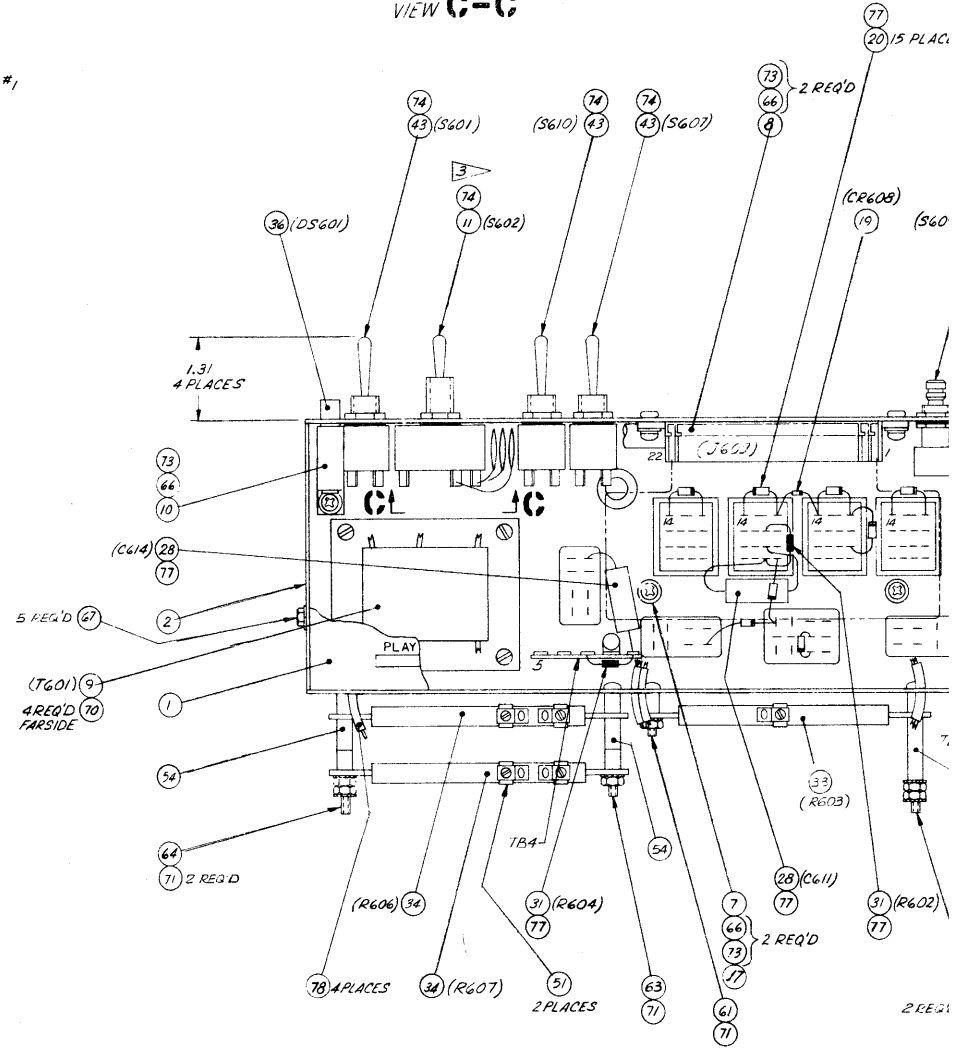
REF 11



②④ 4 REQ'D
(C602-605)
⑦⑦

VIEW C-C

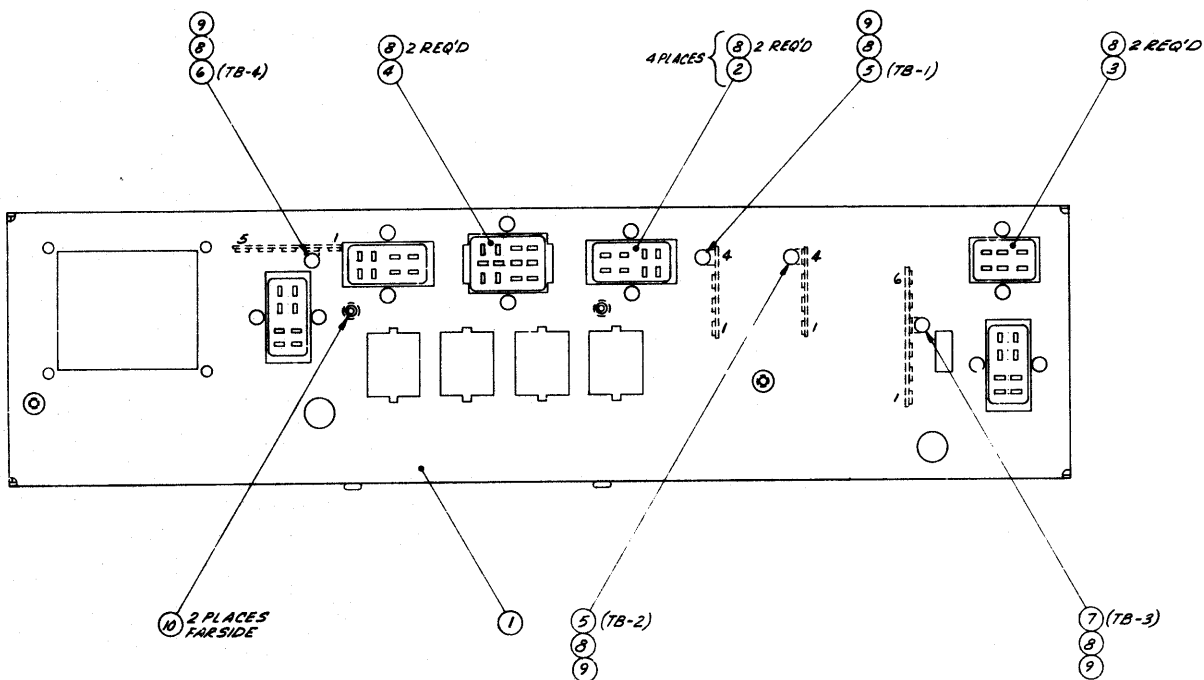
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NEXT HIGHER ASSEMBLY NO. 4020338

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4041092-01		CHASSIS, CONTROL BOX	
2	146-003		CONNECTOR, RECT RECP, 8 SOC	
3	146-004		CONNECTOR, RECT RECP, 6 SOC	
4	146-009		CONNECTOR, RECT RECP, 12 SOC	
5	180-079		STRIP, TERMINAL, SOLDER LUG	
6	180-277		STRIP, TERMINAL, SOLDER LUG	
7	180-994		STRIP, TERMINAL, SOLDER LUG	
8	460-008		RIVET, TUBULAR, OVAL HD, 0.12 DIA X 0.16 LG	
9	502-014		WASHER, LOCK, EXT TOOTH, NO. 6	
10	280-020		SPACER, THD, SWAGE, NO. 6-32 X 1.00 LG	

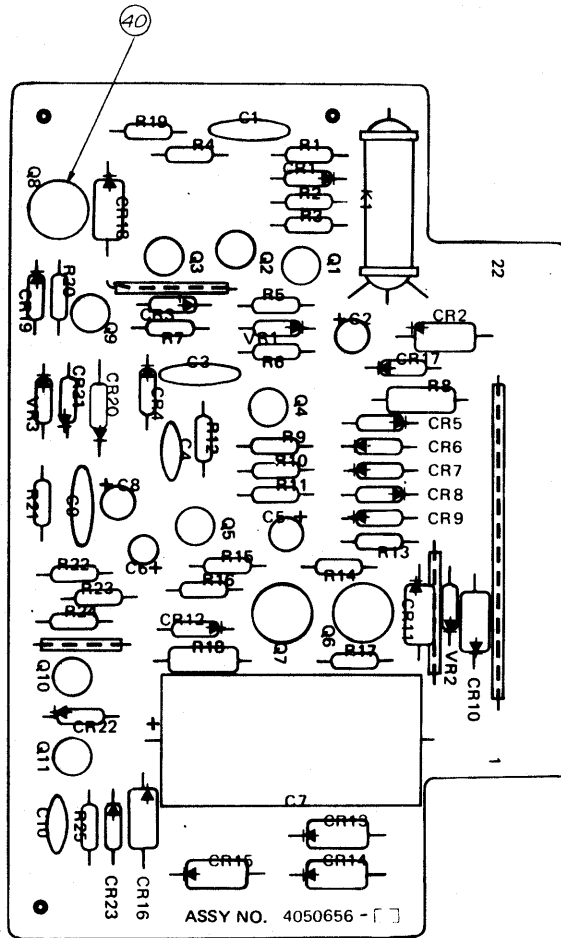
VERSION: 4041149-01



NEXT HIGHER ASSEMBLY NO. 4020338

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
2	4840261		SCHEMATIC, TRANSPORT	
5	013-599	CR1, 3-9, 12, 17, 19, 21-23	DIODE	1N914
6	013-663	VR1, 2	DIODE	1N967B
7	013-678	CR2, 10, 11, 13-16, 18	DIODE	1N4385
8	014-247	Q7	TRANSISTOR	2N2219
9	014-364	Q6, 8	TRANSISTOR	2N2905A
10	014-653	Q5, 11	TRANSISTOR	2N3904A
11	014-698	Q2, 3, 4	TRANSISTOR	2N3565
12	014-781	Q10	TRANSISTOR	MPS6518
13	014-882	Q1	TRANSISTOR	MPS3638A-5
14	020-778	K1	RELAY, SPST, REED	
15	013-983	CR20	DIODE	1N752A
16	013-830	VR3	DIODE	1N966B
17	030-057	C4, 10	CAPACITOR, CER, 0.01 UF, 100V, 20%	
18	030-144	C1, 3, 9	CAPACITOR, CER, 0.05 UF, 100V, 20%	
20	031-126	C7	CAPACITOR, ALUM, 250 UF, 50V	
22	037-895	C2, 8	CAPACITOR, TANT, 3.3 UF, 35V	
23	037-931	C5	CAPACITOR, TANT, 6.8 UF, 35V	
24	037-968	C6	CAPACITOR, TANT, 6.8 UF, 6V	
27	041-052	R8	RESISTOR, COMP, 2.2K, 1/2W, 10%	
28	041-054	R18	RESISTOR, COMP, 3.3K, 1/2W, 10%	
29	041-626	R6, 9, 14, 22	RESISTOR, COMP, 100K, 1/4W, 10%	
30	041-630	R17, 19	RESISTOR, COMP, 22K, 1/4W, 10%	
31	041-632	R16	RESISTOR, COMP, 12K, 1/4W, 10%	
32	041-633	R3, 4, 12, 13, 15, 20, 23	RESISTOR, COMP, 10K, 1/4W, 10%	
33	041-635	R21	RESISTOR, COMP, 6.8K, 1/4W, 10%	
34	041-968	R7, 11	RESISTOR, COMP, 1M, 1/4W, 10%	
35	041-640	R5	RESISTOR, COMP, 820 OHM, 1/4W, 10%	
36	049-372	R1, 2, 24	RESISTOR, COMP, 47K, 1/4W, 10%	
37	049-517	R10	RESISTOR, COMP, 220 OHM, 1/4W, 10%	
38	041-631	R25	RESISTOR, COMP, 15K, 1/4W, 10%	
40	280-998		PAD, MOUNTING	
41	580-440	Q9	TRANSISTOR	MPSA65-5

VERSION: 4050656-02



Assembly No. 4050656, Transport Control PWA

NEXT HIGHER ASSEMBLY NO. 4020338

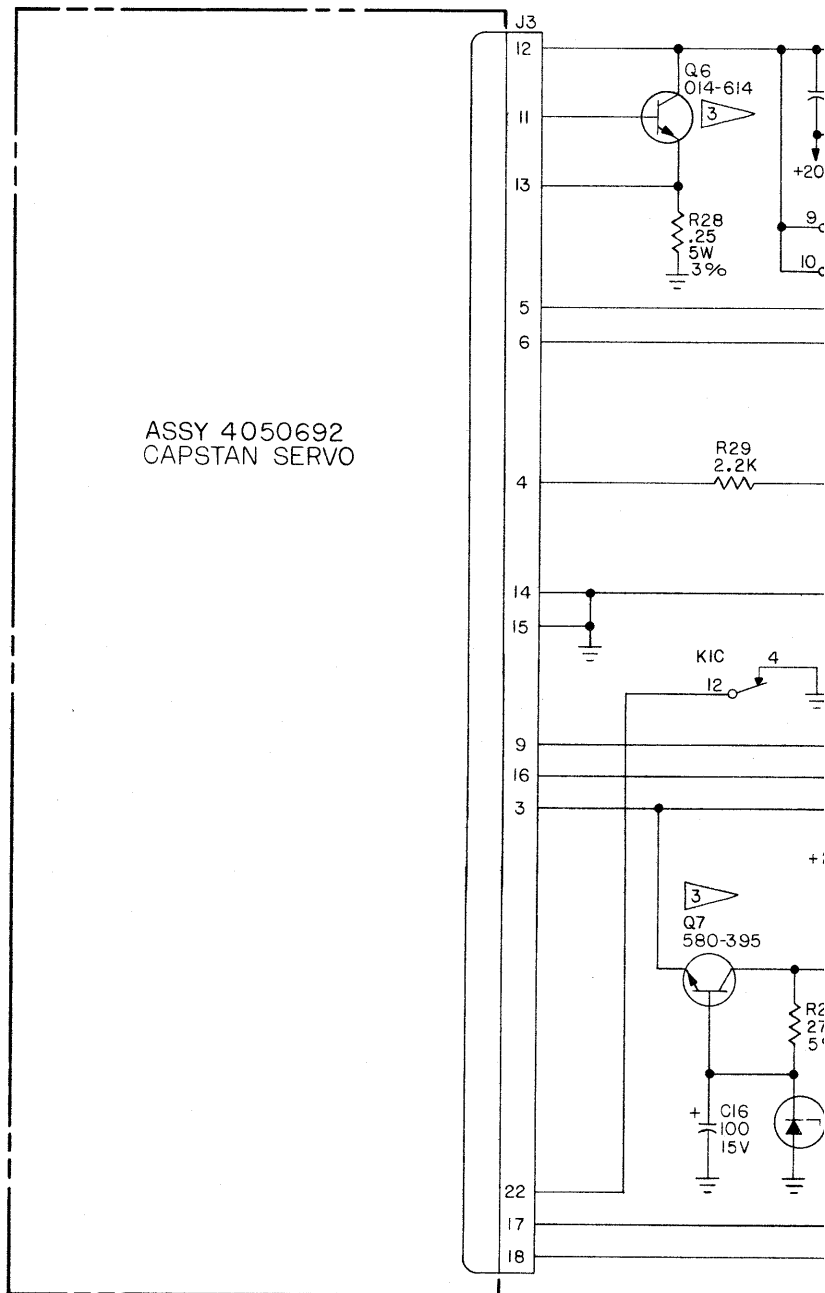
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	171-008	J609	CONNECTOR, SOLDERLESS, KNIFE	
2	167-042		CONNECTOR, RECT, 22 PIN	
3	167-041		PIN, ETCHED BOARD	
4	187-037		PIN, FEMALE	
<p>VERSION: 4050635-02</p>				

NEXT HIGHER ASSEMBLY NO. 4010202, 4010203, 4010204

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4050585-01	P604/602	SERVO POWER CABLE ASSY	
2	4050615-01		CAPSTAN SERVO HARNESS ASSY	
3	4050692-05		CAPSTAN SERVO PWA	
4	4050710-01	P4	DUMMY PLUG ASSY	
6	4230133-02		GUIDE, PRINTED WIRING BOARD	
8	4260490-05		CHASSIS, SERVO CONTROL	
9	4290667-01		COVER, SERVO CHASSIS	
11	1228243-01	T1	TRANSFORMER, POWER	
13	4600066-01		SHIELD, SERVO	
16	013-678	CR2	DIODE	1N4385
17	013-749	VR1	DIODE	1N3023B
18	014-247	Q8	TRANSISTOR	
19	014-614	Q6	TRANSISTOR, W/HARDWARE	
21	020-144	K1	RELAY	
22	020-492		SPRING, RELAY HOLDDOWN	
24	030-145	C15	CAPACITOR, CER, 0.1 MFD, 20%, 50V	
26	041-503	R27	RESISTOR, 270 OHM, 1/4W, 5%	
27	041-633	R31	RESISTOR, 10K, 1/4W, 10%	
28	041-638	R30	RESISTOR, 3.3K, 1/4W, 10%	
29	041-639	R29	RESISTOR, 2.2K, 1/4W, 10%	
30	043-968	R28	RESISTOR, WW, 0.25 OHM, 5W, 3%	
32	063-024	C16	CAPACITOR, ELECT, 100 MFD, 15V	
33	063-149	C17	CAPACITOR, ELECT, 15,600 MFD, 50V	
34	065-004		BRACKET, CAP MOUNTING	
39	119-196	S1	SWITCH, 2PDT SLIDE	
40	143-804	J3	CONNECTOR, PRINTED WIRING BOARD, 28 CONTACT	
41	146-003	J4	CONNECTOR, FEMALE, 8 PIN	
42	146-004	J6	CONNECTOR, FEMALE, 6 PIN	
44	150-992		SOCKET, RELAY	
45	169-318		KEY, PC CONNECTOR	
47	171-007		LUG, SOLDER BLUE	
48	180-085	TB1, 2, 3	STRIP, TERMINAL	
49	180-994	TB4	STRIP, TERMINAL	
51	260-017		GROMMET, 3/8 ID	
55	471-062		SCREW, PN HD, XREC, NO. 4-40 X 3/8 LG	
56	471-063		SCREW, PN HD, XREC, NO. 4-40 X 7/16 LG	
57	471-067		SCREW, PN HD, XREC, NO. 6-32 X 1/4 LG	
59	471-070		SCREW, NO. 6-32 X 7/16 LG	
61	471-091		SCREW, PN HD, XREC, NO. 10-32 X 3/4 LG	
62	471-448		SCREW, PN HD, XREC, NO. 6-32 X 1-1/4 LG	

NEXT HIGHER ASSEMBLY NO. 4010202, 4010203, 4010204

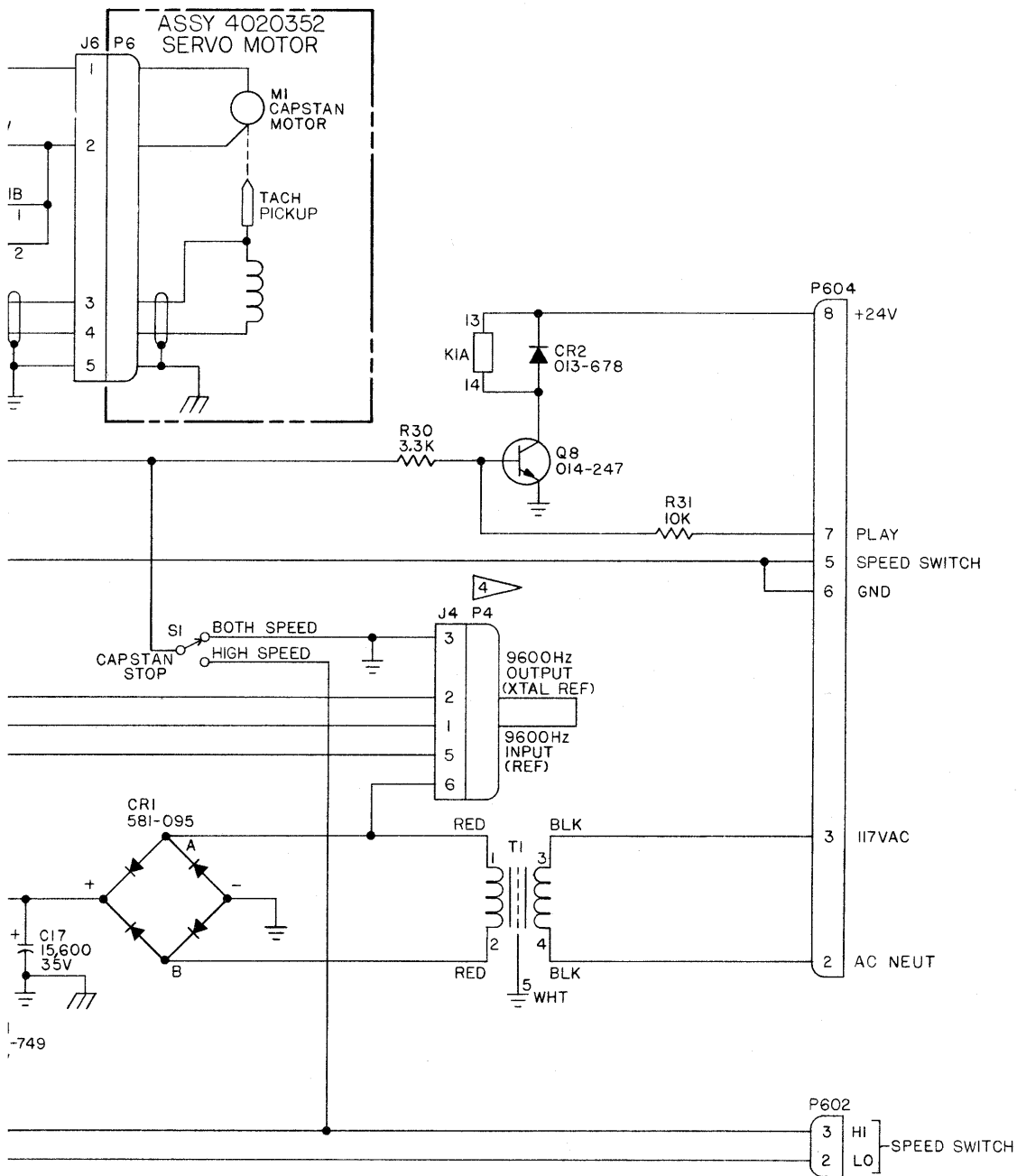
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
63	473-326		SCREW, SEMS, NO. 4-40 X 3/8 LG	
64	473-330		SCREW, SEMS, NO. 6-32 X 1/4 LG	
66	496-004		NUT, KEP, NO. 4-40	
67	496-005		NUT, KEP, NO. 6-32	
68	496-007		NUT, KEP, NO. 10-32	
69	498-445		NUT, SPRING, 0.125	
70	501-008		WASHER, PLAIN, NO. 4	
71	501-009		WASHER, FLAT, NO. 6	
72	580-165		HEATSINK	
73	580-395	Q7	TRANSISTOR, WITH HARDWARE	2N5190
74	581-095	CR1	DIODE BRIDGE ASSY	
81	4840279		SCHEMATIC, CAPSTAN SERVO CHASSIS	
82	4040356		SCHEMATIC, CAPSTAN SERVO BOARD	
VERSION: 4020353-01				



ASSY 4050692
CAPSTAN SERVO

NOTES: UNLESS OTHERWISE SPECIFIED,

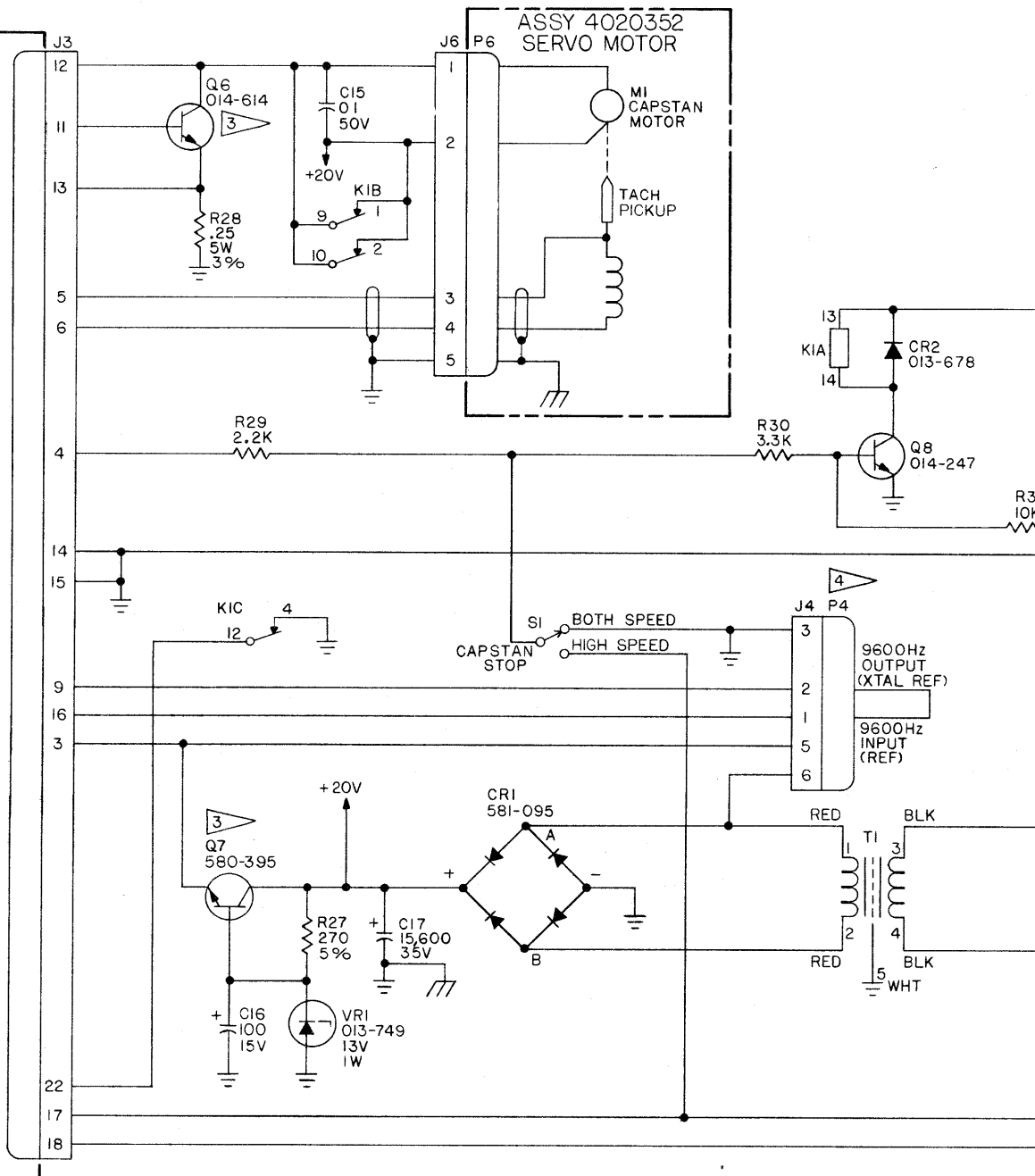
- 1 CAPACITANCE VALUES ARE IN MICROFARADS.
- 2 RESISTANCE VALUES ARE IN OHMS 1/4W, 10%.
- 3 HEATSINK REQUIRED.
- 4 DUMMY PLUG ASSY 4050710-01.
- 5 TO KEEP CAPSTAN RUNNING AT BOTH SPEEDS DURING STANDBY REMOVE K1.



FIELD SERVICE COMPONENT SUBSTITUTION LIST		
AMPEX	P/N	COML. NEAREST EQUIVALENT
014-614		2N3055
580-395		2N5190
581-095		SCBA2(SEMTECH)
013-749		1N4743
014 247		2N2219A

Schematic No. 4840279
Capstan Servo Chassis

ASSY 4050692
CAPSTAN SERVO

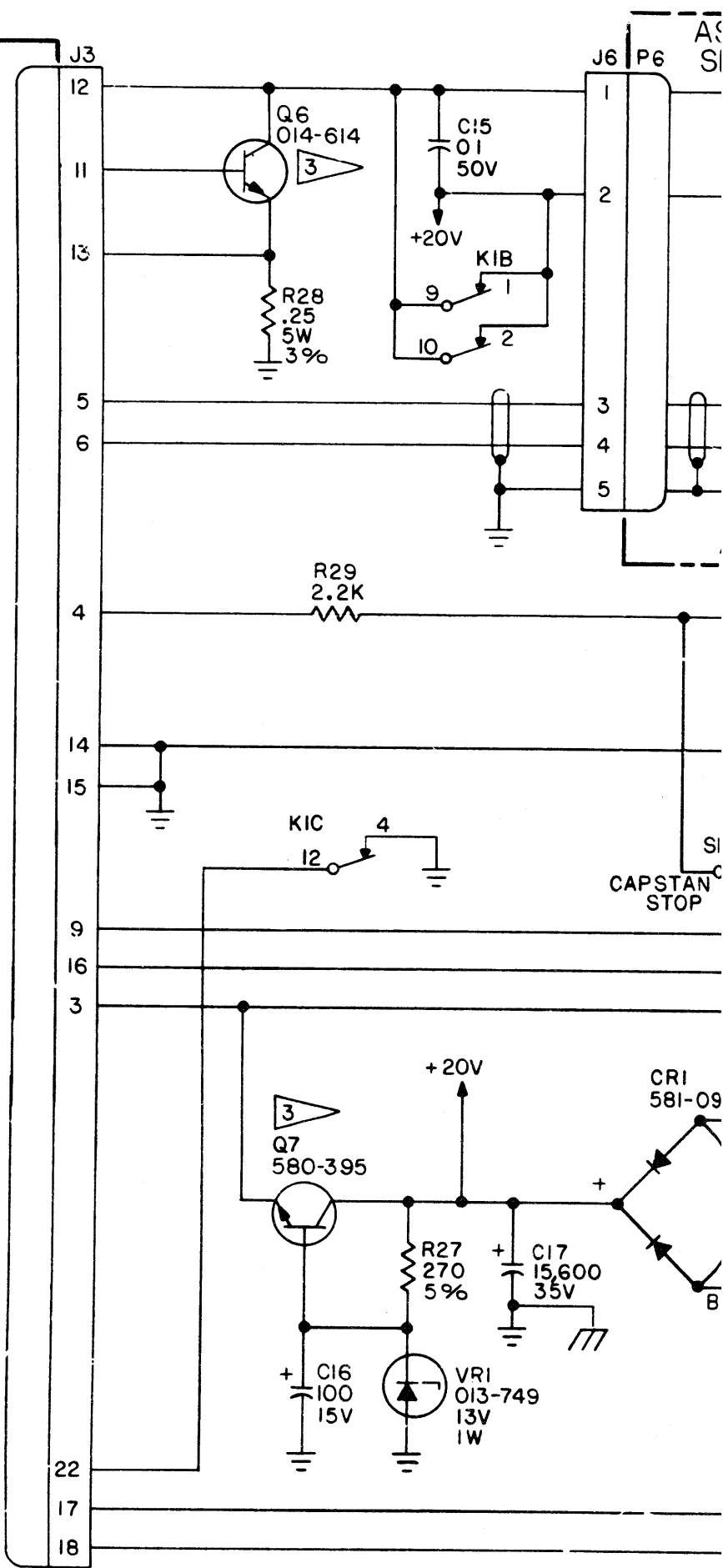


OTHERWISE SPECIFIED,
CAPACITANCE VALUES ARE IN MICROFARADS.
RESISTANCE VALUES ARE IN OHMS 1/4W, 10%.
SINK REQUIRED.
SERVO PLUG ASSY 4050710-01.
KEEP CAPSTAN RUNNING AT BOTH SPEEDS
DURING STANDBY REMOVE KI.

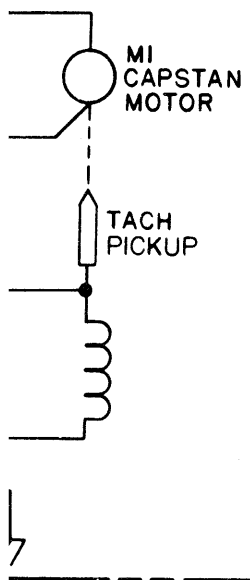
FIELD SERVICE COMPONENT SUBSTITUTION LIST	
AMPEX P/N	COML. NEAREST EQUIVALENT
014-614	2N3055
580-395	2N5190
581-095	SCBA2(SEMTECH)
013-749	IN4743
014-247	2N2219A

ASSY 4050692
CAPSTAN SERVO

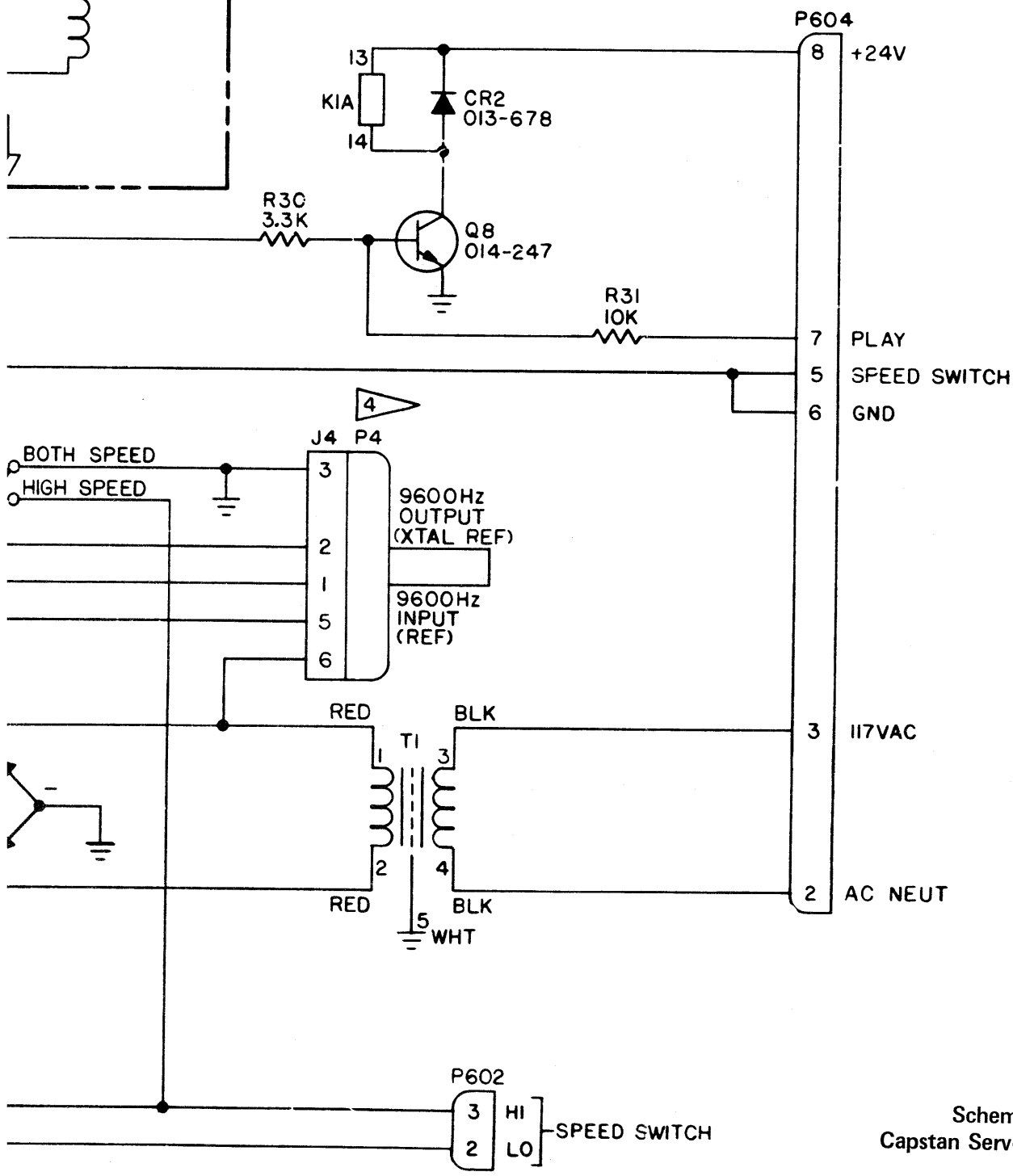
FIELD SERVICE COMPONENT SUBSTITUTION LIST		
AMPEX	P/N	COML. NEAREST EQUIVALENT
	014-614	2N3055
	580-395	2N5190
	581-095	SCBA2 (SEMTECH)
	013-749	1N4743
	014 247	2N2219A



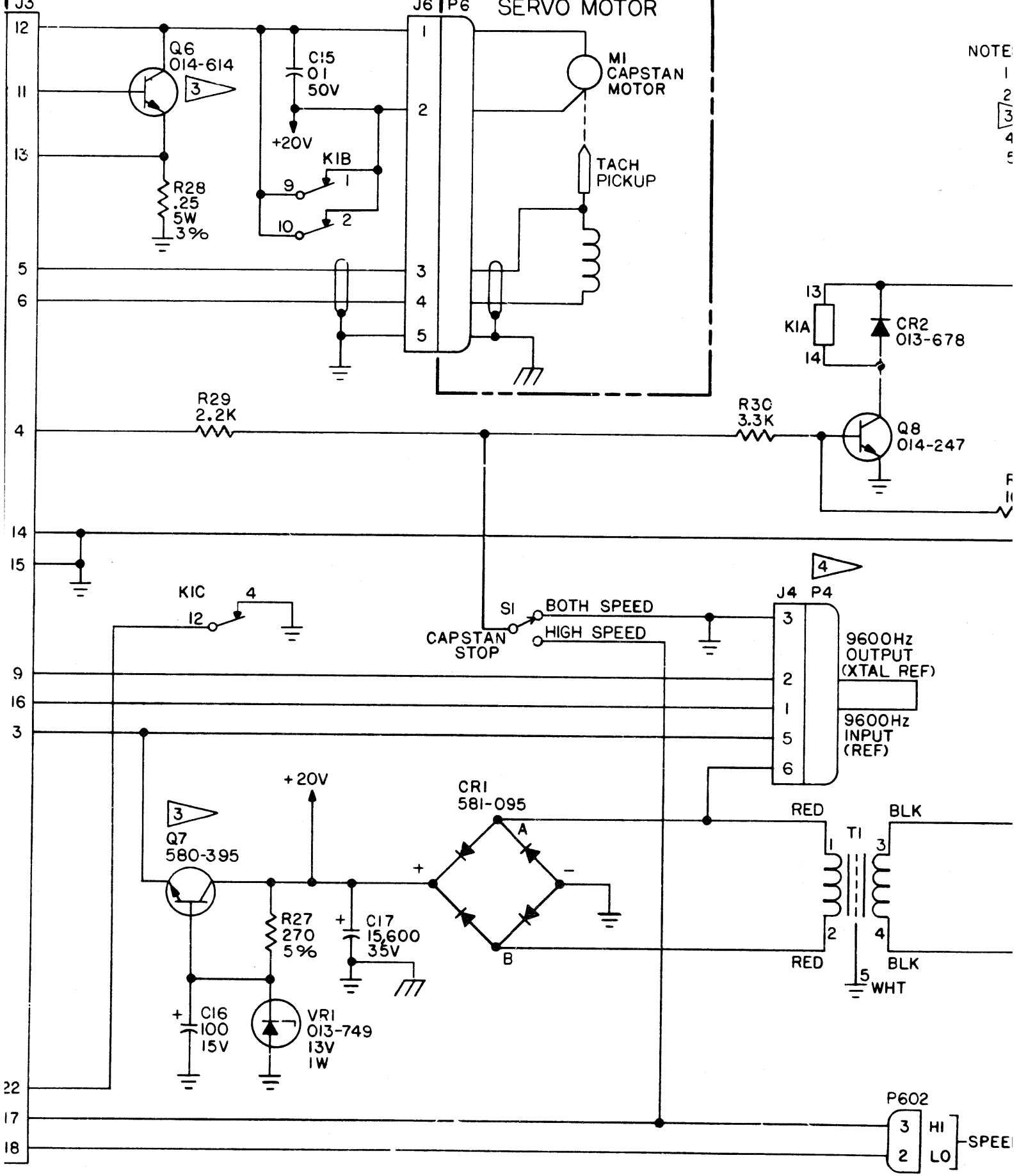
RVO MOTOR



- NOTES: UNLESS OTHERWISE SPECIFIED.
- 1 CAPACITANCE VALUES ARE IN MICROFARADS.
 - 2 RESISTANCE VALUES ARE IN OHMS 1/4W, 10%.
 - 3 HEATSINK REQUIRED.
 - 4 DUMMY PLUG ASSY 4050710-01.
 - 5 TO KEEP CAPSTAN RUNNING AT BOTH SPEEDS DURING STANDBY REMOVE KI.



