AMPEX
4890332

AG-440C-8

operation and maintenance

Catalog No. 4890332-01
Issued: June 1974

AG-440C-8
RECORDER/REPRODUCER

OPERATION AND MAINTENANCE

AMPEX CORPORATION
AUDIO-VIDEO SYSTEMS DIVISION

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INTRODUCTION

This manual, Catalog Number 4890332-01, provides descriptive information, installation, operation, theory of operation, and maintenance instructions for the Ampex Model AG-440C-8 Tape Recorder/Reproducer, Ampex Part Number 4010205-01 and -02.

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AG-440C-8 Tape Recorder/Reproducer

SECTION I
DESCRIPTION

The Ampex Model AG-440C-8 is a professional quality audio tape recorder/reproducer that permits eight channel recording or reproduction, utilizing one-inch width magnetic tape. The 440C-8 is console mounted (see frontispiece photo).

The tape transport unit is equipped with a servo type capstan drive motor. The servo system makes tape speed entirely independent of power line voltage and frequency variations. The two-position tape SPEED switch can be connected (using internal jumpers) to permit selection of either of the two "low"/"high" tape speed choices listed in Table 1-1. Electronic equalization is automatically switched according to the speed selected.

Table 1-1. Available Tape Speeds

CHOICE	SPEED SWITCH	
	(LOW)	(HIGH)
1	7-1/2 in/s	15 in/s
2	15 in/s	30 in/s

Tape speed can also be controlled externally, over the range of 3.00 in/s to 45 in/s, by means of an external reference signal source. Refer to headings: *Speed Pair Selection* and *Variable Tape Speed Mode* in Section III.

An optional unit (Sync Lock Accessory) also permits variable tape speed operation. Also, with the Sync Lock Accessory, tape speed can be controlled by a choice of reference signals or by a 50 Hz or 60 Hz signal recorded on the magnetic tape.

Each of the eight record reproduce electronic units contains a built-in Sel Sync* circuit for recording added channels in perfect synchronization with previously recorded channels. Plug-in accessories, such as microphone preamplifier, a matching line-input transformer, and a remote control unit are available as optional equipment.

*Trademark Ampex Corporation

TAPE TRANSPORT

All components of the tape transport (Figure 1-1) are mounted on a rigid-casting base. The transport, as delivered from the factory accommodates tape reels with NAB hubs up to 10-1/2 inches in diameter. Also, the turntables can be easily repositioned for use with 11-1/2 inch IEC reels. Tape scrape-flutter is minimized by a scrape-flutter idler (mounted on jeweled bearings) installed between the record and reproduce head stacks.

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 obtained by pressing the EDIT pushbutton.

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.

Pushbutton controls, along the front edge of the tape transport, select operational modes: RECORD, PLAY, REWIND, FAST FWD, STOP, and EDIT. These switches are on the front of the tape transport control box. The control box (Figure 1-2) has externally-mounted main fuses, cable receptacles for transport sub-assemblies, and plug-in relays for the play, rewind, fast forward, and edit functions.

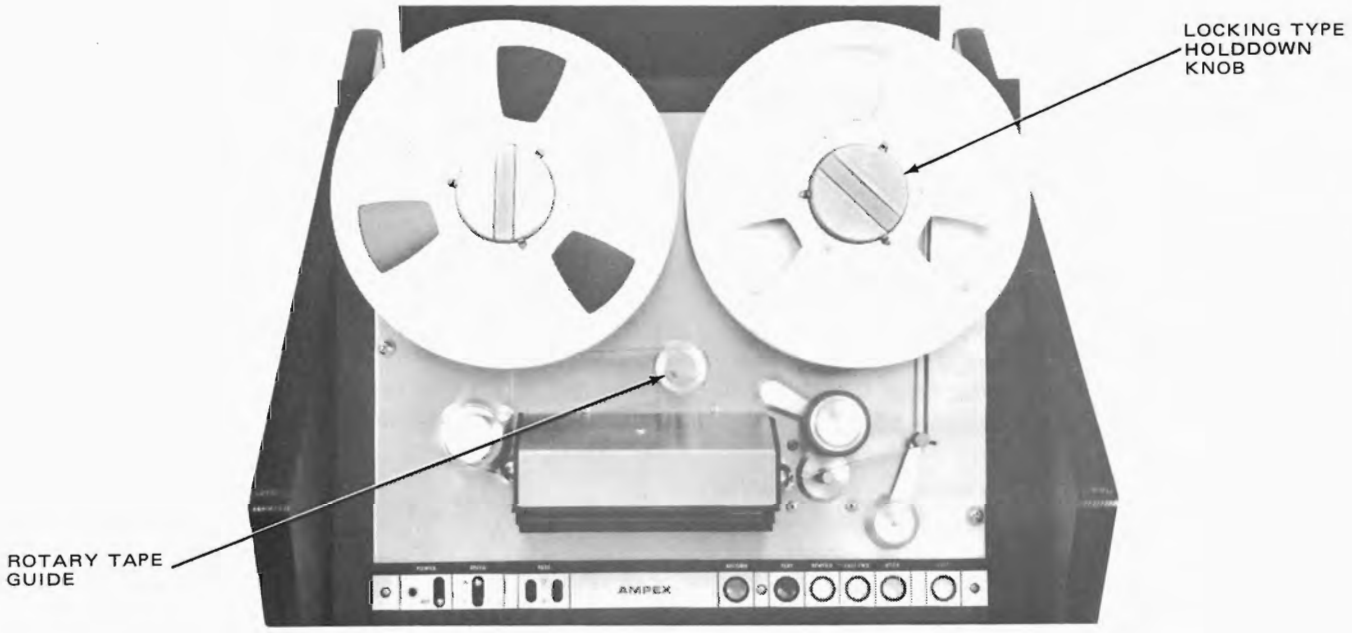


Figure 1-1. Tape Transport (Top View)

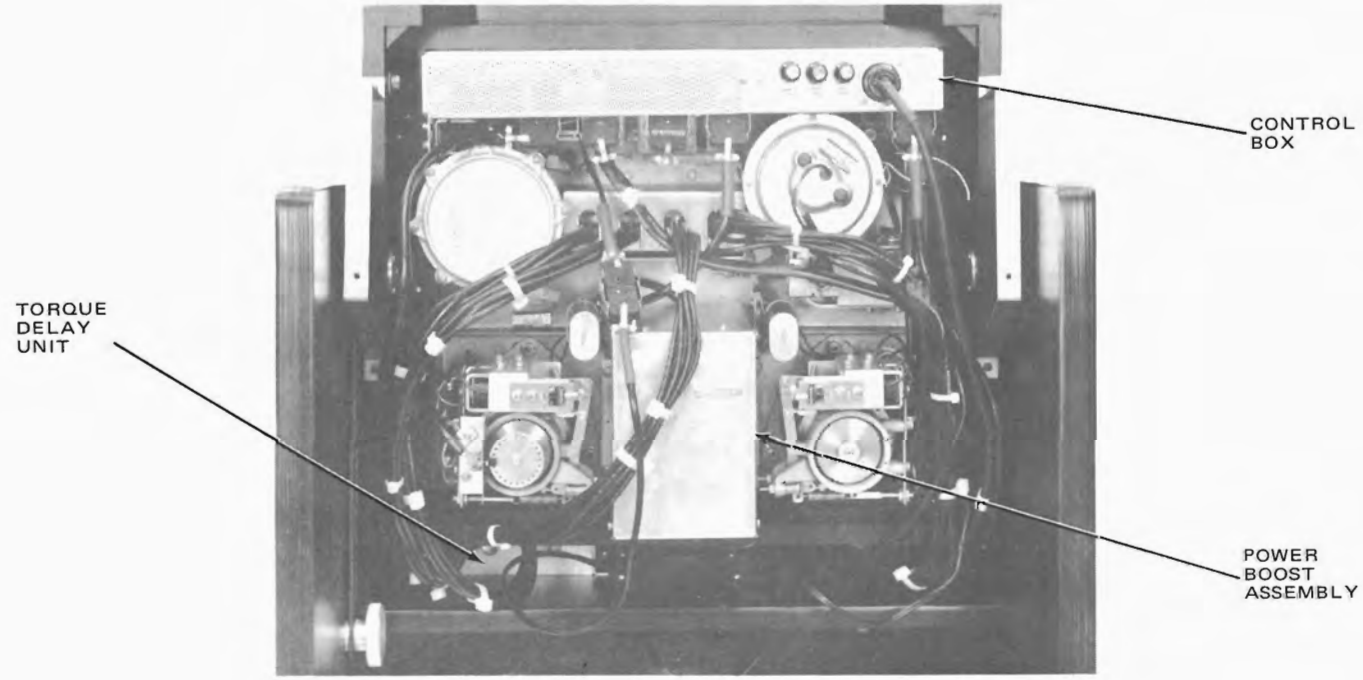


Figure 1-2. Tape Transport (Bottom View)

Components located on the underside of the tape transport are shown in Figure 1-2. The power boost assembly increases the torque of the takeup motor during the start of the play mode and while in a fast winding mode. A torque delay unit is mounted on the shelf below the transport. The torque delay unit delays torque to the supply reel drive motor to enable the tape to come quickly up to speed in the play mode.

ASSEMBLIES MOUNTED ON REAR OF CONSOLE

Assemblies mounted on the rear of the console (Figure 1-3) are: a servo electronics unit and two power supply units.

The servo electronics unit controls the speed of the servo motor (capstan drive motor).

Each of the power supplies provides power to four of the eight record/reproduce units of the AG-440C-8. The upper four electronic units on the console are provided with 39 volts dc (-1/2, +1) by the left-hand (-05 version) power supply, and the lower four channels are powered by the right-hand (-06 version) power supply. The -05 version power supply contains a master bias oscillator, but the -06 version does not. A jumper wire between the two power supplies carries bias from the -05 supply to the -06, so that bias voltage is available to all eight channels.

RECORD/REPRODUCE ELECTRONIC UNIT

One record/reproduce electronic unit (Figure 1-4) is required for each channel of the AG-440C-8. Each record/reproduce unit consists of an electronic chassis with three plug-in modules (Figure 1-5). The modules, removable through a front panel cut-out, are plugged into 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 that electronic alignment controls are accessible through the front panel cut-out. Equalization is automatically switched (according to the tape speed selected) by solid-state switching circuits. Record and reproduce equalizers required for different tape speeds are listed in Table 1-2.

Receptacles for interconnect cables, accessories, and input/output-signal cables are on the back panel of the chassis (Figure 1-6). Also accessible from the rear of the unit are: a line-termination switch (to select correct termination resistance during maintenance procedures), a meter sensitivity switch (permits 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.

Table 1-2. Equalizers

FUNCTION	TAPE SPEED (IN/S)	PART NO.
Record	7-1/2 NAB – 15 NAB	4020269-01
Record	15 NAB – 30 AES	4020269-07
Record	7-1/2 IEC – 15 IEC (CCIR)	4020269-03
Record	15 IEC – 30 AES	4020269-06
Reproduce	7-1/2 NAB – 15 NAB or IEC	4020270-01
Reproduce	15 NAB or IEC – 30 AES	4020270-02

ACCESSORIES

The recorder/reproducer is supplied with a dummy plug, installed in the INPUT ACCESSory socket (on the back panel), when shipped. With the dummy plug installed, an unbalanced-line (100,000 ohm input impedance) input is provided. If a balanced-line or microphone input is to be used, the dummy plug (in the INPUT ACCESSory socket) must be replaced with one of the following:

1. A bridging-input transformer providing unit gain (input impedance of 20,000 ohms balanced). This transformer is supplied with the AG-440C-8.

2. A matching transformer (600 ohm input impedance balanced) providing a gain of approximately 14 dB. This transformer is listed, together with other available optional equipment, in Table 1-3.

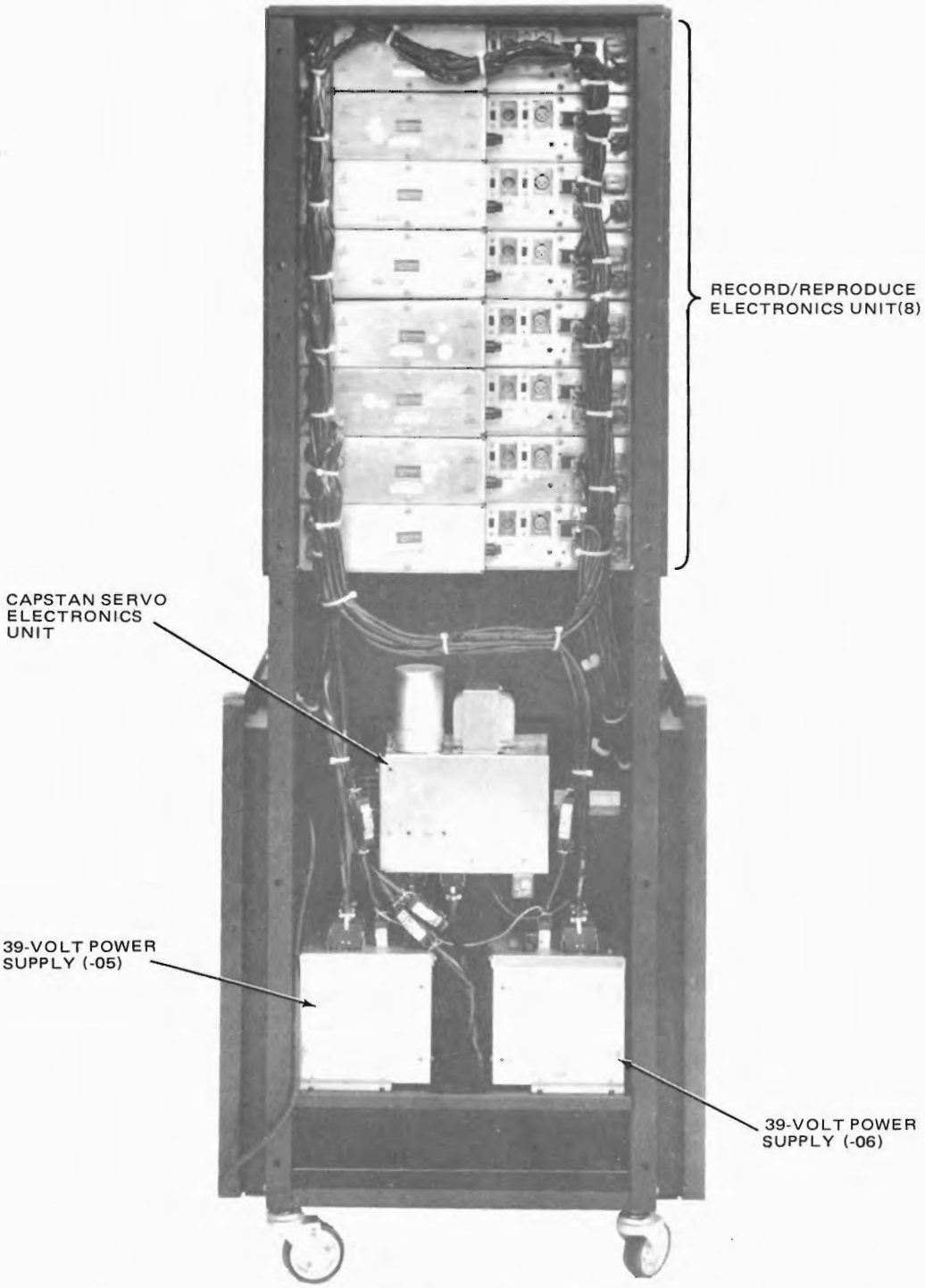


Figure 1-3. Rear View of Console

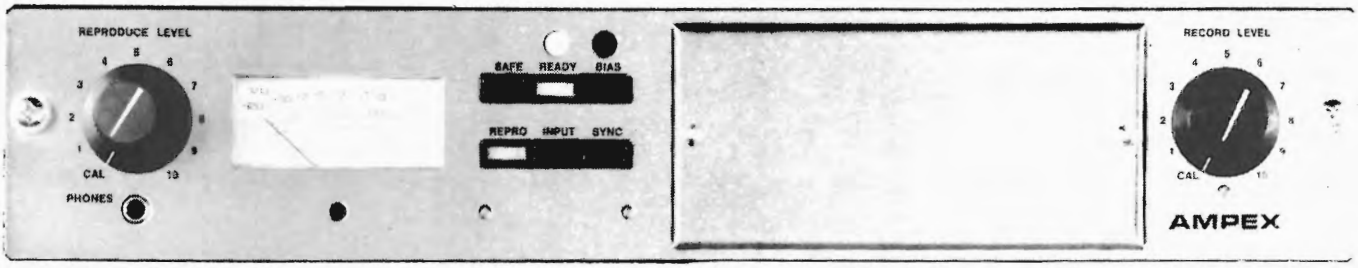


Figure 1-4. Record/Reproduce Electronics Unit (Front View)

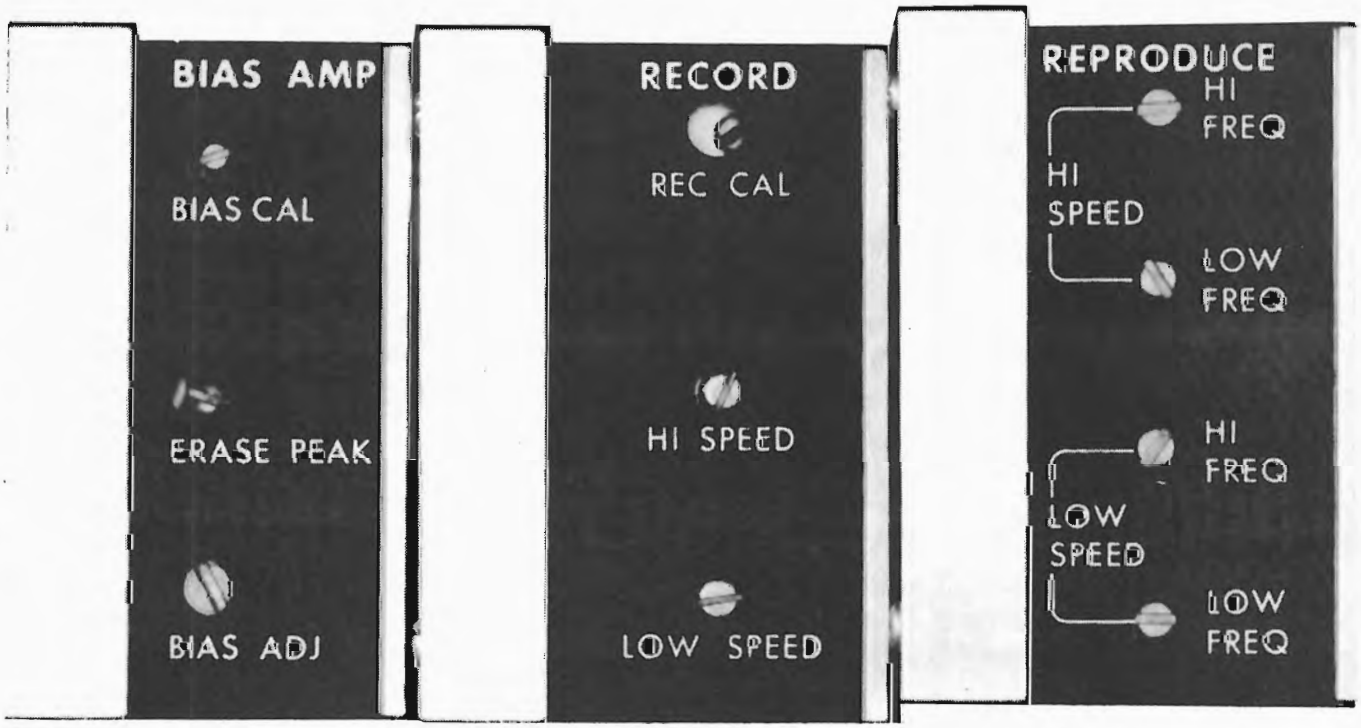


Figure 1-5. Record/Reproduce Electronics Unit, Removable Modules

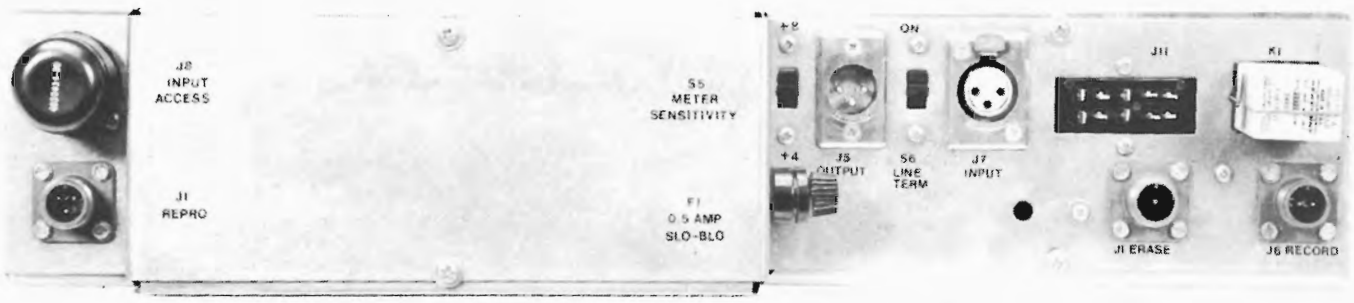


Figure 1-6. Record/Reproduce Electronics Unit (Rear View)

Table 1-3. Available Accessories

DESCRIPTION	AMPEX PART NO.
Microphone Preamplifier	4010066
Remote Control Unit	4010080
Matching Transformer (600 ohms input impedance)	4580200-02
Pickup Recording Kit	4850180
Multivolt Transformer (permits operation from 220 Vac line voltage)	4010186
Electronics Assembly Rear Cover (one required per channel)	4040982
Extender Boards for Circuit Boards:	
Reproduce	4020151
Record	4020152
Bias Amplifier	4020153
Power Supply	4020154
Capstan Servo Electronics	4050695
Record-Equalizer Module	
7-1/2 – 15 in/s IEC (CCIR)	4020269-03
15 – 30 in/s IEC (CCIR)	4020269-06
Reel (10-1/2 inch) for 1-inch width tape	4690003-50

3. A microphone preamplifier (for recording with a microphone). This optional unit is listed in Table 1-3.

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

SPECIFICATIONS

Specifications for significant parameters and features of the AG-440C-8 Recorder/Reproducer are given in Table 1-4.

Table 1-4. Specifications for the AG-440C-8

Track Width:

1-inch tape (25.4 mm)
8 channel: 0.070 inch (1.8 mm)

Tape Speeds:

Choice of two low/high speed combinations, depending upon pin strapping of servo pwa.
7-1/2 in/s (low), 15 in/s (high)
15 in/s (low), 30 in/s (high)
Variable speed operation is also possible.

Reel Size:

10-1/2 inch NAB.
11-1/2 inch (29.2 cm) IEC (CCIR) reels with adaptors

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.

Equalization:

NAB standard for 7-1/2 and 15 in/s, AES standard for 30 in/s. IEC (CCIR) available for 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, and at least 14 dB below operating level for 7-1/2 in/s.

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.

15 in/s NAB ±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	8 TRACK 1 inch Tape
7-1/2 in/s NAB	64 dB
15 in/s NAB	63 dB
30 in/s AES	65 dB

Table 1-4. Specifications for the AG 440C-8 (Continued)

GENERAL (Continued)

Signal to Noise Ratio (Continued):

WEIGHTED

(Using a NAB or ASA "A" weighting filter and a 1000 Hz reference)

TAPE SPEED	8 TRACK 1 inch Tape
7-1/2 in/s NAB	68 dB
15 in/s NAB	66 dB
30 in/s AES	69 dB

Bias and Erase Frequency:

150 kHz.

Erase Efficiency:

75 dB or greater at 1kHz.

Crosstalk:

Better than 65 dB. Measured by recording a 1,000 Hz signal on one track of an erased tape and reproducing on an adjacent track.

Even-Order Distortion:

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

Flutter and WOW:

Measured per ANSI S 4.3 or DIN 45507 using a prerecorded flutter tape.

TAPE SPEED	Peak WTD	Peak UNWTD	RMS UNWTD
7-1/2 in/s	0.06%	0.12%	0.08%
15 in/s	0.06%	0.10%	0.06%
30 in/s	0.06%	0.08%	0.05%

Speed Accuracy:

Speed measured per NAB Standard on Magnetic Tape Recording and Reproduction 1965 Section 2.02.01 with a test tachometer pulley 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 ±0.00005 inch (1.5 mil tape).]

Nominal ±0.08%

Speed Variation Beginning to End of Reel:

Less than 0.08%.

Line Power Requirements

Frequency: 50/60 Hz
Line Voltage: 110 to 125 Vac
Current: ≈4.6 amps (at 117 Vac)

SECTION II
INSTALLATION

This section contains information about unpacking and inspection, equipment connectors and cabling, accessory installation, and initial adjustments.

UNPACKING AND INSPECTION

Upon receipt, examine shipping crate for any signals 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.

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.

Equipment in the console is interconnected at the factory. The console is shipped lying on its back with the tape transport rotated 90° to a horizontal position. To unpack the recorder/reproducer proceed as follows:

1. Open the 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 up and forward until console 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 tape transport to the horizontal position, and retighten knob to secure transport in position.

CONSOLE FRONT-PANEL REMOVAL AND INSTALLATION

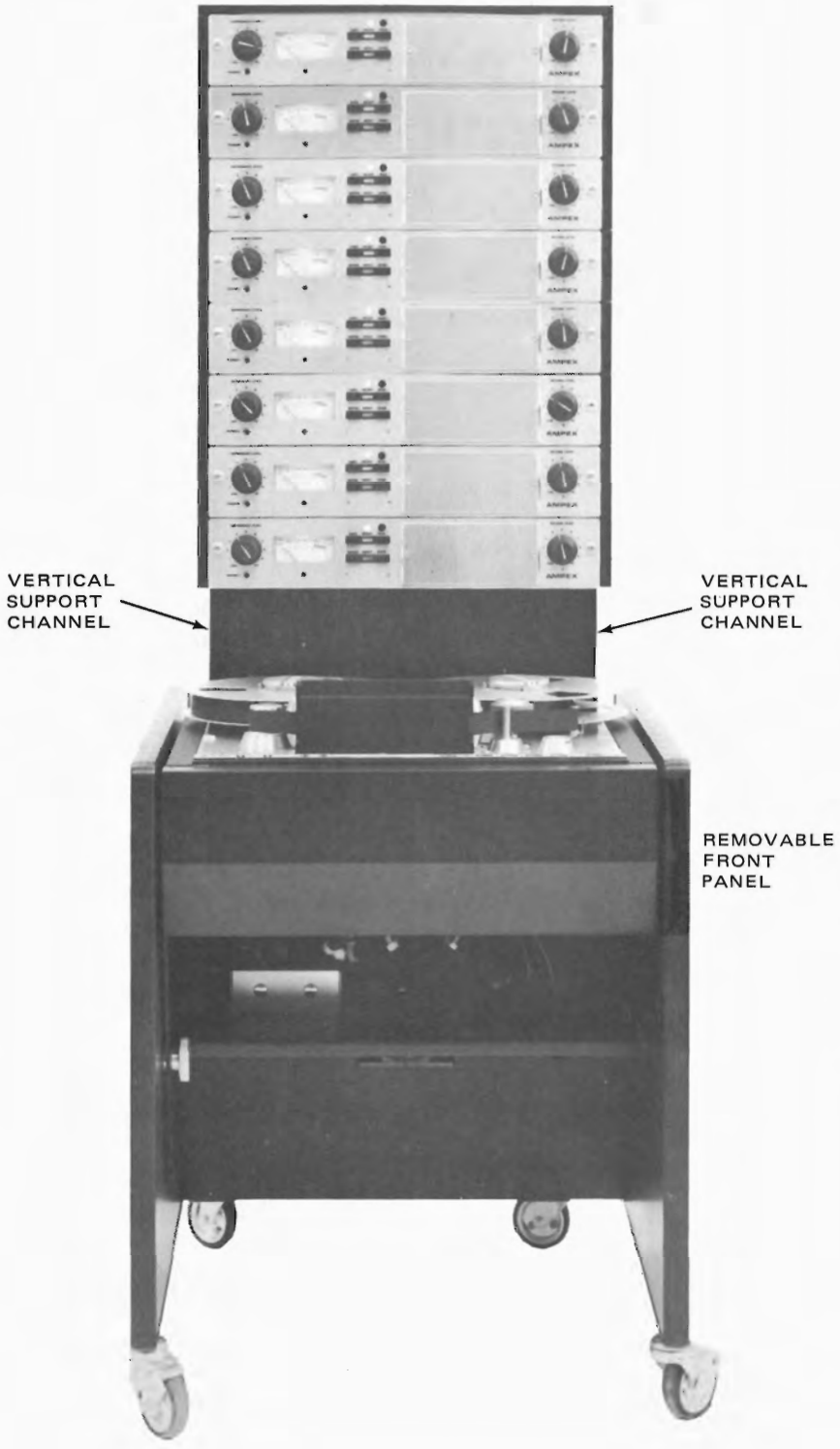
The console has a front panel (Figure 2-2) that extends down and around the bottom of the control panel. This panel must be removed to perform some installation procedures.

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 (top of transport).
3. Move the panel clear of the transport frame and carefully lower the panel until it can be removed.

To install panel:

Reverse the removal procedure given above.



AG-440C-8 Tape Recorder/Reproducer

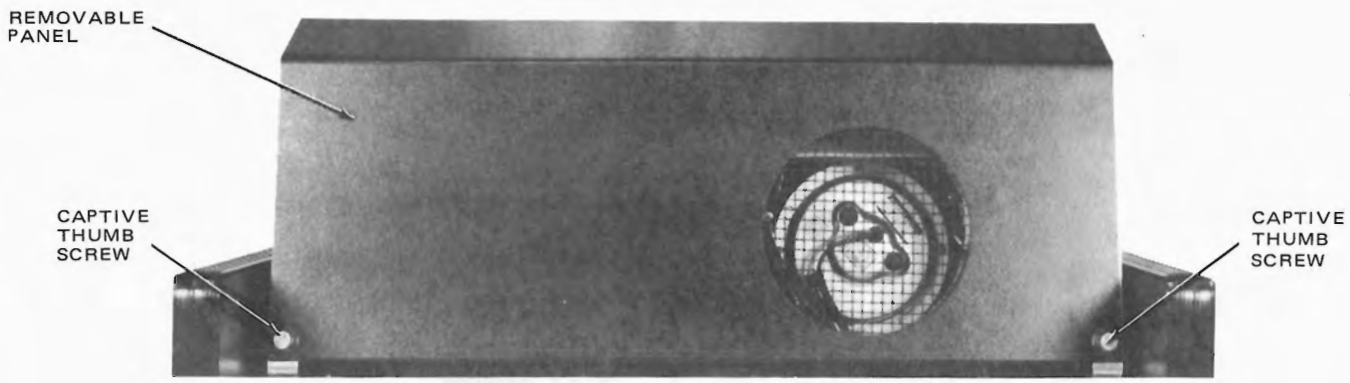


Figure 2-2. Tape Transport Removable Panel

CHECKING CABLES AND COMPONENTS

Equipment is intercabled at the factory; however, ensure that cable connectors are firmly seated and cables are undamaged.

Connectors on the tape transport control box are shown in Figure 2-3. Before attempting to operate the 440C-8 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 (Figure 2-4) to J606S on tape transport control box.
5. Plug-in assemblies (Figure 2-5) of record/reproduce unit(s). Check that the bias amplifier, record amplifier, and reproduce amplifier modules are firmly seated in their connectors.
6. Plug-in equalizer PWA in each record amplifier module and reproduce amplifier module. Ensure that these PWA's 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.

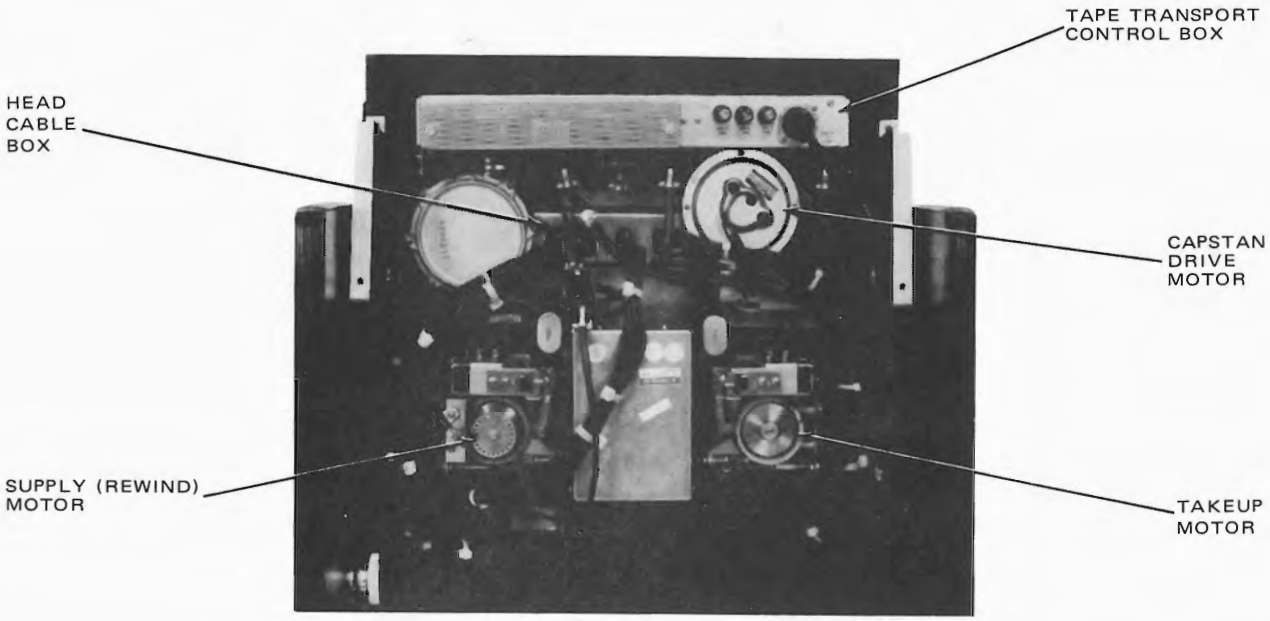


Figure 2-3. Tape Transport (Bottom View)

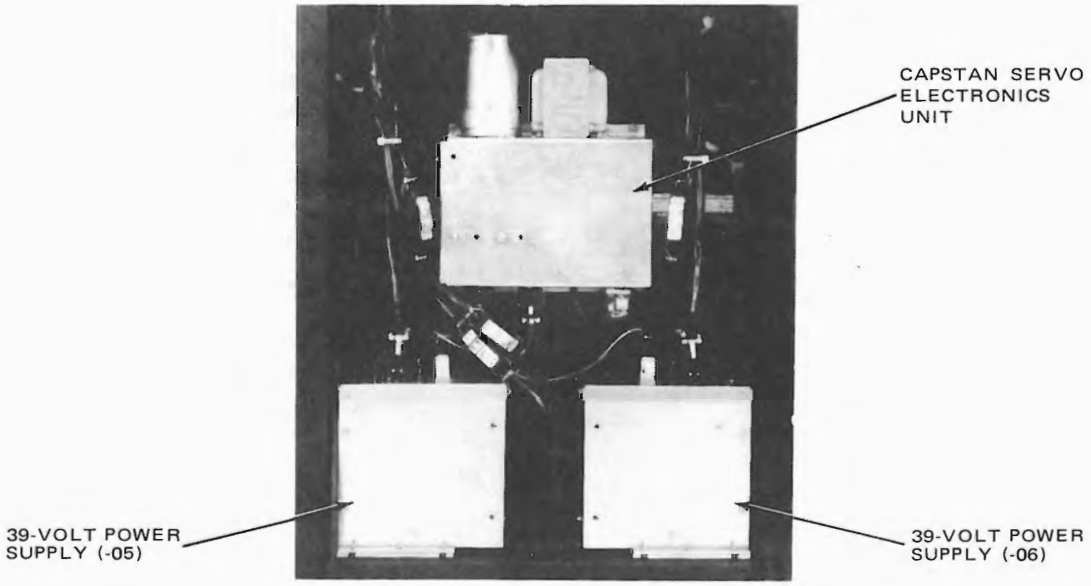


Figure 2-4. Capstan Servo and 39-Volt Power Supplies

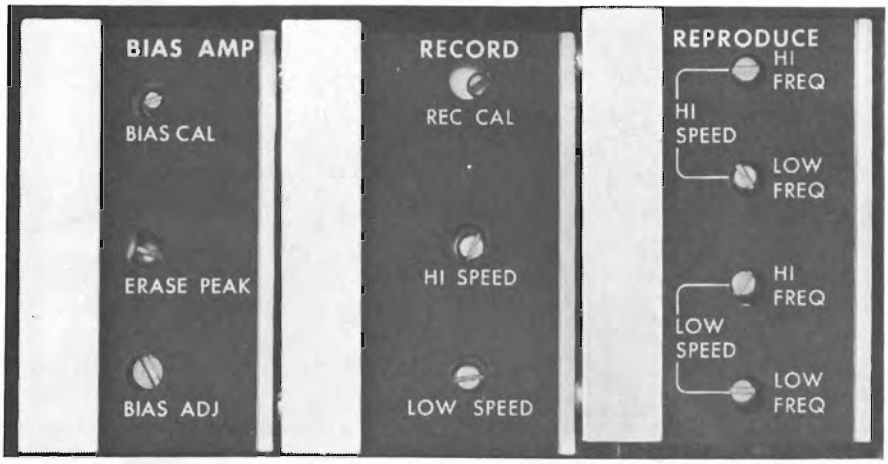


Figure 2-5. Bias, Record, and Reproduce Modules

INITIAL LUBRICATION

When the recorder/reproducer is first installed, check that the capstan idler has sufficient lubrication as follows:

1. Using a knife blade (or similar tool), gently pry 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 Ampex Lubricating Oil, Catalog No. 4010825 or 087-579. (Equivalent oils are Esso Standard Oil Co., Teresso No. 47; and Socony Mobil Oil Co., Mobiloil DTE, Medium.)

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.

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 described on the following page.

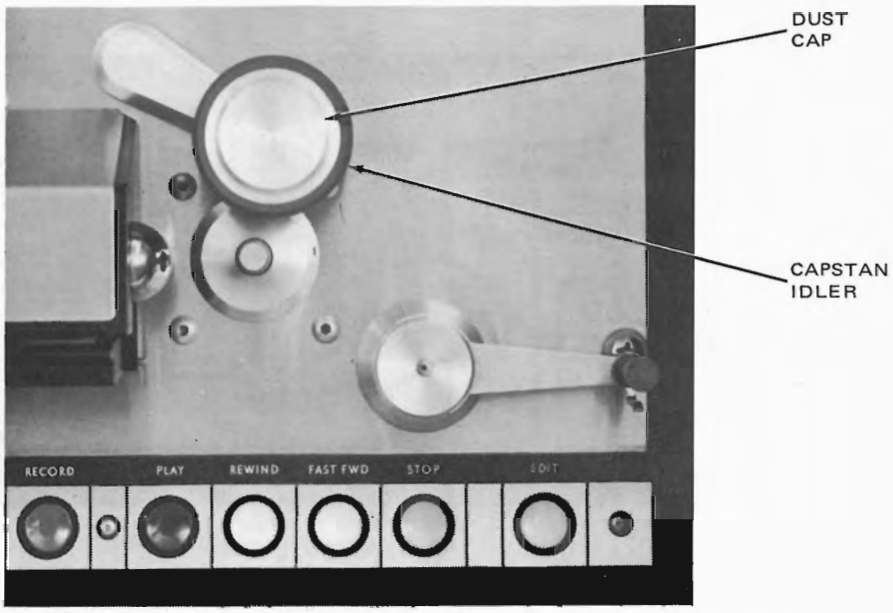


Figure 2-6. Capstan Idler

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. Connector 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 pins 2 and 1 of connector.

Input Signal Setup

The 440C-8 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 (supplied) is 20,000 ohms. Input impedance using a matching transformer (accessory) 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 miphone preamplifier are available as optional accessories. Installation and application of these accessories are discussed in the previous *Input Signal Setup* paragraphs.

Remote Control Unit

Except for the stop/edit and play/edit modes, all operational modes of the 440C-8 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 CONT connector on the tape transport control box.

Console Rear Covers

Rear covers for the equipment consists of 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.

CONNECTING AC POWER

The power requirements of the 440C-8 Recorder/Reproducer are listed in Table 1-4. 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.

INITIAL ADJUSTMENTS

The 440C-8 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 Tape.
Bias and Equalization	Biased and equalized using Ampex 406 high-output, low noise tape.

Some applications of the 440C-8 Recorder/Reproducer require operational adjustments that differ from those established at the factory. For example, the use of conventional tape requires change in 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

To perform the conversion procedures presented in the following paragraphs, the only test items required are a signal generator (Hewlett-Packard, Model 204C or equivalent) and a suitable roll of blank tape. If the 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 recorder/reproducer 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 will be 185 nWb/m.

Biasing for Different Tape

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 Maintenance Section (see heading *Bias Metering Calibration*).

Equalizing for a Different Tape

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

Short Cut Procedures

NOTE

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

Changing from 260 nWb/m to 185 nWb/m (at +8 Vu Line Level). Proceed as follows:

1. Rotate the RECORD LEVEL and REPRODUCE LEVEL controls fully counterclockwise 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 the 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 the VU meter.
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 Level calibrate control (on Record plug-in module) for a 0 indication on the VU meter.

Changing from +8 Vu to +4 Vu Line Level (at 260 nWb/m Operating Level). Proceed as follows:

1. Rotate the RECORD LEVEL and REPRODUCE LEVEL controls fully counterclockwise to CAL.
2. Set METER SENSITIVITY switch to +4.
3. Press READY and INPUT pushbuttons.
4. Adjust the level of the signal generator output signal (700 Hz) for a "0" indication on the VU meter.
5. Press READY and REPRO pushbuttons.
6. Press PLAY and the 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 the 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. Proceed as follows:

1. Rotate the RECORD LEVEL and REPRODUCE LEVEL controls fully counterclockwise to CAL.
2. Set METER SENSITIVITY switch to +4.
3. Press READY and INPUT pushbuttons.
4. Adjust the level of the signal generator output signal (700 Hz) for a "0" indication on VU meter.
5. Press READY and REPRO pushbuttons.

6. Press PLAY and the 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 the 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 Calibrate control (on Record plug-in module) for a "0" indication on VU meter.

Changing from Nominal 600-Ohm to 150-Ohm Output Impedance. Proceed as follows:

1. Rotate the RECORD LEVEL and REPRODUCE LEVEL controls fully counterclockwise 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 then RECORD pushbuttons.

5. Adjust the level of the signal generator output signal (700 Hz) for a "0" indication on the 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 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 counterclockwise 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" 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.

SECTION III
OPERATION

This section contains the following information: location and functioning of the operating controls and indicators, operating instructions for the various operating modes, and a discussion of tape speed capabilities of the 440C-8.

CONTROLS AND INDICATORS

Operator controls and indicators are located on the tape transport and the record/reproduce units. Table 3-1 shows controls of the tape transport and explains the function of each control. Table 3-2 shows controls of the record/reproduce units and explains the function of each control.

OPERATING INFORMATION

NOTE

In order to ensure optimum equipment performance and maximum service life, routine maintenance (refer to Preventive Maintenance in Section 5) 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 (/\) or low-speed (\/) position as required.

NOTE

Appropriate record and playback equalizations are automatically selected to agree with the setting of the SPEED switch.

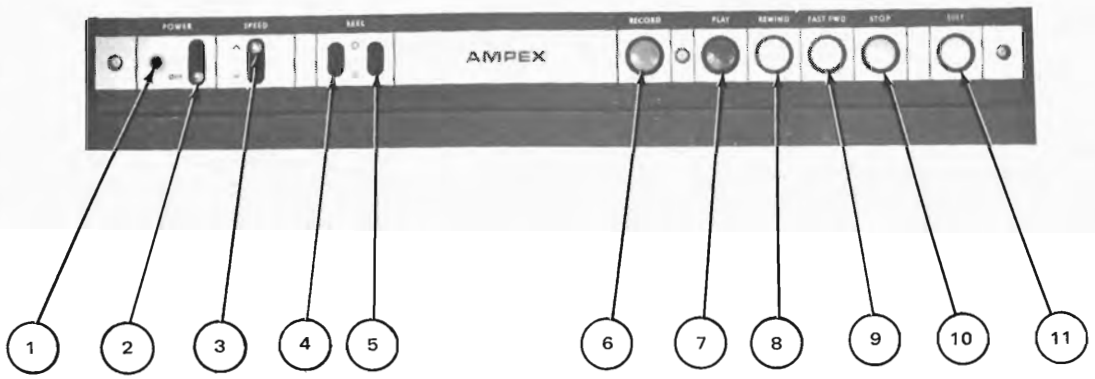
3. Install reel of tape on supply turntable and empty reel on takeup turntable.
4. Thread tape as shown in Figure 3-1. To facilitate tape threading, turn on recorder/reproducer and depress EDIT pushbutton, which reduces turntable braking force so the reels can be easily turned by hand.
5. Anchor tape 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.
6. If desired, a headset or speaker can be connected to the PHONES jack on any 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.

Table 3-1. Tape Transport, Controls and Indicators

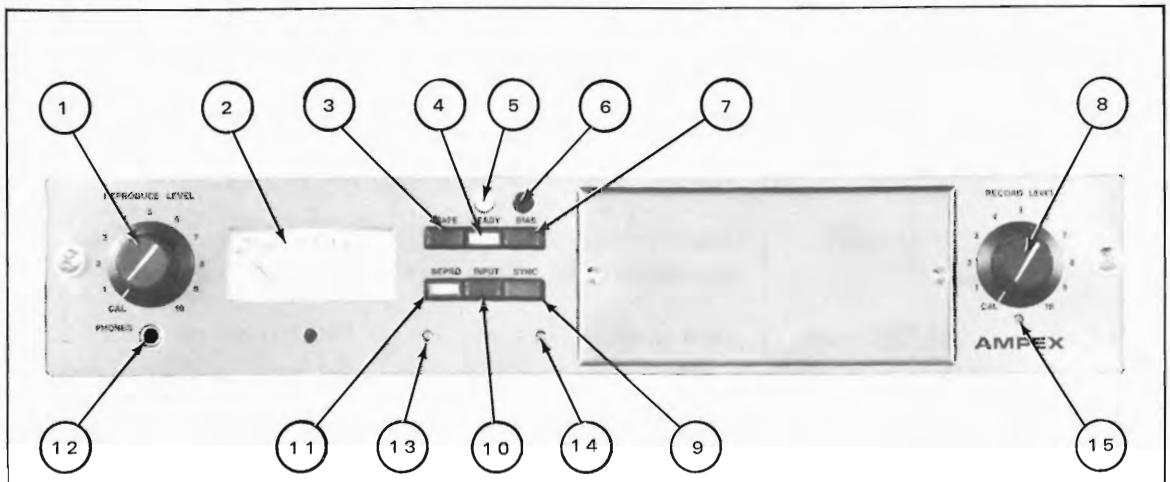


INDEX NO.	NAME	FUNCTION
1	POWER indicator	Lights when power is turned on.
2	POWER toggle switch	Turns on power.
3	SPEED toggle switch	Selects low (∨) or high (∧) tape speed. (Equalization is automatically switched in accordance with speed selection.)
4	REEL	Not functional. (Switch not present.)
5	REEL	Not functional. (Switch not present.)
6	RECORD pushbutton	Used in conjunction with PLAY (Index No. 7, this table) and READY pushbuttons (Index No. 5. Table 3-2). With READY pushbutton depressed, pressing PLAY pushbutton and then RECORD pushbutton selects record mode.
7	PLAYpushbutton	Used to select play mode or used with RECORD (Index No. 6, this table) and READY pushbuttons (Index No. 5, Table 3-2) to select record mode. Pressing PLAY pushbutton during a fast-wind mode has no effect on the

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

INDEX NO.	NAME	FUNCTION
		motion. To enter "play" from a fast wind mode, press STOP, then press PLAY. When the transport comes to a stop from the fast mode, it will enter the play mode.
8	REWIND push-button	Used to select rewind mode. Rewind can be initiated during any mode except record and play/edit modes.
9	FAST FWD push-button	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	Used to initiate one of the following edit modes: **Stop/Edit.** If tape is stopped or not threaded, pressing EDIT pushbutton reduces braking force for easier tape threading or manual tape movement. **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. **Fast/Edit.** If rewind or fast forward mode is active, pressing EDIT pushbutton causes tape lifters to lower tape onto heads to permit audio monitoring.

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



INDEX NO.	NAME	FUNCTION
1	REPRODUCE LEVEL/CAL rotary 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. 13 in 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 and meter indicates level of bias signal of associated channel. Meter lights when recorder/reproducer is turned on.
3	SAFE pushbutton	In depressed position, prevents selection of record mode.
4	READY 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 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 of associated channel.

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

INDEX NO.	NAME	FUNCTION
8	RECORD LEVEL/CAL rotary control	Used to adjust gain of record amplifier of associated channel. CAL position switches gain-adjustment function to input calibrate potentiometer (Index No. 15, in this table).
9	SYNC pushbutton switch	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 in record mode, input signal to be recorded is connected to audio output, PHONES jack, and vu metering circuit of associated channels.
10	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.
11	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.
12	PHONES jack	Receptacle for head phones plug. Reproduced audio of associated channel can be heard on headphones.
13	Reproduce calibrate adjustment	Used to set operating level. (See *Operating Level Adjustment* in Maintenance Section.)
14	Sync calibrate adjustment	Used to set Sel Sync signal level.
15	Input calibrate adjustment	Used to adjust input level.

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.

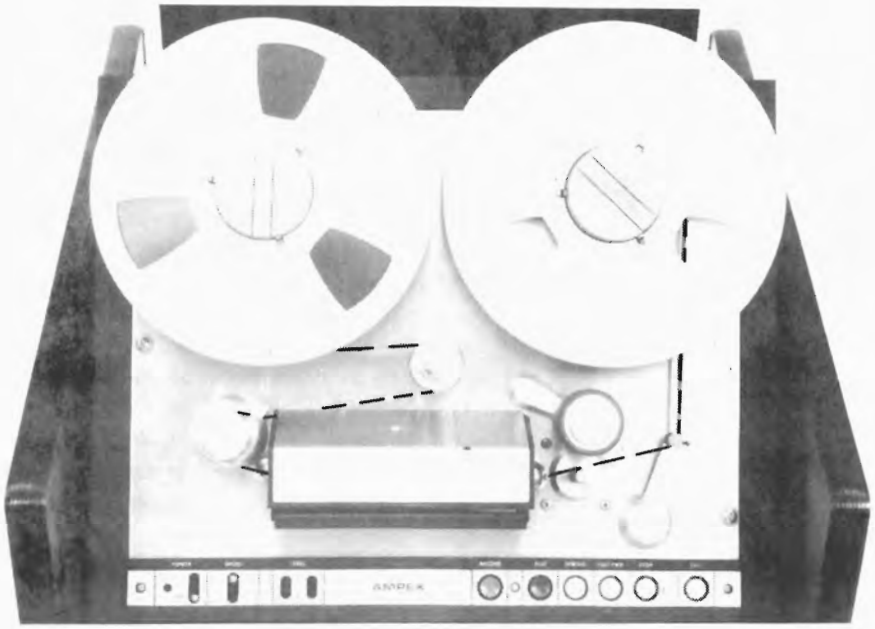


Figure 3-1. Tape Threading Diagram

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. Depress REPRO pushbutton.
4. Depress PLAY pushbutton to begin reproducing recorded material.
5. When desired material has been reproduced, depress STOP pushbutton to stop tape motion and deactivate play mode.

NOTE

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

Sel Sync

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 the recorder/reproducer is equipped with a tape having two prerecorded 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 re-recording the mixed signals on another track.

CAUTION

OFTEN IT IS NOT POSSIBLE TO RE-RECORD 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.

Fast Winding

For fast-winding operations press either the REWIND or FAST FWD pushbutton. For editing and cueing 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 one tape lifter back.

NOTE

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

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.

Speed Pair Section

The front panel SPEED switch on the AG-440C-8 permits the selection of the high or low operating speed. The assignment of the 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, and 7.5 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 (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 or E6).
5. Replace the servo printed wiring assembly in the servo chassis, component side rearward (i.e., facing away from the AG-440C-8).

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.

NOTE

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

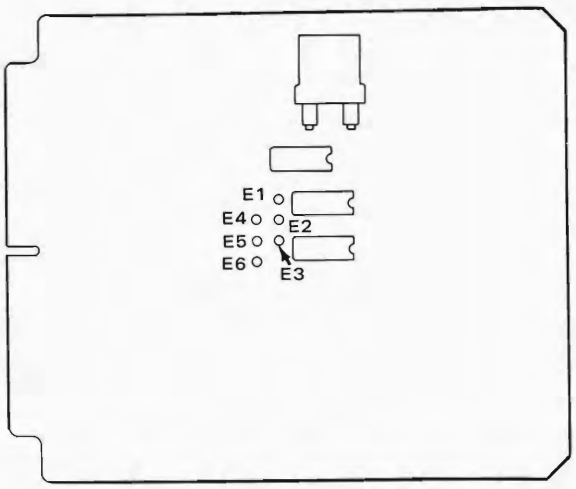
Table 3-3. Tape Speeds for Various Reference Frequency Inputs

TAPE SPEED (IN/S)	INPUT FREQUENCY
7.5	2400
15	4800
30	9600

Capstan Operational Options

Three capstan operational options are available; they are:

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



SPEED STRAPPING				
RANGE		30/15	15/7.5	7.5/ 3.75
HI	E5 TO	E6	E3	E4
LO	E2 TO	E3	E4	E1

Figure 3-2. Tape Speed Pin Strapping

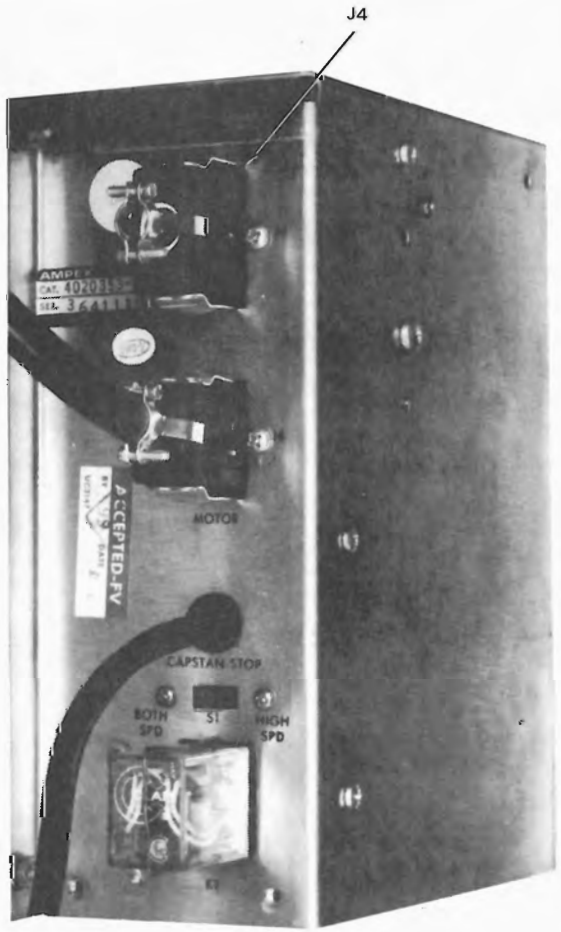


Figure 3-3. Capstan Servo Electronics Unit

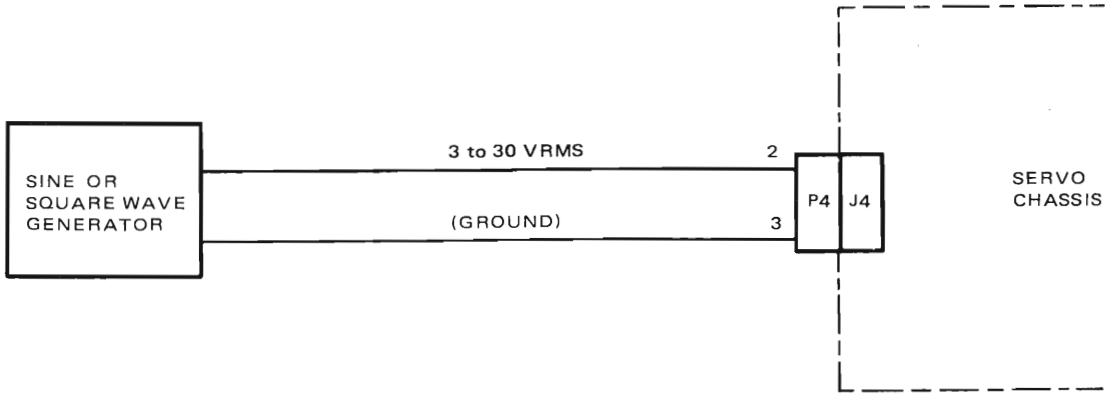


Figure 3-4. Variable Speed Operation, Wiring Diagram

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 functional description of the 440C-8 Recorder/Reproducer. The functional description is followed by a detailed description of the electronic circuitry. A simplified block diagram of the recorder/reproducer is shown in Figure 4-1. Only one of the eight record/reproduce channels of the 440C-8 is shown in Figure 4-1; however, the seven remaining channels are connected and operate in the same manner.

