AMPEX

4890304-02

VOL. I

Master Maker 1000 Recorder/Reproducer

Operation and Maintenance Manual

ISSUED: DECEMBER 1969

CHANGED: OCTOBER 1970

A101A

NOTICE

Only proper use will produce the high performance and reliability for which your Ampex equipment was designed, built, and tested. In order to be sure that you obtain the best possible performance and reliability, please DO NOT:

- INSTALL or CONNECT,
- OPERATE,
- ADJUST or ALIGN,
- MAINTAIN, or
- REPAIR

the equipment without first consulting the applicable portion(s) of the manual.

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Master Maker MM-1000 Tape Recorder/Reproducer

COMMUNICATING WITH AMPEX

SERVICE INFORMATION AND PARTS

FIELD ENGINEERING BULLETIN SERVICE (See note below)

Ampex provides a continuous technical support program for its products. This program is partially implemented through field engineering bulletins, which are published by the Ampex Technical Support Group. Approved modifications, information on special tools and accessories, and improved operating and maintenance techniques are typical of the information distributed in these bulletins.

If the installation of your system or accessory was supervised by an Ampex Field engineer, you will be sent these bulletins automatically. If this is not the case, contact the nearest Ampex field office or write to:

Ampex Corporation
Audio Technical Support Group
401 Broadway
Redwood City, California 94063 USA

SERVICE AND REPLACEMENT PARTS (See note below)

For service and replacement parts, contact your nearest Ampex field office. If the installation of your system or accessory was supervised by an Ampex field engineer, you will be sent information regarding the location of the nearest field office. Alternatively, write to the Technical Support Group at the address shown above.

NOTE

In order for the technical support program to function properly, the user must ensure that his communication is addressed to the proper department, and that it includes the following information, most of which can be obtained from the system identification nameplate on the equipment.

1. System name
2. Model number (including revision number)
3. System number
4. Serial number
5. Power requirements
6. System modifications and special accessories
7. Date of purchase
8. Name and address of your organization
9. Job function to which communication should be addressed
10. Physical location of equipment

COMMUNICATING WITH AMPEX

INSTRUCTION MANUAL CHANGES

Another part of the Ampex program of technical support for its products is the continuous revision and modification of instruction manuals as the equipment is improved or modified. In order to ensure that you always receive this information, write to:

Ampex Corporation
Audio/Video Technical Publications Department
401 Broadway
Redwood City, California 94063 USA

NOTE

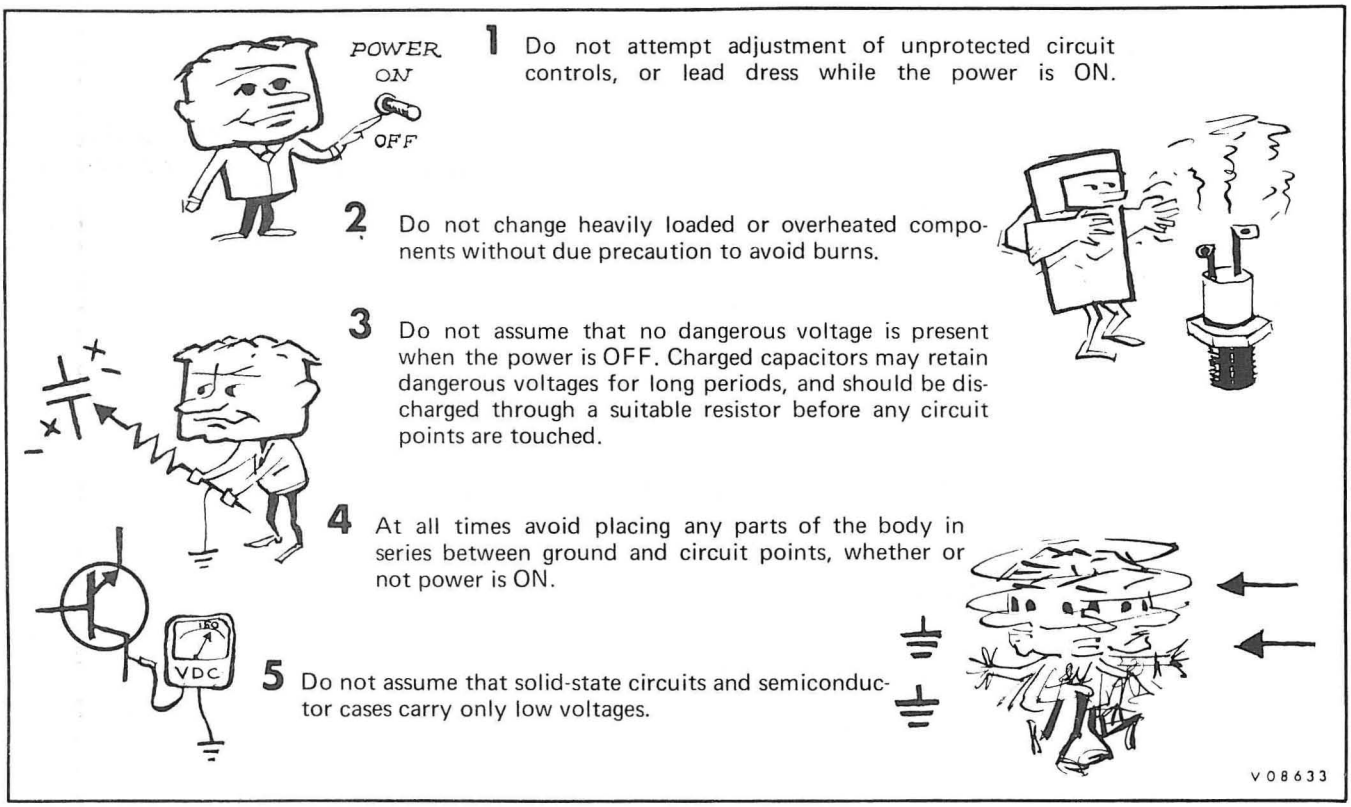
In order to be sure that you always receive information applicable to your equipment, please include the following information when you write to us:

1. System name
2. Model number (including revision number)
3. Serial number
4. Power requirements
5. System modifications and special accessories
6. Approximate date of purchase
7. Name and address of your organization
8. Job function to which communication should be addressed

SAFETY & FIRST AID

Because personnel working with electronic equipment are exposed to the hazard of high voltage, it is imperative that all safety regulations be consistently observed, and that each individual has a clear understanding of basic First Aid methods.

The following typical hazards must be avoided at all times:



1 Do not attempt adjustment of unprotected circuit controls, or lead dress while the power is ON.

2 Do not change heavily loaded or overheated components without due precaution to avoid burns.

3 Do not assume that no dangerous voltage is present when the power is OFF. Charged capacitors may retain dangerous voltages for long periods, and should be discharged through a suitable resistor before any circuit points are touched.

4 At all times avoid placing any parts of the body in series between ground and circuit points, whether or not power is ON.

5 Do not assume that solid-state circuits and semiconductor cases carry only low voltages.

For their own protection, and the protection of others, all electronic personnel should become thoroughly familiar with the approved First Aid treatment of burns and shock. There are three principal degrees of burns, recognizable as follows:

1. A first degree burn reddens the skin
2. A second degree burn blisters the skin
3. A third degree burn chars the flesh and frequently places the victim in a state of shock accompanied by respiratory paralysis.

Respiratory paralysis in the victim can cause death within seconds, by suffocation. For this reason it is imperative that the approved method of artificial respiration be initiated immediately and continued until the victim's breathing is normal.

A muscular spasm or unconsciousness may render the victim unable to free himself of the electric power. If this is the case, turn the power OFF immediately.

CAUTION

DO NOT TOUCH HIM, OR YOU MAY SHARE HIS PREDICAMENT.

If the power cannot be turned OFF immediately, **very** carefully loop a dry rope, article of clothing, length of strong cloth, or a rolled-up newspaper around the victim and pull him free of the power. Carefully avoid touching him or his clothing.

The moment he is clear of the power, place him in a reclining position, cover him with a blanket (or newspapers) to keep him warm, and begin artificial respiration. At the first opportunity, enlist help in the summoning of a doctor. If a doctor cannot be summoned, transport the victim to the doctor, infirmary, or hospital. Be sure that the victim is kept well covered and warm while awaiting professional aid and treatment.

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VOLUME II

SECTION I

DESCRIPTION AND LEADING PARTICULARS

SECTION I

DESCRIPTION

1-1 INTRODUCTION

1-2 The Master Maker MM-1000 Tape Recorder/Reproducer (frontispiece) provides multi-channel audio recording and reproduction. The MM-1000 is available in two standard models: MM-1000-8 and MM-1000-16. The MM-1000-8 provides eight channels recorded on one-inch magnetic tape. The MM-1000-16 uses two-inch tape and a modified transport for 16 channel operation. An eight-channel recorder/reproducer system may be field-converted to a 16-channel system by installing the items in a conversion kit. A 24-channel system using two-inch tape is available on special order, or an existing eight or 16-track system may be factory-converted to serve as a 24-channel recorder/reproducer system.