Schematic No. 4840279
Capstan Servo Chassis Assembly



NOTE
 1
 2
 3
 4
 5

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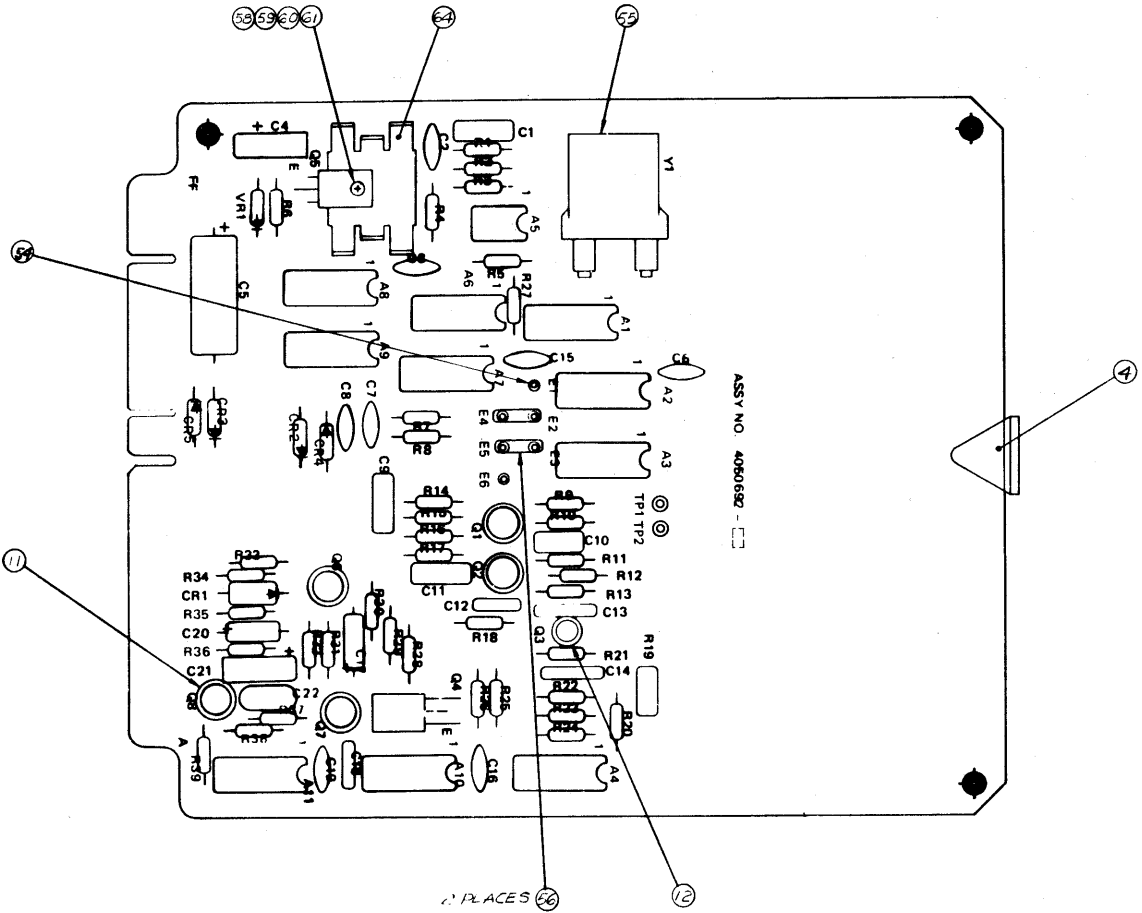
NEXT HIGHER ASSEMBLY NO. 4020353

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
2	4840356		SCHEMATIC	
4	52528-01		HANDLE	
6	013-678	CR1	DIODE	1N4385
7	013-983	VR1	DIODE	1N752A
8	013-599	CR2-5	DIODE	1N914
9	014-652	Q3, 7	TRANSISTOR	2N3906
10	014-698	Q1, 2, 6, 8	TRANSISTOR	2N3565
11	014-793		PAD, MOUNTING, TRANSISTOR	
12	280-130		PAD, MOUNTING, TRANSISTOR	
13	017-122	Y1	CRYSTAL, MONITOR, PRODUCTS	
15	030-057	C2, 3, 6-8, 15, 16, 19	CAPACITOR, CER, DISC, 0.01 UF, 100V, 20%	
16	030-437	C1, 9	CAPACITOR, MONO, 0.1 UF, 25V	
18	055-195	C18	CAPACITOR, MYLAR, 0.0068 UF, 50V, 5%	
19	041-411	R2, 18	RESISTOR, COMP, 47K, 1/4W, 5%	
20	034-283	C22	CAPACITOR, MICA, 820 PF	
22	035-853	C13	CAPACITOR, MYLAR, 0.056 UF, 50V, 5%	
23	035-893	C14	CAPACITOR, MYLAR, 0.1 UF, 50V, 5%	
24	035-596	C11	CAPACITOR, MYLAR, 0.082 UF, 50V, 5%	
25	041-408	R4, 9, 10, 11, 32	RESISTOR, COMP, 10K, 1/4W, 5%	
26	037-367	C17, 20	CAPACITOR, TANT, 2.2 UF, 20V, 10%	
27	037-620	C5	CAPACITOR, TANT, 100 UF, 20V, 10%	
28	037-894	C4, 21	CAPACITOR, TANT, 100 UF, 10V, 5%	
29	041-482	R37	RESISTOR, COMP, 12K, 1/4W, 5%	
31	041-407	R7, 8, 27, 34	RESISTOR, COMP, 3.2 OHM, 1/4W, 5%	
33	041-410	R5, 15, 30	RESISTOR, COMP, 1K, 1/4W, 5%	
35	041-412	R14	RESISTOR, COMP, 4.7K, 1/4W, 5%	
37	041-443	R1	RESISTOR, COMP, 39K, 1/4W, 5%	
38	041-483	R35	RESISTOR, COMP, 27K, 1/4W, 5%	
39	041-495	R3	RESISTOR, COMP, 8.2K, 1/4W, 5%	
40	041-502	R26	RESISTOR, COMP, 240 OHM, 1/4W, 5%	
41	041-503	R6	RESISTOR, COMP, 270 OHM, 1/4W, 5%	
42	041-504	R25	RESISTOR, COMP, 510 OHM, 1/4W, 5%	
44	041-530	R29	RESISTOR, COMP, 15 OHM, 1/4W, 5%	
45	041-409	R36	RESISTOR, COMP, 15K, 1/4W, 5%	
46	041-394	R33, 39	RESISTOR, COMP, 100K, 1/4W, 5%	
47	041-653	R31	RESISTOR, COMP, 39 OHM, 1/4W, 5%	
48	055-133	C10	CAPACITOR, MYLAR, 0.0022 UF, 50V, 5%	
49	055-168	C12	CAPACITOR, MYLAR, 0.0056 UF, 50V, 5%	
50	041-562	R28	RESISTOR, COMP, 43K, 1/4W, 5%	
51	057-137	R12, 13, 16, 17, 21	RESISTOR, METAL FILM, 51K, 1/4W, 2%	

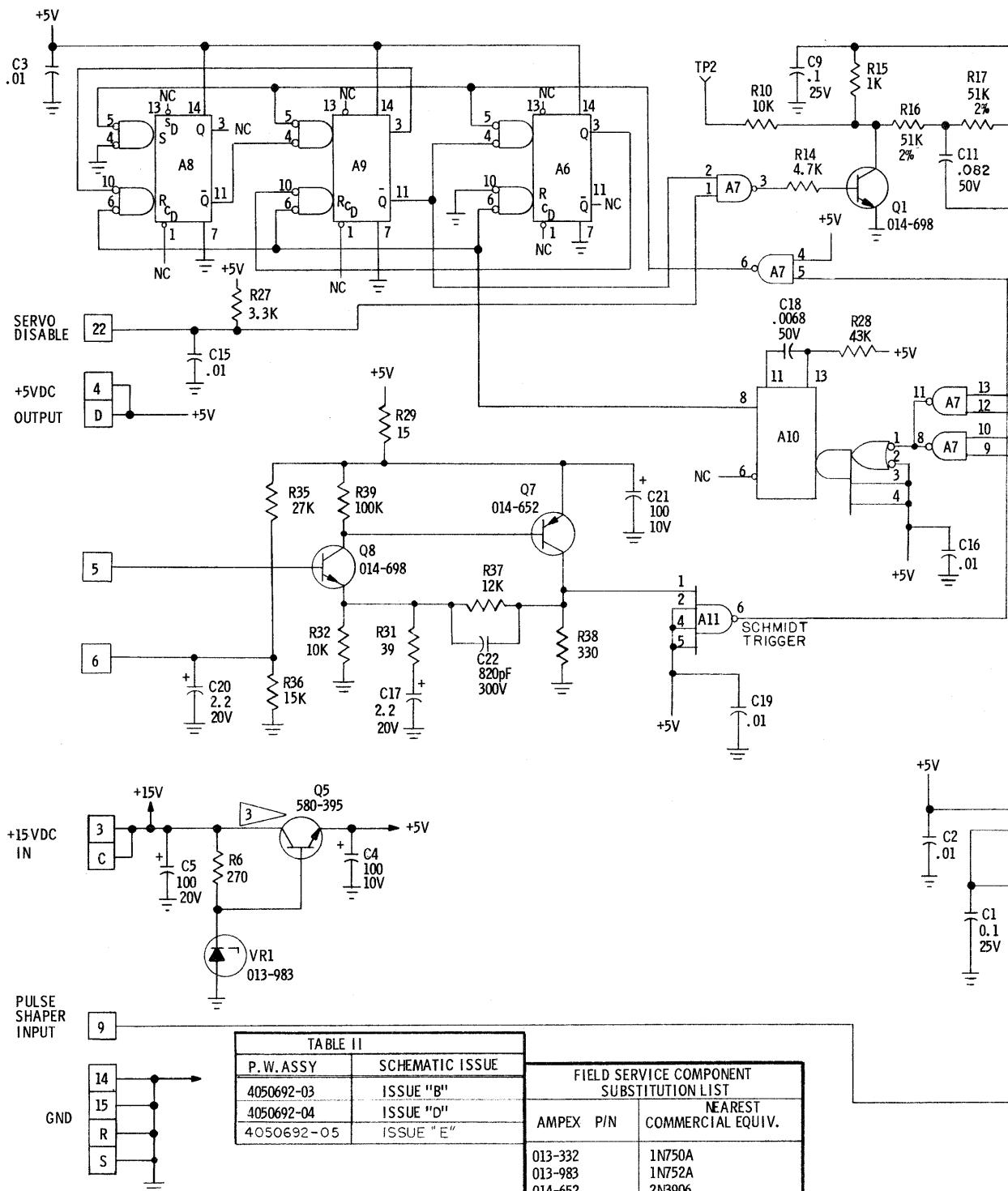
NEXT HIGHER ASSEMBLY NO. 4020353

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
52	041-427	R38	RESISTOR, 330 OHM, 1/4W, 5%	
53	058-754	R19	RESISTOR, VAR, CERMET, 100 OHM, 1W, 20%	
54	143-981	E1-6	CONNECTOR, JACK	
55	150-106		BRACKET, MOUNTING, CRYSTAL	
56	166-628		PLUG, SHORTING BLOCK' BLACK	
58	471-062		SCREW, XREC, PN HD, 4-40 X 0.375 LG	
59	492-008		NUT, PLAIN, HEX, 4-40	
60	501-008		WASHER, FLAT, NO. 4	
61	502-024		WASHER, LOCK, NO. 4	
62	057-122	R20, 23	RESISTOR, METAL FILM, 12K, 1/4W, 2%	
63	057-133	R22, 24	RESISTOR, METAL FILM, 36K, 1/4W, 2%	
64	580-332		HEATSINK	
65	580-395	Q4, 5	TRANSISTOR	2N5190
68	586-153	A7	INTEGRATED CIRCUIT	MC846P
69	586-268	A4	INTEGRATED CIRCUIT	UA741C
70	586-283	A1	INTEGRATED CIRCUIT	SN7493H
71	586-309	A10	INTEGRATED CIRCUIT	U6A9601
72	586-425	A2, 3	INTEGRATED CIRCUIT	MC853P
73	586-698	A6, 8, 9	INTEGRATED CIRCUIT	U6A9950
74	587-086	A5	INTEGRATED CIRCUIT	LM311N
75	586-680	A11	INTEGRATED CIRCUIT	SN7413J

VERSION: 4050692-05



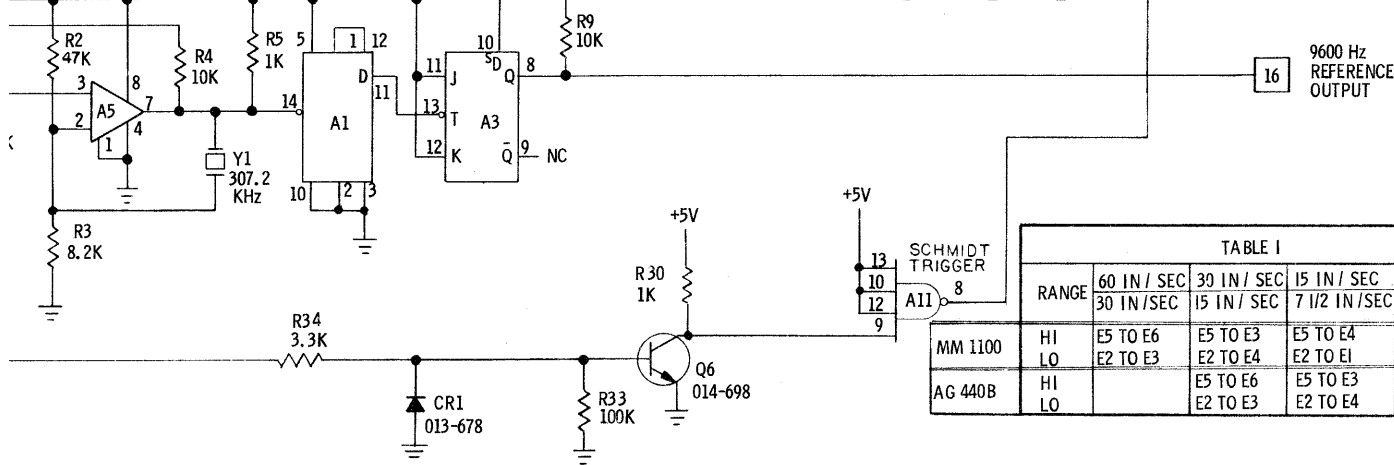
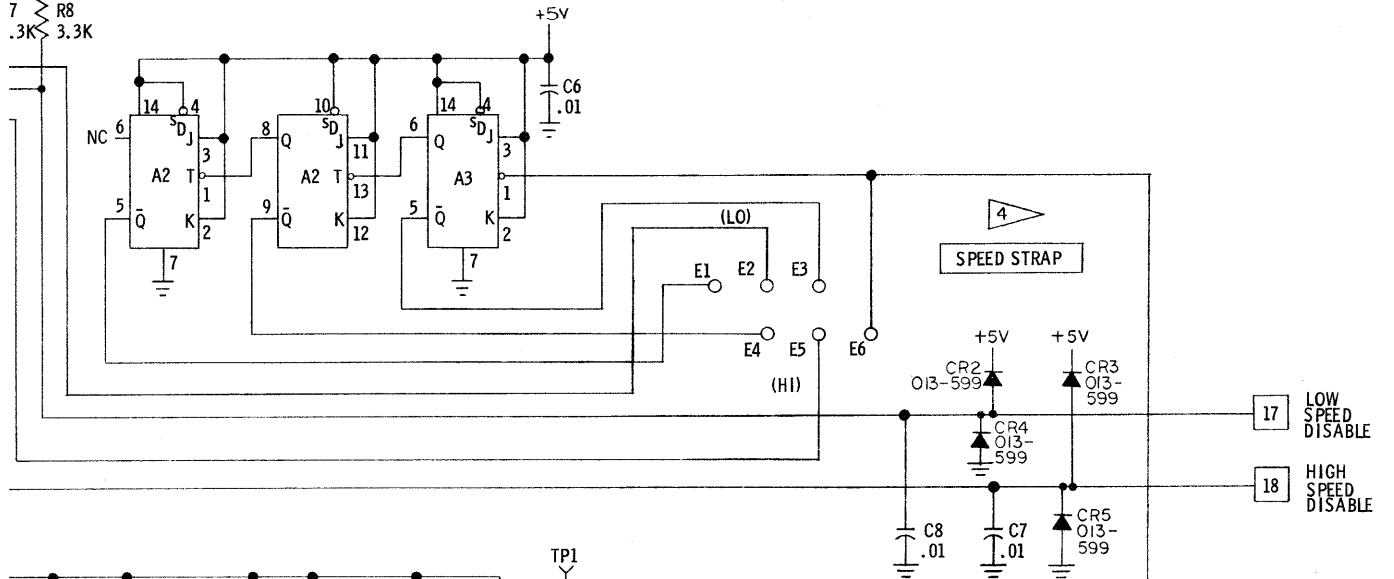
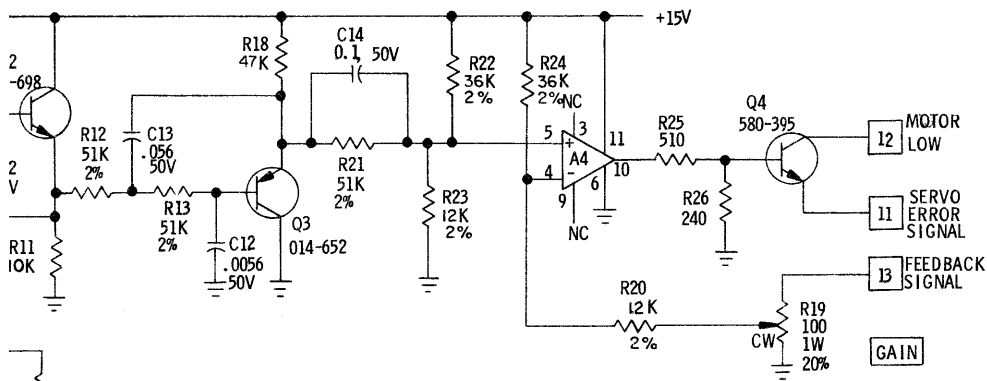
Assembly No. 4050692, Capstan Servo PWA



- NOTES: UNLESS OTHERWISE SPECIFIED
- CAPACITANCE VALUES ARE IN MICROFARADS, 100V.
 - RESISTANCE VALUES ARE IN OHMS 1/4W, 5%.
 - HEATSINK REQUIRED.
 - SEE TABLE I FOR SPEED STRAPPING.

TABLE II		FIELD SERVICE COMPONENT SUBSTITUTION LIST	
P. W. ASSY	SCHEMATIC ISSUE	AMPEX P/N	NEAREST COMMERCIAL EQUIV.
4050692-03	ISSUE "B"	013-332	1N750A
4050692-04	ISSUE "D"	013-983	1N752A
4050692-05	ISSUE "E"	014-652	2N3906
		580-395	2N5190
		014-698	NONE
		013-678	1N4385

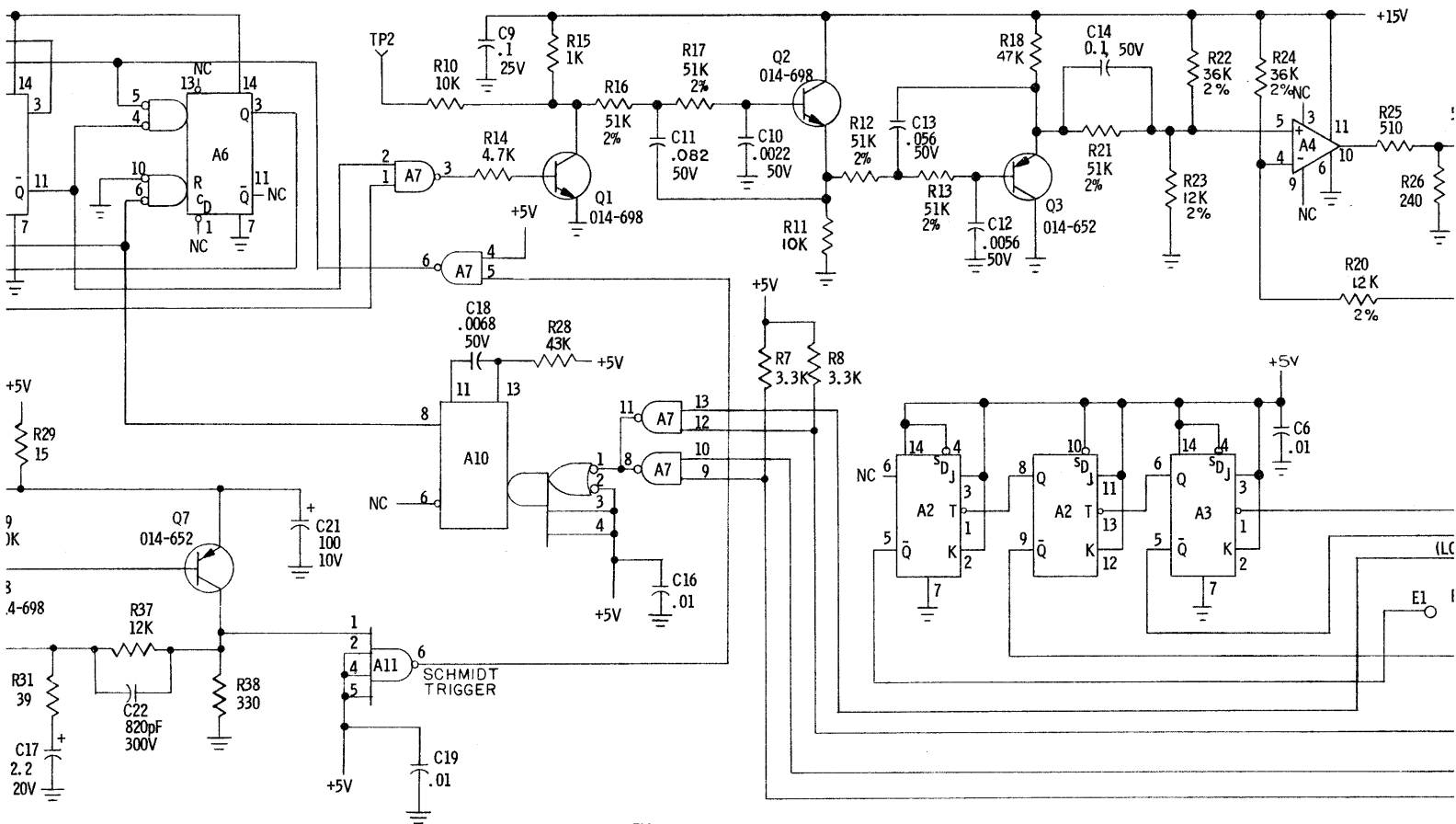
REFERENCE DESIGNATION		I. C. LIST						
LAST USED	NOT USED	REFERENCE DESIGNATION	A11	A6, 8, 9	A7	A4	A1	A
A11	Q8	AMPEX P/N	586-680	586-698	586-153	586-268	586-283	58
C22	Y1	VENDOR P/N	SN7413J	U6A 9950	MC 846P	UA 741C	SN7493N	M
R39	CR5	VOLTAGE PIN	14	14	14	11	5	
TP2	E6	GROUND PIN	7	7	7	6	10	



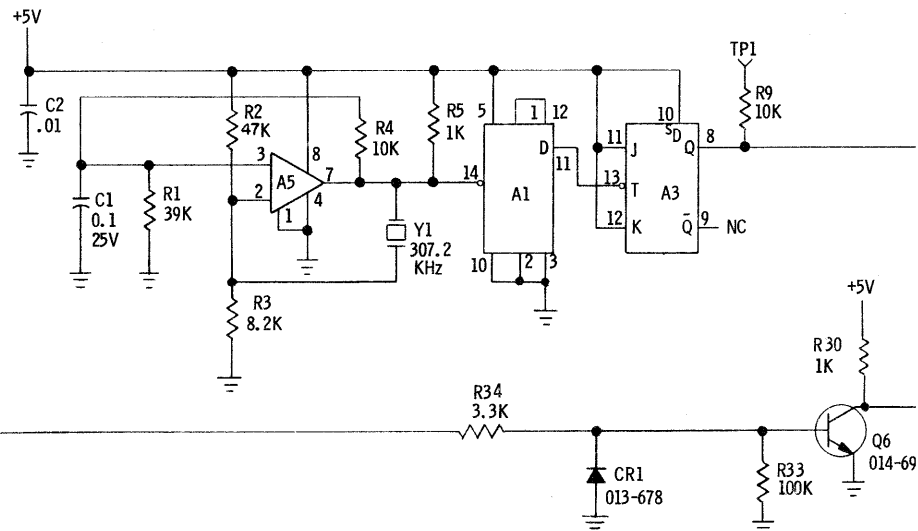
RANGE	60 IN / SEC	30 IN / SEC	15 IN / SEC	7 1/2 IN/SEC
	30 IN / SEC	15 IN / SEC	7 1/2 IN / SEC	3 3/4 IN/SEC
MM 1100	HI LO	E5 TO E6 E2 TO E3	E5 TO E3 E2 TO E4	E5 TO E4 E2 TO E1
AG 440B	HI LO	E5 TO E6 E2 TO E3	E5 TO E3 E2 TO E4	E5 TO E4 E2 TO E1

A5	A10
587-086	586-309
LM-311N	U6 A9601
8	14
4,1	7

Schematic No. 4840356
Capstan Servo PWA



→ +5V
4 00 0V



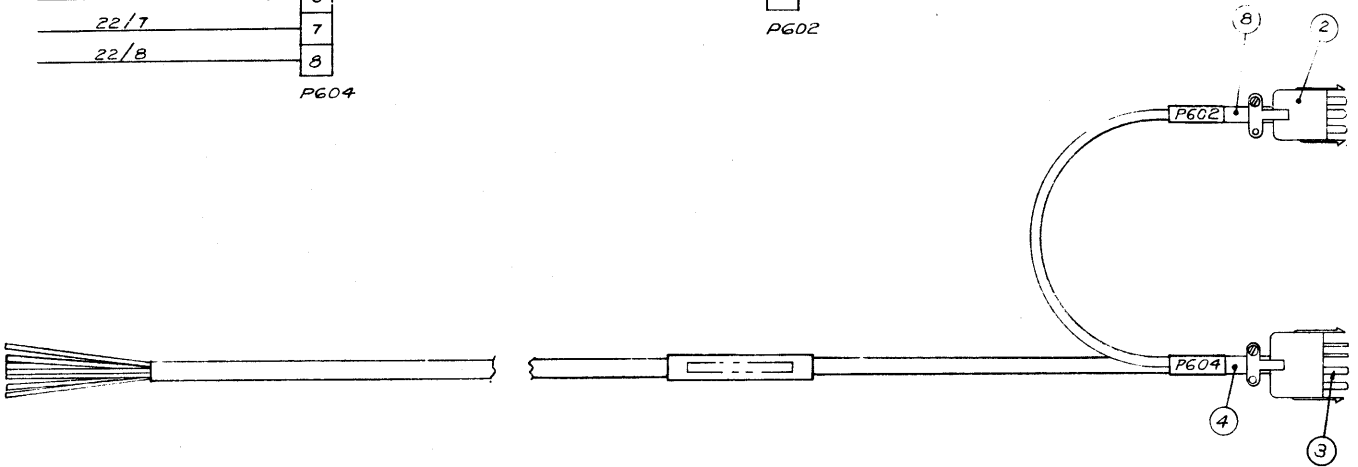
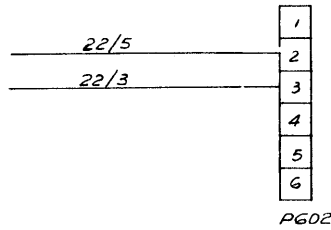
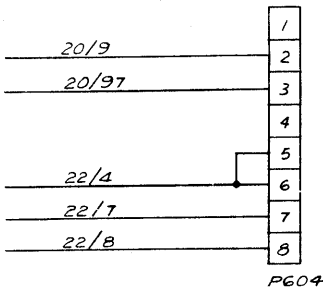
SCHEMATIC ISSUE		FIELD SERVICE COMPONENT SUBSTITUTION LIST	
ISSUE "B"		AMPEX P/N	NEAREST COMMERCIAL EQUIV.
ISSUE "D"			
ISSUE "E"			
		013-332	1N750A
		013-983	1N752A
		014-652	2N3906
		580-395	2N5190
		014-698	NONE
		013-678	1N4385

10V.

REFERENCE DESIGNATION		I.C. LIST								
AST USED	NOT USED	REFERENCE DESIGNATION	A11	A6, 8, 9	A7	A4	A1	A2, 3	A5	A10
Q8		AMPEX P/N	586-680	586-698	586-153	586-268	586-283	586-425	587-086	586-309
Y1		VENDOR P/N	SN7413J	U6A 9950	MC 846P	UA 741C	SN7493N	MC 853P	LM-311N	U6 A9601
CR5		VOLTAGE PIN	14	14	14	11	5	14	8	14
TP2		GROUND PIN	7	7	7	6	10	7	4, 1	7

NEXT HIGHER ASSEMBLY NO. 4020353

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
2	145-012	P602	CONNECTOR, RECT PLUG, 6 PINS	
3	145-013	P604	CONNECTOR, RECT PLUG, 8 PINS	
4	262-004		BUSHING, SLEEVE, 0.437 ID	
8	262-002		BUSHING, SLEEVE, 0.220 ID	
VERSION: 4050585-01				

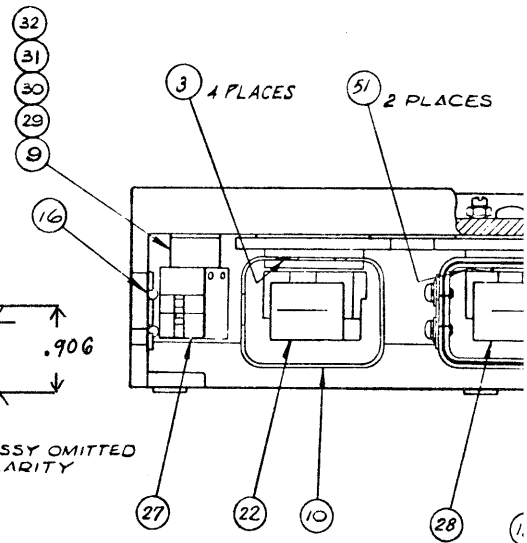
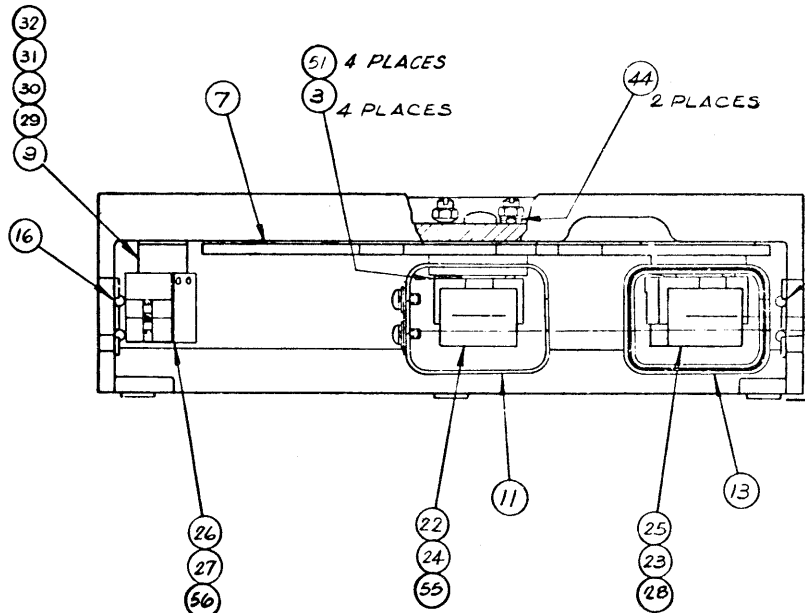
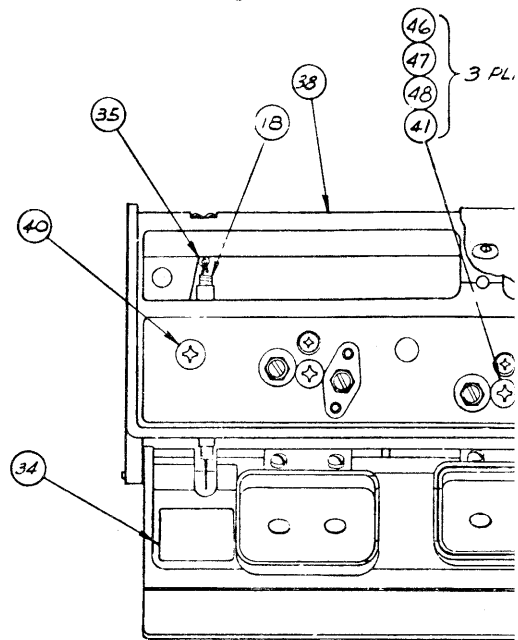
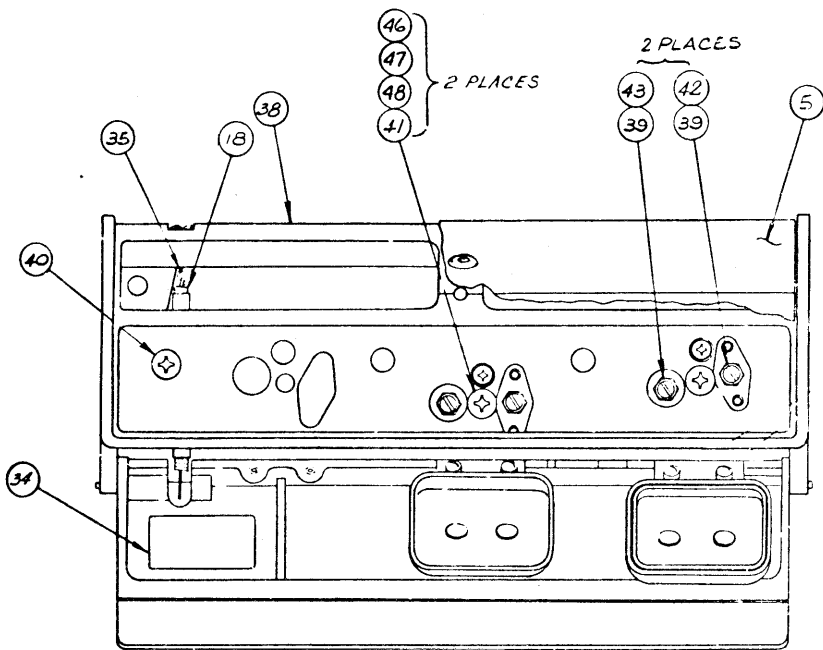


NEXT HIGHER ASSEMBLY NO. 4010202,
4010203

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4050446-01		HEAD CONNECTOR ASSY, 1 TRACK	
2	4050446-02		HEAD CONNECTOR ASSY, 2 TRACK AND 2-4 TRACK	
3	4270167-10		SPRING, HEAD	
4	4350011-01		KNOB, 2-4 TRACK	
5	4350038-01		OVERLAY ASSY, HEAD HOUSING, 1 TRACK AND 2 TRACK	
6	4350038-02		OVERLAY ASSY, HEAD HOUSING, 2-4 TRACK	
7	4350016-01		SPACER, HEAD, 1/4" TAPE	
9	4350019-01		SPACER, ERASE HEAD	
10	4350021-01		SHIELD CAN ASSY, REC POS, NO. 2, 2-4 TRACK	
11	4350022-03		SHIELD CAN ASSY, REC POS, NO. 3, 1 TRACK AND 2 TRACK	
12	4350023-03		SHIELD CAN ASSY, P/B POS, NO. 3, 2-4 TRACK	
13	4350024-01		SHIELD CAN ASSY, P/B POS, NO. 4	
14	4350029-05		HEAD GATE ASSY, 1 TRACK AND 2 TRACK	
15	4350029-06		HEAD GATE ASSY, 2-4 TRACK	
16	4350184-01		TAPE GUIDE ASSY, 1/4"	
17	4210313-01		SWITCH, SHAFT, 2-4 TRACK	
18	4350035-01		SPRING, HEAD GATE	
22	4350094-01		HEAD STACK ASSY, REC, 2 TRACK AND 2-4 TRACK	
23	4350094-02		HEAD STACK ASSY, P/B, 2 TRACK AND 2-4 TRACK	
24	4350095-01		HEAD STACK ASSY, REC, 1 TRACK	
25	4350095-02		HEAD STACK ASSY, P/B, 1 TRACK	
26	4040829-03		HEAD STACK ASSY, ERASE, 1 TRACK	
27	4040831-03		HEAD STACK ASSY, ERASE, 2 TRACK AND 2-4 TRACK	
28	4350068-03		HEAD STACK ASSY, 2-4 TRACK	
29	4350025-01		SHIM, ERASE HEAD, 0.010 THK	
30	4350025-02		SHIM, ERASE HEAD, 0.002 THK	
31	4350025-03		SHIM, ERASE HEAD, 0.003 THK	
32	4350025-04		SHIM, ERASE HEAD, 0.005 THK	
35	401-008		PIN, COTTER, 1/16 DIA X 3/4 LG	
36	403-006		PIN, "DRIV-LOK", 3/32 DIA, TYPE C	
37	470-425		SCREW, HEX SOC, BUTTON HD, NO. 4-40 X 1/4	
38	4350017-03		BASE, HEAD MOUNTING	
39	471-481		SCREW, FILL HD SLOT, NO. 4-40 X 5/8	
40	471-041		SCREW, PN HD, XREC, NO. 10-32 X 3/4	
41	473-156		SCREW, PN HD, XREC, NO. 10-32 X 9/16	

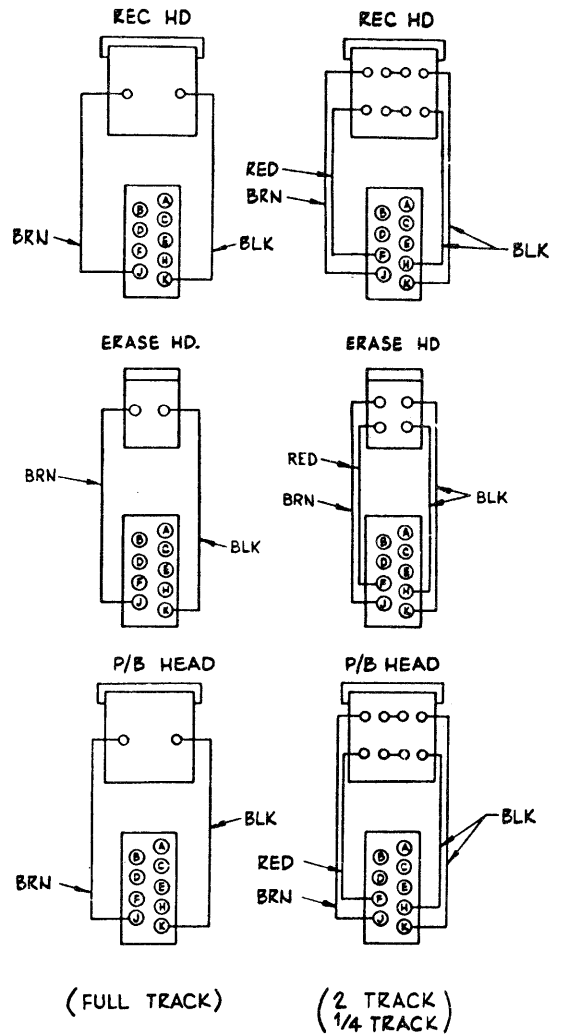
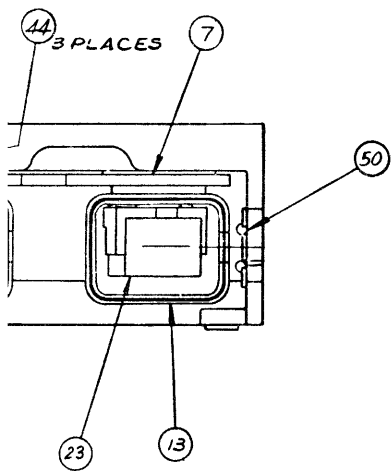
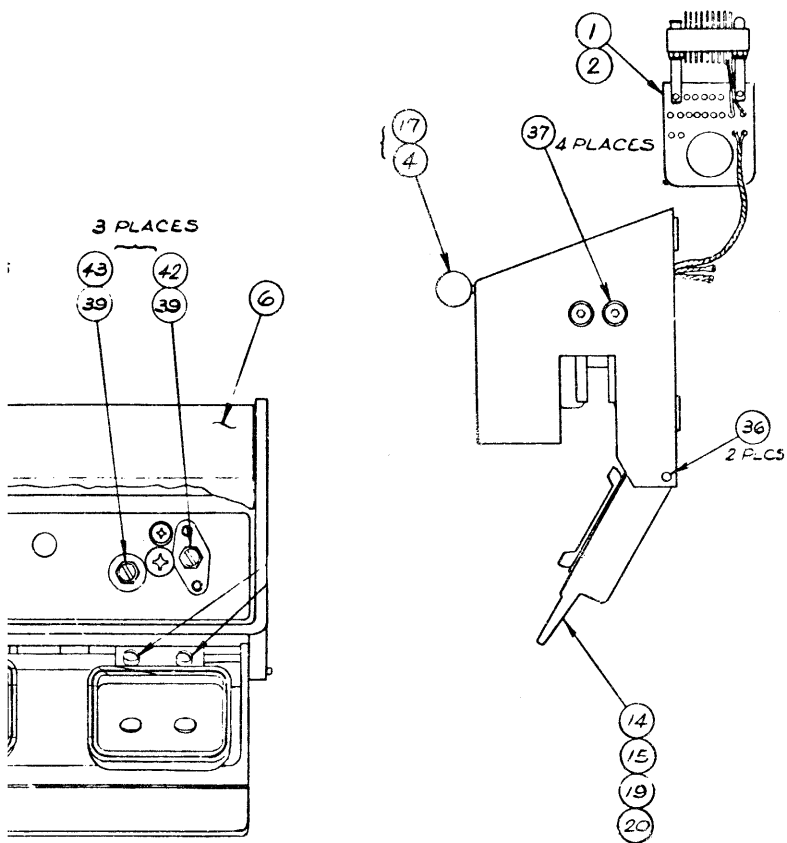
NEXT HIGHER ASSEMBLY NO. 4010202,
4010203