FUNCTIONAL DESCRIPTION

Tape Transport

Tape motion is controlled by the tape transport mechanism for all operational 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 takeup assemblies. 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.

A pair of solenoid-controlled brakes is mounted on each of the two reel 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 only in the stop-edit mode and results in partial brake release.

The capstan drive is provided by a servo-controlled dc capstan motor. The capstan is at the end of the capstan motor shaft and is precision machined and hardened. 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.

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 supply and takeup motor torque, and therefore tape tension, are adjustable. An adjustable resistor (mounted on the transport control box) is in series with each of the reel motors. Torque of each reel motor is adjusted by moving a sliding contact on the appropriate series resistor. The torque delay and power boost circuits reduce the time required to bring the tape up to normal speed. The time following start of tape motion that torque delay and power boost are effective, is adjustable.

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 into 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 lower torque of the other turntable and a fast tape speed results.

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.

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

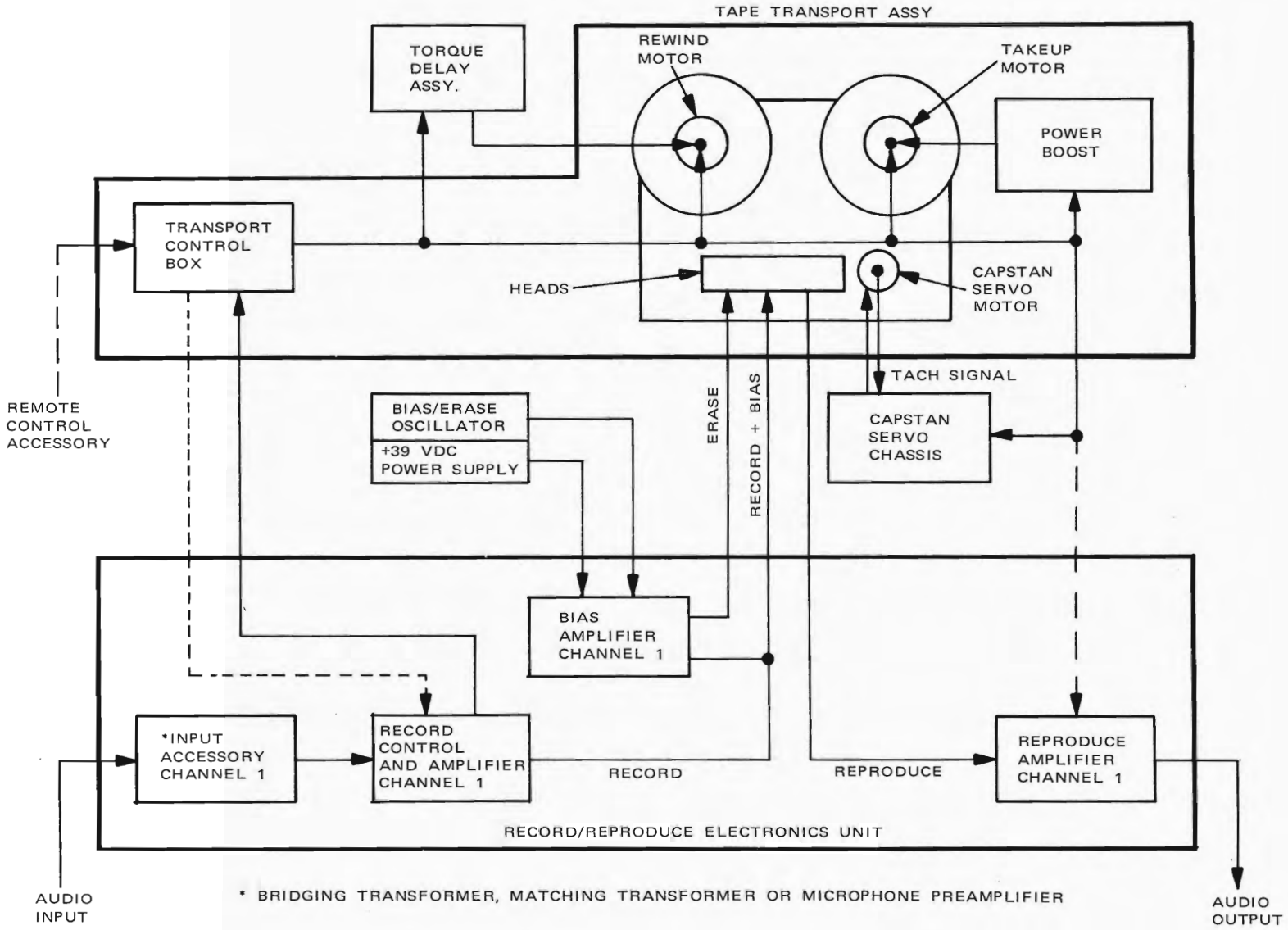


Figure 4-1. AG-440C-8 Recorder/Reproducer, System Block Diagram

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 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 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.

Capstan Servo System

Figure 4-2 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 printed wiring assembly (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 rectangular 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 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.

Record/Reproduce Electronic Units

The record/reproduce units (Figure 4-1) contain circuitry for record control and for amplification of the bias signal, signals to be recorded, and signals to be reproduced (see *Recorder/Reproducer* in Section I).

Operating Modes

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

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 (rewind) 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

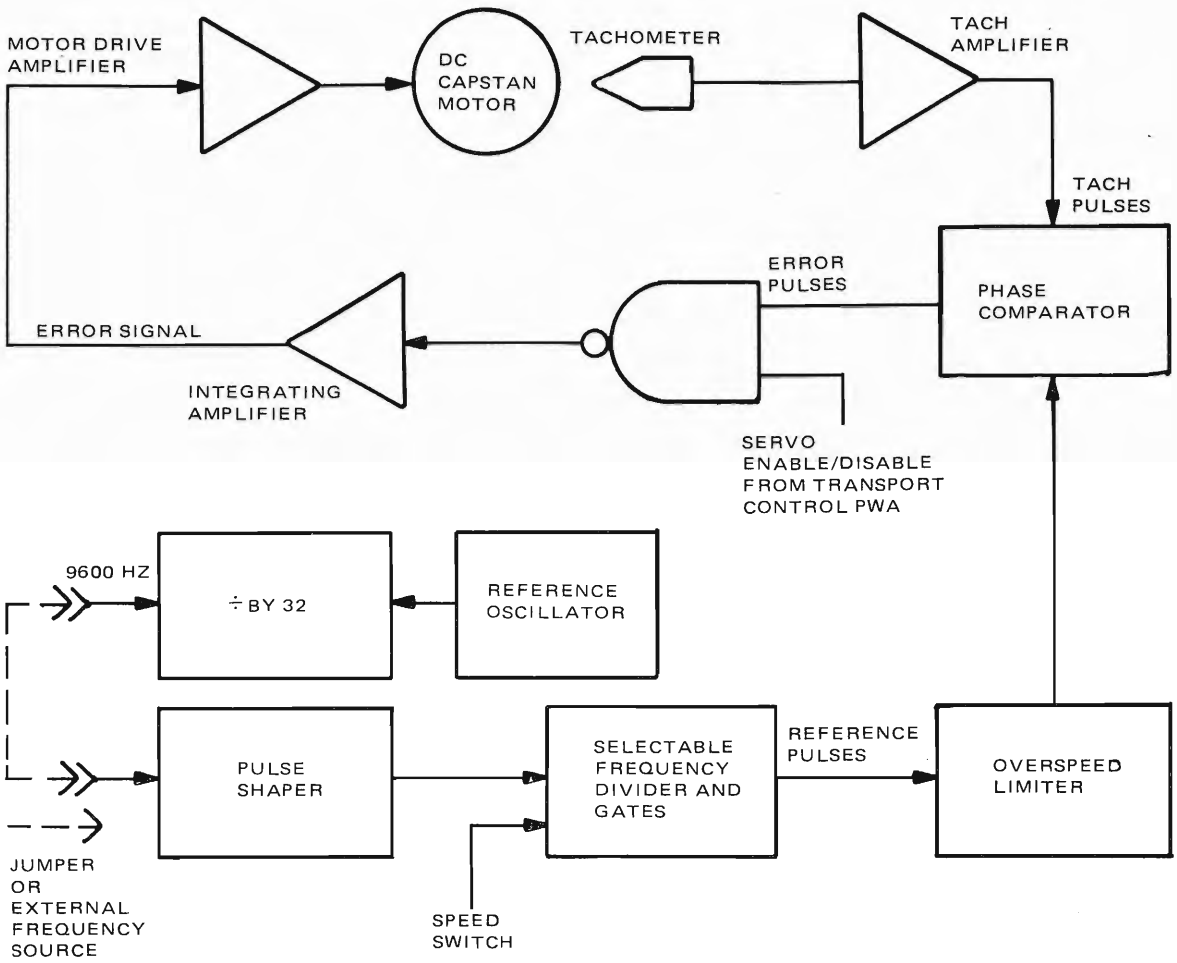


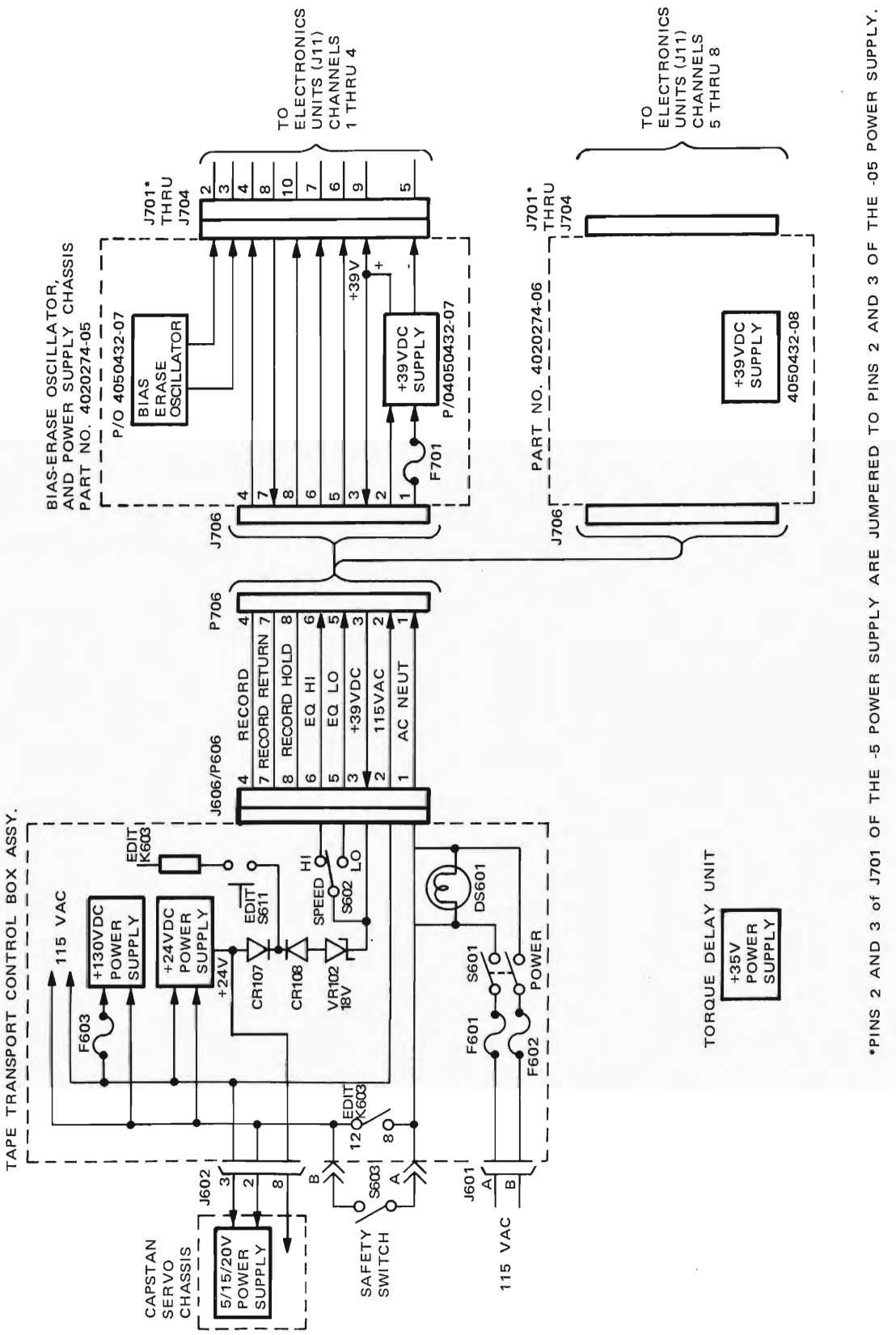
Figure 4-2. Capstan Servo Block Diagram

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.

POWER DISTRIBUTION

AC Distribution

Input 117 Vac power is routed through fuses F601 and F602 (Figure 4-3) to POWER switch S601. With safety switch S603 (actuated by 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



*PINS 2 AND 3 of J701 OF THE -5 POWER SUPPLY ARE JUMPERED TO PINS 2 AND 3 OF THE -05 POWER SUPPLY.

Figure 4-3. Power Distribution, Wiring Diagram

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.

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 VR102 and CR108. When the safety switch is closed, the 24 Vdc power supply is enabled. Enabling the 24 Vdc supply turns off VR102, disconnecting the 39 Vdc supply from certain circuits. These circuits are then powered by the 24 Vdc supply.

Diode CR107 disconnects the 24 Vdc supply from the 39 Vdc supply when the 24 Vdc supply is not active. Diode CR108 disconnects the 39 Vdc supply from the 24 Vdc supply if the 39 Vdc supply fails while the 24 Vdc supply is active.

The 39 Vdc power supply ground is connected to the 24 Vdc power supply ground via the electronics units. Ground is carried by the playback (reproduce) cable outer shield to J1 (electronic chassis), then to J11 (pin 5) and then back to the 39 Vdc power supply. Therefore, if the electronics units are disconnected, edit mode operation is not possible with the safety switch open.

The two Bias-Erase Oscillator and Power Supply Chassis (Figure 4-3) are described in Section I (see *Assemblies Mounted On Rear of Console*).

DETAILED CIRCUIT DESCRIPTION

General

Circuitry of the 440C-8 Recorder/Reproducer is covered under four major headings:

1. Power Supply Assembly
2. Tape Transport and Torque Delay
3. Capstan Servo Chassis and Printed Wiring Assemblies
4. Electronics and Electronic Modules

The four major headings, under which circuit descriptions are given, correspond with the assembly names listed in the first column of Table 4-1.

Table 4-1. Circuit Description Index

ASSEMBLY	PART NUMBER	SCHEMATIC NUMBER
POWER SUPPLY	4020274-05 4020274-06	4840168 4840039
TAPE TRANSPORT and TORQUE DELAY	4020280-12 4020303-01	4840271 4840188
CAPSTAN SERVO CHASSIS and PRINTED WIRING	4020353-02 4050692-04	4840250 4840356
*ELECTRONICS and ELECTRONIC MODULES	4020337-01	4840248 4840249
Reproduce Amplifier	4050435	
Record Amplifier	4050434	
Bias Amplifier	4050433	
Record Equalizer	4020269-01	
Record Equalizer	4020269-07	
Reproduce Equalizer	4020270-02	

*The Record Control Board (Assy No. 4050564) shown on the Electronics schematic (4840248) is explained under *Tape Transport and Torque Delay.*

Power Supply Assembly

Introduction. Two Power Supply assemblies are used in the 440C-8 Recorder/Reproducer (Part No. 4020274-05 and 4020274-06). The -05 version contains circuitry for a +39 Vdc power supply and a bias erase oscillator (see schematic 4840168). The printed wiring assembly in the -06 power supply contains only +39 Vdc power supply circuitry (see schematic 4840039).

The circuit description of the +39 Vdc power supply applies to both the -05 and -06 versions of the power supply. The circuit description of the bias erase oscillator is only applicable to the -05 version of the power supply.

+39 Vdc Power Supply. Schematics 4840168 and 4840039 show 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, and 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.

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 astable 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.

Tape Transport and Torque Delay

Circuitry shown on the Transport schematic (4840271) and the Torque Delay schematic (4840188) is explained below. Also, the Record Control Board (Assy No. 4050564), shown on the Electronics schematic (4840248), is explained due to the close interrelationship of circuits.

Control Circuitry. The transport control circuitry is located in three places: the control box underneath the transport controls, the power boost assembly located in the rear center of the transport,

and in the torque delay assembly located on the console shelf underneath the transport. Four power supplies are associated with the control circuits:

1. 130 Vdc (CR615 through CR618) to operate the capstan and brake solenoids. This supply is at power line potential.

2. 24 Vdc (CR601 through CR604) to operate the relays, logic circuitry and edit solenoid.

3. 39 Vdc electronics power supply which supplies logic power when the 30 Vdc power supply is deactivated by the safety switch.

4. 35 Vdc power supply (CR1 and CR2) in the torque delay box to provide power to the torque delay circuit. This supply is at power line potential.

Five relays are associated with the transport functions: Play (K602), Edit (K603), Fast forward (K604), Rewind (K601), and Takeup power boost (12K11). These relays control the power to the solenoids and motors in addition to performing logic functions. The transistor logic located on the etched board in the control box, coupled with the logic of the relays, controls energizing of these relays. The general functions of the transistors located in the tape transport and torque delay assemblies are given in Table 4-2.

PLAY MODE. The tape transport will enter the play mode whenever the play relay (K602) is energized. When the play pushbutton is pressed, +30 volts is supplied through normally closed contacts of the rewind relay (K601-11/3) and normally closed contacts of the fast forward relay (K604-9/1) and Play pushbutton S608 to pin 13 of the Play relay K602.

The Play relay is held in the energized state by holding contacts K602-9/5 as long as Q109, in the ground leg of the relay, is conducting.

The play mode is terminated by turning off Q109 or by energizing K601 or K604. Q109 also controls the turn off or inhibiting of edit relay K603.

Table 4-2. General Functions of Transistors

SCHEMATIC DESIG	LOCATION	FUNCTION
Q101, Q102, Q103	Control box PWB (schematic 4840271)	Fast wind motion sense
Q104	Control box PWB (schematic 4840271)	Fast wind inhibit during record
Q105	Control box PWB (schematic 4840271)	Record stop delay (delays stopping of the transport until the bias decays)
Q106, Q109	Control box PWB (schematic 4840271)	Stopping the play and edit modes (deactivation of the play and edit relays)
Q107	Control box PWB (schematic 4840271)	Voltage regulator to provide +21 volts to fast wind motion sense circuit
Q108	Control box PWB (schematic 4840271)	Record detector that senses when any electronics is recording
Q110, Q111, Q112	Control box PWB (schematic 4840271)	Play memory circuit. Remembers that the Play pushbutton was pressed during fast wind deceleration
Q606	Control box (schematic 4840271)	Energizes the tape lifter solenoid
12Q7	Power Boost Box (schematic 4840271)	Discharges 12C22 during stop modes to assure proper timing when play is activated
Q1	Torque delay PWB (schematic 4840188)	Constant current source to charge capacitor C2
Q2	Torque delay PWB (schematic 4840188)	Emitter follower to transform impedance and voltage levels
Q3	Torque delay PWB (schematic 4840188)	Discharge of capacitor C2 when play mode is completed
Q4, Q5	Torque delay chassis and PWB (schematic 4840188)	Current amplifier to control the supply motor current through diode bridge A1

In the standby condition Q109 is held in the conducting state by base current supplied from the +30 Vdc supply (via CR107, R116, and CR109), or from the +39 Vdc supply (via VR102, CR108, R116 and CR109). Transistor Q109 is turned off or inhibited if Q106 is conducting or whenever the fast motion circuit (Q101, Q102, and Q103) is active.

If Q106 conducts, the base drive to Q109 is shunted to ground through R112 and the collector of Q106. Q106 conducts when the local or remote Stop pushbutton is pressed. Pressing Stop removes a ground from the junction of CR106 and R117, and Q106 is turned on by base drive delivered through R117, CR106, and R114. If Q108 (the record detector explained under the heading *Record Mode*) is turned on, the ability of Q106 to turn off Q109 is overridden by current through R119. Therefore, pressing Stop does not terminate the Play mode if the recording process is active.

Transistor Q109 is also turned off whenever the fast motion circuit (Q101, Q102, and Q103) is active (see discussion under heading *Fast Motion Sensor*). Base drive is removed from Q109 by conduction of Q103 through CR102.

The play relay can also be energized by the play memory circuit (Q110, Q111, and Q112). If the Stop button is pressed (while in fast wind mode) and then the Play button is pressed (before the tape comes to a stop), the memory circuit will latch up. When the tape comes to a stop, the memory circuit will start the transport in the play mode.

When decelerating from a fast wind mode, the junction of CR110 and CR111 is held at a positive voltage by Q101. However, this positive voltage does not turn on Q110, Q111, or Q112 (these transistors will remain off until the Play button is pressed). When the Play button is pressed, a pulse is created. The positive edge of this pulse passes through C111, R124, and CR113 and causes conduction of Q111. Conduction of Q111 causes Q110 to conduct and Q110 now supplies base drive to Q111 through R121, CR115 and CR110. Transistors Q110 and Q111 latch into a conducting state and remain latched as long as the CR110/CR111 junction is high or charge is present on C109. Although Q111 is conducting, Q112 (which supplies positive voltage to the play relay) cannot conduct because its base circuit is back biased by CR111. When tape motion finally stops, the positive voltage is removed from the junction of CR110 and CR111. However, the Q110/Q111 latch remains conducting due to the charge on capacitor C109.

With the positive voltage removed from the junction of CR110 and CR111, a path for Q112 base current is provided through VR103, R123, Q111, CR112, and Stop button S606 to ground. Therefore, Q112 supplies a positive pulse to the play relay and the tape transport enters the play mode (since Q109 has also returned to its normal conducting state).

When the play relay is energized, the takeup and supply brake solenoids and the capstan solenoid are energized. Holdback and takeup power are supplied to the rewind and takeup motors. The brake solenoids are energized by contact set K602-12/8 in the negative side of the 130 Vdc supply and the capstan solenoid is energized through contact set K602-11/7 in the positive side of the 130 Vdc supply.

Power (117 Vac) is applied to the supply motor (B603) via the following path: contact set K602-10/6, R630, J608-3, diode bridge A1 in the torque delay box (schematic 4840188), J608-4, R604, normally closed contacts of the rewind relay (K601-10/2), and J607-2 to the rewind motor. The rewind motor return is through the safety switch (S603) to ac neutral. The torque delay box improves the play start characteristics of the transport by providing reduced holdback tension when the play mode is activated, then gradually increasing holdback tension to the normal value.

When the play relay is energized ac line voltage energizes the primary of transformer T1 (schematic 4840188), producing a positive dc voltage at E4 with respect to E5. A portion of this voltage is delivered from the movable contact of potentiometer R9 (R9 sets the initial starting torque), through capacitor C2, to the base of Q2. A portion of this voltage is transferred to Q4, through the emitter of Q2, and divided by resistors R6 and R7. Transistor Q4 is a current amplifier for Q5. Transistor Q5 determines the amount of ac current that is delivered to the rewind motor via bridge rectifier A1.

Transistor Q1 is a constant current amplifier that supplies charging current to capacitor C2 as the tape is coming up to speed. As capacitor C2 charges, the base of Q2 is driven more positive, driving Q5 harder and increasing the ac current supplied to the rewind motor. Variable resistor R8 (Time adjust) establishes the current that Q1 passes and thus controls the time it takes for C2 to fully charge. During Play, transistor Q3 is cut off and

serves no function. When Play is terminated, Q3 conducts briefly and capacitor C2 is discharged returning the circuit to the normal state.

Power (117 Vac) is supplied to the takeup motor (B602) through the following path: contact set K602-10/6, R630, R605 (the play takeup tension adjustment), normally closed contacts of the fast forward relay (K604-10/2, and J603-2). In addition, contact sets 12K11-11/7 and -12/8 (on the power boost relay) short out R630 and R605. This results in applying the full 117 Vac to the takeup motor for a short time after Play is activated. The motor return path (to ac neutral) is through J603-1, K603-1, K603-12/4 on the edit relay, and safety switch S603.

During standby, base drive is supplied to 12Q7 (in the power boost assembly) through K601-11/3, K604-9/1, K602-9/1 and 12R27. This action discharges capacitor 12C22. When the Play relay energizes, base drive is removed from 12Q7 and dc voltage is applied to capacitor 12C22 through K602-9/5 and 12CR7. This charging current energizes relay 12K11 and the relay remains energized until capacitor 12C22 is charged. The takeup boost time adjust resistor (12R29) is in parallel with the relay. Therefore, capacitor charging time (and thus the time the relay is energized and power boost is operative) is adjustable.

RECORD MODE. During the following discussion reference is made to circuitry on the record control board (schematic 4840248) and to the transport (schematic 4840271). The record mode can be activated by pressing the Record button provided that the play relay is energized, the edit relay is deenergized, and either Ready or Bias is selected on the electronics unit. This applies base drive to 9Q1 through K601-11/3, K604-9/1, K602-9/5, K603-11/3, record button S609, J606-4, 4J11-4, and 9R4.

Providing the 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 Q108, which turns on Q108. The current supplied to the base of transistor 9Q3 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 Q108.

With transistor Q108 turned on, the resulting high level at its collector forward biases the base/emitter junction of transistor Q105. Transistor Q105 and capacitor C104 form a stop-memory circuit that is only active in the record mode. When either the local or remote Stop pushbutton is pressed, capacitor C104 charges through diode CR105 and resistor R117. Also, the emitter circuit of transistor 9Q1 is opened.

Opening the emitter circuit of 9Q1 turns off transistors 9Q1, 9Q2, and 9Q3. Transistor 9Q4 is held on by the charge on capacitor 8C1, which keeps record relay 4K1 energized and transistor Q108 conducting (via 9R6 and 9CR2). Consequently, transistor Q109 is held on by the collector current of Q108, 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 C104 is longer than that associated with 8C1. As a result, transistor Q106 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 Q108. Turning off Q108 allows Q106 to turn off Q109, which turns off play relay K602, thus causing the tape to be stopped. When C104 has discharged enough to turn off Q106, transistor Q109 is turned on again by the current flowing thru R116, CR109, and the base/emitter junction of Q109 and the circuit is returned to the standby condition.

FAST FORWARD. The fast forward mode can be entered from any mode except Record. Pressing the fast forward pushbutton applies +30 Vdc to K604-13. The return path of K604 is via Q104, CR104, and Stop pushbutton S606 to ground. In any mode except Record, Q104 is turned on, but when recording the turn on of transistor Q108 applies reverse bias to the base of Q104. Relay

K604 is kept energized, after the Fast Forward pushbutton is released, by applying +30 Vdc via K604-5/9 and K601-3/11. Fast forward is terminated by interrupting the relay current; either by pressing the Stop button or by energizing the rewind relay.

When the fast forward relay is energized, the brake solenoids are energized via K604-12/8 in the negative side of the 130 volt supply. The takeup motor is supplied with 150 Vac as follows: the 117 Vac at J604-2 is stepped up by 12T2 to 150 Vac at J604-3 and applied via K604-6/10 and J603-2 to takeup motor B602. Holdback torque is supplied to the rewind motor (B603) via R607 and J607-2.

In fast forward, transistor Q606 is turned on by base current furnished from the +30 Vdc supply, via CR114 and R104. Conduction of Q606 energizes the tape lifter solenoid. Since the emitter of Q606 is connected to ground through CR623 and the normally closed contacts of the Edit pushbutton (S611), pressing the Edit pushbutton interrupts current through the tape lifter solenoid and the tape lifters are inoperative.

REWIND. The rewind operation is identical to that of fast forward except that the roles of the reel motors are reversed. Circuits of the takeup and rewind motors are symmetrical.

EDIT MODE. In play-edit and stop-edit, the edit relay (K603) is energized, but in fast-wind-edit K603 remains deenergized. As discussed in the previous text, transistor Q109 is turned on in the play and stop mode and turned off in the fast-wind modes (via CR102). 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 energizes the edit brake solenoids (K606 and K608), which release the edit brakes. Energizing the edit brake solenoids 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 Stop pushbutton. Pressing STOP causes transistor Q106 to conduct, reverse biasing transistor Q109 and deenergizing 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 CR611 dampens the inductive transient produced by the edit brake solenoids when they are deenergized.

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 K603-10/2 breaks the circuit to the takeup main brake solenoid, engaging the takeup reel brake. Further, contact set K603-4/8/12 breaks the takeup motor circuit and disables 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 pushbutton.

In the fast wind-edit mode the edit relay is prevented from being energized by the fast wind motion circuitry holding off conduction of Q109. The only action that occurs when the edit pushbutton is depressed is that tape lifter solenoid current is interrupted (see *Fast Forward*).

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, opening safety switch S603. In all modes except edit, the safety switch removes ac power from the reel motors, capstan servo, +130 Vdc power supply, and the +30 Vdc power supply. Thus, the reel motors and capstan motor are deenergized, the capstan pinch roller retracts, 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 disc that is fixed to the motor shaft. When the shaft is turning, the light path between the diode and phototransistor is periodically broken by the disc. 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 C101 to the base of transistor Q102. Diode CR101 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 +30 Vdc through CR114 and R107 to the base circuit of Q103 and Q103 turns on. 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 R106 turns on transistor Q101. Turning on Q101 establishes alternate current paths for Q606 and the base circuit of Q103.

When another mode is selected, either contact set K601-3/7/11 or K604-3/7/11 disconnects the positive voltage from the base of Q103 and Q606. 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. Q101 supplies the base drive to Q606. When tape motion stops, Q102 stops conducting, causing Q101 and Q103 to stop conducting. Consequently, Q606 shuts off allowing the tape to be lowered onto the heads. Also, play mode can now be entered since Q109 is no longer held off by Q103.

24 Vdc Power Supply. This supply receives 115 Vac power 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. This supply receives a nominal 117 Vac power from the ac power-distribution circuitry of the recorder/reproducer. A bridge rectifier (CR602, CR603, CR604, and 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.

35 Vdc Power Supply. The 35 Vdc power supply is located in the Torque Delay assembly (refer to schematic 4840188). Transformer T1 steps down the 117 Vac line voltage and CR1 and CR2 provide full-wave rectification.

Capstan Servo Chassis and Printed Wiring Assemblies

The complete capstan servo system is shown on schematic 4840250. All components on schematic 4840250 except the Servo Motor Assembly (4020352) are considered to be a part of the Capstan Servo Chassis Assembly (4020353). The servo motor assembly is considered to be a part of the transport assembly.

Schematic 4840250 shows chassis mounted components and the Printed Wiring Assembly (4050692) located in the capstan servo chassis. A detailed diagram of printed wiring assembly circuitry is provided by schematic 4840356. Both capstan servo schematics (4840250 and 4840356) will be referred to during discussion of capstan servo system circuitry.

+5/12/20 Vdc Power Supply. The +5/12/20 Vdc power supply (schematic 4840250) 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 VR1, 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 (shown on schematic as +15 Vdc) is applied to stages Q1, Q2, Q3, and A4, and to a +5 volt regulator.

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.

Servo System Circuit Description. Integrated circuit A5 (schematic 4840356), crystal Y1, and associated components comprise the internal reference oscillator. Crystal Y1 is in the feedback path of stage A5 and is series resonant at a frequency of 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 signal is fed to stage A1.

Integrated circuit A1 is connected to divide the oscillator signal by 16. The 19.2 kHz output of A1 is divided by two by IC A3, and the 9,600 Hz signal at A3-8 is outputted from the board (PWA) at pin 16. The 9,600 Hz signal outputted at J3-16 (schematic 4840250) or an external 9,600 Hz signal is delivered to J4-2 and thence to J3-9. This signal is applied to the pulse shaper input (pin 9) of the PWA (schematic 4840356).

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 cleanly shaped pulse train to flip-flop A3-1.

Flip-flops A3 and A2 form a divider chain. The 9,600 Hz pulse frequency is divided by factors of 8, 4, 2, and 1 at strapping points E1, E4, E3, and E6 respectively. Interconnection of strapping points for desired tape speeds is discussed under *Speed Pair Selection* in the Operation section of this manual.

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 A7-8 and disables gate A7-11. Therefore the appropriate pulse frequency is delivered to pin 1 of retriggerable one-shot A10 (overspeed limiter).

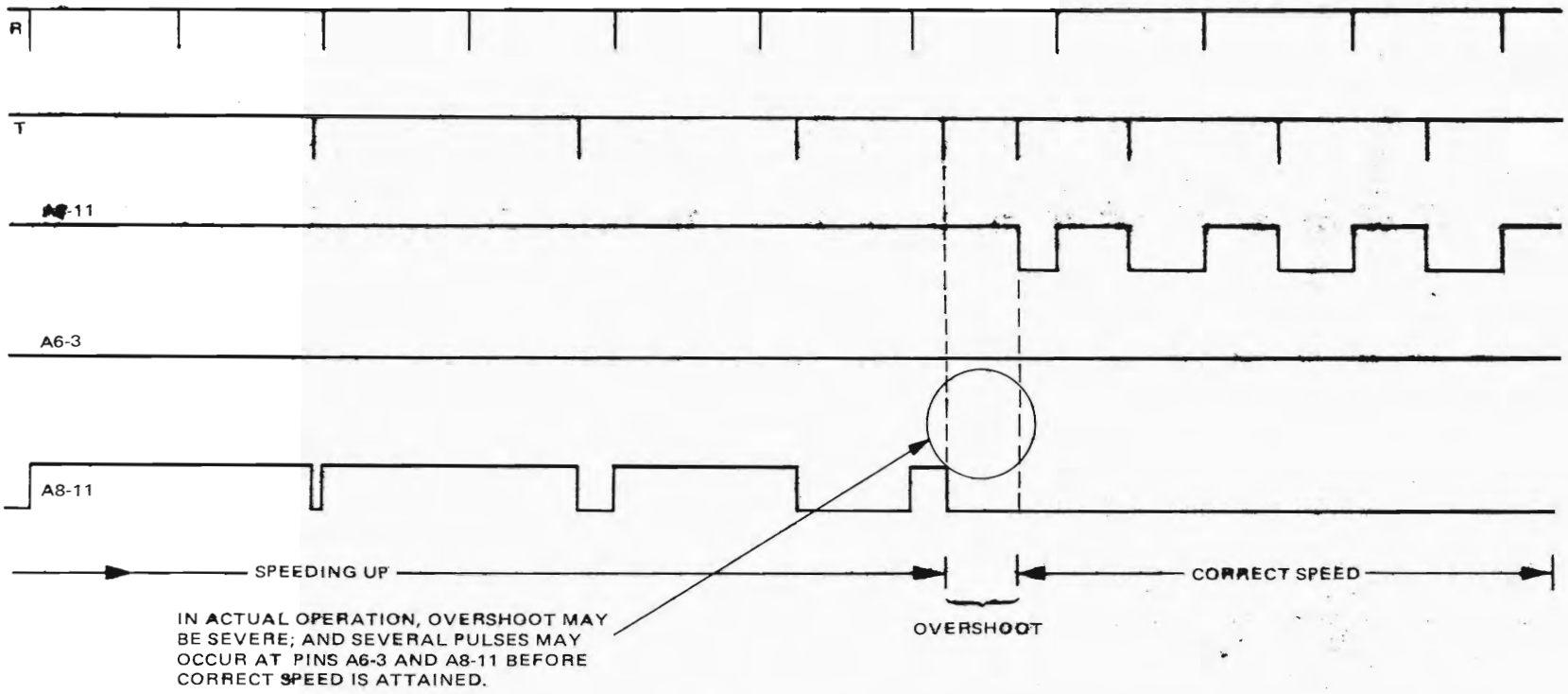
In normal operation, one-shot A10 delivers a train of negative-going pulses to pin 6 of flip-flops A8, A9, and A6 (phase comparator). If the repetition rate of the pulses exceeds approximately 12 kHz, the output level of A10 remains high. This high level causes the phase comparator to stop the capstan motor, thus preventing the motor from overspeeding.

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 4-4 shows a typical set of waveforms for the capstan phase comparator, while increasing speed to the synchronous value, 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 square 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 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 4-4 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



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 4-4. Servo System Waveforms

wave at the correct frequency is again produced at pin A9-11. (The motor-slowing sequence is not shown in Figure 4-4.) 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 A7-3. 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 (Q3 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 on schematic 4840250. 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.

Electronics and Electronics Modules

All circuitry shown on schematic 4840248 (Electronics) and schematic 4840249 (Electronic Modules), except the Record Control Board Assembly is discussed below. The Record Control Board Assembly was explained, along with other control circuitry, under *Tape Transport and Torque Delay*.

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 thumps 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 (BIAS ADJ). 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 effect 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, thereby 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.

SECTION V
MAINTENANCE

This section provides maintenance information for the AG-440C-8 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,* suitable test equipment (mechanical and electronic) for testing, adjustment, and maintenance of the AG-440C-8 is given (Table 5-1). Preventive Maintenance includes procedures for cleaning, demagnetizing, and lubrication. Information under the heading *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 REQUIREMENTS

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 12 during Electronic Alignment, and items 13 through 16 are required for Tape Transport Adjustments. Equivalent equipment can be substituted for the equipment suggested in Table 5-1.

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

Table 5-1. Overall Test Equipment Required

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 Bridge	Micom (Bahrs), Model B8100 or 8100W	Flutter test
5	Tape-Speed Strobe	Dubbings Electronics, Model Deluxe AA for 7-1/2, 15, or 30 in/s	Speed test
6	Standard Alignment Tape	Refer to Table 5-2	Reproduce head azimuth, reproduce response, and operating level adjust
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 Flutter Check	Flutter test
9	DC Voltmeter (20,000 ohm)	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	Plastic hex-tuning stick	0.125 inch across flats	Tuning bias amplifier transformers
13	Spring scales	Chatillon, 0-16 oz. and 0-10 lbs.	Tape transport adjustments
14	Cord or twine, about 30 inches long, with small loop at one end		
15	Empty reel, NAB hub		
16	Technician tools		

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 440C-8 Recorder/Reproducer that require lubrication are the capstan idler and the scrape-flutter idler. Ampex Lubricating Oil (Catalog No. 4010825 or 087-579) is recommended for the 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.*

Capstan Idler. Every three months, or after each 1000 hours of operation, lubricate the capstan idler (Figure 5-1) as follows:

1. Using a knife blade (or similar tool), gently pry the dust cap from the hub of the capstan idler to expose the felt washer.
2. Apply sufficient oil to just saturate the washer.

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.

Scrape-Flutter Idler. Ultrasonically clean and then lubricate the scrape-flutter idlers once a year or after every 2000 hours of operation. This cleaning and lubrication should be done by a local jeweler or watchmaker, who has an ultrasonic cleaner and the special jewel oil

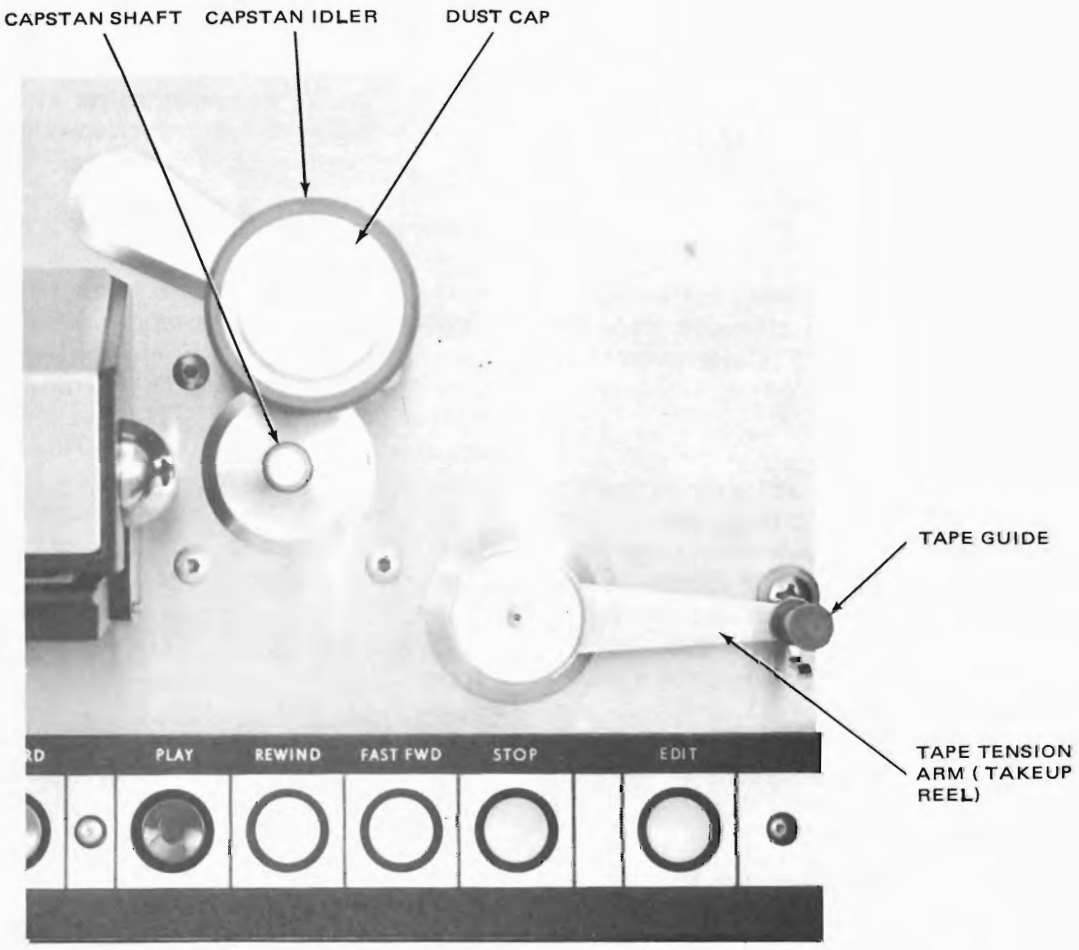


Figure 5-1. Tape Drive and Takeup Tensioning Components

required. Otherwise, clean and lubricate the idler as follows:

1. Remove head assembly. Refer to *Head Assembly Removal and Replacement* paragraph in this section.

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 1-4. Performance tests should also be performed whenever the equipment appears to be malfunctioning and following repairs 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 5-3), 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 head assembly and other tape-handling components before installing the first 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. 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.

Table 5-2. Standard Alignment Tapes

Speed (in/s)	Equalization (Time Contants)	Standard	Tracks	Catalog No.
7.5	50 μs & 3180 μs	NAB	8	4690007-01
	70 μs & ∞	IEC	Full	4690032-01
	70 μs & ∞	IEC	8	4690021-01
15	50 μs & 3130 μs	NAB	Full	4690005-01
	50 μs & 3180 μs	NAB	8	4690006-01
	35 μs & ∞	IEC	Full	4690031-01
	35 μs & ∞	IEC	8	4690020-01
30	17.5 μs & ∞	AES	Full	4690048-01
	17.5 μs & ∞	AES	8	4690042-01

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

Meter Sensitivity (Line Level)	Tape Speed (in/s)	VTVM Reading Monitoring Input or Repro.	VU Meter Reading Monitoring Input
+8	7-1/2	-6 dBm	20% mark
+8	15 or 30	+8 dBm	0
+4	7-1/2	-10 dBm	20% mark
+4	15 or 30	+4 dBm	0

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 a 440C-8 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 1-1.
2. Set controls of the record/reproduce unit for each channel to be checked as shown on the following page.

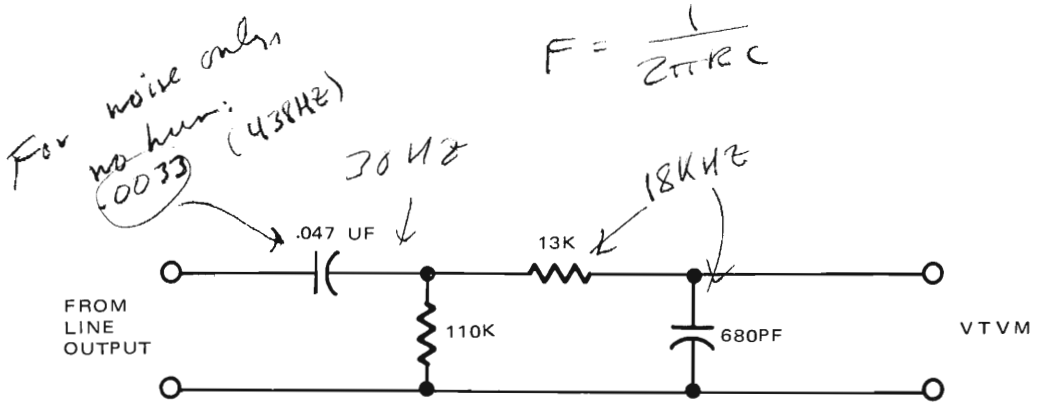


Figure 5-2. 30 Hz to 18 kHz Noise Filter

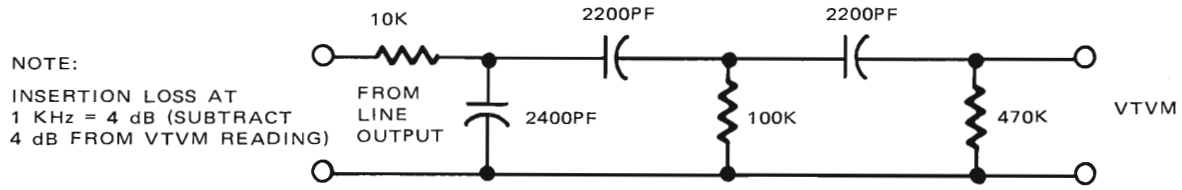


Figure 5-3. ASA "A" Weighted Filter

a. Set REPRODUCE LEVEL control to CAL.

b. Press SAFE pushbutton.

3. Set SPEED switch to appropriate position.

4. Set REEL switches to appropriate position.

5. Press PLAY pushbutton. The 185 nWb/m, 700-Hz operating level tone should produce a -3 vu indication on the VU meters if the recorder/reproducer is adjusted for a 260 nWb/m operating level. When adjusted for a 185 nWb/m operating level a 0 vu indication results.

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 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 to off position (down); or, if no external load is to be used (or impedance of external load is more than 2,000 ohms), set LINE TERM switch to ON.

2. Install dummy plug or appropriate input accessory unit into INPUT ACCESS connector.

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 3-3.

5. Set SPEED switch to appropriate position.

6. Set REPRODUCE LEVEL and RECORD LEVEL controls to CAL.

7. 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 the 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 pushbuttons 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 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/reproducer 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. Placing all channels in the record mode prevents the possibility of a previous recording on an adjacent track from cross-tracking into the channel under test.

9. Press STOP and then REWIND pushbuttons, 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 text associated with Table 5-4.

Overall Distortion Check

To accurately check 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.

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.

Flutter Check

Record a 3000-Hz or 3150-Hz signal for 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.

Perform the flutter check as follows:

1. Depress the SAFE and REPRO pushbuttons. Set REPRODUCE LEVEL control to 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. Start the previously recorded 3000-Hz or 3150-Hz 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.

5. Read the indication on the flutter meter, repositioning the % Full Scale selector on the flutter meter as required. Rewind the tape and repeat the measurement several times and average the readings. The average reading should meet the specification given in Table 1-4.

Measuring Tape Speed

The recommended method of measuring tape speed is to use an NAB speed measuring pulley similar to that manufactured by Dubbings 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 inches (1.5 mil tape) the strobe bars will remain stationary when the tape is traveling at nominal speed. The NAB speed measuring pulley diameter is 1.4305/1.4307 inch 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 thick (1.5 mil tape) on the transport. Set tape speed.

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 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 13 through 16 or equivalent).

Tape Tension, Torque Delay, and Torque Boost

Tape tension is determined indirectly by measuring the torque of both tape reel motors. Required tension adjustments are made by positioning sliders on on resistors located on the tape 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.

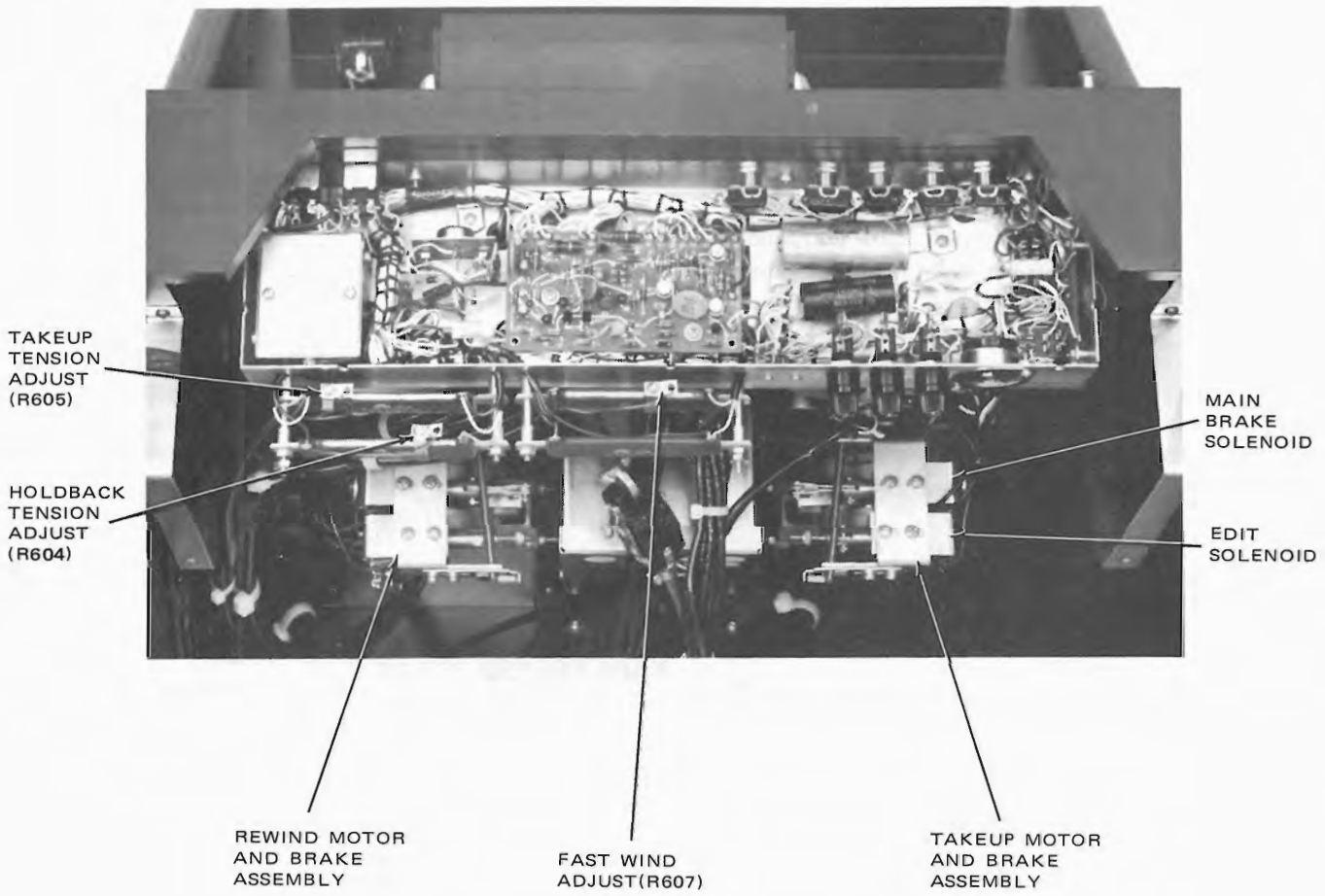


Figure 5-4. Tape Transport Control Box (Chassis Cover Removed)

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

When adjusting resistors in the following steps, loosen contact screws just enough to slide the contacts; then tighten screws just enough to make good electrical contact.

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

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

3. Install the empty NAB reel on the takeup turntable.

4. Press the PLAY pushbutton, and after the torque boost subsides, adjust the slider on R605 (resistor nearest chassis) for the takeup tension given in Table 5-5.

5. Press STOP and change reel to the supply turntable. Press PLAY, and after the

torque delay disappears, adjust the slider of R604 (farthest from chassis) for the holdback tension given in Table 5-5.

Table 5-5. Tape Tension Adjustments

PLAY HOLDBACK	PLAY TAKEUP	FAST WIND HOLDBACK
11 ± 1/2 oz. (300 to 330 g)	12 ± 1 oz. (310 to 370 g)	3 to 4 oz. (85 to 110 g)

6. Press STOP and then press FAST FORWARD.

7. Adjust the slider on R607 for the fast wind holdback tension given in Table 5-5.

NOTE

The holdback torque delay adjustments are located on the chassis mounted on the console shelf underneath the tape transport. The left potentiometer adjusts the starting torque and the right potentiometer adjusts the length of time it takes for the holdback motor to assume normal torque. The following tests should be made at 15 in/s with the capstan motor running.

8. Position the right-hand timing control for maximum time (fully clockwise).

9. Press the PLAY pushbutton and quickly adjust the left-hand tension control for a 5 ounce (140 g) reading. Stop and start again to verify the reading.

10. Adjust the right-hand timing control so that in approximately two seconds the tension increases to normal value.

NOTE

The takeup torque boost timing adjustment is located on the hinged cover of the torque boost assembly on the bottom of the transport.

11. Install the empty NAB reel on the takeup turntable.

12. Press the PLAY pushbutton and adjust the torque boost adjustment so that the torque surge disappears in 1/2 to 1 second.

13. As a final test, check the machine with a full roll of tape. With the full reel on the supply turntable and about 1/2 inch of tape on the takeup reel, prerecord a tone.

14. Rewind the recorded portion of the tape and press the PLAY pushbutton. The prerecorded tone should immediately reach full level. If there is evidence that the initial tape to head pressure is too low, the left-hand initial torque adjustment should be increased.

15. Run the tape FAST FORWARD until almost a full tape pack is on the takeup reel, and then press STOP.

16. With the lowest anticipated line voltage, when PLAY is pressed, the transport must not throw tape slack to the point of shutting off the recorder. If it does shut off, increase the power boost time until successful starts are made.

Brakes

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

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 counterclockwise, with the loop at the free end of the cord.

3. Insert the spring scale hook into the loop in the cord. Pull the scale to rotate the reel and check the scale reading indication while the reel is moving slowly and steadily. Adjust brake nuts as necessary (screw in to increase force, and out to decrease force) to provide a braking force of 23 ±1 ounce (620 to 680 grams).

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.

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 3-1/2 and 5-1/2 oz. (100 to 155 g). Adjust edit-brake nut as necessary (screw in to decrease force, and out to increase force). Press the STOP pushbutton.

6. Move the empty reel to the takeup turntable. Wind the cord on the hub clockwise. Measure and adjust brake nut per step 3.

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

8. 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 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.