1-3 The MM-1000 provides the capability to record on a number of channels simultaneously or to listen to a previously recorded channel while recording in synchronization on additional channel(s). When multi-channel recording is complete, any desired blending or balancing for special effects may be accomplished by external mixing of the recorded channel signals. The SEL-SYNC* (self synchronous) feature is made possible by using the record head(s) of the pre-recorded channel as playback head(s). An optional motor drive amplifier may be used to vary capstan speed for special effects. Specifications for the recorder are given in Table 1-1.

1-4 TAPE TRANSPORT (See Figure 1-1)

1-5 The MM-1000 features a rugged transport for precision handling of wide tape. Rigid mounting of tape-handling components ensures permanent precision alignment for tape guiding. Other features include: a tape-motion sensor; scrape-flutter idlers; flutter-reducing capstan flywheel; automatic tape lifter; individual channel Record/Play/Sel-Sync selection. Remote Sel-Sync selection controls and a precision tape timer that indicates tape travel time in hours, minutes, and seconds are available as optional equipment. Refer to Table 1-2 for details and other optional equipment.

1-6 The standard tape speed pair is 7-1/2 - 15 ips, and an optional speed pair of 15 - 30 ips is available. Speed selection is set at a pushbutton switch on the main console control panel. The transport accommodates non-precision and precision tape reels of 8 or 10-1/2-inch diameter. Transport control is maintained through solenoid-actuating pushbuttons. Motion sensing locks out all other controls until the transport comes to a stop during the changing of modes. Momentary high-boost torque is supplied to the takeup turntable for fast starting.

1-7 The capstan is belt-driven from a two-speed synchronous motor. The tape is moved forward when a solenoid-actuated idler wheel presses the tape against the capstan. The drive motor, pulleys, and capstan are a complete assembly.

1-8 Each reel turntable is driven by an ac induction motor, with the two motors turning in opposite directions. Torque adjustments for each turntable motor produce the required differential for correct tape tension. Turntable brakes are

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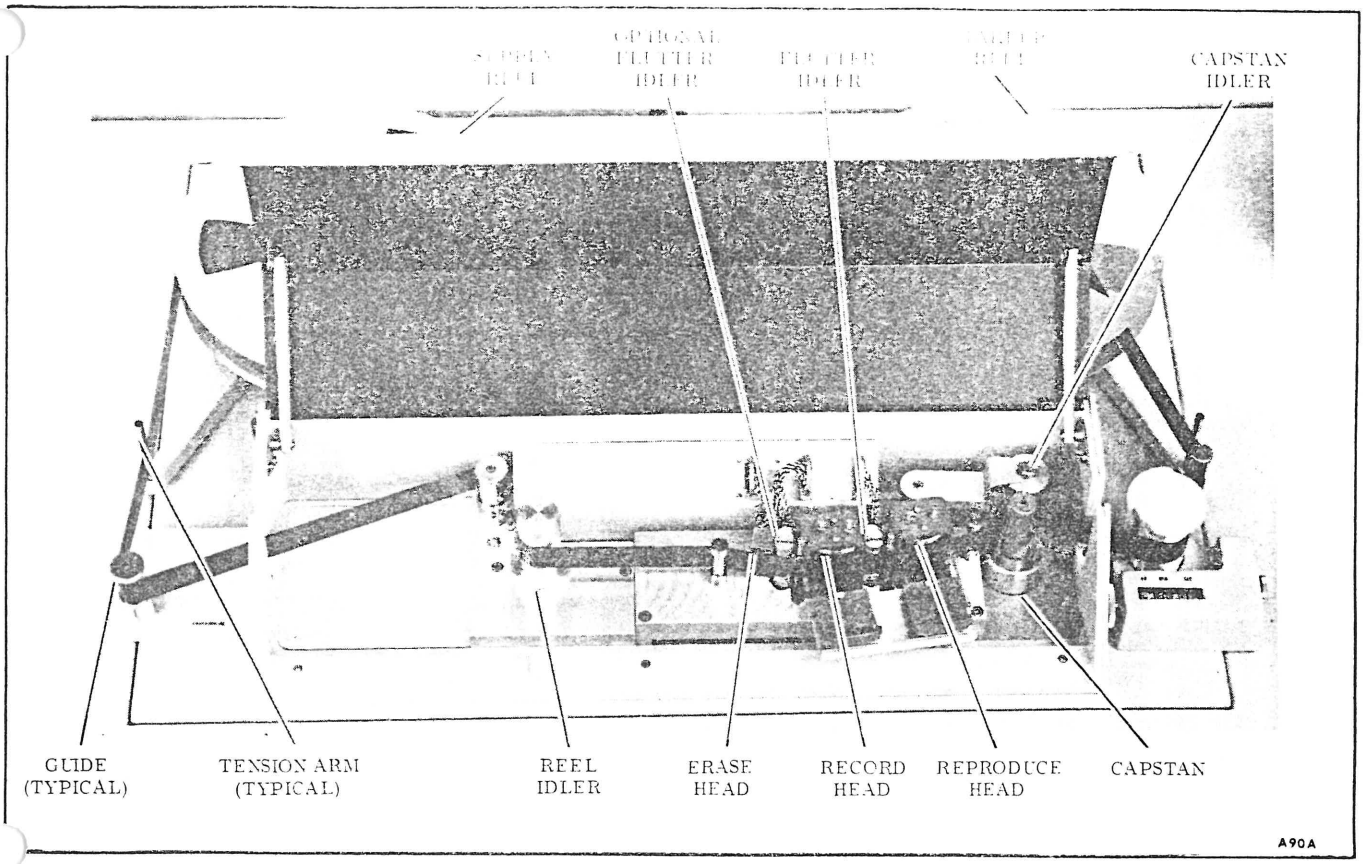


Figure 1-1. Tape Transport

solenoid-operated, with a 3 to 1 differential from the trailing turntable brakes to the leading turntable brakes to avoid tape loops and spillage. When the tape is threaded on the machine, both brakes are applied in the stop mode. The brakes may be released by moving either tension arm outward, or by actuating a footswitch, which is furnished as optional equipment.

1-9 High-frequency flutter is eliminated by precision scrape-flutter idlers mounted beside the heads. A solenoid-actuated tape lifter automatically removes the tape from contact with the heads and flutter idlers during the fast forward and rewind modes. For fast-mode editing, override of the tape lifter is provided under local or remote control.

1-10 Tape transport operating pushbutton controls on the main control panel are: PLAY, FAST FORWARD, REWIND, RECORD, and STOP. Other control panel switches are SPEED SELECTION, LOCAL/REMOTE, TAPE LIFTER OVERRIDE, PLAY/SYNC and an individual CHANNEL SELECTOR for RECORD, NON-RECORD, or SEL-SYNC modes.

1-11 RECORD/REPRODUCE ELECTRONIC UNIT (Figures 1-2 and 1-3)

1-12 One record/reproduce electronic unit is required for each recorder/reproducer channel. The record/reproduce unit consists of an electronic chassis with three plug-in printed-circuit-board modules.

1-13 Front panel controls are: RECORD LEVEL, REPRODUCE LEVEL, RECORD CALIBRATION, REPRODUCE CALIBRATION, RECORD SELECTOR, and OUTPUT SELECTOR. Pilot lamps light to indicate that the associated channel is ready to record or is recording. A vu meter monitors levels from the record, reproduce, and bias