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
42	492-008		NUT, HEX, NO. 4-40	
43	493-001		NUT, SELF-LOCKING, NO. 4-40	
44	502-062		WASHER, LOCK, DOUBLE COIL, NO. 4	
46	501-054		WASHER, FLAT, 0.203 ID X 0.375 OD X 0.005 THK	
47	501-057		WASHER, FLAT, 0.203 ID X 0.375 OD X 0.010 THK	
48	501-064		WASHER, FLAT, 0.203 ID X 0.375 OD X 0.003 THK	
50	4350184-02		TAPE GUIDE ASSY, 1/4"	
51	4270167-40		SPRING, HEAD, 2-4 TRACK	
			VERSIONS: 4020355-01 1 TRACK 4020355-02 2 TRACK 4020355-03 2-4 TRACK	



FULL TRACK & 2 TRACK

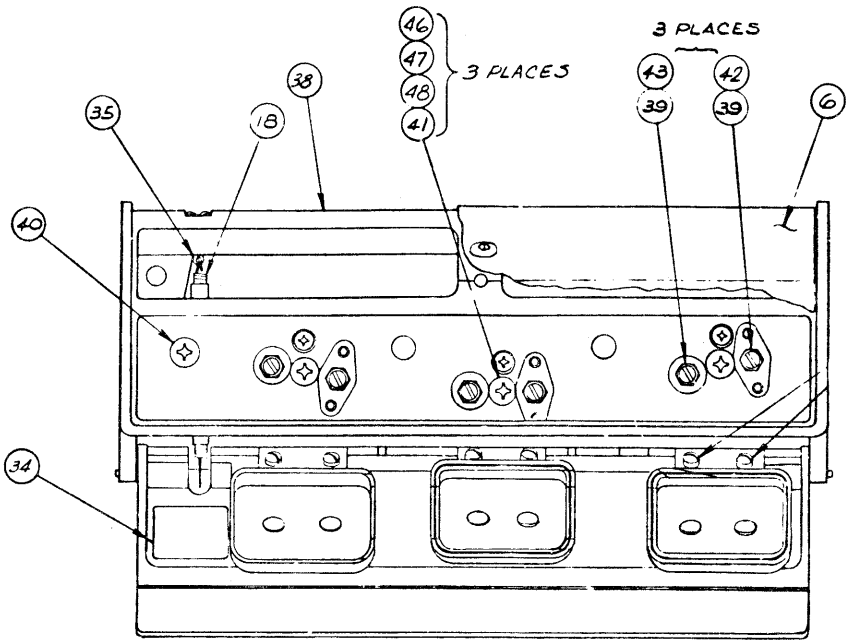
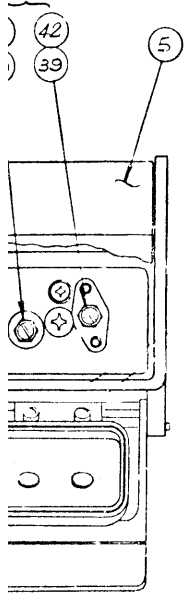
2-4 TRACK



WIZING DIAGRAM

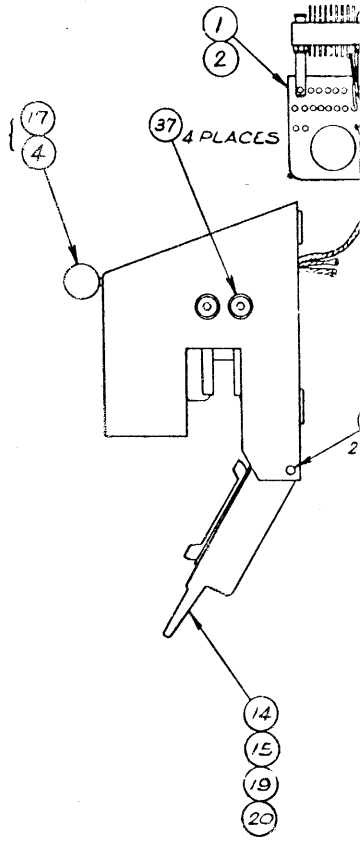
Assembly No. 4020355
 1 Track, 2 Track, 2-4 Track Head Assembly
 for 1/4-Inch Tape

2 PLACES

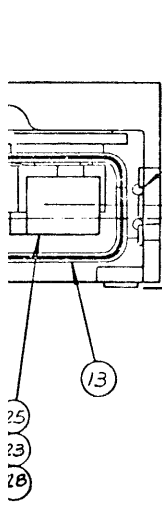


3 PLACES

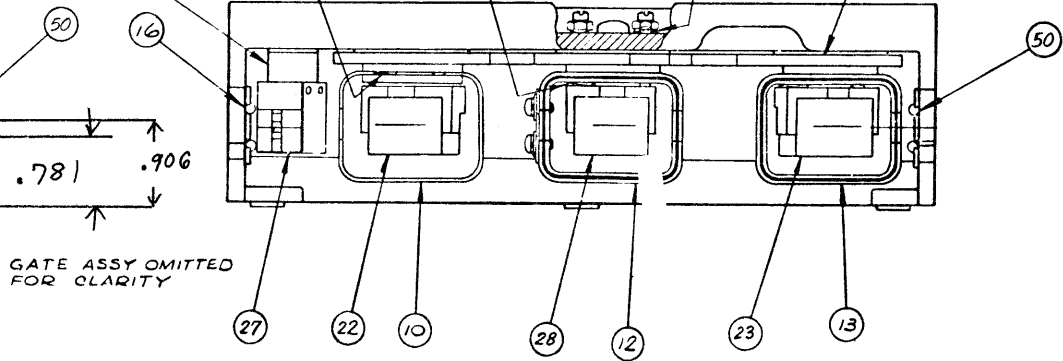
3 PLACES



2 PLACES



32
31
30
29
9



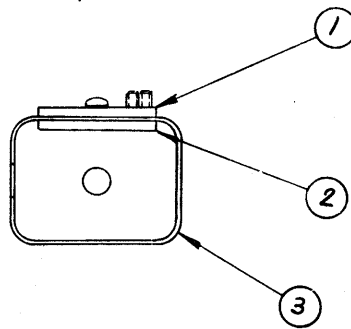
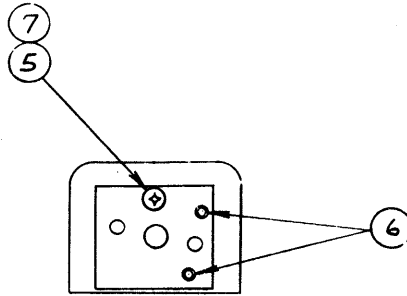
GATE ASSY OMITTED FOR CLARITY

.781
.906

2-4 TRACK

NEXT HIGHER ASSEMBLY NO. 4020355

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4350001-01		PLATE, OUTER	
2	4350004-01		PLATE, INNER	
3	4350006-01		SHIELD CAN, 1/4"	
5	471-010		SCREW, MACH, PN HD, PHILL, NO. 4-40 X 1/4	
6	477-112		SCREW, SET, HEX SOC, NO. 4-40 X 3/8	
7	501-186		WASHER, FLAT, 0.115 ID X 0.209 OD X 0.016 THK	
VERSION: 4350021-01				



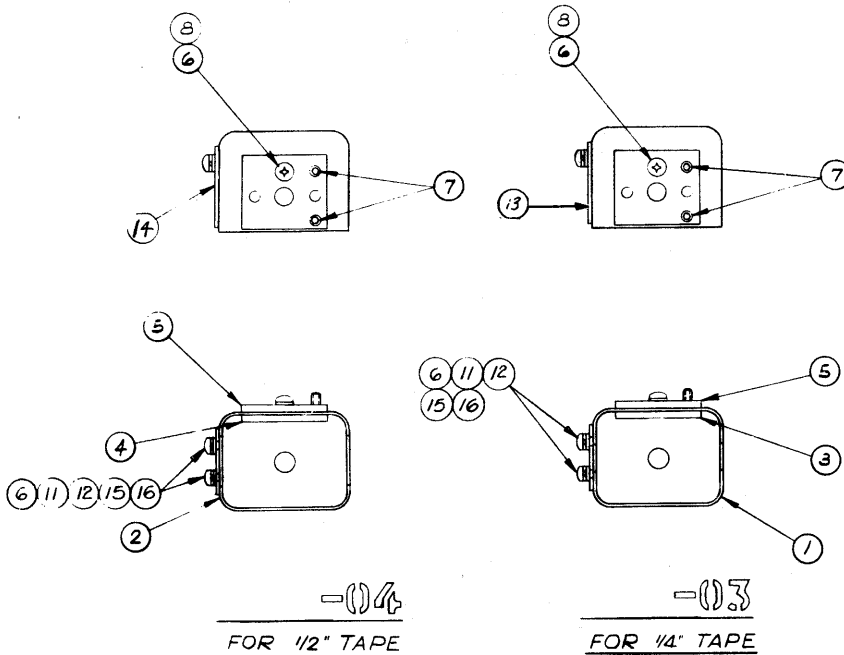
— () |

FOR 1/4" TAPE

NEXT HIGHER ASSEMBLY NO. 4020359,
4020355, 4020356

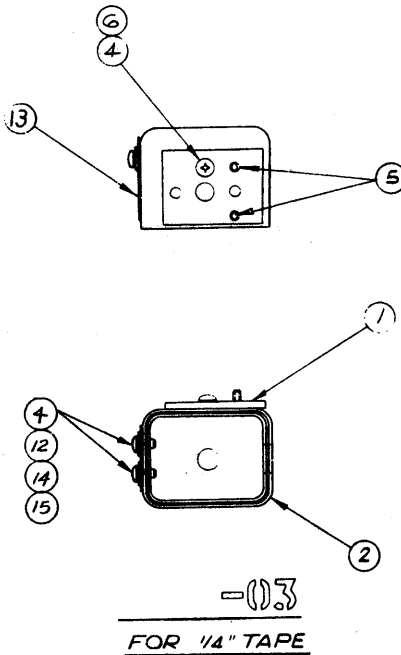
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4350007-03		SHIELD CAN, 1/4"	
2	4350007-04		SHIELD CAN, 1/2"	
3	4350005-01		PLATE, INNER, RECORD, 1/4"	
4	4350005-02		PLATE, INNER, RECORD, 1/2"	
5	4350002-01		PLATE, TOP	
6	471-010		SCREW, MACH, PN HD, PHILL, NO. 4-40 X 1/4	
7	477-112		SCREW, SET, HEX SOC, NO. 4-40 X 3/8	
8	501-186		WASHER, FLAT, 0.115 ID X 0.209 OD X 0.016 THK	
11	501-002		WASHER, FLAT, NO. 4	
12	502-002		WASHER, LOCK, SPLIT, NO. 4	
13	4350186-01		TAPE GUIDE ASSY, 1/4"	
14	4350190-01		TAPE GUIDE ASSY, 1/2"	
15	470-425		SCREW, HEX SOC BUT HD, 4-40 X 1/4 LG	
16	501-061		WASHER, FLAT, .017 THK, NO. 4	

VERSION: 4350022-03 1/4 INCH TAPE
4350022-04 1/2 INCH TAPE



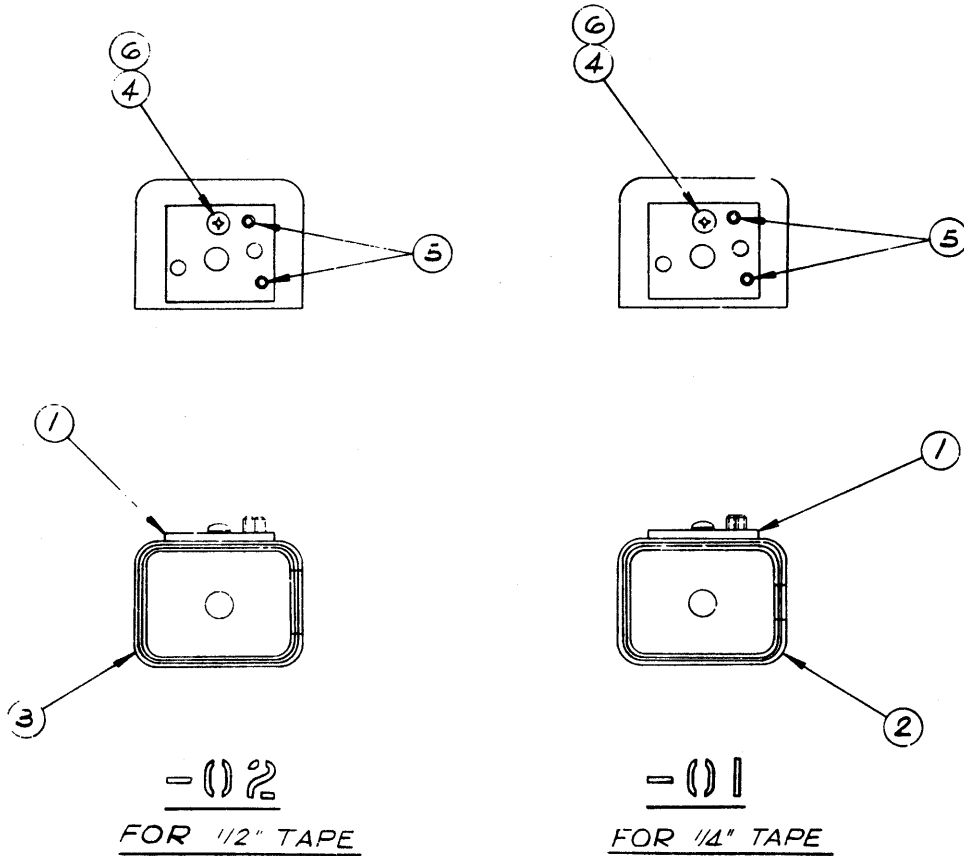
NEXT HIGHER ASSEMBLY NO. 4020355

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4350002-01		PLATE	
2	4350008-03		SHIELD CAN, 1/4"	
4	471-010		SCREW, MACH, PN HD, PHILL, NO. 4-40 X 1/4	
5	477-112		SCREW, SET, HEX SOC, NO. 4-40 X 3/8	
6	501-186		WASHER, FLAT, 0.115 ID X 0.209 OD X 0.016 THK	
12	502-002		WASHER, LOCK, SPLIT, NO. 14	
13	4350186-01		TAPE GUIDE ASSY, 1/4"	
14	470-425		SCREW, HEX SOC BUT HD, 4-40 X 1/4 LG	
15	501-061		WASHER, FLAT, .017 THK, NO. 4	
VERSION: 4350023-03				



NEXT HIGHER ASSEMBLY NO. 4020359, 4020355, 4020356

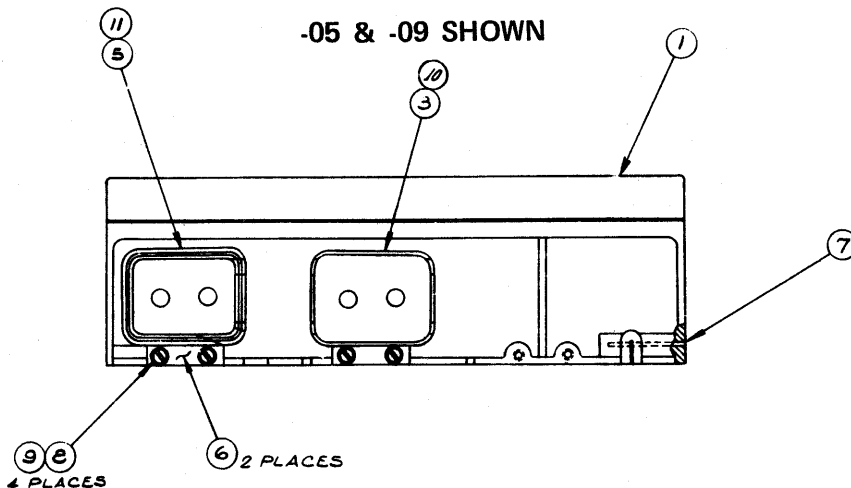
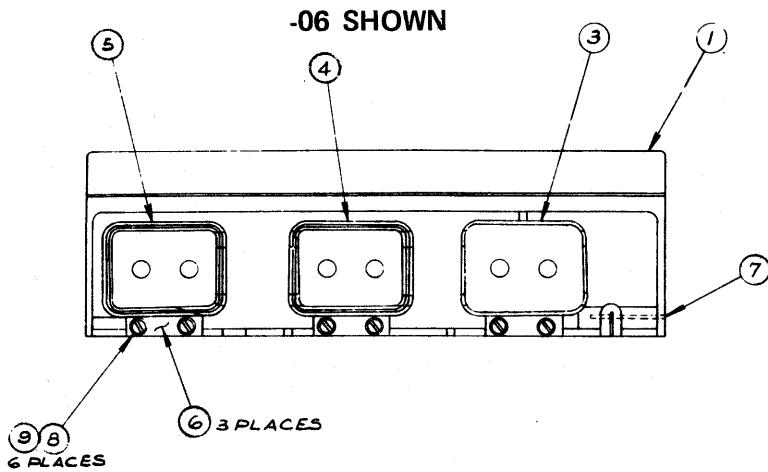
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4350003-01		PLATE	
2	4350009-01		SHIELD CAN, 1/4"	
3	4350009-02		SHIELD CAN, 1/2"	
4	471-010		SCREW, MACH, PN HD, PHILL, NO. 4-40 X 1/4	
5	477-112		SCREW, SET, HEX SOC, NO. 4-40 X 3/8	
6	501-186		WASHER, FLAT, 0.115 ID X 0.209 OD X 0.016 THK	
VERSION: 4350024-01 1/4 INCH TAPE 4350024-02 1/2 INCH TAPE				



NEXT HIGHER ASSEMBLY NO. 4020359, 4020355, 4020356

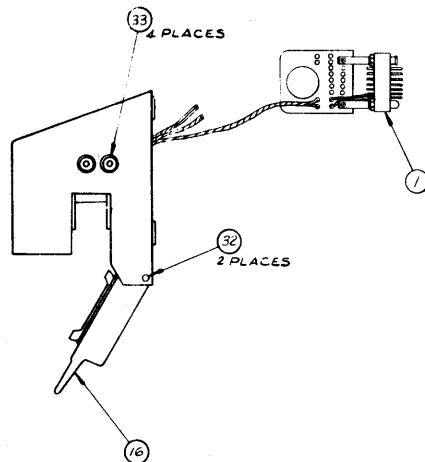
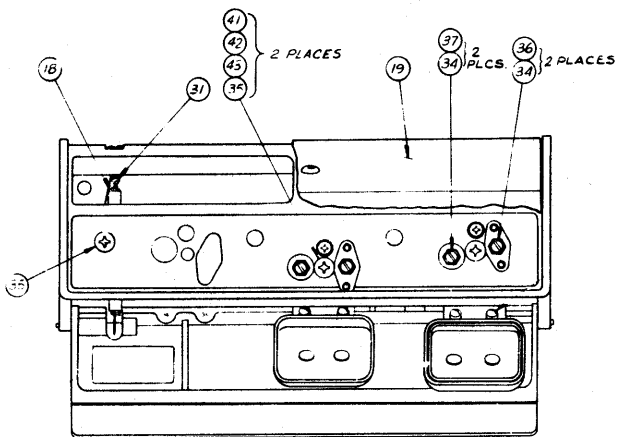
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4350013-02		GATE	
3	4350026-01		SHIELD COVER ASSY, 1/4" TAPE	
4	4350027-01		SHIELD COVER ASSY, 2-4 TRACK	
5	4350028-01		SHIELD COVER ASSY, 1/4" TAPE	
6	4270155-10		PLATE	
7	406-046		PIN, "ROLLPIN", 0.062 DIA X 1.00 LG	
8	471-478		SCREW, MACH, FL HD, SLOTTED, NO. 4-40 X 3/16	
9	502-002		WASHER, LOCK, SPRING, NO. 4	
10	4350026-02		SHIELD COVER ASSY, 1/2" TAPE	
11	4350028-02		SHIELD COVER ASSY, 1/2" TAPE	

VERSIONS: 4350029-05 1 TRACK
4350029-06 2 TRACK
4350029-09 4 TRACK

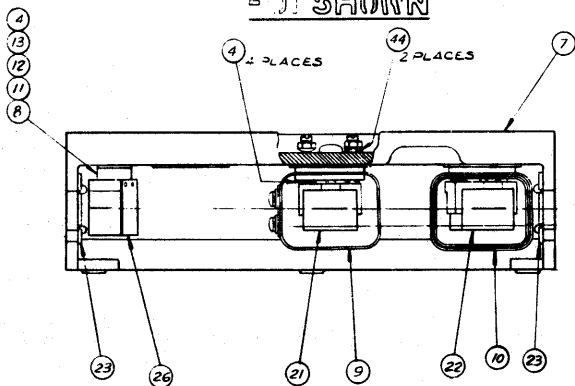


NEXT HIGHER ASSEMBLY NO. 4010204

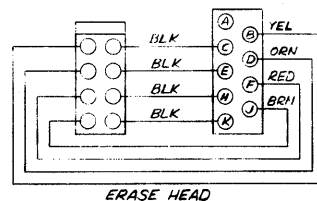
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4050446-04		HEAD CONNECTOR ASSY	
4	4270167-10		SPRING, HEAD ADJUST	
7	4350017-03		BASE, HEAD MOUNTING	
8	4350019-02		SPACER, ERASE HEAD	
9	4350022-04		RECORD SHIELD CAN ASSY, POS, NO. 3	
10	4350024-02		PLAYBACK SHIELD CAN ASSY, POS, NO. 4	
11	4350025-01		SHIM ERASE HEAD 0.010 THK	
12	4350025-02		SHIM ERASE HEAD	
13	4350025-03		SHIM, ERASE HEAD, 0.003 THK	
14	4350025-04		SHIM, ERASE HEAD, 0.005 THK	
16	4350029-09		HEAD GATE ASSY	
18	4350035-01		SPRING, EXTENSION HEAD GATE	
19	4350038-01		OVERLAY ASSY, HEAD HOUSING	
21	4350096-01		HEAD STACK ASSY, 4 CHANNEL, REC, 4 TRACK	
22	4350096-02		HEAD STACK ASSY, 4 CHANNEL, P/B, 4 TRACK	
23	4350188-01		TAPE GUIDE ASSY	
26	1231888-04		ERASE HEAD ASSY, 1/2", 4 TRACK	
31	401-008		PIN, COTTER, 1/16 DIA X 3/4 LG	
32	403-006		PIN, "DRIV-LOK", TYPE C, 3/32 DIA	
33	470-425		SCREW, CAP, HEX SOC, BUT HD, NO. 4-40 X 1/4	
34	471-481		SCREW, MACH, FILL HD, SLOT, NO. 4-40 X 5/8	
35	473-098		SCREW, MACH, PN HD, XREC, NO. 10-32 X 7/16	
36	492-008		NUT, HEX, NO. 4-40	
37	493-001		NUT, SELF-LOCKING, HEX, NO. 4-40	
41	501-054		WASHER, FLAT, 0.203 DIA X 0.375 OD X 0.005 THK	
42	501-057		WASHER, FLAT, 0.203 ID X 0.375 OD X 0.010 THK	
43	501-064		WASHER, FLAT, 0.203 ID X 0.375 OD X 0.003 THK	
44	502-062		WASHER, LOCK, DOUBLE COIL, NO. 4	
			VERSION: 4020356-01	



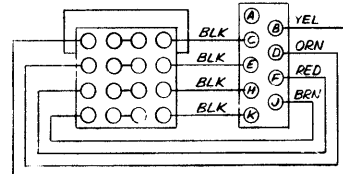
AS SHOWN



GATE ASSY (ITEM 9) OMITTED FOR DRAWING CLARITY



ERASE HEAD



P/B HEAD & REC HEAD

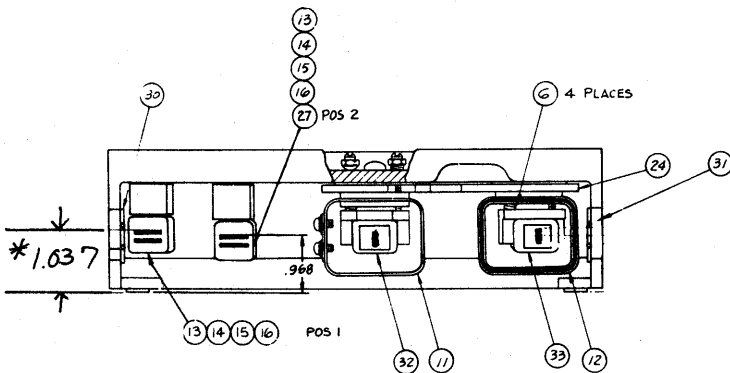
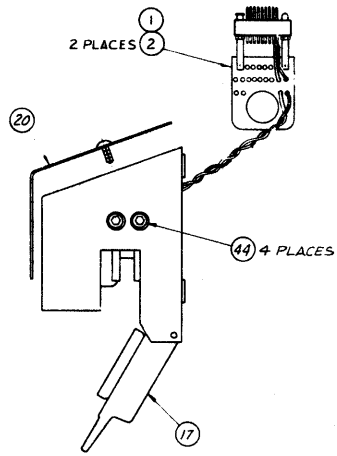
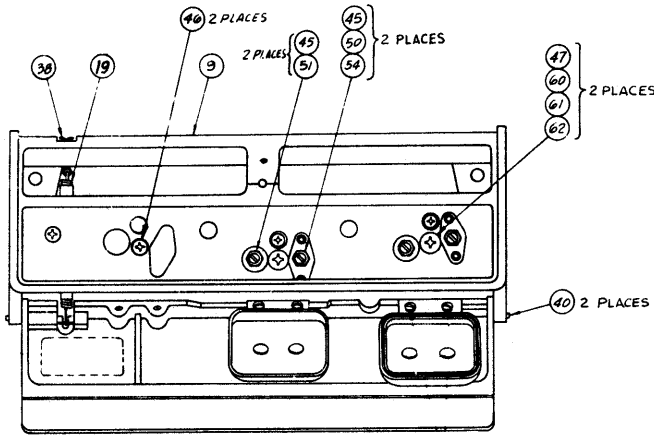
WIRING DIAGRAM

Assembly No. 4020356, 4 Track Head Assembly, 1/2-Inch Tape

NEXT HIGHER ASSEMBLY NO. 4010204

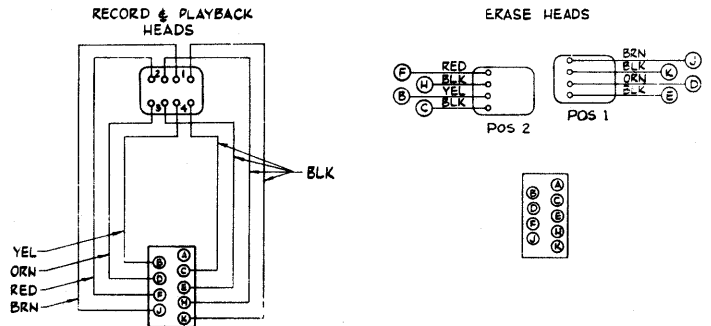
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4050446-04		HEAD CONNECTOR ASSY	
2	4050446-05		HEAD CONNECTOR ASSY	
6	4270167-10		SPRING, HEAD	
9	4350017-03		BASE, HEAD MOUNTING	
11	4350022-03		SHIELD, CAN ASSY, REC POS 3	
12	4350024-01		SHIELD, CAN ASSY, P/B, POS 4	
13	4350025-01		SHIM, ERASE HEAD, .010 THK	
14	4350025-02		SHIM, ERASE HEAD, .002 THK	
15	4350025-03		SHIM, ERASE HEAD, .003 THK	
16	4350025-04		SHIM, ERASE HEAD, .005 THK	
17	4350029-05		HEAD GATE ASSY	
19	4350035-01		SPRING, HEAD GATE	
20	4350038-01		OVERLAY ASSY, HEAD HOUSING	
24	4350063-01		SPACER, HEAD, 1/4" TAPE	
26	4350117-01		ERASE HEAD ASSY, TR 1 AND 3	
27	4350117-02		ERASE HEAD ASSY, TR 2 AND 4	
30	4350184-01		TAPE GUIDE ASSY, 1/4"	
31	4350184-02		TAPE GUIDE ASSY, 1/4"	
32	4350194-01		HEAD STACK ASSY, RECORD	
33	4350194-02		HEAD STACK ASSY, REPRO	
38	401-008		PIN, COTTER, 0.062 DIA X 0.750 LG	
40	403-006		PIN, GROOVED, HEADLESS, 0.094 DIA X 0.625 LG	
44	470-425		SCREW, HEX SOC, NO. 4-40 X 1/4 LG	
45	471-481		SCREW, FL HD, SLOT, NO. 4-40 X 5/8 LG	
46	471-088		SCREW, PN HD, XREC, NO. 10-32 X 3/4 LG	
47	473-156		SCREW, PN HD, XREC, NO. 10-32 X 9/16 LG	
50	492-008		NUT, HEX, NO. 4-40	
51	493-001		NUT, HEX, SELF LOCKING, NO. 4-40	
54	502-062		WASHER, LOCK, DOUBLE COIL	
60	501-054		SHIM, 0.203 ID X 0.375 OD X 0.005 THK	
61	501-057		SHIM, 0.203 ID X 0.375 OD X 0.10 THK	
62	501-064		SHIM, 0.203 ID X 0.375 OD X 0.003 THK	

VERSION: 4020359-01



-OI SHOWN

* 1.031 FOR RECORD+PLAY

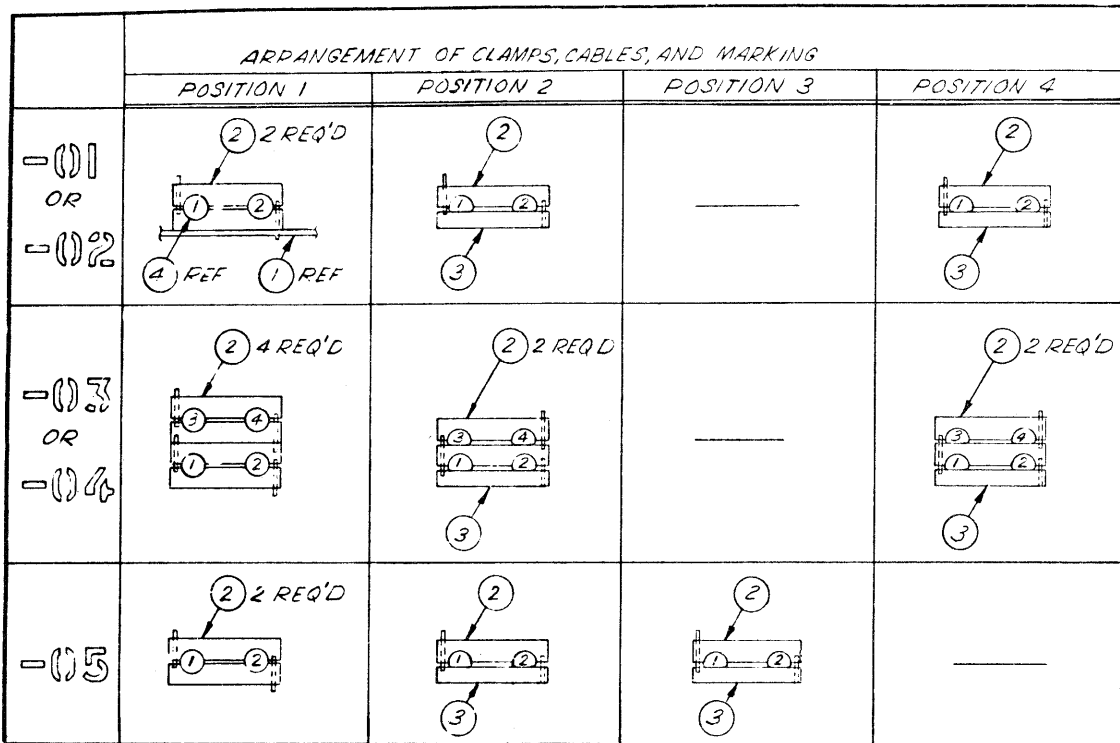


WIRING DIAGRAM OF HEADS

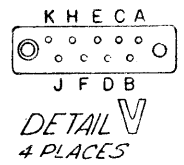
Assembly No. 4020359, 4 Track Head Assembly, 1/4-Inch Tape

NEXT HIGHER ASSEMBLY NO. 4010202, 4010203, 4010204

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4040947-02		BRACKET, HEAD CABLE MOUNTING	
2	4040951-01		CLAMP ASSY, CABLE	
3	4040952-01		CLAMP ASSY, CABLE PLAYBACK	
4	4050143-60		HEAD CABLE ASSY, ERASE	
5	4050445-01		HEAD CABLE ASSY, REPRODUCE	
6	4050651-01		HEAD CABLE ASSY, RECORD	
7	4041090-01		SHIELD, 2-4 TRACK	
8	4260110-01		BRACKET, HEAD SWITCH	
9	4290644-01		COVER, HEAD CABLE	
13	4350034-01		ROD, CONNECTING, 2-4 TRACK	
15	4600055-01		SHIELD, HEAD SWITCH, 2-4 TRACK	
16	4620124-20		SWITCH, SLIDE, 2-4 TRACK	
21	143-301		CONNECTOR, RECT RECP, 9 SOCKET	
22	180-983		STRIP, TERMINAL	
29	471-060		SCREW, PN HD, PHILL, XREC, NO. 4-40 X 0.250 LG	
30	471-069		SCREW, PN HD, PHILL, XREC, NO. 6-32 X 0.375 LG	
32	476-200		SCREW, SELF-TAP, HEX WASH HD, NO. 6 X 0.188 LG	
33	493-001		NUT, SELF-LOCKING, HEX, NO. 4-40	
34	493-007		NUT, SELF-LOCKING, NO. 8-32	
35	496-005		NUT, KEP, NO. 6-32	
38	501-009		WASHER, FLAT, NO. 6	
39	501-010		WASHER, FLAT, NO. 8	
VERSION: 4050653-01 1 TRACK 4050653-02 2 TRACK 4050653-04 4 TRACK 4050653-05 2-4 TRACK				



- (1) 1 THRU
3 PLACES (



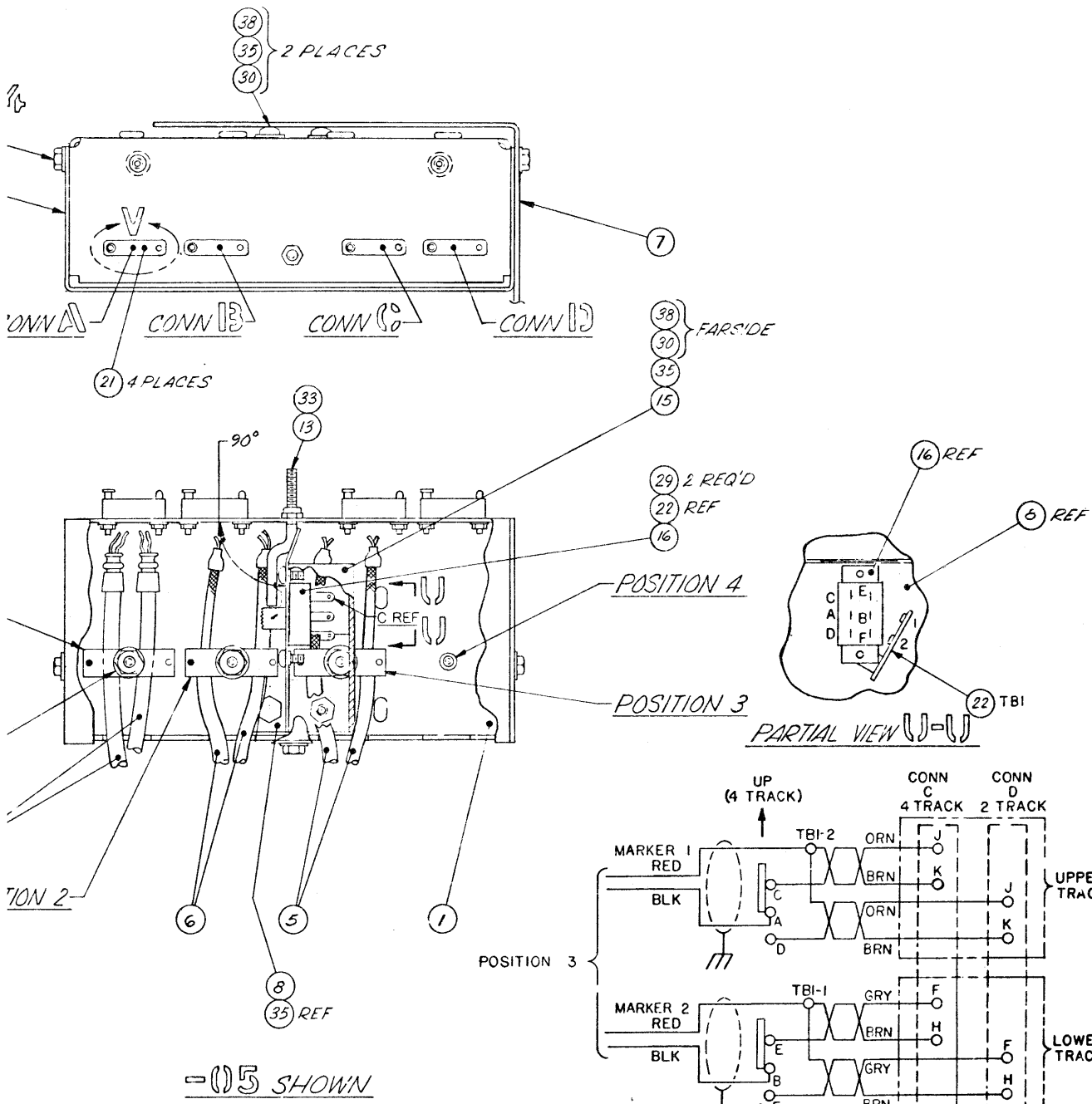
POSITION.