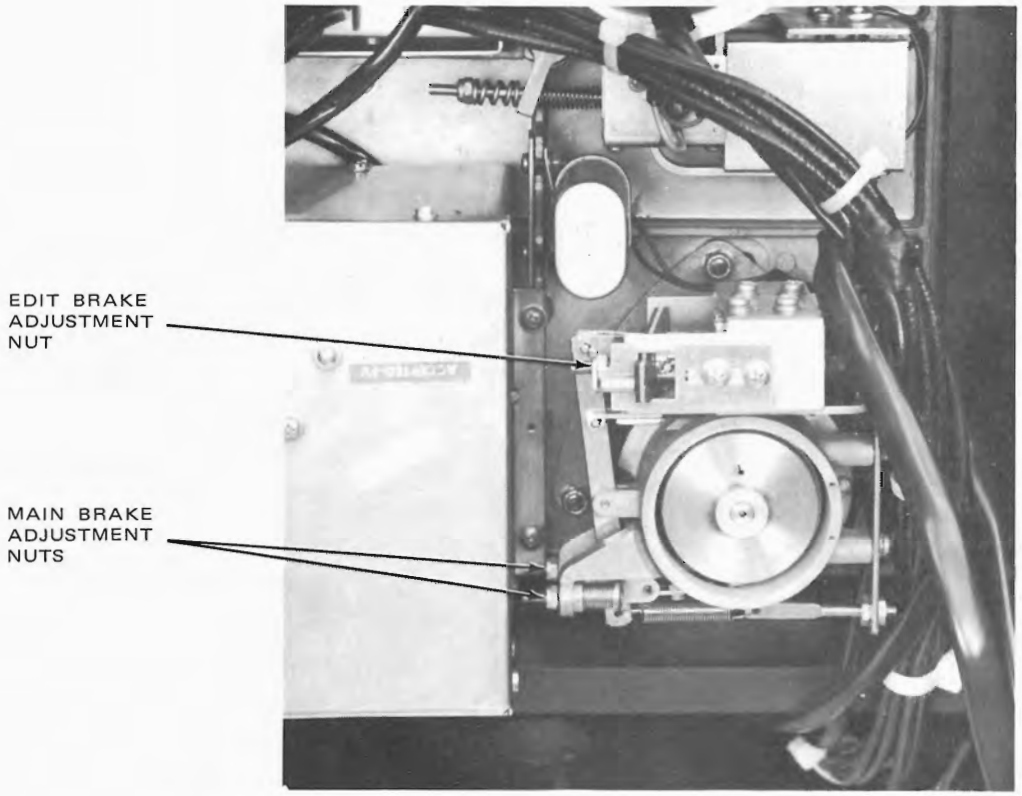


Figure 5-5. Brake Adjustments (Takeup Brake Shown)

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.

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 ±1/2 lb (3.9 to 4.3 kg).

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.

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 440C-8 Recorder/Reproducer are provided below.

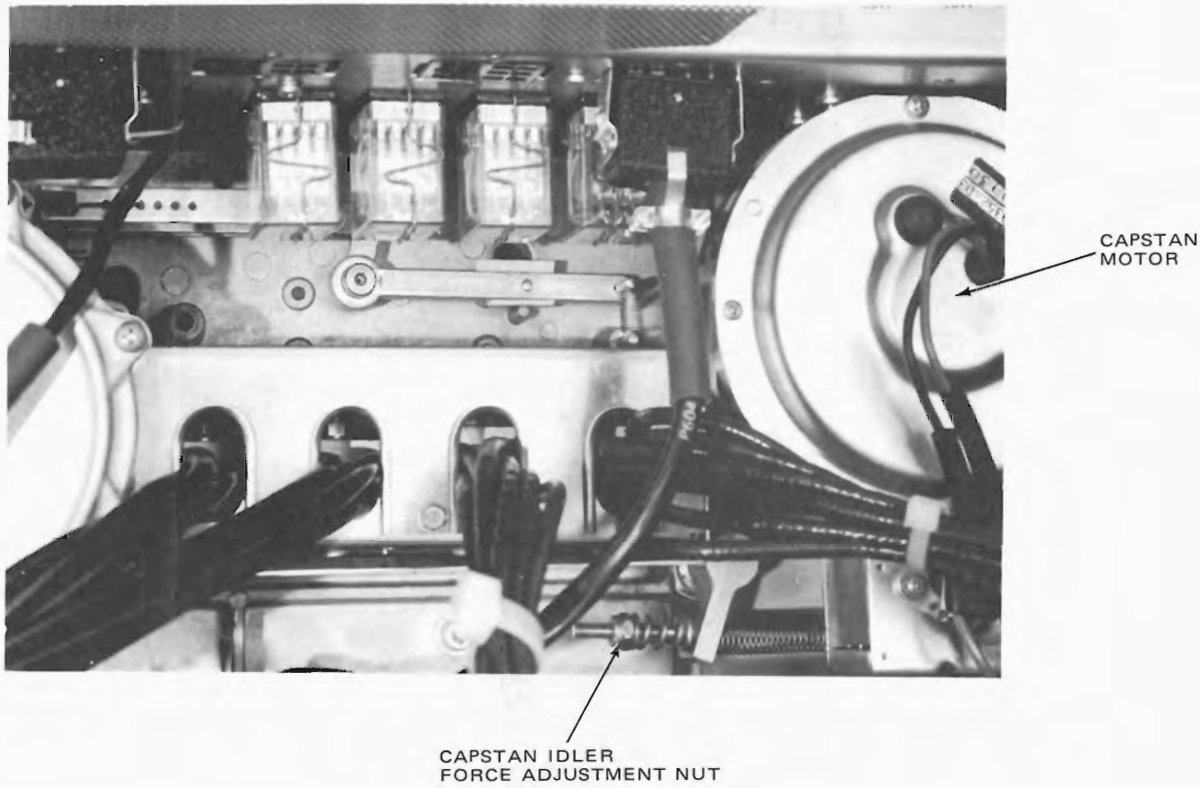


Figure 5-6. Capstan Idler Adjustment

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. Two power supplies are mounted on a shelf at the rear of the console. The left-hand (viewed from rear of console) power supply feeds electronic channels 1 through 4 and contains the bias oscillator. The right-hand power supply feeds channels 5 through 8. 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. The voltmeter should indicate 39 volts (±1V).

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.

Test Equipment

Test equipment required for electronic alignment is listed in Table 5-1 (Items 1 through 12).

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 located in the left-hand power supply, on the same plug in printed circuit board as the 39V 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

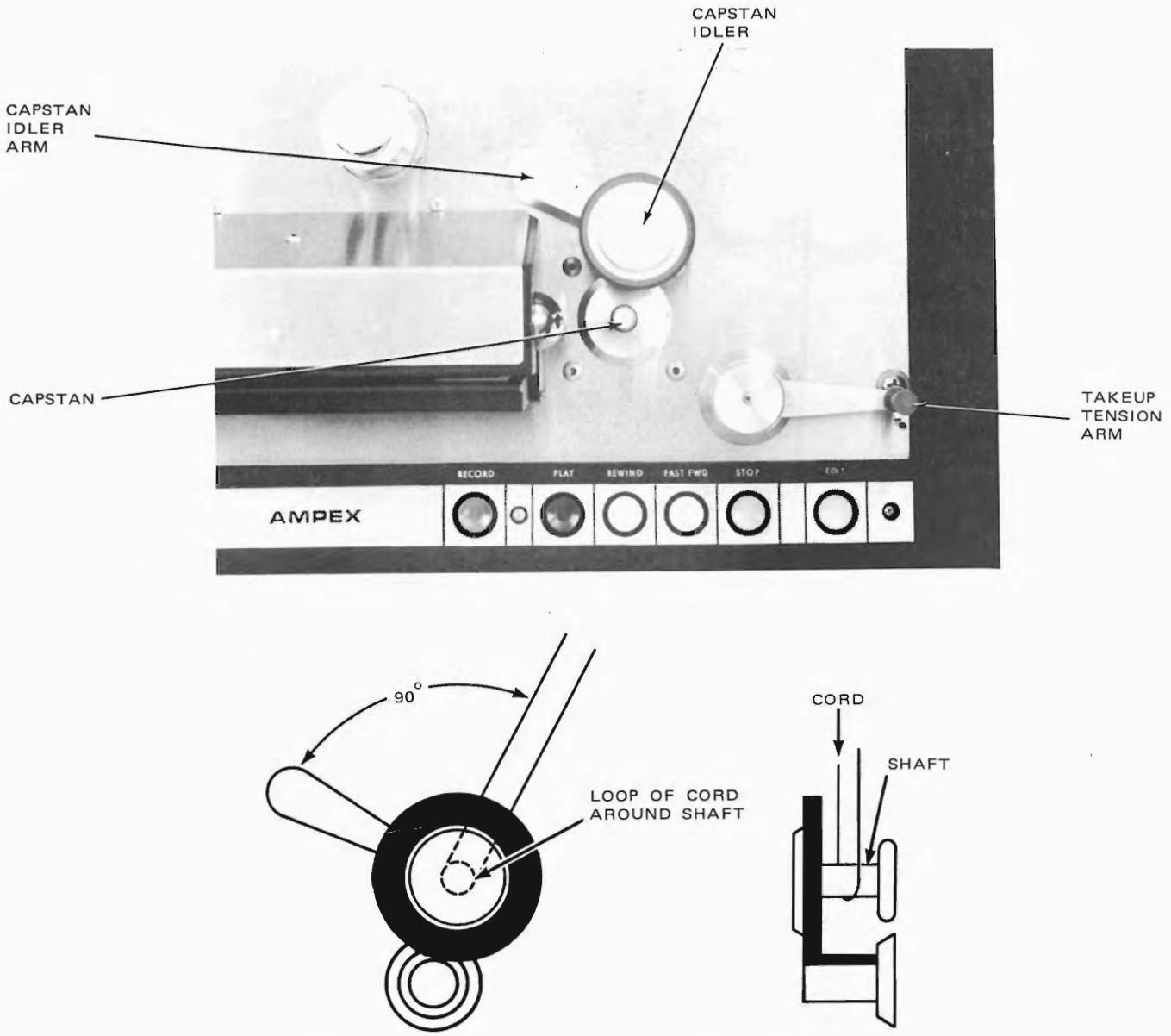


Figure 5-7. Capstan Idler Tension Measurement

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.

Tuning Bias/Erase Amplifier Transformers. Transformers T3 and T4 may require retuning if either transformer is replaced or if one or more of the transistors of the Bias/Erase Amplifier (schematic 4840249) is replaced. Unless these transformers are tuned to provide maximum output at the Bias/Erase Oscillator frequency a poor signal-to-noise ratio may result.

Each transformer (T3 and T4 on schematic 4840249) should exhibit two output peaks (one with the transformer core partly out from centered position and the other with the core partly in). Tune the cores of T3 and T4 to either output peak, using a 1/8-inch hex-core driver.

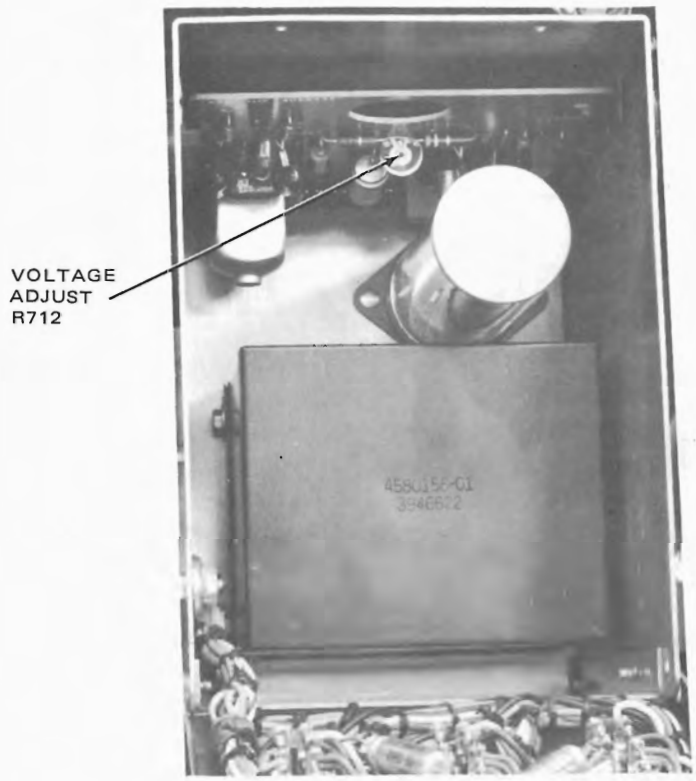


Figure 5-8. Interior of Power Supply Box

Reproduce Alignment

High Frequency Equalization. The recommended 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 due to its integrating characteristics. 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 1-5) 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 below:

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 if servo is strapped for 15-30 in/s).

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 5-6 that agrees with the equalization being verified. The dB readings in Table 5-6 should be interpreted as dB with respect to a -10 dBm reference.

9. Switch to 5 kHz and check that response agrees with Table 5-6, 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.

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

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 5-6.

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 5-6.

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 5-6 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 5-6 reading.

Reproduce Head Azimuth. It is recommended that the reproduce head azimuth be adjusted at the lowest tape speed. 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.

Table 5-6. High Frequency Equalization Response

OPERATION	FREQ (HERTZ)	7-1/2 IEC (70 μs)	7-1/2 NAB (50 μs)	15 NAB (50 μs)	15 IEC (35 μs)	30 AES (17.5 μs)
Set level	500	+ 0.2 dB	+ 0.1 dB	+ 0.1 dB	+ 0.05 dB	0 dB
Adjust high frequency equalization	5,000 10,000	+ 7.7 dB –	+ 5.4 dB –	+ 5.4 dB –	+ 3.4 dB –	– + 3.5 dB
Adjust head resonance (R32) for 7-1/2 – 15 in/s recorders	15,000	+18.0 dB	+15.0 dB*	–	–	–
Adjust head resonance (R32) for 15 – 30 in/s recorders	15,000	–	–	+14.5 dB*	+11.5 dB*	–

*Due to variation in head inductance it may not be possible to reach these center values. Set as close as possible to these readings.

1. Remove the head cover by loosening the captive screw on its angled back.

2. Apply power. Thread an appropriate standard alignment tape on the transport. Set the speed switch accordingly.

3. Depress the pushbuttons to 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. 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.

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 from 12 kHz to 15 kHz, the previous adjustments are probably adequate. If it does not meet these requirements check the following possible problem areas.

1. Defective alignment tape.

2. Dirty heads.

3. Improper head racking (gap not centered on the tape contact area).

4. Reproduce high frequency equalizers improperly set.

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

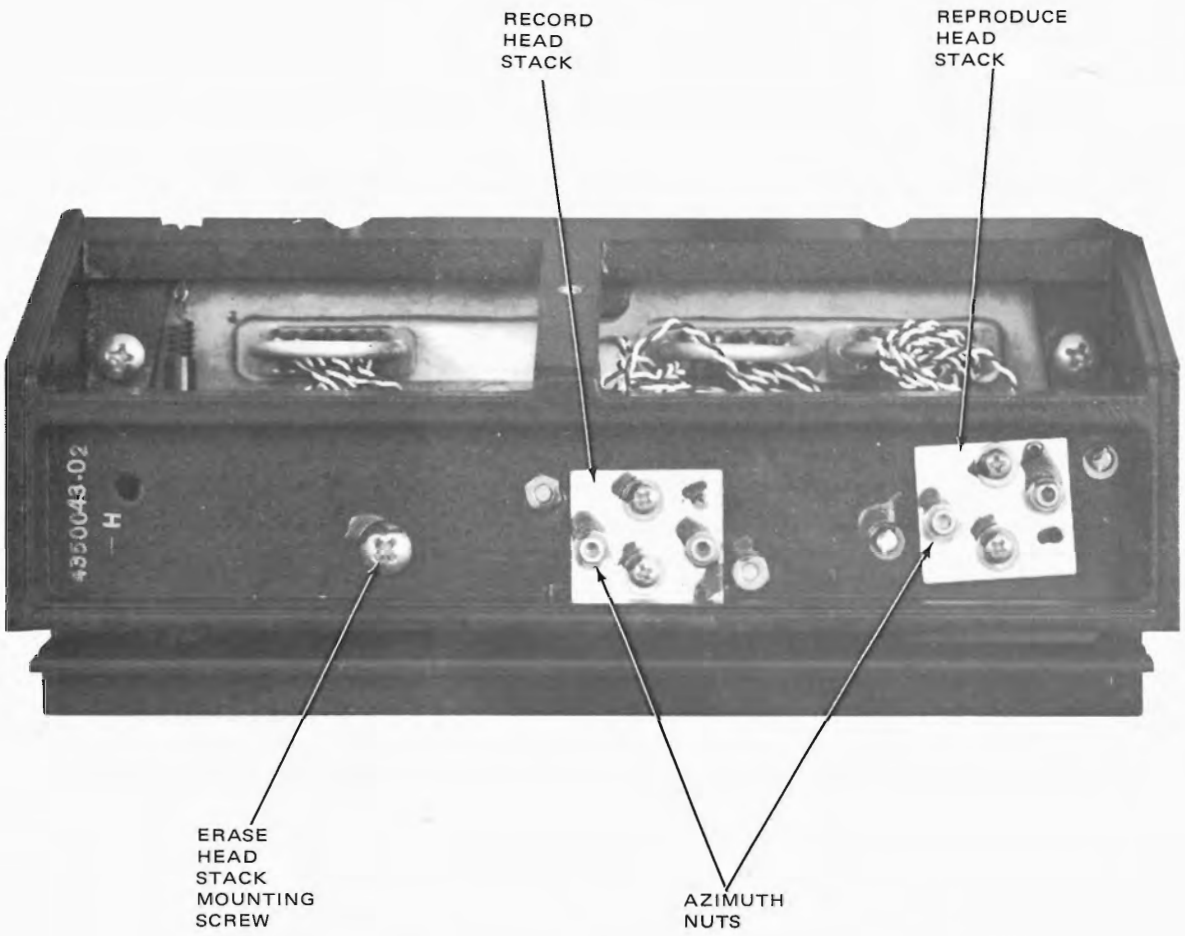


Figure 5-9. Head Azimuth Adjustments

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 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 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. The adjustment is made with the reproduce calibrate

potentiometer when the reproduce level control is in the 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 calibrate 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 operation 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 a +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 1-5), 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 is 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 an extender card.
2. Press the bias pushbutton on the channel being adjusted (the remaining channels should be in SAFE).
3. Start the tape in the 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 a maximum VU meter reading, and then adjust the slugs on the coils. Since the three adjustments interact slightly, repeat the adjustment until the maximum reading is obtained.
6. Stop the tape.
7. Press SAFE.
8. 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.

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, or 500 Hz at 7-1/2 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, or 5 kHz at 7-1/2 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 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 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.
   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 mils wavelength falls within the range of peak bias at 15 mils wavelength.

Bias Metering Calibration. Immediately after adjusting the bias (see paragraph above) 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. 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 in/s or 30 in/s, but should be made at least 14 dB below operating level for 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 the 7-1/2 in/s speed 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 head racking (gap not centered on the tape contact area).
   c. Attempting to adjust 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 shown on the following page.

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. Perform input calibration adjustment 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 change in major components of the servo system make it necessary.

Proceed as follows:

1. Put the capstan-servo PWA on extender (4050695).

2. Attach a scope probe to test point No. 2 of the capstan servo PWA.

3. Put recorder in Play.

4. Adjust R19 on capstan servo PWA for minimum signal jitter.

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 is discussed in the *Electronic Alignment* portion of this section. Head assembly removal and head and tape adjustments are explained below. Head height is precisely set at the factory, therefore, head height adjustment is seldom required.

Head Assembly Removal and Replacement

To remove the head assembly from the transport, proceed as follows:

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

2. Carefully disconnect the three head connectors. (Figure 5-10).

3. Remove the two screws holding the head assembly to the transport.

4. Being careful to avoid bumping or scratching the scrape-flutter idler (Figure 5-20), lift the head assembly up and off.

To install the head assembly, reverse the above steps.

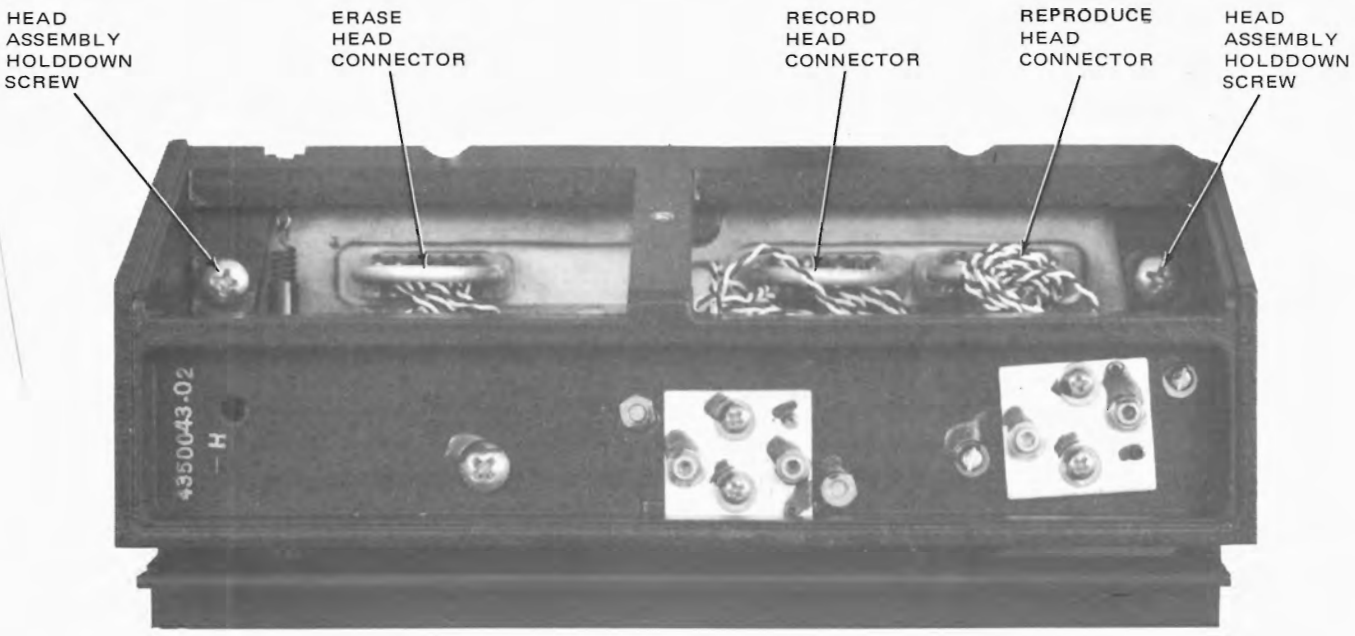


Figure 5-10. Head Assembly Removal

Adjusting Head Height

Record/Reproduce. 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 5-11) approximately 1/4 turn.
4. Turn the two hex-socket setscrews 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. Finally tighten the hex nut until it is snug.
7. Stop tape motion.
8. Check head zenith and tape wrap. Check head azimuth as explained earlier in this section.
9. Replace head housing cover.

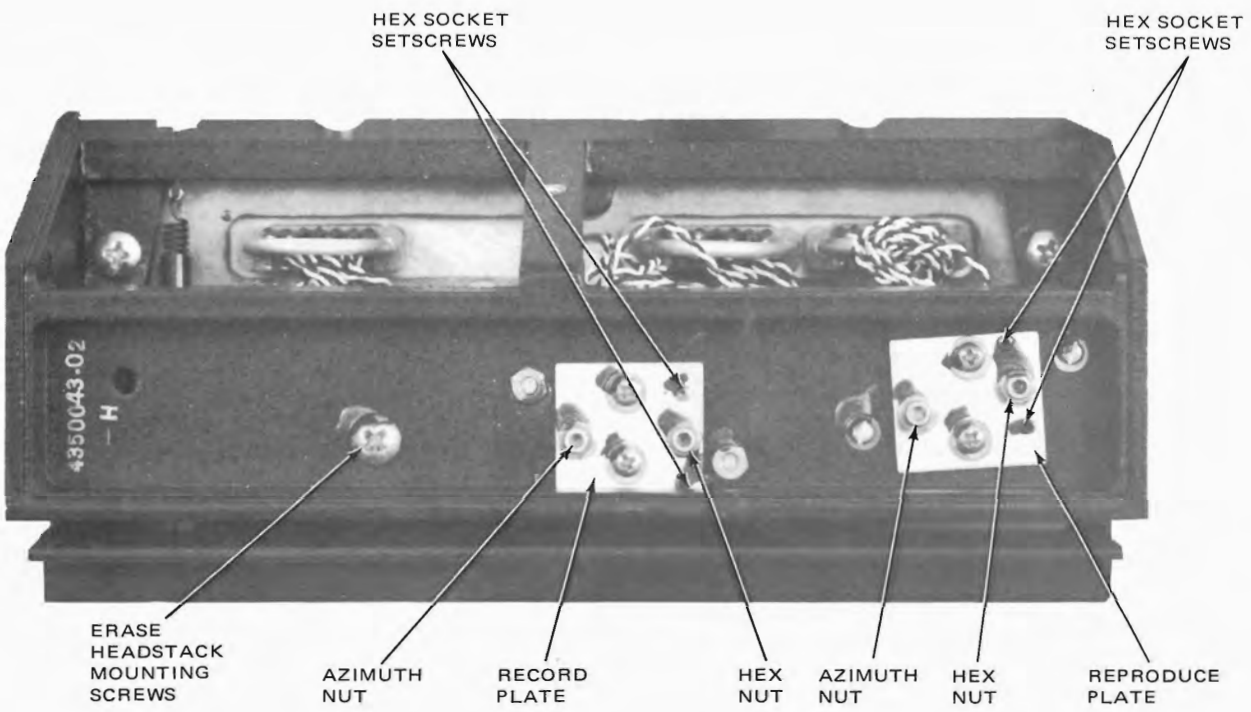


Figure 5-11. Head Height Adjustment

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 5-11).

Shim the heads until the ferrite portion of the outermost head 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 remove exactly half the shim thickness needed to move the head stack from the top to bottom of the tape.

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 angle back surface. Loosen the two crosshead screws (Figure 5-12), and carefully use a screwdriver to push at the side of the aluminum plate (through which the head stack mounting screws protrude) in the required direction. Then, retighten the crosshead screws. Check that the shield is aligned with the head gate shield. If not aligned, loosen the shield can mounting screws

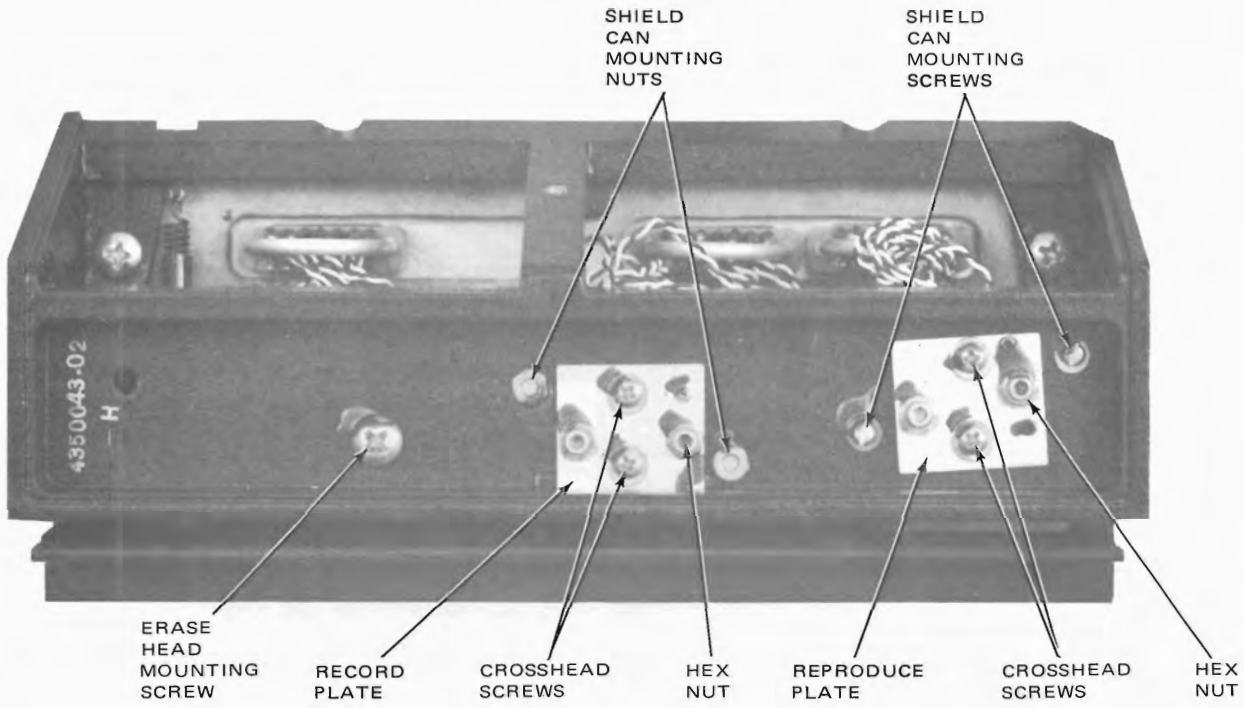


Figure 5-12. Tape Wrap and Zenith Adjustments

(reproduce head) or mounting nuts (record head) and adjust position of shield. Retighten the shield can mounting screws (reproduce head) or mounting nuts (record head). Recheck the tape wrap. 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 grease pencil method described above. Repeat the adjustment until the head zenith is correct (no zenith adjustment is required for the erase head). Finally tighten the hex nut.

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

Changing Head Stacks

Record or Reproduce Stack. Change head stack as follows:

CAUTION

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

1. Remove the complete head assembly from the transport.

2. Remove the head stack shield by removing the mounting screws (reproduce head) or mounting nuts (record head) as shown in Figure 5-13.

3. Unscrew the azimuth and hex nuts to their limit. Being careful not to lose the double coil lockwasher located under the hex nut, unscrew the two head stack (cap head) mounting screws.

4. Being careful not to lose the two springs and shield plate (Figure 5-14), remove the head stack from the head assembly housing. The shield and springs are located between the head stack and the head assembly housing.

5. Install the replacement head stack in the reverse order of the above procedure.

6. Check and adjust as necessary, head height, tape wrap, zenith, and head azimuth as described previously.

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 the tape wrap.

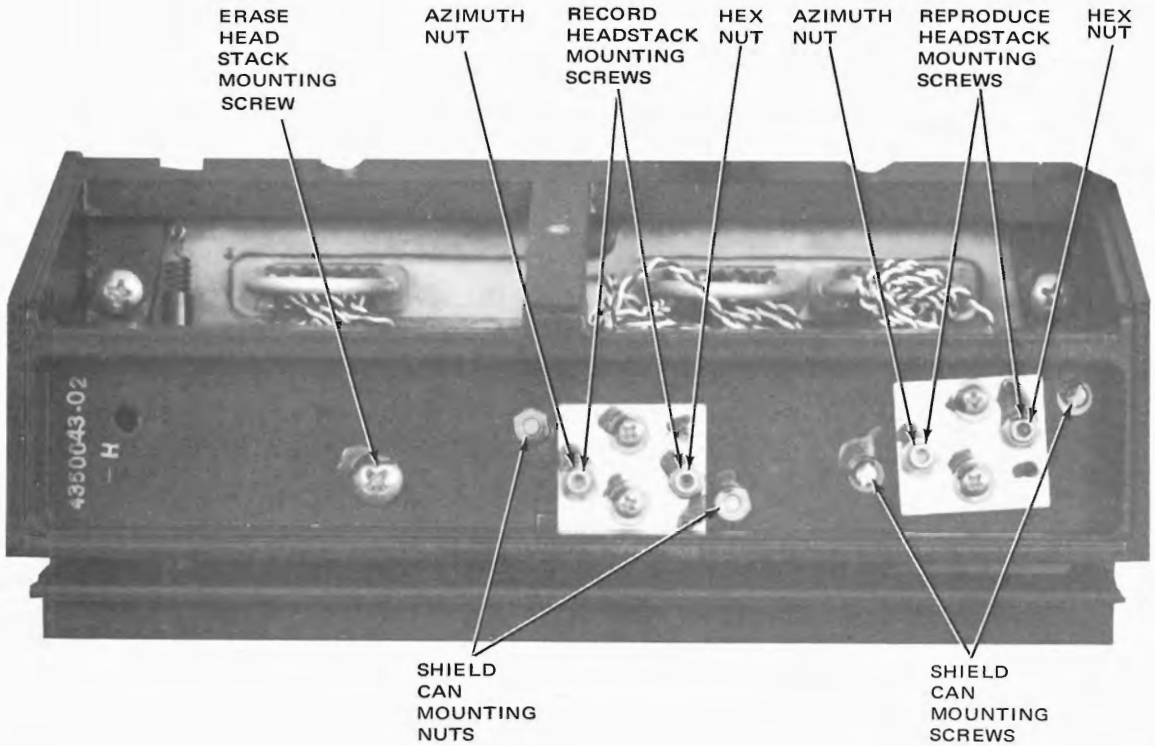


Figure 5-13. Change Head Stacks (Top View)

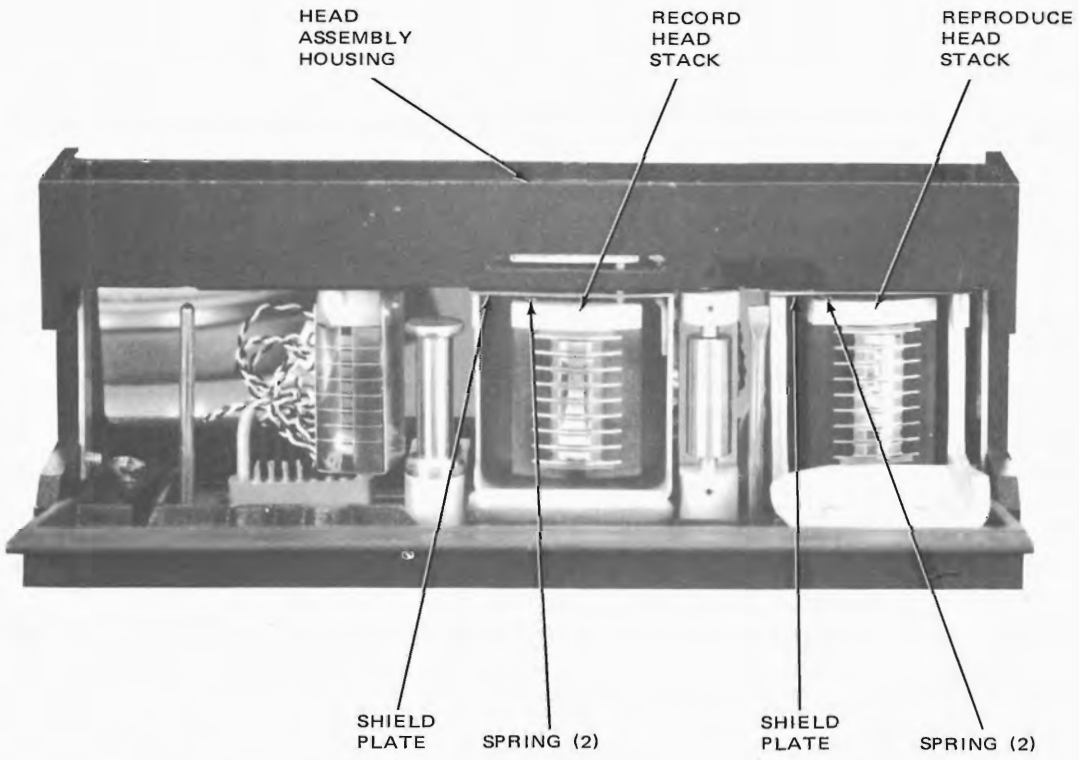


Figure 5-14. Changing Head Stacks (Front View)

TRANSPORT MAINTENANCE

The following paragraphs contain transport corrective maintenance, parts replacement, 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 with 600 grit sandpaper. Do not use emery cloth or carborundum-coated paper.

Solenoids. A corroded solenoid plunger, which doesn't 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.

Takeup and Rewind Assemblies

Major components in the takeup and rewind assemblies (Figure 5-15) are the torque motor and

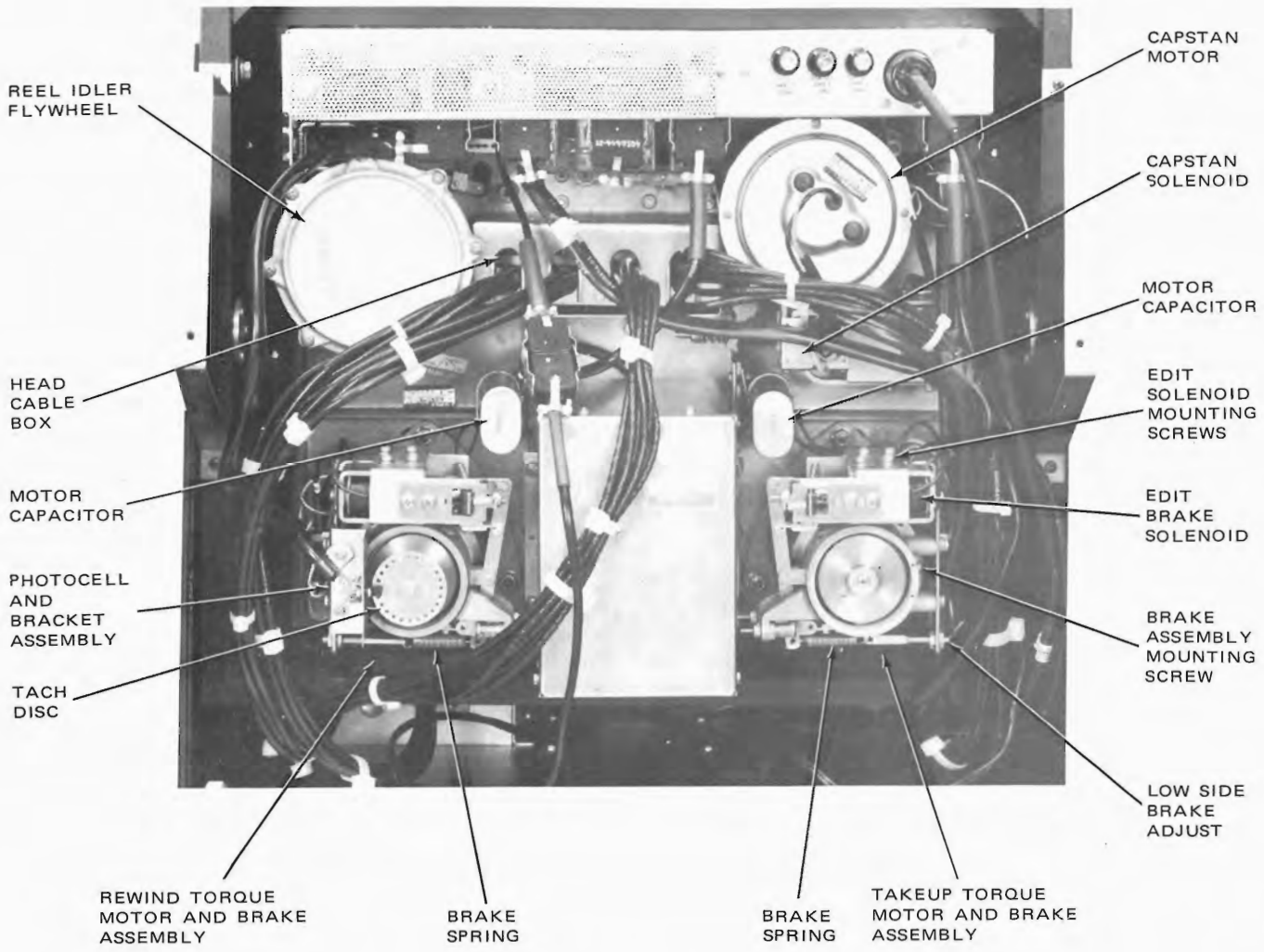


Figure 5-15. Tape Transport Components (Bottom View)

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.

Replacing Takeup or Rewind Assembly. The takeup and rewind assemblies are each secured, through slotted holes in the top plate, to the reel guards. When either assembly is removed, the reel guard (Figure 5-16) will also be released.

To remove either assembly (Figure 5-15), 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 5-17).

Reinstall the assembly in the reverse order of removal procedures. Secure the assembly in the innermost 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.

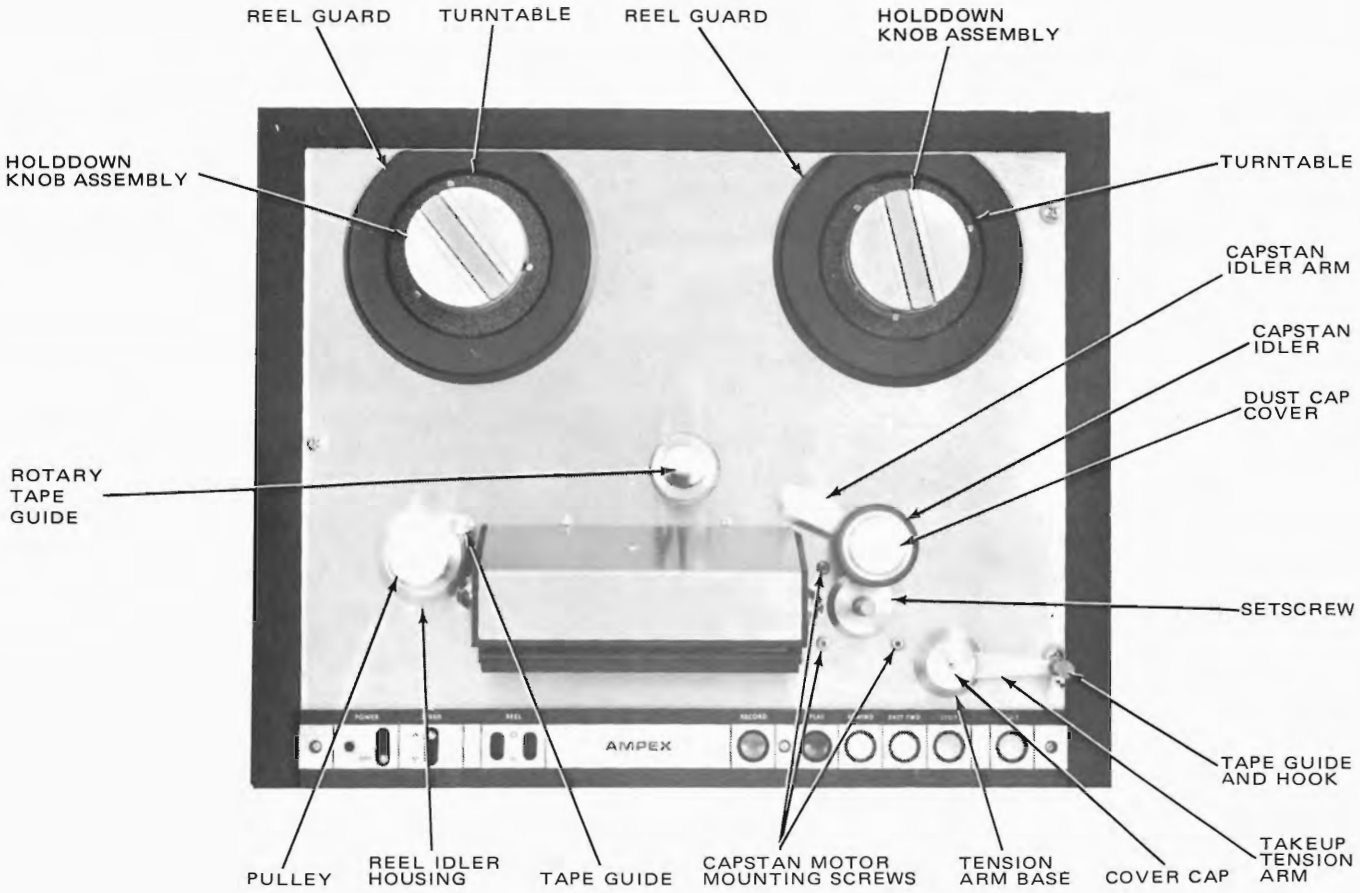


Figure 5-16. Tape Transport Components (Top View)

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 5-15). 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 5-15).

2. Remove the two socket-head capscrews and washers which secure the brake

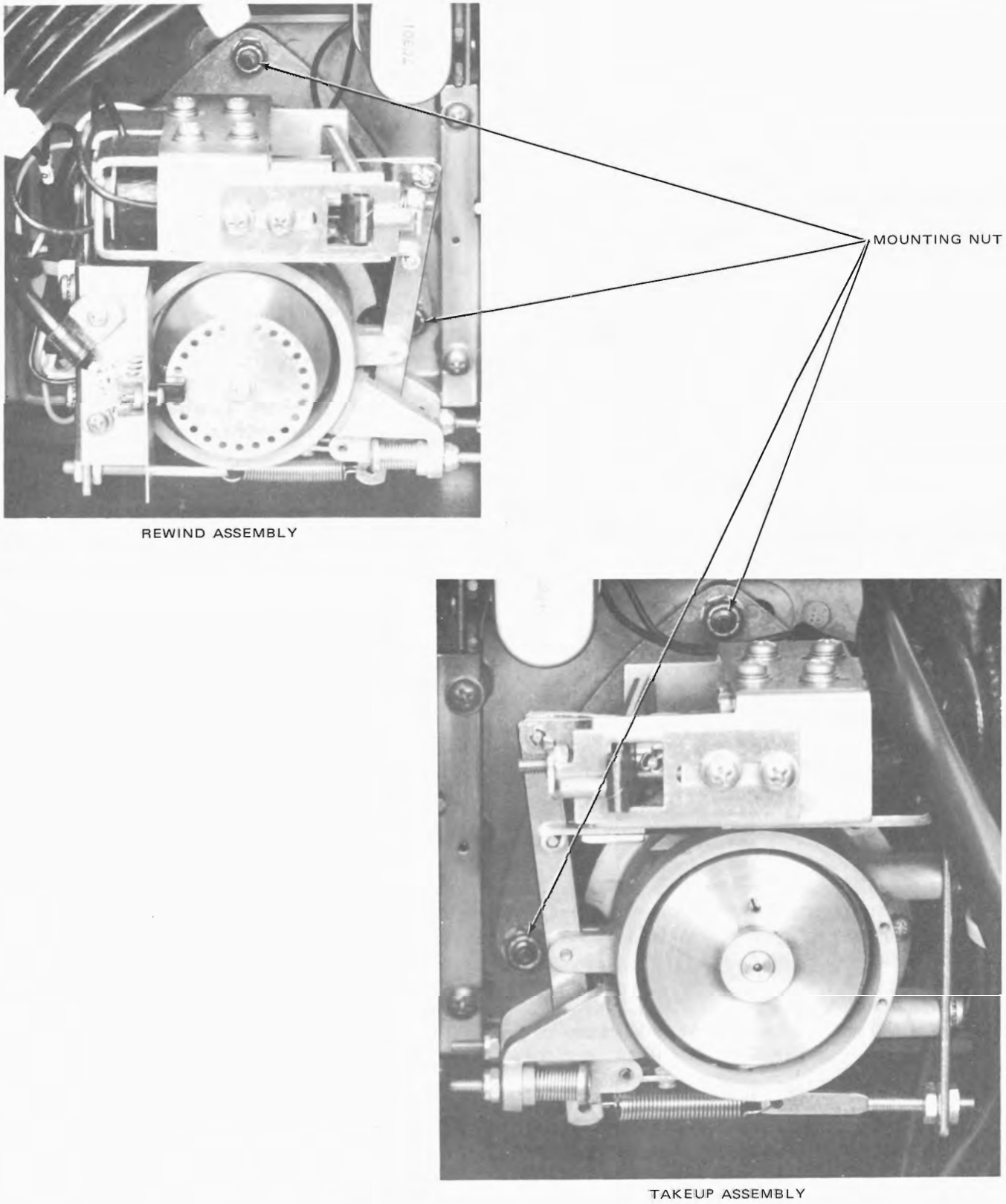


Figure 5-17. Takeup and Rewind Assembly Mounting Nuts

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 capscrews 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 capscrews, and the lockwashers 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 capscrews 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 5-15); 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 of removal procedures. Perform the 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 5-15.

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 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 photo cell 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 5-15) 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 clutches associated with the rewind and takeup assemblies insure 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 capscrew. 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 5-15).

Motor Capacitor Replacement

To remove the takeup or rewind motor capacitor (Figure 5-15) 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 and reconnect the leads.

Capstan Motor Replacement

CAUTION

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

1. Disconnect the motor cable at the servo chassis.

2. Remove the capstan dust cap cover from the capstan motor by loosening the setscrew (Figure 5-16). Push the capstan idler back so the metal dust cap cover can be lifted off.

3. Manually support the motor and remove the four screws from the motor and top plate.

4. Install the capstan motor in the reverse order of removal.

Reel Idler

Pulley Replacement. The pulley (Figure 5-16) is held in the reel idler housing by the reel idler flywheel (Figure 5-15) 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 flat portion of the shaft 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 – 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 flywheet 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 2-1/2 and 3-1/4 ounces (70 to 90g) of tension should be required to move the arm from its stop.

If adjustment is indicated, remove the pulley assembly (see *Pulley Replacement*). Loosen the two screws, revealed by removal of the pulley assembly, 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 and 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 5-16). Remove the two screws that

secure the reel idler assembly to the casting (Figure 5-15), and remove the idler assembly from the transport.

Install the idler 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 Assembly 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 CAREFUL NOT TO COCK THE BEARINGS IN THE HOUSING.

Install the lower bearing, against the retaining ring, by pushing only on 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 5-16) 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 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 back of the transport. Remove the connectors for capstan and takeup motors from the transport control box. Hold other wires aside so the safety switch (Figure 5-18) 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 the tape guide and hook (Figure 5-16) from the takeup tension arm by removing the screw under the tension arm.

To install the hook and guide, use the spring pin to mate the hook locating hole to the guide bottom slot, with all shim washers repositioned betweeen the guide and hook. Insert the spring and screw in the guide, then tighten the screw in the arm.

Tape Tension Arm Replacement. To remove the takeup tension arm assembly, disconnect the capstan

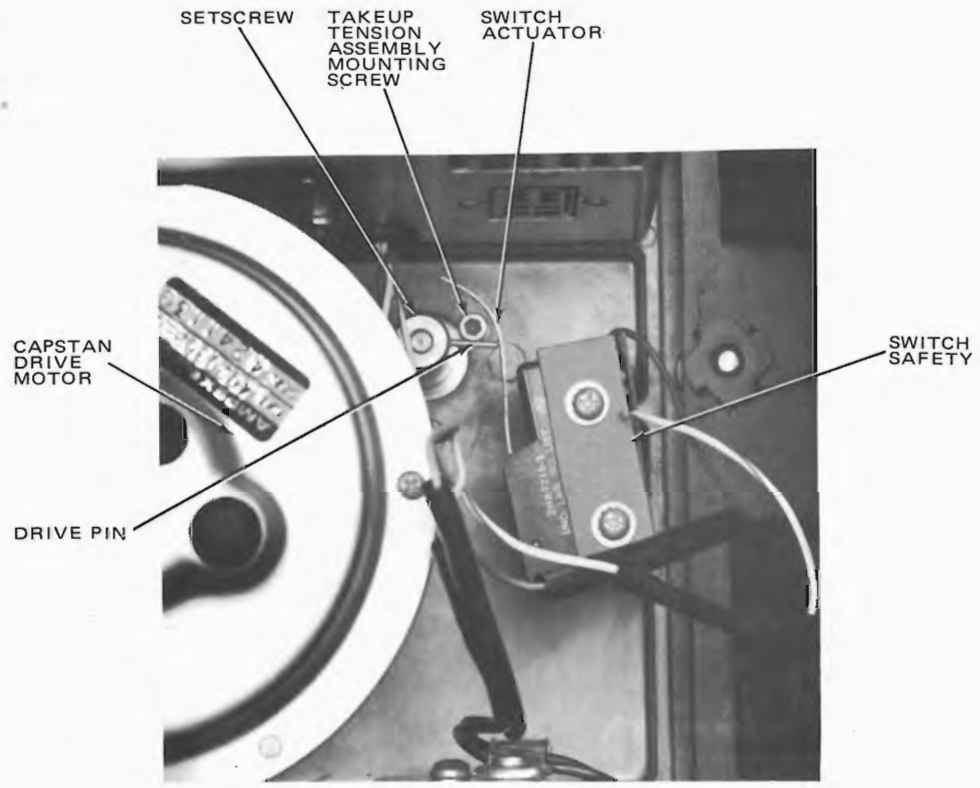


Figure 5-18. Takeup Tension Arm Safety Switch

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 5-18) and lift the assembly from the transport while carefully guiding the protruding pin 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*. Adjustment of idler force against the capstan is given under the heading *Tape Tension (Capstan Idler)*.

Non-Removable Parts. The capstan idler arm (Figure 5-16) and associated components cannot be removed from the transport, because the solenoid idler arm (Figure 5-19) is secured to the idler arm shaft by a press fit rollpin. Removing and installing this rollpin requires special tools. The solenoid idler arm will not pass through the hole in the transport so parts between the capstan idler arm and the solenoid idler 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 MAY RESULT.

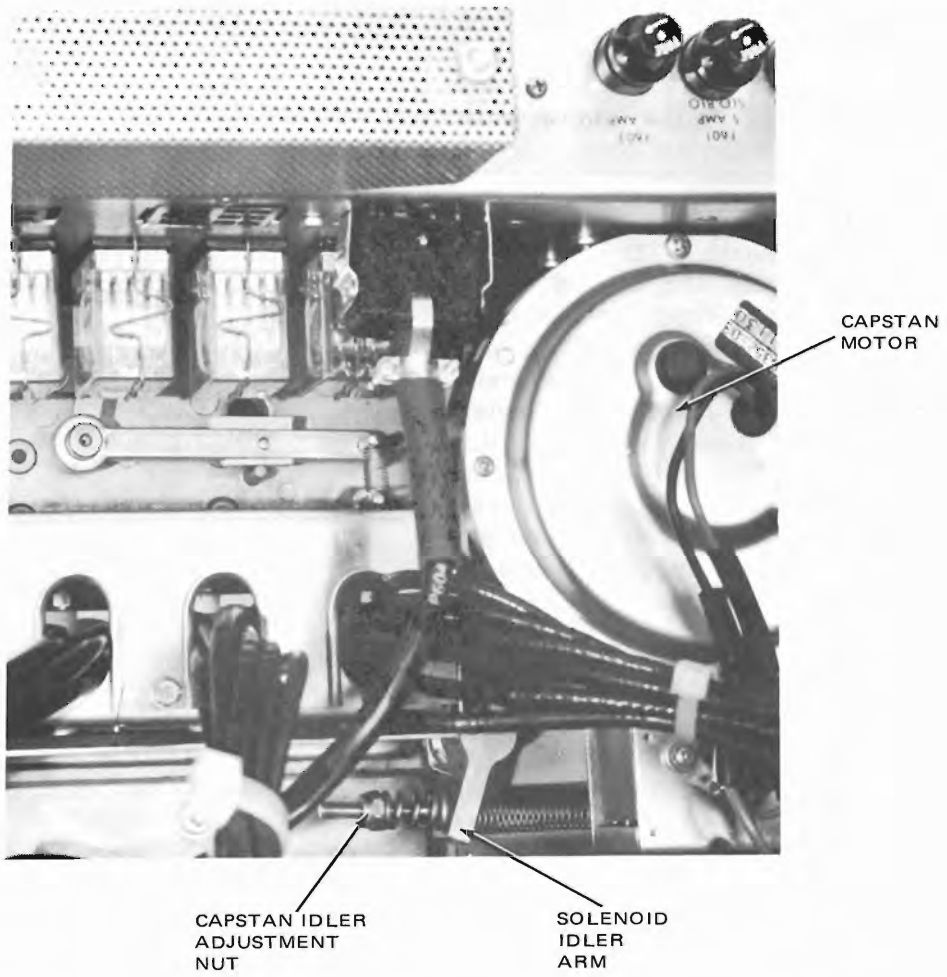


Figure 5-19. Capstan Motor and Capstan Idler Components

Idler Positioning. The normal clearance between the idler tire and the capstan should be 7/16 to 1/2 inch. 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 to give maximum clearance. Place an appropriately dimensioned spacer, such as a 15/32 inch drill bit, between the capstan and the idler tire. Tape wound on a pencil, to provide the proper dimension, can also be used as a spacer. 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 to 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 spade bolt drags on the solenoid stop.