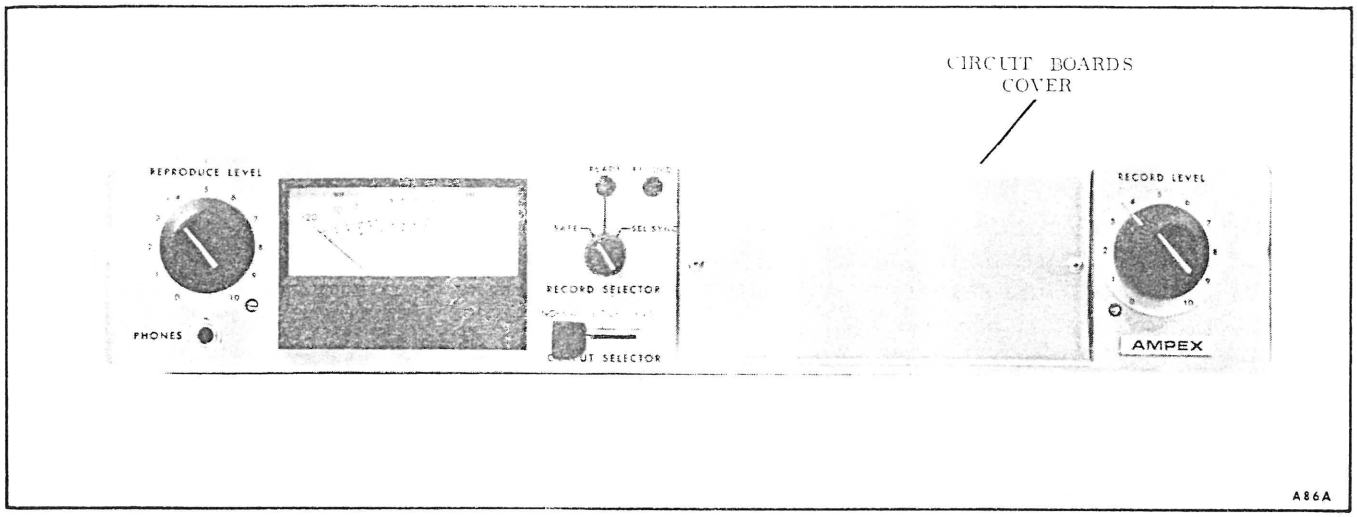


Figure 1-2. Record/Reproduce Unit

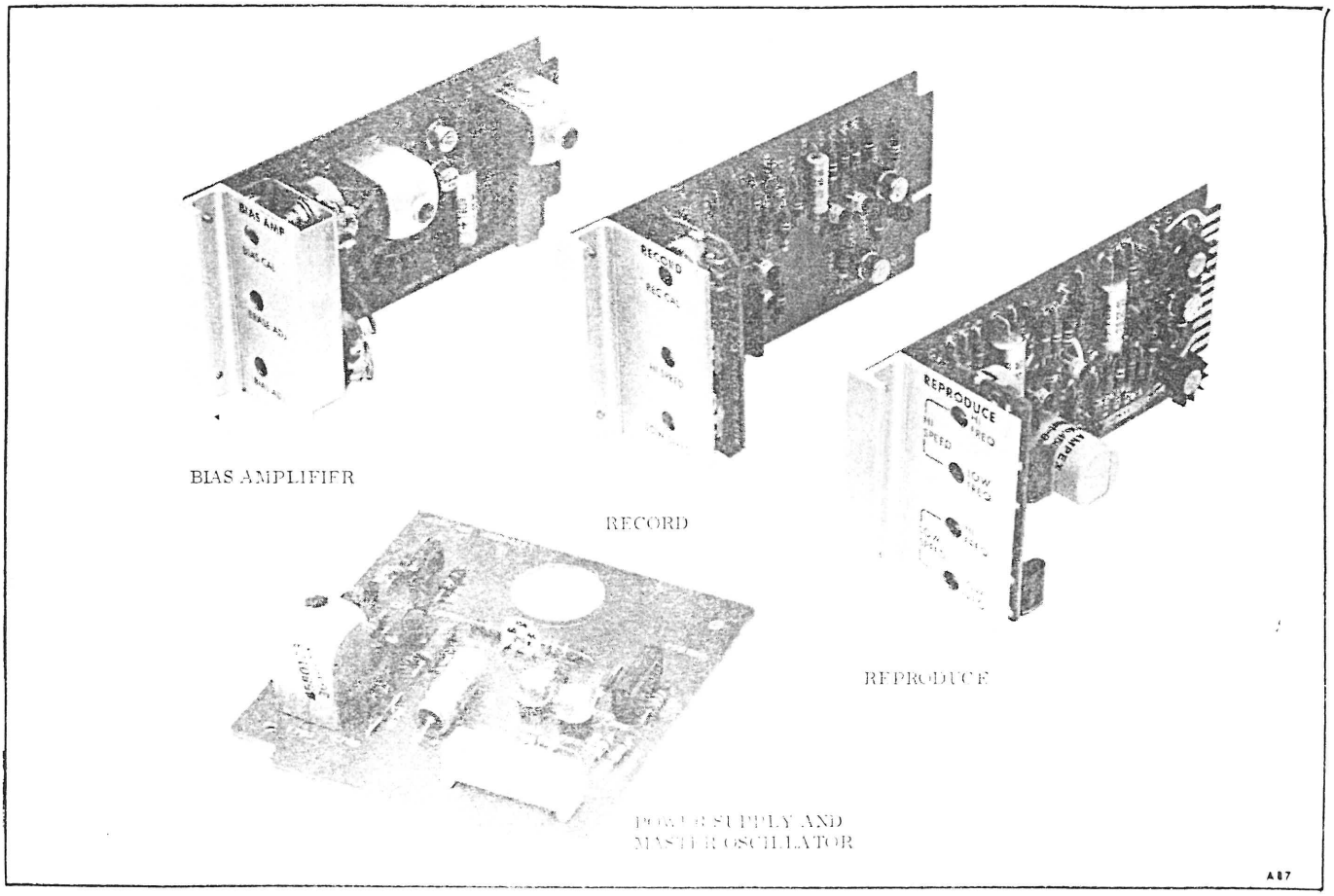


Figure 1-3. Printed Circuit Boards

plug-in modules. The modules, removable through a front panel cutout, are guided to printed-circuit-board receptacles when inserted in the chassis.

1-14 The three removable modules provide amplification for record, reproduce, and bias. The record and reproduce modules each contain an equalization printed-circuit-board receptacle that is mounted at right angles to the main boards, so the board alignment controls are accessible at the module face. Equalization is automatically switched (according to the tape speed selected) by a solid-state switching circuit.

1-15 One regulated 39-volt power supply is provided for each four channels of record/reproduce electronics. The regulator printed wiring board in one of the power supplies also contains the master oscillator for bias and erase use.

1-16 Receptacles for interconnect cables, accessories, and input/output-signal cables are on the back panel of the chassis. The panel also has a line-termination switch (as an alternate termination during maintenance procedures), one Sel-Sync adjustment, a plug-in record relay, and a power fuse. A supplied dummy plug is inserted in the INPUT ACCESSory socket (on the back panel) during shipment and when an unbalanced-line input is used. A supplied bridging transformer is inserted in the socket for a balanced line input (input impedance with the transformer is 20,000 ohms).

1-17 Internal strapping provides either a +8 dBm, or a +4 dBm, nominal output level into a 600-ohm line. The equipment is strapped for a +4 dBm output, which can easily be changed when desired.

1-18 REPRODUCE ELECTRONIC MODULE (Figure 1-4)

1-19 The plug-in reproduce-and-equalizer printed circuit board in the reproduce module is the same as the one in the record/reproduce unit. Each module contains the complete circuitry for one reproduce channel.

1-20 A screwdriver-slot reproduce-level control is on the front panel of each module. The back panel contains the reproduce-head input receptacle, the line-output receptacle, a monitor jack, a line-termination switch (for use during maintenance), and a captive power-cable for connection to the transport power supply box.

1-21 HEAD ASSEMBLY (Figure 1-5)

1-22 The three tape heads, erase, record and reproduce, are mounted in the forward tape path in the order mentioned above. The record and reproduce head stacks are magnetically shielded with mu-metal. All heads are mounted, with the tape guides and idlers, on a precision-milled removable aluminum block for simple changing of complete head assemblies. Two scrape-flutter idlers are mounted on the eight-channel assembly. A single scrape-flutter idler is used on the 16-channel assembly. The leads from each head stack are terminated in a single grip-handle connector plug.

1-23 OPTIONAL EQUIPMENT

1-24 Available optional equipment is listed in Table 1-2. If a balanced-line or microphone input is to be used, the dummy plug (in the INPUT ACCESS socket) must be replaced with one of these accessories:

a. Bridging-input transformer (providing unity gain with an input of 20,000 ohms).

b. Matching input transformer (providing a gain of approximately 14 dB).

c. Microphone preamplifier (for recording with a microphone).

1-25 The preamplifier is a two-stage solid-state unit that is wired so the RECORD LEVEL control is connected between the two stages, making it a variable-gain device usable with a wide range of microphones.