CONN A			
ITEM NO.	MARKER NO.	WIRE COLOR	PIN LETTER
(4) (ERASE)	1	WHT	J
		BLK	K
	2	WHT	F
		BLK	H
	3	WHT	D
		BLK	E
	4	WHT	B
		BLK	C

CONN D			
ITEM NO.	MARKER NO.	WIRE COLOR	PIN LETTER
(5) (REP)	1	RED	J
		BLK	K
	2	RED	F
		BLK	H
	3	RED	D
		BLK	E
	4	RED	B
		BLK	C

CONN B			
ITEM NO.	MARKER NO.	WIRE COLOR	PIN LETTER
(6) (REC)	1	RED	J
		BLK	K
	2	RED	F
		BLK	H
	3	RED	D
		BLK	E
	4	RED	B
		BLK	C

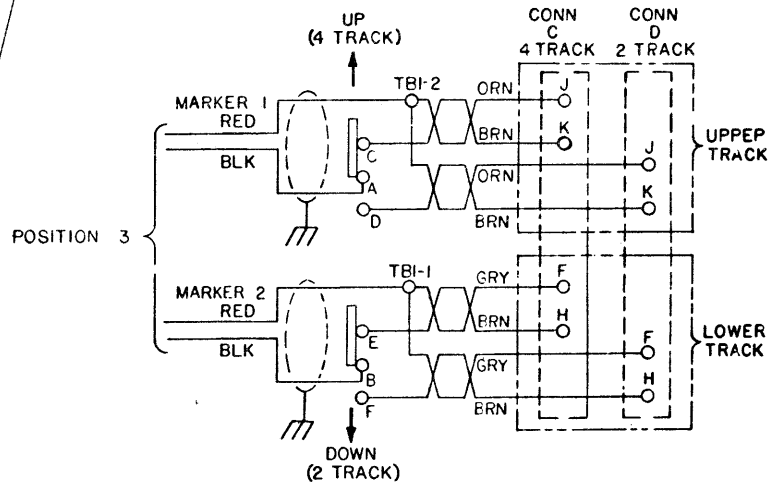
- (1) 5 ONLY
 FOR HOOKUP TO
 CONNECTORS C & D
 SEE SCHEMATIC



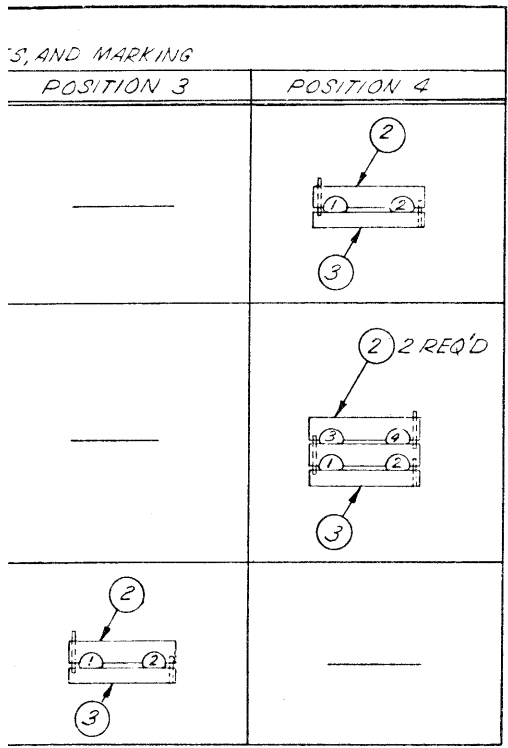
POSITION 2

8 35 REF

- (1) 5 SHOWN

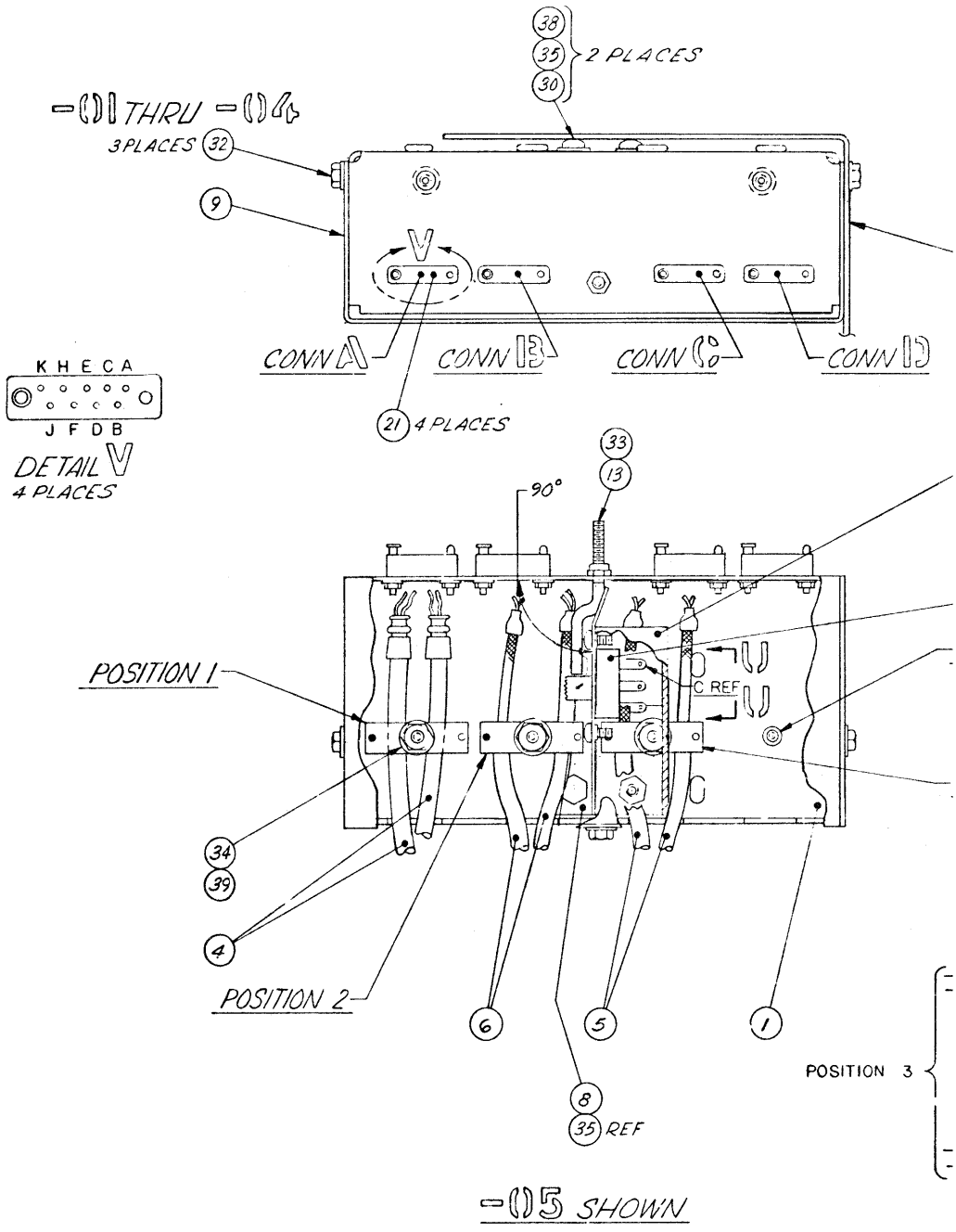


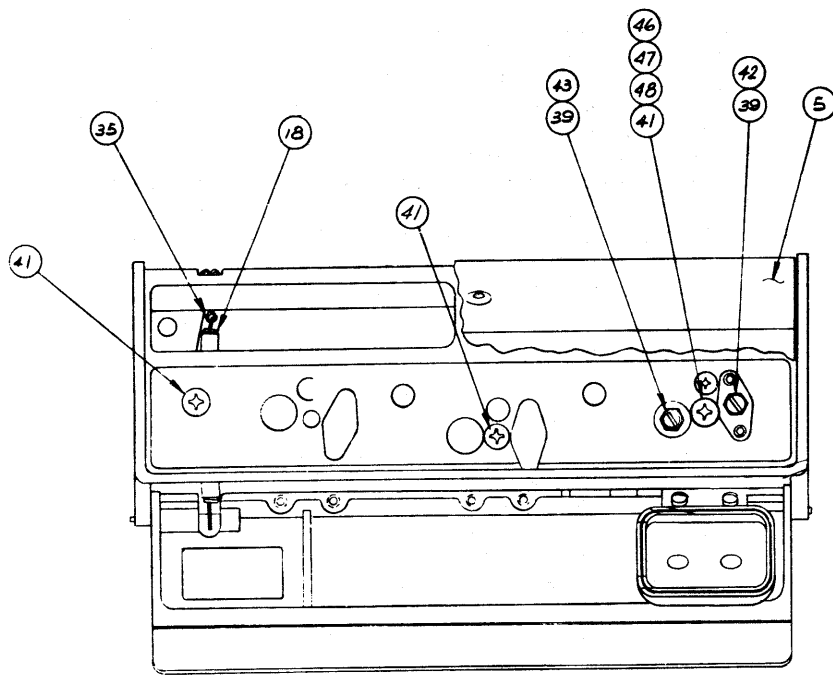
SCHEMATIC
- (1) 5 ONLY



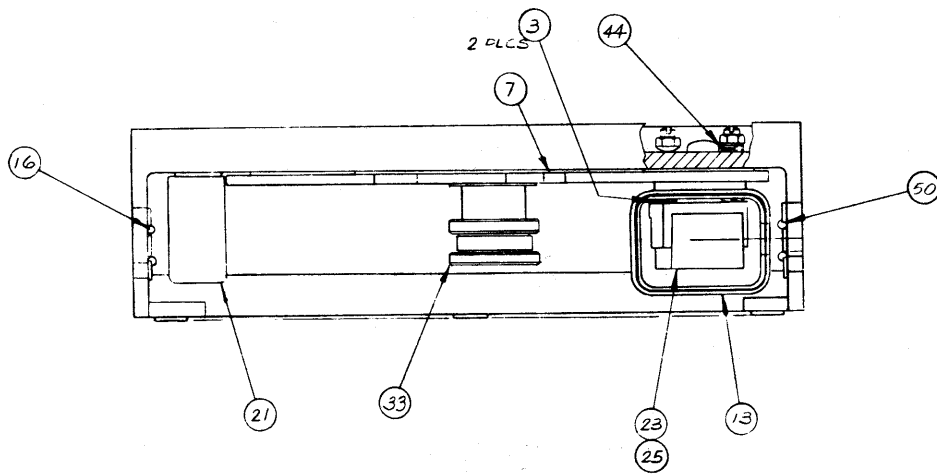
MARKER NO.	WIRE COLOR	CONN D
		PIN LETTER
1	RED	J
	BLK	K
2	RED	F
	BLK	H
3	RED	D
	BLK	E
4	RED	B
	BLK	C

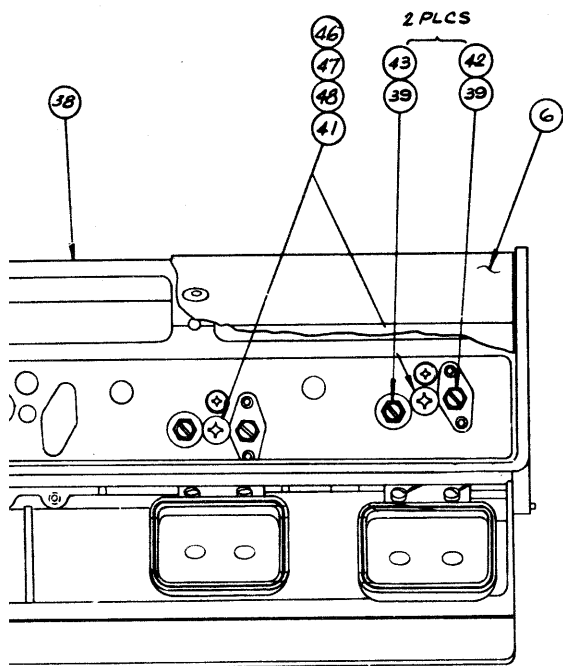
-05 ONLY
 FOR HOOKUP TO
 CONNECTORS C & D
 SEE SCHEMATIC



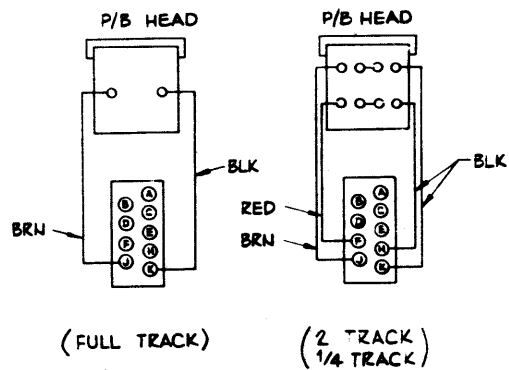
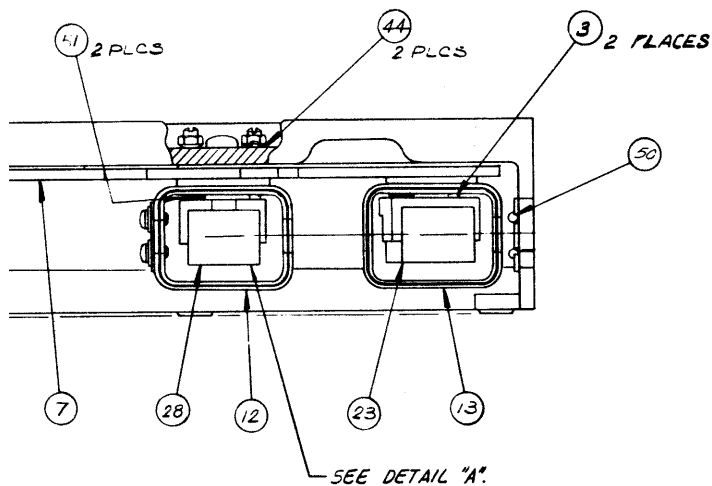
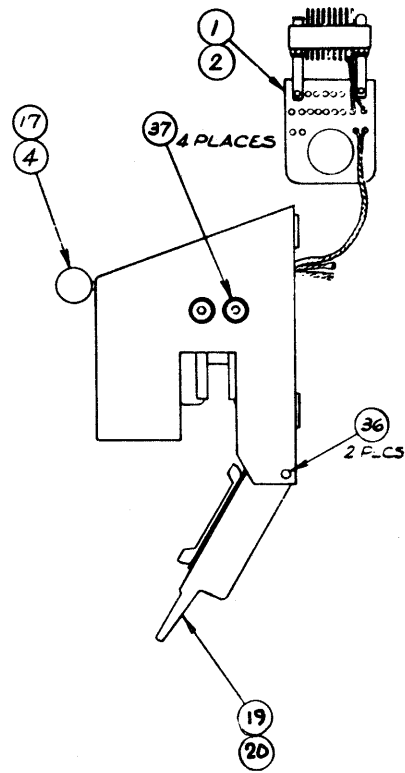


-04, -05



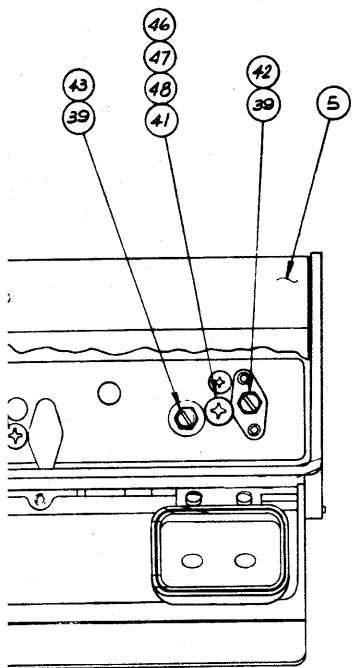


-06

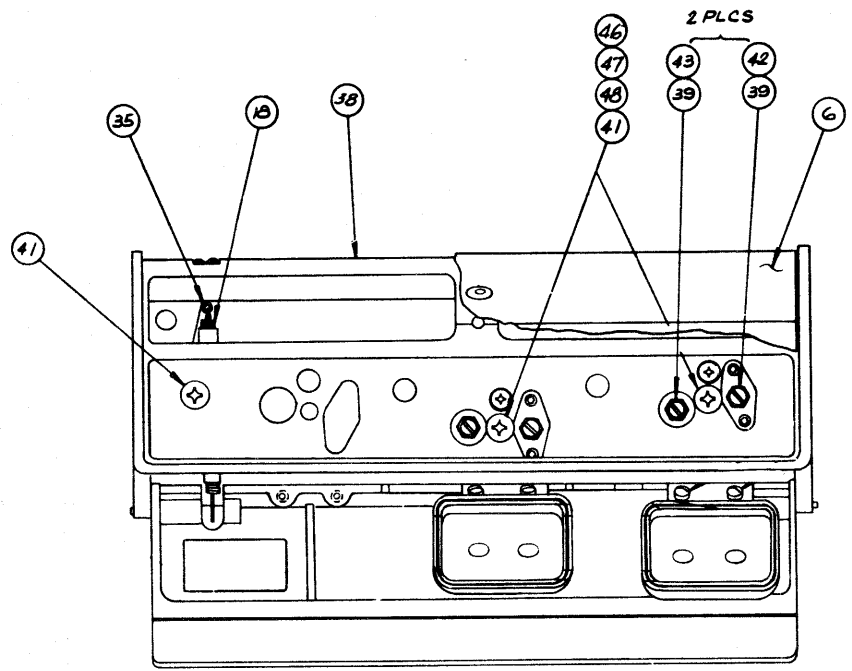


WIZING DIAGRAM

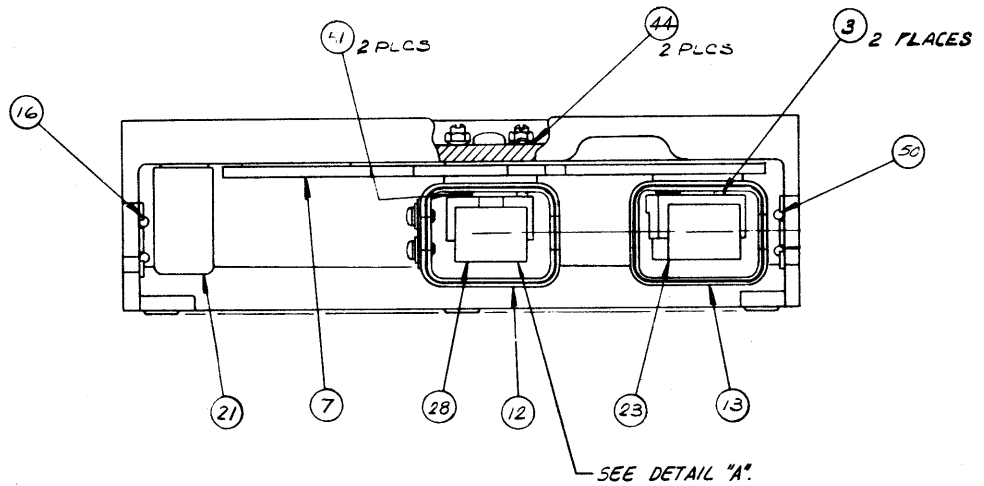
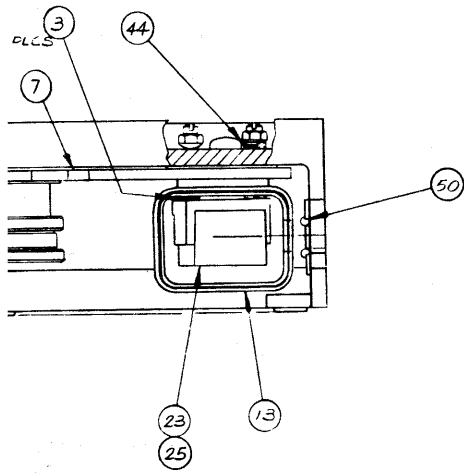
1 Track, 2 Track and 2-4 Track Head
Assemblies for 1/4" Tape
Assy No. 4020355



-05



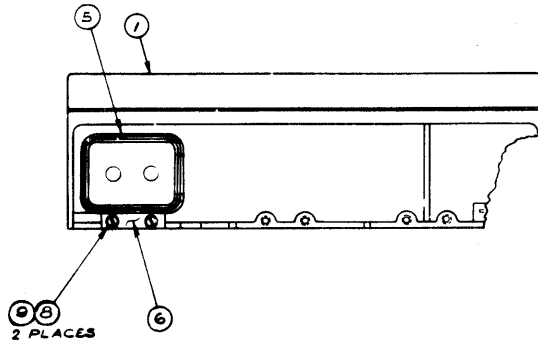
-06



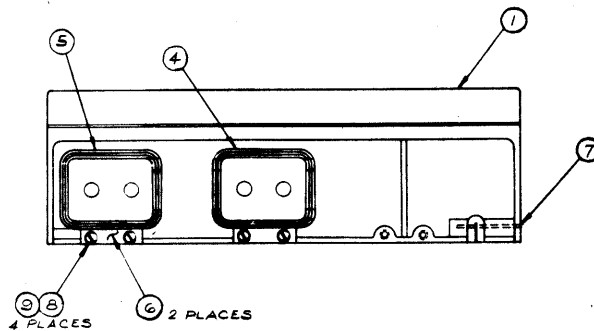
NEXT HIGHER ASSEMBLY NO. 4010297, 4010208

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4050446-01		HEAD CONNECTOR ASSY, 1 TRACK ONLY	
2	4050446-02		HEAD CONNECTOR ASSY, 2 AND 2-4 TRACK	
3	4270167-10		SPRING, HEAD	
4	4350011-01		KNOB, 2-4 TRACK ONLY	
5	4350038-01		OVERLAY ASSEMBLY, HEAD HOUSING, 1 AND 2 TRACK ONLY	
6	4350038-02		OVERLAY ASSEMBLY, HEAD HOUSING, 2-4 TRACK ONLY	
7	4350016-01		SPACER, HEAD 1/4" TAPE	
12	4350023-03		SHIELD, CAN ASSY, P/B POS. NO. 3, 2-4 TRACK ONLY	
13	4350024-01		SHIELD CAN ASSY, P/B POS. NO. 4	
16	4350184-01		TAPE GUIDE ASSY, 1/4"	
17	4210313-01		SHAFT, SWITCH 2-4 TRACK ONLY	
18	4350035-01		SPRING, HEAD GATE	
19	4350029-07		HEAD GATE ASSY, 1 AND 2 TRACK ONLY	
20	4350029-08		HEAD GATE ASSY, 2-4 TRACK ONLY	
21	4210136-01		POST, DUMMY HEAD	
23	4350094-22		HEAD STACK ASSY, P/B 2 TRACK	
25	4350095-02		HEAD STACK ASSY, 1 TRACK	
28	4350068-03		HEAD STACK ASSY. <i>1/4 TRACK SPAN 50 R 02/10</i>	
33	4210193-30		GUIDE, TAPE, 1 AND 2 TRACK ONLY	
35	401-008		PIN, COTTER, 1/16 DIA X 3/4 LG	
36	403-006		PIN, 'DRIV-LOK', 3/32 DIA, TYPE C	
37	470-425		SCREW, HEX SOC. BUT. HD. NO. 4-40 X 1/4	
39	471-481		SCREW, FILL. HD. SLOT, NO. 4-40 X 5/8	
41	473-156		SCREW, PAN HD. XREC, NO. 10-32 X 9/16	
42	492-008		NUT, HEX, NO. 4-40	
43	493-001		NUT, SELF LOCKING, NO. 4-40	
44	502-062		LOCKWASHER, DOUBLE COIL, NO.4	
46	501-054		WASHER, FLAT, 0.203 ID X 0.375 OD X 0.005 THK.	
47	501-057		WASHER, FLAT, 0.203 ID X 0.375 OD X 0.010 THK.	
48	501-064		WASHER, FLAT, 0.203 ID X 0.375 OD X 0.003 THK.	
50	4350184-02		TAPE GUIDE ASSY, 1/4"	
51	4270167-40		SPRING, HEAD, 2 AND 2-4 TRACK	
			VERSIONS: 4020355-04, 1 TRACK 4020355-05, 2 TRACK 4020355-06, 2 CHANNEL, 2-4 TRACK	

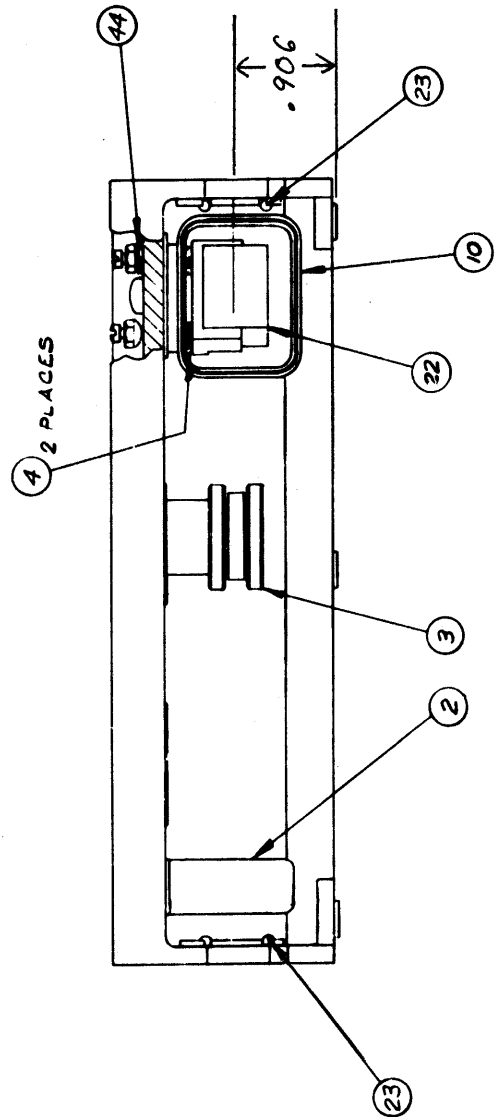
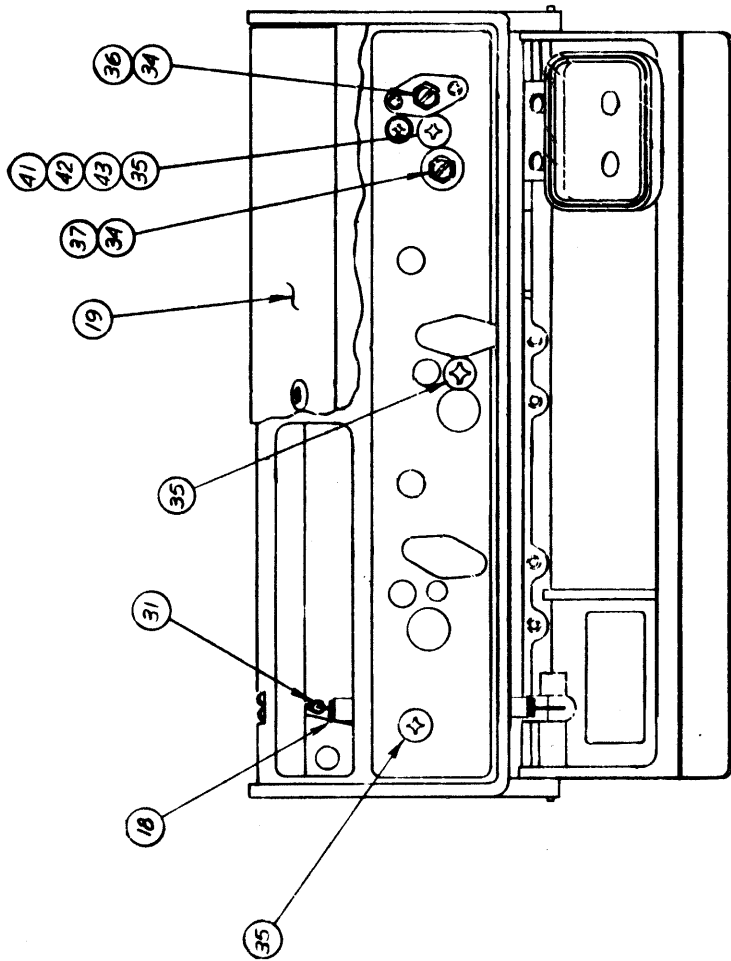
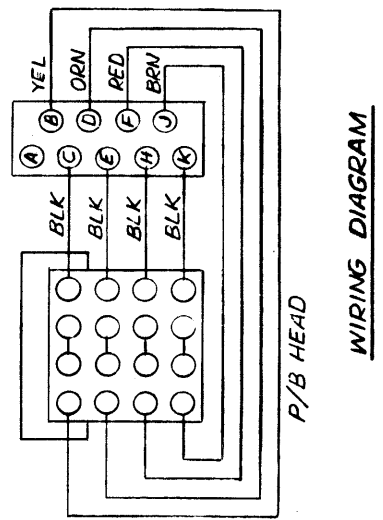
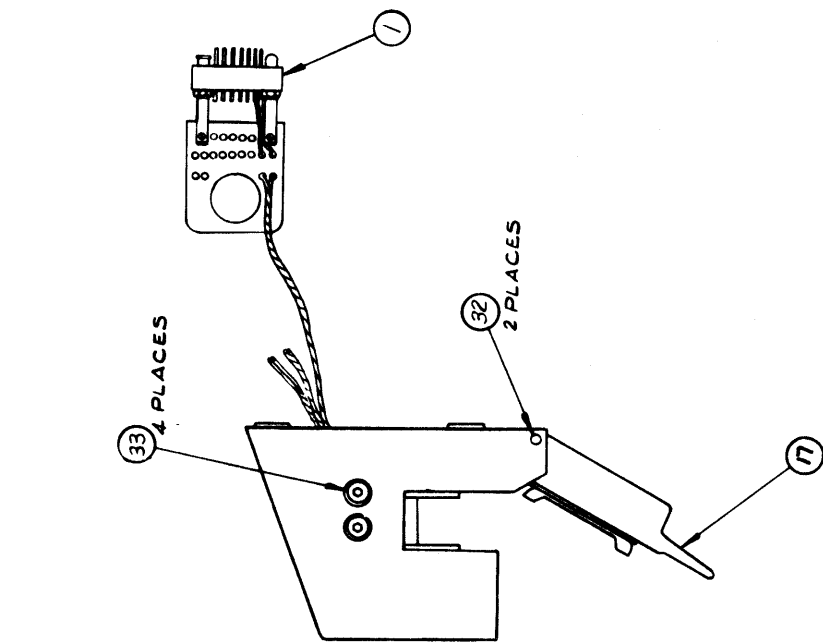
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4350018-02		GATE	
4	4350027-01		SHIELD COVER ASSY.	
5	4350028-01		SHIELD COVER ASSY.	
6	4270155-10		PLATE	
7	406-046		PIN, "ROLLPIN", 0.062 DIA X 1.00 LG	
8	471-478		SCREW, MACH. FIL. HD. SLOTTED (NO. 4-40 X 3/16)	
9	502-002		WASHER, LOCK SPRING NO. 4	
			VERSION: 4350029-07, 1 AND 2 TRACK 4350029-08, 2-4 TRACK	



1 AND 2 TRACK



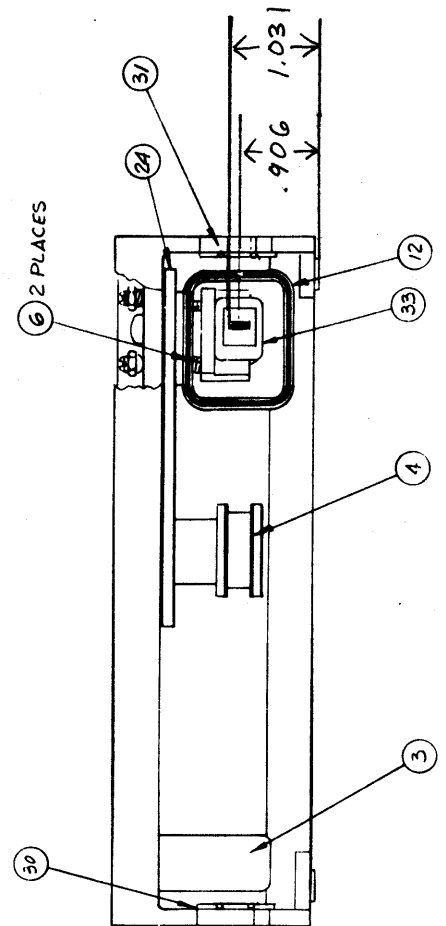
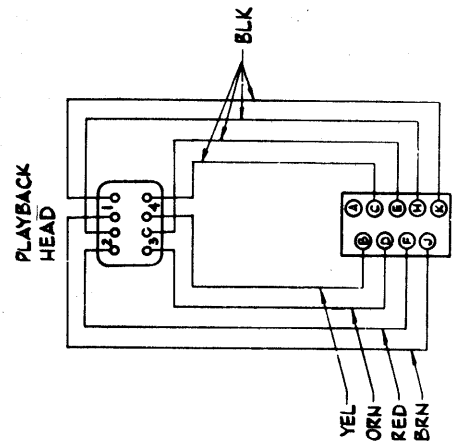
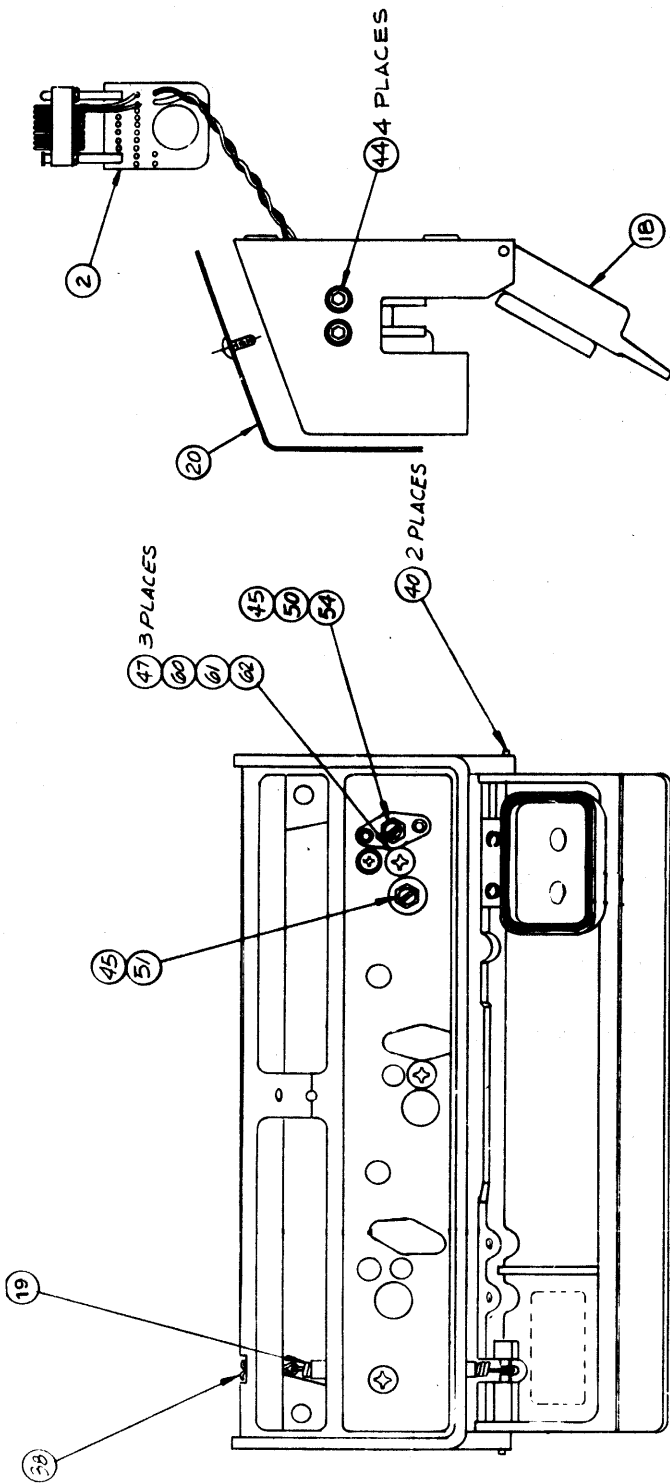
2-4 TRACK



4 Track Head Assembly for 1/2" Tape
Assy No. 4020356

NEXT HIGHER ASSEMBLY NO. 4010209

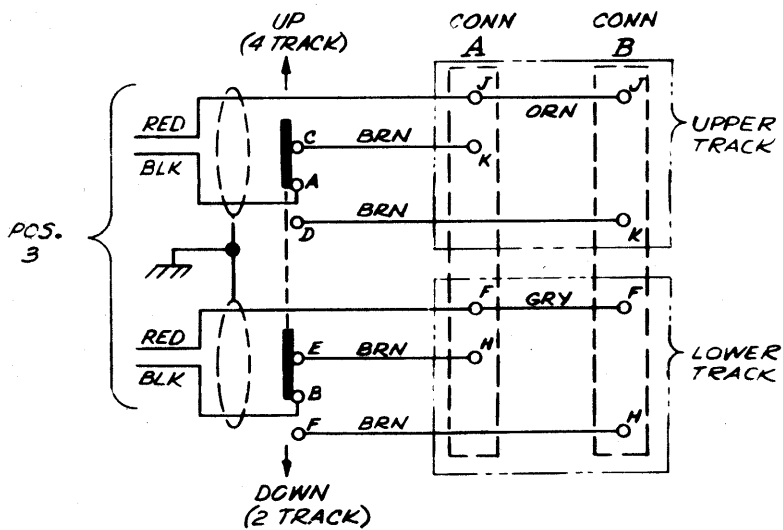
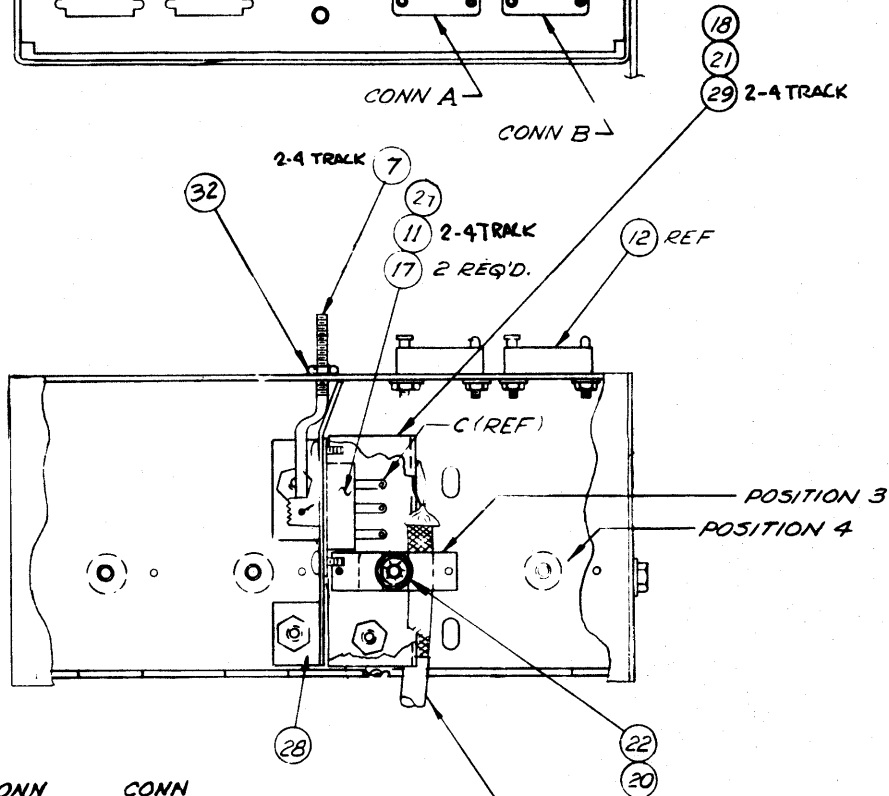
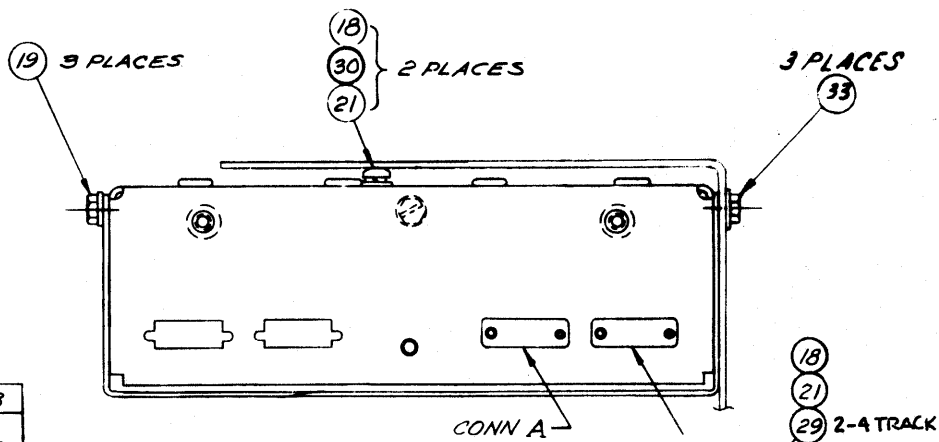
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4050446-04		HEAD CONNECTOR ASSY.	
2	4210136-01		POST, DUMMY HEAD	
3	4210193-40		GUIDE, TAPE	
4	4270167-10		SPRING, HEAD ADJUST	
10	4350024-02		SHIELD CAN ASSY, P/B POS. NO. 4	
11	4350025-01		SHIM, ERASE HEAD 0.010 THK	
12	4350025-02		SHIM, ERASE HEAD, 0.002 THK	
13	4350025-03		SHIM, ERASE HEAD, 0.003 THK	
14	4350025-04		SHIM, ERASE HEAD, 0.005 THK	
16	4350029-09		GATE ASSY. HEAD	
17	4350029-10		HEAD GATE ASSY	
18	4350035-01		SPRING, EXTENSION HEAD GATE	
19	4350038-01		OVERLAY ASSY HEAD HOUSING	
22	4350096-02		HEAD STACK ASSY, 4 CHANNEL P/B 4 TRACK	
23	4350188-01		TAPE GUIDE ASSY	
31	401-008		PIN, COTTER, 1/16 DIA. X 3/4 LG	
32	403-006		PIN, "DRIV-LOK", TYPE C 3/32 DIA.	
33	470-425		SCREW, CAP, HEX, SOC. BUT. HD, NO. 4-40 X 1/4	
34	471-481		SCREW, MACH, FILL. HD. SLOT., NO. 4-40 X 5/8	
35	473-098		SCREW, MACH. PAN HD. XREC., NO. 10-32 X 7/16	
36	492-008		NUT, HEX, NO. 4-40	
37	493-001		NUT, SELF LOCKING, HEX, NO. 4-40	
41	501-054		WASHER, 0.203 DIA X 0.375 OD X 0.005 THK, FLAT	
42	501-057		WASHER, 0.203 ID X 0.375 OD X 0.010 THK, FLAT	
43	501-064		WASHER, 0.203 ID X 0.375 OD X 0.003 THK, FLAT	
44	502-062		WASHER, LOCK, DOUBLE COIL, NO. 4	
			VERSION: 4020356-02	