Idler Assembly Replacement. The rubber-tired idler assembly is held on the capstan idler arm (Figure 5-16) by a setscrew. To remove the idler assembly, loosen the setscrew and slide the idler shaft from the idler arm. Install the new idler assembly, so that the tape is centered on the idler.

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. Reinstall the idler wheel in the reverse order using the shims to allow slight end play.

Capstan Idler Solenoid Replacement. To remove the capstan solenoid (Figure 5-15) remove the capstan motor. Disconnect the takeup motor cable from the transport control box. Remove the self-locking nut (capstan idler 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 solenoid 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 solenoid return spring on the bolt and then insert the bolt end through the solenoid arm. Slide the plate and solenoid over the casting extrusions. Tighten the screws to clamp the solenoid in position. Install the solenoid adjusting spring, and then the self-locking nut on the bolt. Connect the leads to the solenoid. Install the drive motor. Reconnect the takeup motor cable. 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 (Figures 5-10 and 5-15).
2. Disconnect the capstan motor cable, the electronic power cable, the supply motor cable, and the takeup motor cable.
3. Use pressure sensitive tape to hold the takeup tension arm away from the safety switch.
4. Loosen the two hex head screws at each end of the tape lifter bracket (Figure 5-20). Make sure the spring that connects the solenoid to the bracket is in the third hole.
5. 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 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 inch of spring back can be anticipated.
6. Energize the tape lifter solenoid by pressing one of the fast mode pushbuttons.
7. 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 (do not extend the spring). While holding the bracket in this position, tighten the inboard hex head screw; then, the hex head screw under the spring.
8. Working from the front of the transport, remove the resilient material and again check the distance measured in step 5. This distance should be 1/4 to 9/32 inch. If not, repeat steps 4 through 7 using a different allowance for spring back.
9. Press the STOP pushbutton.

10. Measure the distance between the front surface of the scrape flutter idler and the front surface of the lifter in the retracted position (distance should be 1/8 ±1/32) inch). If not, loosen the two screws that hold the solenoid stop to the solenoid. Move the stop to attain this dimension making sure that there is no slack in the solenoid-lifter bracket spring. Tighten these screws.

11. Replace the reel idler flywheel and pulley and the head assembly.

12. Reconnect the cables previously removed.

Solenoid Replacement. To remove the tape lifter solenoid (Figure 5-20), 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 (Figure 5-20). 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, lockwashers, 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. Remove the tape lifter solenoid and tape-lifter return spring. Remove the two socket-head shoulder screws and remove the complete assembly.

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

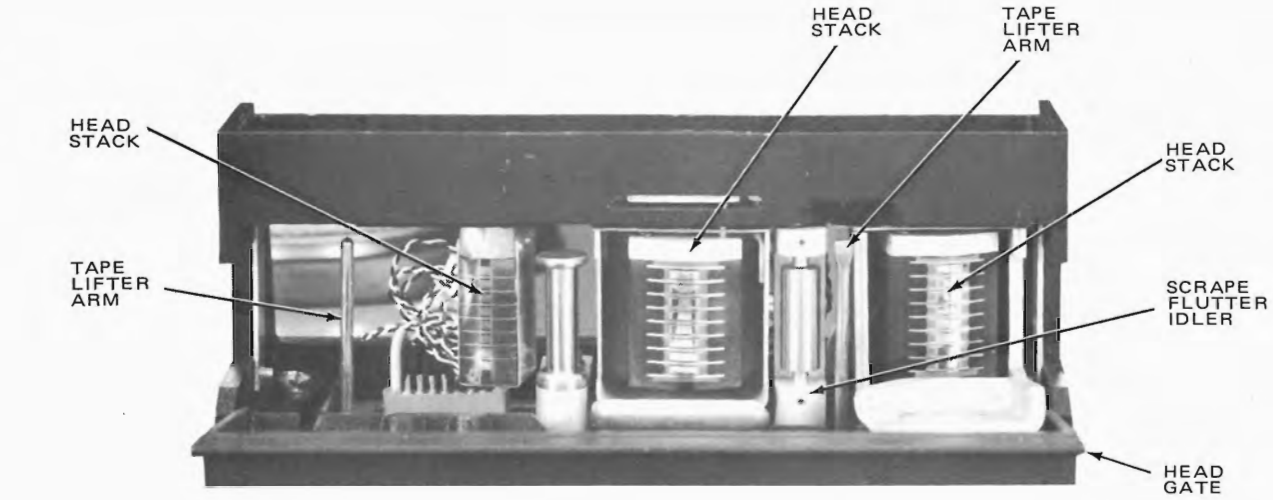
To remove the safety switch (Figure 5-18), disconnect the capstan motor and takeup motor cables from the transport control box. Move other wiring aside for access. Slide the plastic sleeving from the solderless connectors on the safety switch leads and disconnect the wires. The switch is secured to mounting 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 5-4). 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).



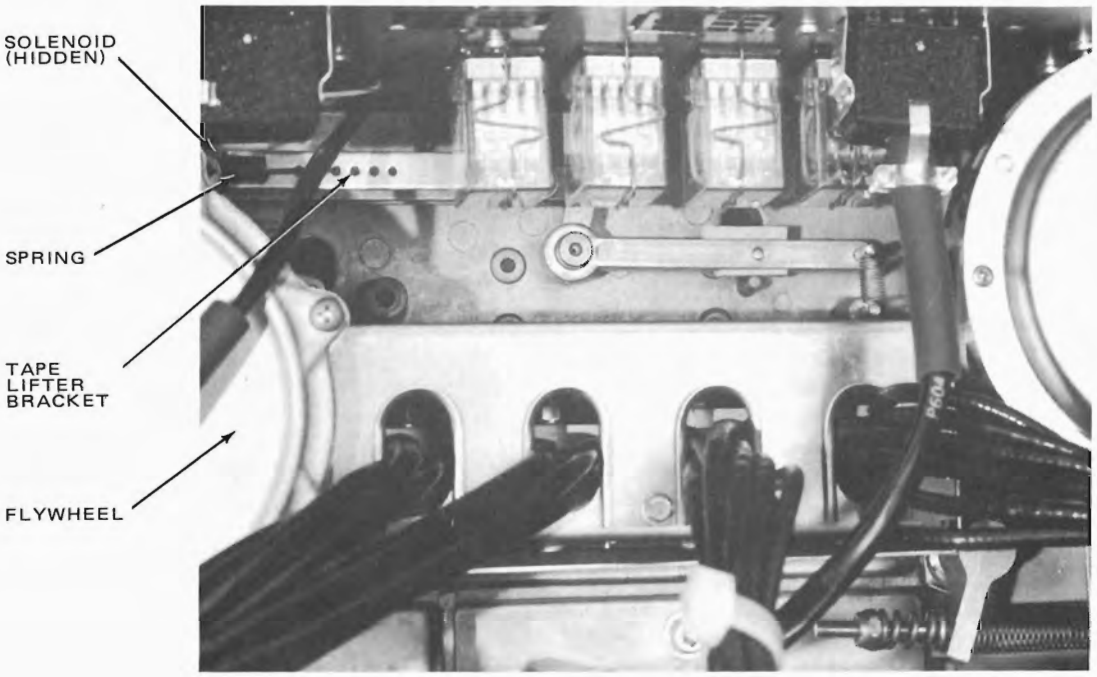


Figure 5-20. Tape Lifter Components

WARNING

DANGEROUS VOLTAGES ARE PRESENT INSIDE THE CONTROL BOX AND ACROSS THE TENSION ADJUST RESISTORS WHEN THE POWER CORD IS CONNECTED. 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 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.

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, use a piece of adhesive tape attached to the eraser end of a pencil.

Control Box Switches

Remove the control box from the transport. When new pushbutton switches are installed, set the switch face to 19/32 (±1/32) inch above the chassis. Set toggle switch handles 1-5/16 ±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 socket with pliers. When replacing the lamps note that the terminals are not centered on the lamp.

The lamps should be replaced with the lamp terminals closest to the bottom of the socket. 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 the channel, and 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.

2. Non-corrosive 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 soldered joints during this procedure, and especially avoid heating joints that are not to be unsoldered. 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, 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 at the rear of this manual are helpful in locating parts.

TROUBLESHOOTING

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 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 backing tape is run, the actual tape speed will be approximately 0.1% slower than when a 1.5-mil tape is used.

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. Reel idler dragging so that it does not come up to speed.

   g. Capstan surface polished.

   h. Defective motor.

Causes of Noise

NOTE

The signal to noise ratios listed in Table 1-2 apply to Ampex 406 Tape and are 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. Transformer(s) in erase/bias amplifier not properly tuned.

8. Reproduce head height incorrect, so that a portion of the head does not contact the recorded track.

Causes of Distortion

Some causes of distortion, detected during performance tests, are given below.

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 so that bias oscillator output becomes unsymmetrical.

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.

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. Servo motor; servo gain incorrectly adjusted, loose or maladjusted rotor, loose or maladjusted tach probe, malfunction of servo electronics.

3. Supply motor; excessive or erratic holdback tension, dragging brakes, or bent shaft.

4. Capstan idler; defective rubber tire, bearing defective or needs lubrication, pressure incorrectly adjusted.

5. Reel idler; bent shaft, flywheel not balanced, damaged bearing.

6. Head assembly; poor tape guiding.

7. Reels; tape scrapes on reel flanges, caused by warped or damaged reels.

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 5-7 for an indication of the cause of trouble.

If flutter is caused by the supply motor assembly, the frequency will vary from low, when the tape pack on the supply reel is large, progressively increasing as the tape pack gets smaller. The takeup motor assembly seldom causes appreciable flutter,

Table 5-7. Rotational Rates (Hertz)

COMPONENT	TAPE SPEED		
	7-1/2 IN/S	15 IN/S	30 IN/S
Servo Motor	6.25	12.5	25
Capstan Idler	1.2	2.4	4.8
Reel Idler	1.6	3.2	6.4
Scrape-Flutter Idler	6.3	12.7	25.4

because it is isolated from the heads by the capstan and capstan idler. If it causes flutter, the frequency will 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 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 servo motor control, 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 Figure 5-21 and 5-22. The test setup for inducing a constant voltage is shown in Figure 5-23. Typical response curves for the various speeds are shown in Figures 5-24 and 5-25.

Troubleshooting the Record Amplifier

There are 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 5-23).

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 5-27. The high frequency response will vary with the high frequency pre-emphasis used. Typical mid-frequency operating level signals will be approximately 1/2 mA with method 1 and 0.05V (-24 dBm) with method 2.

Troubleshooting Hints

Electronic. Troubleshooting hints for electronic portions of the recorder/reproducer are given in Table 5-8.

Tape Transport. Troubleshooting hints for the tape transport are given in Table 5-9.

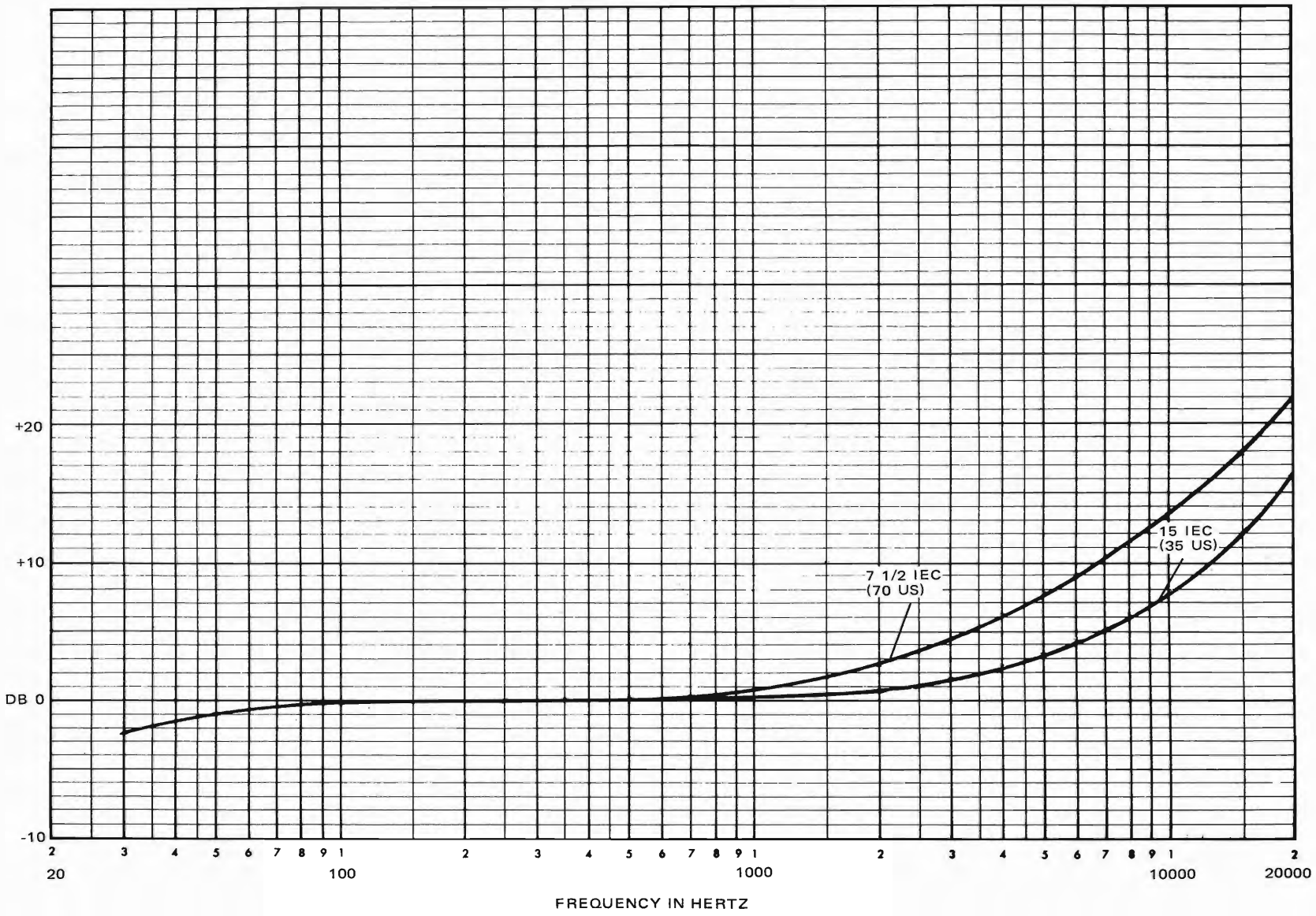


Figure 5-21. Reproduce Amplifier Response with Constant Flux to Head (IEC)

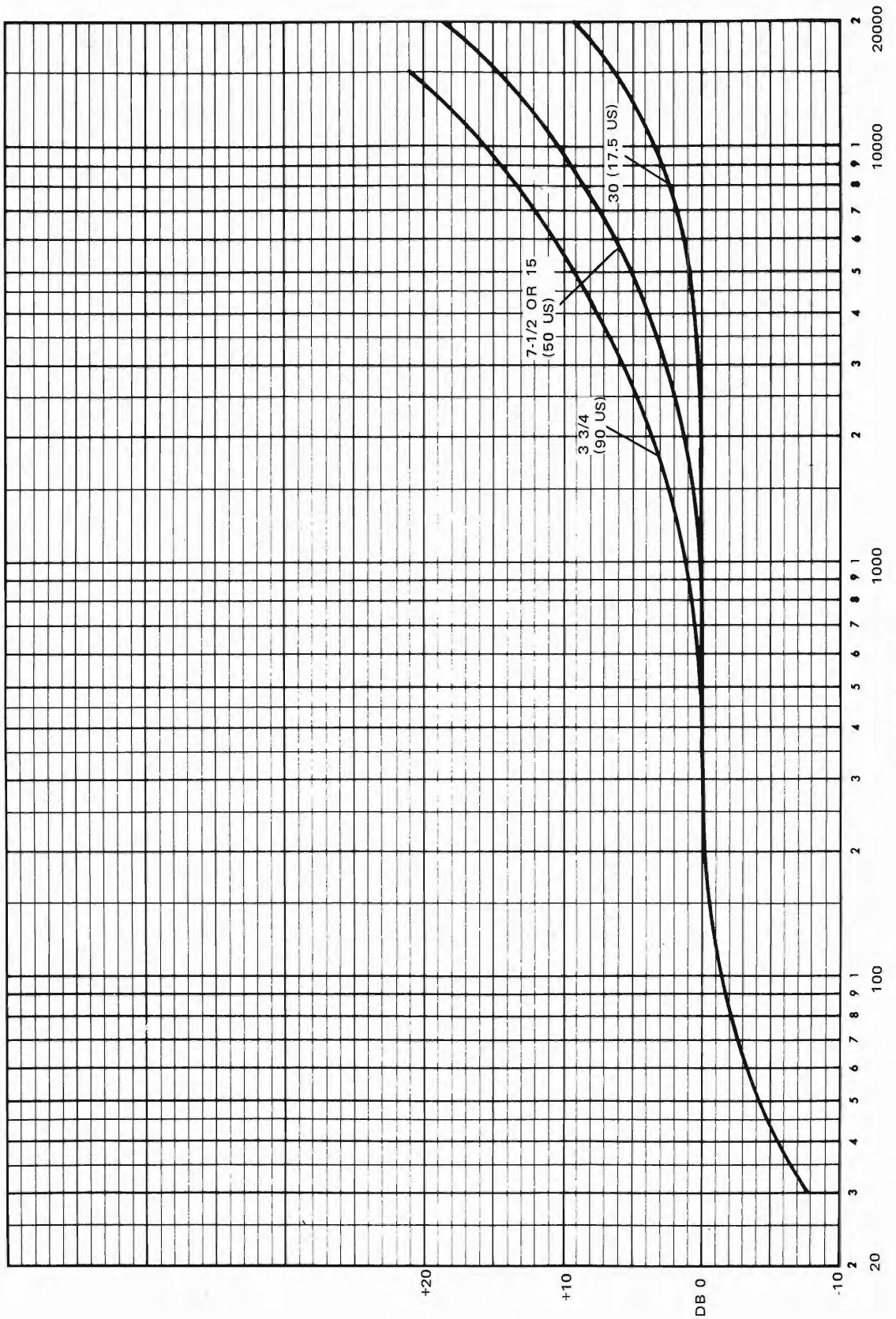


Figure 5-22. Reproduce Amplifier Response with Constant Flux to Head (NAB and AES)

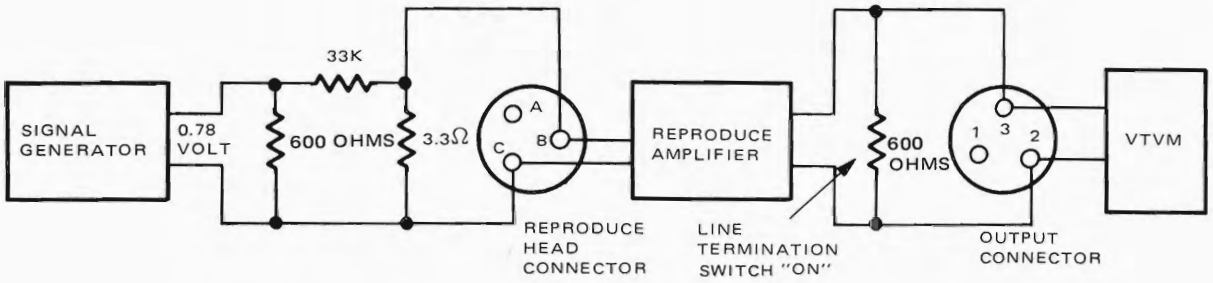


Figure 5-23. Troubleshooting Setup for Reproduce Amplifier

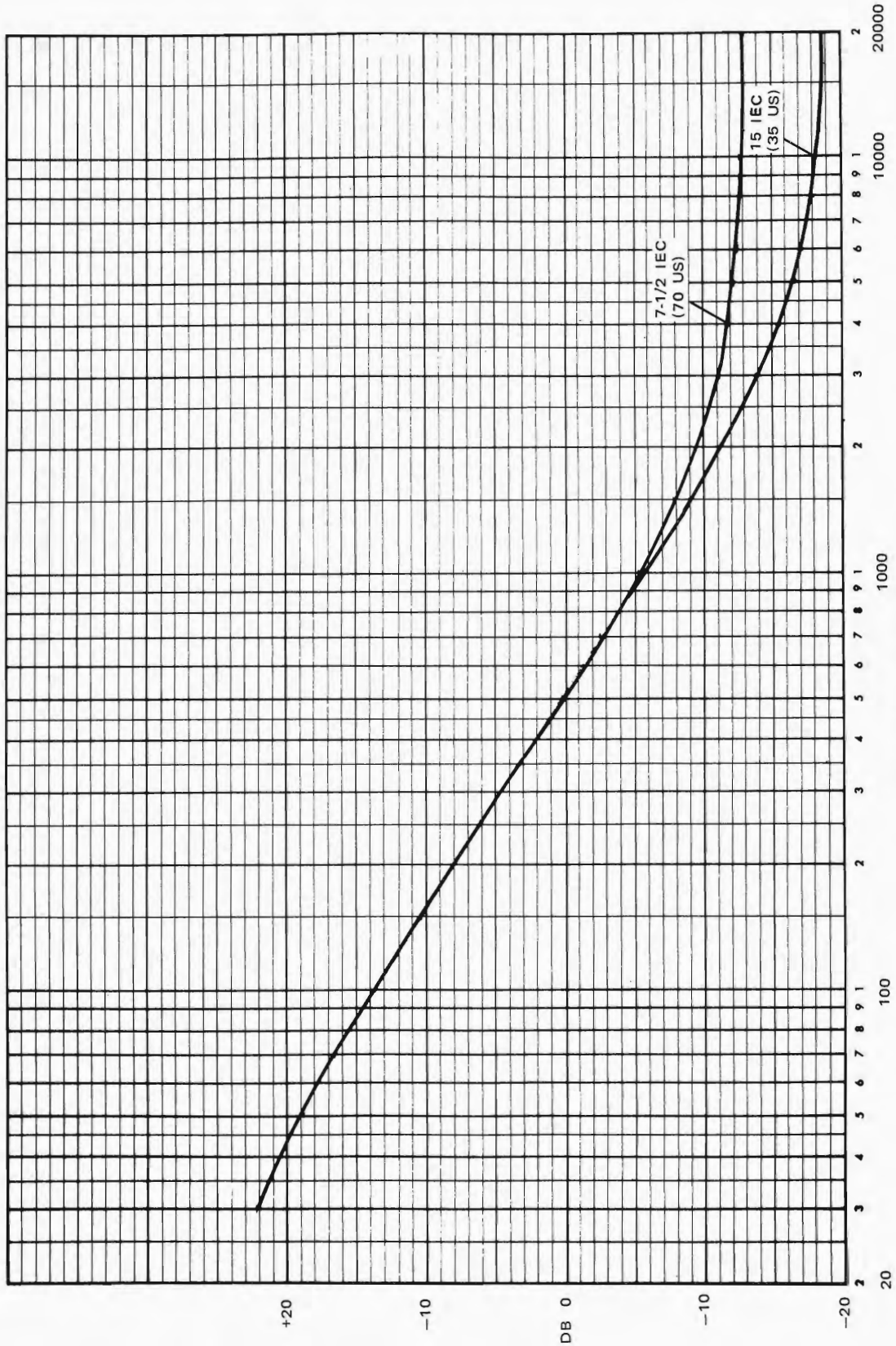


Figure 5-24. Reproduce Amplifier Response with Constant Voltage Input (IEC)

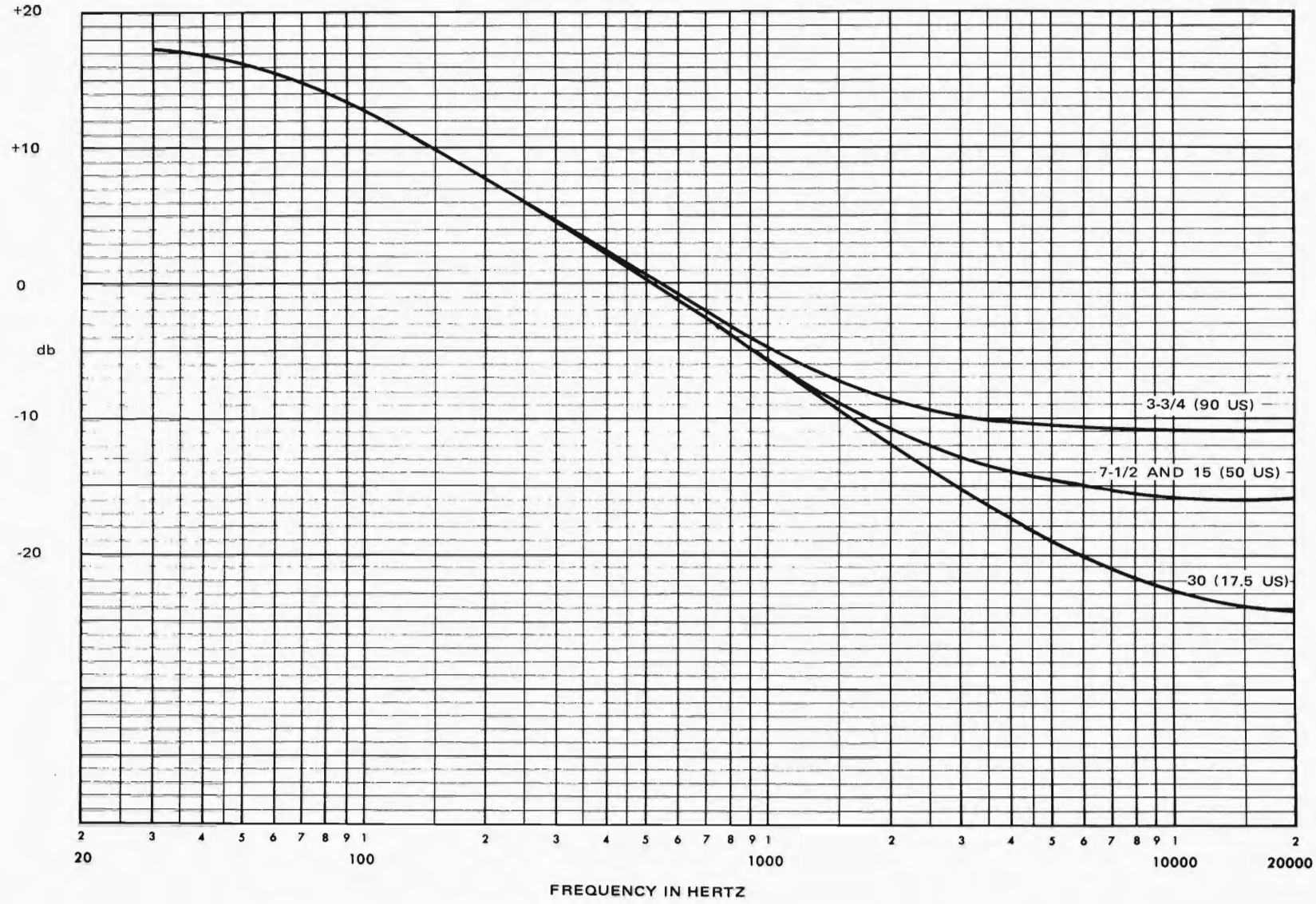


Figure 5-25. Reproduce Amplifier Response with Constant Voltage Input (NAB and AES)

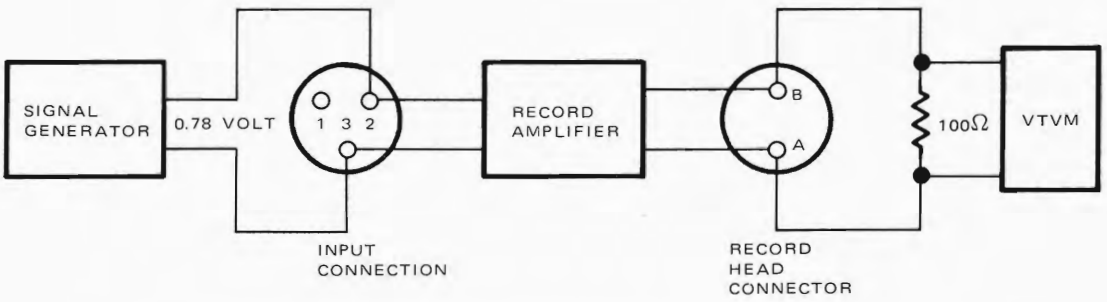


Figure 5-26. Troubleshooting Setup for Record Amplifier

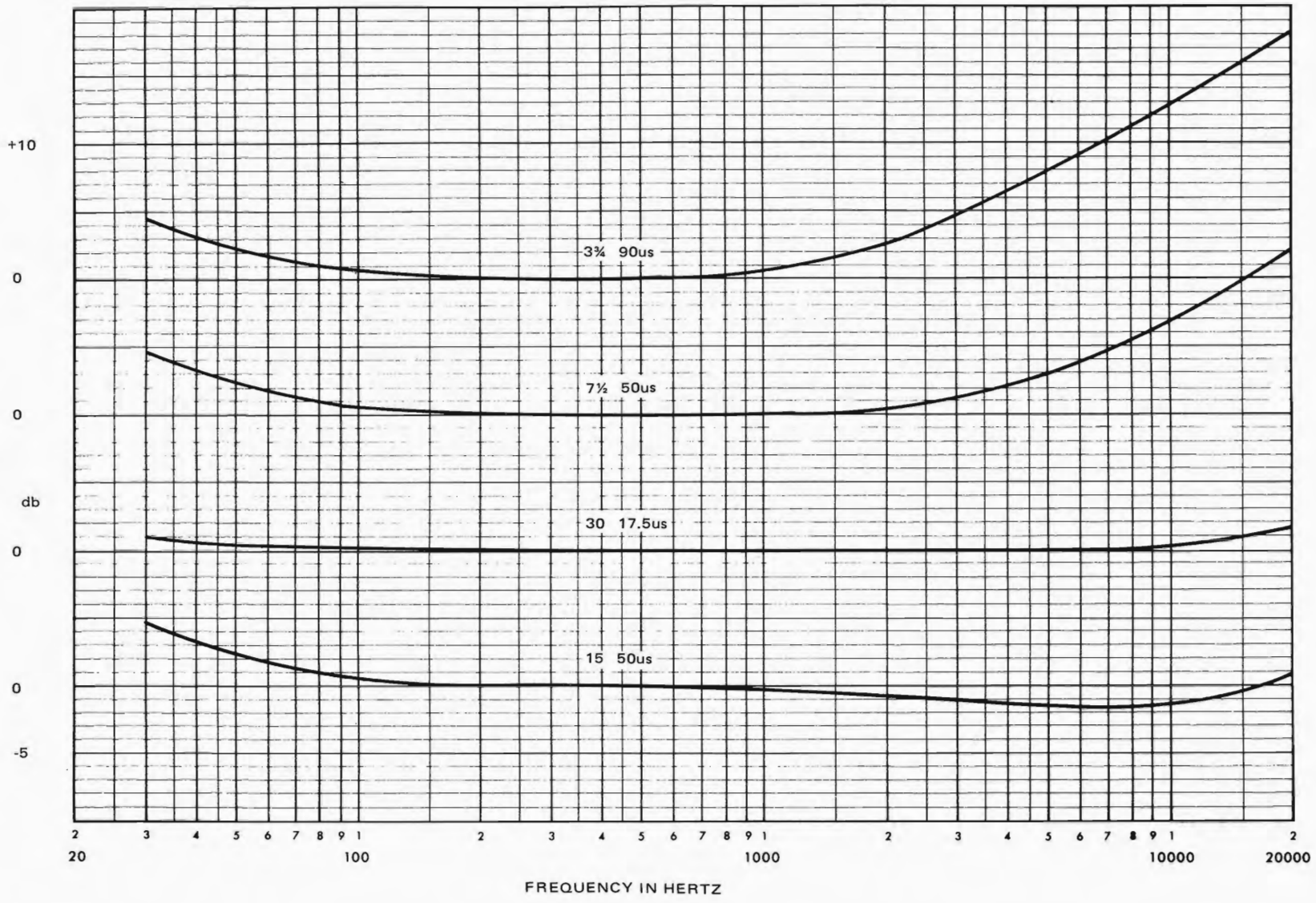


Figure 5-27. Record Current Response (Pre-emphasis Set for Flat Responses)

Table 5-8. Troubleshooting Hints – Electronic

SYMPTOM	POSSIBLE CAUSE
Neither the VU meter lamp nor the READY lamp light.	+39V power supply is disconnected or defective (F701 on power supply blown) or F1 on electronics unit is blown.
No output indicated on VU meter or present on 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 904, 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.	Transistor 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 SAFE switch is depressed.	Transistor 9Q3 or 9Q4 on record control board is shorted.
RECORD light comes on when READY switch is pressed.	Transistor 9Q1 on record control board shorted.

Table 5-9. Troubleshooting Hints — Tape Transport

SYMPTOM	POSSIBLE CAUSE
Neither transport pilot lamp nor VU meter lamp lights.	F601 or F602 on control box is blown. Indicator lamp is defective.
No action when PLAY, REWIND, or FAST FORWARD buttons are pressed but EDIT operates and latches.	Safety switch inoperable.
No action when PLAY, REWIND, or FAST FORWARD buttons are pressed and Edit operates only while button is pressed (does not latch).	Failure in 30V power supply.
Relays click when PLAY, REWIND, or FAST FORWARD 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 thru outer shield) or +39V power supply inoperative or cables disconnected.
Servo motor fails to start when tape is threaded and safety switch activated.	Capstan stop option selected in error.
Servo motor fails to start when Play mode is selected.	Dummy plug missing in accessory socket J4 on servo chassis.

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.

- Manual sequence
- Numerical sequence by assembly part number
- Numerical sequence by schematic diagram number

Five illustrations (Figures 6-1 through 6-5) follow to aid in the identification and location of major components and assemblies.

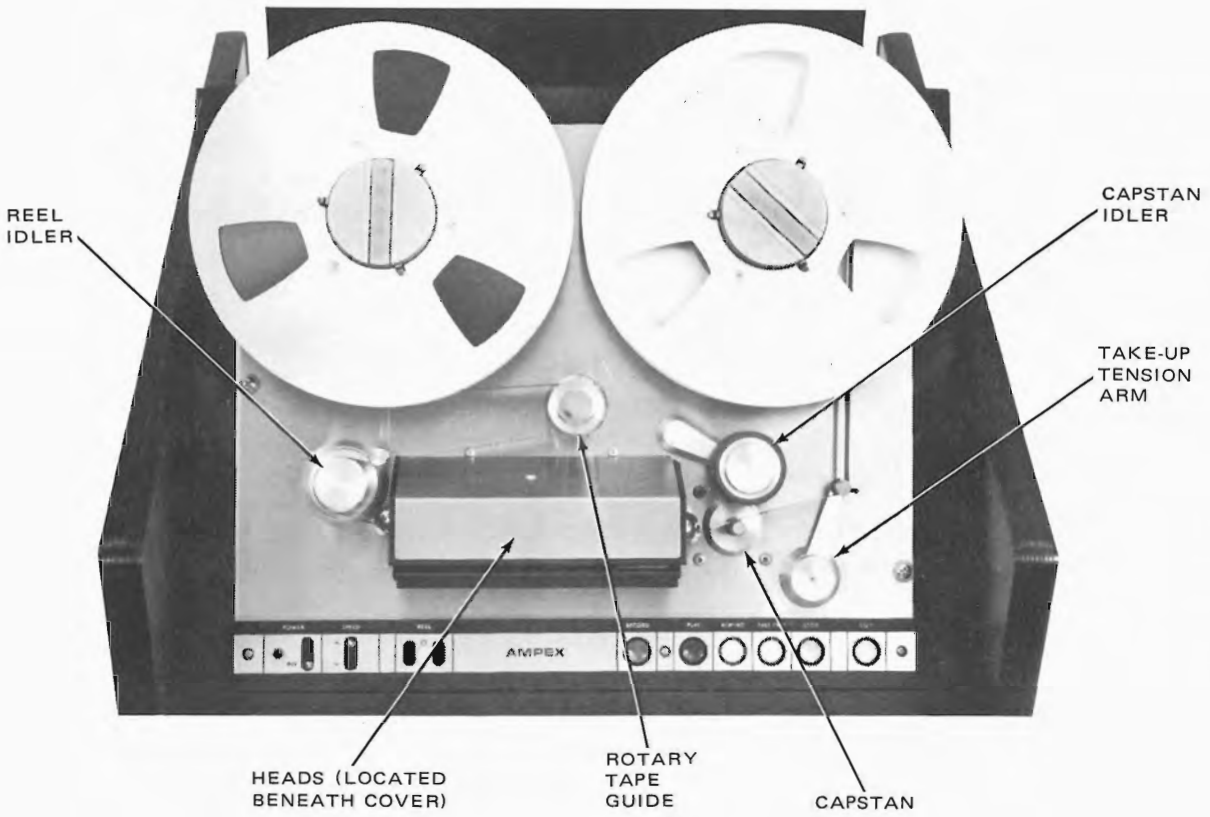


Figure 6-1. Location of Parts, Top of Transport

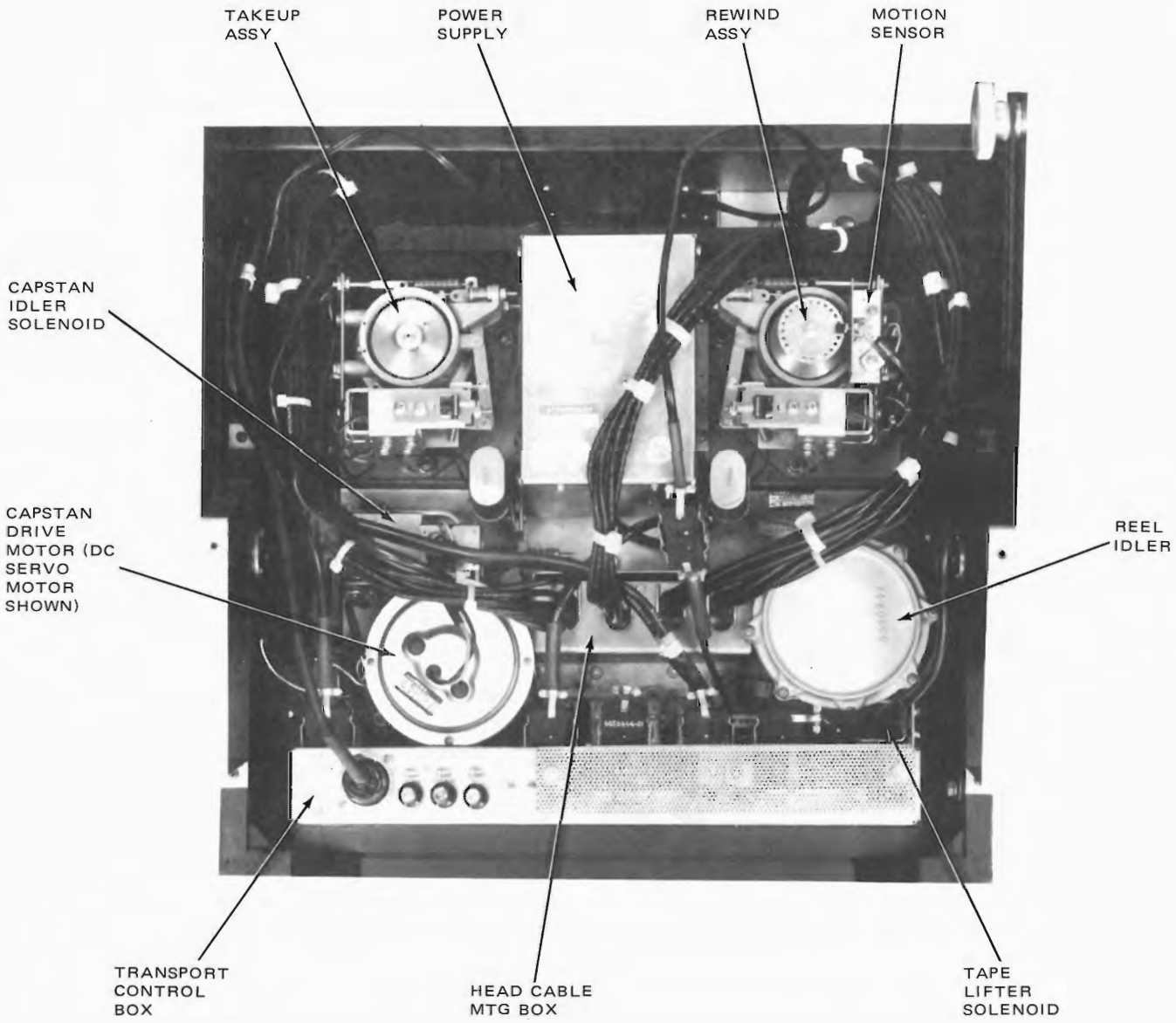


Figure 6-2. Location of Parts, Bottom of Transport

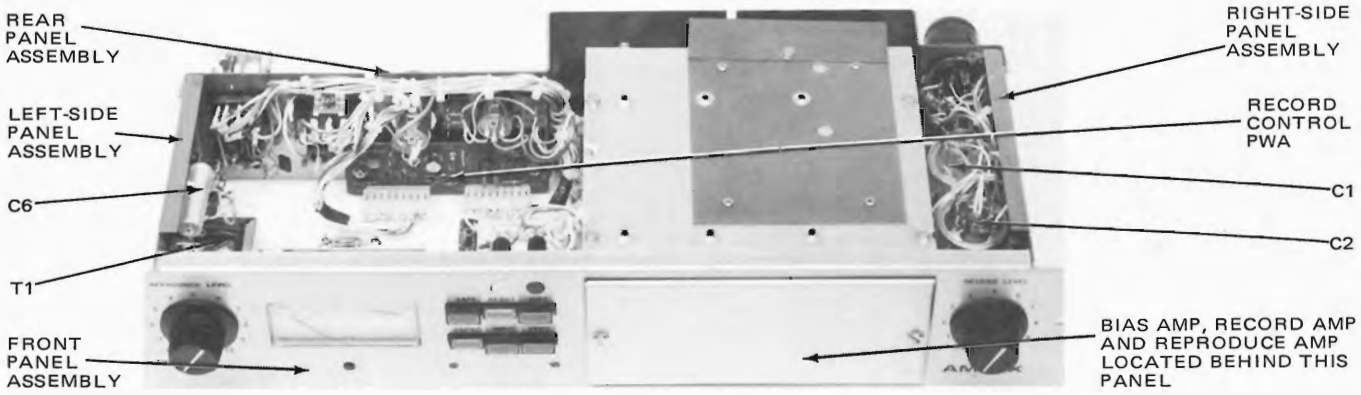


Figure 6-3. Location of Components, Record/Reproduce Unit

Figure 6-4. Rear Panel of Record/Reproduce Unit

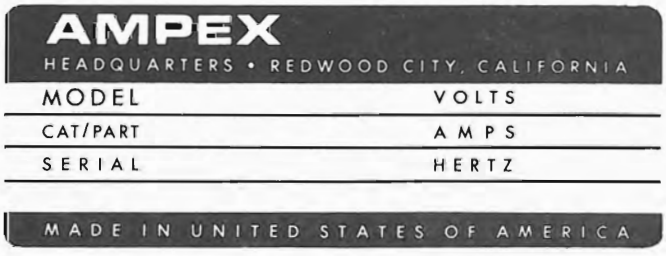


Figure 6-5. Identification Plate

DRAWING INDEX

MISSING

DRAWING INDEX (Continued)

NUMERICAL INDEX TO PARTS LISTS

NUMERICAL INDEX TO PARTS LISTS (Continued)

NUMERICAL INDEX TO SCHEMATICS

ASSEMBLY NO. 4010205C TITLE: TAPE RECORDER, 8 CHANNEL 1" TAPE SHEET 1 OF 2

NEXT HIGHER ASSEMBLY NO. CATALOG

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4020084-10		CONSOLE ASSY	
2	4020269-01		RECORD EQUALIZER PWA, 7-1/2-15	
3	4020269-07		RECORD EQUALIZER PWA, 15-30	
4	4020270-02		REPRODUCE EQUALIZER PWA	
5	4020274-05		POWER SUPPLY ASSY	
6	4020274-06		POWER SUPPLY ASSY	
7	4020280-12		TRANSPORT ASSY, W/SERVO MOTOR	
8	4020300-03		HEAD ASSY, 1" TAPE	
9	4020303-01		TORQUE DELAY ASSY	
10	4020337-01		ELECTRONICS ASSY W/OUT EQUALIZERS	
11	4020353-02		CAPSTAN SERVO CHASSIS ASSY	
13	4030099-02		TAPE GUIDE ASSY	
14	4040992-02		COVER PANEL, DECORATIVE	
15	4041048-05		SCRAPE FLUTTER IDLER ASSY	
17	4050416-02		CABLE ASSY, POWER	
18	4050442-01		ELECTRONICS INTERCONNECT CABLE ASSY	
19	4050654-01		HEAD CABLE MOUNTING BOX ASSY	
20	4050456-01		POWER SUPPLY EXTENSION CABLE ASSY	
21	4050457-01		POWER SUPPLY JUMPER CABLE ASSY	
22	4050459-01		CABLE ASSY, FAN	
38	4260117-01		STRAP, RETAINING POWER SUPPLY	
39	4290659-01		SHIELD, RESISTOR, CONTROL BOX	
41	4580200-01		TRANSFORMER, BRIDGING	
42	4600008-10		SHIELD, P/B HEAD, CONNECTOR	
43	4690003-50		REEL ASSY, 10 1/2 X 1 TAPE	
47	4840188		SCHEMATIC, TORQUE DELAY ASSY	
52	4930504-01		NUTDRIVER, MODIFIED	
59	144-003		CONNECTOR, PLUG, FEMALE, 3 PIN	
60	145-009		CONNECTOR, PLUG, MALE, 3 PIN	
62	302-336		CLAMP, CABLE, STRAP, BLUE	
64	430-016		RING, RETAINER, 7/8"	
66	470-384		SCREW, BUTTON HD, SOC, NO. 8-32 X 1/2	
67	471-081		SCREW, PAN HD, XREC, NO. 8-32 X 5/8	
68	471-084		SCREW, PAN HD, XREC, NO. 8-32 X 1	
69	471-108		SCREW, PAN HD, XREC, NO. 4-40 X 0.19	
70	471-470		SCREW, PAN HD, XREC, NO. 6-32 X 1-1/2	
71	471-865		SCREW, PAN HD, XREC, NO. 10-24 X 0.625	
73	472-889		SCREW, OVAL HD, XREC, NO. 12-24 X 3/4	
74	472-967		SCREW, OVAL HD, XREC, NO. 12-24 X 1-1/4	
75	476-222		SCREW, WOOD, ROUND HD, SLOTTED, NO. 6 X 7/16	
76	496-005		NUT, KEP, NO. 6-32	

ASSEMBLY NO. 4010205C TITLE: TAPE RECORDER, 8 CHANNEL 1" TAPE SHEET 2 OF 2

NEXT HIGHER ASSEMBLY NO. CATALOG

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
77	496-006		NUT, KEP, No. 8-32	
79	501-009		WASHER, FLAT, NO. 6	
80	501-010		WASHER, FLAT, NO. 8	
83	502-004		WASHER, LOCK, NO. 8	
84	502-005		WASHER, LOCK, NO. 10	
85	503-087		WASHER, WHITE, NO. 12	
			VERSION: 4010205-01 – 7 1/2 IPS 4010205-02 – 15-30 IPS	

ASSEMBLY NO. 4020280AL TITLE: TAPE TRANSPORT ASSY 1" TAPE SHEET 1 OF 2

NEXT HIGHER ASSEMBLY NO. 4010205

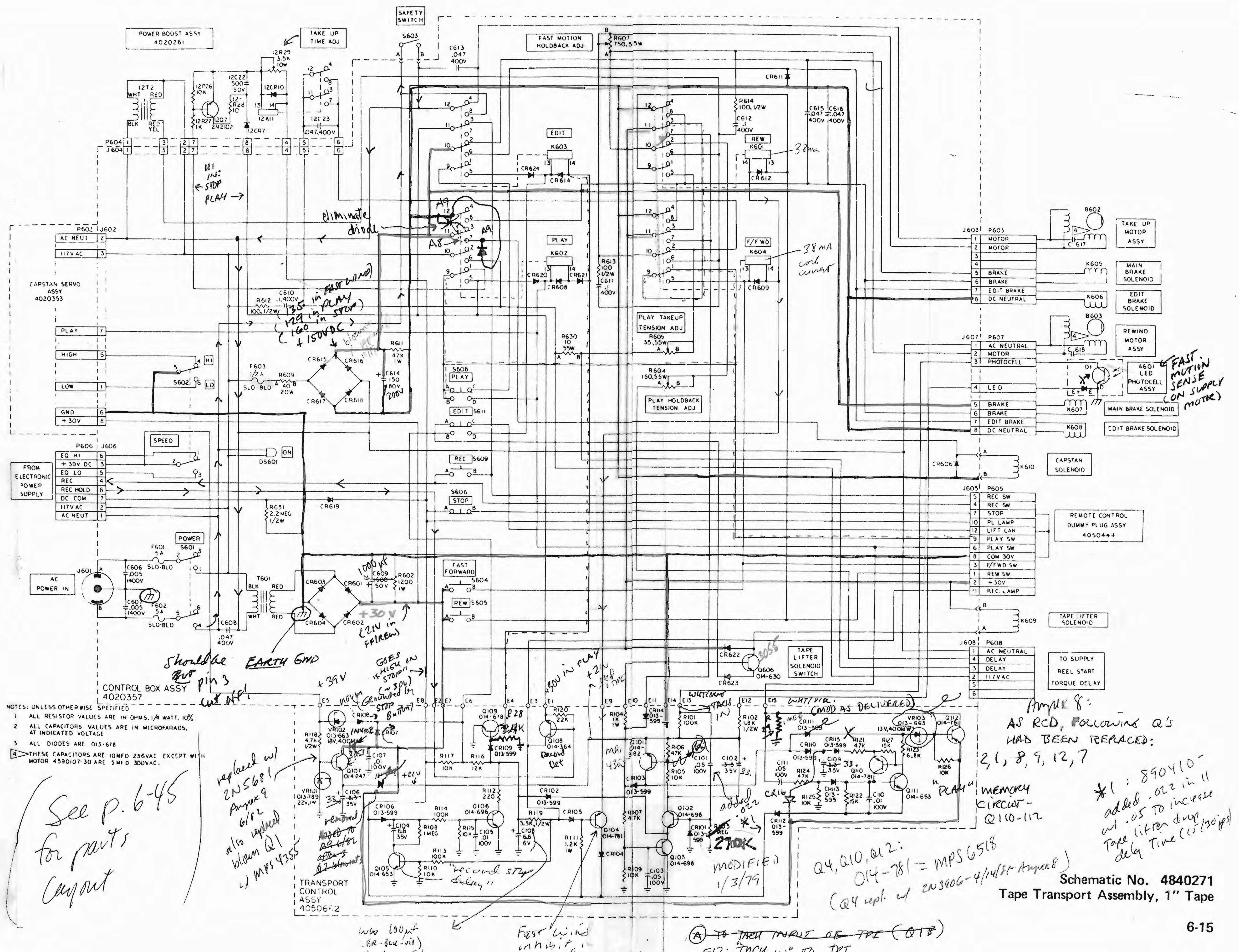
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
2	4020281-01		POWER BOOST ASSY	
5	4030094-01		ARM ASSY, CAPSTAN IDLER	
6	4030135-30		ROTARY TAPE GUIDE ASSY	
7	4030196-50		FLYWHEEL ASSY, DAMPED	
8	4030259-04		TAPE LIFTER ASSY	
10	4030273-02		SOLENOID ASSY, TAPE LIFTER	
16	4030279-24		CAPSTAN IDLER ASSY, 7-1/2 – 15	
19	4040970-04		REEL IDLER ASSY	
20	4040974-16		TAKE-UP TENSION ARM ASSY	
27	4050436-01		SAFETY SWITCH ASSY	
29	4020361-02		SERVO MOTOR ASSY	
31	4100182-01		PUSHBUTTON, WHITE	
32	4100182-02		PUSHBUTTON, YELLOW	
33	4100182-03		PUSHBUTTON, RED	
34	4100182-04		PUSHBUTTON, GREEN	
35	4110266-02		ESCUTCHEON, PUSHBUTTON, RIGHT	
36	4110267-02		GUARD, REEL	
38	4130103-01		PAD, TOGGLE SWITCH	
40	4170184-01		SHIELD, SWITCH	
43	4220103-02		SPACER, REEL IDLER FLYWHEEL	
44	4230160-10		ARM SOLENOID	
46	4270117-01		SPRING TAPE LIFTER SOLENOID	
47	4270252-02		SPRING TAPE LIFTER RETURN	
50	4330090-01		FACING, TOP PLATE	
51	4330255-01		PLATE, TAPE LIFTER SOLENOID MOUNTING	
52	4330256-01		PLATE, MOTOR CAPACITOR MTG	
53	4330257-01		PLATE, CAPSTAN SOLENOID MTG	
55	4400594-01		SCREW, MODIFIED	
57	4440025-30		WASHER, LAMICOID, 0.015 THK	
58	4440113-10		WASHER, 0.315 I.D. X 0.005 THK	
59	4440113-20		WASHER, 0.315 I.D. X 0.010 THK	
60	4440113-30		WASHER, 0.315 I.D. X 0.003 THK	
62	6000035-02		LABEL, IDENTIFICATION	
67	302-007		CLAMP, CABLE, 1/4 I.D.	
68	406-005		PIN, "ROLLPIN" 0.028 WALL, 0.125 DIA X 0.75 LG	
70	435-164		CLIP, CABLE	
71	470-165		BOLT, HEX SOCKET CAP HD, NO. 1/4-28 X 1/2 LG	
72	470-423		SCREW, CAP, HEX SOC BUTTON HD, NO. 10-24 X 5/8 LG	
73	470-427		SCREW, CAP, HEX SOC BUTTON HD, NO. 6-32 X 3/8 LG	
74	471-081		SCREW, MACH, XREC, PAN HD, NO. 8-32 X 5/8 LG	
76	471-334		SCREW, MACH, FLAT HD, XREC, NO. 6-32 X 1/4 LG	
77	472-415		SCREW, MACH, PAN HD, XREC, NO. 10-24 X 3/8 LG	
78	473-123		SCREW, MACH, HEX HD, NO. 8-32 X 1/2 LG	
80	475-023		SCREW, SEM, PAN HD, SLOTTED, NO. 8-32 X 1/2 LG	

ASSEMBLY NO. 4020280AL TITLE: TAPE TRANSPORT ASSY 1" TAPE SHEET 2 OF 2

NEXT HIGHER ASSEMBLY NO. 4010205

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
81	475-080		SCREW, SEM, PAN HD, XREC, NO. 6-32 X 1-1/8 LG	
82	475-095		SCREW, SEM, PAN HD, XREC, NO. 6-32 X 7/8 LG	
83	475-100		SCREW, SEM, PAN HD, XREC, NO. 6-32 X 1/2 LG	
85	477-046		SCREW, SET, CUPPOINT, HEX SOC, NO. 8-32 X 5/8 LG	
86	477-047		SCREW, SET, CUPPOINT, HEX SOC, NO. 10-32 X 1/4 LG	
89	477-426		SCREW, SET, CUPPOINT, HEX SOC, NO. 4-40 X 3/32 LG	
91	493-012		NUT, SELF LOCKING, HEX, 1/4-20	
93	496-006		NUT, KEP, 8-32	
95	501-006		WASHER, FLAT, 1/4	
96	501-010		WASHER, FLAT, NO. 8	
97	501-011		WASHER, FLAT, NO. 10	
98	501-012		WASHER, 0.265 I.D. X 0.500 O.D. X 0.064 THK	
99	501-021		WASHER, FLAT, NO. 6	
100	501-040		WASHER, FLAT, 0.171 I.D. X 0.375 O.D. X 0.062 THK	
101	501-908		WASHER, FLAT, NO. 10, 0.062 THK	
102	502-005		WASHER, LOCK SPRING, NO. 10	
103	502-016		LOCKWASHER, FLAT EXT TOOTH, NO. 10	
104	502-133		WASHER, LOCK SPRING, NO. 8	
111	4030300-03		TAKEUP ASSY	TAKANAWA MOTOR
116	40505040-02		CAPACITOR ASSY, 5 UFD	
117	4100198-02		DUST CAP, CAPSTAN	
119	4030334-02		REWIND ASSY	
120	4020357-02		CONTROL BOX ASSY	
121	4030272-04		CAPSTAN IDLER SOLENOID ASSY	
122	4040911-04		ESCUTCHEON ASSY	
131	4840271		SCHEMATIC, TAPE TRANSPORT	