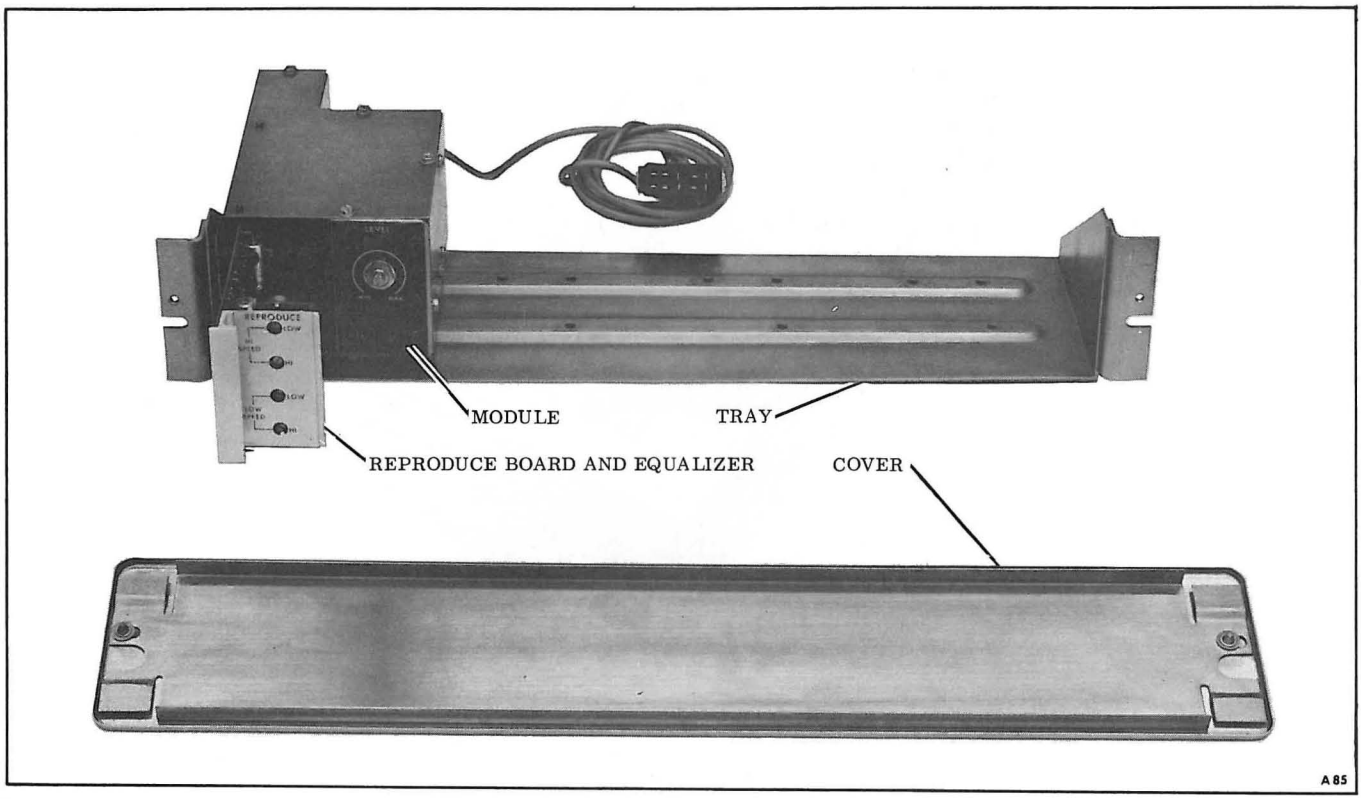


Figure 1-4. Reproduce Electronic Module

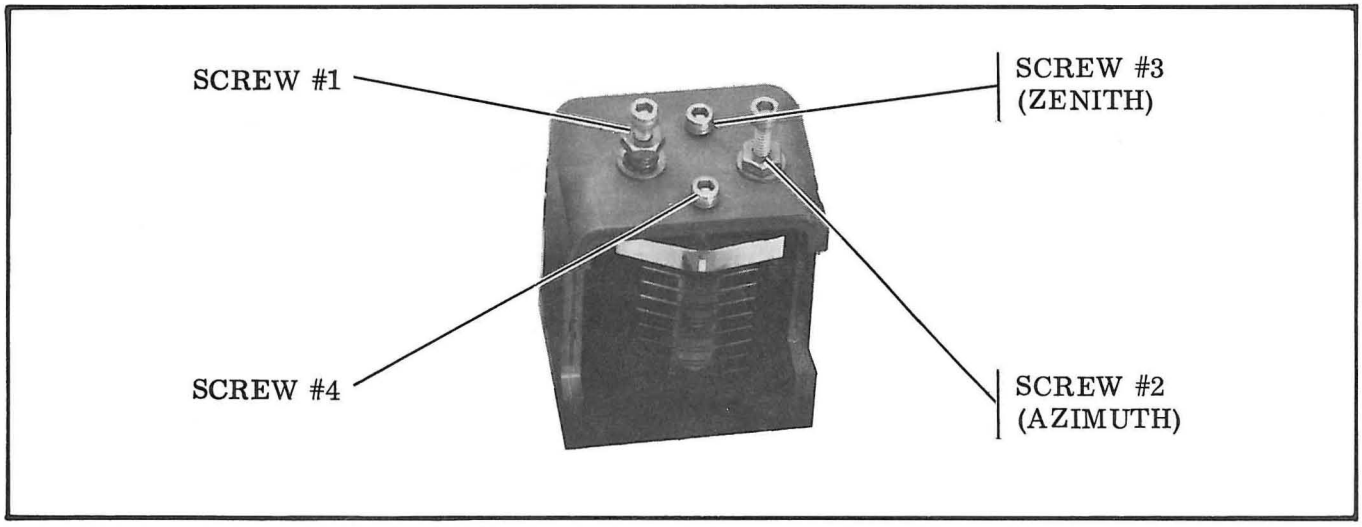


Figure 1-5. Head Assembly

1-26 SPECIFICATIONS

1-27 Specifications for significant parameters and features of the MM-1000 Recorder/Reproducer and Recorder are given in Table 1-1.

Table 1-1. Specifications

PARAMETER	SPECIFICATION
Tape Widths	1 inch for 8-track systems 2 inch for 16- or 24-track systems
Tape Speeds	7.5 and 15 ips (15 and 30 ips available on order)
Reel Size	NAB hub up to 10-1/2 inch diameter
Inputs	100 KΩ unbalanced; convertible to 20 KΩ balanced, with optional bridging transformer. Accepts line levels from -17 dBm to produce recommended operating level
Outputs	600 ohms balanced or unbalanced with nominal output levels of +4 dBm or +8 dBm
Equalization	Automatically switched with speed change, using NAB plug-in equalization circuits (CCIR plug-in circuits available on order)
Electronics	All electronics are solid-state. Plug-in printed circuit boards for record, reproduce, equalization, and bias amplifiers
Power Supplies	Regulated, 24 vdc, and 39 vdc
Electronic Overload Margin	Record Amplifier: record level (before clipping) is 28 dB or more above normal operating level
Overall Frequency Response	15 ips: ±2 dB, from 30 Hz to 18 kHz 7.5 ips: ±2 dB, from 40 Hz to 15 kHz
Signal-to-Noise Ratio	7.5 or 15 ips: 60 dB or better for 8 and 16 channels, 55 dB min for 24 channels (peak record level to unweighted noise at 30 Hz - 18 kHz). Includes bias, erase and playback amplifier noises. (Using Ampex 404 tape, or equivalent.)
Third Harmonic Distortion	7.5 or 15 ips: Below 1.1% at normal operational level
Bias/Erase Frequency	150 kHz nominal

Table 1-1. Specifications (Continued)

PARAMETER	SPECIFICATION
Erase Capability	At least 68 dB on channel(s) selected
Sel-Sync Response	±5 dB from 50 Hz to 12 kHz
Flutter	15 ips: below 0.08% rms 7.5 ips: below 0.1% rms Percentage of total flutter is measured according to ASA 257.1-1-1954, in a band 0.5 to 200 Hz, while reproducing an Ampex flutter test tape (flutter on test tape less than 0.03%).
Crosstalk	-50 dB minimum for 8, 16 and 24 channels at 500 Hz
Timing Accuracy	±0.1% (1.8 seconds, in a 30-minute record time) for tape recorded, rewound, and reproduced on the same unit; otherwise, ±0.2%
Tape Position Index	Reads hours, minutes and seconds, with repeat accuracy of ±0.1% at 15 ips
Timing Reference	AC line power is timing standard. Optional motor-drive amplifier allows capstan drive timing from external frequency standard, or from internal variable-frequency oscillator.
Heads	Eight-track 1-inch tape stacks are adjustable in azimuth, zenith, and height. 16- and 24-stack heads are non-adjustable precision-mounted.
Start Time	Full speed (7.5 or 15 ips) within 0.5 seconds
Rewind Time	2.0 minutes, for 10.5-inch reel of 1.5-mil tape
Power Requirements, 8, 16, or 24-Channel Systems	105 - 125 vac, 60 Hz. (50 Hz units are available on special order.) MM-1000-8 0.65KVA MAX. MM-1000-16 0.85KVA MAX. MM-1000-24 1.10 KVA MAX. } without accessories
Dimensions, 8 or 16-Channel Systems	Height: 42.5" (plus overbridge, total 65 inches) Width: 42.3" Depth: 27.5" Weight: 8 channel - approximately 500 lbs 16 channel - approximately 650 lbs 24 channel - approximately 850 lbs