4 Track Head Assembly for 1/4" Tape
 Assy No. 4020359

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
2	4050446-05		HEAD CONNECTOR ASSY	
3	4210136-01		POST, DUMMY HEAD	
4	4210193-30		GUIDE, TAPE	
6	4270167-10		SPRING, HEAD	
12	4350024-01		SHIELD CAN ASSY, P/B, POS NO. 4	
13	4350025-01		SHIN, ERASE HEAD, 0.010 THK	
14	4350025-02		SHIN, ERASE HEAD, 0.002 THK	
15	4350025-03		SHIN, ERASE HEAD, 0.003 THK	
16	4350025-04		SHIN, ERASE HEAD, 0.005 THK	
18	4350029-07		HEAD GATE ASSY.	
19	4350035-01		SPRING, HEAD GATE	
20	4350038-01		OVERLAY ASSY, HEAD HOUSING	
24	4350063-01		SPACER, HEAD, 1/4" TAPE	
30	4350184-01		TAPE GUIDE ASSY 1/4"	
31	4350184-02		TAPE GUIDE ASSY 1/4"	
33	4350194-02		HEAD STACK ASSY, REPRO.	
38	401-008		PIN, COTTER, 0.062 DIA X 0.750 LG	
40	403-006		PIN, GROOVED, HEADLESS, 0.094 DIA X 0.625 LG	
44	470-425		SCREW, HEX SOC, NO. 4-40 X 1/4 LG	
45	471-481		SCREW, FIL. HD, SLOT, NO. 4-40 X 5/8 LG	
47	473-156		SCREW PAN HD, XREC, NO. 10-32 X 9/16 LG	
50	492-008		NUT, HEX, NO. 4-40	
51	493-001		NUT, HEX SELF LOCKING, NO. 4-40	
54	502-062		LOCKWASHER, DOUBLE COIL	
60	501-054		SHIM, 0.203 I.D. X 0.375 O.D. X 0.005 THK	
61	501-057		SHIM, 0.203 I.D. X 0.375 O.D. X 0.10 THK	
62	501-064		SHIM, 0.203 I.D. X 0.375 O.D. X 0.003 THK	
			VERSION: 4020359-02	

ITEM NO.	MARKER NO.	WIRE COLOR	PIN LETTER	CONN B
⑥ (REP)	1	RED	J	
		BLK	K	
	2	RED	F	
		BLK	H	
	3	RED	D	
		BLK	E	
	4	RED	B	
		BLK	C	



SCHMATIC
2-4 TRACK

Head Cable Mounting Box Assembly
(1, 2 and 4 Channel)
Assy No. 4050448

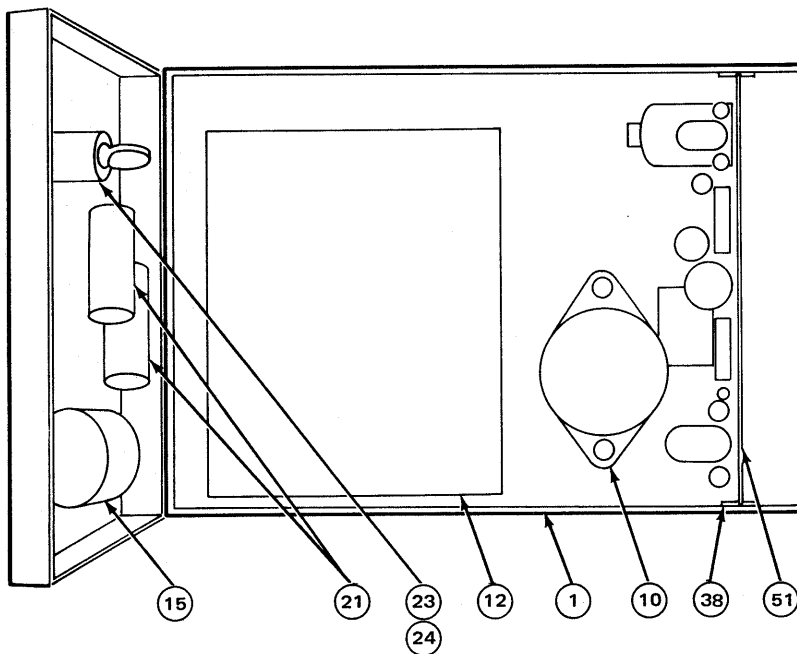
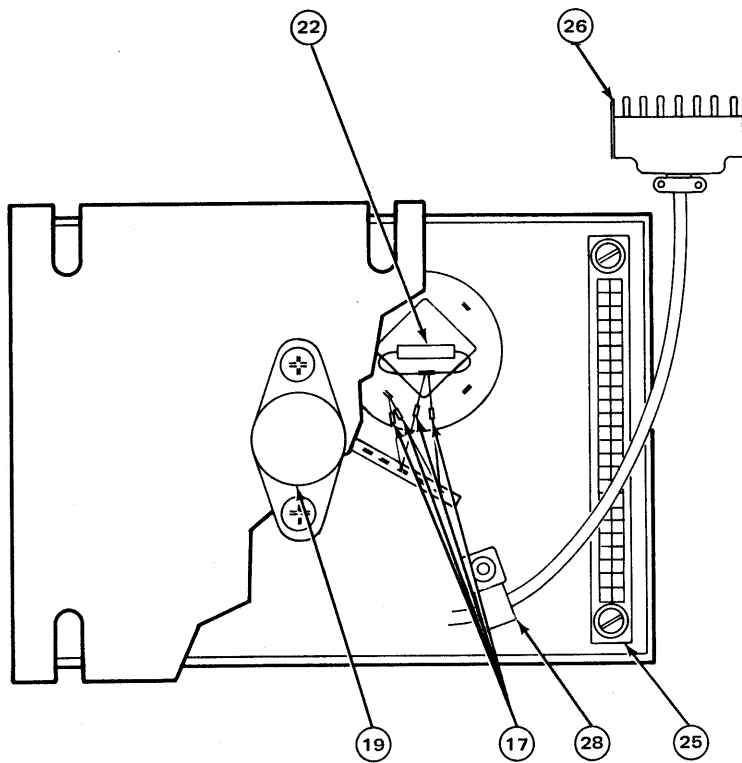
NEXT HIGHER ASSEMBLY NO. 4010207, 4010206, 4010209

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
2	4040951-01		CLAMP ASSY, CABLE	
3	4040952-01		CLAMP ASSY, PLAYBACK CABLE	
6	4050445-01		REPRODUCE, HEAD CABLE ASSY.	
7	4350034-01		ROD, SWITCH, U/O, 2-4 TRACK ONLY	
11	4620124-20		SWITCH, SLIDE, U/O 2-4 TRACK ONLY	
12	143-301		CONNECTOR, RECP, 9 SOCKET, RECTANGULAR	
17	471-060		SCREW, PAN HD, XREC, NO. 4-40 X 1/4	
18	471-069		SCREW, PAN HD, XREC, NO. 6-32 X 3/8	
19	476-200		SCREW, SELF TAP, HEX WASHER HD, NO. 6 X 3/16	
20	493-007		NUT, SELF LOCK, NO. 8-32	
21	501-009		WASHER, FLAT, NO. 6	
22	501-010		WASHER, FLAT, NO. 8	
27	180-983	TB1	STRIP, TERM, U/O 2 CHANNEL ONLY	
28	4260110-01		BRACKET, HEAD SWITCH	
29	4600055-01		SHIELD, HEAD SWITCH, U/ 2-4 TRACK ONLY	
30	496-005		NUT, KEP, NO. 6-32	
32	493-001		NUT, SELF LOCK, HEX, 4-40	
33	476-998		SCREW, SELF TAP, NO. 6 X 0.250	
			VERSIONS: 4050448-06 SINGLE CHANNEL 4050448-09 FOUR CHANNEL 4050448-11 2 CHANNEL	

NEXT HIGHER ASSEMBLY NO. 4010202, 4010203, 4010204

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4040967-01		CHASSIS, POWER SUPPLY ASSY	
2	4040968-03		PANEL, CONNECTOR, POWER SUPPLY	
5	4050443-01		HARNESS ASSY, POWER SUPPLY	
6	4290639-01		END COVER, POWER SUPPLY	
7	4290640-01		ENCLOSURE, POWER SUPPLY	
8	4330264-01		HEATSINK, POWER SUPPLY	
9	4400310-10		SCREW, SHOULDER	
10	4550147-03	C707	CAPACITOR, ELECT, 200 UF, 80V	
12	4580156-01	T702	TRANSFORMER, POWER	
15	001-945	C706	CAPACITOR, 500 MFD, 50V	
17	013-678	CR701-CR704	DIODE	1N4385
19	014-796	Q705	TRANSISTOR	2N4348
21	031-205	C709, 710	CAPACITOR, 5 UF, 50V	
22	041-158	R706	RESISTOR, 10K, 1W, 10T	
23	070-075	F701	FUSE, 1.5 AMP, 125V, SLO-BLO	
24	085-001		FUSEHOLDER, SHORT BODY	
25	143-307		CONNECTOR, PWB, 18 CONTACTS	
26	145-013	P706	CONNECTOR, MALE, 8 PINS	
27	260-052		GROMMET, NYLON	
28	302-007		CLAMP, CABLE, 1/4 ID	
29	471-064		SCREW, PAN HD, XREC, NO. 4-40 X 1/2 LG	
30	471-069		SCREW, PAN HD, XREC, NO. 6-32 X 3/8 LG	
31	476-998		SCREW, SELF-TAP, HEX HD, NO. 6 X 1/4 LG	
32	476-999		SCREW, SELF-TAP, HEX HD, NO. 6 X 3/8 LG	
33	496-004		NUT, KEP, NO. 4-40	
34	496-005		NUT, KEP, NO. 6-32	
35	496-006		NUT, KEP, NO. 8-32	
36	501-008		WASHER, FLAT, NO. 4	
37	506-013		WASHER, FLAT, D	
38	4230133-02		GUIDE, PWB	
42	014-703		WASHER, MICA	
43	172-003		LUG, TERMINAL, NO. 6	
44	471-071		SCREW, PAN HD, XREC, NO. 6-32 X 1/2	
45	496-005		NUT, KEP, NO. 6-32	
46	501-009		WASHER, FLAT, NO. 6	
47	503-089		WASHER, SHOULDER, NYLON	
48	302-030		CLAMP, CABLE, 3/8 ID	
50	498-445		NUT, SHEET SPRING, 0.125 DIA	
51	4050432-07		REGULATOR AND OSCILLATOR, PWA	
80	4840168		SCHEMATIC	

VERSION: 4020274-05

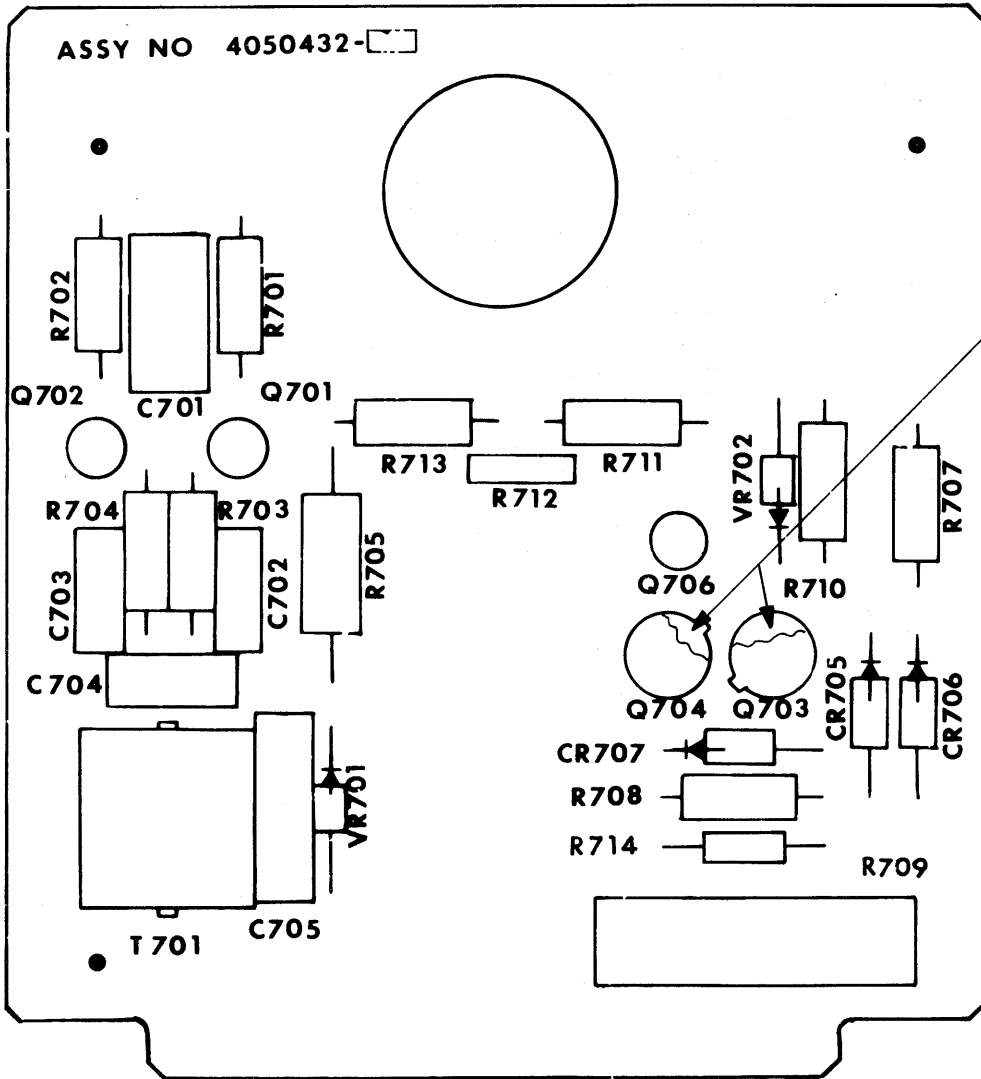


Assembly No. 4020274, Power Supply Assembly

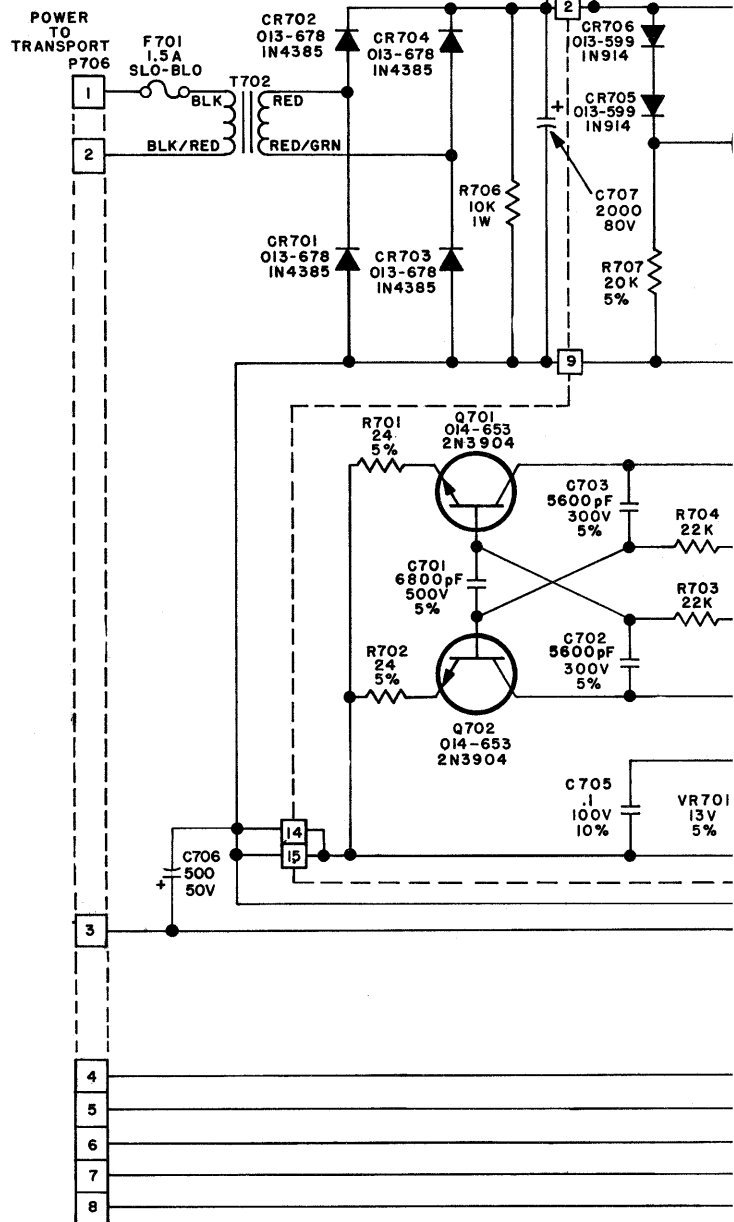
NEXT HIGHER ASSEMBLY NO. 4020274

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
2	4580123-01	T701	COIL, BIAS OSCILLATOR	
3	013-599	CR705, 706,707	DIODE	1N914
4	013-712	VR702	DIODE	LMAZ-24-OA
5	013-747	VR701	DIODE	2EZ13,OD5
6	014-590	Q704	TRANSISTOR	2N3053
7	014-653	Q701,702,706	TRANSISTOR	2N3904
9	014-704	Q703	TRANSISTOR	2N398A
11	034-994	C704	CAPACITOR, MICA, 2500 PF, 500V, 5%	
12	034-507	C702,703	CAPACITOR, MICA, 5600 PF, 300V, 5%	
15	041-055	R711	RESISTOR, FIXED, 3.9K, 1/2W, 10%	
16	041-064	R703, 704	RESISTOR, FIXED, 22K, 1/2W, 10%	
18	041-147	R705	RESISTOR, FIXED, 1.2K, 1W, 10%	
19	041-533	R701, 702	RESISTOR, FIXED, 24 OHM, 1/2W, 5%	
20	044-370	R712	RESISTOR, VAR, 1K, 1/10W	
21	055-106	C705	CAPACITOR, MYLAR, 0.1 UF, 100V, 10%	
22	056-108	C701	CAPACITOR, MICA, 6800 PF, 500V, 5%	
23	059-016	R709	RESISTOR, 1 OHM, 5W, 5%	
24	041-529	R707	RESISTOR, 20K, 1/2W, 5%	
26	280-131		PAD, TRANSISTOR	
27	041-038	R714	RESISTOR, FIXED, 100 OHM, 1/2W, 10%	
28	041-048	R708,710	RESISTOR, FIXED, 1K, 1/2W, 10%	
29	041-052	R713	RESISTOR, FIXED, 2.2K, 1/2W, 10%	
30	103307-01		STANDOFF	
37	4840168		SCHEMATIC	

VERSION: 4050432-07



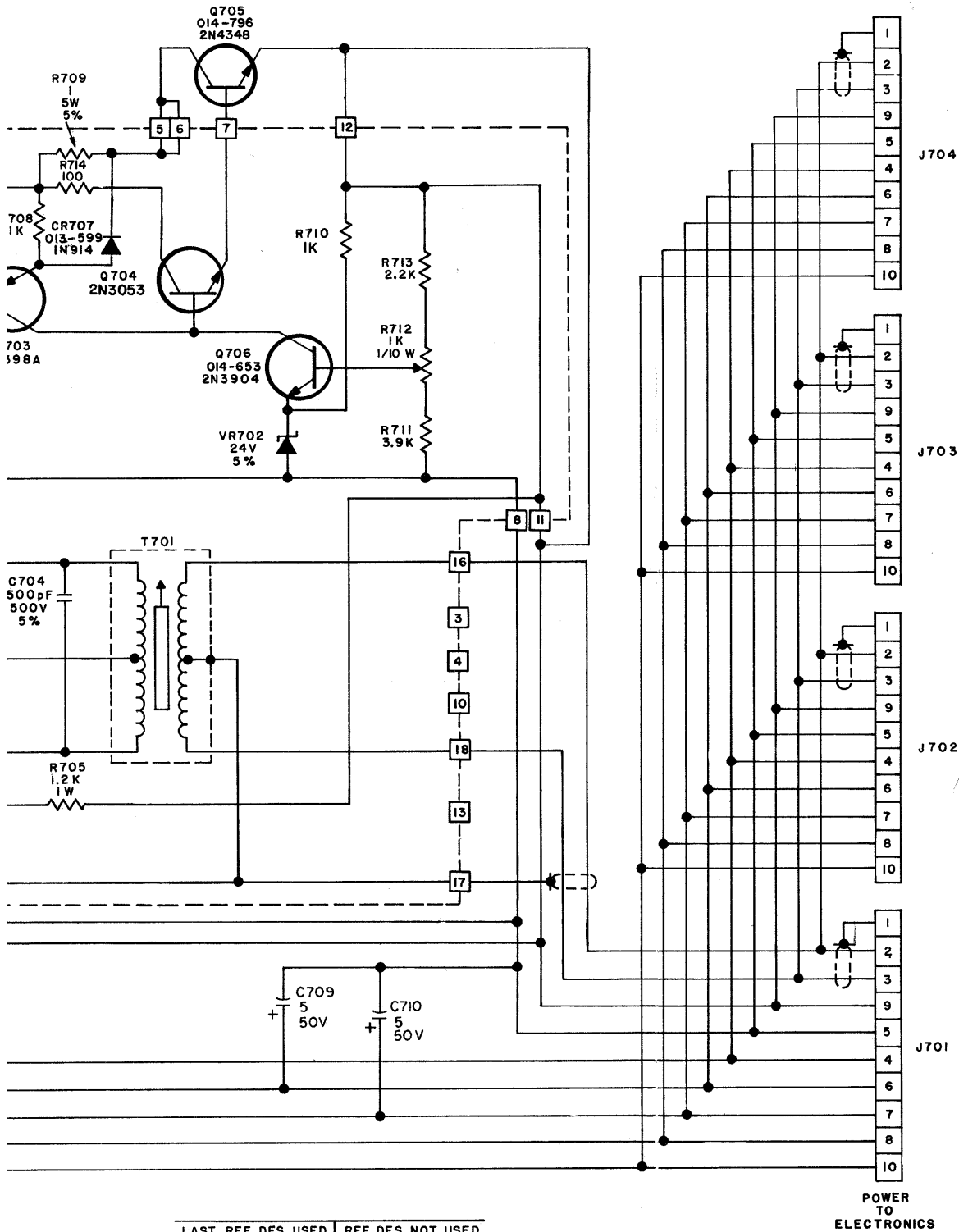
Assembly No. 4050432, Regulator and Oscillator PWA



NOTES:

UNLESS OTHERWISE SPECIFIED

1. ALL CAPACITOR VALUES ARE IN MICROFARADS, RATINGS AS INDIC
2. ALL RESISTORS VALUES ARE IN OHMS, 1/2 WATT, 10%.



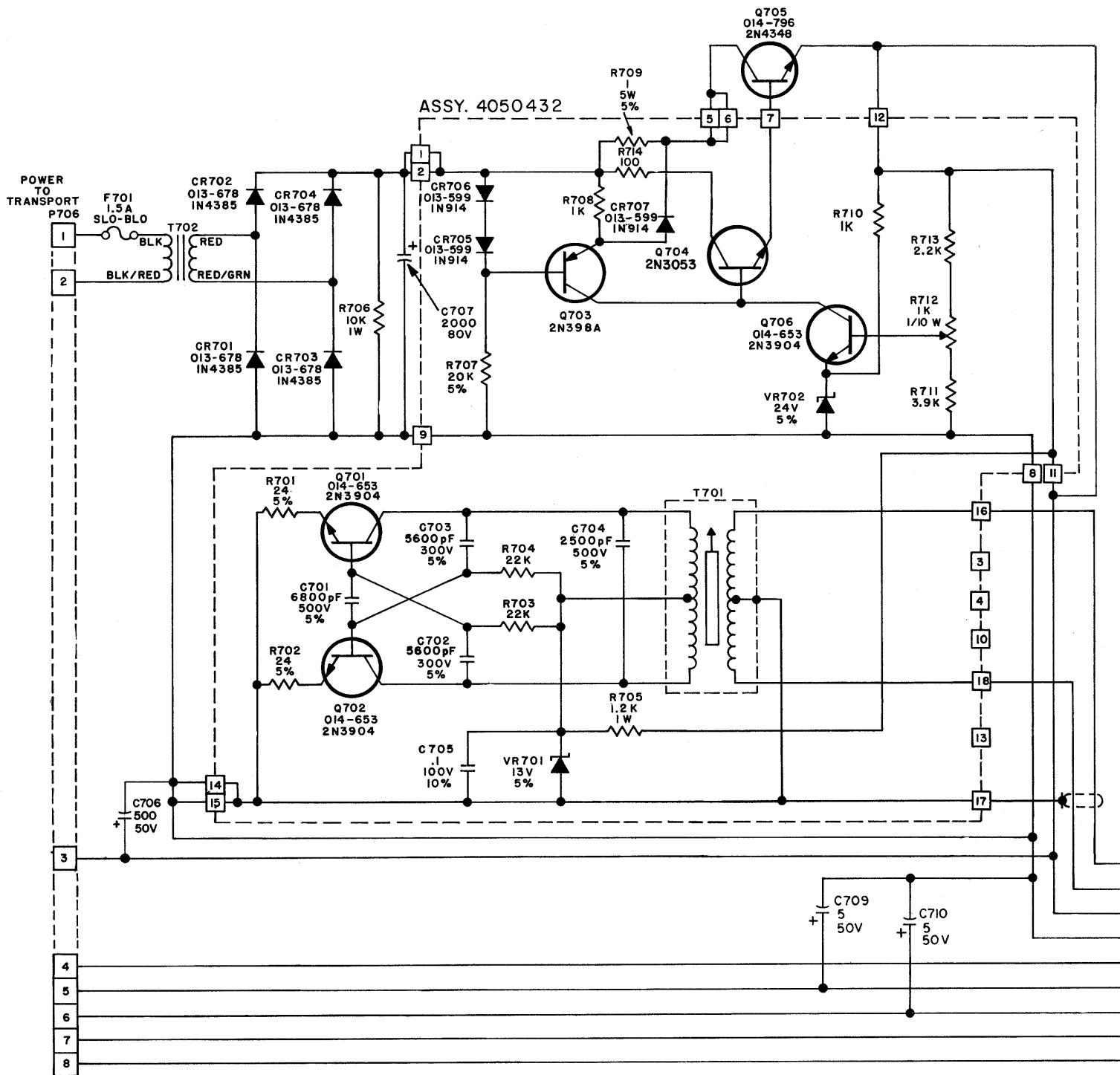
LAST REF. DES. USED	REF. DES. NOT USED
C710	C708
CR707	
Q706	
VR702	
T702	
R714	

D.

POWER
TO
ELECTRONICS

Schematic No. 4840168
Power Supply

6-87/88



NOTES:

UNLESS OTHERWISE SPECIFIED

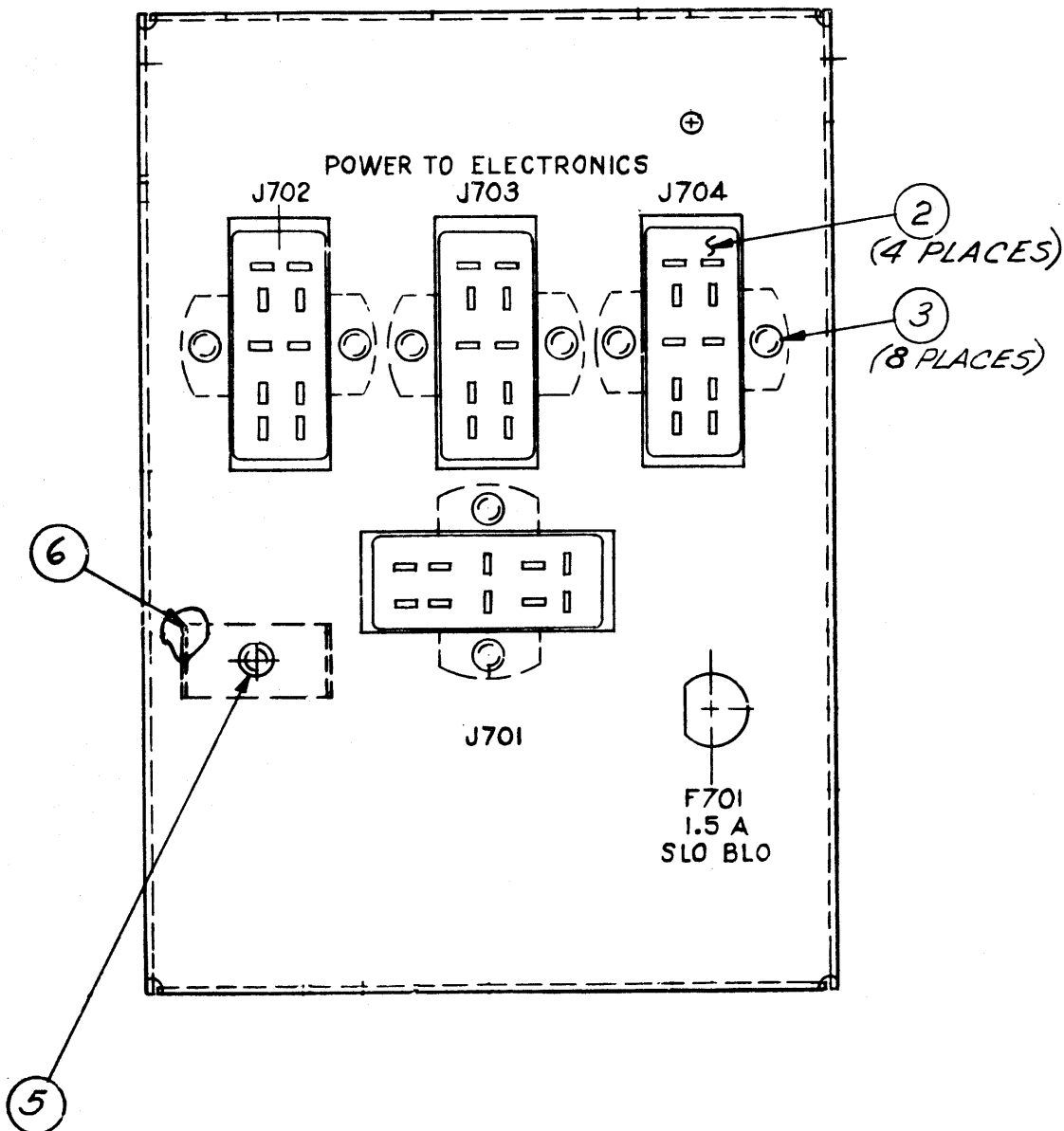
1. ALL CAPACITOR VALUES ARE IN MICROFARADS, RATINGS AS INDICATED.
2. ALL RESISTORS VALUES ARE IN OHMS, 1/2 WATT, 10%.

LAST REF. DES. USED	REF. DES. NOT USED
C710	C708
CR707	
Q706	
VR702	
T702	
R714	

NEXT HIGHER ASSEMBLY NO. 4020274

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
2	146-018		CONNECTOR, RECP, 10 PINS, FEMALE	
3	460-037		RIVET, 0.125 DIA X 0.156 LG	
5	460-998		RIVET, 0.125 DIA X 0.218 LG	
6	301-138		RETAINER, CAPACITOR	

VERSION: 4040968-03



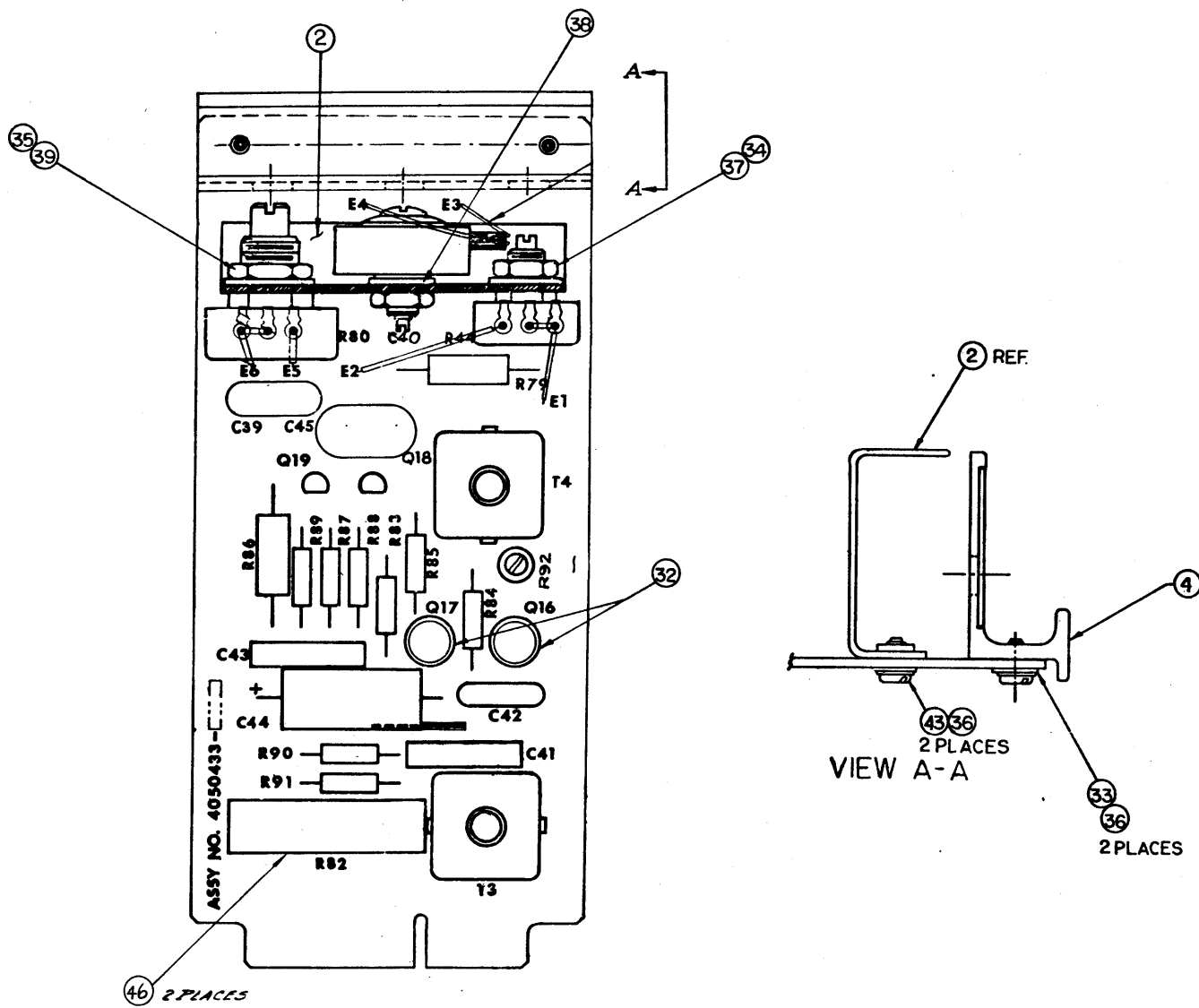
NEXT HIGHER ASSEMBLY NO. 4010202, 4010203, 4010204

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4030034-30		DUMMY PLUG ASSY	
2	4040978-01		COVER, ELECTRONICS	
3	4040978-02		COVER, ELECTRONICS	
6	4050433-08		BIAS AMPLIFIER PWA, 1/2" TAPE UNIT	
7	4050434-03		RECORD PWA	
8	4050435-12		REPRODUCE PWA	
9	4050564-01		RECORD CONTROL PWA	
10	4050593-01		PANEL ASSY, LEFT SIDE	
11	4050601-01		PANEL ASSY, BACK	
12	4050616-01		PANEL ASSY, FRONT	
13	4050621-01		PANEL ASSY, RIGHT SIDE	
14	4050632-01		ELECTRONICS HARNESS ASSY	
15	4050639-01		ENCLOSURE ASSY	
16	4050433-09		BIAS AMPLIFIER PWA, 1/4" TAPE UNIT	
18	4220245-01		SPACER, CHASSIS	
19	4600080-01		SHIELD, ENCLOSURE REAR	
23	4840248		SCHEMATIC, ELECTRONICS	
24	4840249		SCHEMATIC, ELECTRONIC MODULES	
31	302-160		CLAMP, CABLE, PLASTIC, 0.250 ID	
32	302-200		CLAMP, CABLE, PLASTIC, 0.375 ID	
34	471-069		SCREW, PAN HD, XREC, 6-32 X 3/8 LG	
35	473-105		SCREW, PAN HD, XREC, 6-32 X 2-1/2 LG	
36	473-324		SCREW, PAN HD, XREC, 4-40 X 1/4 LG	
39	475-085		SCREW, PAN HD, XREC, 6-32 X 5/16 LG	
40	476-998		SCREW, HEX WASHER HD, SELF TAPPING, NO. 6 X 1/4 LG	
41	476-999		SCREW, HEX WASHER HD, SELF TAPPING, NO. 6 X 3/8 LG	
43	496-005		NUT, KEP, NO. 6-32	
44	501-008		WASHER, FLAT, NO. 4	
45	501-009		WASHER, FLAT, NO. 6	
46	506-012		WASHER, NO. 6'D'	
			VERSION: 4020337-01 1/2 INCH TAPE UNIT 4020337-02 1/4 INCH TAPE UNIT	