VERSION: 4020280-12



Schematic No. 4840271
Tape Transport Assembly, 1" Tape

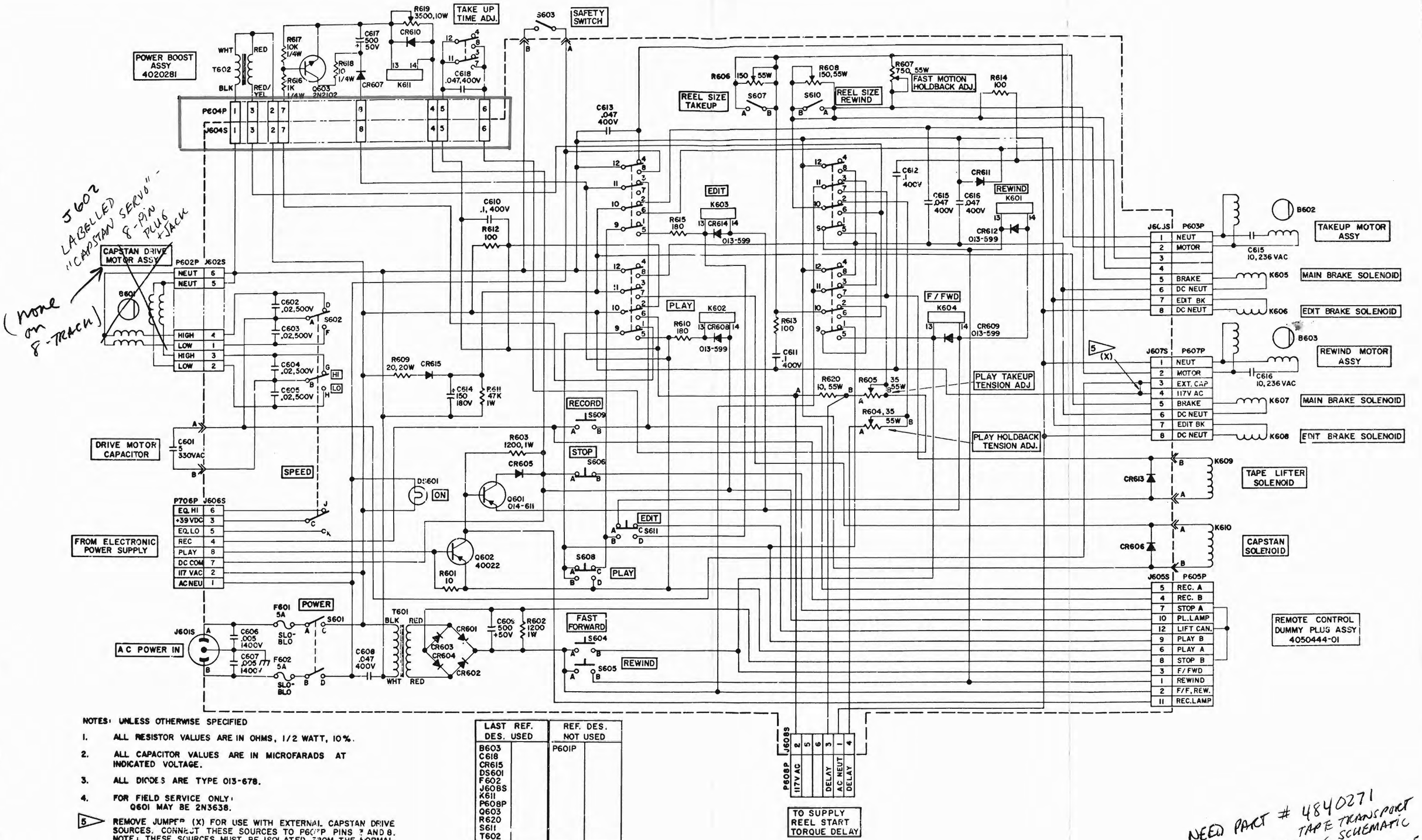
ASSEMBLY NO. 4020281C TITLE: POWER BOOST ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020280

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
5	4400310-10		SCREW, SHOULDER	
6	4580156-01	T2	TRANSFORMER, POWER	
11	013-678	CR7,12CR10	DIODE	1N4385
12	014-329	Q7	TRANSISTOR	2N2102
13	020-144	K11	RELAY, 4PDT	
14	020-492		SPRING, RELAY HOLDDOWN	
15	031-134	C22	CAPACITOR, 500 UF, 50V	
16	035-985	C23	CAPACITOR, 0.047, 400V	
17	040-159	R29	RESISTOR, ADJ, 3500 OHM, 10W	
18	041-633	R26	RESISTOR, 10K, 1/4W, 10%	
19	041-979	R27	RESISTOR, 1K, 1/4W, 10%	
20	049-394	R28	RESISTOR, 10 OHM, 1/4W, 10%	
21	145-013	P604P	CONNECTOR, RECT PLUG, 8 PIN	
22	150-119		SOCKET, RELAY	
23	302-007		CLAMP, CABLE, 1/4	
24	302-031		CLAMP, CABLE, 3/16	
25	471-069		SCREW, PAN HD, XREC, NO. 6-32 X 3/8	
26	471-507		SCREW, NO. 6-32 X 2-1/4	
27	476-998		SCREW, SELF-TAP, HEX HD, NO. 6 X 1/4	
28	496-005		NUT, KEP, NO. 6-32	
29	496-006		NUT, KEP, NO. 8-32	
30	501-009		WASHER, FLAT, NO. 6	
31	503-012		WASHER, FIBRE, SHOULDER	
32	506-013		WASHER, FLAT, NO. 6 "D"	
33	506-140		WASHER, FLAT, NO. 8 "D"	
47	302-094		STRAP, CABLE	
48	501-010		WASHER, FLAT, NO. 8	
52	262-003		BUSHING	
82	4840056		SCHEMATIC	

VERSION: 4020281-01

Power Boost Assembly
Assy No. 4020281



NOTES: UNLESS OTHERWISE SPECIFIED

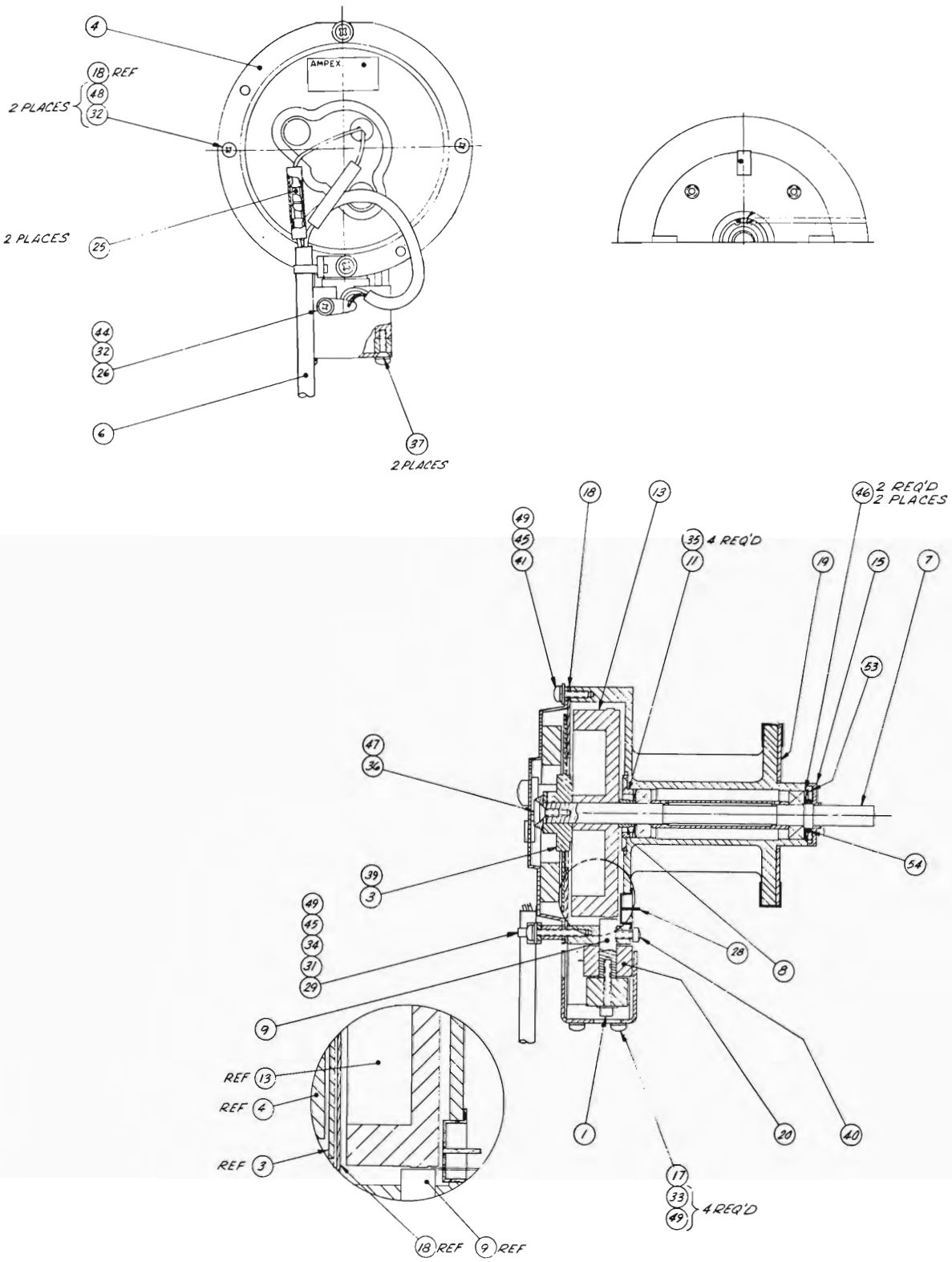
1. ALL RESISTOR VALUES ARE IN OHMS, 1/2 WATT, 10%.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS AT INDICATED VOLTAGE.
3. ALL DIODES ARE TYPE 013-678.
4. FOR FIELD SERVICE ONLY: Q601 MAY BE 2N3638.

5 REMOVE JUMPER (X) FOR USE WITH EXTERNAL CAPSTAN DRIVE SOURCES. CONNECT THESE SOURCES TO P607P PINS 7 AND 8. NOTE: THESE SOURCES MUST BE ISOLATED FROM THE NORMAL A.C. MAINS SUPPLY AND GROUND.

LAST REF. DES. USED		REF. DES. NOT USED	
B603		P601P	
C618			
CR615			
DS601			
F602			
J608S			
K611			
P608P			
Q603			
R620			
S611			
T602			

NEED PART # 4840271 TAPE TRANSPORT SCHEMATIC
A? B? 440A-8 P 6-15, 16

Schematic No. 4840056
~~Power Boost Assembly~~
TRANSPORT CONTROL
6-19



Servo Motor Assembly
Assy No. 4020361

ASSEMBLY NO. 4020361A TITLE: SERVO MOTOR ASSY SHEET 1 OF 1

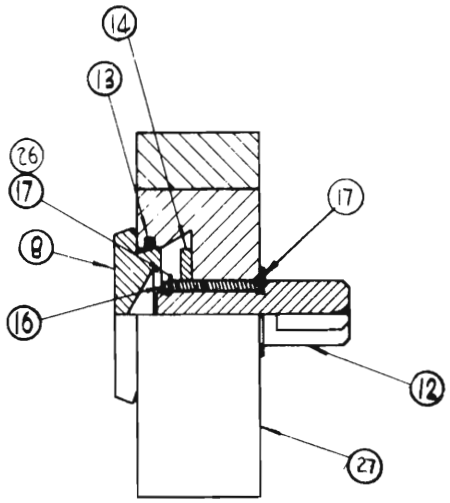
NEXT HIGHER ASSEMBLY NO. 4020280

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4030347-01		MAGNET ASSY	
3	4041197-01		HUB AND ARMATURE ASSY	
4	4041196-01		BACK PLATE ASSY	
6	4050665-03		CABLE ASSY, MOTOR TACH	
7	4041195-02		SHAFT ASSY	
8	4220272-01		SPACER, TACHOMETER	
9	4210327-01		CORE, TACH COIL	
11	4220273-01		FLANGE, SERVO MOTOR	
13	5250087-01		TACHOMETER	
15	4280030-01		SEAL, BEARING	
17	4290759-02		COVER, PICKUP COIL	
18	4330311-01		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, 0.375 LG	
31	302-365		TIE, CABLE	
32	471-060		SCREW, PAN HD, XREC 4-40 X 0.25 LG	
33	471-068		SCREW, PAN HD, XREC 6-32 X 0.31 LG	
34	471-074		SCREW, PAN HD, XREC 6-32 X 0.88 LG	
35	471-327		SCREW, FLAT HD, 4-40 X 0.31 LG	
36	471-345		SCREW, FLAT HD, 8-32 X 0.38 LG	
37	471-389		SCREW, FLAT HD, 6-32 X 0.50 LG	
39	477-497		SCREW SET, CUP POINT, NO. 6-32 X 0.19 LG	
40	473-348		SCREW, PAN HD, NYLON, 8-32 X 0.31 LG	
41	475-070		SCREW, PAN HD, XREC, 6-32 X 0.44 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, SPRING LOCK NO. 4	
49	502-003		WASHER, SPRING LOCK NO. 6	
53	430-085		RING, RETAINING, INTERNAL	
54	432-072		SEAL, O-RING, 0.437 ID, 0.625 OD	

ASSEMBLY NO. 4030279G TITLE: CAPSTAN IDLER ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020280

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
8	4100166-10		CAP	
12	4210189-50		SHAFT, 1"	
13	4320112-10		RING, LOCK	
14	4440239-10		WASHER, FELT	
16	430-004		RING, RETAINING, 0.250 I.D.	
17	501-049		WASHER, FLAT, 0.002 THK	
26	501-689		WASHER, FLAT	
27	4250199-02		PUCK ASSY	
			VERSION: 4030279-24	

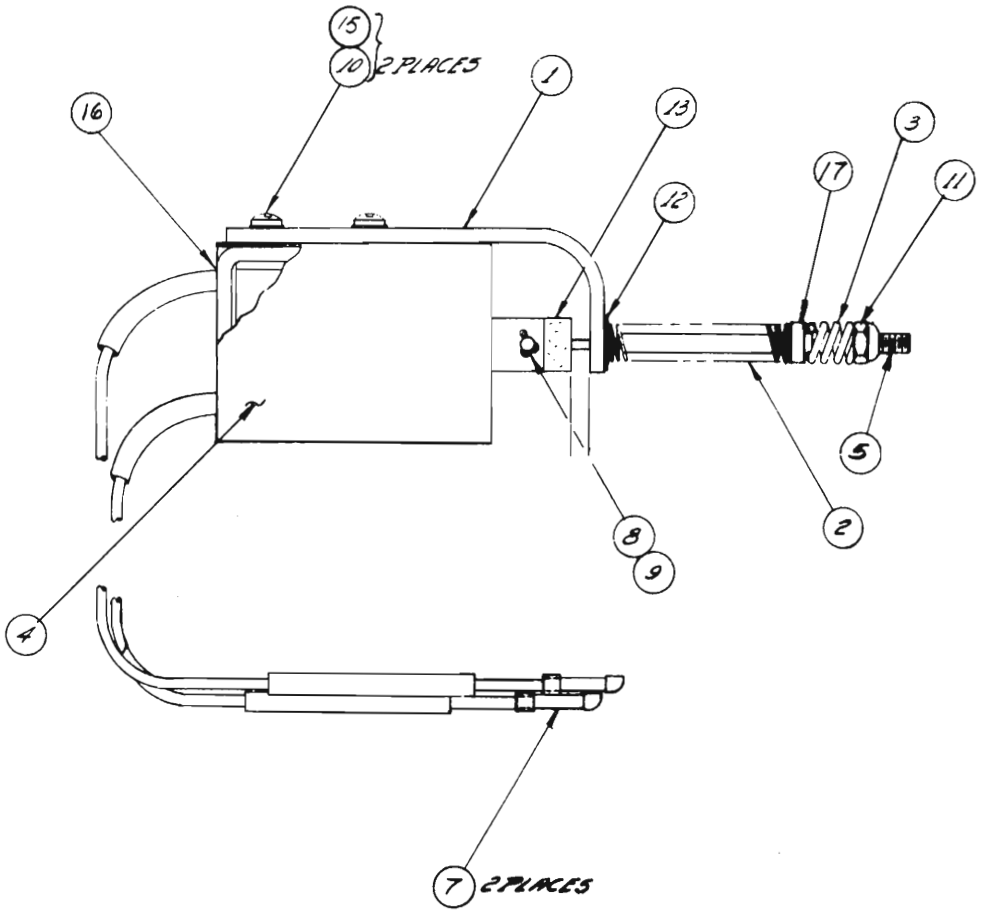


Capstan Idler Assembly
Assy No. 4030279

ASSEMBLY NO. 4030272J TITLE: CAPSTAN IDLER SOLENOID ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020280

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	
4	4290642-01		SHIELD, CAPSTAN SOLENOID	
5	4400604-20		BOLT, EYE	
7	171-008		CONNECTOR, SOLDERLESS	
8	400-009		CLEVIS PIN, 0.125 DIA X 17/32 LG	
9	401-005		COTTER PIN, 0.062 DIA X 1/2 LG	
10	475-092		SCREW, NO. 8-32 X 3/8	
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 I.D. 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	

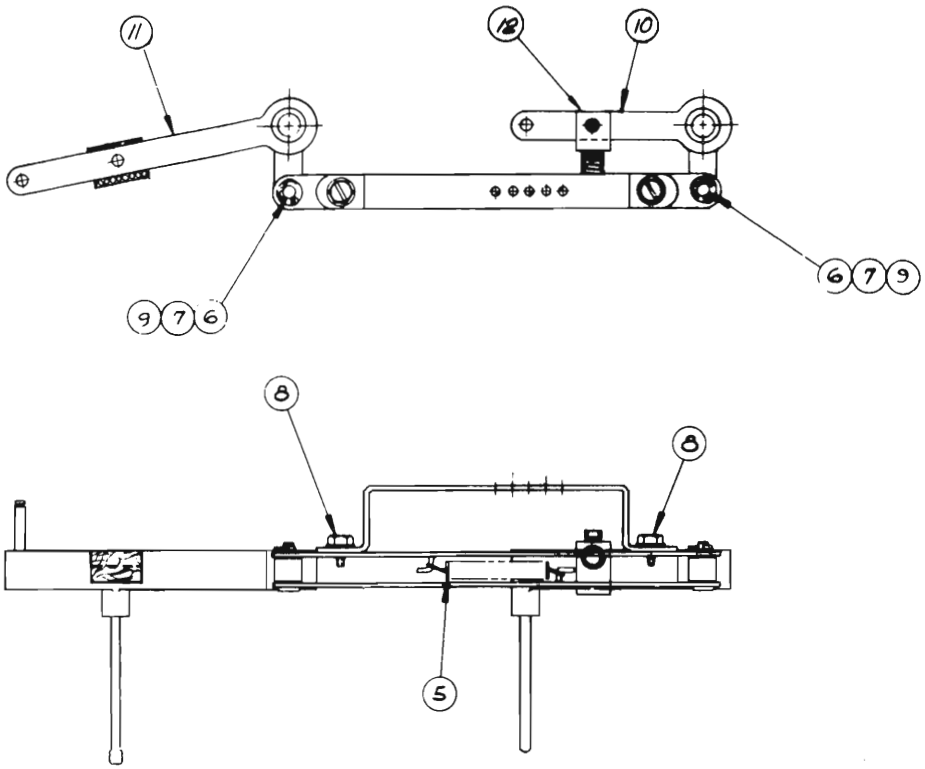


Capstan Idler Solenoid Assembly
Assy No. 4030272

ASSEMBLY NO. 4030259E TITLE: TAPE LIFTER ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020280

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
5	4270254-01		SPRING	
6	400-005		PIN, STRAIGHT, HEADED, CLEVIS, 1/8 DIA	
7	401-005		PIN, COTTER, 1/16 DIA X 1/2 LG	
8	476-011		SCREW, SELF TAPPING, HEX HD, NO. 6 X 1/4	
9	501-008		WASHER, FLAT, NO. 4	
10	4040965-04		TAPE LIFTER ASSY, L.H.	
11	4040966-04		TAPE LIFTER ASSY, R.H.	
12	4030278-01		SPRING CLIP ASSY	
			VERSION: 4030259-04	

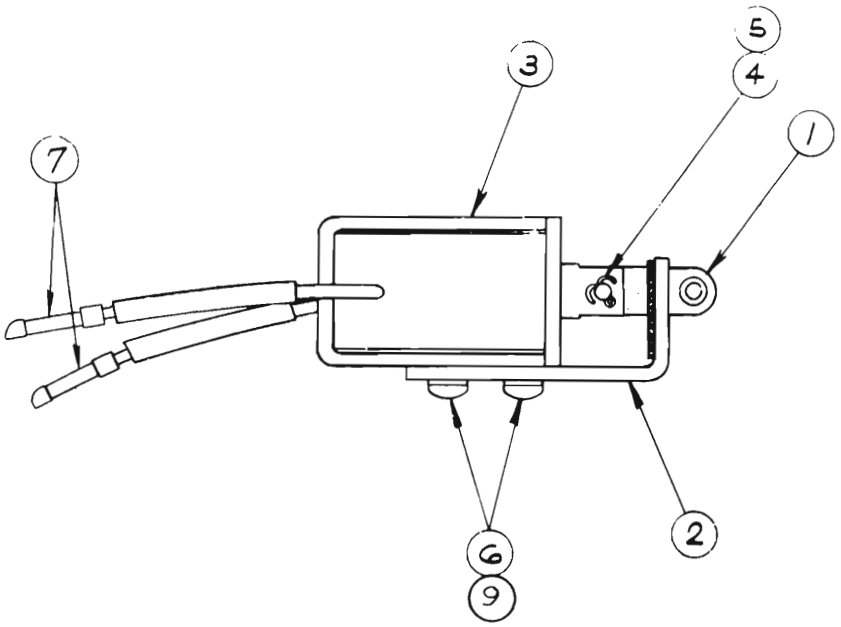


Tape Lifter Assembly
Assy No. 4030259

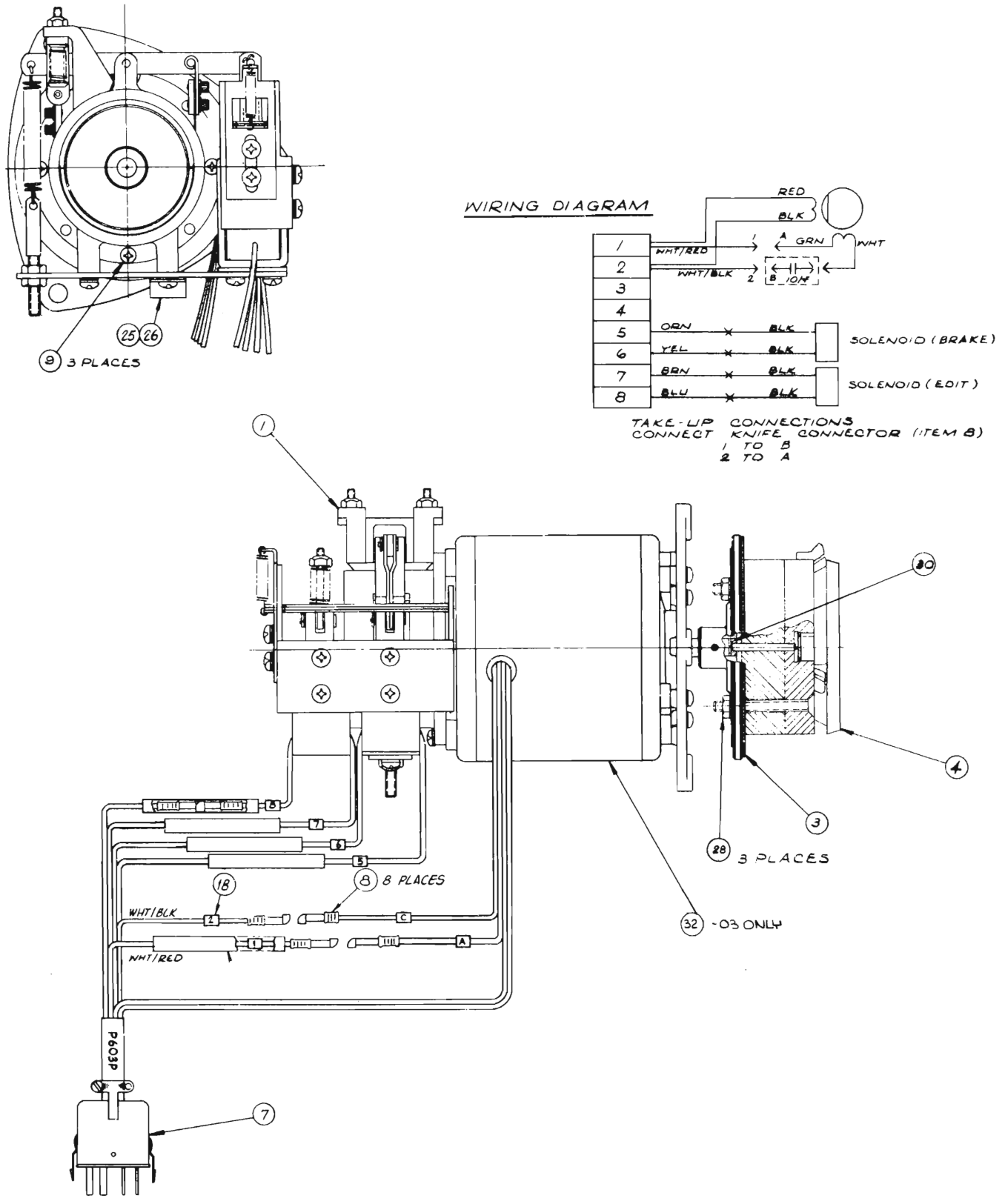
ASSEMBLY NO. 4030273 TITLE: TAPE LIFTER SOLENOID ASSY. SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020280

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4230242-01		LINK	
2	4260184-10		STOP	
3	4041070-02		SOLENOID ASSY.	
4	400-007		PIN, STRAIGHT HEADED, 1/8 DIA.	
5	401-005		PIN, COTTER, 1/16 DIA. 1/2 LG.	
6	475-107		SCREW, SEM. PAN HD, XREC, NO. 8-32 X 5/16	
7	171-008		CONNECTOR, SOLDERLESS	
9	501-010		WASHER, FLAT, NO. 8	



Tape Lifter Solenoid Assembly
Assy No. 4030273



Takeup Assembly
Assy No. 4030300

ASSEMBLY NO. 4030300E TITLE: TAKEUP ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020280

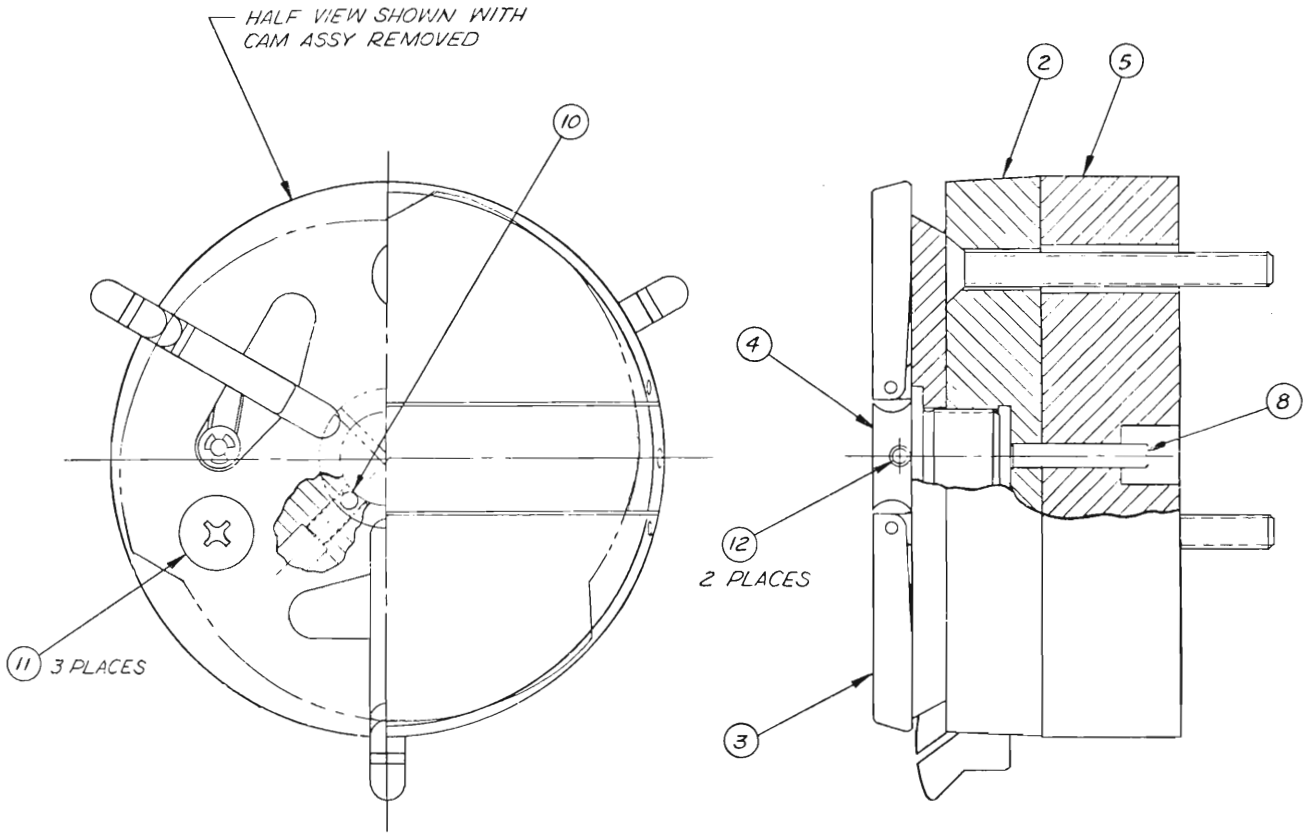
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4030264-03		BRAKE ASSY	
3	18119-01		PAD, TURNTABLE	
4	4100190-01		KNOB ASSY	
7	145-013		CONNECTOR, RECT, PLUG, 8 PIN	
8	171-008		CONNECTOR, SOLDERLESS, KNIFE	
9	475-098		SCREW, PAN HD, XREC, NO. 6-32 X 1/2	
25	302-078		CLAMP, CABLE, 5/8, BLK	
26	506-016		WASHER, "D", NO.	
28	496-007		NUT, KEP, NO. 10-32	
30	23041-02		PILOT, HOLDDOWN KNOB	
32	4040768-12		MOTOR ASSY, TAKANAWA	
33	4050540-02		CAPACITOR ASSY	

VERSION: 4030300-03

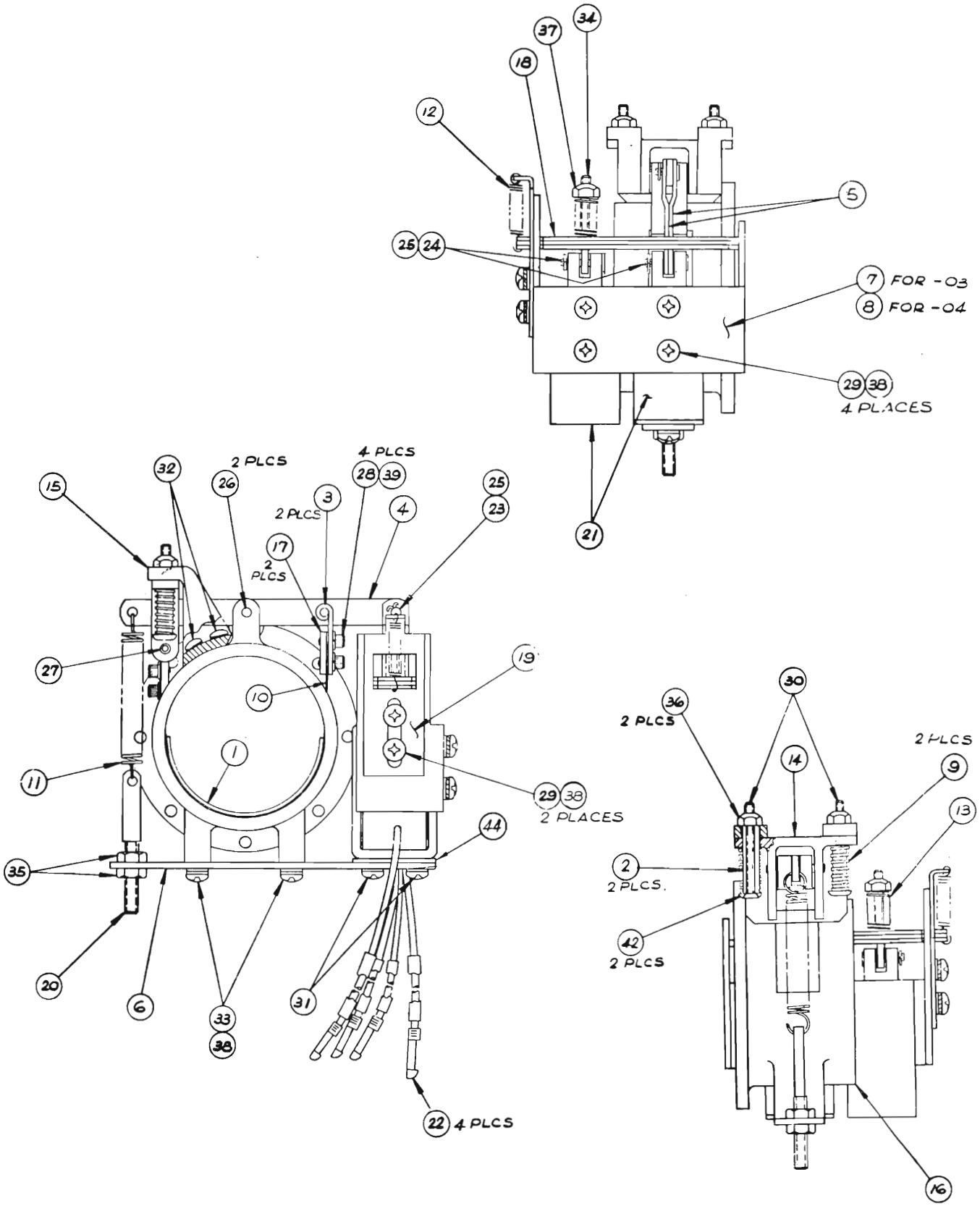
ASSEMBLY NO. 4100190A TITLE: REEL HOLDDOWN KNOB ASSEMBLY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4030300

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	18147-01		BUSHING, HOLDDOWN KNOB	
2	60849-01		BASE ASSY	
3	60850-01		HANDLE ASSY	
4	60852-01		COVER	
5	4220267-01		SPACER, REEL HOLDDOWN KNOB	
8	402-005		PIN, DOWEL, 0.1252 DIA X 3/4 LG	
9	402-018		PIN, DOWEL, 0.1250 DIA X 1-1/4 LG	
10	420-010		BALL, NYLON, 1/8 DIA	
11	471-743		SCREW, FLAT HD PHL, 10-32 X 1-3/4	
12	477-031		SCREW, SET, HEX SOCKET, CUP PT, 4-40 X 1/4	
13	477-040		SCREW, SET, HEX SOCKET, CUP PT, 8-32 X 3/16	
			VERSION: 4100190-01	



Reel Holddown Knob Assembly
Assy No. 4100190

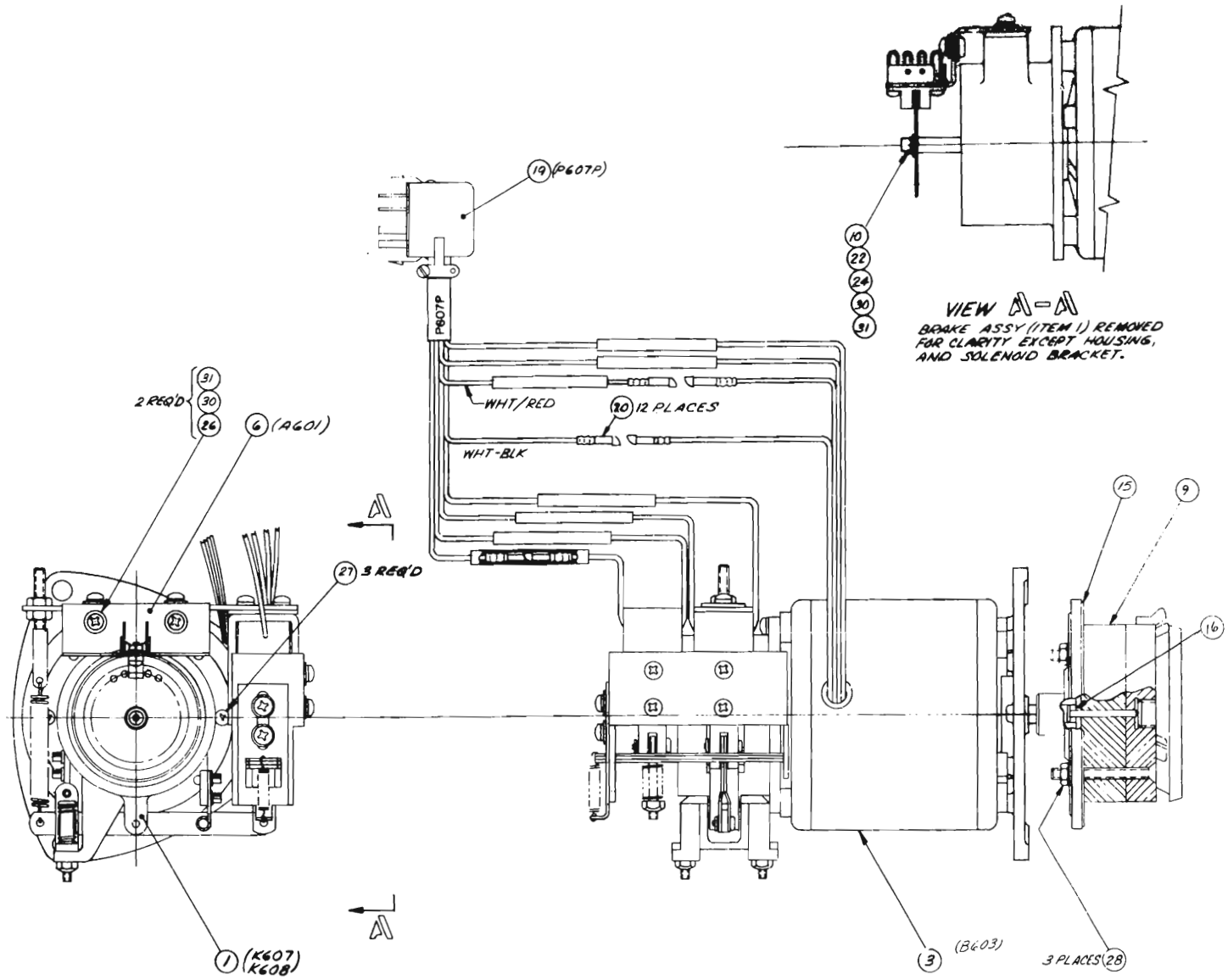


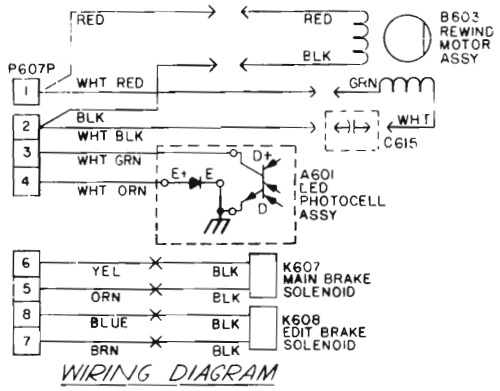
Takeup and Rewind Brake Assembly
Assy No. 4030264

ASSEMBLY NO. 4030264G TITLE: TAKEUP AND REWIND BRAKE ASSY. SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4030300, 4030334

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	
8	4260386-04		BRACKET, EDIT SOLENOID	
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 DIA X 9/32 LG	
24	400-007		PIN, STRAIGHT HEADED, 1/8 DIA X 15/32 LG	
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, PAN HD PHILL, NO. 8-32 X 5/16	
30	472-890		SCREW, MACH, FLAT HD PHILL, NO. 6-32 X 1-3/8	
31	475-072		SCREW, SEMS, PAN HD PHILL, INT TOOTH, NO. 8-32 X 1/4	
32	475-085		SCREW, SEMS, PAN HD PHILL, INT TOOTH, NO. 6-32 X 5/16	
33	475-102		SCREW, SEMS, PAN 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, NO. 6-32	
37	493-007		NUT, SELF-LOCKING, HEX, NO. 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	





WIRING DIAGRAM

Rewind Assembly
Assy No. 4030334

ASSEMBLY NO. 4030334A TITLE: REWIND ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020280

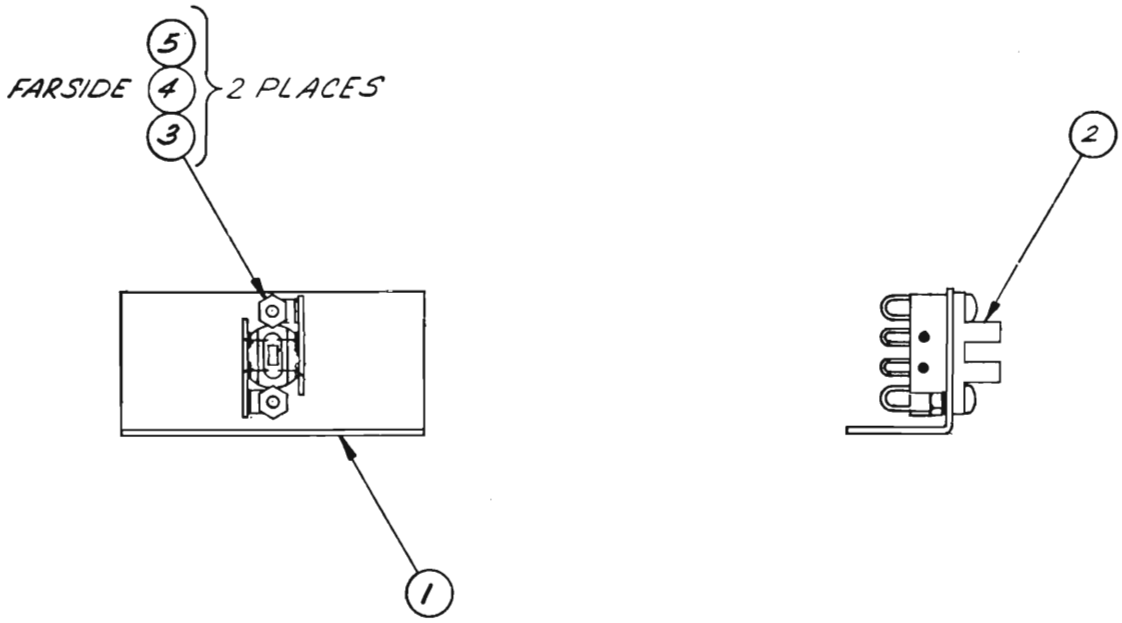
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4030264-04	K607,K608	BRAKE ASSY	
3	4041166-06	B603	MOTOR ASSY REWIND	
6	4050587-01	A601	MOTION SENSOR ASSY	
9	4100190-01		KNOB ASSY	
10	4250081-01		DISC, MOTION SENSOR	
15	18119-01		PAD, TURNTABLE	
16	23041-02		PILOT, HOLDDOWN KNOB	
19	139-295	P607P	CONNECTOR, RECT PLUG, 8 PIN	
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, NO. 6-32 X 1.00	
26	471-069		SCREW, MACH, PAN HD, XREC, NO. 6-32 X 0.38	
27	473-331		SCREW, MACH ASSY WASHER, PAN HD, XREC, NO. 6-32 X 0.50	
28	496-007		NUT, KEP, NO. 10-32	
30	501-009		WASHER, PLAIN, 0.156 I.D.	
31	502-003		WASHER, LOCK, SPRING, 0.141 I.D.	

VERSION: 4030334-02

ASSEMBLY NO. 4050587A TITLE: MOTION SENSOR ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4030334

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		TERMINAL STRIP	
4	471-062		SCREW, MACH, PAN HD, NO. 4-40 X 0.38	
5	496-004		NUT, LOCKING, HEX, NO. 4	
			VERSION: 4050587-01	

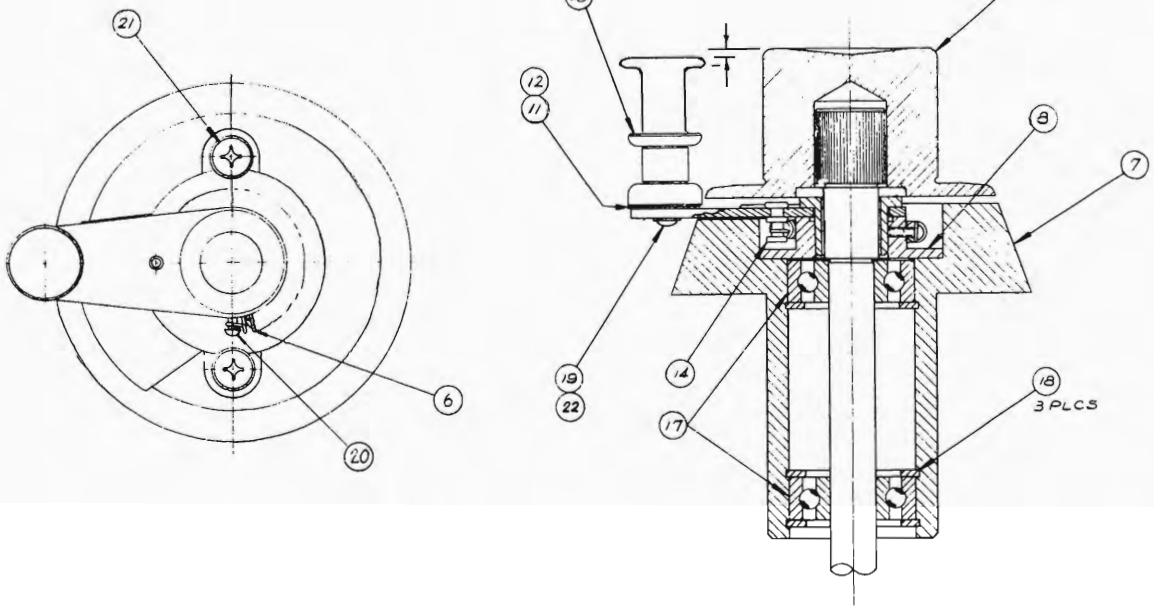


Motion Sensor Assembly
Assy No. 4050587

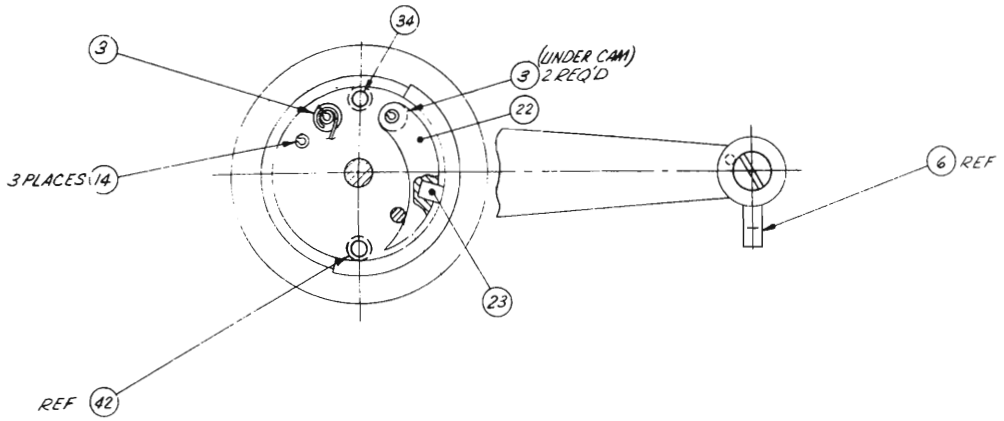
ASSEMBLY NO. 4040970K TITLE: REEL IDLER ASSY SHEET 1 OF 1

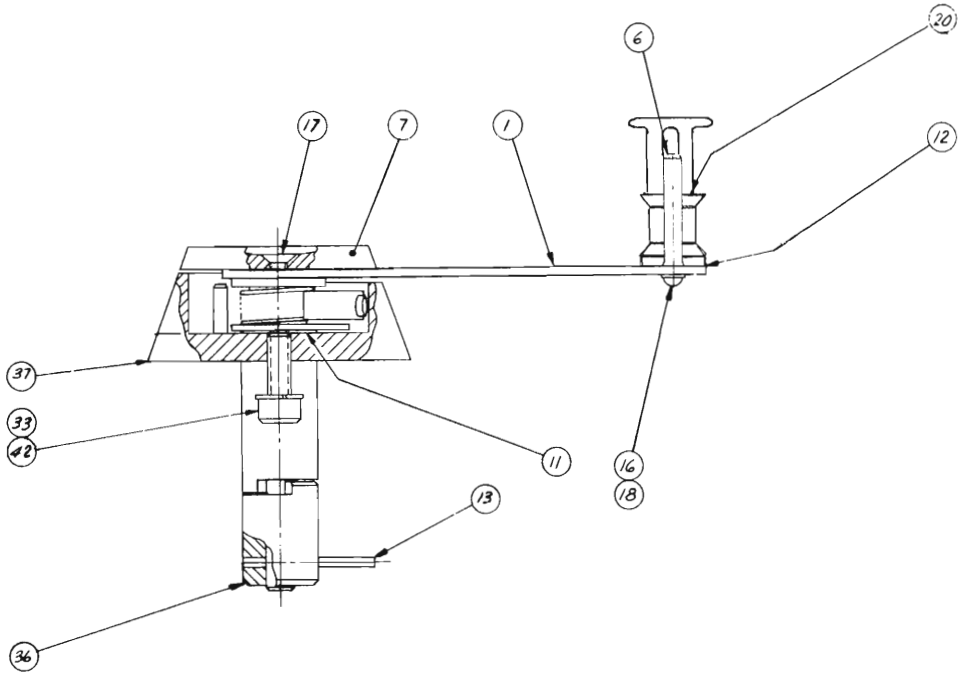
NEXT HIGHER ASSEMBLY NO. 4020280

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
6	4270160-20		SPRING, TENSION ARM	
7	4290272-10		HOUSING, REEL IDLER	
8	4290273-10		MOUNT, REEL IDLER	
10	4210187-10		GUIDE, 1" TAPE	
11	4440282-01		WASHER, 0.003 THK	
12	4440282-02		WASHER, 0.025 THK	
13	4040408-20		PULLEY ASSY	
14	173-251		TERMINAL, TURRET	
17	421-116		BEARING, BALL, 0.3150 BORE X 0.8661 O.D.	
18	430-027		RING, RETAINING, INTERNAL, 0.866	
19	472-573		SCREW, MACH, HEX SOC BUTTON HD, NO. 4-40 X 1/4	
20	474-004		SCREW, DRIVE "U" ROUND HD, NO. 0 X 3/16	
21	475-081		SCREW, PAN HD, PHILL, NO. 6-32 X 1/4	
22	502-013		WASHER, LOCK, FLAT, EXT TOOTH, NO. 4	
			VERSION: 4040970-04	



Reel Idler Assembly
Assy No. 4040970



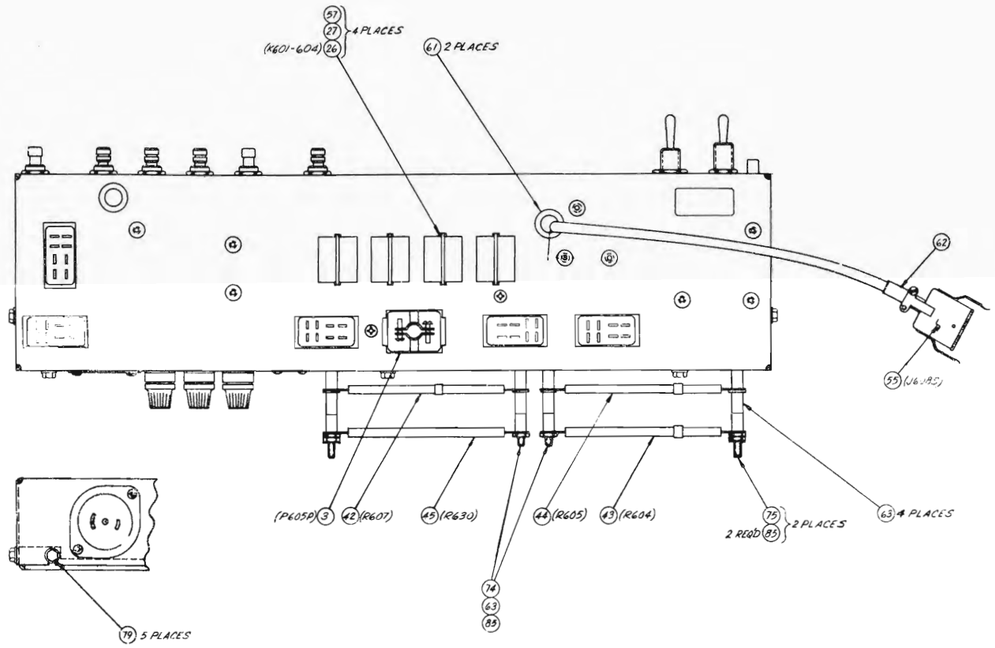


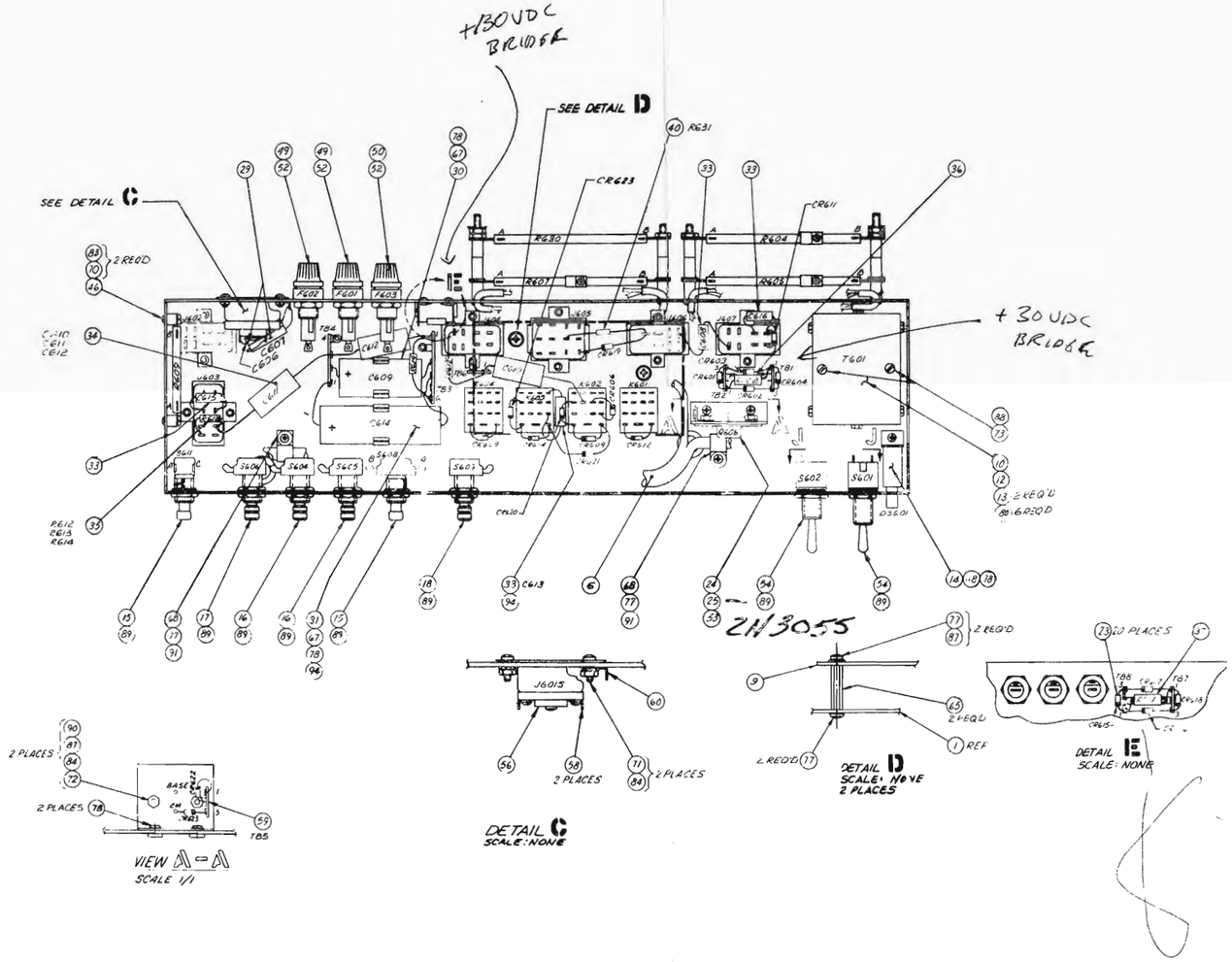
Takeup Tension Arm Assembly
Assy No. 4040974