Table 1-2. Optional Equipment

DESCRIPTION		AMPEX NO.
Remote Control Box	8 channel fixed speed	4010153-01
	8 channel variable speed	4010153-02
	16 channel fixed speed	4010153-03
	16 channel variable speed	4010153-04
	24 channel fixed speed	4010153-05
	24 channel variable speed	4010153-06
Head Assemblies	8 track	4940177-01
	16 track	4940178-01
	24 track	4940179-01
Extender Card Assemblies for	Reproduce Module	4020151-01
	Record Module	4020152-01
	Bias Amplifier	4020153-01
	CCIR Equalizer Module	4020269-03
	+39 Volt DC Power Supply	4020154
Microphone Preamplifier		4010066-02
Line Balancing Transformer		4580200-02
Impedance Matching Transformer		4850200-02
Electronic Tape Timer		1805179-01
Capstan Motor Drive Amplifier		4940147-01
Sync Lock		4940161-02
Sync Lock with Capstan Motor Drive Amplifier		4940161-02 4940147-01
Conversion Kit	8 to 16 channels	4940150-01
	16 to 24 channels	4940150-03
Test Tapes		
NAB, 1 inch	15 ips 8 track	4690006-01
	15 ips Full track	4690005-01
	7-1/2 ips 8 track	4690007-01
CCIR. 1 inch	15 ips 8 track	4690020-01
	15 ips Full track	4690031-01
	7-1/2 ips 8 track	4690021-01
	7-1/2 ips Full track	4690032-01

Table 1-2. Optional Equipment (Continued)

DESCRIPTION		AMPEX NO.
Test Tapes (Continued)		
NAB, 2 inch	15 ips 16 track	4690018-01
	15 ips Full track	4690024-01
	7-1/2 ips 16 track	4690022-01
	7-1/2 ips Full track	4690025-01
CCIR, 2 inch	15 ips 16 track	4690033-01
	15 ips Full track	4690035-01
	7-1/2 ips 16 track	4690034-01
	7-1/2 ips Full track	4690036-01

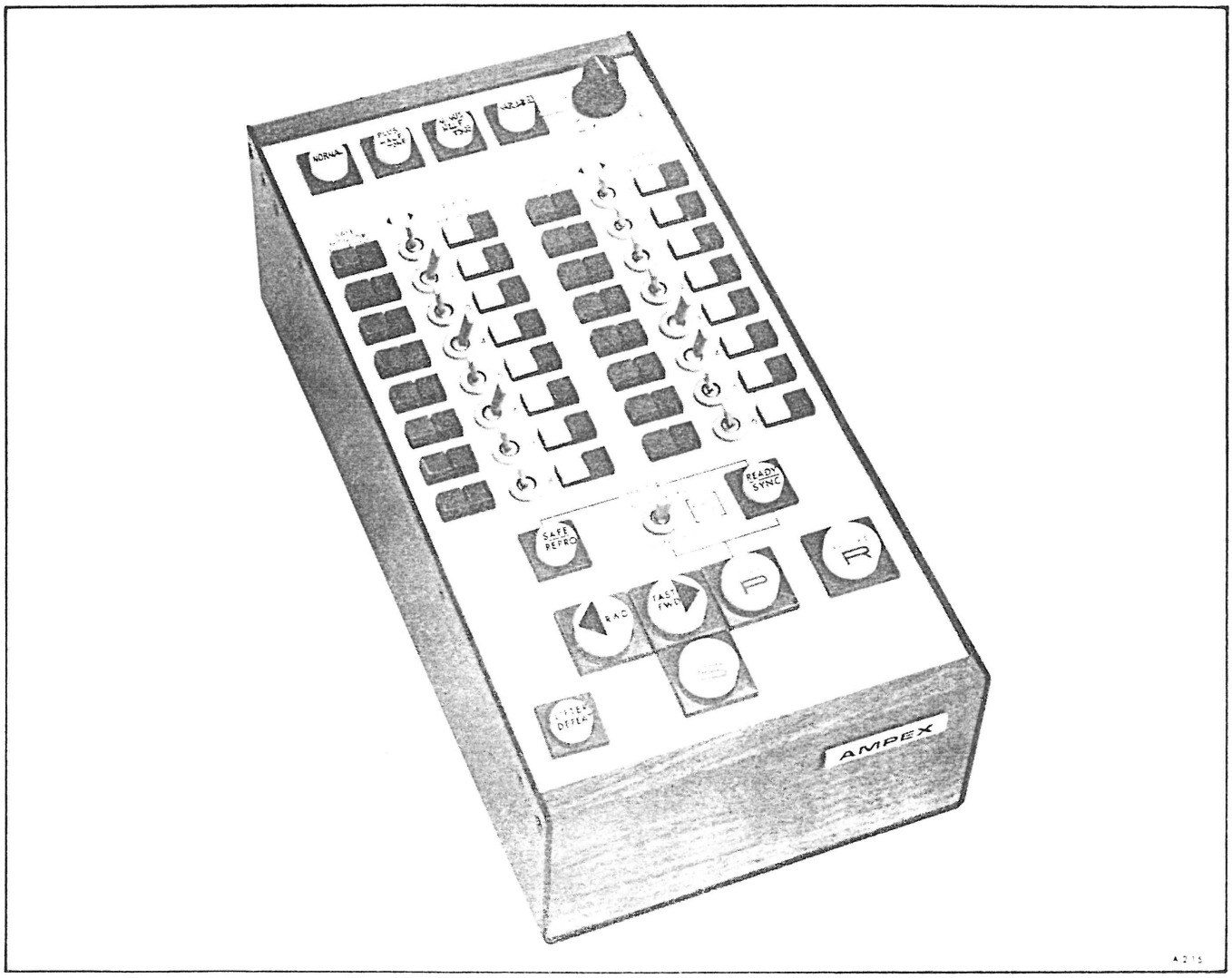


Figure 1-6. Remote Control Box

SECTION II

INSTALLATION

SECTION II

INSTALLATION

2-1 SITE

2-2 The installation site should be free of sources of strong electrostatic or electromagnetic fields which could interfere with, or degrade, the magnetic recording. The atmosphere should be relatively dust free, with temperature from 32°F to 131°F (0°-55°C) and relative humidity 10 to 90 percent. The floor area required is 27.5 by 42.3 inches plus access clearances. Other physical data on the system is given in Table 1-1.

2-3 UNPACKING

2-4 Examine equipment for any sign of damage, and check the packing list to determine that all items have been received. Immediately report any damage or shortage to the Ampex distributor and the transportation company.

NOTE

The three plug-in electronic modules, are shipped mounted behind the small front panel of the electronic assembly and the oscillator board is mounted in one power supply box (in back of the unit).

2-5 Remove all materials (adhesive tape, rubber bands, etc.) used to secure tape-handling and other moving components during shipment.

2-6 Accessory equipment ordered with the MM-1000 is shipped assembled to the system with connections completed between the assemblies. An exception is the MDA unit which is usually shipped uninstalled.

2-7 PREPARATION FOR USE

2-8 LINE TERMINATION

2-9 The two-position LINE TERMINATION switch (see Figure 2-1), is usually at OFF, except during test or adjustment procedures. However, if the equipment is to be used to drive a high-impedance load (2000 ohms or more), the switch must be in the ON position.

2-10 RESTRAPPING OUTPUT (See Figure 2-2)

2-11 Record/reproduce units are delivered with the output strapped to provide a +4 dBm operating-level output into a 600-ohm line. If a +8 dBm operating-level output is required, the circuit can easily be restrapped as follows:

a. Remove the top cover from electronic unit.

b. On the right panel, terminal strip TB3 (toward the back of the assembly) has a jumper wire between terminals 1 and 2. Disconnect the jumper end from terminal 1, and reconnect it to terminal 3.