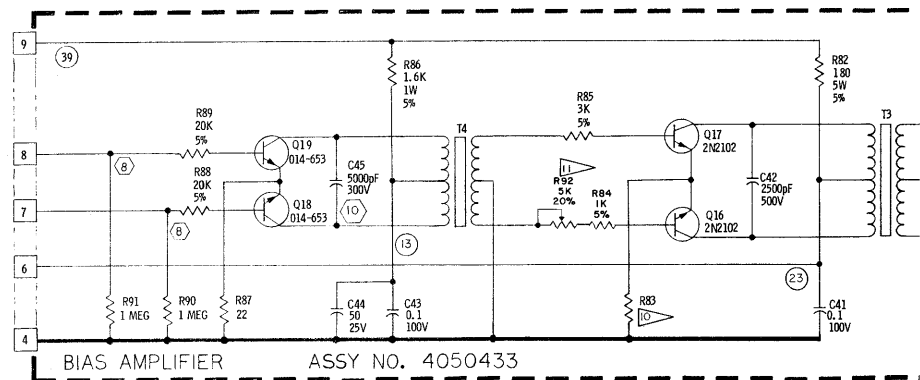
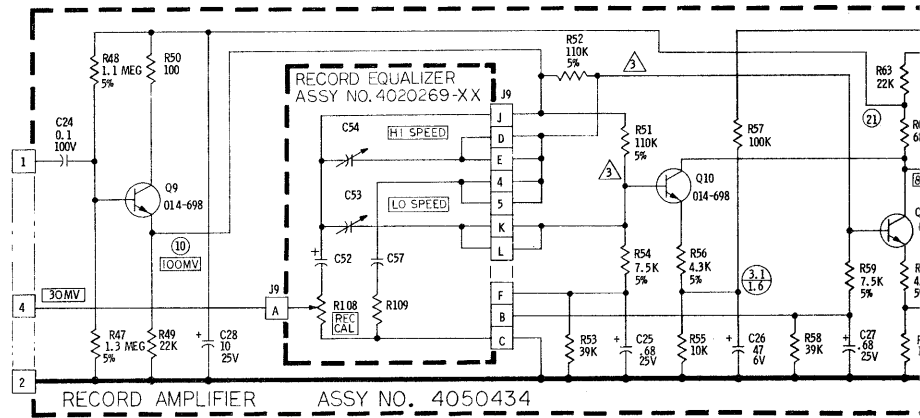
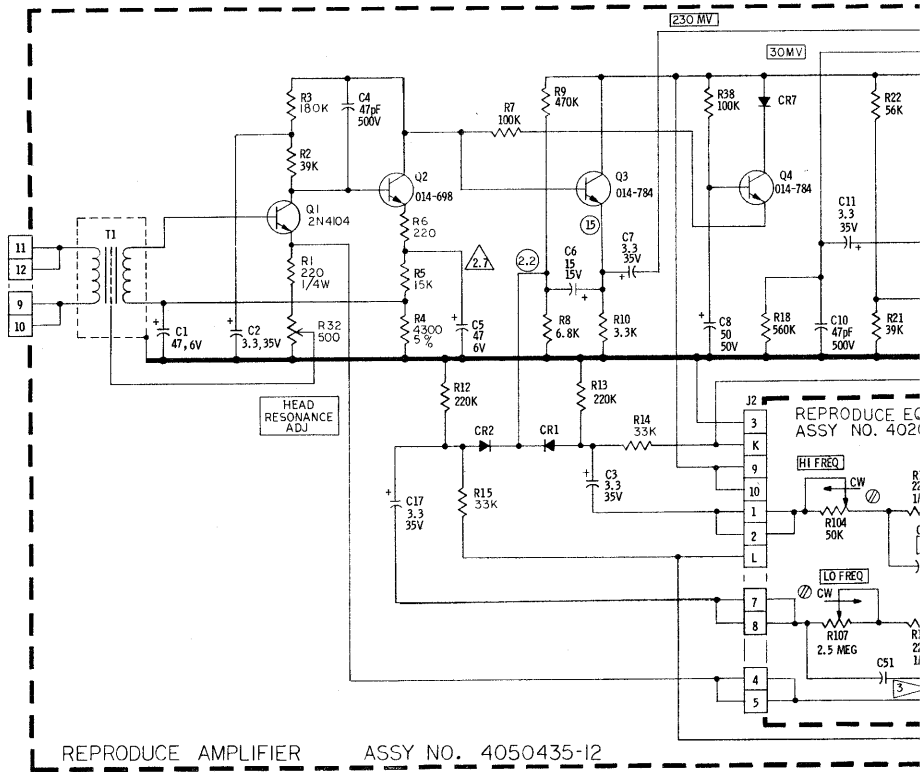
NEXT HIGHER ASSEMBLY NO. 4020337

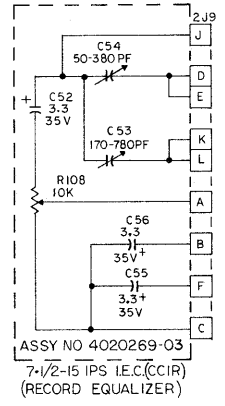
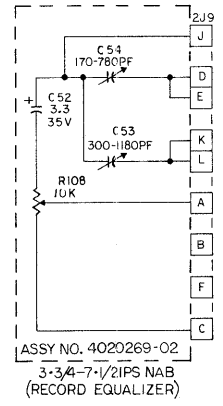
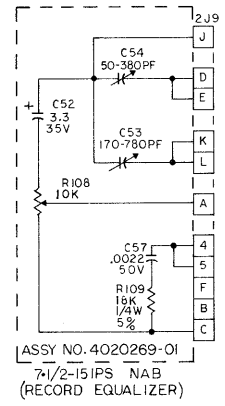
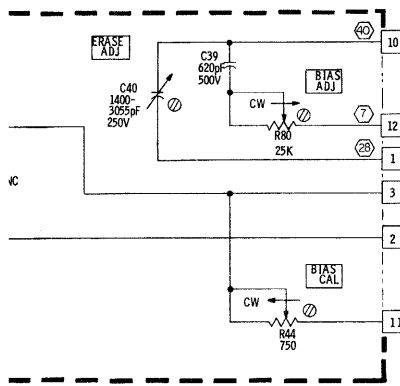
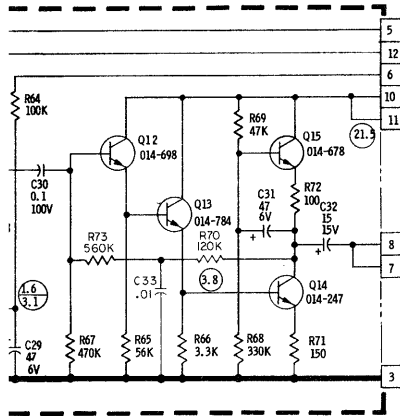
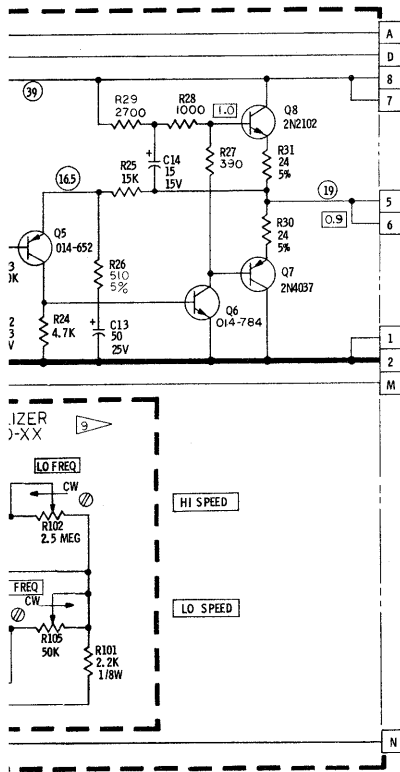
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
2	4040972-01		BRACKET, BIAS EQUALIZATION	
4	4330261-01		PLATE, FRONT, BIAS MODULE	
5	4520154-01	R44	POTENTIOMETER BIAS CALIBRATE, 750 OHM	
6	4520145-20	R80	POTENTIOMETER BIAS ADJUST, 24K	
7	4580123-01	T3,4	COIL, OSCILLATOR	
18	014-329	Q16,17	TRANSISTOR	2N2102
19	014-653	Q18,19	TRANSISTOR	2N3904
20	031-190	C44	CAPACITOR, ELEC, 50 MFD, 25V	
21	034-994	C42	CAPACITOR, MICA, 2500 PFD, 500V, 5%	
22	034-960	C45	CAPACITOR, MICA, 5000 PFD, 300V, 5%	
24	041-031	R90,91	RESISTOR, FIXED, 1M, 1/2W, 10%	
25	041-033	R87	RESISTOR, COMP, 22 OHM, 1/2W, 10%	
26	041-345	R83	RESISTOR, COMP, 51 OHM, 1/2W, 5%, USED ON 1/2" TAPE UNIT	
27	041-353	R86	RESISTOR, FIXED, 1.6K, 1W, 5%	
29	041-529	R88,89	RESISTOR, FIXED, 20K, 1/2W, 5%	
30	055-106	C41,43	CAPACITOR, MYLAR, 0.1 MFD, 100V, 10%	
31	059-017	R82	RESISTOR, WW, 180 OHM, 5W, 5%	
32	280-131		PAD, TRANSISTOR, 0.200 DIA	
33	475-006		SCREW, PAN HD, NO. 4-40 X 1/4 LG	
34	492-046		NUT, HEX, 1/4-32	
35	492-095		NUT, HEX, 3/8-32	
36	501-008		WASHER, FLAT, NO. 4	
37	502-028		WASHER, FLAT, INT TOOTH, 1/4"	
38	502-059		WASHER, FLAT, INT TOOTH, NO. 12	
39	502-083		WASHER, FLAT, INT TOOTH, 3/8	
42	034-028	C39	CAPACITOR, MICA, 620 PF, 500V, 5%	
43	475-007		SCREW, PAN HD, NO. 4-40 X 5/16 LG	
44	038-011	C40	CAPACITOR, VAR, 1,400 - 3,055 PF, 250V	
45	041-257	R83	RESISTOR, COMP, 180 OHM, 1/2W, 10%, USED ON 1/4" TAPE UNIT	
46	103307-01		STANDOFF	
47	041-245	R84	RESISTOR, COMP, 1K OHM, 1/2W, 5%	
48	044-944	R92	RESISTOR, VAR, CER, 5K OHM, 20%	
49	041-475	R85	RESISTOR, COMP, 3K OHM, 1/2W, 5%	
81	4840249		SCHEMATIC	

VERSION: 4050433-08 1/2" TAPE UNIT
 4050433-09 1/4" TAPE UNIT



Assembly No. 4050433, Bias Amplifier PWA

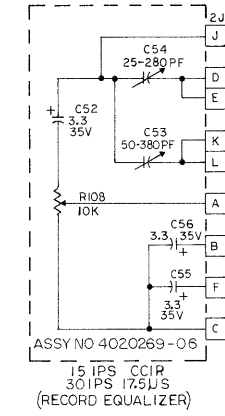
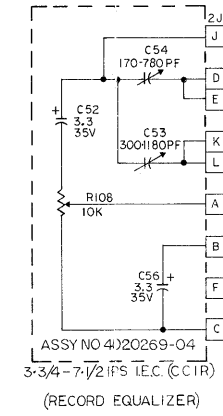
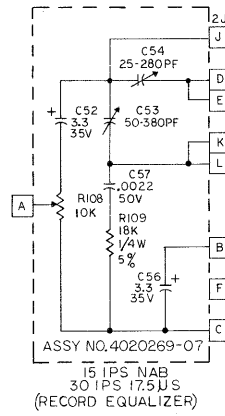


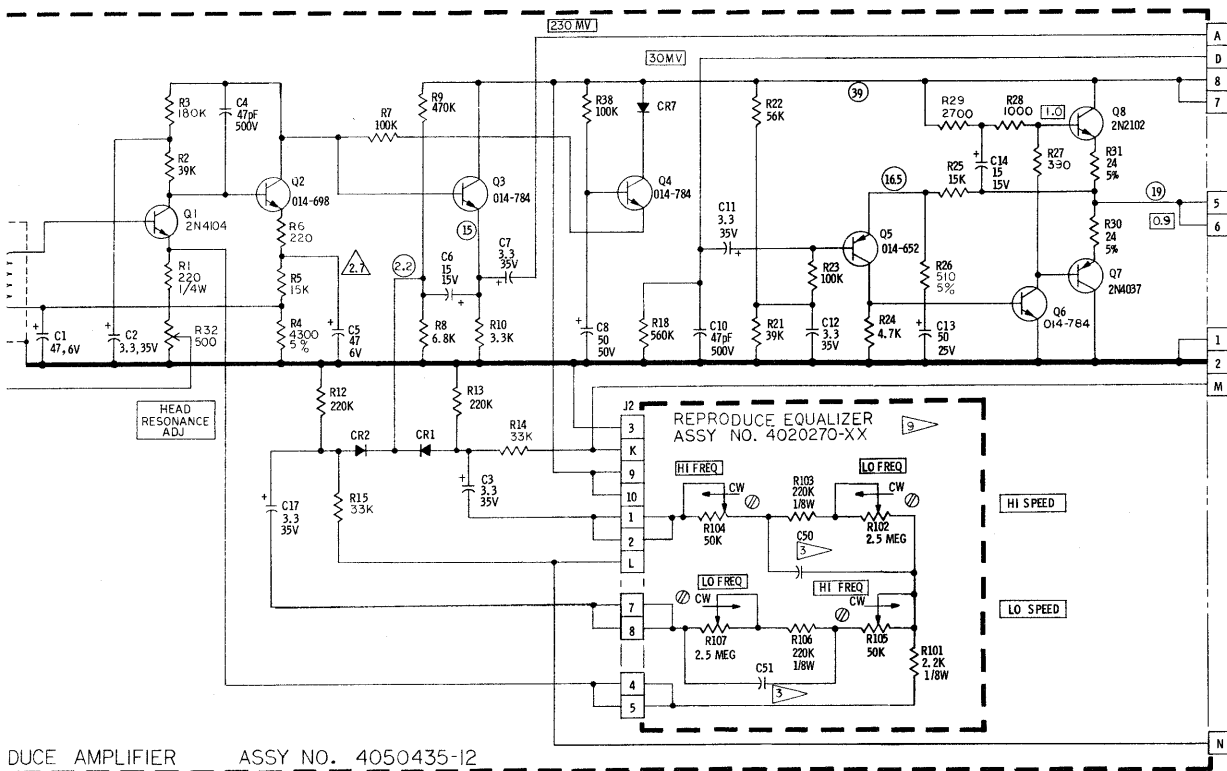


- NOTES: UNLESS OTHERWISE SPECIFIED
- CAPACITANCE VALUES ARE IN MICROFARADS
 - DIODES ARE TYPE 013-599.
 - .0047 FOR 4020270-01 EQUALIZER, .0033 FOR 4020270-02
 - RESISTANCE VALUES ARE IN OHMS 1/2W, 10%.
 - ⊗ INDICATES VOLTS D.C. MEASURED WITH A 20,000 OHM/VOLT METER.
 - ⊕ INDICATES VOLTS D.C. MEASURED WITH A HIGH IMPEDANCE VTVM.
 - ⊗⊗ INDICATES VOLTS R.M.S. MEASURED WITH A HIGH IMPEDANCE VTVM AT OPERATING LEVEL OF 700 Hz., +8VU OUT, 75 MIL TRACK HEADS.
 - ⊗⊗ INDICATES VOLTS R.M.S. MEASURED WITH A HIGH IMPEDANCE VTVM AT BIAS FREQUENCY.
 - EQUALIZER 4020270-01 CAN BE ADJUSTED FOR 3 3/4 THRU 15 IPS, NAB OR CCIR. EQUALIZER 4020270-02 CAN BE ADJUSTED FOR 7 1/2 THRU 30 IPS, NAB OR CCIR.

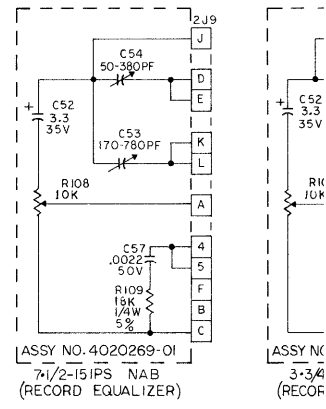
REF. DES.	AMPEX PIN	NEAREST COML. EQUIVALENT
CR1, CR2, CR7	013-599	1N914
Q14	014-247	2N2219
Q5	014-652	2N3906
Q18, Q19	014-653	2N3904
Q15	014-678	2N2219A
Q2, Q9-12	014-698	2N3117 OR 2N5088
Q3, 4, 13, 6	014-784	2N4946

- ⚠ 51Ω, 5% EXCEPT 180Ω, 10% FOR USE WITH 1/4 TRACK ERASE HEADS.
- ⚠ ADJUST R52 FOR MINIMUM NOISE FROM TAPE. IF NOISE NULL CAN NOT BE FOUND, CHECK COMPONENTS FOR IMBALANCE OR HEADS FOR MAGNETIZATION

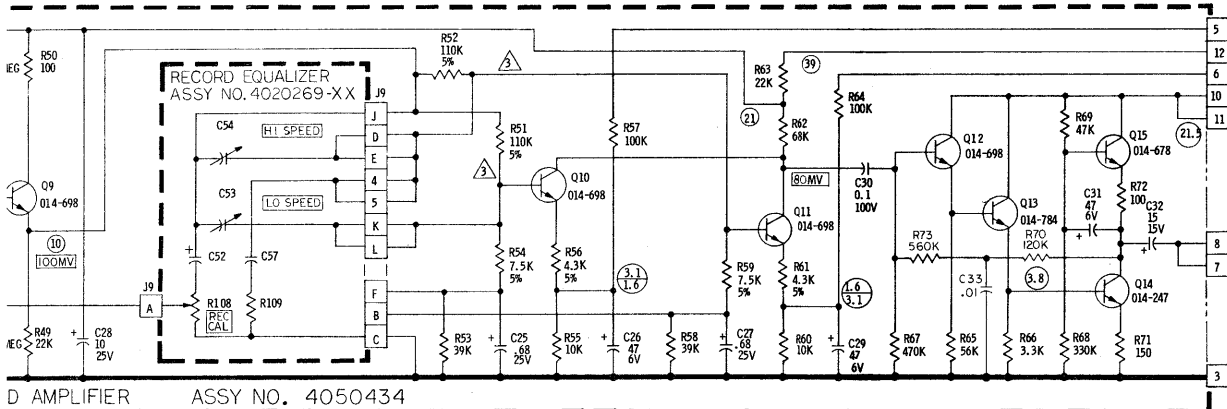




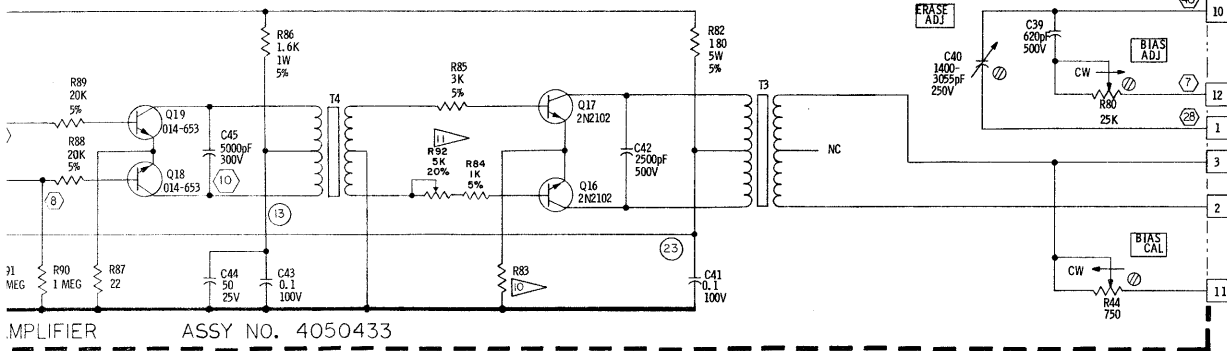
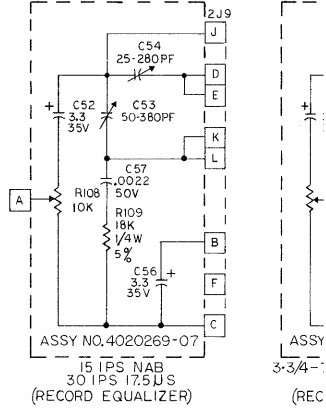
DUCE AMPLIFIER ASSY NO. 4050435-12



- NOTES: UNLESS OTHERWISE SPECIFIED:
- CAPACITANCE VALUE
 - DIODES ARE TYPE C
 - .0047 FOR 4020269-01
 - RESISTANCE VALUE
 - INDICATES VOLTAGE
 - INDICATES VOLTAGE
 - INDICATES VOLTAGE
 - INDICATES VOLTAGE
 - EQUALIZER 4020269-01



D AMPLIFIER ASSY NO. 4050434



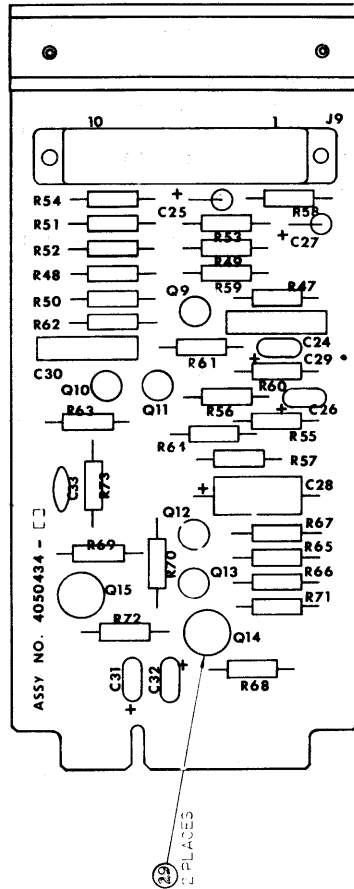
REF. DES.	A
CR1, CR2, CR7	
Q14	
Q5	
Q18, Q19	
Q15	
Q2, Q9-12	
Q3, 4, 13, 6	

51Ω, 5% I
ADJUST R92
CHECK COM

ASSY
3-3/4-
(REC)

NEXT HIGHER ASSEMBLY NO. 4020337

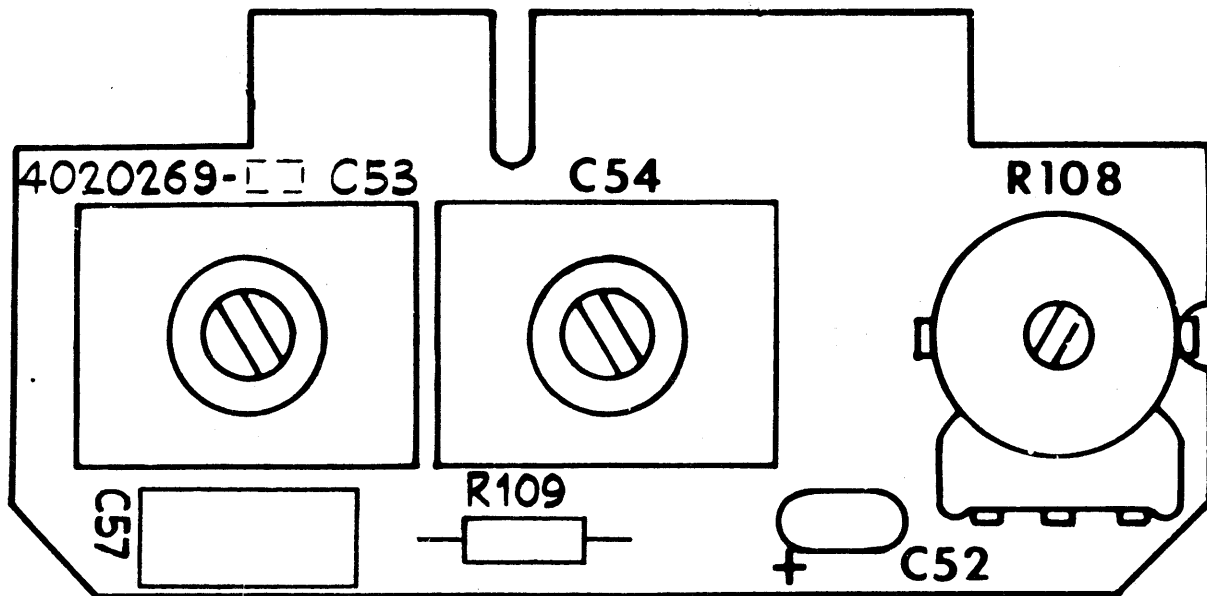
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
2	4030262-01		PLATE, FRONT, RECORD MODULE	
5	031-148	C28	CAPACITOR, ELEC, 10 UF, 25V	
6	037-446	C32	CAPACITOR, TANT, 15 UF, 15V, 20%	
7	037-494	C26, 29, 31	CAPACITOR, TANT, 47 UF, 6V, 20%	
9	055-106	C24, 30	CAPACITOR, MYLAR, 0.1 UF, 100V, 10%	
10	041-012	R56, 61	RESISTOR, FIXED, 4.3K, 1/2W, 5%	
11	041-024	R51, 52	RESISTOR, FIXED, 110K, 1/2W, 5%	
12	041-038	R50, 72	RESISTOR, FIXED, 100 OHM, 1/2W, 10%	
13	041-054	R66	RESISTOR, FIXED, 3.3K, 1/2W, 10%	
14	041-060	R55, 60	RESISTOR, FIXED, 10K, 1/2W, 10%	
15	041-064	R49, 63	RESISTOR, FIXED, 22K, 1/2W, 10%	
16	041-067	R53, 58	RESISTOR, FIXED, 39K, 1/2W, 10%	
17	041-068	R69	RESISTOR, FIXED, 47K, 1/2W, 10%	
18	041-069	R65	RESISTOR, FIXED, 56K, 1/2W, 10%	
19	041-070	R62	RESISTOR, FIXED, 68K, 1/2W, 10%	
20	041-072	R57, 64	RESISTOR, FIXED, 100K, 1/2W, 10%	
21	041-078	R68	RESISTOR, FIXED, 330K, 1/2W, 10%	
22	041-080	R67	RESISTOR, FIXED, 470K, 1/2W, 10%	
24	041-241	R71	RESISTOR, FIXED, 150 OHM, 1/2W, 10%	
25	041-361	R54, 59	RESISTOR, FIXED, 7.5K, 1/2W, 5%	
26	041-377	R47	RESISTOR, FIXED, 1.3M, 1/2W, 5%	
27	041-898	R48	RESISTOR, FIXED, 1.1M, 1/2W, 5%	
29	280-131		PAD, TRANSISTOR	
30	475-006		SCREW, PAN HD, NO. 4-40 X 1/4	
31	501-008		WASHER, FLAT, NO. 4	
32	4030270-01	J9	CONNECTOR ASSY, 10 PIN	
35	014-784	Q13	TRANSISTOR	2N4946
36	014-678	Q15	TRANSISTOR	2N3945
37	014-247	Q14	TRANSISTOR	2N2219
38	014-698	Q9-12	TRANSISTOR	2N3565
39	067-026	C25, 27	CAPACITOR, TANT, .68 UF, 25V, 5%	
41	041-073	R70	RESISTOR, COMP, 120K, 1/2W, 10%	
42	041-081	R73	RESISTOR, COMP, 560K, 1/2W, 10%	
45	030-057	C33	CAPACITOR, CER, 0.01 UF, 100V, 20%	
49	4840249		SCHEMATIC	
VERSION: 4050434-03				



Assembly No. 4050434, Record Amplifier PWA

NEXT HIGHER ASSEMBLY NO. 4010202, 4010203, 4010204

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
3	4540314-02	C54	CAPACITOR, TRIMMER, 50-380 PF, 7-1/2 - 15 IPS	
4	4540314-03	C53	CAPACITOR, TRIMMER, 170-780 PF, 7-1/2 - 15 IPS	
5	4540314-03	C54	CAPACITOR, TRIMMER, 170-780 PF, 3-3/4 - 7-1/2 IPS	
6	4540314-04	C53	CAPACITOR, TRIMMER, 300-1180 PF, 3-3/4 - 7-1/2 IPS	
7	037-654	C52	CAPACITOR, TANT, 3.3 UF, 35V, 20%	
10	055-164	C57	CAPACITOR, TANT, 3.3 UF, 35V, 20%	
11	041-436	R109	RESISTOR, FIXED, 18K, 1/4W, 5%, 7-1/2 - 15 IPS & 15-30 IPS	
12	037-654	C56	CAPACITOR, TANT, 3.3 UF, 35V, 20%, 15-30 IPS	
13	4540314-01	C54	CAPACITOR, TRIMMER, 25-280 PF, 15-30 IPS	
14	4540314-02	C53	CAPACITOR, TRIMMER, 50-380 PF, 15-30 IPS	
18	4520153-07	R108	POTENTIOMETER, RECORD CALIBRATION, 10K	
21	4840249		SCHEMATIC	
VERSION: 4020269-01 7-1/2 - 15 NAB 4020269-02 3-3/4 - 7-1/2 NAB 4020269-07 15 - 30 NAB				

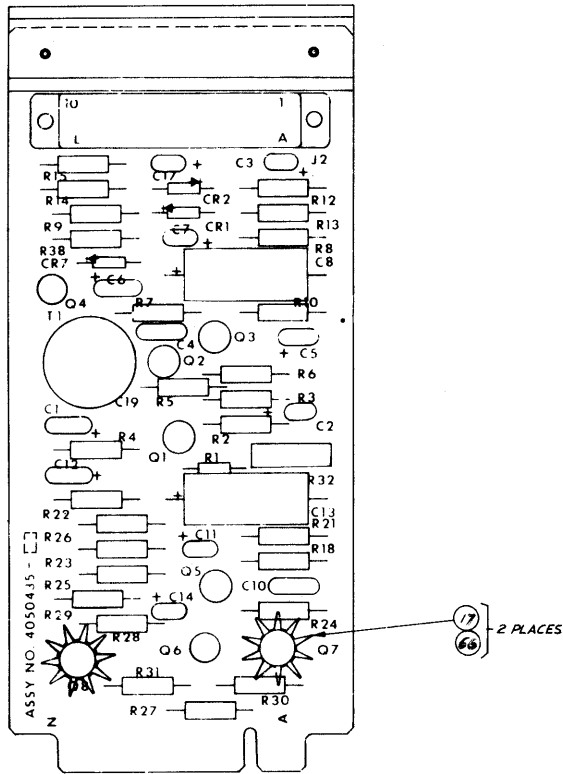


Assembly No. 4020269, Record Equalizer PWA

NEXT HIGHER ASSEMBLY NO. 4020337

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4030270-02	J2	CONNECTOR ASSY, 10 CONTACT	
4	4330263-01		PLATE, FRONT, REPRODUCE MODULE	
8	4580199-01	T1	TRANSFORMER, INPUT	
12	013-599	CR1, 2, 7	DIODE	1N914
13	014-329	Q8	TRANSISTOR	2N2102
15	014-652	Q5	TRANSISTOR	2N3906
16	014-698	Q2	TRANSISTOR	2N3565
17	014-706		HEATSINK, TRANSISTOR	
18	014-723	Q7	TRANSISTOR	2N4037
19	014-784	Q3, 4, 6	TRANSISTOR	2N4946
21	031-187	C8	CAPACITOR, ELEC, 50 MFD, 50V	
22	031-190	C13	CAPACITOR, ELEC, 50 MFD, 25V	
24	034-181	C4, 10	CAPACITOR, MICA, 47 PFD, 500V, 5%	
28	037-446	C6, 14	CAPACITOR, TANT, 15 MFD, 15V, 20%	
29	037-494	C1, 5	CAPACITOR, TANT, 3.3 MFD, 35V, 20%	
30	037-654	C2, 3, 7, 11, 12, 17	CAPACITOR, TANT, 3.3 MFD, 35V, 20%	
33	041-012	R4	RESISTOR, COMP, 4.3K, 1/2W, 5%	
34	041-040	R6	RESISTOR, 220 OHM, 1/2W, 10%	
35	041-043	R27	RESISTOR, 390 OHM, 1/2W, 10%	
36	041-048	R28	RESISTOR, COMP, 1K, 1/2W, 10%	
40	041-053	R29	RESISTOR, 2.7K, 1/2W, 10%	
41	041-054	R10	RESISTOR, COMP, 3.3K, 1/2W, 10%	
42	041-056	R24	RESISTOR, COMP, 4.7K, 1/2W, 10%	
44	041-058	R8	RESISTOR, COMP, 6.8K, 1/2W, 10%	
46	041-062	R25, 5	RESISTOR, COMP, 15K, 1/2W, 10%	
47	041-067	R2, 21	RESISTOR, COMP, 39K, 1/2W, 10%	
48	041-069	R22	RESISTOR COMP, 56K, 1/2W, 10%	
49	041-072	R7, 23, 38	RESISTOR, COMP, 100K, 1/2W, 10%	
50	041-075	R3	RESISSTOR, COMP, 130K, 1/2W, 10%	
51	041-076	R12, 13	RESISTOR, COMP, 220K, 1/2W, 10%	
52	041-080	R9	RESISTOR, COMP, 470K, 1/2W, 10%	
53	041-081	R18	RESISTOR, COMP, 560K, 1/2W, 10%	
56	041-404	R26	RESISTOR, COMP, 510 OHM, 1/2W, 5%	
58	041-533	R30, 31	RESISTOR, COMP, 24 OHM, 1/2W, 5%	
61	041-066	R14, 15	RESISTOR, COMP, 33K, 1/2W, 10%	
62	049-517	R1	RESISTOR, COMP, 220 OHM, 1/4W, 10%	
63	058-689	R32	RESISTOR, VAR, 500 OHM, 10%	
65	280-130		PAD, MOUNTING, TRANSISTOR	
66	280-131		PAD, MOUNTING	
69	475-007		SCREW, PAN HD, NO. 4-40 X 5/16	
71	501-008		WASHER, FLAT, NO. 4	
73	580-135	Q1	TRANSISTOR	2N4104
76	4840249		SCHEMATIC	

VERSION: 4050435-12



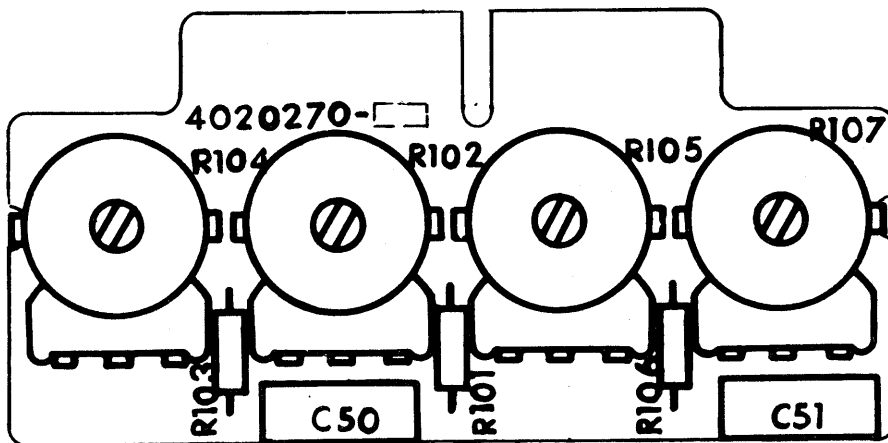
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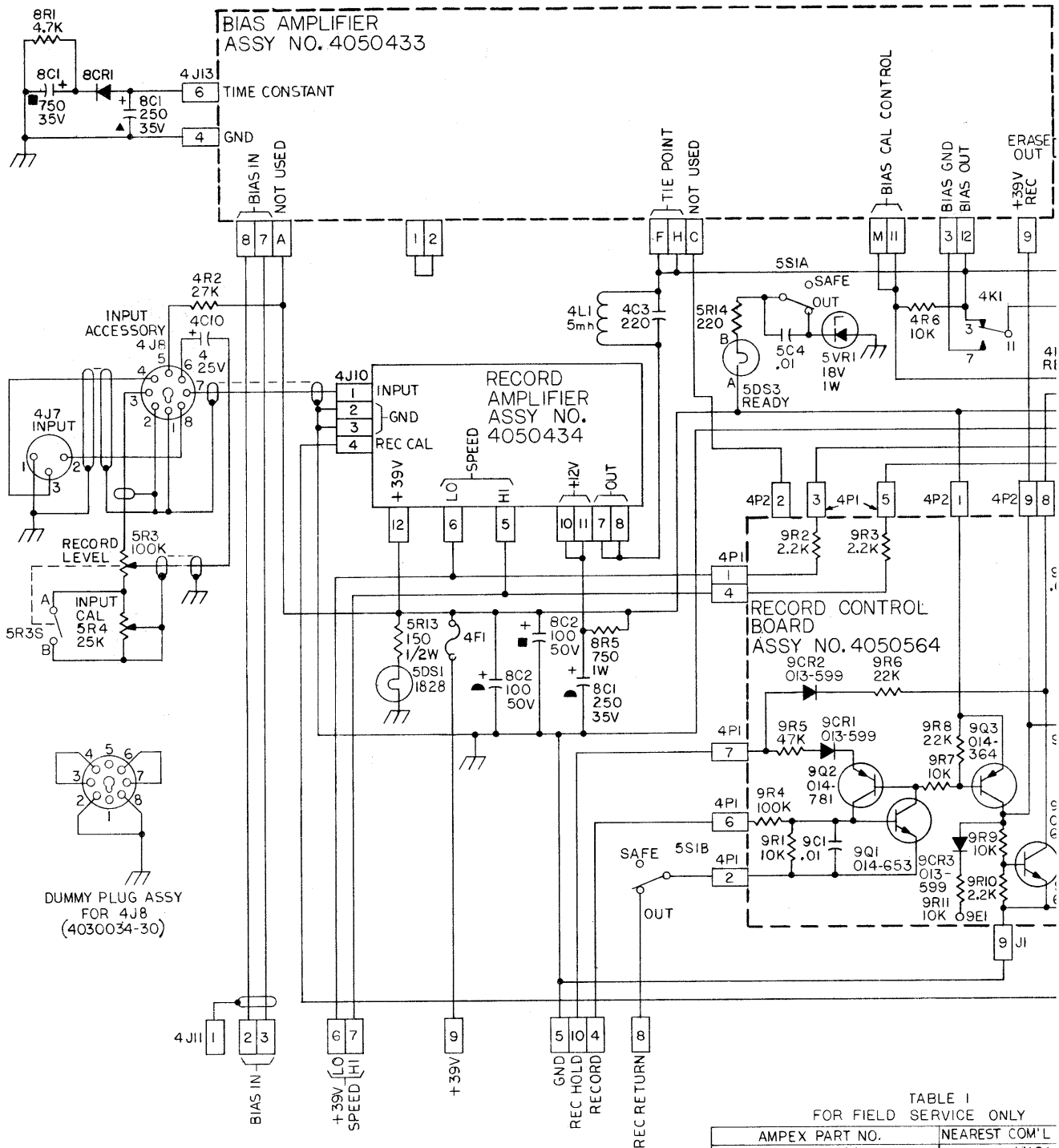
Assembly No. 4050435, Reproduce Amplifier PWA

NEXT HIGHER ASSEMBLY NO. 4010202, 4010203, 4010204

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
2	4520152-01	R104, 105	POTENTIOMETER, 50K	
3	4520152-02	R102, 107	POTENTIOMETER, 2.5M	
4	049-528	R103, 106	RESISTOR, 220K, 1/8W, 10%	
5	049-527	R101	RESISTOR, 2.2K, 1/8W, 10%	
6	055-222	C50, 51	CAPACITOR, MYLAR, 0.0047 MFD, 3-3/4-7-1/2 IPS & 7-1/2-15 IPS	
8	055-889	C50, 51	CAPACITOR, MYLAR, 0.0033 MFD, 15-30 IPS	
15	4840249		SCHEMATIC	