ASSEMBLY NO. 4040974M TITLE: TAKEUP TENSION ARM ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020280

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4040973-04		ARM ASSY	
3	4220097-01		SPACER, TENSION ARM	
6	4230158-20		HOOK	
7	4250193-01		CAP	
11	4440235-10		SHIM	
12	4440282-01		WASHER	
13	408-071		PIN, SPRING, 0.012 WALL X 0.062 DIA X 7/8 LG	
14	406-026		PIN, SPRING, 0.094 DIA X 0.500 LG	
16	471-813		SCREW, CAP, BUTTON HD, HEX SOC, NO. 4-40 X 5/16	
17	471-598		SCREW, CAP, FLAT HD, HEX SOC, NO. 4-40 X 1/4	
18	502-013		WASHER, LOCK, FLAT, EXT TOOTH, NO. 4	
20	4210184-10		GUIDE, 1" TAPE	
22	4230138-01		CAM	
23	4210161-03		PIN, DAMPER	
33	502-004		WASHER, LOCK, HELICAL SPRING, NO. 8	
34	477-046		SCREW, SET, HEX SOC, CUP PT, NO. 8-32 X 5/8	
36	4220120-01		COLLAR	
37	4330104-40		BASE	
42	470-019		SCREW, CAP, HEX SOC, NO. 8-32 X 0.438	
			VERSION: 4040974-16	





Control Box Assembly
Assy No. 4020357

ASSEMBLY NO. 4020357C TITLE: CONTROL BOX ASSY SHEET 1 OF 2

NEXT HIGHER ASSEMBLY NO. 4020280

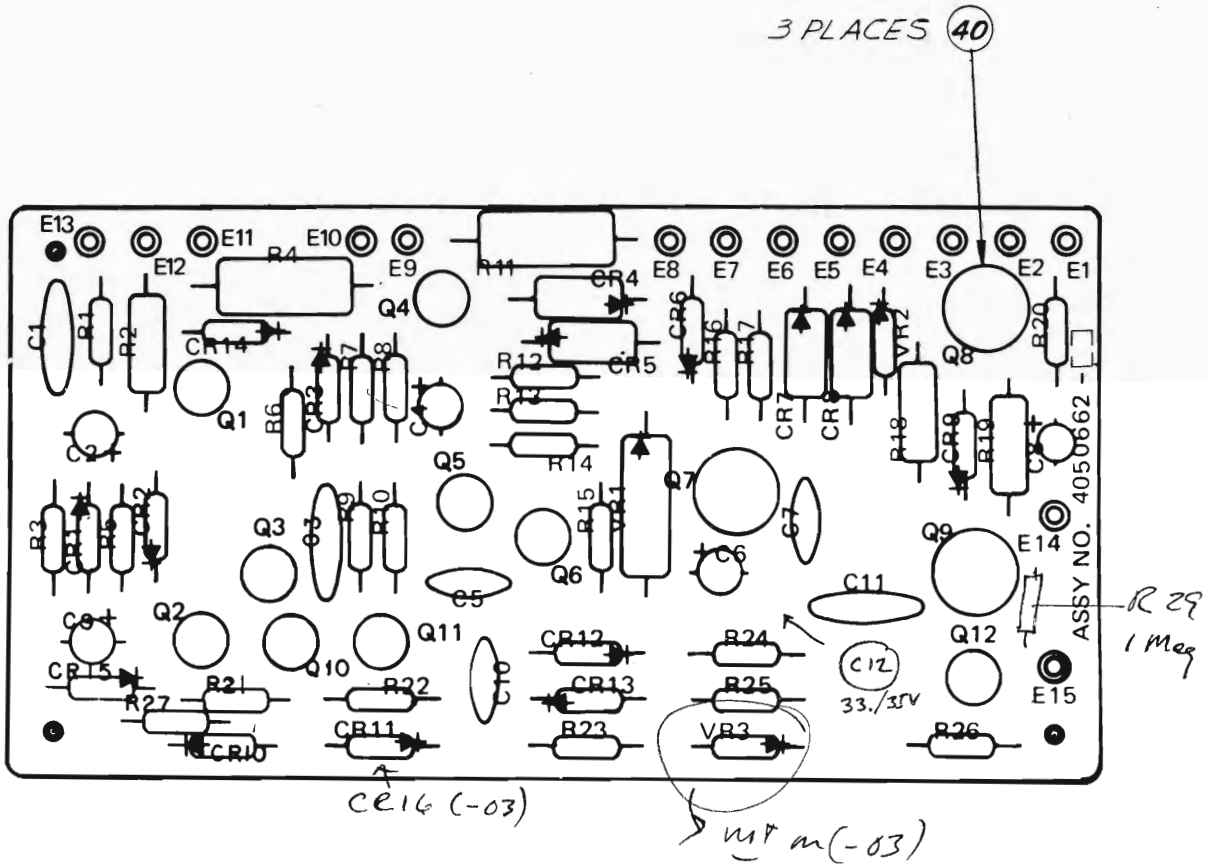
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4040971-08		CONTROL BOX CHASSIS	
3	4050444-01	P605P	PLUG, DUMMY, REMOTE CONTROL	
6	4050642-02		HARNESS ASSY, CONTROL BOX	
9	4050662-01		TRANSPORT CONTROL PWA	
10	4580198-01	T601	TRANSFORMER, POWER	
12	4600149-01		SHIELD, POWER TRANSFORMER	
13	4600150-01		SHIELD, POWER TRANSFORMER	
14	4610083-01		LAMPHOLDER, PILOT LIGHT	
15	4620064-01	S608,611	SWITCH, PUSHBUTTON	
16	4620144-10	S604,605	SWITCH, PUSHBUTTON "N O"	
17	4620144-20	S606	SWITCH, PUSHBUTTON "N C"	
18	4620144-30	S609	SWITCH, PUSHBUTTON "N O"	
23	013-678	CR601-604,606, 608,609,611,612, 614-624	DIODE	1N4385
24	014-630	Q606	TRANSISTOR	2N3055
25	014-703		WASHER, MICA, TRANSISTOR MOUNTING	
26	020-144	K601,602,603, 604	RELAY, 4PDT	
27	020-492		SPRING, RELAY HOLD DOWN	
29	030-465	C606,607	CAPACITOR, 0.005 MFD, 1400V	
30	031-134	C609	CAPACITOR, ELECT, 500 MFD, 50V	
31	031-624	C614	CAPACITOR, ELECT, 150 MFD, 180V	
33	035-985	C608,613,615, 616	CAPACITOR, 0.047 MFD, 400V, 20%	
34	035-999	C610,611,612	CAPACITOR, 0.1 MFD, 400V, 20%	
35	041-038	R612,613,614	RESISTOR, 100 OHMS, 1/2W, 10%	
36	041-147	R602	RESISTOR, COMP, 1.2K, 1W, 10%	
37	041-166	R611	RESISTOR, COMP, 47K, 1W, 10%	
40	049-569	R631	RESISTOR, 2.2 MEGOHMS, 1/4W, 10%	
42	059-013	R607	RESISTOR, ADJ, 750 OHMS, 55W	
43	059-014	R604	RESISTOR, ADJ, 150 OHMS, 55W, 10%	
44	059-166	R605	RESISTOR, ADJ, 35 OHMS, 55W, 10%	
45	059-188	R630	RESISTOR, 10 OHMS, 55W, 10%	
46	059-236	R609	RESISTOR, W.W., 40 OHMS, 20W	
48	060-323	DS601	LAMP, 120V, 0.025 AMP	
49	070-020	F601,602	FUSE, SLO-BLO, 5 AMP	
50	070-026	F603	FUSE, SLO-BLO, 1/2 AMP, 125V	
52	085-001		FUSEHOLDER, SHORT BODY	
54	119-249	S601,602	SWITCH, POWER	
55	144-013	J608S	CONNECTOR, RECT PLUG, 6 SOC	
56	145-501	J601S	CONNECTOR, POWER, 3 CONTACT, MALE	
57	150-992		SOCKET, RELAY	
58	172-010		TERMINAL, SOLDER LUG, PLAIN, NO. 6	
59	180-021	TB-5	STRIP, TERMINAL	
60	172-003		TERMINAL, SOLDER LUG, NO. 6	
61	260-017		GROMMET, 3/8 I.D. X 5/8 O.D. X 1/4 THK	

ASSEMBLY NO. 4020357C TITLE: CONTROL BOX ASSY SHEET 2 OF 2

NEXT HIGHER ASSEMBLY NO. 4020280

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
62	262-003		BUSHING, SLEEVE, FLANGED, 0.312 I.D.	
63	280-026		SPACER, PLAIN	
65	280-110		SPACER, HEX, 1-1/8", 6-32	
67	301-011		CLAMP, CAPACITOR	
68	302-006		CLAMP, CABLE, PLASTIC, 7/16 I.D.	
70	471-064		SCREW, MACH, PAN HD, XREC, NO. 4-40 X 1/2 LG	
71	471-069		SCREW, PAN HD, XREC, NO. 6-32 X 3/8 LG	
72	471-071		SCREW, PAN HD, XREC, NO. 6-32 X 1/2 LG	
73	471-521		SCREW, ROUND HD, NO. 6-32 X 2 LG	
74	472-408		SCREW, PAN HD, XREC, NO. 8-32 X 1-3/4 LG	
75	472-409		SCREW, PAN HD, XREC, NO. 8-32 X 2 LG	
77	475-058		SCREW, PAN HD, XREC SEMS, NO. 6-32 X 3/8 LG	
78	475-064		SCREW, PAN HD, X REC SEMS, NO. 6-32 X 1/4 LG	
79	476-200		SCREW, HEX HD, SELF TAPPING, NO. 6 X 3/16 LG	
80	476-998		SCREW, HEX HD, SELF TAPPING, NO. 6-32 X 1/4 LG	
83	496-004		NUT, KEP, NO. 4-40	
84	496-005		NUT, KEP, NO. 6-32	
85	496-006		NUT, KEP, NO. 8-32	
87	501-009		WASHER, FLAT, NO. 6	
88	502-025		LOCKWASHER, FLAT, INT TOOTH, NO. 6	
89	502-347		LOCKWASHER, INT TOOTH	
90	503-089		WASHER, SHOULDER, NYLON	
91	506-013		WASHER, "D" CABLE CLAMP, NO. 6	

VERSION: 4020357-02



not The one in Aspen 9 (-03)
(7½-15 ips machine)

Transport Control PWA
Assy No. 4050662
-01?

ASSEMBLY NO. 4050662A TITLE: TRANSPORT CONTROL PWA SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020357

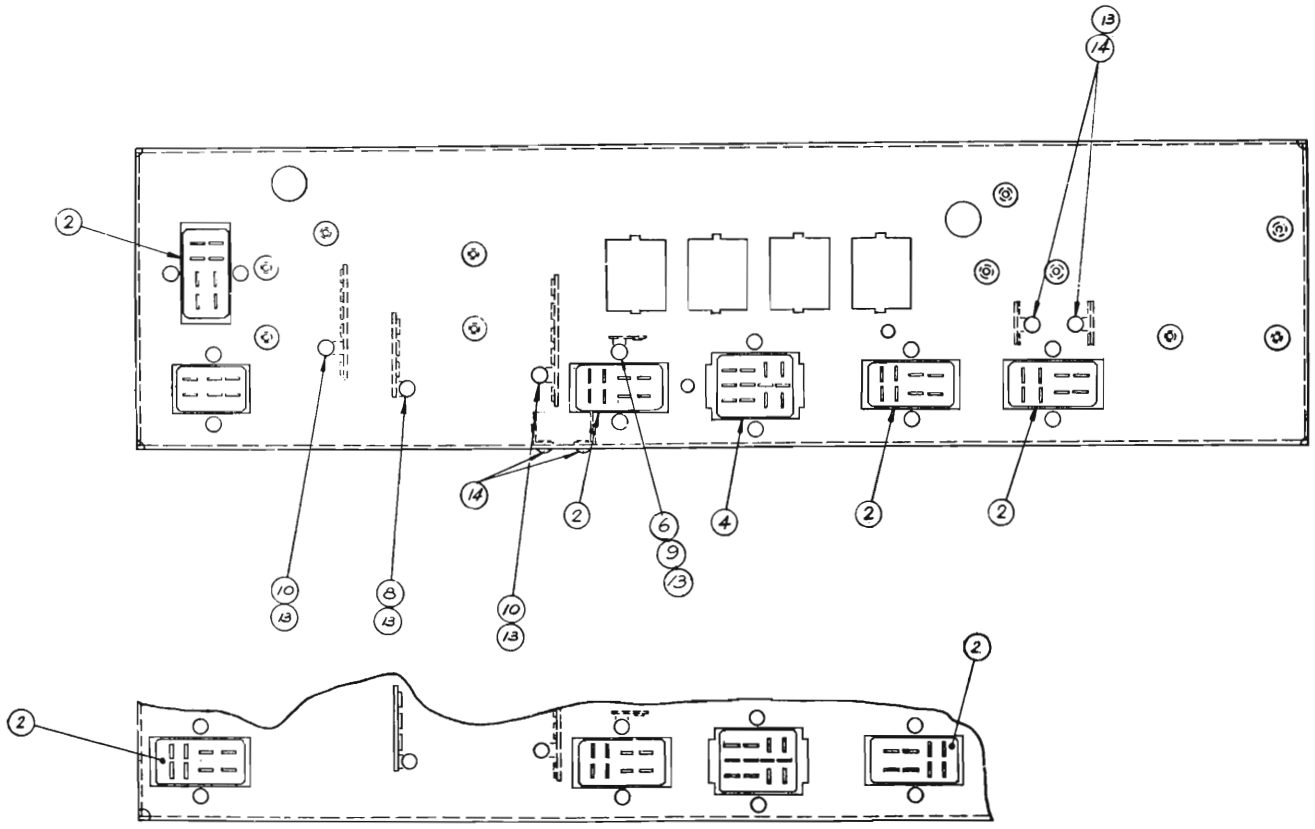
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
2	4840271		SCHEMATIC, TRANSPORT	
4	013-599	CR1,2,3,6,9,10, 11-14,15	DIODE	1N914
5	013-663	VR2,3	DIODE	1N967B
6	013-678	CR4,5,7,8	DIODE	1N4385
7	013-789	VR1	DIODE 22V zener	1N3028B
9	014-247	Q7	TRANSISTOR	2N2219
10	014-364	Q8	TRANSISTOR	2N2905A
11	014-653	Q5,11	TRANSISTOR	2N3904
12	014-678	Q9	TRANSISTOR	2N3945
13	014-698	Q2,3,6	TRANSISTOR	2N3565
14	014-781	Q4,10,12	TRANSISTOR	MPS6518
15	014-882	Q1	TRANSISTOR	MPS3638A-5
17	030-057	C5,7,10	CAPACITOR, CER, 0.01 UF, 100V, 20%	
18	030-144	C1,3,11	CAPACITOR, CER, 0.05 UF, 100V, 20%	
20	037-895	C2,6,9	CAPACITOR, TANT, 3.3 UF, 35V	
21	037-931	C4	CAPACITOR, TANT, 6.8 UF, 35V	
22	037-968	C8	CAPACITOR, TANT, 6.8 UF, 6V	
24	041-051	R2	RESISTOR, COMP, 1.8K, 1/2W, 10%	
25	041-054	R19	RESISTOR, COMP, 3.3K, 1/2W, 10%	
26	041-056	R18	RESISTOR, COMP, 4.7K, 1/2W, 10%	
27	041-146	R4	RESISTOR, COMP, 1K, 1W, 10%	
28	041-147	R11	RESISTOR, COMP, 1.2K, 1W, 10%	
29	041-626	R1,13,14	RESISTOR, COMP, 100K, 1/4W, 10%	
30	041-630	R20	RESISTOR, COMP, 22K, 1/4W, 10%	
31	041-631	R22,27	RESISTOR, COMP, 15K, 1/4W, 10%	
32	041-632	R16	RESISTOR, COMP, 12K, 1/4W, 10%	
33	041-633	R5,9,10,15,17, 25,26	RESISTOR, COMP, 10K, 1/4W, 10%	
34	041-635	R23	RESISTOR, COMP, 6.8K, 1/4W, 10%	
35	041-968	R3,8	RESISTOR, COMP, 1 MEGOHM, 1/4W, 10%	
36	049-372	R6,7,21,24	RESISTOR, COMP, 47K, 1/4W, 10%	
37	049-517	R12	RESISTOR, COMP, 220 OHMS, 1/4W, 10%	
40	280-998		PAD, MOUNTING	

VERSION: 4050662-01

ASSEMBLY NO. 4040971K TITLE: CONTROL BOX CHASSIS ASSEMBLY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020357

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
2	146-003		CONNECTOR, RECT RECP, 8 SOC	
4	146-009		CONNECTOR, RECT RECP, 12 SOC	
6	180-026		TERMINAL STRIP, SOLDER LUG	
8	180-079		TERMINAL STRIP, SOLDER LUG	
10	180-279		TERMINAL STRIP, SOLDER LUG	
12	490-011		NUT, ANCHOR, WELD TYPE, NO. 6-32	
13	502-014		WASHER, LOCK, EXT TOOTH, NO. 6	
14	180-997		TERMINAL STRIP, PLAIN, SOLDER LUG	
			VERSION: 4040971-08	

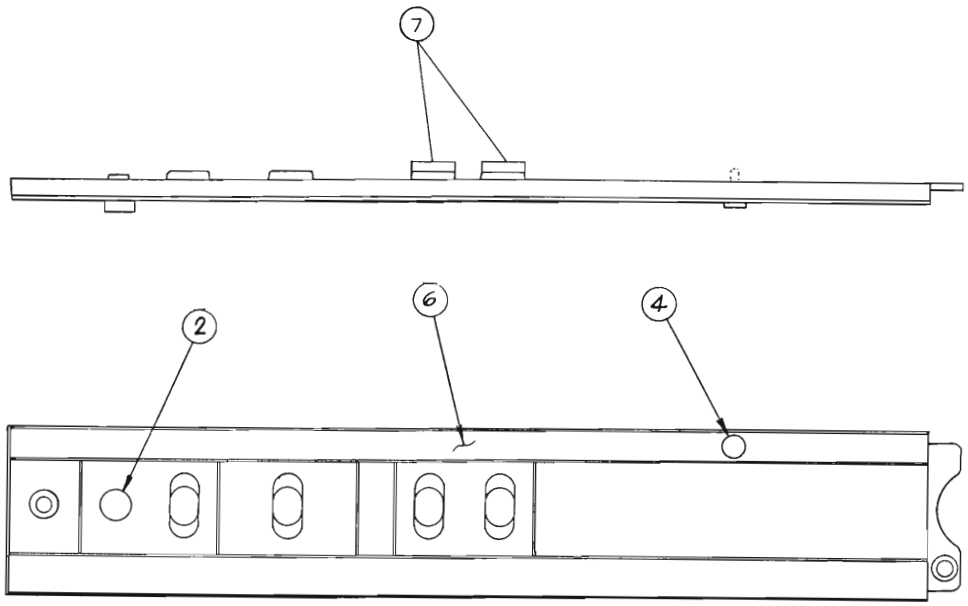


Control Box Chassis Assembly
Assy No. 4040971

ASSEMBLY NO. 4040991C TITLE: ESCUTCHEON ASSEMBLY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020280

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
2	4110258-01		JEWEL, AMBER	
4	250-007		BUMPER, RUBBER	
6	4110265-04		ESCUTCHEON	
7	4130103-02		PAD, TOGGLE SWITCH	
			VERSION: 4040991-04	



Escutcheon Assembly
Assy. No. 4040991

ASSEMBLY NO. 4020353D TITLE: CAPSTAN SERVO CHASSIS ASSY SHEET 1 OF 2

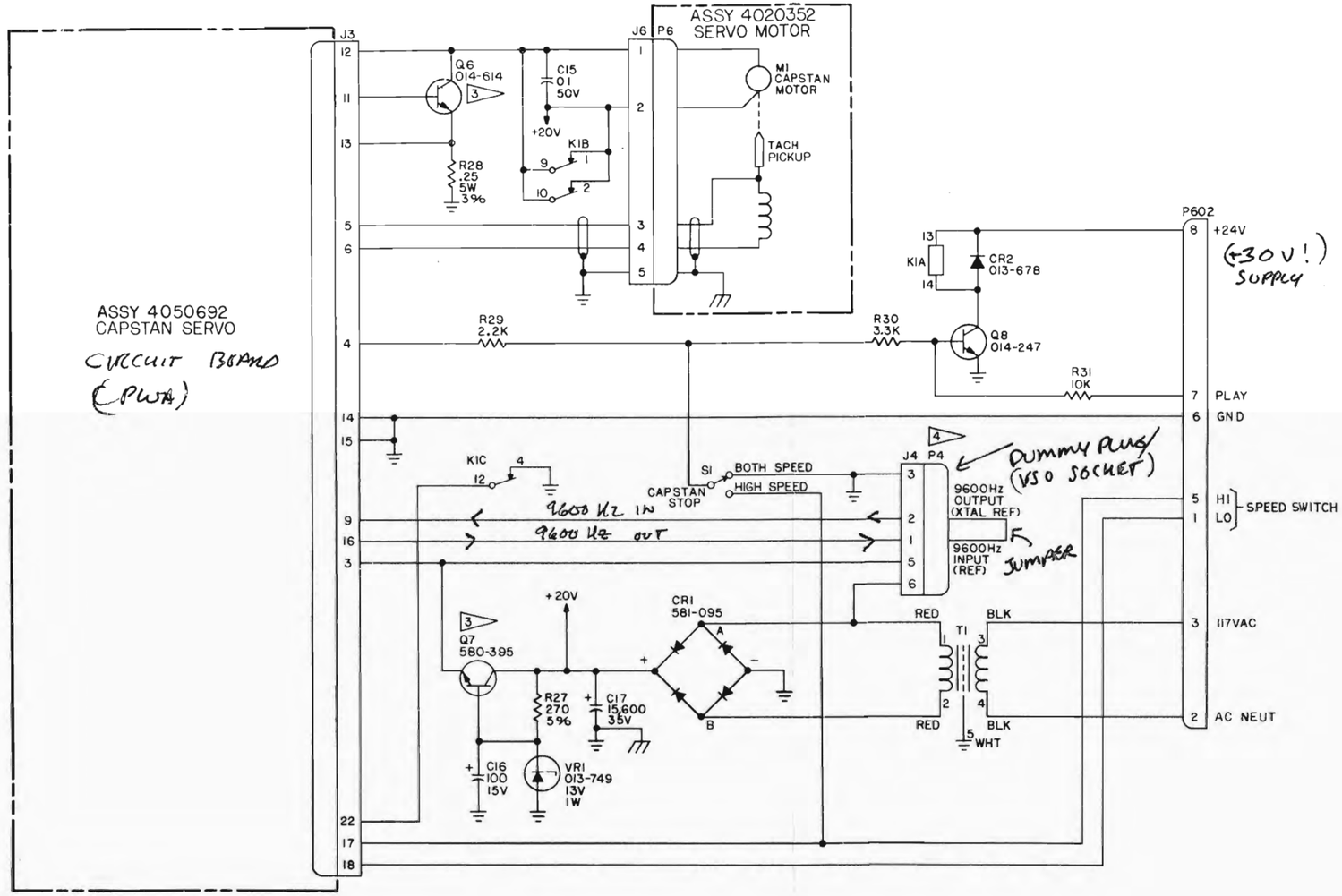
NEXT HIGHER ASSEMBLY NO. 4010205

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
2	4050615-01		CAPSTAN SERVO HARNESS ASSY	
3	4050692-04		CAPSTAN SERVO PWA	
4	4050710-01	P4	PLUG ASSY, DUMMY	
5	4050644-01		SERVO POWER CABLE ASSY	
6	4230133-02		GUIDE, PWB	
11	1228243-01	T1	TRANSFORMER, POWER	
16	013-678	CR2	DIODE	1N4385
17	014-749	VR1	DIODE	1N3023B
18	014-247	Q8	TRANSISTOR	2N2219
19	014-614	Q6	TRANSISTOR, WITH HARDWARE	2N3715
21	020-144	K1	RELAY	
22	020-492		SPRING, RELAY HOLDDOWN	
24	030-145	C15	CAPACITOR, CER, 0.1, 50V	
26	041-503	R27	RESISTOR, 270 OHMS, 1/4W, 5%	
27	041-633	R31	RESISTOR, 10K OHMS, 1/4W, 10%	
28	041-638	R30	RESISTOR, 3.3K OHMS, 1/4W, 10%	
29	041-639	R29	RESISTOR, 2.2K OHMS, 1/4W, 10%	
30	043-968	R28	RESISTOR, W.W., 0.25 OHMS, 5W, 3%	
32	063-024	C16	CAPACITOR, ELECT, 100 MFD, 15V	
33	063-149	C17	CAPACITOR, ELECT, 15,600, 50V	
39	119-196	S1	SWITCH, SLIDE, 2PDT	
40	143-804	J3	CONNECTOR, PWB, 28 CONTACT	
41	146-003	J4	CONNECTOR, FEMALE, 8 PIN	
42	146-004	J6	CONNECTOR, FEMALE, 6 PIN	
43	150-142		KIT, MTG, TRANSISTOR	
44	150-992		SOCKET, RELAY	
45	169-318		KEY, PC CONNECTOR	
47	171-007		LUG, SOLDER, BLUE	
51	260-017		GROMMET, 3/8 I.D.	
53	302-265		STRAP, CABLE	
55	471-062		SCREW, PAN HD, XREC, NO. 4-40 X 3/8 LG	
56	471-063		SCREW, PAN HD, XREC, NO. 4-40 X 7/16 LG	
57	471-067		SCREW, PAN HD, XREC, NO. 6-32 X 1/4	
59	471-070		SCREW, NO. 6-32 X 7/16 LG	
61	471-091		SCREW, PAN HD, XREC, NO. 10-32 X 3/4 LG	
62	471-448		SCREW, PAN HD, XREC, NO. 6-32 X 1-1/4 LG	
63	473-326		SCREW, NO. 4-40 X 3/8 LG	
64	473-330		SCREW, 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	

ASSEMBLY NO. 4020353D TITLE: CAPSTAN SERVO CHASSIS ASSY SHEET 2 OF 2

NEXT HIGHER ASSEMBLY NO. 4010205

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
73	580-395	Q7	TRANSISTOR, WITH HARDWARE	2N5190
74	581-095	CR1	DIODE BRIDGE ASSY	SCBA2
80	4840250		SCHEMATIC, CAPSTAN SERVO CHASSIS	
			VERSION: 4020353-02	

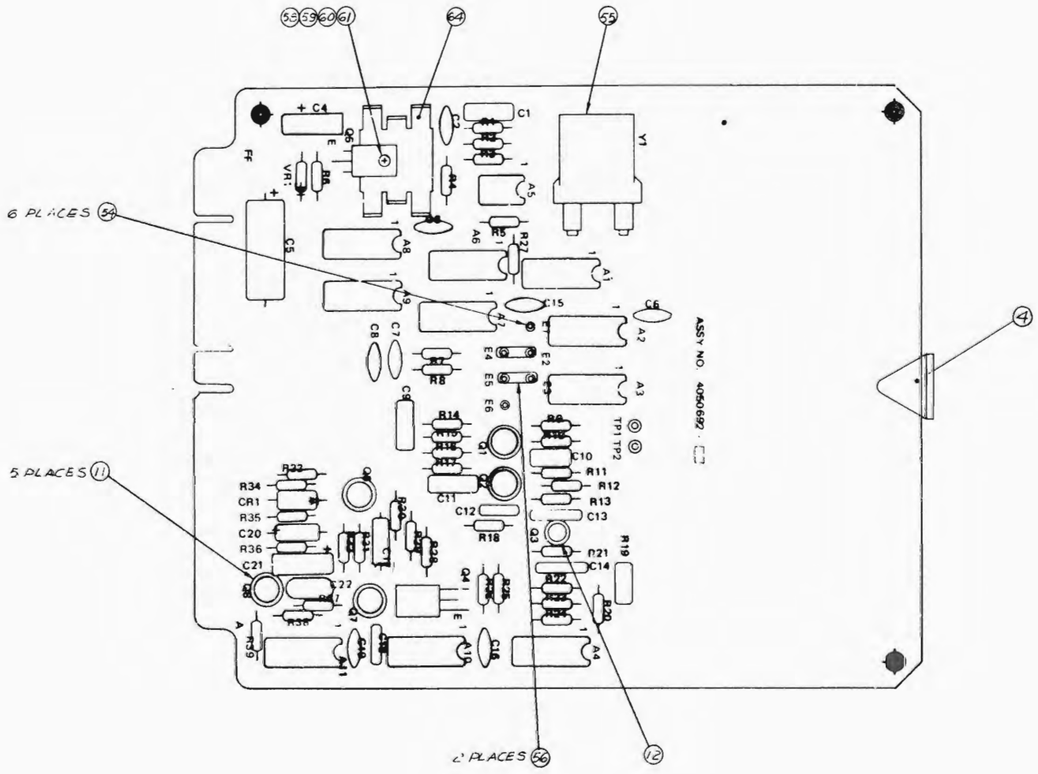


NOTES: UNLESS OTHERWISE SPECIFIED.

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	IN4743
014 247	2N2219A

Schematic No. 4840250
Capstan Servo Chassis



ASSEMBLY NO. 4050692F TITLE: CAPSTAN SERVO PWA SHEET 1 OF 2

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	IN4385
7	013-983	VR1	DIODE	IN752A
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	
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, 300V, 5%	
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, 0.083 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, 3.3K, 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 OHMS, 1/4W, 5%	
41	041-503	R6	RESISTOR, COMP, 270 OHMS, 1/4W, 5%	
42	041-504	R25	RESISTOR, COMP, 510 OHM, 1/4W, 5%	
44	041-530	R29	RESISTOR, COMP, 15 OHMS, 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 OHMS, 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%	
52	041-427	R38	RESISTOR, 330 OHMS, 1/4W, 5%	
53	058-754	R19	RESISTOR, VAR, CER MET, 100 OHMS, 1W, 20%	
54	143-981	E1-6	CONNECTOR, JACK	
55	150-106		BRACKET, MOUNTING, CRYSTAL	
56	166-628		PLUG, SHORTING BLOCK, BLK	
58	471-062		SCREW, XREC, PAN HD, 4-40 x 0.375	

Capstan Servo PWA
Assy No. 4050692

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
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	SN7493N
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: 4050692-04

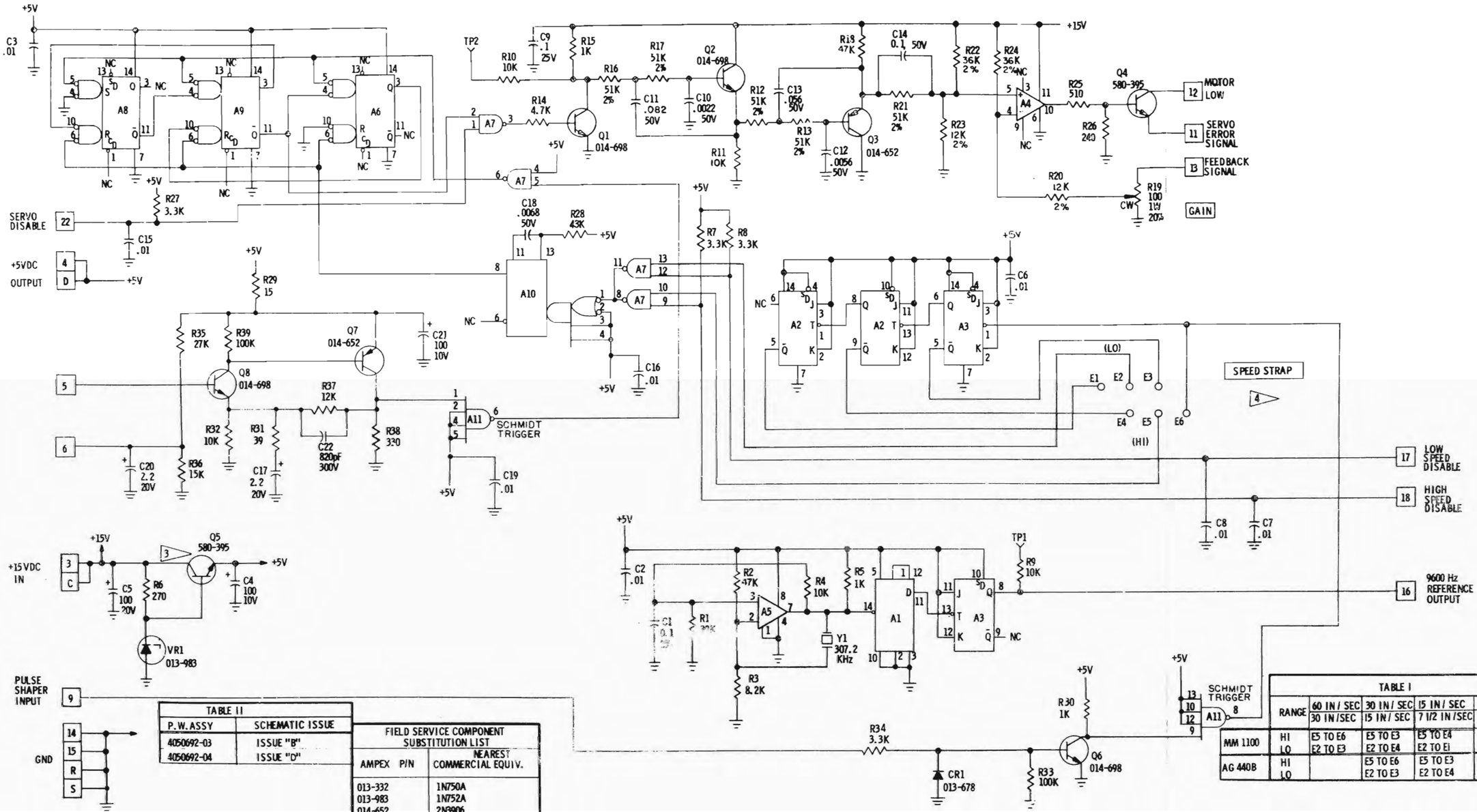


TABLE II	
P.W. ASSY	SCHEMATIC ISSUE
4050692-03	ISSUE "B"
4050692-04	ISSUE "D"

FIELD SERVICE COMPONENT SUBSTITUTION LIST	
AMPEX P/N	NEAREST COMMERCIAL EQUIV.
013-332	1N750A
013-983	1N752A
014-652	2N3906
580-395	2N5190
014-698	NONE
013-678	1N4385

TABLE I					
RANGE	60 IN/SEC 30 IN/SEC	30 IN/SEC 15 IN/SEC	15 IN/SEC 7 1/2 IN/SEC	7 1/2 IN/SEC 3 3/4 IN/SEC	
MM 1100	HI	E5 TO E6	E5 TO E3	E5 TO E4	
	LO	E2 TO E3	E2 TO E4	E2 TO E1	
AG 440B	HI		E5 TO E6	E5 TO E3	E5 TO E4
	LO		E2 TO E3	E2 TO E4	E2 TO E1

NOTES: UNLESS OTHERWISE SPECIFIED

1. CAPACITANCE VALUES ARE IN MICROFARADS, 100V.
2. RESISTANCE VALUES ARE IN OHMS 1/4W, 5%.
3. HEATSINK REQUIRED.
4. SEE TABLE 1 FOR SPEED STRAPPING.

REFERENCE DESIGNATION	
LAST USED	NOT USED
A11 Q8 C22 Y1 R39 CR1 TP2 E6 VR1	

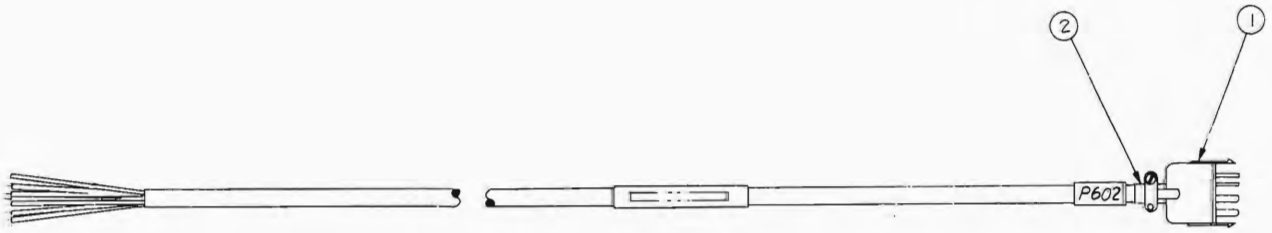
I.C. LIST								
REFERENCE DESIGNATION	A11	A6,8,9	A7	A4	A1	A2,3	A5	A10
AMPEX P/N	586-680	586-698	586-153	586-268	586-283	586-425	587-086	586-309
VENDOR P/N	SN7413J	UGA9950	MC 846P	UA 741C	SN7493N	MC 853P	LM-311N	UGA9601
VOLTAGE PIN	14	14	14	11	5	14	8	14
GROUND PIN	7	7	7	6	10	7	4,1	7

Schematic No. 4840356
Capstan Servo PWA

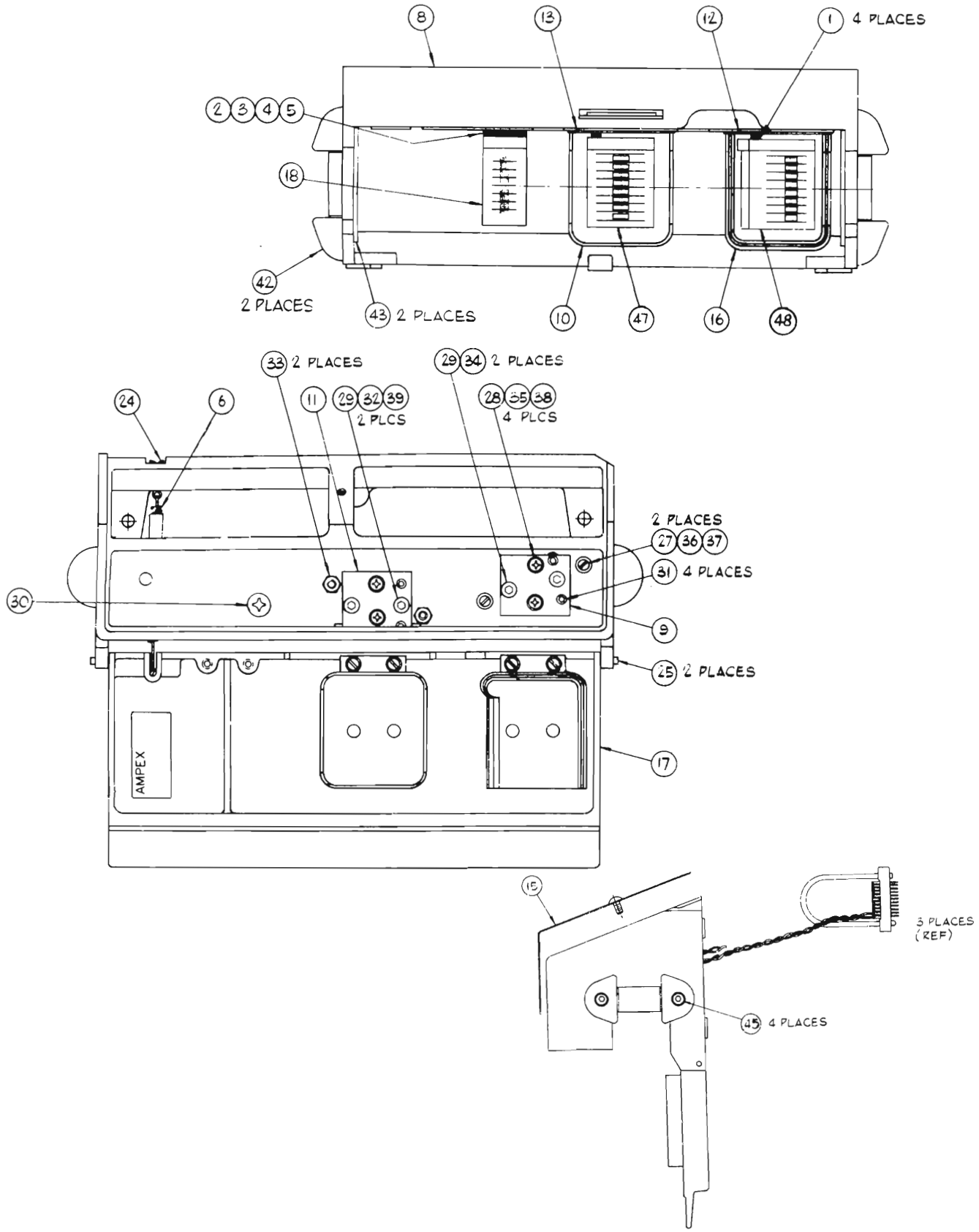
ASSEMBLY NO. 4050644 – TITLE: SERVO POWER CABLE ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020353

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	145-013	P602	CONNECTOR, RECT PLUG, 8 PIN	
2	262-004		BUSHING, SLEEVE, 0.437 ID	
			VERSION: 4050644-01	



Servo Power Cable Assembly
Assy No. 4050644



1" Tape Head Assembly
Assy No. 4020300

ASSEMBLY NO. 4020300G TITLE: 1 INCH TAPE HEAD ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4010205

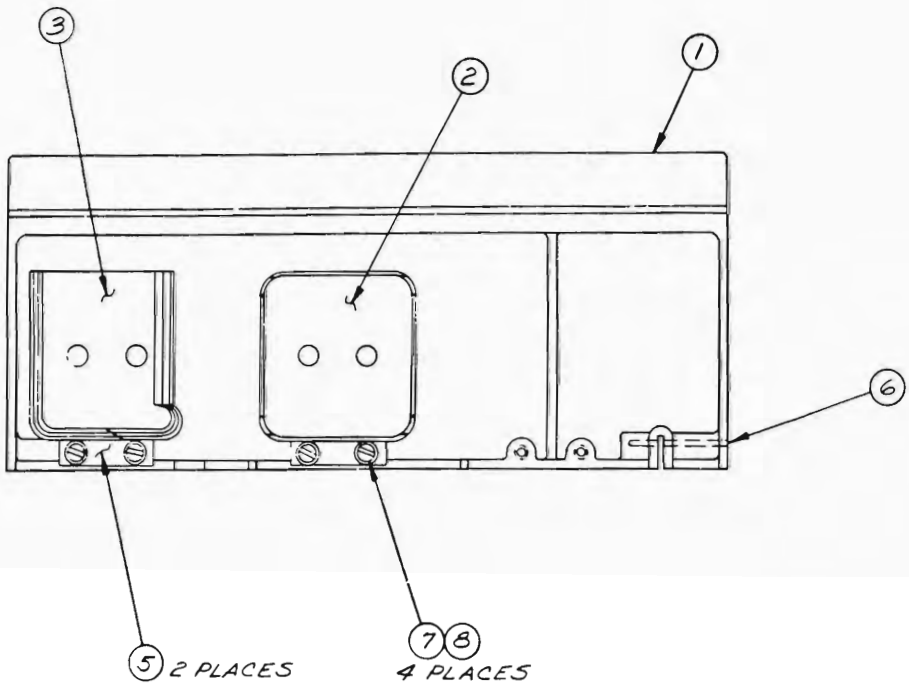
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4270167-10		SPRING, HEAD ADJUST	
2	4350025-01		SHIM, ERASE HEAD, 0.010 THK	
3	4350025-02		SHIM, ERASE HEAD, 0.002 THK	
4	4350025-03		SHIM, ERASE HEAD, 0.003 THK	
5	4350025-04		SHIM, ERASE HEAD, 0.005 THK	
6	4350035-01		SPRING, EXTENSION HEAD, GATE	
8	4350043-02		BASE, HEAD MOUNTING	
9	4350044-01		PLATE, PLAYBACK, POS NO. 4	
10	4350045-01		SHIELD, CAN, REC, POS NO. 3	
11	4350046-01		PLATE, RECORD, POS NO. 3	
12	4350047-01		SHIELD, POS NO. 4	
13	4350048-01		SHIELD, POS NO. 3	
15	4350038-03		OVERLAY, HEAD HOUSING	
16	4350051-01		SHIELD, CAN ASSY, PLAYBACK, POS NO. 4	
17	4350058-01		HEAD GATE ASSY	
18	1232483-01		ERASE HEAD ASSY, 8 TRACK	
24	401-008		PIN, COTTER, 0.063 DIA X 0.750 LG	
25	403-006		PIN, GROOVED, HEADLESS, 0.094 DIA X 0.625 LG	
27	471-006		SCREW, PAN HD, SLOTTED, NO. 2-56 X 7/16 LG	
28	471-010		SCREW, PAN HD, XREC, NO. 4-40 X 1/4 LG	
29	470-014		SCREW, CAP, HEX SOC, NO. 4-40 X 3/4 LG	
30	473-099		SCREW, PAN HD, XREC, NO. 10-32 X 3/8 LG	
31	477-404		SCREW, SET, OVAL PT, HEX SOC, NO. 4-40 X 1/2 LG	
32	492-008		NUT, HEX, NO. 4-40	
33	492-034		NUT, SMALL PATTERN, NO. 6-32	
34	493-001		NUT, HEX, SELF LOCKING, NO. 4-40	
35	501-002		WASHER, FLAT	
36	501-155		WASHER, FLAT, NO. 2	
37	502-001		LOCKWASHER, SPRING, NO. 2	
38	502-002		LOCKWASHER, SPRING, NO. 4	
39	502-062		LOCKWASHER, DOUBLE COIL, NO. 4	
42	4210154-01		GUIDE, TAPE	
43	4330267-01		NUT PLATE, HEAD	
45	470-071		SCREW, CAP, HEX SOC, NO. 6-32 X 0.500 LG	
47	4350161-01		HEAD STACK ASSY, 8 TRACK, RECORD	
48	4350161-02		HEAD STACK ASSY, 8 TRACK, PLAY	

VERSION: 4020300-03

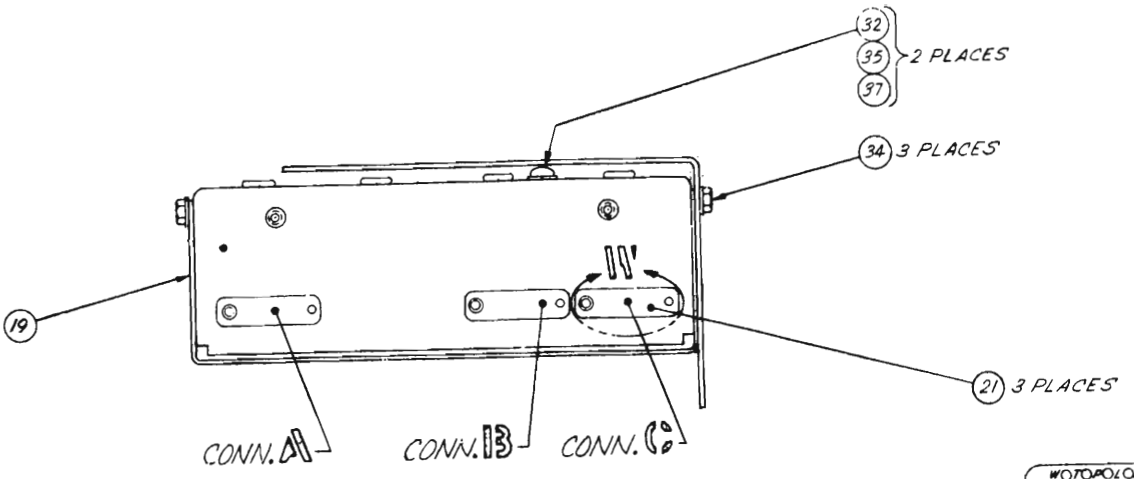
ASSEMBLY NO. 4350058 TITLE: HEAD GATE ASSY 1 INCH TAPE SHEET 1 OF 1

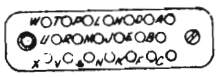
NEXT HIGHER ASSEMBLY NO. 4020300

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4350042-01		GATE, HEAD, 1 INCH	
2	4350056-01		SHIELD COVER ASSY	
3	4350057-01		SHIELD COVER ASSY	
5	4270155-10		SPRING, PLATE	
6	406-046		PIN, "ROLLPIN", 0.062 DIA X 1.00 LG	
7	471-478		SCREW, MACH, FILL HD, SLOTTED, NO. 4-40 X 3/16	
8	502-002		WASHER, SPRING LOCK, NO. 4	
			VERSION: 4350058-01	

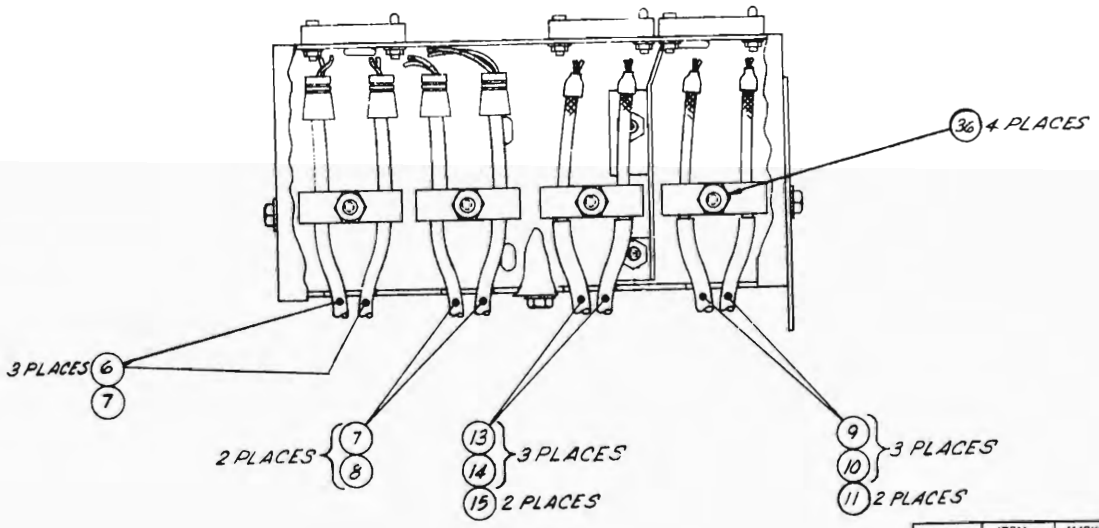


Head Gate Assembly, 1" Tape
Assy No. 4350058





DETAIL W'
SCALE: NONE



HEAD	ITEM NO.	MARKER NO.	WIRE COLOR	PIN LETTER	CONNECTOR
ERASE	6	1	WHT	A	A
			BLK	D	
	6	2	WHT	H	
			BLK	L	
	6	3	WHT	P	
			BLK	T	
	7	4	WHT	W	
			BLK	U	
	7	5	WHT	R	
			BLK	M	
	7	6	WHT	J	
			BLK	E	
	8	7	WHT	B	
			BLK	C	
	8	8	WHT	F	
			BLK	K	
RECORD	13	1	RED	A	B
			BLK	D	
	13	2	RED	H	
			BLK	L	
	13	3	RED	P	
			BLK	T	
	14	4	RED	W	
			BLK	U	
	14	5	RED	R	
			BLK	M	
	14	6	RED	J	
			BLK	E	
	15	7	RED	B	
			BLK	C	
	15	8	RED	F	
			BLK	K	
PLAYBACK	9	1	RED	A	C
			BLK	D	
	9	2	RED	H	
			BLK	L	
	9	3	RED	P	
			BLK	T	
	10	4	RED	W	
			BLK	U	
	10	5	RED	R	
			BLK	M	
	10	6	RED	J	
			BLK	E	
	11	7	RED	B	
			BLK	C	
	11	8	RED	F	
			BLK	K	

ARRANGEMENT OF CLAMPS, CABLES AND MARKING

POSITION 1	POSITION 2	POSITION 3	POSITION 4
3 4 / 1 2 — 1 4 REQ'D	7 8 / 5 6 — 1 4 REQ'D	2 — 1 4 REQ'D	2 — 1 4 REQ'D

Head Cable Mounting Box Assembly
Assy No. 4050654

ASSEMBLY NO. 4050654– TITLE: HEAD CABLE MOUNTING BOX ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4010205

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4040951-01		CLAMP ASSY, CABLE	
2	4040952-01		CLAMP ASSY, P/B CABLE	
6	4050143-60		HEAD CABLE ASSY, ER	
7	4050143-70		HEAD CABLE ASSY, ER	
8	4050143-80		HEAD CABLE ASSY, ER	
9	4050445-01		HEAD CABLE ASSY, P/B	
10	4050445-04		HEAD CABLE ASSY, P/B	
11	4050445-05		HEAD CABLE ASSY, P/B	
13	4050651-01		HEAD CABLE ASSY, REC	
14	4050651-02		HEAD CABLE ASSY, REC	
15	4050651-03		HEAD CABLE ASSY, REC	
19	4290644-01		COVER, HEAD CABLE BRACKET	
21	146-129		CONNECTOR, RECT RECP, 20 SOC	
32	471-069		SCREW, PAN HD, XREC, NO. 6-32 X 3/8	
34	476-998		SCREW, SELF TAPPING, SLOT HD, NO. 6 X 1/4	
35	496-005		NUT, KEP, 6-32	
36	493-007		NUT, SELF LOCK, NO. 8-32	
37	501-009		WASHER, FLAT, NO. 6	

VERSION: 4050654-01

ASSEMBLY NO. 4020337A TITLE: ELECTRONICS ASSY, W/O EQUALIZERS SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4010205