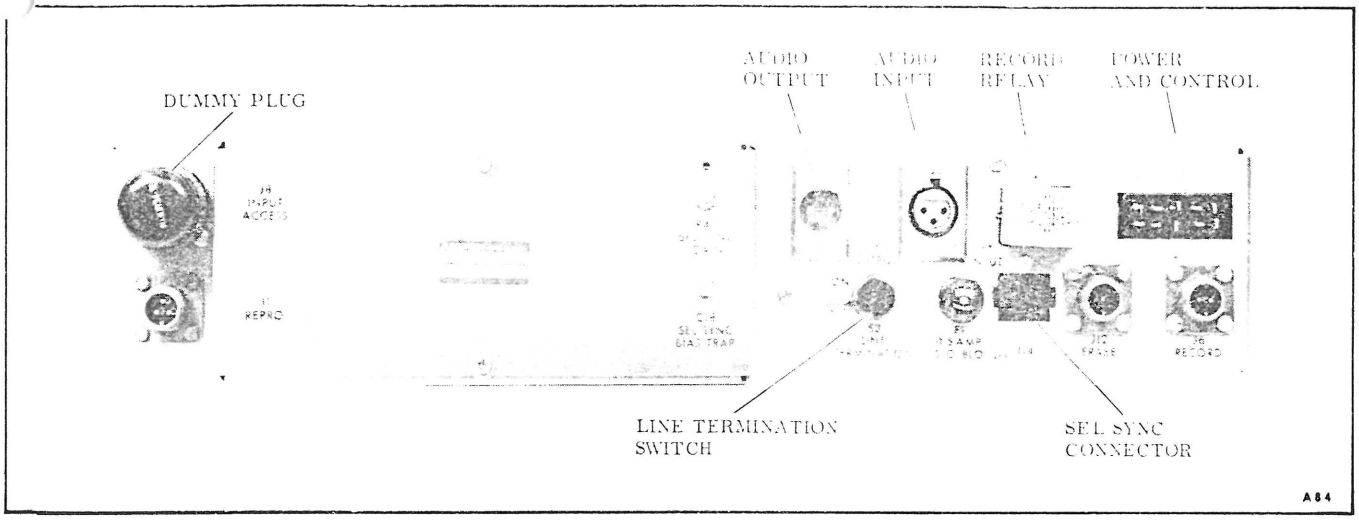


Figure 2-1. Electronics Unit (Rear)

c. If the operating level output is affected, recalibrate the record, reproduce, and bias levels according to paragraphs 5-65 through 5-71.

2-12 CONNECTING POWER

2-13 Connect the power cable from AC POWER receptacle on the rear of the machine to the power source.

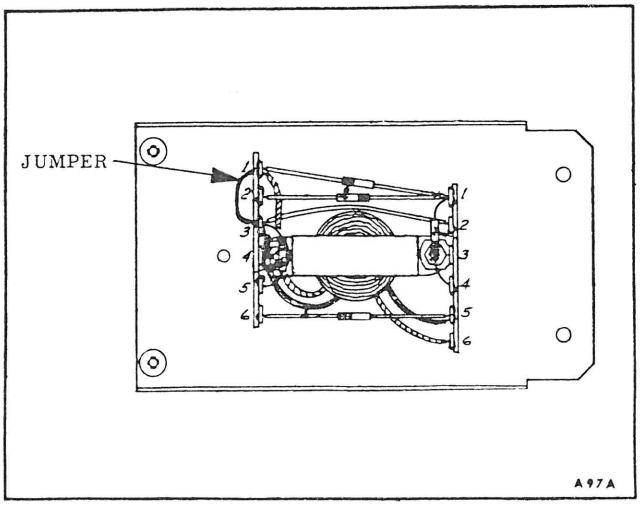


Figure 2-2. Electronics Unit (Right Side Panel)

2-14 INSTALLING ACCESSORIES OR DUMMY PLUGS (See Figure 2-1)

2-15 INPUT TRANSFORMER OR MICROPHONE PREAMPLIFIER. The equipment is shipped with a dummy plug (4952338) installed in the INPUT ACCESS receptacle on the back panel of each record/reproduce unit. This plug provides correct input for an unbalanced line with input impedance 100,000 ohms. For a balanced-line input, remove the dummy plug and insert the bridging input transformer in the accessory socket; input impedance with the transformer is 20,000 ohms. For a balanced-line input with the optional matching input transformer (4850200-02), gain is approximately 14 dB and input impedance is 600 ohms.

2-16 To record from a microphone, the optional microphone preamplifier (4010066) must be installed in the accessory socket.

2-17 REMOTE CONTROL UNIT. Except for the speed function, all modes can be controlled from a remote location by the optional Ampex remote control unit. This unit is plugged into the REMOTE CONTROL receptacle on the rear of the unit.

2-19 The remote control can disconnect the automatic tape-lifting mechanism so

that cueing can be quickly accomplished in the fast-winding modes.

2-21 CHECKING CABLES AND COMPONENTS

2-22 Check and secure all connectors and items that could vibrate loose during shipment, especially the following:

a. Captive cables from all three motors and each power supply to their connectors.

b. Record/reproduce unit circuit boards behind the small front panel. Especially check that the equalizer boards in the front of the record and reproduce boards are firmly in position.

c. Reproduce modules in a tray behind the solid-front cover. Especially check plug-in board in each module.

d. Fuses: one on the relay power supply, one in the relay box, one on each power supply box, and one on the rear panel of each record/reproduce unit or reproduce module; also check that fuses are intact.

e. Plug-in relays: one in the relay panel, and one on each record/reproduce unit back panel.

f. The circuit board in each power supply box in the back of the console.

MAKE SURE THAT 117 VAC POWER CABLE PLUG GROUND CONTACT (GREEN) IS CORRECTLY GROUNDED.

SECTION III

OPERATION

SECTION III

OPERATION

3-1 CONTROLS AND INDICATORS

3-2 Controls and indicators on the master control panel are described with their functions in Table 3-1. Table 3-2 describes the Electronics Unit and Table 3-3 describes the Breaker Panel. The controls are shown in Figures 3-1, 3-2 and 3-3.

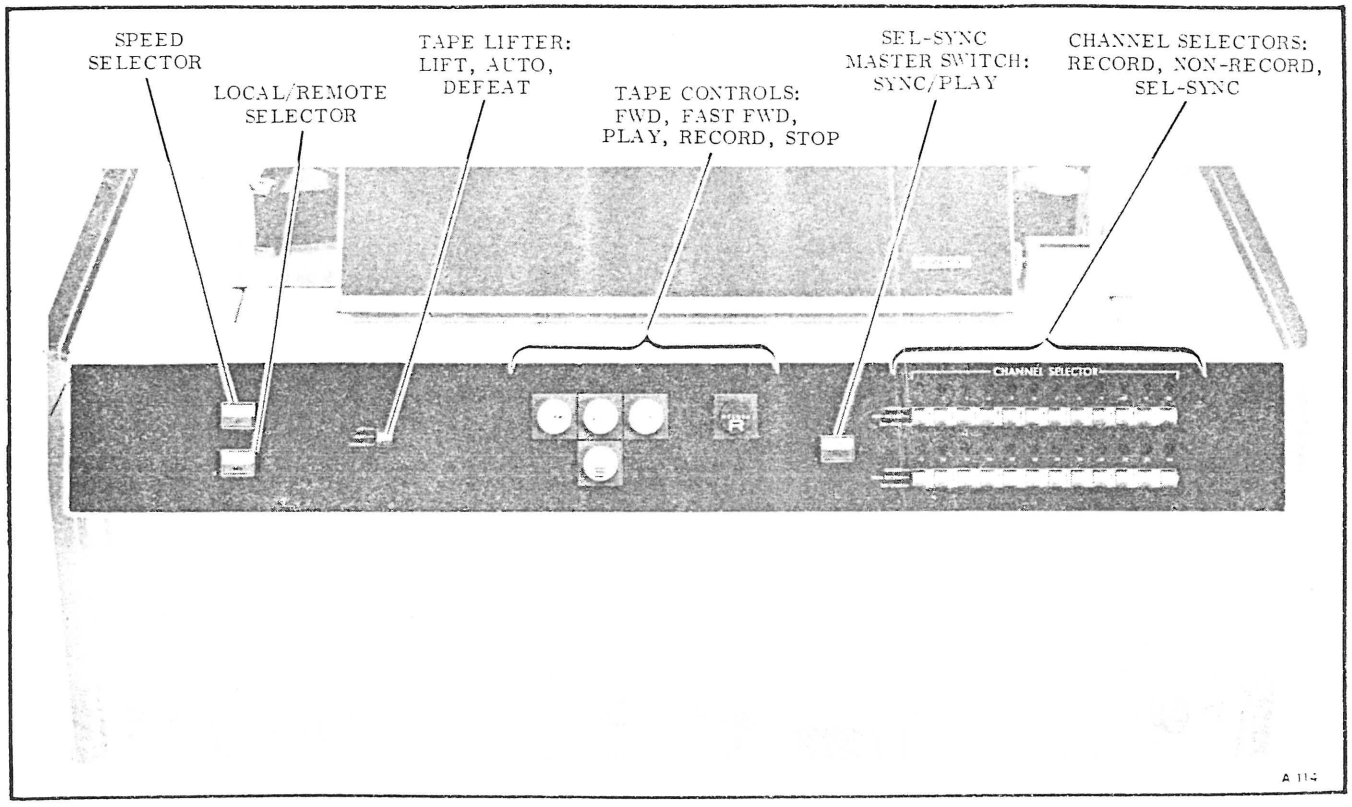


Figure 3-1. Master Control Panel

Table 3-1. Master Controls and Indicators

DESCRIPTION	FUNCTION
Speed Selector pushbutton	Alternately selects high or low tape speeds (the applicable half of the button lights).
LOCAL/REMOTE pushbutton	In the LOCAL mode. all controls are operated from the Console Master Control Panel. In the REMOTE mode. the console functions are controlled from the Remote Control Box.
Tape Lifter switch	Controls tape lifter mode:
LIFT (top position)	Actuates lifter to move tape away from heads (in any mode).
AUTO (center	When the FAST FWD or REWIND buttons are pressed, the lifter automatically moves the tape away from the heads until the tape stops. The lifter also lifts the tape when switching from RECORD to STOP (to prevent an electrical "pop" on the tape.
DEFEAT (bottom)	Defeats AUTO and LIFT positions. Tape remains in contact with play and record heads in the REWIND and FAST FORWARD modes.
RECORD pushbutton	When pressed simultaneously with PLAY pushbutton, sets the system to the Record mode for channels with the CHANNEL SELECTOR(S) set at RECORD.
REWIND pushbutton	Sets supply turntable to the fast-winding speed.
FAST FWD pushbutton	Sets takeup turntable to the fast-winding speed.
PLAY pushbutton	Sets the transport to the reproduce mode.
STOP pushbutton	Stops the transport from any mode.
SYNC/PLAY	Alternately selects the Play or Sync mode (the applicable half of the button lights). When the transport is not in Record mode, all channels set at NON-RECORD operate in the mode set by this switch.