VERSIONS: 4020270-01 3-3/4 - 7-1/2 & 7-1/2 - 15 IPS
4020270-02 15-30 IPS





- NOTES UNLESS OTHERWISE SPECIFIED
- 1 ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 10%
 - 2 ALL CAPACITOR VALUES ARE IN MICROFARADS AT INDICATED VOLTAGE
 - 3 ALL DIODES ARE TYPE O13-678
 - 4 SEE TABLE I FOR FIELD SERVICE TRANSISTOR

TABLE I
FOR FIELD SERVICE ONLY

AMPEX PART NO.	NEAREST COM'L
013-599	1N914
014-364	2N2904
014-653	2N3904
014-781	MPS6
013-678	1N4348

LAST REF DES USED		
R16	P2	
C11	CR2	
DS4	VRI	
L3	F1	
T1	K1	
M1	S7	
J13		

REF DES	
DS2	

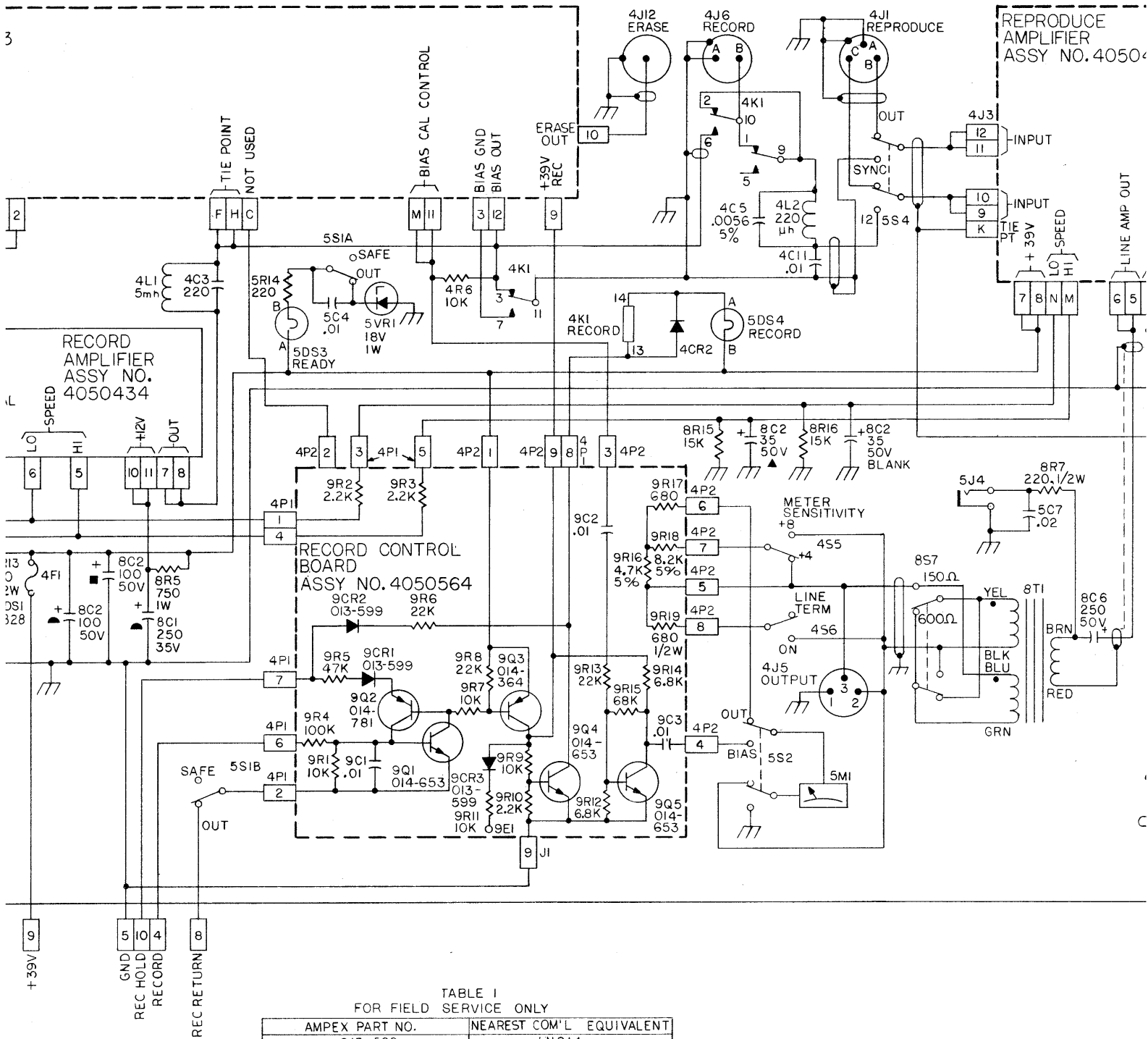


TABLE I
FOR FIELD SERVICE ONLY

AMPEX PART NO.	NEAREST COM'L EQUIVALENT
013-599	1N914
014-364	2N2905A
014-653	2N39C4
014-781	MPS 6518
013-678	1N4385

LAST REF DES USED	
R16	P2
C11	CR2
DS4	VR1
L3	F1
T1	K1
M1	S7
J13	

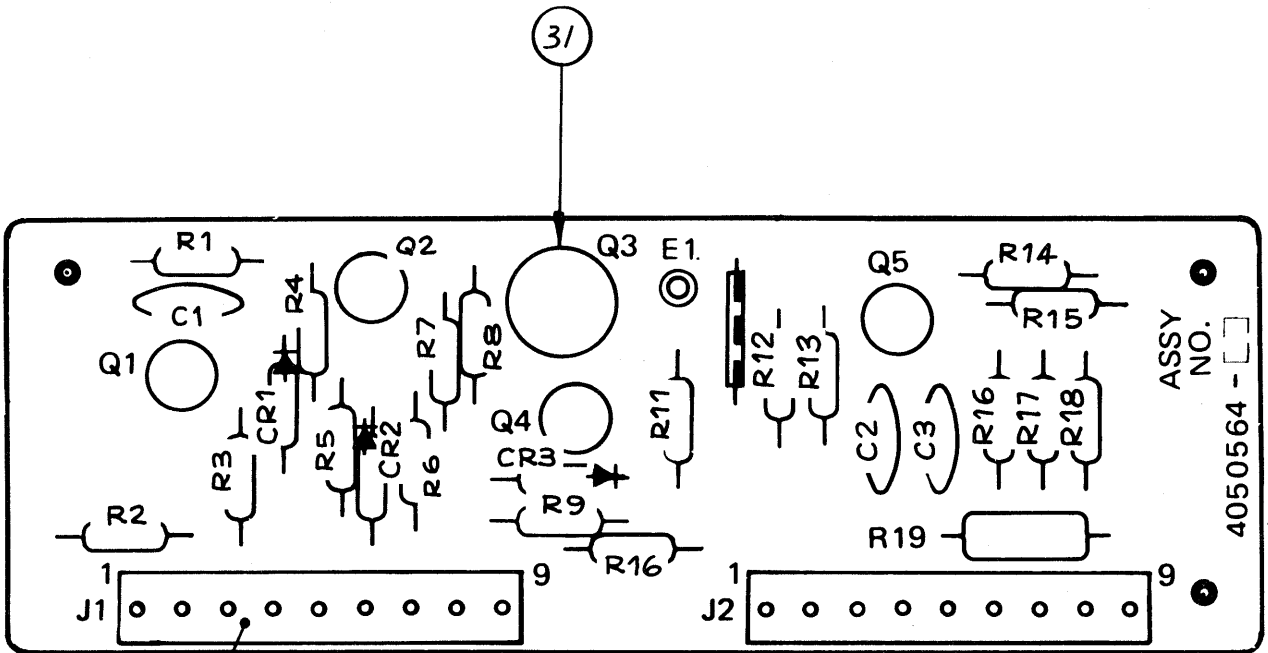
REF DES NOT USED	
DS2	

N, 10%
RADS

ISTOR

NEXT HIGHER ASSEMBLY NO. 4020337

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
4	139-633	J1, 2	CONNECTOR, 9 PIN	
6	013-599	CR1, 2, 3	DIODE	1N914
8	014-364	Q3	TRANSISTOR	2N2905A
9	014-653	Q1, 4, 5	TRANSISTOR	2N3904
10	014-781	Q2	TRANSISTOR	MPS 6518-5
13	030-057	C1, 2, 3	CAPACITOR, CER, 0.01 UF, 100V, 20%	
16	041-046	R19	RESISTOR, COMP, 680 OHM, 1/2W, 10%	
17	041-412	R16	RESISTOR, COMP, 4.7K, 1/4W, 5%	
18	041-495	R18	RESISTOR, COMP, 8.2K, 1/4W, 5%	
19	041-626	R4	RESISTOR, COMP, 100K, 1/4W, 10%	
20	041-628	R15	RESISTOR, COMP, 68K, 1/4W, 10%	
21	041-630	R6, 8, 13	RESISTOR, COMP, 22K, 1/4W, 10%	
23	041-633	R1, 7, 9, 11	RESISTOR, COMP, 10K, 1/4W, 10%	
24	041-635	R12, 14	RESISTOR, COMP, 6.8K, 1/4W, 10%	
25	041-639	R2, 3, 10	RESISTOR, COMP, 2.2K, 1/4W, 10%	
27	049-334	R17	RESISTOR, COMP, 680 OHM, 1/4W, 10%	
28	049-372	R5	RESISTOR, COMP, 47K, 1/4W, 10%	
31	280-009		PAD, MOUNTING, TRANSISTOR	
32	4840248		SCHEMATIC	
VERSION: 4050564-01				



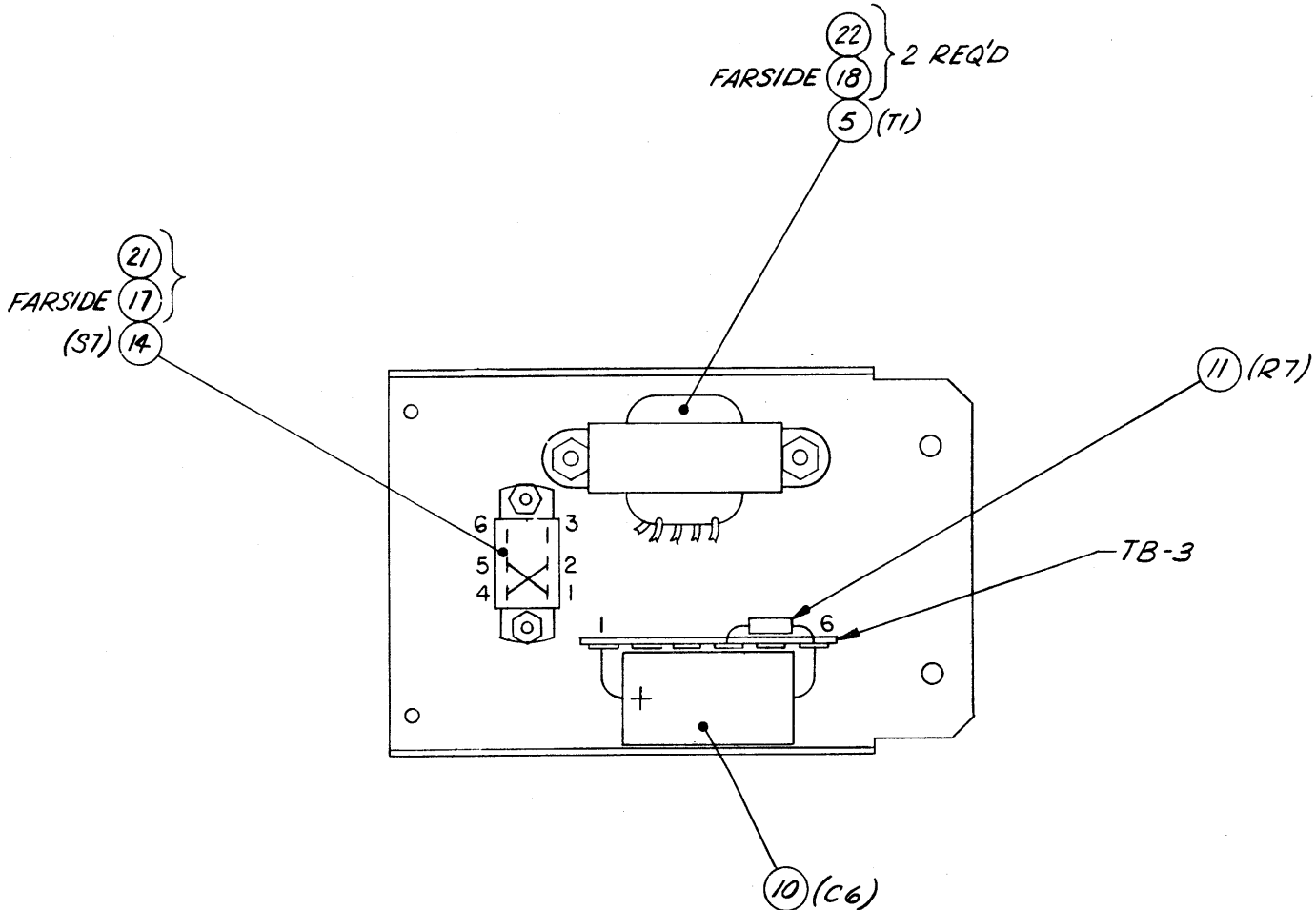
4 2 PLACES

Assembly No. 4050564, Record Control PWA

NEXT HIGHER ASSEMBLY NO. 4020337

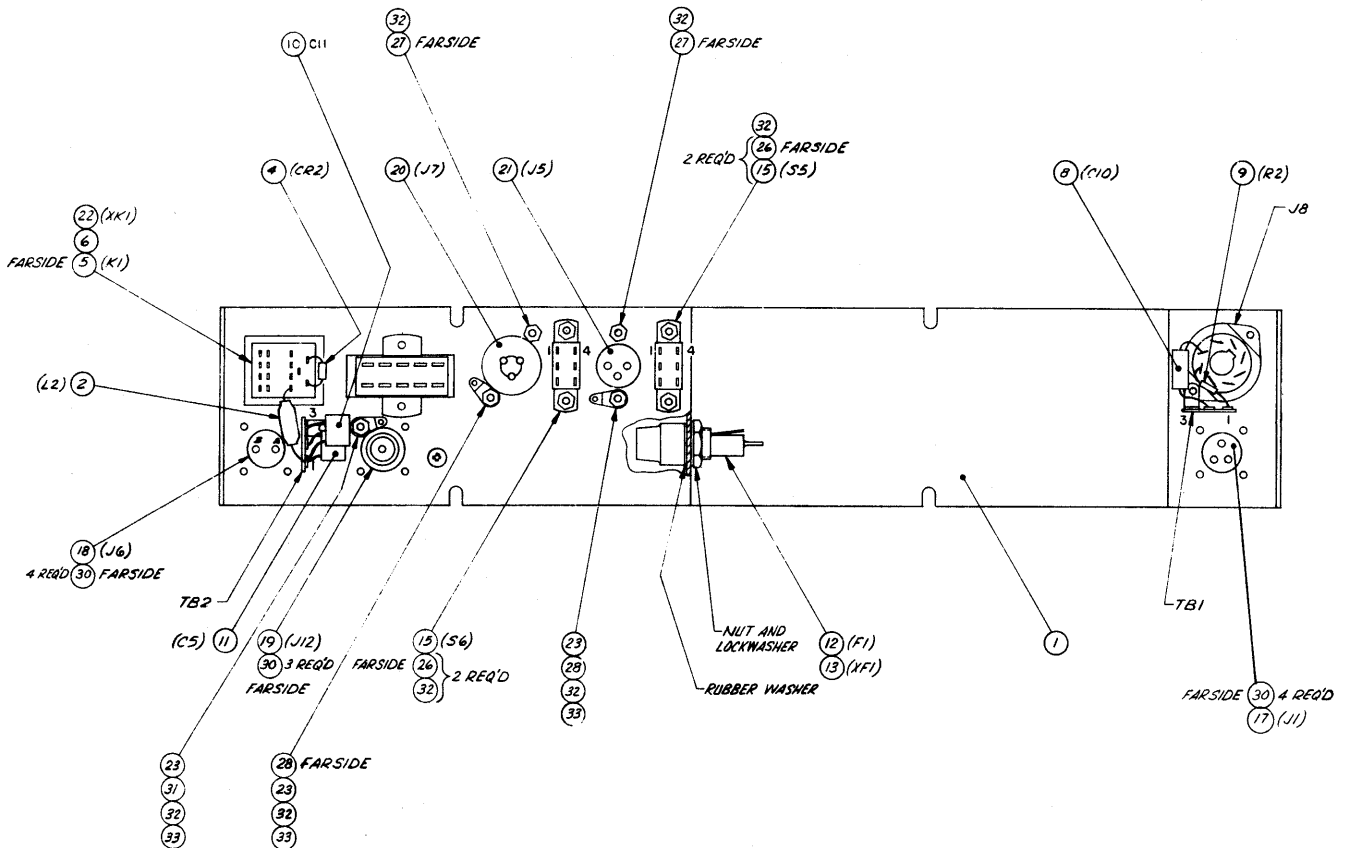
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4041174-01		PANEL, LEFT SIDE	
5	4580057-01	T1	TRANSFORMER, OUTPUT	
10	031-126	C6	CAPACITOR, FIXED, 250 MFD, 50V	
11	041-040	R7	RESISTOR, COMP, 220 OHM, 1/2W, 10%	
14	119-196	S7	SWITCH, SLIDE DPDT	
17	471-060		SCREW, PAN HD, XREC, NO. 4-40 X 0.250 LG	
18	471-067		SCREW, PAN HD, XREC, NO. 6-32 X 0.250 LG	
21	496-004		NUT, KEP, NO. 4-40	
22	496-005		NUT, KEP, NO. 6-32	

VERSION: 4050593-01



NEXT HIGHER ASSEMBLY NO. 4020337

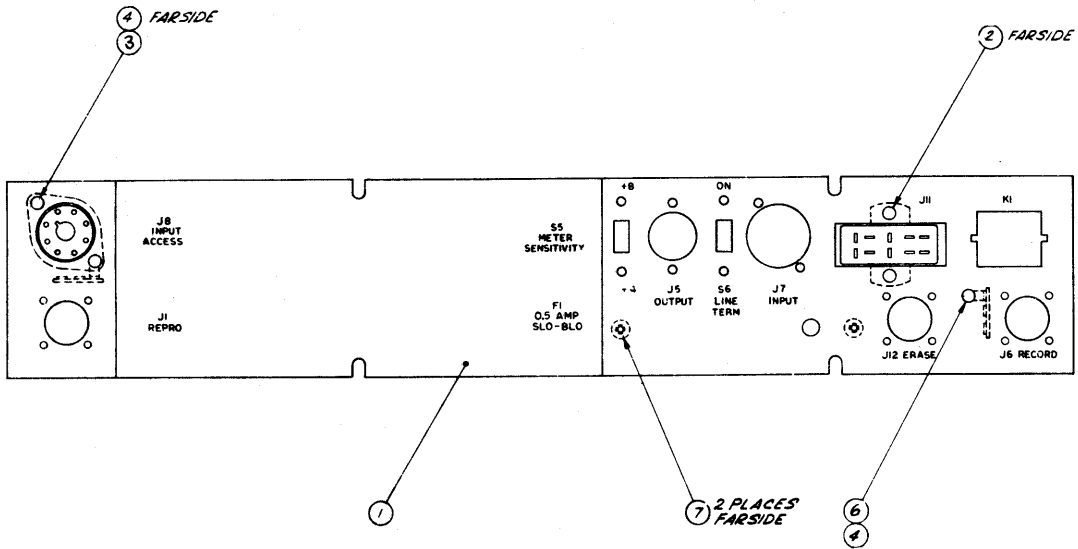
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4041183-01		REAR PANEL ASSY	
2	4050723-01	L2	SHIELDED CHOKE ASSY, 220 UH	
4	013-678	CR2	DIODE	1N4385
5	020-144	K1	RELAY, 24V, 4 PDT	
6	020-492		SPRING, RELAY HOLDDOWN	
8	031-309	C10	CAPACITOR, 4 MFD, 25V	
9	041-629	R2	RESISTOR, COMP, 27K, 1/4W, ±10%	
10	055-161	C11	CAPACITOR, MYLAR, .01 UF, 50V, ±10%	
11	055-102	C5	CAPACITOR, MYLAR, 0.0056 UF, 100V, ±5%	
12	070-026	F1	FUSE, SLO-BLO, 0.5 AMP, 125V	
13	085-001	XF1	FUSEHOLDER	
15	119-196	S5, 6	SWITCH, DPDT, SLIDE	
17	143-008	J1	CONNECTOR, 3 PIN, MALE	
18	143-009	J6	CONNECTOR, 2 PIN, MALE	
19	143-010	J12	CONNECTOR, 1 PIN, MALE	
20	146-998	J7	CONNECTOR, AUDIO RECP, 3 SOC	
21	147-999	J5	CONNECTOR, AUDIO RECP, 3 PIN	
22	150-992	XK1	SOCKET, RELAY, 14 CONT	
23	172-004		LUG, SOLDER, NO. 4	
26	471-060		SCREW, PAN HD, XREC, NO. 4-40 X 0.250 LG	
30	476-057		SCREW, WASHER, HEX HD, SELF TAPPING, NO. 4-40 X 5/12	
31	476-329		SCREW, WASHER, HEX HD, SELF TAPPING, NO. 4-40 X 0.375 LG	
32	496-004		NUT, KEP, NO. 4-40	
33	501-008		WASHER, FLAT, NO. 4	
VERSION: 4050601-01				



Assembly No. 4050601, Rear Panel Assembly

NEXT HIGHER ASSEMBLY NO. 4050601

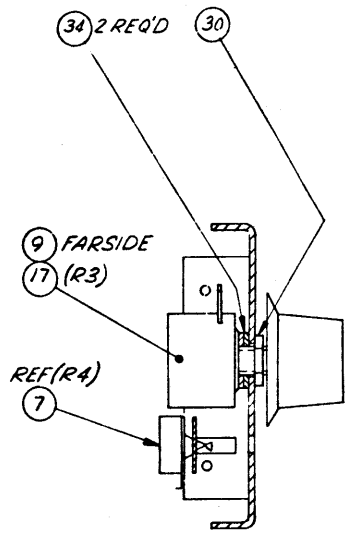
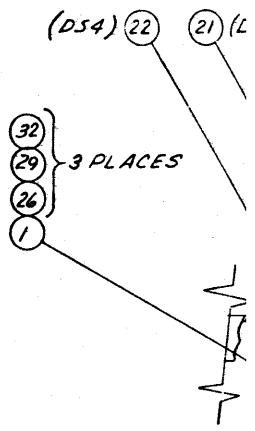
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4290688-01		PANEL, REAR	
2	147-014		CONNECTOR, RECP, 10 PINS, MALE	
3	150-023		SOCKET, OCTAL	
4	180-272		STRIP, TERMINAL	
6	502-014		WASHER, LOCK, EXT TOOTH, NO. 6	
7	280-441		SPACER, THD SWAGE, 4-40 X .38	
VERSION: 4041183-01				



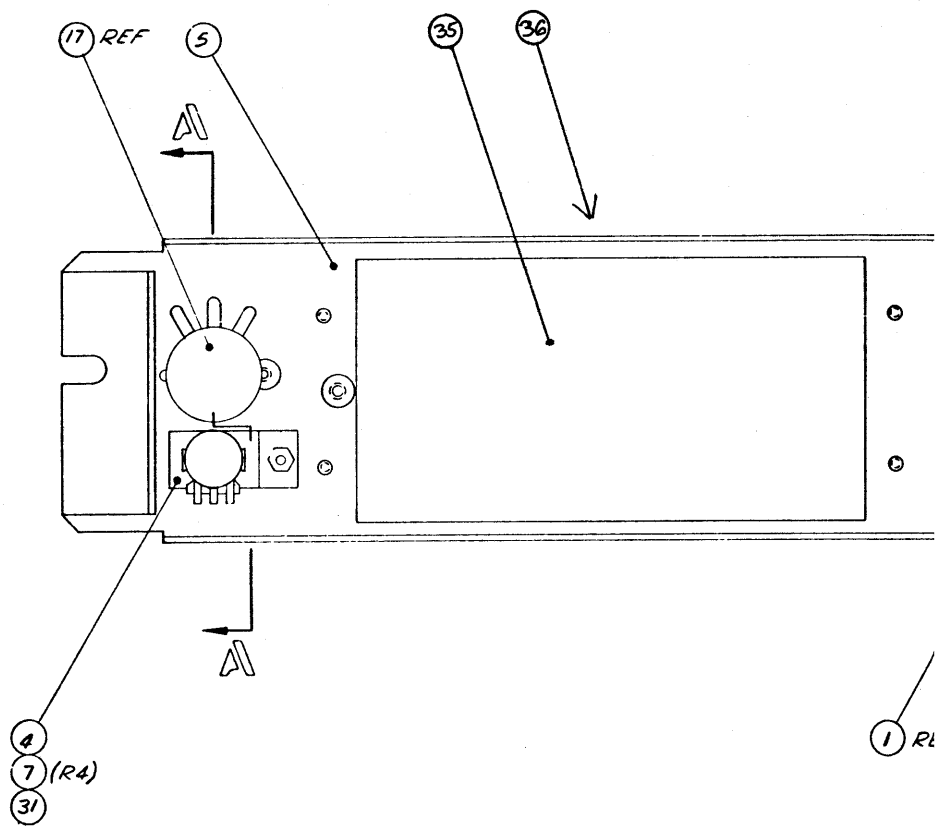
Assembly No. 4041183, Rear Panel

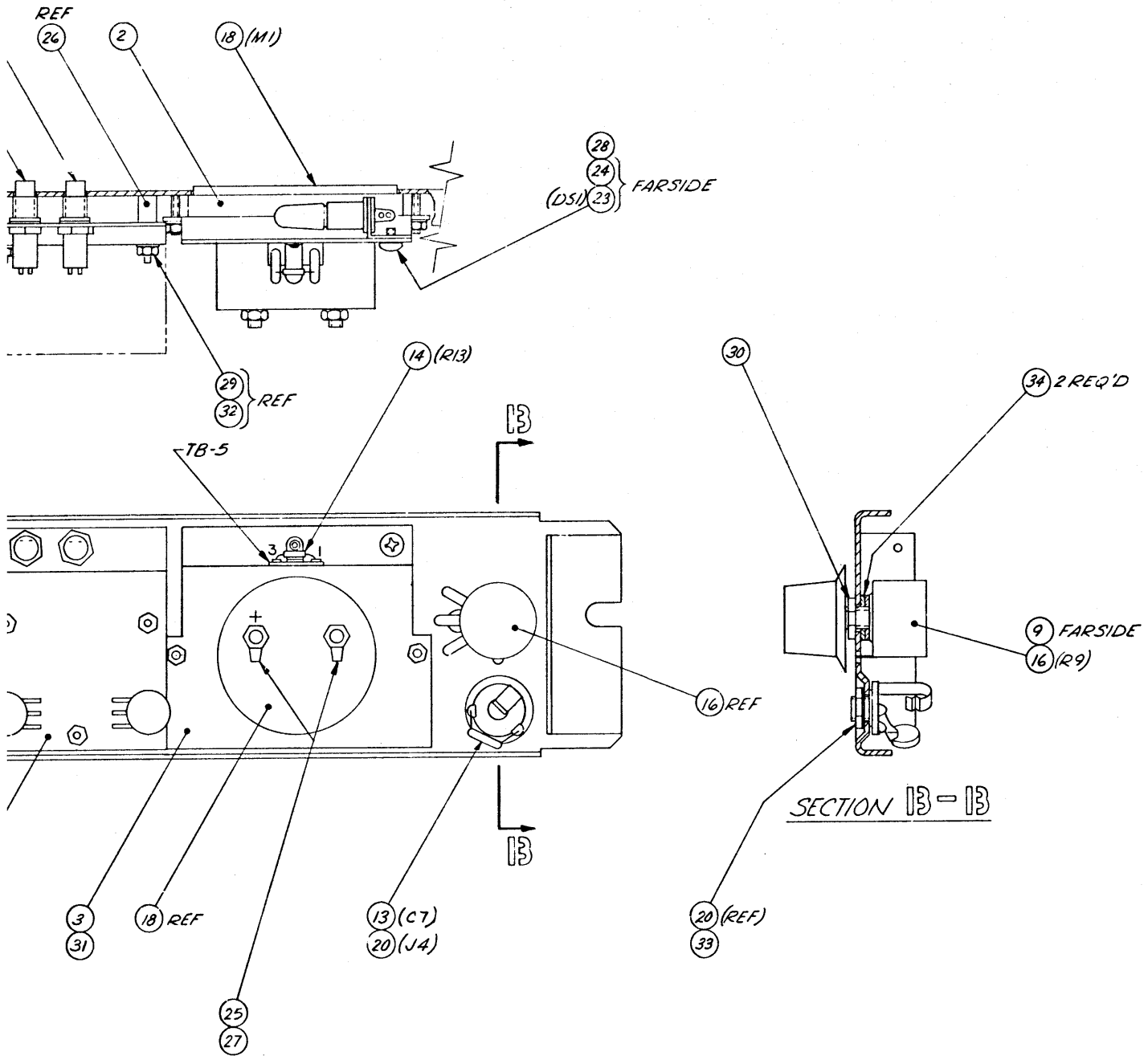
NEXT HIGHER ASSEMBLY NO. 4020337

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4050617-01		CONTROL CLUSTER ASSY	
2	4130054-01		DIFFUSER, METER LAMP	
3	4260415-01		BRACKET, METER MOUNTING	
4	4250424-01		BRACKET, POTENTIOMETER	
7	4520034-01	R4	RESISTOR, VAR, 25K	
9	6000009-20		KNOB, BLACK SKIRTED	
13	030-001	C7	CAPACITOR, FIXED CER, 0.02 UF, 500V	
14	041-241	R13	RESISTOR, COMP, 150 OHM, 1/2W, 10%	
16	058-594	R9	RESISTOR, VAR, 10K, 2W, 20%	
17	058-888	R3	RESISTOR, VAR, 100K, 2W, 20%, ALT: 044-992	
18	090-178	M1	METER, VU	
20	148-015	J4	JACK, PHONE	
21	132-335	DS3	LAMP, YELLOW	
22	132-334	DS4	LAMP, RED	
23	060-489	DS1	LAMP, METER	NO. 1828
24	132-332		SOCKET, METER LAMP	
25	172-005		LUG, SOLDER, INT TOOTH, NO. 10	
26	280-781		SPACER, PLAIN, NO. 6 X 5/8"	
27	492-011		NUT, PLAIN, NO. 10-32	
28	476-383		SCREW, TAPPING, HEX WASHER, NO. 8-32 X 1/4	
29	492-034		NUT, HEX, SMALL PATTERN, NO. 6-32	
30	492-095		NUT, 3/8 - 32	
31	496-004		NUT, KEP, NO. 4-40	
32	502-025		WASHER, LOCK, INT TOOTH, NO. 6	
33	502-077		WASHER, LOCK, INT TOOTH - FINE, 3/8	
34	502-083		WASHER, LOCK, INT TOOTH - COARSE, 3/8	
35	4040992-02		<i>COVER PLATE</i>	
36	4110139-01		<i>DRESS PANEL</i>	
VERSION: 4050616-01				

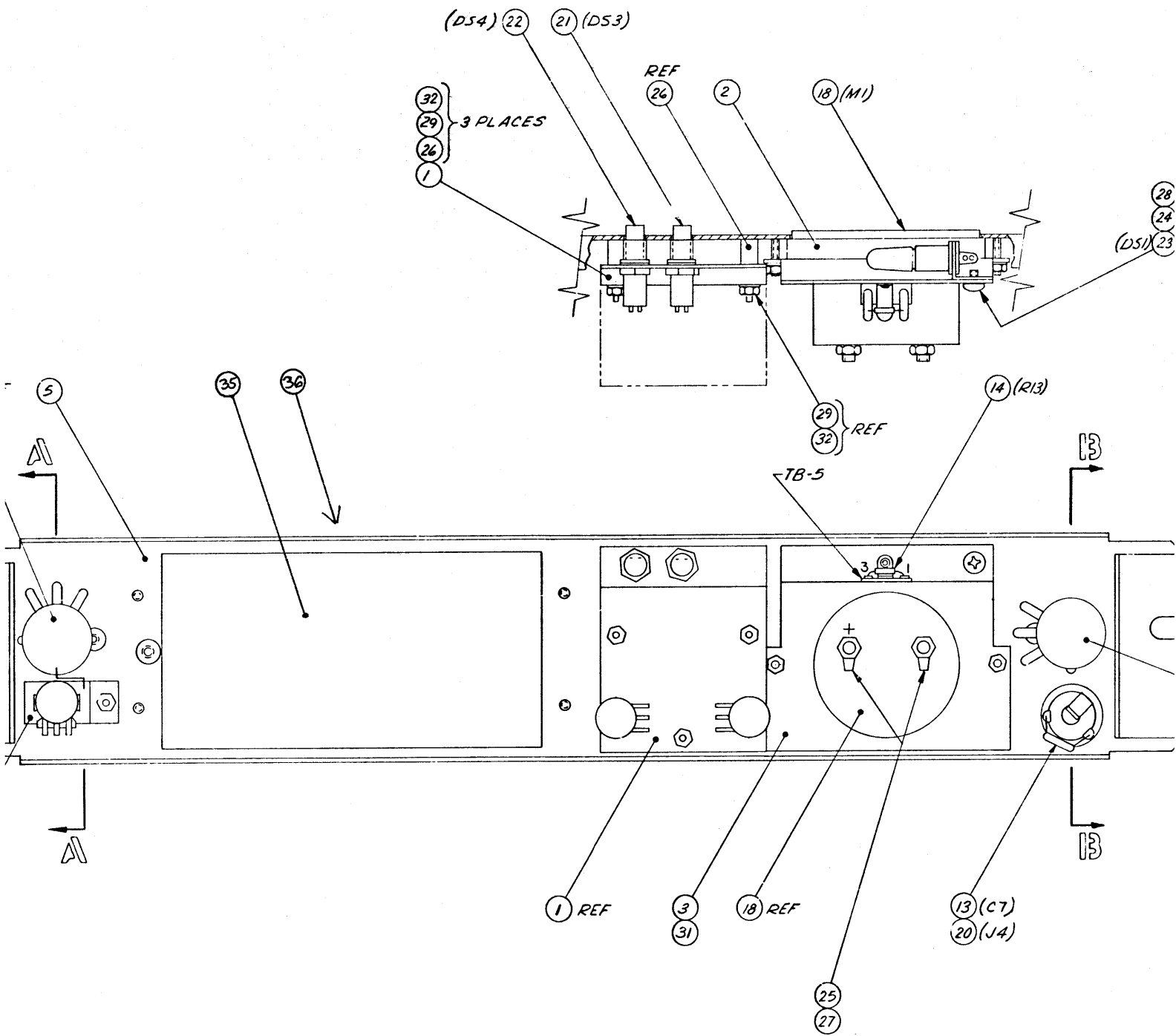


SECTION A-A





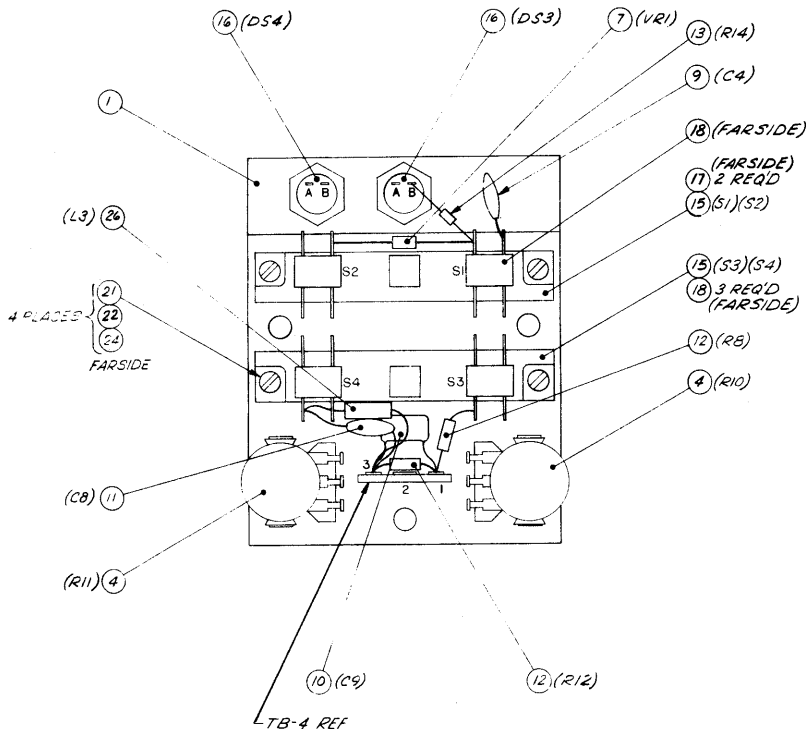
Assembly No. 4050616
 Front Panel Assembly



NEXT HIGHER ASSEMBLY NO. 4050616

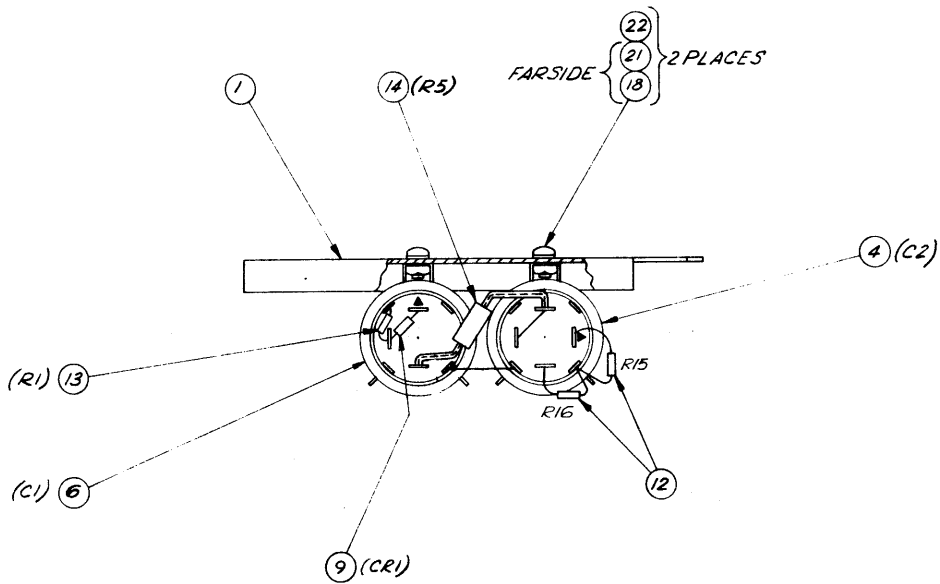
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4041191-01		BRACKET, SWITCH MOUNTING	
4	4520034-01	R10, 11	POTENTIOMETER, 25K	
7	013-176	VR1	DIODE	
9	030-057	C4	CAPACITOR, CER, 0.01 UFD, 100V, 20%	
10	034-228	C9	CAPACITOR, MICA, 620 PF, 300V, 5%	
11	034-938	C8	CAPACITOR, MICA, 110 PF, 500V, 5%	
12	041-633	R8, 12	RESISTOR, 10K, 1/4W, 10%	
13	049-517	R14	RESISTOR, 220 OHM, 1/4W, 10%	
15	119-250	S1-4	SWITCH, PUSHBUTTON	
16	132-333	DS3, 4	SOCKET, LAMP	
17	121-186		PUSHBUTTON, INDICATOR, ORANGE	
18	121-187		PUSHBUTTON, INDICATOR, GREEN	
21	472-113		SCREW, PAN HD, XREC, 2-56 X 1/4 LG	
22	492-007		NUT, HEX, NO. 2-56	
24	502-023		WASHER, LOCK, INT TOOTH, NO. 2	
26	051-952	L3	CHOKE, 10 MH, ±5%	