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4030034-30		DUMMY PLUG ASSY	
6	4050433-05		BIAS AMPLIFIER PWA	
7	4050434-03		RECORD AMPLIFIER PWA	
8	4050435-12		REPRODUCE AMPLIFIER PWA	
9	4050564-01		RECORD CONTROL PWA	
10	4050593-01		PANEL ASSY, LEFT SIDE	
11	4050601-01		PANEL ASSY, REAR	
12	4050616-01		PANEL ASSY, FRONT	
13	4050621-01		PANEL ASSY, RIGHT SIDE	
14	4050632-01		ELECTRONICS HARNESS ASSY	
15	4050639-01		ENCLOSURE ASSY	
18	4220245-01		SPACER, CHASSIS	
23	4840248		SCHEMATIC, ELECTRONICS	
24	4840249		SCHEMATIC, ELECTRONIC MODULES	
27	6000035-02		LABEL, IDENTIFICATION	
31	302-160		CLAMP, CABLE, PLASTIC, 0.250 I.D.	
32	302-200		CLAMP, CABLE, PLASTIC, 0.375 I.D.	
34	471-069		SCREW, PAN HD, 6-32 X 3/8	
35	473-105		SCREW, PAN HD, 6-32 X 2-1/2	
36	473-324		SCREW, PAN HD, XREC, SEM, 4-40 X 1/4	
39	475-085		SCREW, PAN HD, XREC, 6-32 X 5/16	
40	476-998		SCREW, HEX WASHER HD, SELF TAPPING, NO. 6 X 1/4	
41	476-999		SCREW, HEX WASHER HD, SELF TAPPING, NO. 6 X 3/8	
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, "D", NO. 6	
			VERSION: 4020337-01	

Electronics Assembly W/O Equalizers
Assy No. 4020337

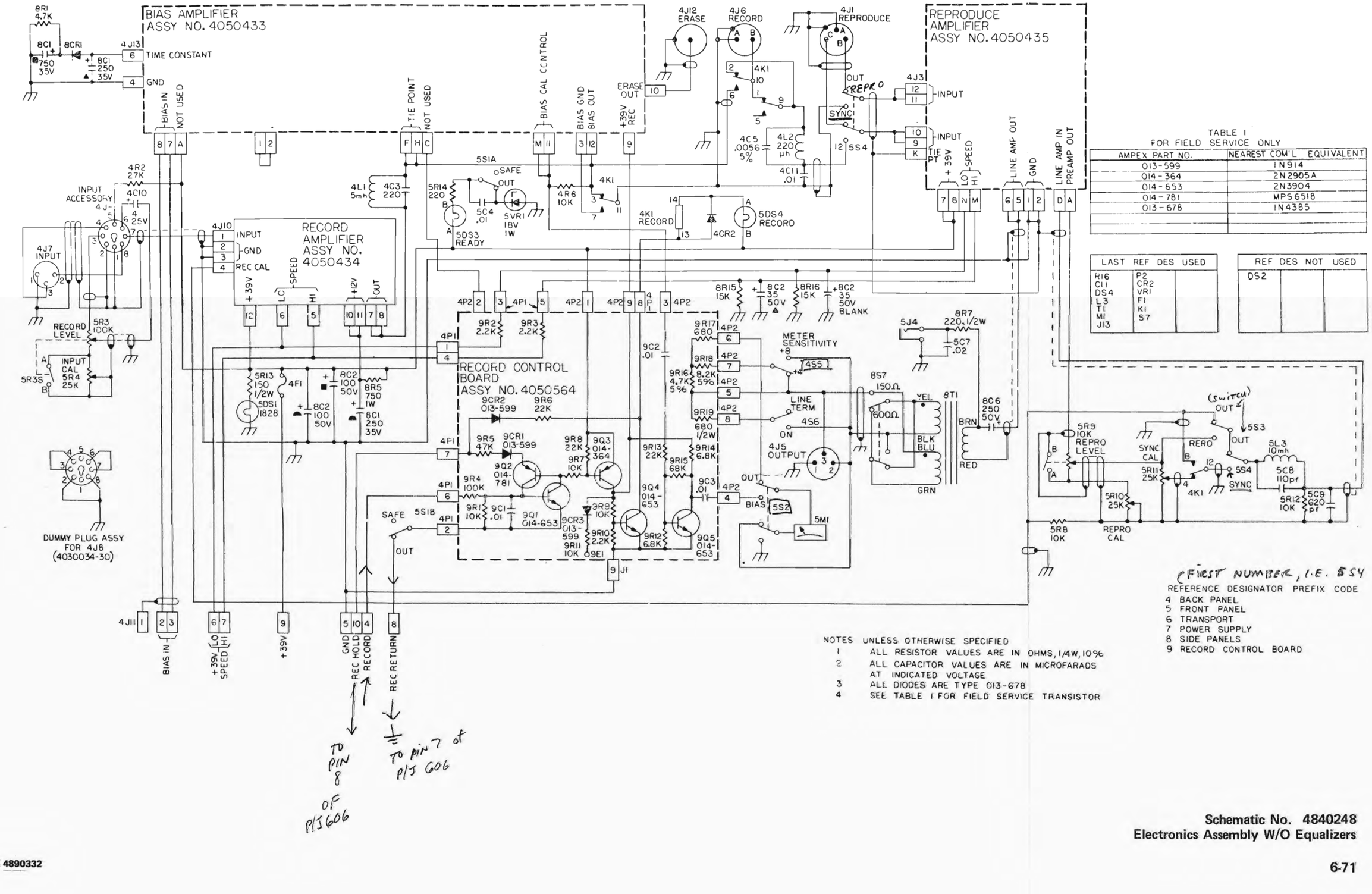


TABLE I
FOR FIELD SERVICE ONLY

AMPEX PART NO.	NEAREST COM'L EQUIVALENT
013-599	1N914
014-364	2N2905A
014-653	2N3904
014-781	MPS6518
013-678	1N4385

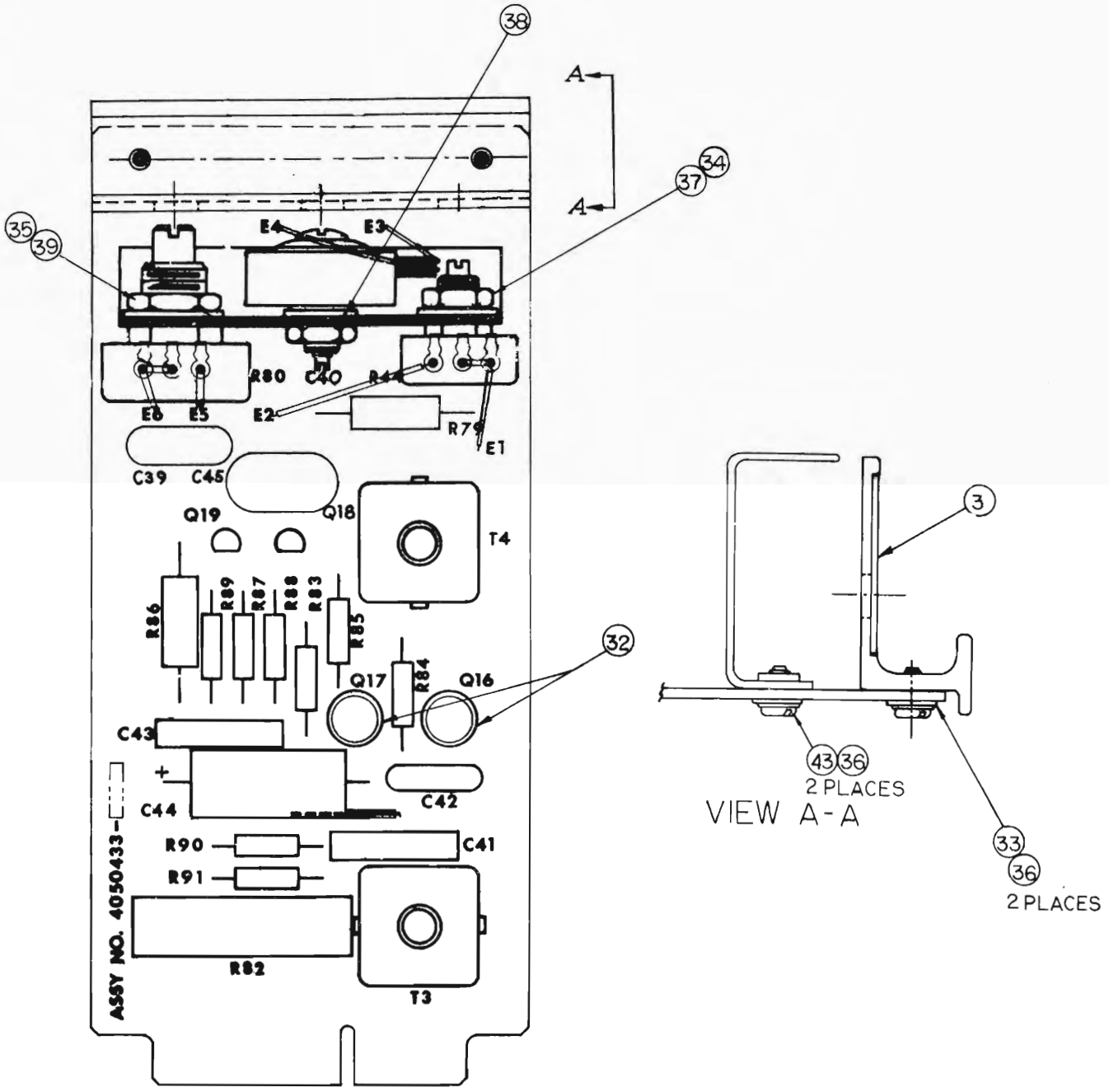
LAST REF DES USED		
R16	P2	
C11	CR2	
DS4	VR1	
L3	F1	
T1	K1	
M1	S7	
J13		

REF DES NOT USED		
DS2		

(FIRST NUMBER, I.E. 5S4
REFERENCE DESIGNATOR PREFIX CODE
4 BACK PANEL
5 FRONT PANEL
6 TRANSPORT
7 POWER SUPPLY
8 SIDE PANELS
9 RECORD CONTROL BOARD

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 013-678
4 SEE TABLE I FOR FIELD SERVICE TRANSISTOR

Schematic No. 4840248
Electronics Assembly W/O Equalizers



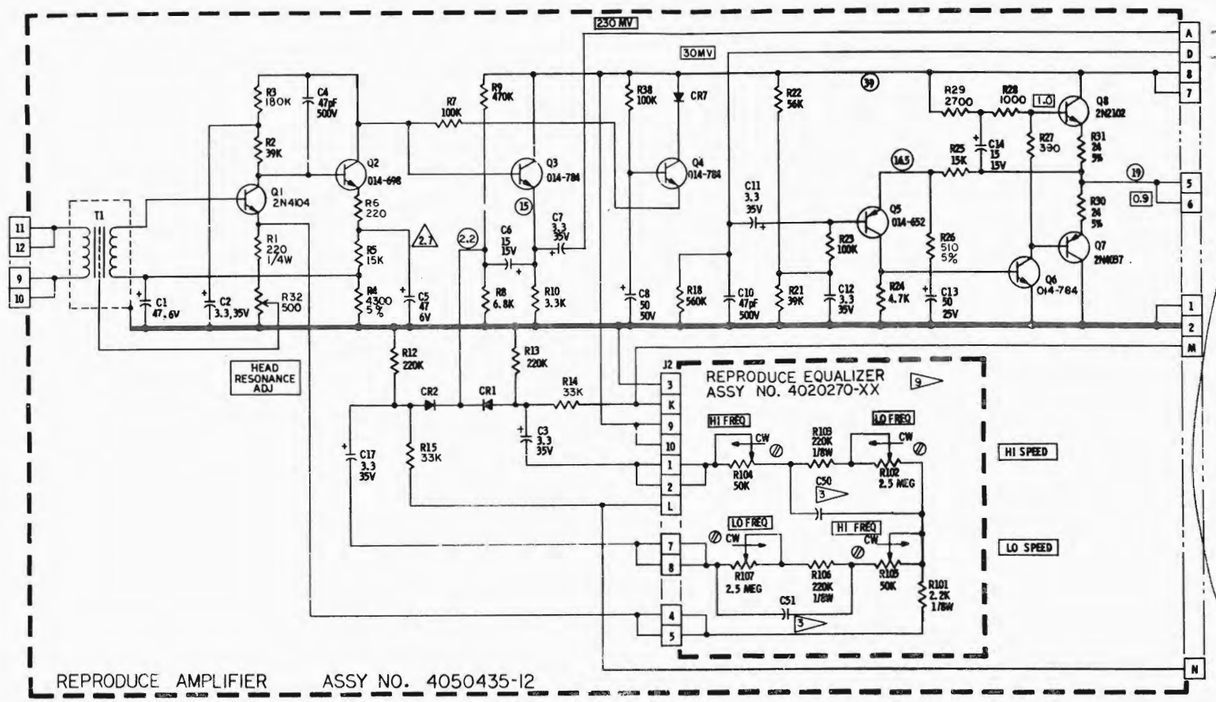
Bias Amplifier PWA
Assy No. 4050433

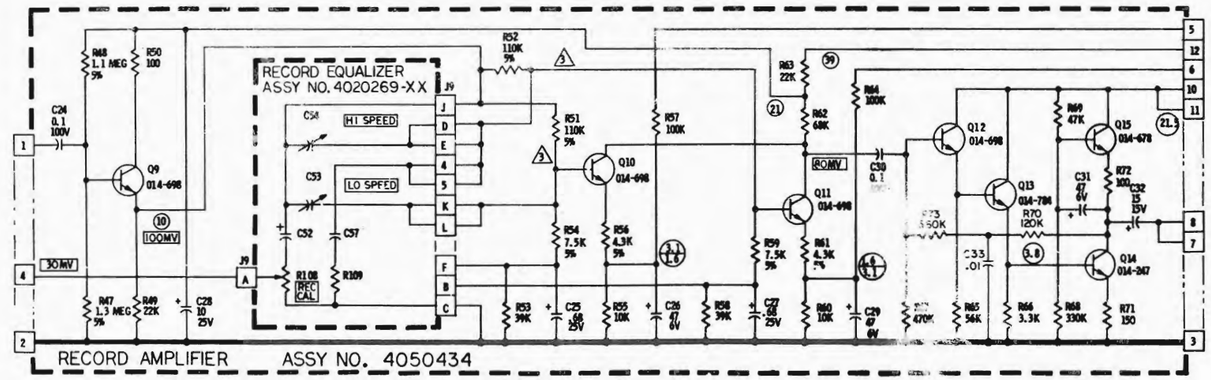
ASSEMBLY NO. 4050433K TITLE: BIAS AMPLIFIER PWA SHEET 1 OF 1

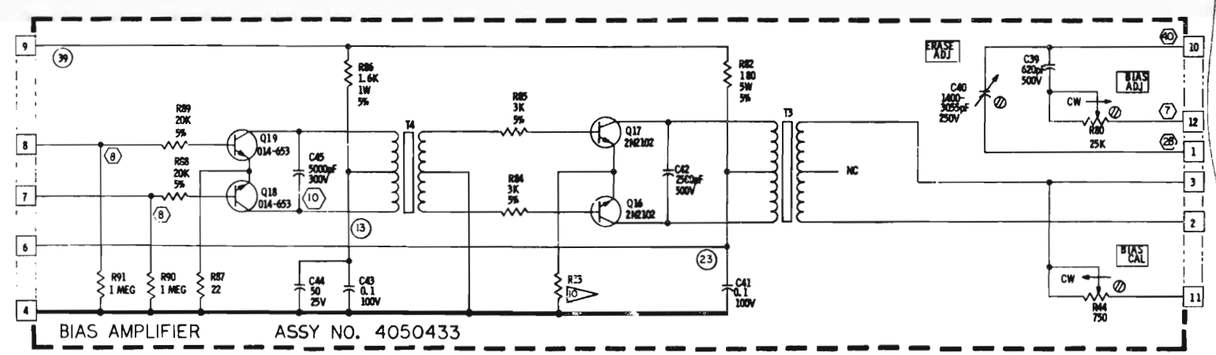
NEXT HIGHER ASSEMBLY NO. 4020337

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
3	4110269-01		LABEL, BIAS MODULE	
4	4330261-01		PLATE, FRONT, BIAS MODULE	
5	4520154-01	R44	POT, BIAS CALIBRATE, 750 OHMS	
6	4520145-20	R80	POT, BIAS ADJUST, 25K	
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, ELECT, 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, 1 MEGOHM, 1/2W, 10%	
25	041-033	R87	RESISTOR, COMP, 22 OHMS, 1/2W, 10%	
26	041-345	R83	RESISTOR, COMP, 51 OHMS, 1/2W, 5%	
27	041-353	R86	RESISTOR, FIXED, 1.6K, 1W, 5%	
28	041-475	R84,85	RESISTOR, COMP, 3K, 1/2W, 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, W.W., 180 OHMS, 5W, 5%	
32	280-131		PAD, TRANSISTOR, 0.200 DIA	
33	475-006		SCREW, PAN HD, NO. 4-40 X 1/4	
34	492-046		NUT, HEX, NO. 1/4-32	
35	492-095		NUT, HEX, NO. 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	034-928	C39	CAPACITOR, MICA, 620 PF, 500V, 5%	
43	475-007		SCREW, PAN HD, NO. 4-40 X 5/16	
44	038-011	C40	CAPACITOR, VARIABLE, 1,400-3,055 PF, 250V	
46	103307-01		STANDOFF	

VERSION: 4050433-05







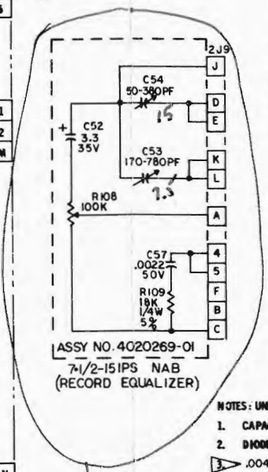
REPRO HEAD IN

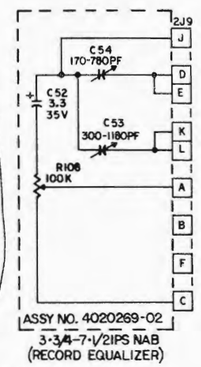
PREAMP OUT

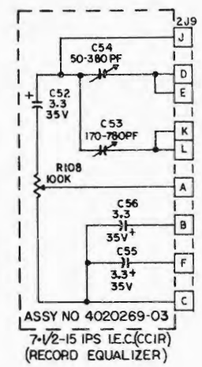
LINE AMP IN

LINE AMP OUT

Q1 2N404
Q2 = 2N3565
Q3,4,6: 2N4946
Q5: 2N3906
Q7: 2N4037
Q8: 2N2102





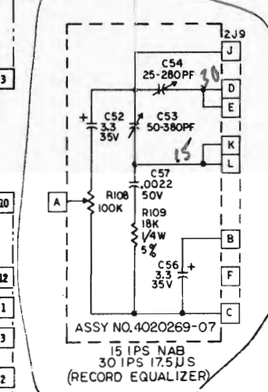


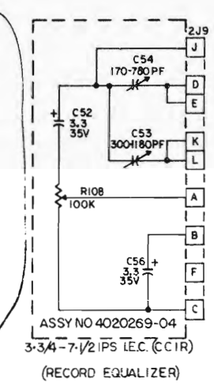
NOTES: UNLESS OTHERWISE SPECIFIED

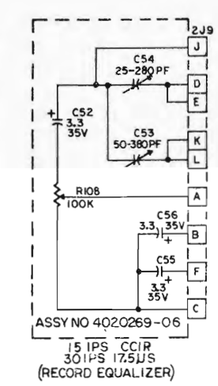
1. CAPACITANCE VALUES ARE IN MICROFARADS
2. DIODES ARE TYPE 913-599.
3. .0047 FOR 4020270-01 EQUALIZER, .0033 FOR 4020270-02
4. RESISTANCE VALUES ARE IN OHMS 1/2W, 10%.
5. (XX) INDICATES VOLTS D.C. MEASURED WITH A 20,000 OHM/VOLT METER.
6. XX INDICATES VOLTS D.C. MEASURED WITH A HIGH IMPEDANCE VTVM.
7. XX INDICATES VOLTS R.M.S. MEASURED WITH A HIGH IMPEDANCE VTVM AT OPERATING LEVEL OF 700 Hz., +8VU OUT, 75 MIL TRACK HEADS.
8. (XX) INDICATES VOLTS R.M.S. MEASURED WITH A HIGH IMPEDANCE VTVM AT BIAS FREQUENCY.
9. EQUALIZER 4020270-01 CAN BE ADJUSTED FOR 3¾ THRU 15 IPS, NAB OR CCIR.
   EQUALIZER 4020270-02 CAN BE ADJUSTED FOR 7-½ THRU 30 IPS, NAB OR CCIR.

REF. DES.	AMPEX P/N	NEAREST COML. EQUIVALENT
CR1, CR2, CR7	913-599	1N914
Q14	814-267	2N2219
Q5	814-652	2N3906
Q18, Q19	814-653	2N3904
Q15	814-678	2N2219A
Q2, Q9-12	814-698	2N3117 OR 2N5088
Q3,4,13,6	814-784	2N4946

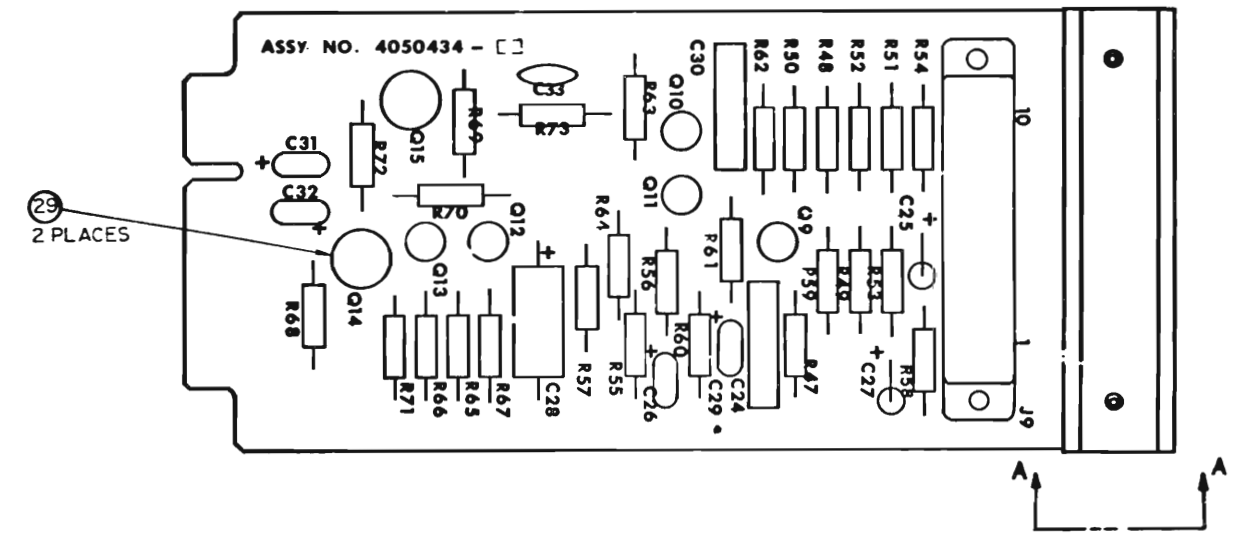
10. 51Ω, 5% EXCEPT 180Ω, 10% FOR USE WITH 1/4 TRACK ERASE HEADS.

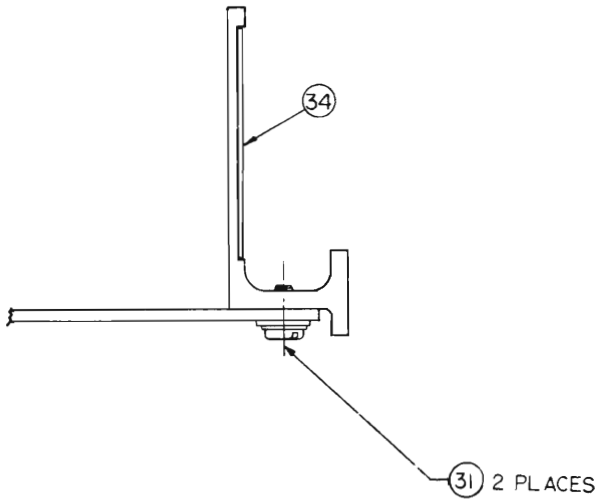






Electronic Modules
Assy No. 4840249





Record Amplifier PWA
Assy No. 4050434

ASSEMBLY NO. 4050434J TITLE: RECORD AMPLIFIER PWA SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020337

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
2	4330262-01		PLATE, FRONT, RECORD MODULE	
5	031-148	C28	CAPACITOR, ELECT, 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 OHMS, 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 OHMS, 1/2W, 10%	
25	041-361	R54,59	RESISTOR, FIXED, 7.5K, 1/2W, 5%	
26	041-377	R47	RESISTOR, FIXED, 1.3 MEGOHMS, 1/2W, 5%	
27	041-898	R48	RESISTOR, FIXED, 1.1 MEGOHMS, 1/2W, 5%	
29	280-131		PAD, TRANSISTOR	
30	475-006		SCREW, SEM, PAN HD, NO. 4-40 X 1/4	
31	501-008		WASHER, FLAT, NO. 4	
32	4030270-01	J9	CONNECTOR ASSY, 10 PIN	
34	4110270-01		LABEL, RECORD MODULE	
35	014-784	Q13	TRANSISTOR	2N4946
36	014-678	A15	TRANSISTOR	1N4385
37	014-247	Q14	TRANSISTOR	2N2219
38	014-698	Q9-12	TRANSISTOR	2N3565
39	067-026	C25,27	CAPACITOR, TANT, 0.68 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	

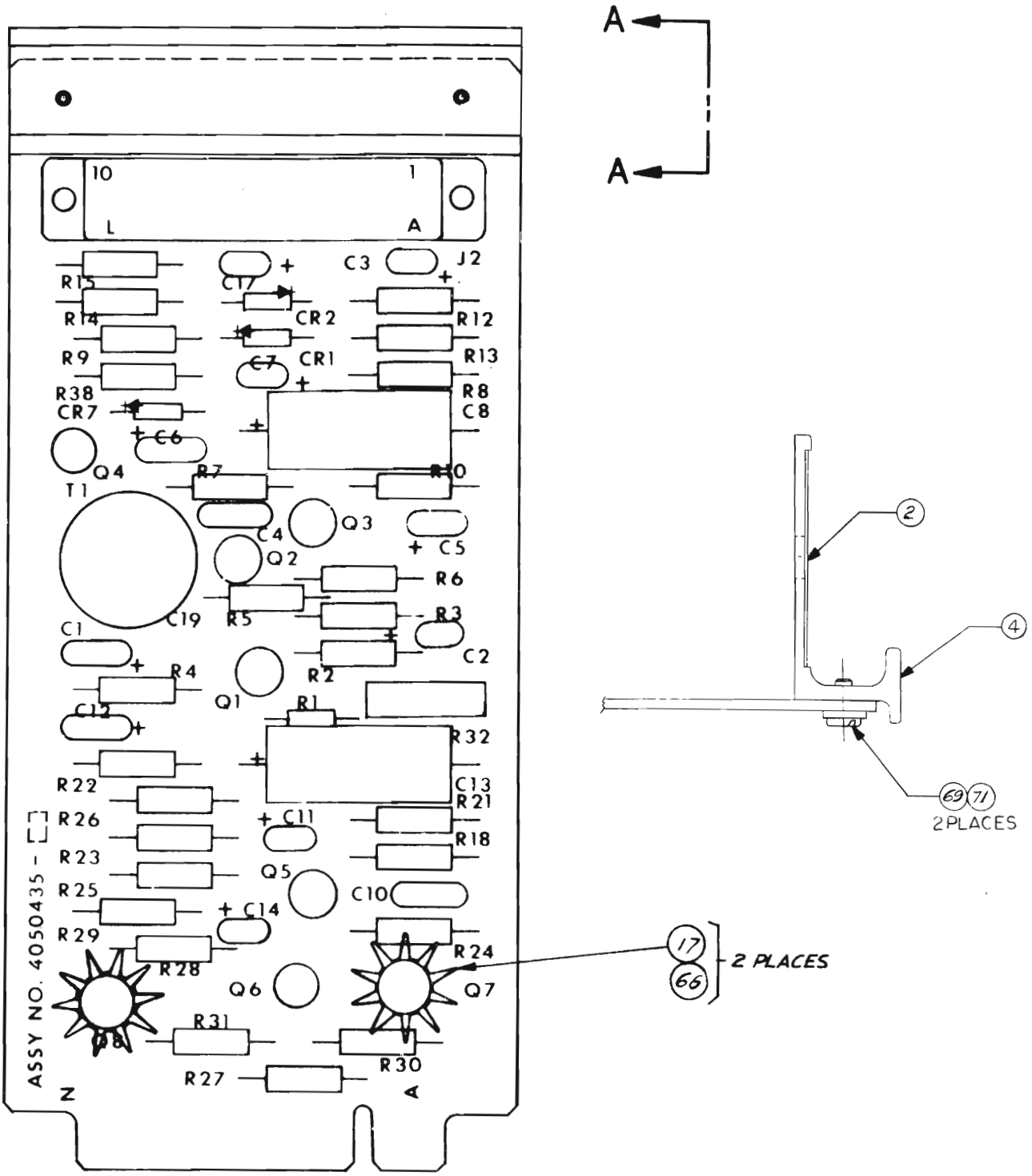
ASSEMBLY NO. 4020269H TITLE: RECORD EQUALIZER PWA SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4010205

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
2	4520153-01	R108	RESISTOR, VARIABLE, 100K	
3	4540314-02	C54	CAPACITOR, TRIMMER, 50-380 PF, 7-1/2—15 NAB/CCIR	
4	4540314-03	C53	CAPACITOR, TRIMMER, 170-780 PF, 7-1/2—15 NAB/CCIR	
7	037-654	C52	CAPACITOR, TANT, 3.3 UF, 35V, 20%	
8	037-654	C55,56	CAPACITOR, TANT, 3.3 UF, 35V, 20%, 7-1/2—15/-5-30 CCIR	
10	055-164	C57	CAPACITOR, MYLAR, 0.0022 UF, 50V, 10%, 7-1/2—15/15-30 NAB	
11	041-436	R109	RESISTOR, FIXED, 18K, 1/4W, 5%, 7-1/2—15/15-30 NAB	
12	037-654	C56	CAPACITOR, TANT, 3.3 UF, 35V, 20%, 15-30 NAB	
13	4540314-01	C54	CAPACITOR, TRIMMER, 25-280 PF, 15-30 NAB/CCIR	
14	4540314-02	C53	CAPACITOR, TRIMMER, 50-380 PF, 15-30 NAB/CCIR	
16	4840249		SCHEMATIC	

VERSIONS: 4929269-01 — 7 1/2-15 IPS
4020269-07 — 15-30 IPS

Record Equalizer PWA
Assy No. 4020269



Reproduce Amplifier PWA
Assy No. 4050435

ASSEMBLY NO. 4050435Z TITLE: REPRODUCE AMPLIFIER PWA SHEET 1 OF 1

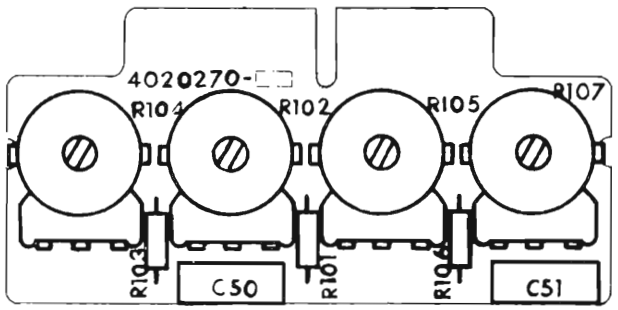
NEXT HIGHER ASSEMBLY NO. 4020337

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4030270-02	J2	CONNECTOR ASSY, 10 CONTACT	
2	4110271-01		LABEL, REPRODUCE MODULE	
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, ELECT, 50 MFD, 50V	
22	031-190	C13	CAPACITOR, ELECT, 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, 47 MFD, 6V, 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, 1/2V, 5%	
34	041-040	R6	RESISTOR, 220 OHMS, 1/2W, 10%	
35	041-043	R27	RESISTOR, 390 OHMS, 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	R5,25	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	RESISTOR, COMP, 180K, 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 OHMS, 1/2W, 5%	
58	041-533	R30,31	RESISTOR, COMP, 24 OHMS, 1/2W, 5%	
61	041-066	R14,15	RESISTOR, COMP, 33K, 1/2W, 10%	
62	049-517	R1	RESISTOR, COMP, 220 OHMS, 1/4W, 10%	
63	058-689	R32	RESISTOR, VARIABLE, 500 OHMS, 10%	
65	280-130		PAD, MTG, TRANSISTOR	
66	280-131		PAD, MTG, TRANSISTOR	
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	

ASSEMBLY NO. 4020270C TITLE: REPRODUCE EQUALIZER PWA SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4050435

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, 2.5 MEGOHM	
4	049-528	R103,106	RESISTOR, 220K, 1/8W, 10%	
5	049-527	R101	RESISTOR, 2.2K, 1/8W, 10%	
8	055-889	C50,51	CAPACITOR, MYLAR, 0.0033 MFD	
9	4840249		SCHEMATIC	
			VERSION: 4020270-02	

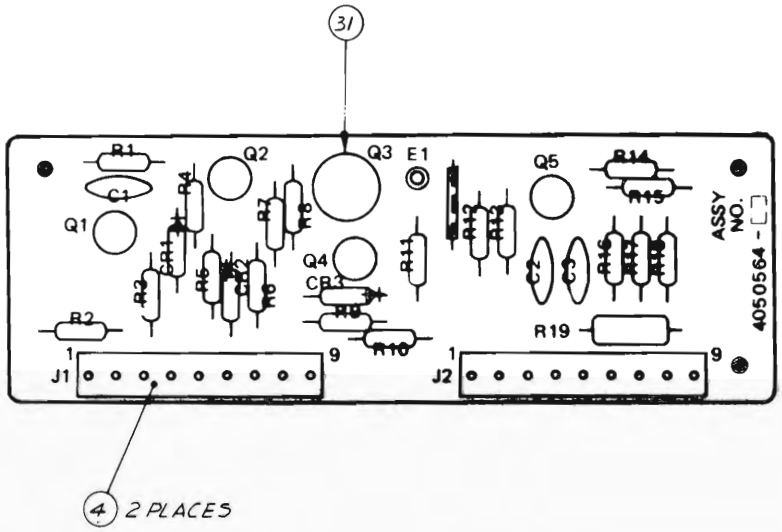


Reproduce Equalizer PWA
Assy No. 4020270

ASSEMBLY NO. 4050564B TITLE: RECORD CONTROL PWA SHEET 1 OF 1

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 OHMS, 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 OHMS, 1/4W, 10%	
28	049-372	R5	RESISTOR, COMP, 47K, 1/4W, 10%	
31	280-998		PAD, MTG, TRANSISTOR	
99	4840248		SCHEMATIC	
			VERSION: 4050564-01	

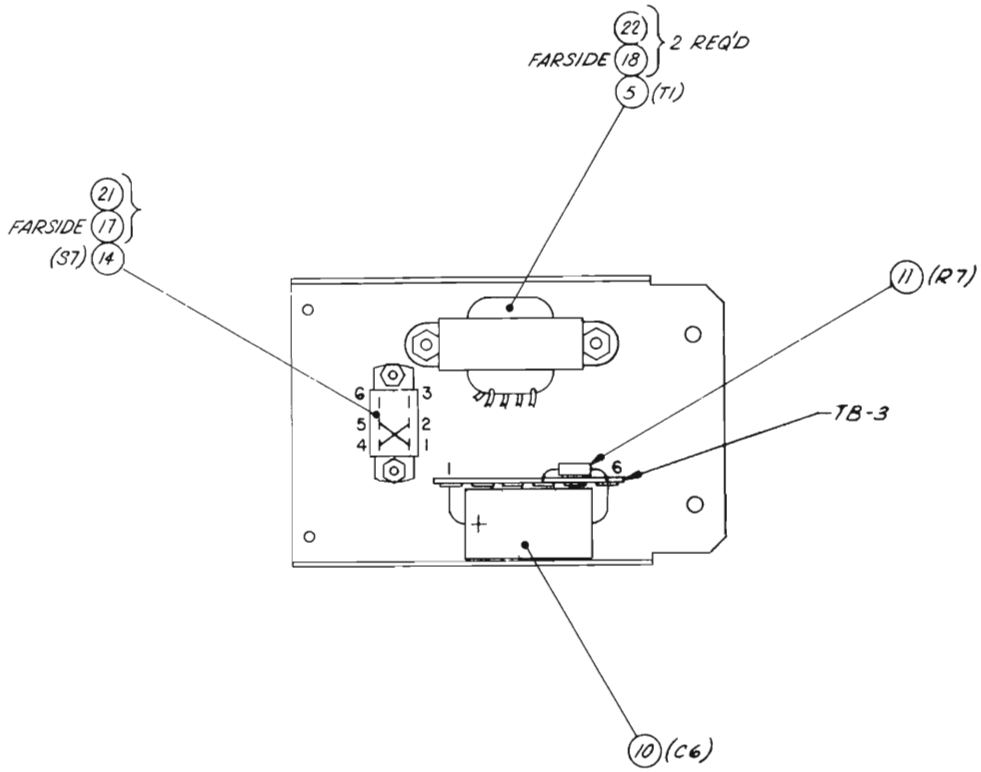


Record Control PWA
Assy No. 4050564

ASSEMBLY NO. 4050593– TITLE: LEFT SIDE PANEL ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020337

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
5	4580057-01	T1	TRANSFORMER, OUTPUT	
10	031-126	C6	CAPACITOR, FIXED, 250 MFD, 50V	
11	041-040	R7	RESISTOR, COMP, 220 OHMS, 1/2W, 10%	
14	119-196	S7	SWITCH, SLIDE, DPDT	
17	471-060		SCREW, PAN HD, XREC, NO. 4-40 X 0.250	
18	471-067		SCREW, PAN HD, XREC, NO. 6-32 X 0.250	
21	496-004		NUT, KEP, NO. 4-40	
22	496-005		NUT, KEP, NO. 6-32	
			VERSION: 4050593-01	

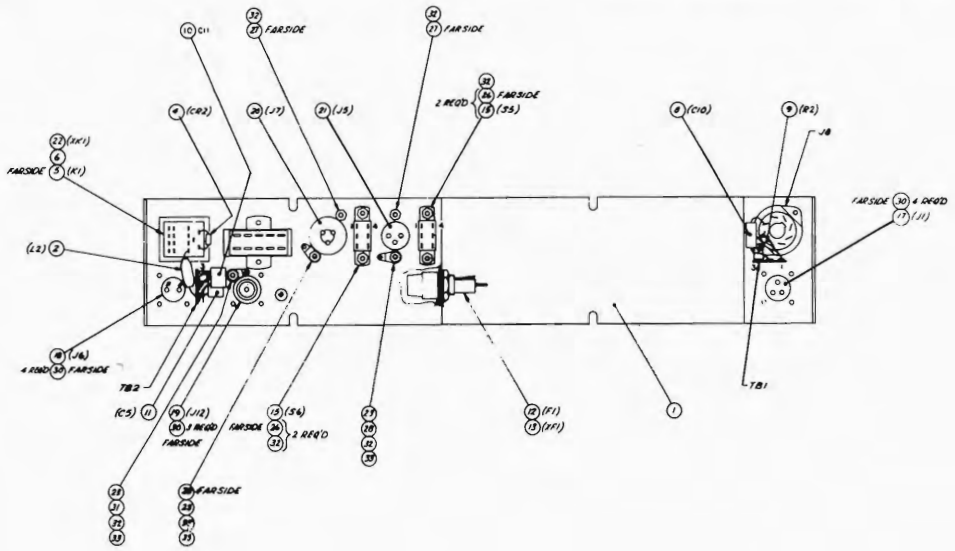


Left Side Panel Assembly
Assy No. 4050593

ASSEMBLY NO. 4050601A TITLE: REAR PANEL ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020337

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4041183-01		REAR PANEL SUBASSY	
2	4050723-01	L2	CHOKE ASSY, SHIELDED, 220 UH	
4	013-678	CR2	DIODE	1N4385
5	020-144	K1	RELAY, 24V, 4PDT	
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, 0.01 UF, 50V, ±10%	
11	055-102	C5	CAPACITOR, MYLAR, 0.0056 UF, 100V, ±10%	
12	070-026	F1	FUSE, SLO-BLO, 0.5 AMP, 125V	
13	085-001	XF1	FUSEHOLDER	
15	119-196	S5,6	SWITCH, SLIDE, DPDT	
17	143-008	J1	CONNECTOR, MALE, 3 PIN	
18	143-009	J6	CONNECTOR, MALE, 2 PIN	
19	143-010	J12	CONNECTOR, MALE, 1 PIN	
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 CONTACT	
23	172-004		LUG, SOLDER, NO. 4	
26	471-060		SCREW, PAN HD, XREC, NO. 4-40 X 0.250	
27	471-327		SCREW, FLAT HD, XREC, NO. 4-40 X 0.312	
28	471-328		SCREW, FLAT HD, XREC, NO. 4-40 X 0.375	
30	476-057		SCREW, WASHER, HEX HD, SELF TAPPING, NO. 4-40 X 5/16	
31	476-329		SCREW, WASHER, HEX HD, SELF TAPPING, NO. 4-40 X 0.375	
32	495-004		NUT, KEP, NO. 4-40	
33	501-008		WASHER, FLAT, NO. 4	
			VERSION: 4050601-01	

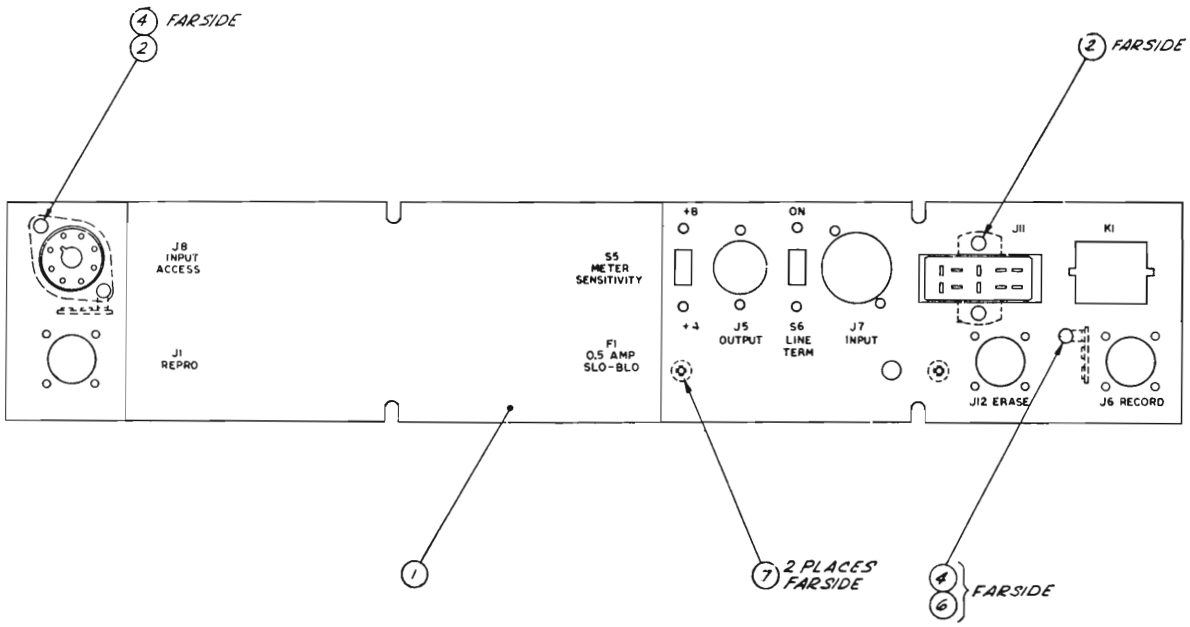


Rear Panel Assembly
Assy No. 4050601

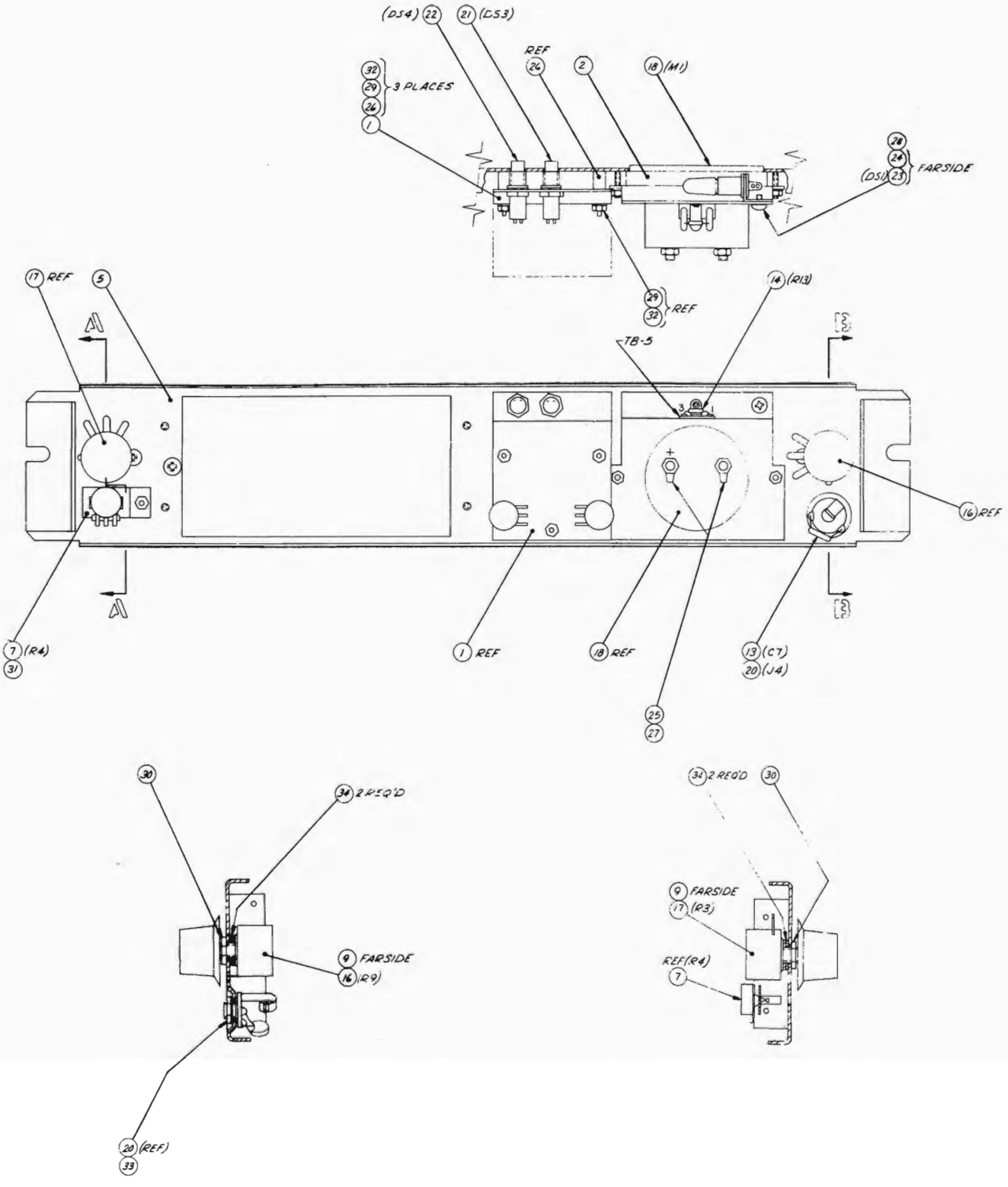
ASSEMBLY NO. 4041183 _ TITLE: REAR PANEL SUBASSY SHEET 1 OF 1

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, RECPT, MALE, 10 PIN	
3	150-023		SOCKET, OCTAL, ELECTRONIC TUBE PART	
4	180-272		TERMINAL STRIP	
6	502-014		WASHER, LOCK, EXT TOOTH, NO. 6	
7	280-441		SPACER, THD, SWAGE, 4-40 X 0.38	
			VERSION: 4041183-01	



Rear Panel Subassembly
Assy No. 4041183



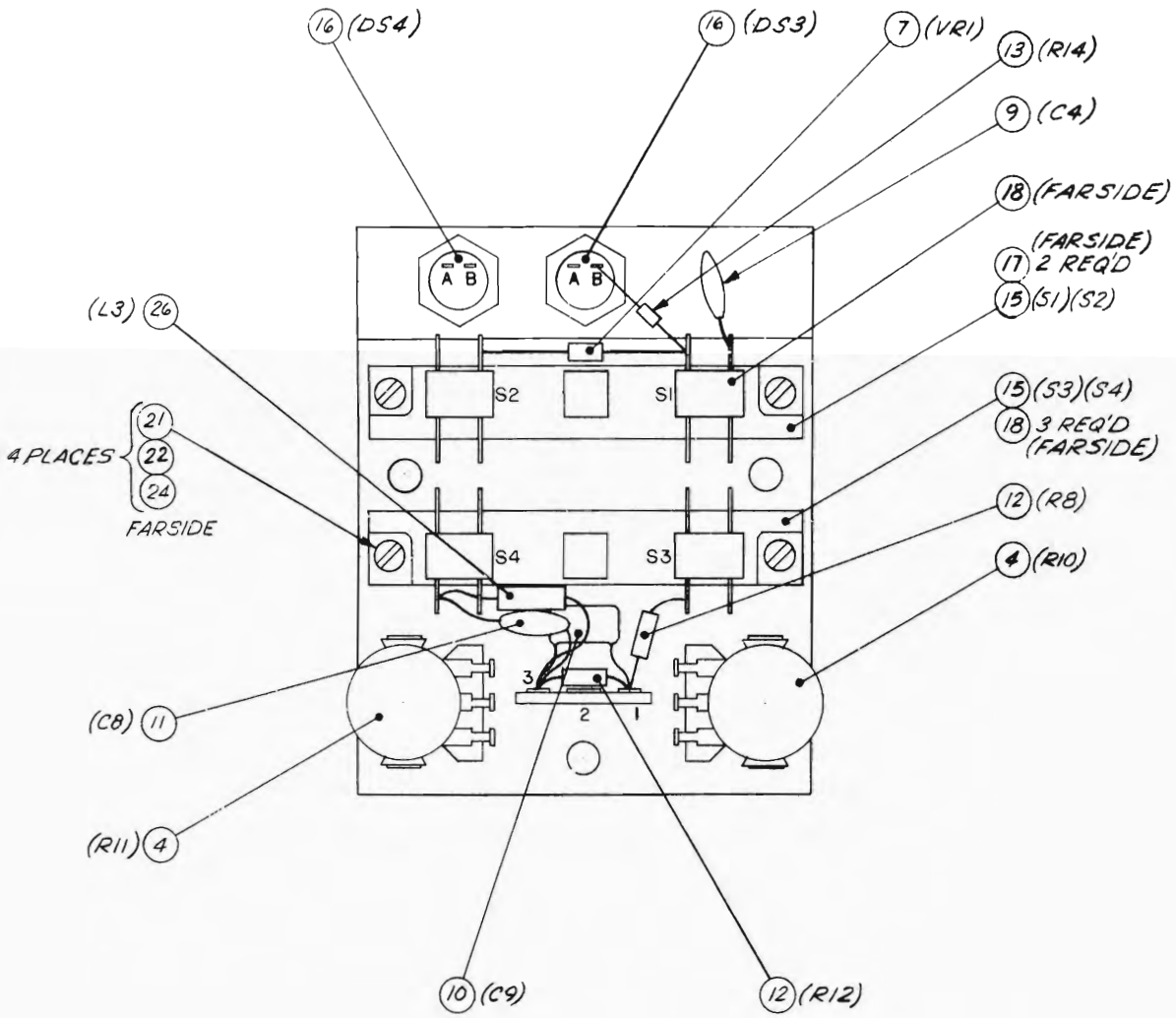
Front Panel Assembly
Assy No. 4050616

ASSEMBLY NO. 4050616A TITLE: FRONT PANEL ASSY SHEET 1 OF 1

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	
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 OHMS, 1/2W, 10%	
16	058-594	R9	RESISTOR, VAR, 10K, 2W, 20%	
17	058-888	R3	RESISTOR, VAR, 100K, 2W, 20%	
18	090-178	M1	METER, VU	
20	148-015	J4	JACK, PHONE	
21	132-335	DS3	LAMP, YELLOW	
22	132-224	DS4	LAMP, RED	
23	060-489	DS1	LAMP, METER	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		LOCKWASHER, INT TOOTH, NO. 6	
33	502-077		LOCKWASHER, INT TOOTH—FINE, 3/8	
34	502-083		LOCKWASHER, INT TOOTH—COARSE, 3/8	

VERSION: 4050616-01



Control Cluster Assembly
Assy No. 4050617

ASSEMBLY NO. 4050617B TITLE: CONTROL CLUSTER ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4050616

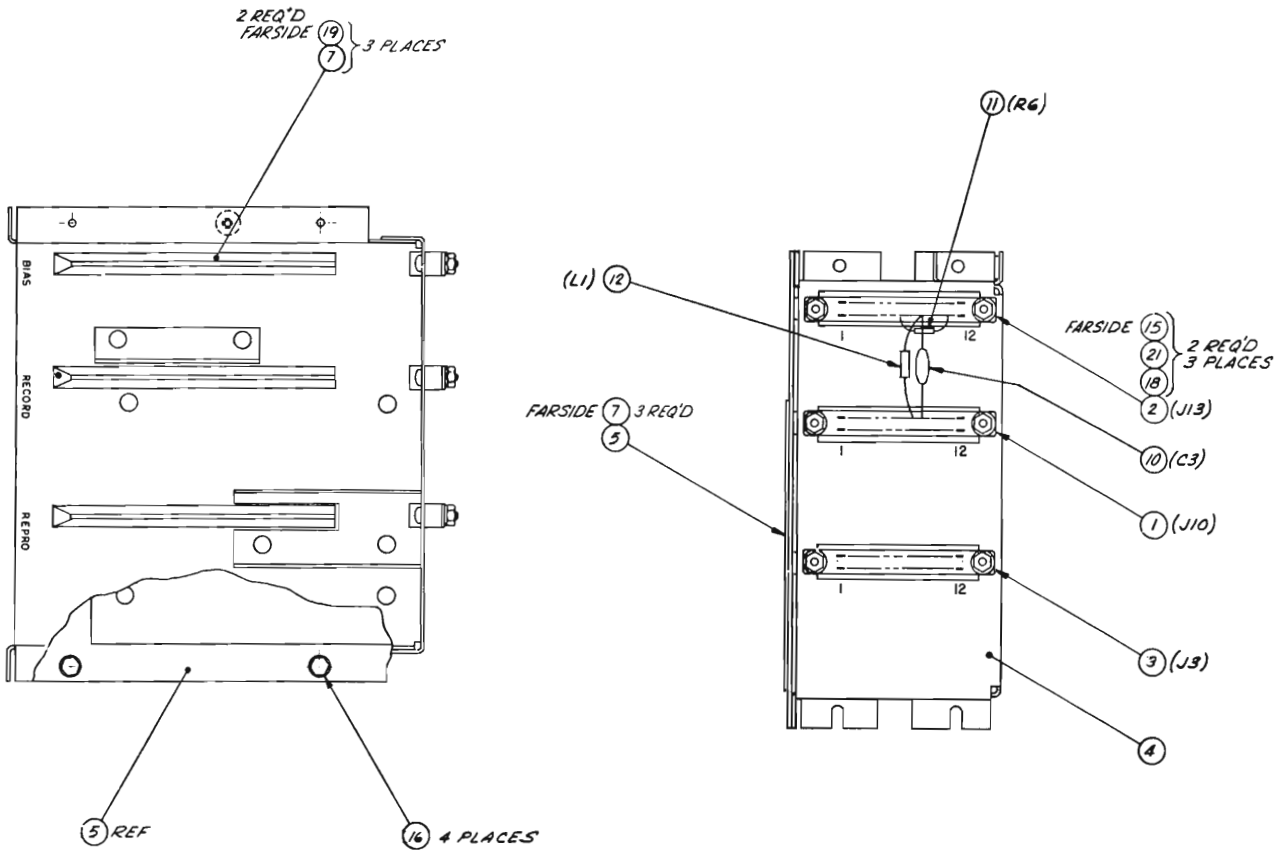
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
4	4520034-01	R10,11	POTENTIOMETER, 25K	
7	013-176	VR1	DIODE, ZENER, 18V, 1W	
9	030-057	C4	CAPACITOR, CER, 0.01 UFD, 100V, 20%	
10	034-228	C9	CAPACITOR, MICA, 620 PF, 300V, 5%	
11	034-938	C8	CAPACITOR, MICA, 110 PF, 500V, 5%	
12	041-633	R8,12	RESISTOR, 10K, 1/4W, 10%	
13	049-517	R14	RESISTOR, 220 OHMS, 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, NO. 2-56 X 1/4	
22	492-007		NUT, HEX, NO. 2-56	
24	502-023		LOCKWASHER, INT TOOTH, NO. 2	
26	540-055	L3	CHOKE, 10 UH, ±10%	

VERSION: 4050617-01

ASSEMBLY NO. 4050639C TITLE: ENCLOSURE ASSY SHEET 1 OF 1

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, WASHER, HEX 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	

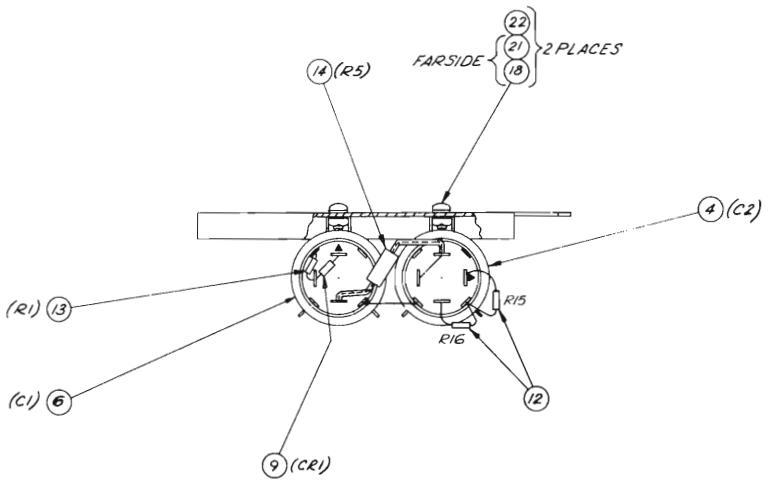


Enclosure Assembly
Assy No. 4050639

ASSEMBLY NO. 4050621B TITLE: RIGHT SIDE PANEL ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020337

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
4	4550147-05	C2	CAPACITOR, ELECT, 100, 100, 35, 35/50V	
6	4550147-11	C1	CAPACITOR, ELECT, 250, 750, 250/35V	
9	013-678	CR1	DIODE, POWER RECTIFIER	1N4385
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 OHMS, 1W, 5%	
18	301-010		RETAINER, CAPACITOR MTG	
21	473-330		SCREW, PAN HD, XREC, NO. 6-32 X 1/4	
22	492-009		NUT, PLAIN, NO. 6-32	
			VERSION: 4050621-01	



Right Side Panel Assembly
Assy No. 4050621

ASSEMBLY NO. 4050632B TITLE: ELECTRONICS HARNESS ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020337

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	
			VERSION: 4050632-01	

Electronics Harness Assembly
Assy No. 4050632

ASSEMBLY NO. 4020274P TITLE: POWER SUPPLY ASSEMBLY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4010205

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
2	4040968-03		POWER SUPPLY CONNECTOR PANEL	
5	4050443-01		POWER SUPPLY HARNESS ASSY	
9	4400310-10		SCREW, SHOULDER	
10	4550147-03	C707	CAPACITOR, ELECT, 2000 UF, 80V	
11	6000035-02		LABEL, IDENTIFICATION	
12	4580156-01	T702	TRANSFORMER, POWER	
15	031-945	C706	CAPACITOR, 500 MFD, 50V	
17	013-678	CR701-704	DIODE	1N4385
19	014-796	Q705	TRANSISTOR	2N4348
21	031-205		CAPACITOR, 5 UF, 50V	
22	041-158	R706	RESISTOR, 10K, 1W, 10%	
23	070-075	F701	FUSE, SLO-BLO, 1.5 AMP, 125V	
24	085-001		FUSEHOLDER, SHORT BODY	
25	143-307		CONNECTOR, PWB, 18 CONTACT	
26	145-013	P706	CONNECTOR, MALE, 8 PIN	
27	260-052		GROMMET, NYLON	
28	302-007		CLAMP, CABLE, 1/4 I.D.	
29	471-064		SCREW, PAN HD, XREC, NO. 4-40 X 1/2	
30	471-069		SCREW, PAN HD, XREC, NO. 6-32 X 3/8	
31	476-998		SCREW, HEX HD, SELF TAPPING, NO. 6 X 1/4	
32	476-999		SCREW, HEX HD, SELF TAPPING, NO. 6 X 3/8	
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	302-036		CLAMP, CABLE, 3/8 I.D.	
50	498-445		NUT, SHEET SPRING, 0.125 DIA	
51	4050432-07		REGULATOR & OSCILLATOR PWA	
52	4050432-08		REGULATOR PWA	
53	4840168		SCHEMATIC	
			VERSIONS: 4020274-05 – REG. & OSC. 4020274-06 – REG.	