Table 3-1. Master Controls and Indicators (Continued)

DESCRIPTION	FUNCTION
CHANNEL SELECTORS (3-position switches)	Selects the operation mode for each channel
RECORD (top)	Sets desired channels to Ready or Record modes; then when the transport is in Record mode, these channels operate in Record. The available output signals in the Stop, Playback, or Record Mode are listed in Table 3-4 or 3-5.
NON-RECORD (center)	Sets desired channels to the Safe (Non-Record) or Play mode when the SYNC/PLAY switch is at PLAY. When the transport is in Play mode, the channels operate in Play. When the SYNC/PLAY switch is at SYNC, these channels operate in Sync mode.
SEL-SYNC (bottom)	Sets desired channels in Sel-Sync mode, regardless of the setting of the SYNC/PLAY selector.

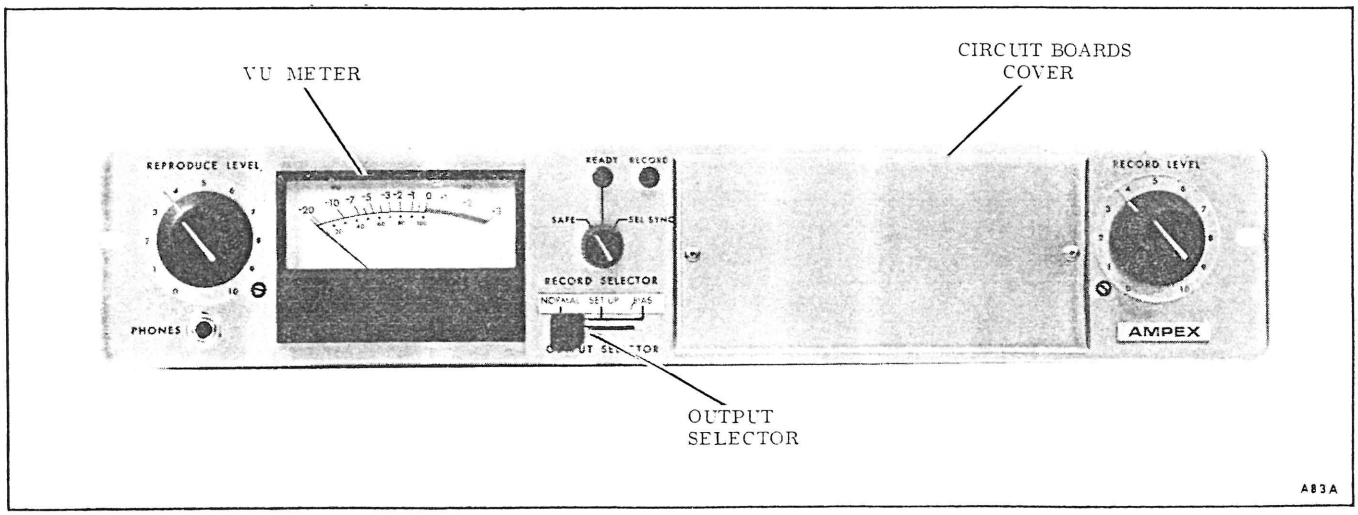


Figure 3-2. Electronic Unit Controls

Table 3-2. Electronic Unit Controls and Indicators

DESCRIPTION	FUNCTION
REPRODUCE LEVEL control	Adjusts reproduce level.
Calibration Attenuator (recessed, not labelled on panel)	Provides a pre-set output level when the Reproduce level control is switched at the minimum (fully counterclockwise) position.
VU Meter	Indicates reproduce, record or bias level, as selected by the OUTPUT SELECTOR switch.

Table 3-2. Electronic Unit Controls and Indicators (Continued)

DESCRIPTION	FUNCTION
RECORD SELECTOR switch	
position SAFE	Not used in this system
position SEL SYNC	Not used in this system
position READY	Places a channel in the "ready to record" position
PHONES	Connection for headphone audio monitoring
OUTPUT SELECTOR switch	
position NORMAL position SET-UP	Positions NORMAL and SET-UP are described in paragraph 3-12
position BIAS	Switches BIAS signal across VU meter for monitoring
RECORD LEVEL control	Permits adjustment of the RECORD level
RECORD CALIBRATION Attenuator (recessed, not labelled on panel)	Provides a pre-set output level when the RECORD level control is switched at the minimum (fully counterclockwise) position

3-3 PRE-OPERATING PROCEDURES

3-4 POWER APPLICATION

3-5 To apply power to the system, set the Power Breaker switch on the front of the machine to ON. The VU meter lamp (on the record/reproduce electronic assembly) lights. The control panel lamps light after the tape is threaded.

3-6 TAPE SPEED SELECTION

3-7 The two standard tape speeds available on the transport are 7-1/2 ips and 15 ips. The low speed or the high speed is selected by pushing the transport SPEED pushbutton. Electronic equalization is automatically switched to conform to the tape speed selected.

3-8 TAPE THREADING

3-9 The tape threading path is shown in Figure 3-4. Threading is facilitated by applying transport power and moving the supply tension arm to its maximum left position, or by using the foot switch (optional accessory). This removes the braking force at each turntable so the reels can be easily turned.

3-10 Wrap the tape on the hub of the takeup reel, then turn the takeup reel until the supply reel starts to rotate. This removes tape slack and signals the machine logic that the transport is ready to operate. The control panel switches light when the machine is threaded and slack removed from the tape.

Table 3-3. Breaker Panel

DESCRIPTION	FUNCTION
Power Breaker switch	Switches input power to the MM-1000.
Power Outlet	Auxiliary line power outlet rated at 3 amps.
Brake Release Receptacle	Provides plug-in receptacle for foot switch. (Optional equipment)

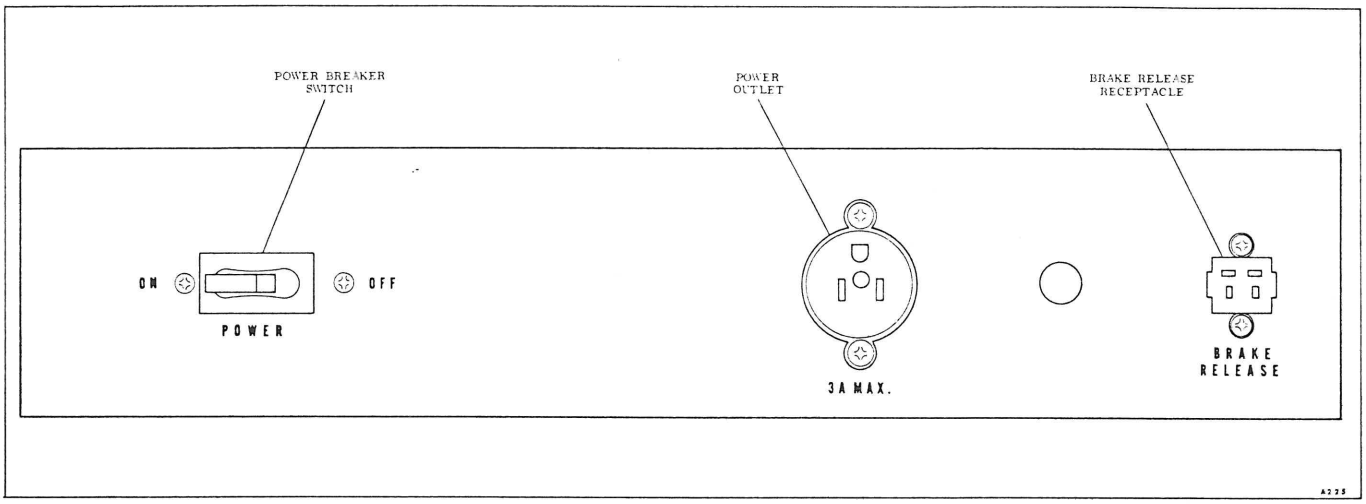


Figure 3-3. Breaker Panel

3-11 MONITORING FACILITIES

3-12 The signals which appear at the output of the MM-1000 for the three positions of the CHANNEL SELECTOR switches with the recorder in either the Stop, Playback, or Record mode are listed in Tables 3-4 and 3-5 below. Note that the RECORD SELECTOR switches of all Record/Reproduce Units remain in the READY position at all times. For Table 3-5, the Master Panel PLAY/SYNC control is in the SYNC position, and the signals can be monitored as shown in the table.