VERSION: 4050617-01



NEXT HIGHER ASSEMBLY NO. 4020337

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.	
1	4290670-01		PANEL, RIGHT SIDE		
4	4550147-05	C2	CAPACITOR, ELECTROLYTIC, 100, 100, 35, 35/50V	1N4385	
6	4550147-11	C1	CAPACITOR, ELECTROLYTIC, 250, 750, 250/35V		
9	013-678	CR1	DIODE, POWER RECTIFIER		
12	041-631	R15, 16	RESISTOR, COMP, 15K, 1/4W, 10%		
13	041-636	R1	RESISTOR, COMP, 4.7K, 1/4W, 10%		
14	041-833	R5	RESISTOR, COMP, 750 OHM, 1W, 5%		
18	301-010		RETAINER, CAPACITOR MOUNTING		
21	473-330		SCREW, PAN HD, XREC, 6-32 X 1/4 LG		
22	492-009		NUT, PLAIN, NO. 6-32		
VERSION: 4050621-01					

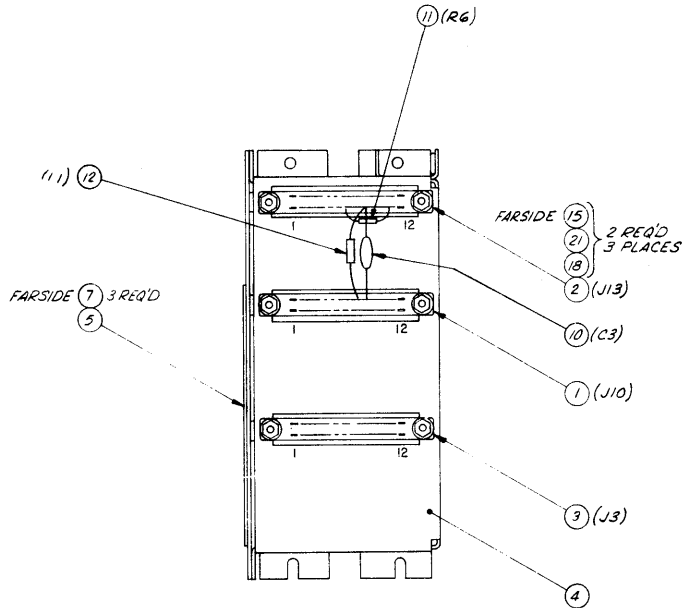
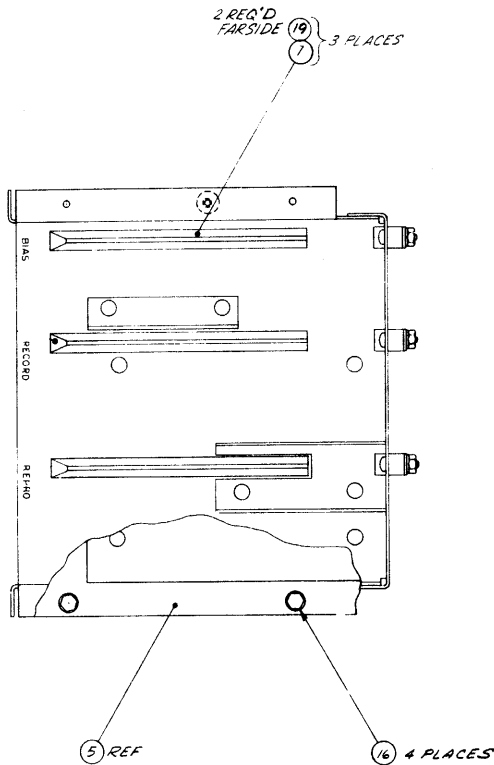


ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	139-632	P1, 2	CONNECTOR, MOLEX	
2	167-019		PIN, MOLEX	
<p>VERSION: 4050632-01</p>				

NEXT HIGHER ASSEMBLY NO. 4020337

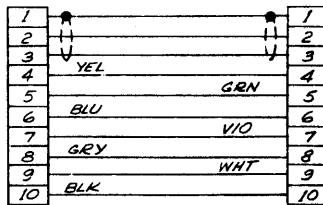
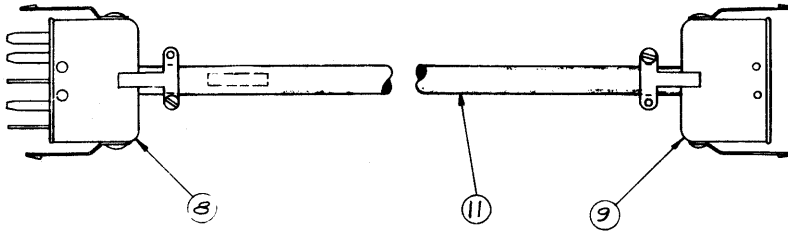
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4030269-01	J10	CONNECTOR ASSY, 12 CONTACT	
2	4030269-02	J13	CONNECTOR ASSY, 12 CONTACT	
3	4030269-03	J3	CONNECTOR ASSY, 12 CONTACT	
4	4041189-01		ENCLOSURE, MODULE ASSY	
5	4041190-01		ENCLOSURE, SHIELD ASSY	
7	4230133-02		GUIDE, PWB	
10	034-358	C3	CAPACITOR, MICA, 220 PF, 5%	
11	041-633	R6	RESISTOR, COMP, 10K, 1/4W	
12	051-342	L1	CHOKE, 5 MH	
15	471-064		SCREW, PAN HD, NO. 4-40 X 1/2	
16	476-998		SCREW, HEX WASHER HD, NO. 6 X 1/4	
18	496-004		NUT, KEP, NO. 4-40	
19	498-445		NUT, SPRING, 0.125 DIA	
21	501-008		WASHER, FLAT, NO. 4	

VERSION: 4050639-01



NEXT HIGHER ASSEMBLY NO. 4010202,
4010203, 4010204

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
8	145-020		CONNECTOR, RECT, RECP, 10 CONTACTS	
9	144-058		CONNECTOR, RECT, PLUG, 10 CONTACTS	
11	616-400		CABLE, SHIELDED (GRAY), 2 COND, NO. 22 GA, BLK/WHT VERSION: 4050442-01	



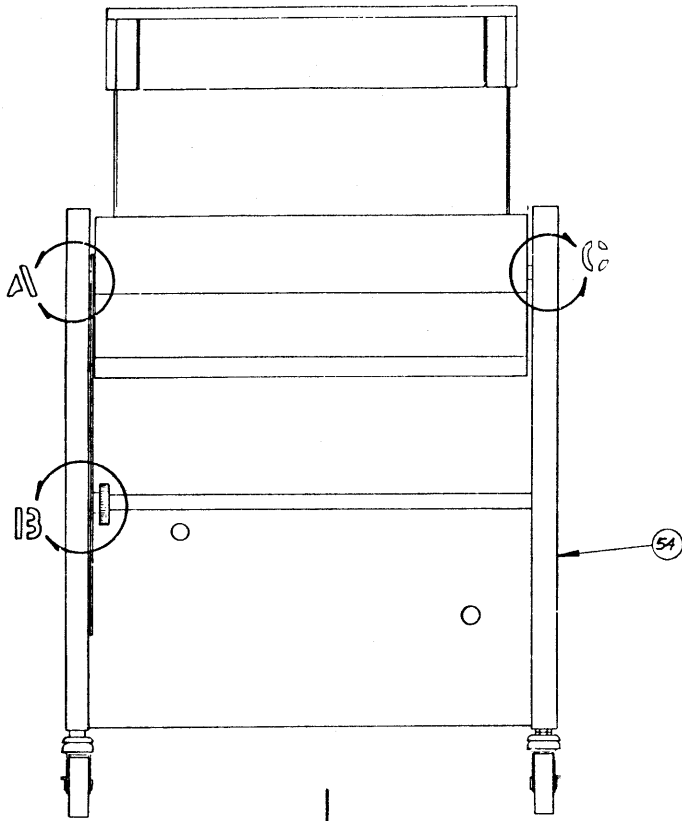
SCHEMATIC DIAGRAM

NEXT HIGHER ASSEMBLY NO. 4010202, 4010203, 4010204

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4041012-01		COVER ASSY, ELECTRONICS SUPPORT	
2	4040977-01		LINK ASSY, SWIVEL	
4	4040980-02		SUPPORT, FRONT PANEL	
5	4040981-06		PANEL, FRONT, CONSOLE	
6	4220246-01		SPACER, ELEC, SUPPORT COVER	
7	4040983-01		COVER, DOGHOUSE SUPPORT	
9	4100184-01		KNOB, CONSOLE	
10	4150226-02		TRUNNION	
11	4150316-01		SUPPORT, DOGHOUSE	
12	4150328-01		FRAME, TAPE TRANSPORT	
13	4210317-01		STUD, LOCK	
14	4260404-03		SUPPORT, ELEC, CONSOLE	
15	4440295-01		WASHER, SPACER	
16	4440295-02		WASHER, SPACER	
17	4440296-01		WASHER, TAKEUP	
18	4440297-01		WASHER, THRUST	
19	4440302-01		WASHER, THRUST	
20	471-072		SCREW, MACH, PAN HD, XREC, NO. 6-32 X 5/8 LG	
22	478-031		SCREW, WOOD, RD HD, XREC, NO. 8 X 3/4 LG	
23	478-157		SCREW, WOOD, FL HD, XREC, NO. 6 X 3/4 LG	
24	480-070		BOLT, HEX HD, 5/16 - 18 X 1-1/4	
25	492-009		NUT, HEX, NO. 6-32	
26	492-067		NUT, HEX, 1/4-20	
29	501-009		WASHER, FLAT, NO. 6	
30	501-022		WASHER, FLAT, 5/16	
32	502-003		WASHER, LOCK, SPLIT, NO. 6	
33	502-105		WASHER, LOCK, SPLIT, 5/16	
34	4440303-01		WASHER	
37	302-094		CLAMP, CABLE, NYLON, 7.5 LG	
46	502-025		WASHER, LOCK, INT TOOTH, NO. 6	
52	501-067		WASHER, FLAT, 1/4"	
54	4040979-03		BASE ASSY, CONSOLE	
57	471-081		SCREW, PAN HD, XREC, 8-32 X 0.625 LG	
58	492-010		NUT, HEX, 8-32	
59	501-205		WASHER, NO. 8	
60	502-004		WASHER, LOCK, SPRING, NO. 8	
			VERSION: 4020084-06 SINGLE CHANNEL 4020084-07 DUAL CHANNEL 4020084-09 FOUR CHANNEL	

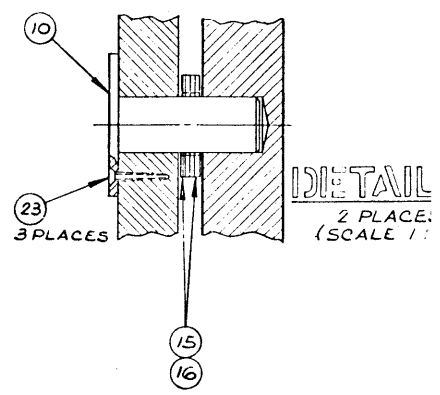
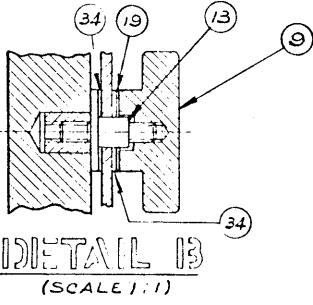
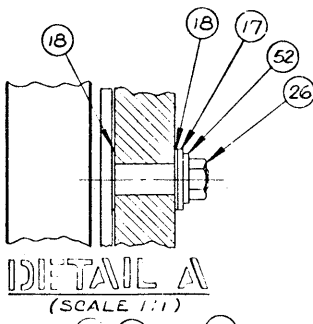
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- (1) SHOWN

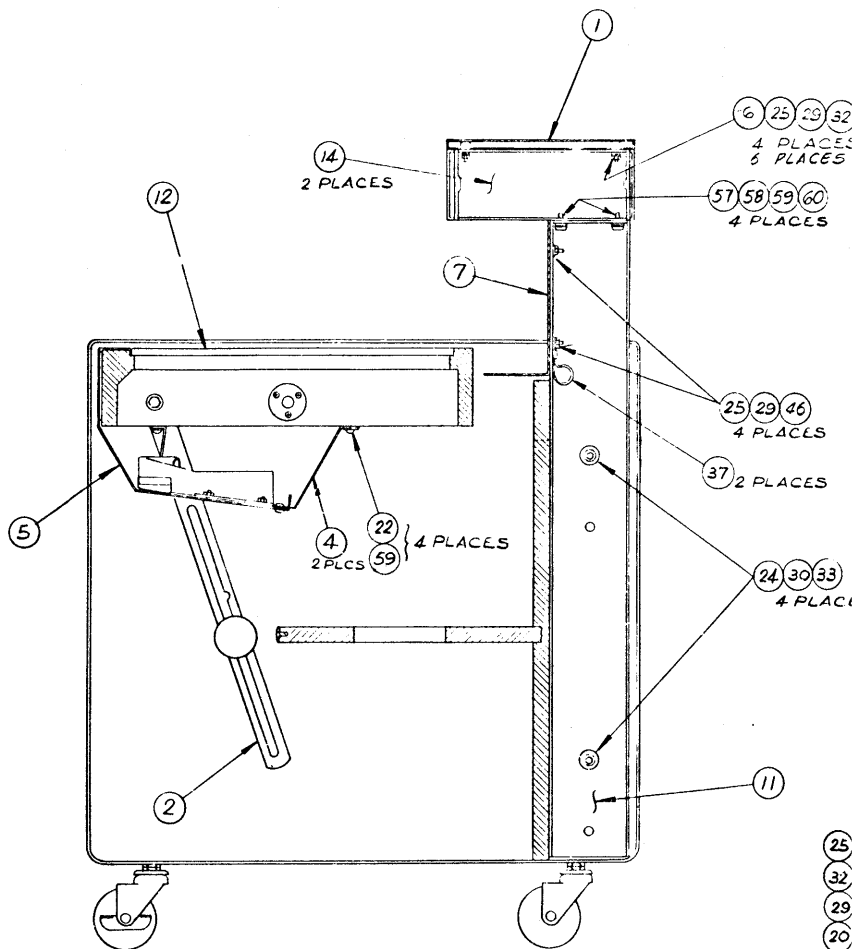
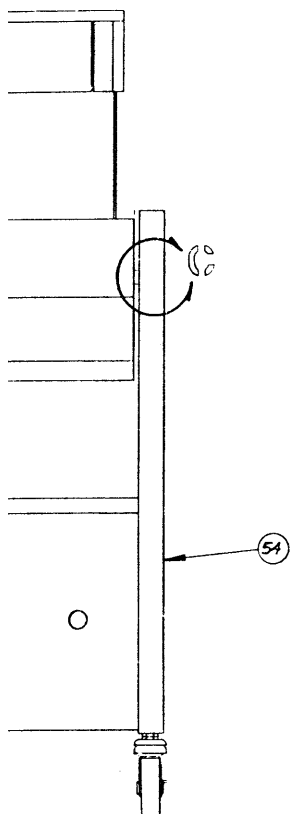


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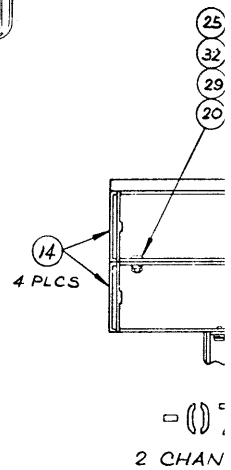
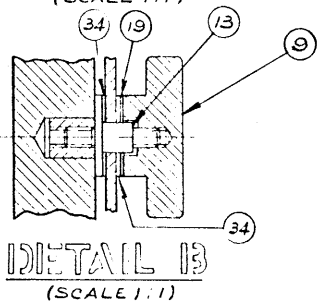
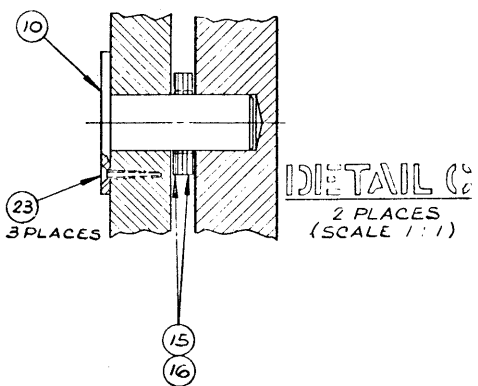
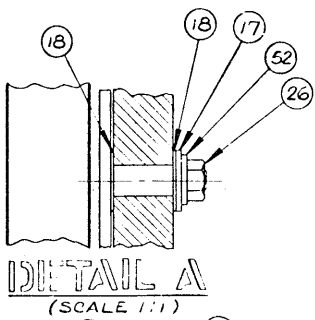
12 →



- (D) SHOWN



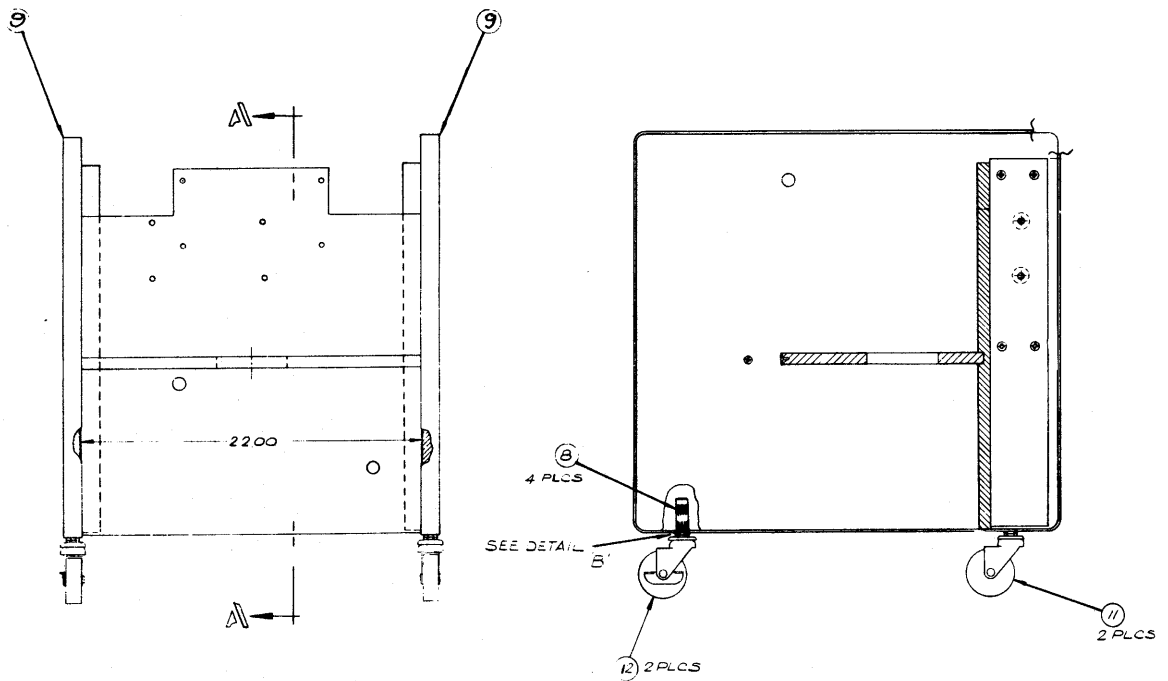
SECT. D-D



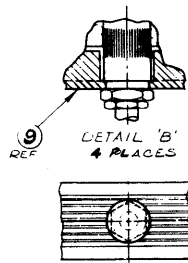
NEXT HIGHER ASSEMBLY NO. 4020084

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
8	4210315-01		INSERT, CASTER MOLDING, SIDE PANEL CASTER CASTER W/BRAKE	
9	4980005-01			
11	4150169-01			
12	4150169-02			

VERSION: 4040979-04



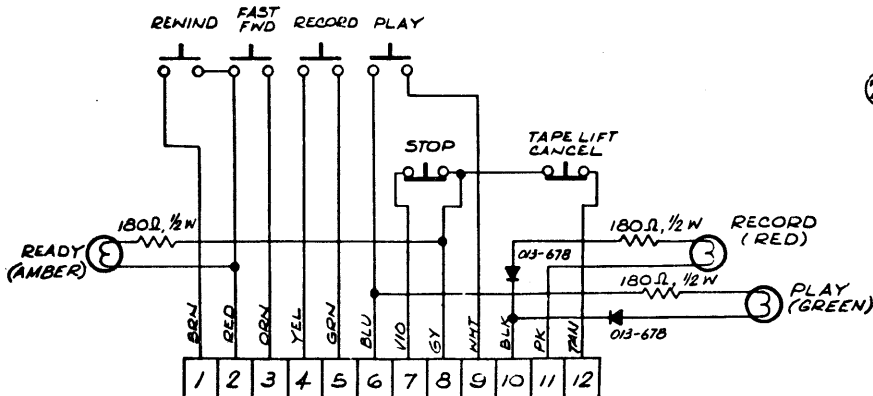
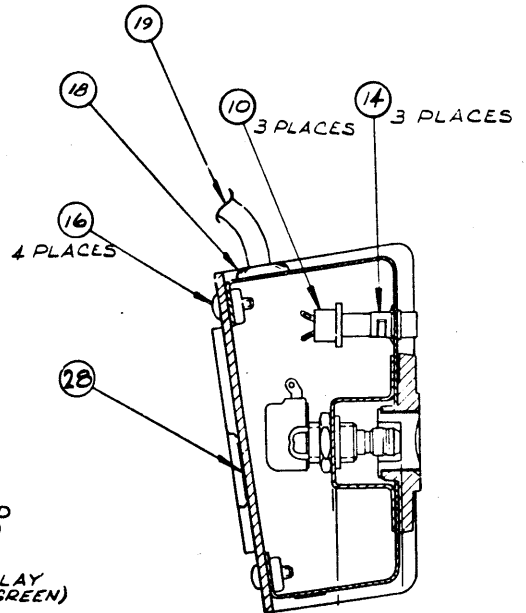
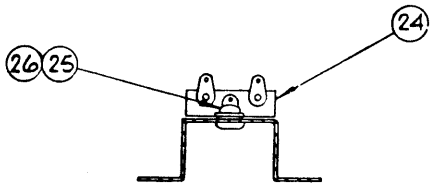
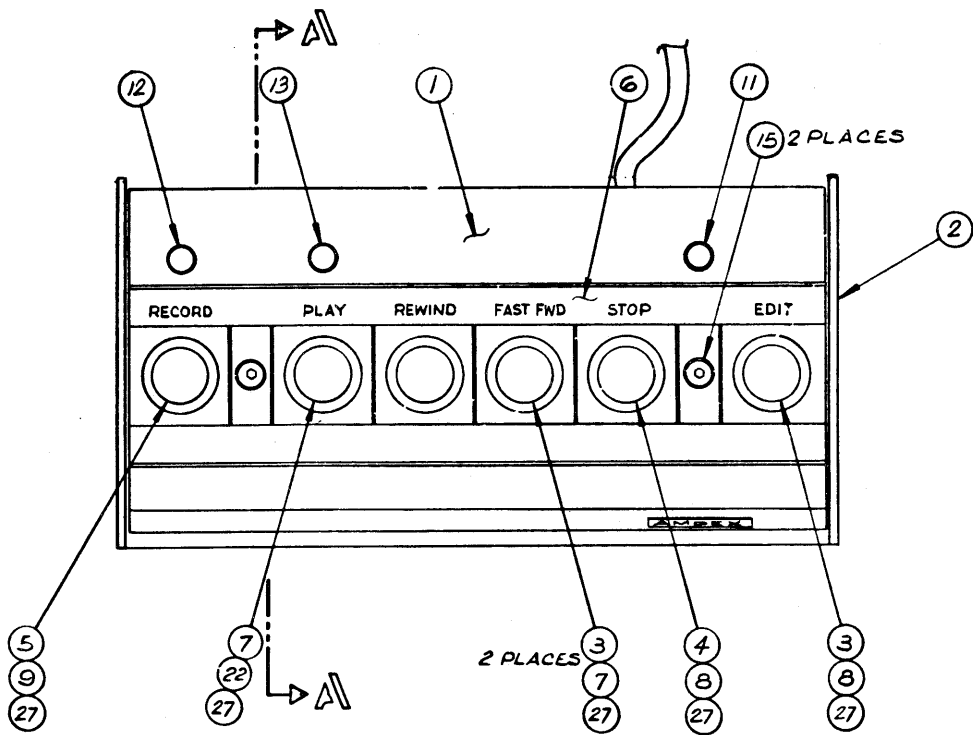
SECT. A-A



NEXT HIGHER ASSEMBLY NO. ACCESSORY

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4040997-02		PANEL ASSEMBLY	
2	4040999-01		BASE ASSEMBLY	
3	4100183-01		PUSHBUTTON, WHITE	
4	4100183-02		PUSHBUTTON, YELLOW	
5	4100183-03		PUSHBUTTON, RED	
6	4110274-01		ESCUTCHEON	
7	4620144-10		SWITCH, PUSHBUTTON	
8	4620144-20		SWITCH, PUSHBUTTON	
9	4620144-30		SWITCH, PUSHBUTTON	
10	132-160		SOCKET, LIGHT	
11	132-099		LIGHT, INDICATOR, AMBER	
12	132-100		LIGHT, INDICATOR, RED	
13	060-338		LIGHT, INDICATOR, GREEN	
14	435-069		RETAINER, C-LITE	
15	470-384		SCREW, CAP, HEX SOCKET, BUT HD 8-32 X 1/2 LG	
16	473-040		SCREW, MACH, XREC, TRUSS HD 8-32 X 7/16	
17	041-257		RESISTOR, FIXED, COMP, 180 OHM, 1/2W, 10%	
18	264-011		STRAIN RELIEF	
19	4050086-01		CABLE ASSY, REMOTE CONTROL	
22	4100183-04		PUSHBUTTON, GREEN	
23	013-678		DIODE	1N4385
24	180-240		TERMINAL STRIP	
25	471-062		SCREW, XREC, PAN HD, 4-40 X 3/8 LG	
26	501-913		WASHER, FLAT, NO. 4	
27	502-128		WASHER, LOCK, FLAT, INT TOOTH, 1/2"	
28	6000035-02		LABEL, IDENTIFICATION	

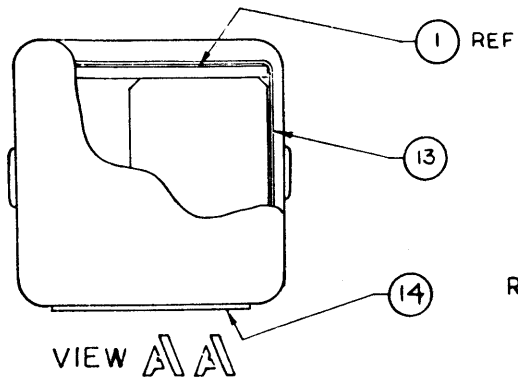
VERSION: 4010080-02



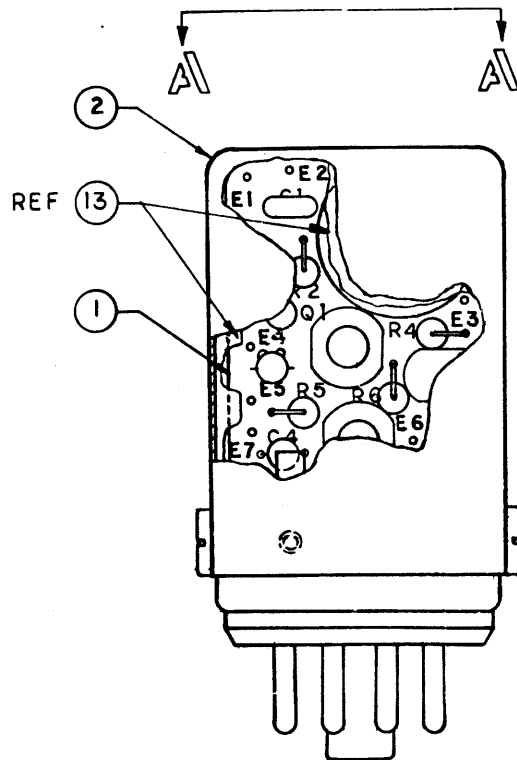
Assembly No. 4010080, Remote Control Assembly

NEXT HIGHER ASSEMBLY NO. ACCESSORY

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
1	4050409-01		TRANSISTOR MICROPHONE PREAMP PWA	
2	4290201-10		CAN, PLUG-IN MODIFIED	
3	4170150-05		LABEL, PREAMPLIFIER	
12	4890164		INSTRUCTION SHEET	
13	4130147-10		PAD	
14	4170150-06		LABEL, PREAMPLIFIER	
15	4840153		SCHEMATIC	
VERSION: 4010066-02				



WIRE NO	FROM		TO		ITEM NO. OF LM 4010066
	REF	DES TERM	REF	DES TERM	
1	P2	8	PWB	E1	11
2	P2	4	PWB	E2	7
3	P2	2	PWB	E3	5
4	P2	3	PWB	E4	6
5	P2	5	PWB	E5	8
6	P2	6	PWB	E6	9
7	P2	7	PWB	E7	10
8	P2	1	ITEM 2	GRD	4



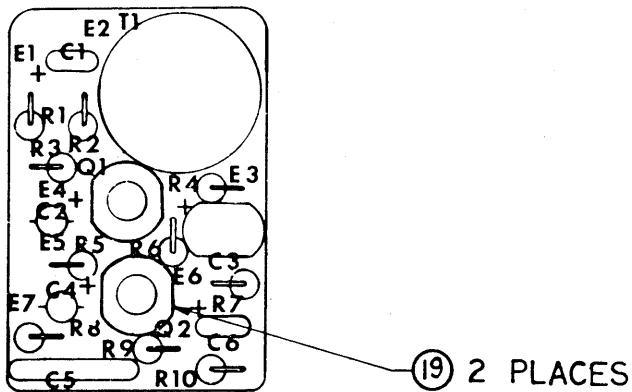
bridging transformer: P/N 4580200-01
 balanced transformer: P/N 45802-0-02

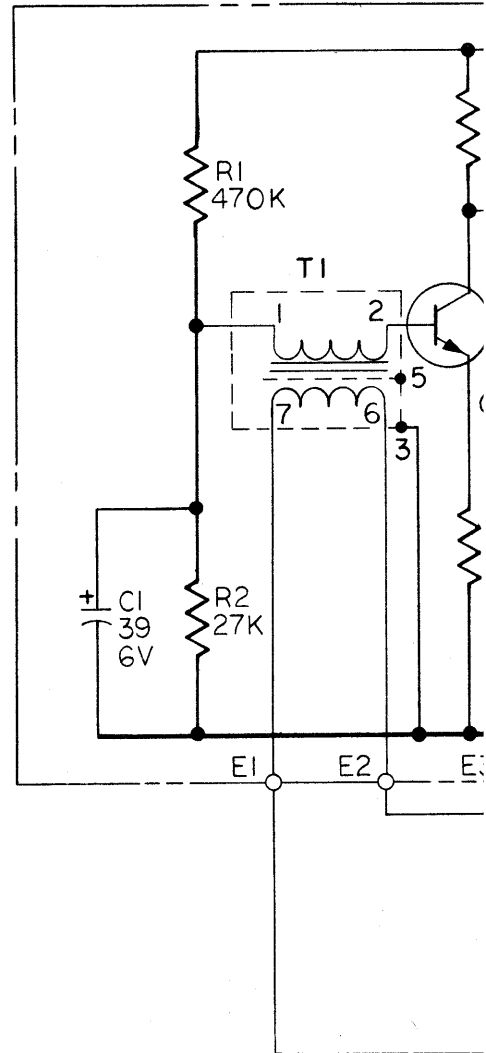
Assembly No. 4010066, Transistor Microphone Preamplifier Assembly

NEXT HIGHER ASSEMBLY NO. 4010066

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR. PART NO.
2	4580197-01	T1	TRANSFORMER, MICROPHONE	2N3565
3	014-698	Q1, 2	TRANSISTOR	
4	030-102	C5	CAPACITOR, CERAMIC, 0.0022 UF, 500V	
5	037-450	C2, 4	CAPACITOR, TANT, 0.22 UF, 25V	
6	037-452	C1, 6	CAPACITOR, TANT, 39 UF, 6V	
7	037-451	C3	CAPACITOR, TANT, 68 UF, 20V	
8	041-015	R2	RESISTOR, CARBON COMP, 27K, 1/2W, 5%	
9	041-029	R1, 7	RESISTOR, CARBOM COMP, 470K, 1/2W, 5%	
10	041-006	R4	RESISTOR, CARBON COMP, 620 OHM, 1/2W, 5%	
11	041-377	R6	RESISTOR, CARBON COMP, 1.3M, 1/2W, 5%	
12	041-009	R9	RESISTOR, CARBON COMP, 1800 OHM, 1/2W, 5%	
13	041-016	R10	RESISTOR, CARBON COMP, 22K, 1/2W, 5%	
14	041-373	R5	RESISTOR, CARBON COMP, 9100 OHM, 1/2W, 5%	
15	042-482	R8	RESISTOR, METAL FILM, 47.5K, 1/4W, 1%	
16	057-208	R3	RESISTOR, METAL FILM, 22.1K, 1/4W, 1%	
18	4840153		SCHEMATIC	
19	280-130		SPACER, TRANSISTOR	

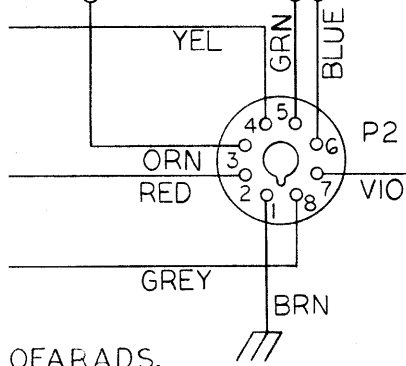
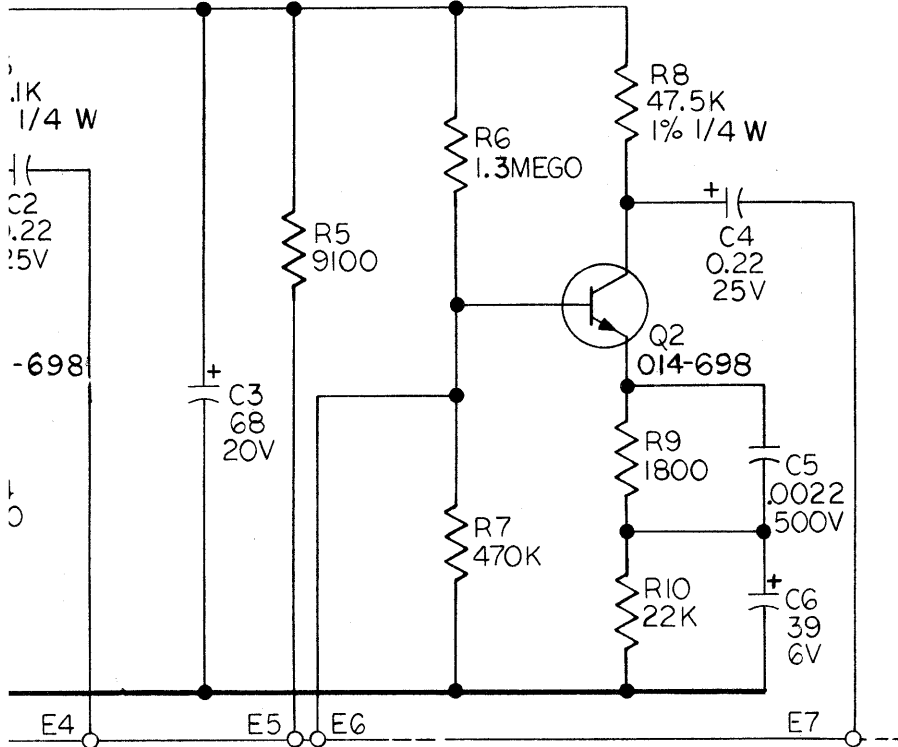
VERSION: 4050409-01





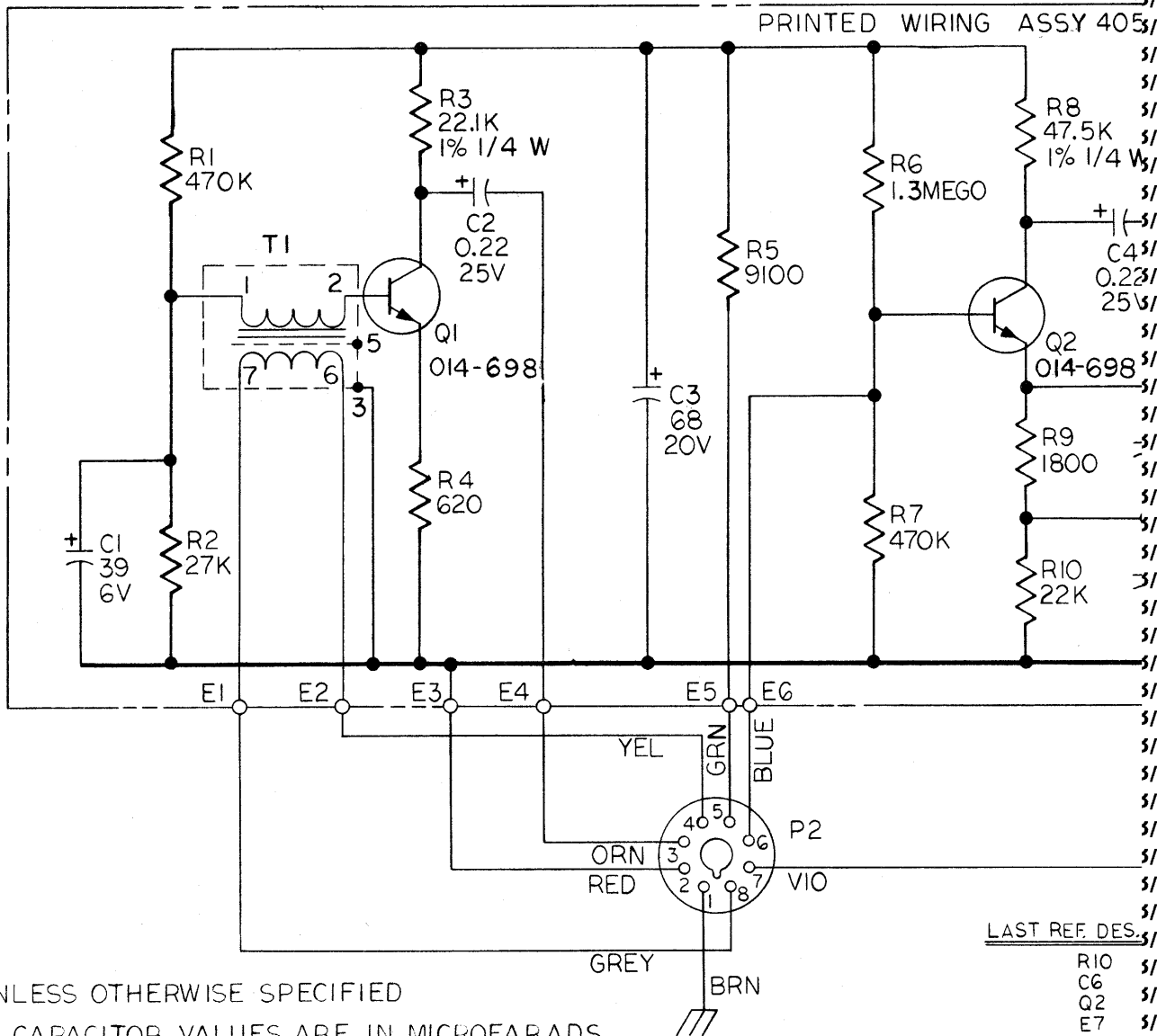
- NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL CAPACITOR VALUES ARE IN MICROFARADS
 2. ALL RESISTOR VALUES ARE IN OHMS
 3. TRANSISTORS 2N3117 OR 2N3565
INSTEAD OF 014-698 FOR
SERVICE USE ONLY.

PRINTED WIRING ASSY 4050409



OFARADS.
1/2W, 5%.
MAY BE USED

LAST REF. DES. USED	REF. DES. NOT USED
R10	PI
C6	
Q2	
E7	
P2	
T1	



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL CAPACITOR VALUES ARE IN MICROFARADS.
2. ALL RESISTOR VALUES ARE IN OHMS, 1/2W, 5%.
3. TRANSISTORS 2N3117 OR 2N3565 MAY BE USED INSTEAD OF 014-698 FOR SERVICE USE ONLY.

LAST REF DES.

R10
C6
Q2
E7
P2
T1