Power Supply Assembly
Assy No. 4020274

ASSY. 4050432

Ampex 8 shunted (2/6/81)
replaced CR 702 + CR 704 w/ IN4005's - clbs, w. secured replacement C707 (loose)

POWER TO TRANSPORT P706

AC NEUTRAL
117 VAC
DC NEUTRAL

F701 1.5A SLO-BLO

T702 — BLK, BLK/RED, RED, RED/GRN

CR702 013-678 IN4385
CR704 013-678 IN4385 (IN4004)
CR701 013-678 IN4385
CR703 013-678 IN4385

706 10K 1W

C707 2000 80V

CR706 013-599 IN914
CR705 013-599 IN914

R707 20K 5%

R709 1 5W 5%
R714 100
R708 1K
CR707 013-599 IN914

Q705 014-796 2N4348
Q704 2N3053
Q703 2N398A
Q706 014-653 2N3904

R710 1K
R713 2.2K
R712 1K 1/10 W
R711 3.9K
VR702 24V 5%

R701 24 5%
Q701 014-653 2N3904
C703 5600pF 300V 5%
C701 6800pF 300V 5%
R704 22K
R703 22K
R702 24 5%
C702 5600pF 300V 5%
Q702 014-653 2N3904

T701

C704 2500pF 500V 5%
R705 1.2K 1W
C705 .1 100V 10%
VR701 13V 5%

C706 500 50V
+39VDC

C709 5 50V
C710 5 50V

REC
EQ LO
EQ HI
DC COM
~~PLAY~~ REC (HOLD)

J704
J703
J702
J701

BIAS
BIAS
+39V
GROUND
RECORD
LO SPEED
HI SPEED
REC RETURN
RECORD HOLD

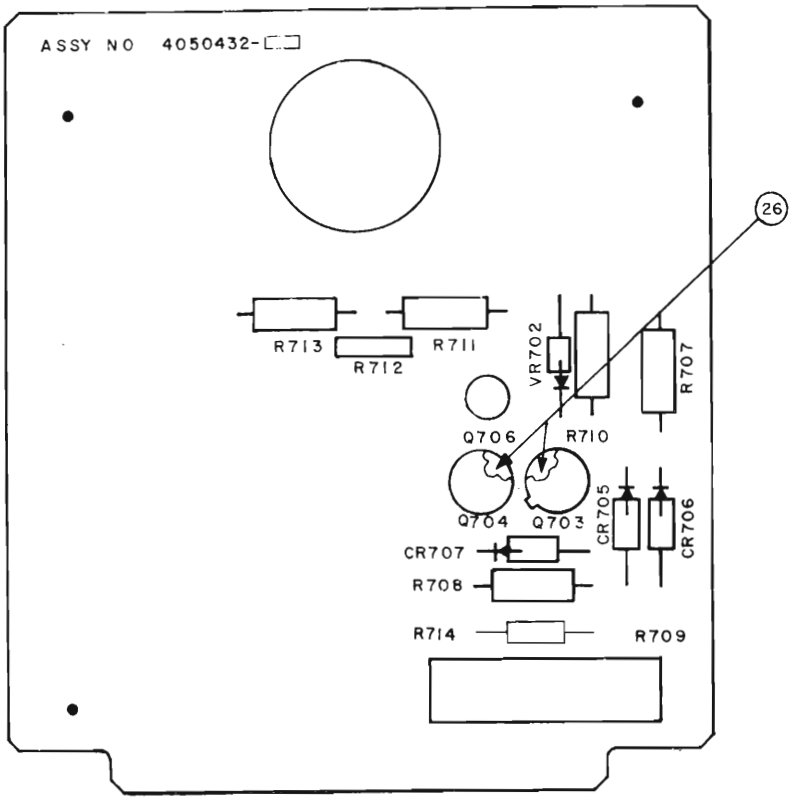
POWER TO ELECTRONICS

DB Transport Electronics

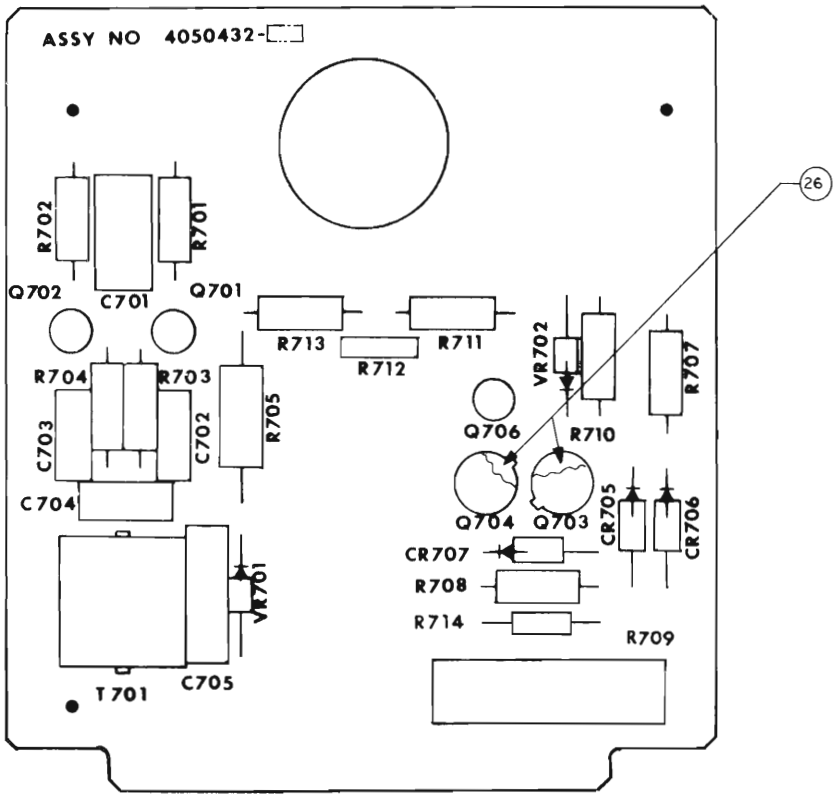
LAST REF. DES. USED	REF. DES. NOT USED
C710	C708
CR707	
Q706	
VR702	
T702	
R714	

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%.

Schematic No. 4840168
Power Supply Assembly



Version -08



Version -07

Regulator and Oscillator PWA
Assy No. 4050432

ASSEMBLY NO. 4050432L TITLE: REGULATOR AND OSCILLATOR PWA SHEET 1 OF 1

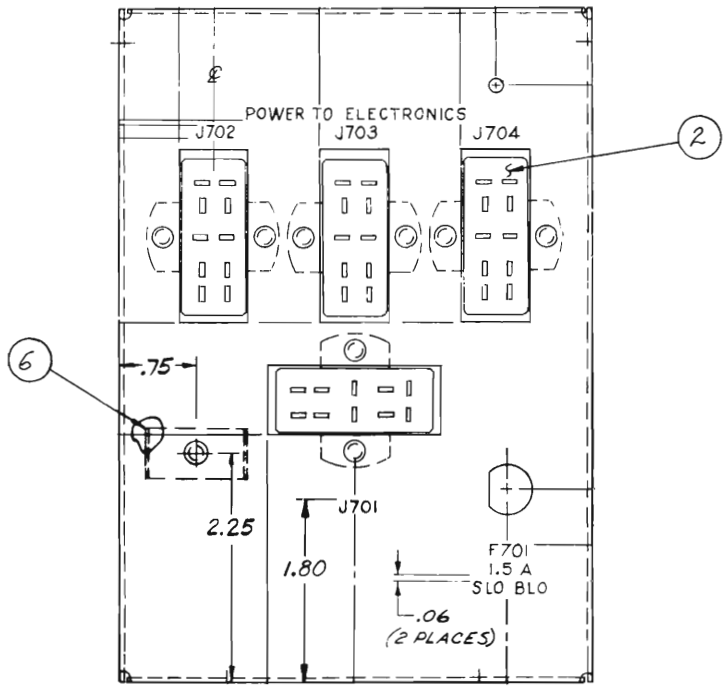
NEXT HIGHER ASSEMBLY NO. 4020274

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
2	4580123-01	T701	COIL, BIAS OSCILLATOR – REGULATOR AND OSCILLATOR PWA	
3	013-599	CR705,706,707	DIODE	1N914
4	013-712	VR702	DIODE, 24V, 5%	LMAZ-24.0A
5	013-747	VR701	DIODE, 13V, 5% – REGULATOR AND OSCILLATOR PWA	2EZ13.0D5
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% – REG. AND OSC. PWA	
12	034-507	C702,703	CAPACITOR, MICA, 5600 PF, 300V, 5% – REG. AND OSC. PWA	
15	041-055	R711	RESISTOR, FIXED, 3.9K, 1/2W, 10%	
16	041-064	R703,704	RESISTOR, FIXED, 22K, 1/2W, 10% – REG. AND OSC. PWA	
18	041-147	R705	RESISTOR, FIXED, 1.2K, 1W, 10% – REG. AND OSC. PWA	
19	041-533	R701,702	RESISTOR, FIXED, 24 OHM, 1/2W, 5% – REG. AND OSC. PWA	
20	044-370	R712	RESISTOR, VAR, 1K, 1/10W	
21	055-106	C705	CAPACITOR, MYLAR, 0.1 UF, 100V, 10% – REG. AND OSC. PWA	
22	056-108	C701	CAPACITOR, MICA, 6800 PF, 500V, 5% – REG. AND OSC. PWA	
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%	
37	4840168		SCHEMATIC :	
			VERSIONS: 4050432-07 – REGULATOR AND OSCILLATOR 4050432-08 – REGULATOR	

ASSEMBLY NO. 4040968E TITLE: POWER SUPPLY CONNECTOR PANEL SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020274

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
2	146-018	J701-704	CONNECTOR, RECPT, FEMALE, 10 PIN	
6	301-138		RETAINER, CAPACITOR	
			VERSION: 4040968-03	

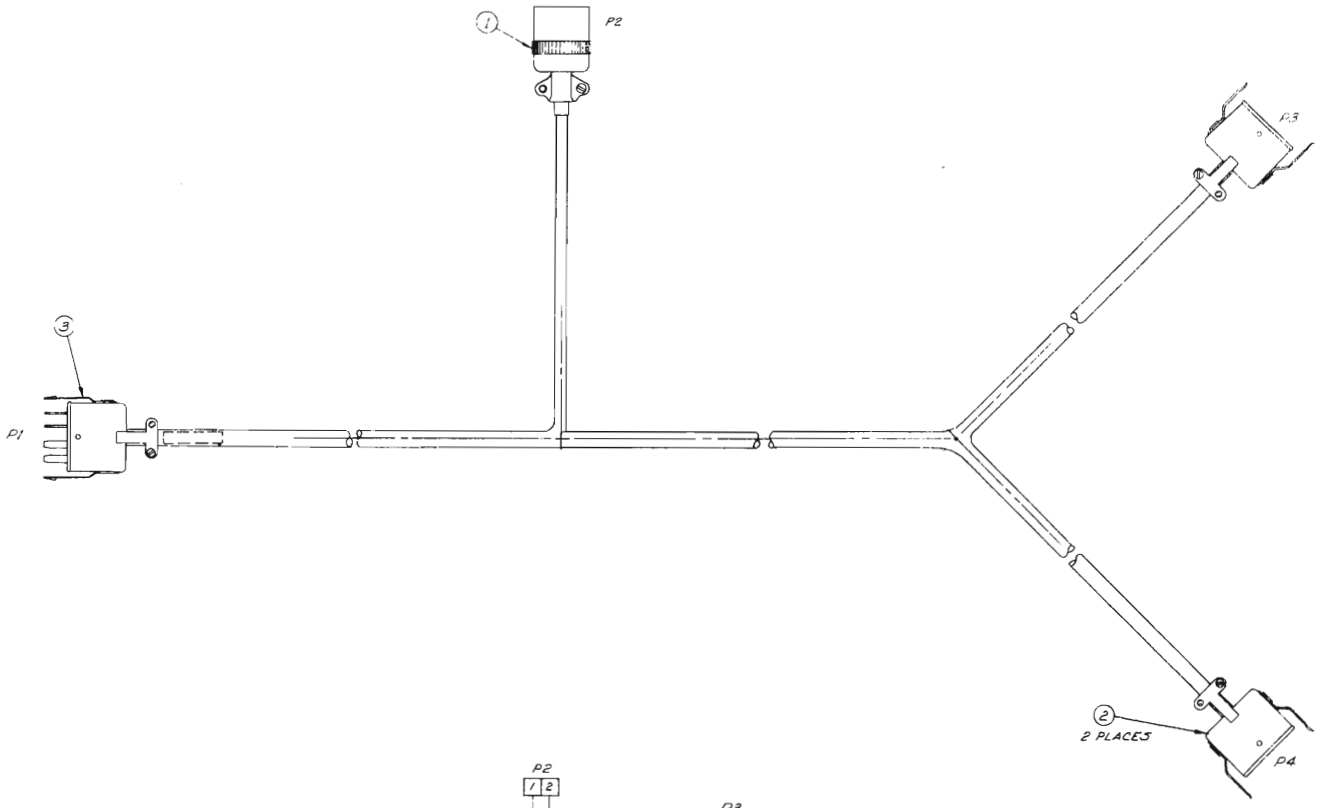


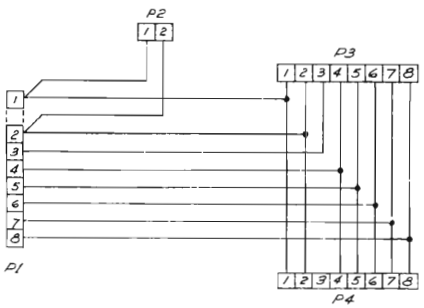
Power Supply Connector Panel
Assy No. 4040968

ASSEMBLY NO. 4050456 TITLE: POWER SUPPLY EXTENSION CABLE ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4010205

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	144-014	P2	CONNECTOR, FEMALE, CONVENIENCE	
2	144-019	P3,4	CONNECTOR, RECT RECP, 8 SOC	
3	145-013	P1	CONNECTOR, RECT PLUG, 8 PIN	
			VERSION: 4050456-01	





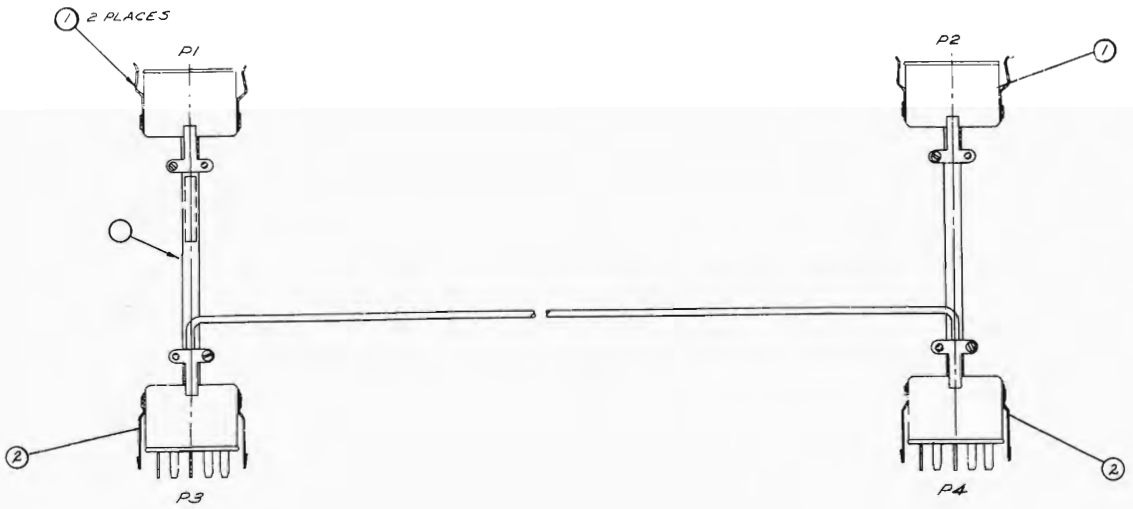
SCHEMATIC

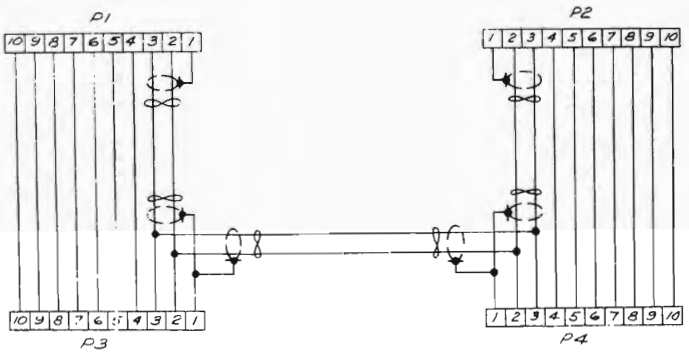
Power Supply Extension Cable Assembly
Assy No. 4050456

ASSEMBLY NO. 4050457- TITLE: POWER SUPPLY JUMPER CABLE ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4010205

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	143-639	P1,2	CONNECTOR, RECT RECP. 10 SOC	
2	145-020	P3,4	CONNECTOR, RECT PLUG, 10 PIN	
			VERSION: 4050457-01	





Power Supply Jumper Cable Assembly
Assy No. 4050457

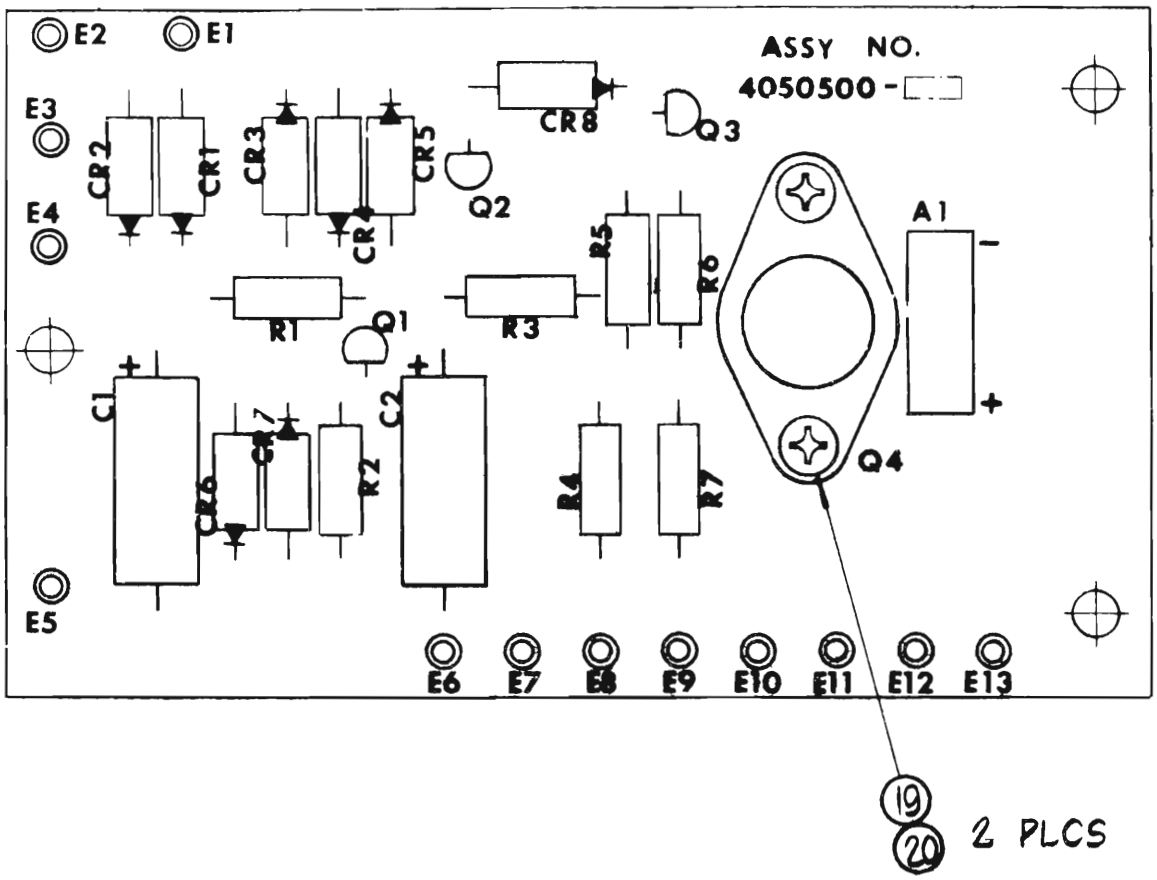
ASSEMBLY NO. 4020303B TITLE: TORQUE DELAY ASSY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4010205

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
2	4050500-01		TORQUE DELAY PWA	
5	4580194-02	T1	TRANSFORMER, POWER	
7	014-703		INSULATOR, TRANSISTOR	
8	014-820	Q5	TRANSISTOR	DTS-410
9	044-360	R8	RESISTOR, VAR, 25K, 2W, 10%	
10	044-916	R9	RESISTOR, VAR, 5K, 2W, 10%	
14	145-012		CONNECTOR, MALE, 6 PIN	
15	172-003		LUG, TERMINAL, SOLDER, NO. 6	
16	180-023		STRIP, TERMINAL	
18	251-004		BUTTON, PLUG	
19	260-005		GROMMET, 0.31 I.D.	
20	260-006		GROMMET, 0.22 I.D.	
22	302-007		CLAMP, CABLE, 0.25 I.D.	
24	471-066		SCREW, PAN HD, XREC, NO. 6-32 X 0.19	
25	471-069		SCREW, PAN HD, XREC, NO. 6-32 X 0.38	
26	471-071		SCREW, PAN HD, XREC, NO. 6-32 X 0.50	
27	475-051		SCREW, PAN HD, XREC, SEMS, NO. 6-32 X 0.25	
28	492-049		NUT, 3/8-32	
29	496-005		NUT, KEP, NO. 6-32	
31	501-009		WASHER, FLAT, NO. 6	
32	502-077		WASHER, INT TOOTH, 3/8	
33	503-013		WASHER, SHOULDER	
34	506-013		WASHER, "D"	

VERSION: 4020303-01

Torque Delay Assembly
Assy No. 4020303



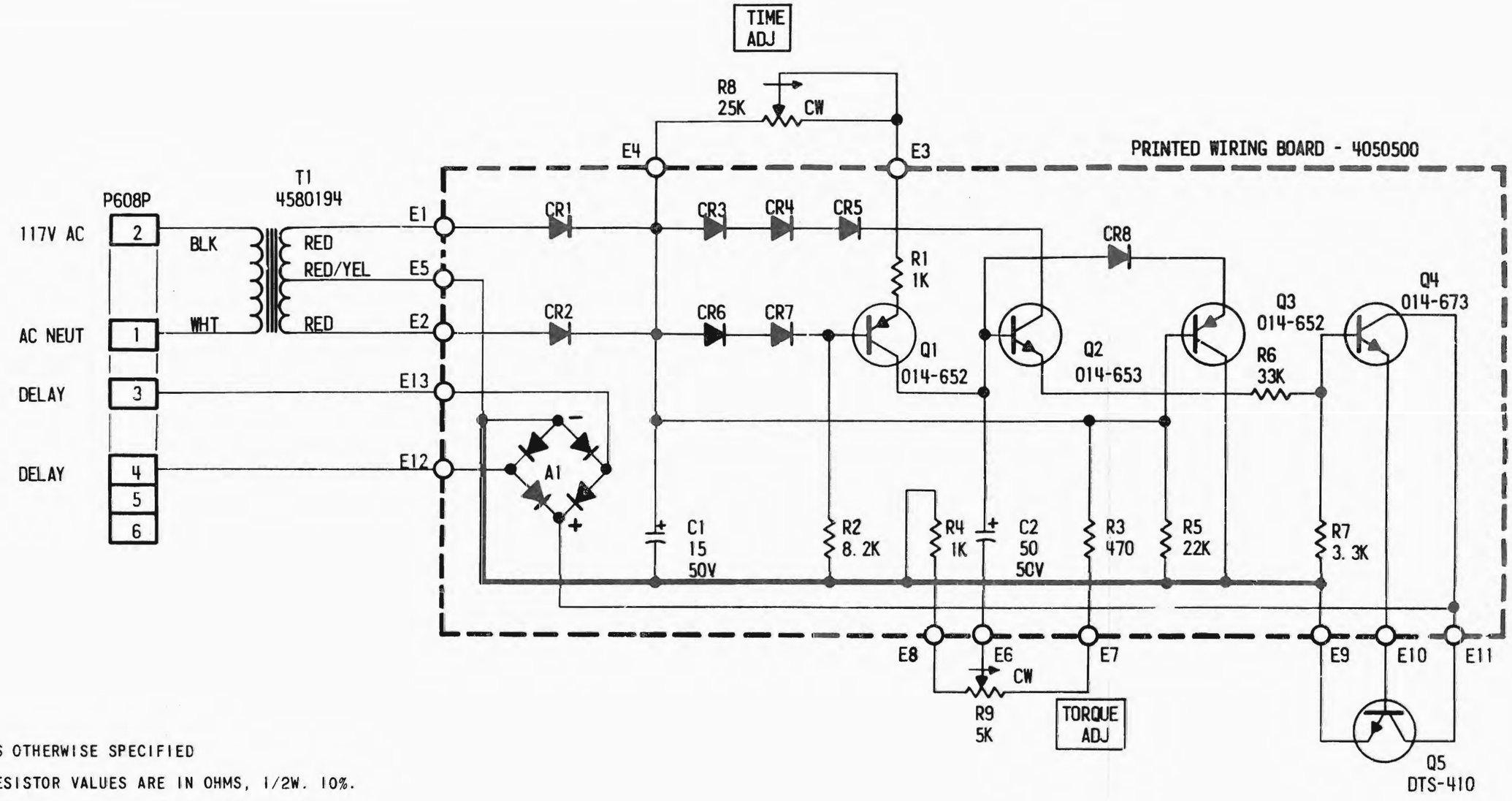
Torque Delay PWA
Assy No. 4050500

ASSEMBLY NO. 4050500D TITLE: TORQUE DELAY PWA SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. 4020303

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
4	013-678	CR1-8	DIODE	1N4385
6	014-652	Q1,3	TRANSISTOR	2N3906
7	014-673	Q4	TRANSISTOR	2N3583
8	014-653	Q2	TRANSISTOR	2N3904
9	031-892	C2	CAPACITOR, 50 UF, 50V	
10	031-250	C1	CAPACITOR, 15 UF, 50V	
11	041-044	R3	RESISTOR, COMP, 470 OHM, 1/2W, 10%	
12	041-048	R1,4	RESISTOR, COMP, 1K, 1/2W, 10%	
14	041-054	R7	RESISTOR, COMP, 3.3K, 1/2W, 10%	
15	041-059	R2	RESISTOR, COMP, 8.2K, 1/2W 10%	
16	041-064	R5	RESISTOR, COMP, 22K, 1/2W, 10%	
17	041-066	R6	RESISTOR, COMP, 3K, 1/2W, 10%	
19	471-061		SCREW, PAN HD, XREC, NO. 4-40 X 0.31	
20	496-004		NUT, KEP	
21	501-156		WASHER, FLAT, NO. 6	
22	581-049	A1	DIODE ASSY	
23	014-793		PAD, MTG, TRANSISTOR	
37	4840188		SCHEMATIC	

VERSION: 4050500-01



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTOR VALUES ARE IN OHMS, 1/2W. 10%.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS, AT INDICATED VOLTAGE.
3. ALL DIODES ARE TYPE 013-678.
4. FOR FIELD SERVICE ONLY:

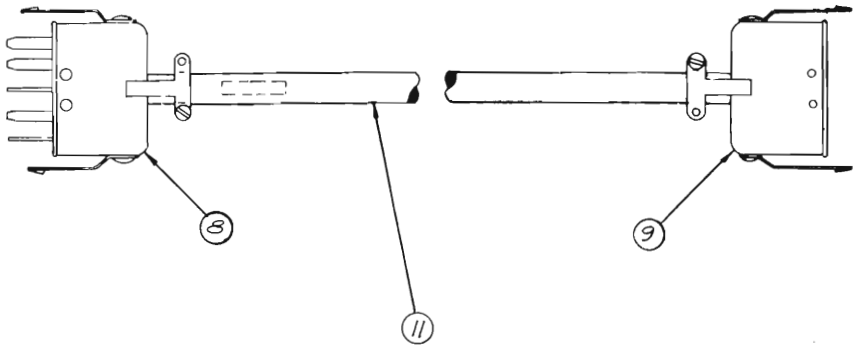
   Q1 & Q3 USE 2N3906.
   Q2 USE 2N3904.
   Q4 USE 2N3583.

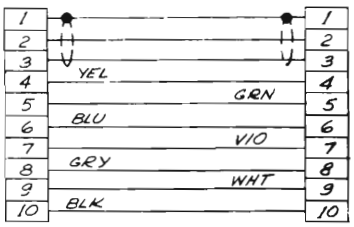
Schematic No. 4840188
Torque Delay PWA

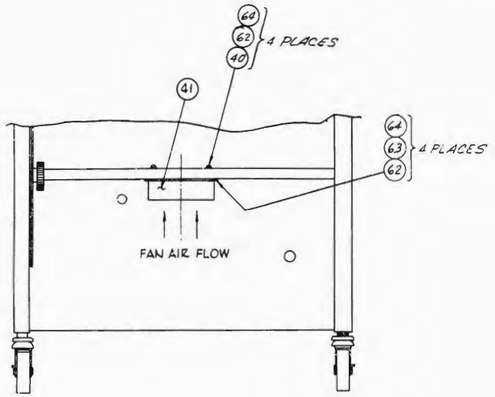
ASSEMBLY NO. 4050442B TITLE: ELECTRONICS INTERCONNECT CABLE ASSY SHEET 1 OF 1

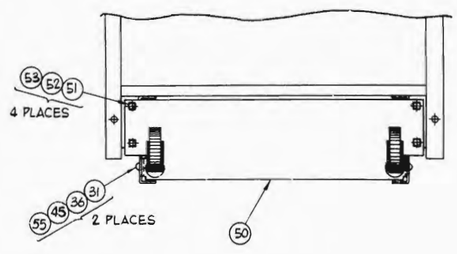
NEXT HIGHER ASSEMBLY NO. 4010205

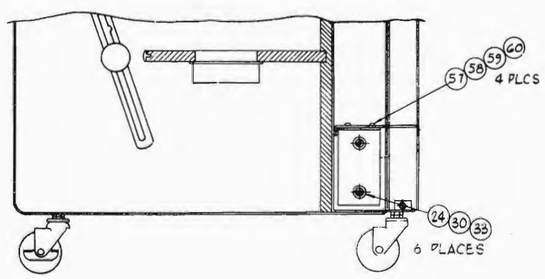
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
8	145-020		CONNECTOR, RECT RECP, 10 CONTACT	
9	144-058		CONNECTOR, RECT PLUG, 10 CONTACT	
11	616-400		CABLE, SHIELDED, GRY, 2 COND, NO. 22 GA, BLK, WHT	
			VERSION: 4050442-01	

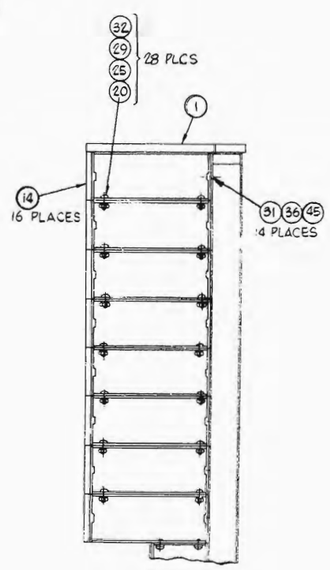


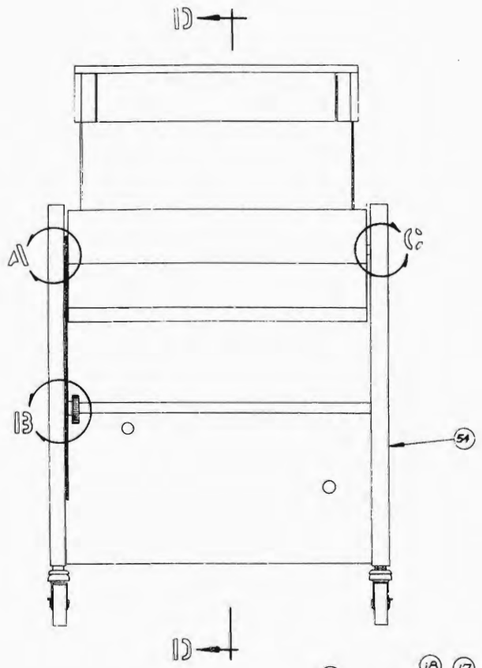


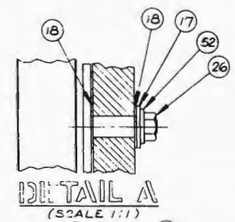


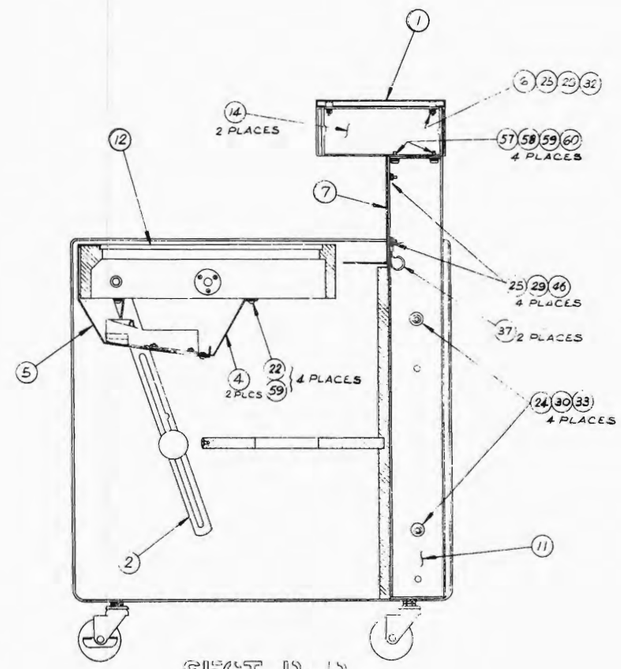












Console Assembly
Assy No. 4020084

ASSEMBLY NO. 4020084S TITLE: CONSOLE ASSY SHEET 1 OF 2

NEXT HIGHER ASSEMBLY NO. 4010205

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, ELECTRONICS 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		RISER, ELECTRONICS	
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, ROUND HD, XREC, NO. 8 X 3/4 LG	
23	478-157		SCREW, WOOD, FLAT 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	492-467		NUT, HEX, 1/4-20	
29	501-009		WASHER, FLAT, NO. 6	
30	501-022		WASHER, FLAT, 5/16	
31	501-070		WASHER, FLAT, NO. 10	
32	502-003		LOCKWASHER, SPLIT, NO. 6	
33	502-105		LOCKWASHER, SPLIT, 5/16	
34	4440303-01		WASHER	
36	502-005		LOCKWASHER, SPRING, NO. 10	
37	302-094		CLAMP, CABLE, NYLON, 7.5 LG	
40	471-470		SCREW, PAN HD, XREC, NO. 6-32 X 1-1/2	
41	591-053		FAN	
42	4150195-01		SCREEN, FAN	
45	471-088		SCREW, PAN HD, XREC, NO. 10-32 X 7/16	
46	502-025		LOCKWASHER, INT TOOTH, NO. 6	
50	4260118-01		BRACKET, CASTER	
51	480-089		BOLT, LAG, SQUARE HD, NO. 1/4 X 2 LG	
52	501-067		WASHER, FLAT, NO. 1/4	
53	502-006		LOCKWASHER, SPRING, NO. 1/4	
54	4040979-04		CONSOLE BASE ASSY	
55	492-011		NUT, HEX, NO. 10-32	
57	471-081		SCREW, PAN HD, XREC, NO. 8-32 X 0.625 LG	
58	492-010		NUT, HEX, NO. 8-32	
59	501-205		WASHER, NO. 8	

ASSEMBLY NO. 4020084S TITLE: CONSOLE ASSY SHEET 2 OF 2

NEXT HIGHER ASSEMBLY NO. 4010205

ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
60	502-004		LOCKWASHER, SPRING, NO. 8	
62	260-025		BUSHING, RUBBER	
63	493-002		NUT, SELF LOCKING, NO. 6-32	
64	501-115		WASHER, PLAIN, NO. 6	

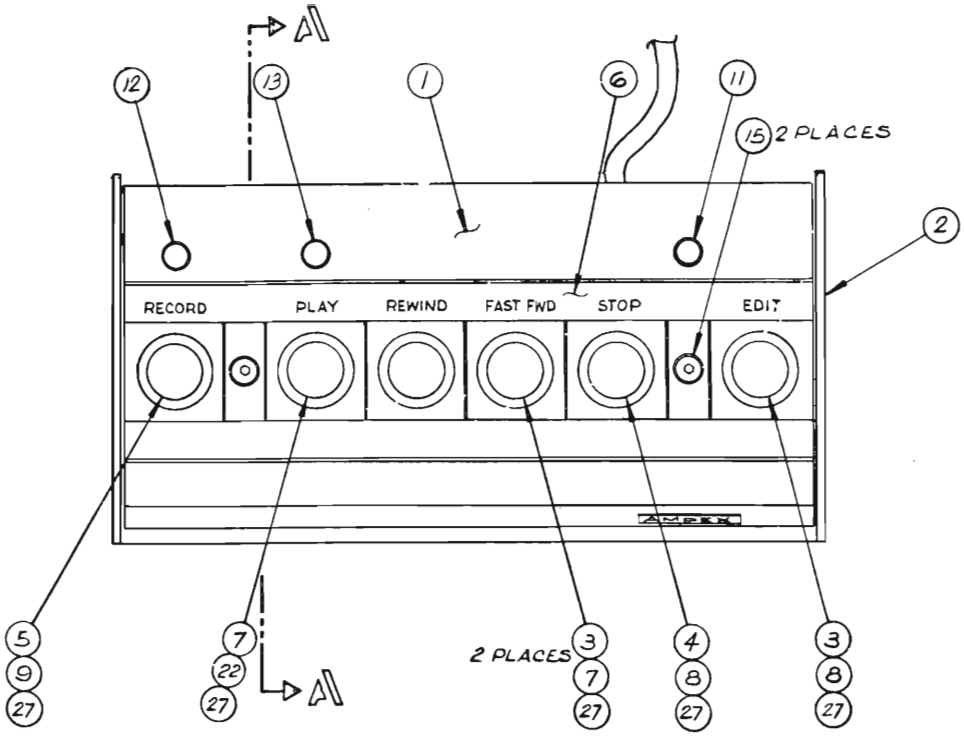
VERSION: 4020084-10

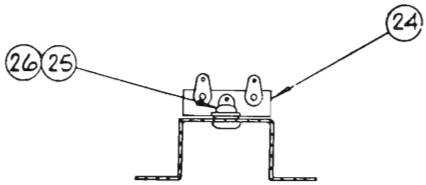
ASSEMBLY NO. 4040979H TITLE: CONSOLE BASE ASSY SHEET 1 OF 1

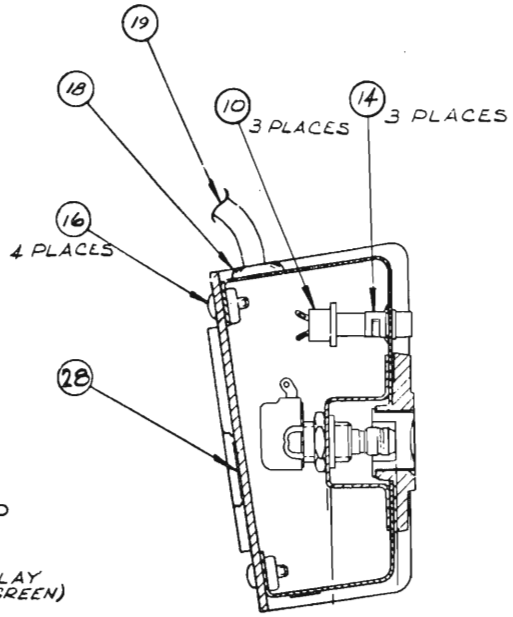
NEXT HIGHER ASSEMBLY NO. 4020084

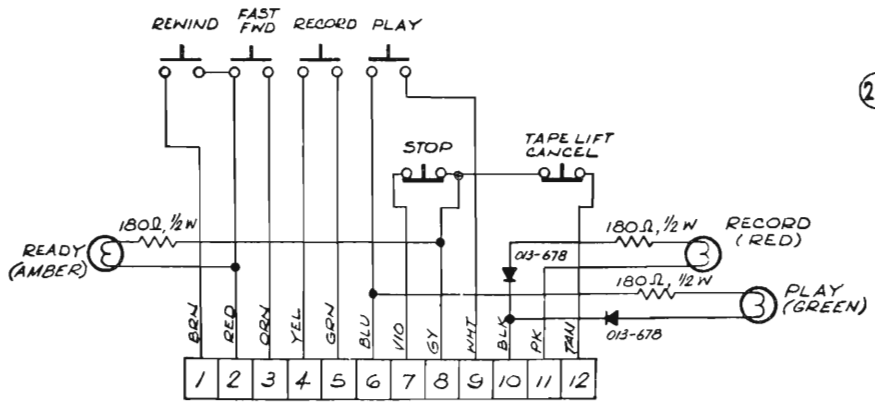
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4150303-01		TRIM, SPREADER	
3	4150325-01		SUPPORT, UPRIGHT, L.H.	
4	4150325-02		SUPPORT, UPRIGHT, R.H.	
8	4210315-01		INSERT, CASTER	
9	4980005-01		MOLDING, SIDE PANEL	
11	4150169-01		CASTER	
12	4150169-02		CASTER, W/BRAKE	
15	478-158		SCREW, WOOD, FLAT HD, NO. 12 X 1-1/2	
17	493-157		NUT, ANCHOR, NO. 1/4-20	
20	4150345-01		PANEL, SIDE, L.H.	
21	4150345-02		PANEL, SIDE, R.H.	
22	4150326-03		SUPPORT, BACK	
23	4150321-03		SPREADER, CONSOLE	
			VERSION: 4040979-04	

Console Base Assembly
Assy No. 4040979









Remote Control Assembly (Optional Accessory)
Assy No. 4010080

ASSEMBLY NO. 4010080E TITLE: REMOTE CONTROL ASSEMBLY SHEET 1 OF 1

NEXT HIGHER ASSEMBLY NO. ACCESSORY

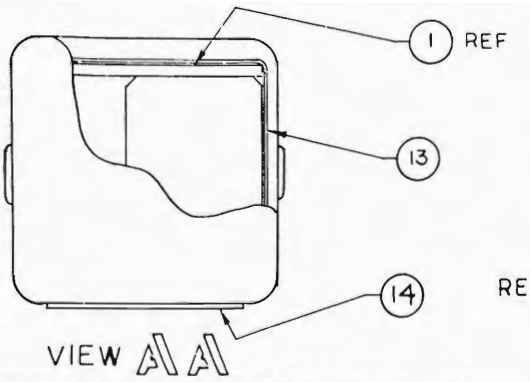
ITEM NO.	AMPEX PART NO.	REFERENCE NUMBER	DESCRIPTION	JEDEC NO. OR MFR PART NO.
1	4040997-02		PANEL ASSEMBLY	
2	4040999-01		BASE ASSEMBLY	
3	4100183-01		PUSHBUTTON, WHITE	
4	4100183-02		PUSHBUTTON, YELLOW	
5	4100183-03		PUSHBUTTON, RED	
6	4110274-01		ESCUTCHEON	
7	4620144-10		SWITCH, PUSHBUTTON	
8	4620144-20		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	

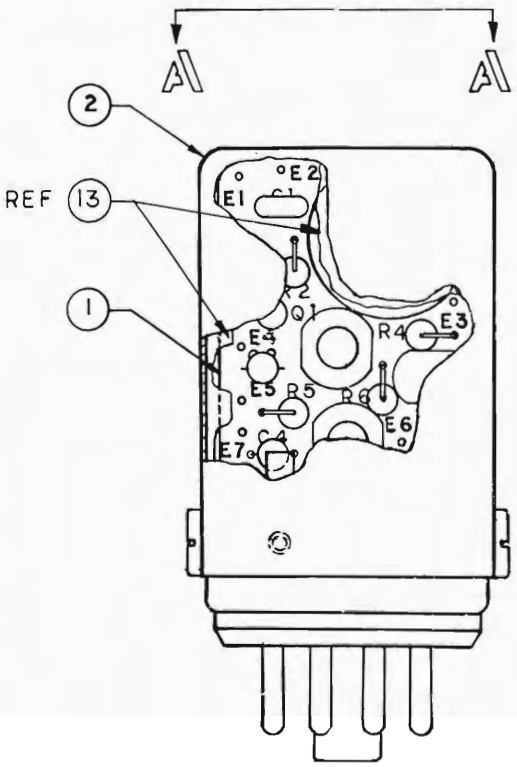
VERSION: 4010080-01

ASSEMBLY NO. 4010066B TITLE: TRANSISTOR MICROPHONE PREAMPLIFIER ASSY SHEET 1 OF 1

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 LEAD LIST

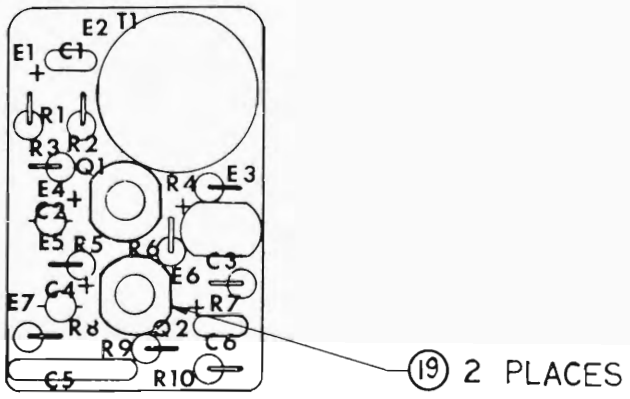
WIRE NO	FROM REF DES	FROM TERM	TO REF DES	TO TERM	ITEM NO. OF LM 4010066
1	P2	8	PWB	E1	11
2	P2	4	PWB	E2	7
3	P2	2	PWB	E3	5
4	P2	3	PWB	E4	6
5	P2	5	PWB	E5	8
6	P2	6	PWB	E6	9
7	P2	7	PWB	E7	10
8	P2	1	ITEM 2	GRD	4

Transistor Microphone Preamp Assembly (Optional Accessory)
Assy No. 4010066

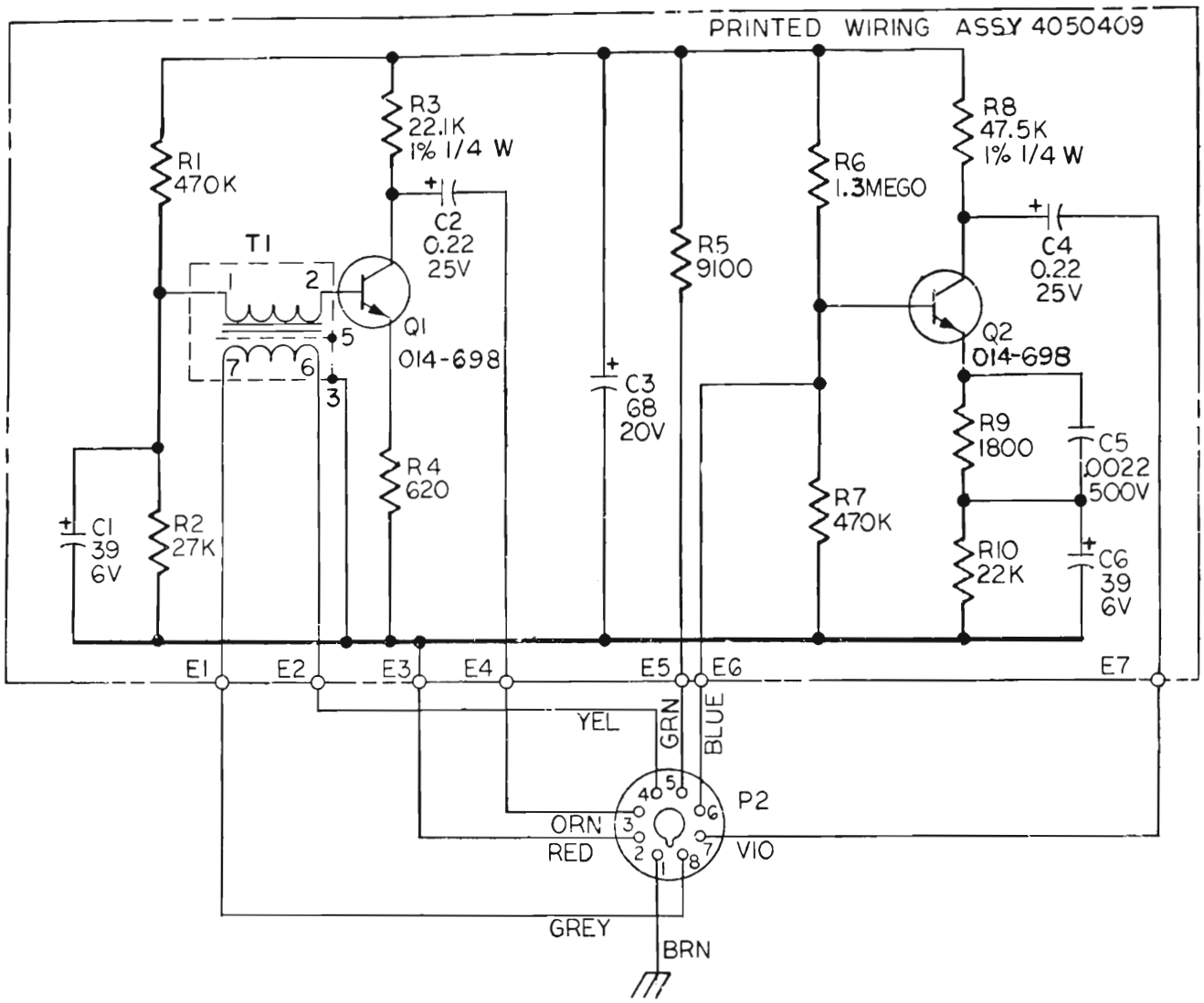
ASSEMBLY NO. 4050409B TITLE: TRANSISTOR MICROPHONE PREAMPLIFIER PWA SHEET 1 OF 1

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	
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 OHMS, 1/2W, 5%	
11	041-377	R6	RESISTOR, CARBON COMP, 1.3M, 1/2W, 5%	
12	041-009	R9	RESISTOR, CARBON COMP, 1800 OHMS, 1/2W, 5%	
13	041-016	R10	RESISTOR, CARBON COMP, 22K, 1/2W, 5%	
14	041-373	R5	RESISTOR, CARBON COMP, 9100 OHMS, 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	



Transistor Microphone Preamplifier PWA
Assy No. 4050409



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. USED	REF. DES. NOT USED
R10	P1
C6	
Q2	
E7	
P2	
T1	

Transistor Microphone Preamplifier PWA
Schematic No. 4840153

AMPEX

AG-440C-8