Table 3-4. Signals Available at the OUTPUT with Master PLAY/SYNC switch set to PLAY

POSITION OF CHANNEL SELECTOR SWITCH		RECORDER IN STOP MODE	RECORDER IN PLAYBACK MODE	RECORDER IN RECORD MODE
RECORD	(NORMAL)	Input Signal	Playback Signal	Input Signal
	(SET-UP)	Input Signal	Input Signal	Playback Signal
NON-RECORD		Playback Signal	Playback Signal	Playback Signal
SEL-SYNC		Sel-Sync Signal	Sel-Sync Signal	Sel-Sync Signal

Table 3-5. Signals Available at the OUTPUT with Master PLAY/SYNC switch set to SYNC

POSITION OF CHANNEL SELECTOR SWITCH		RECORDER IN STOP MODE	RECORDER IN PLAYBACK MODE	RECORDER IN RECORD MODE
RECORD	(NORMAL)	Input Signal	Sync Signal	Input Signal
	(SET-UP)	Input Signal	Input Signal	Playback Signal
NON-RECORD		Sel-Sync Signal	Sel-Sync Signal	Sel-Sync Signal
SEL-SYNC		Sel-Sync Signal	Sel-Sync Signal	Sel-Sync Signal

3-13 OPERATION

3-14 RECORDING

3-15 WITHOUT SEL-SYNC. To record without Sel-Sync, proceed as follows:

a. Switch POWER to ON.

b. Thread blank tape on transport, then close head gate.

NOTE

Always bulk-erase any tape that was recorded on equipment with a different head configuration, to make sure that it is completely erased.

c. At tape transport, set tape speed.

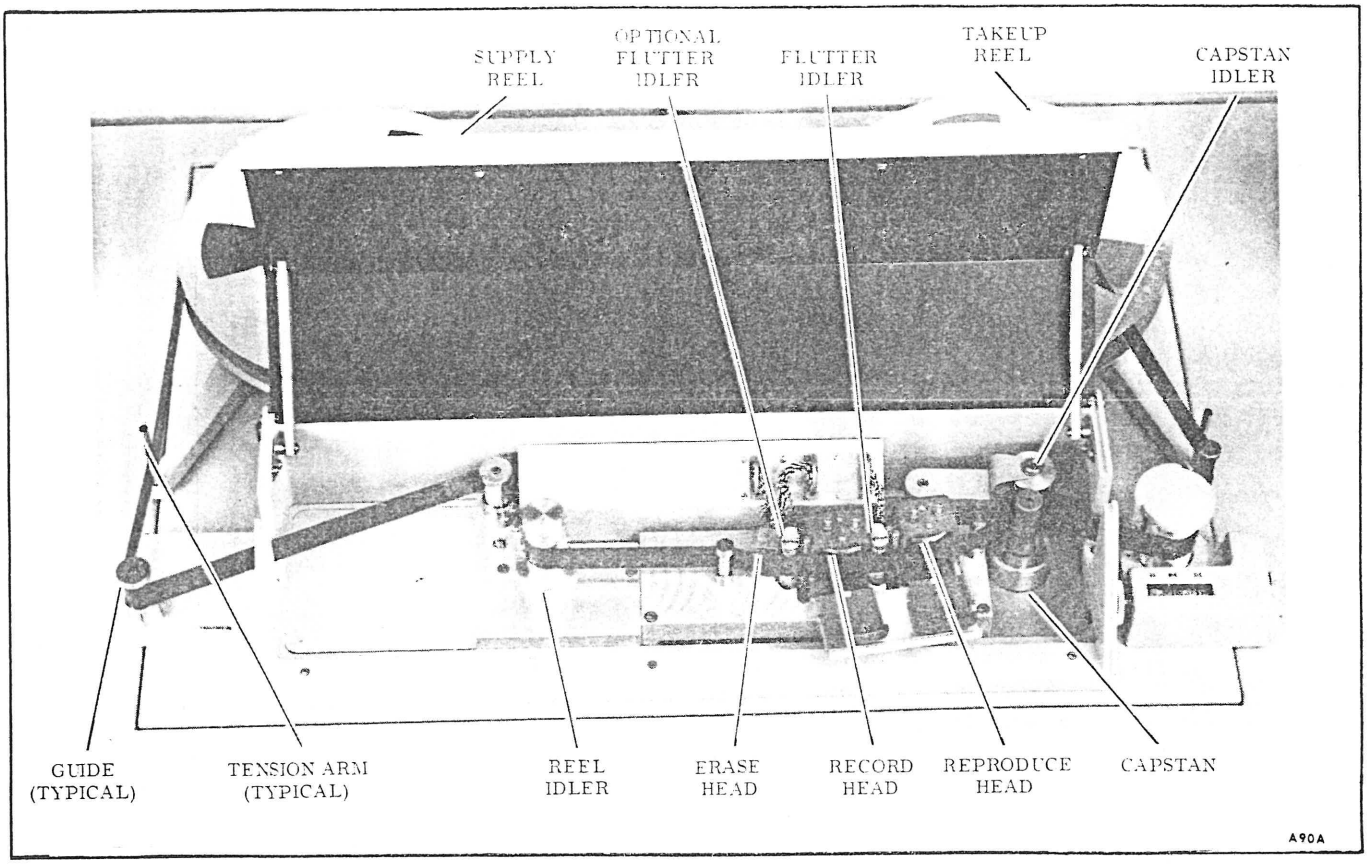


Figure 3-4. Tape Threading Path

d. On all record/reproduce units, set RECORD SELECTOR to READY (READY indicator will light). For channels to be recorded, set the CHANNEL SELECTOR switches at RECORD.

e. Set OUTPUT SELECTOR switches to SET-UP. Using a rehearsal-run or test signal, adjust RECORD LEVEL so the VU meter indicates "0" for most audio peaks (extreme peaks can indicate +2 or +3).

f. Simultaneously press PLAY and RECORD pushbuttons (channels set at RECORD then record, and the RECORD lamps light).

NOTE

During the record run, the input signal may be compared with the recorded signal by setting OUTPUT SELECTOR switch(es) alternately to SET-UP and NORMAL.

g. Press STOP pushbutton (tape motion stops and record mode ends).

3-16 WITH SEL-SYNC. The Sel-Sync circuitry of each record/reproduce unit allows initial recording, and then additional recording in synchronization with the material recorded.

a. Make recording according to paragraph 3-15.

b. Rewind tape to align heads with the tape location to start re-recording.

c. On recorded channel to be monitored, set CHANNEL SELECTOR switch to SEL-SYNC; or set MASTER MODE to SYNC.

d. Set OUTPUT SELECTOR switch(es) on the recording record/reproduce unit(s) at SET-UP. Use a rehearsal-run or test signal to adjust RECORD LEVEL so the VU meter indicates "0" for most audio peaks (extreme peaks can indicate +2 or +3).

e. Set OUTPUT SELECTOR on recording channels to NORMAL.

f. Connect headset to desired electronics unit OUTPUT monitor jack.

g. Press PLAY and RECORD pushbuttons. The recording can then be altered in synchronization with audio available at the output.

h. Press STOP pushbutton (tape motion stops and record mode ends).

i. For any additional channel, the operator is to monitor, set the corresponding CHANNEL SELECTOR at SEL-SYNC, and set desired channel at RECORD.

j. Repeat procedure for each additional channel to be recorded.

3-17 REPRODUCING

3-18 To reproduce a recording, proceed as follows:

a. Switch POWER to ON.

b. For all channels, set CHANNEL SELECTOR at NON-RECORD.

c. Thread recorded tape on transport; then close head gate.

d. Select tape speed corresponding to speed at which tape was recorded.

e. Set OUTPUT SELECTOR to NORMAL on record/reproduce units (otherwise there will be no output). Set MASTER MODE to PLAY.

f. Press PLAY pushbutton (tape starts in the reproduce mode). Adjust REPRODUCE LEVEL as necessary.

g. Press STOP pushbutton (if tape runs completely off the supply reel, operation will automatically stop).

3-19 FAST-WINDING

3-20 For tape editing or cueing, the tape is rapidly wound by pressing the REWIND or FAST FWD pushbuttons. The pushbuttons can be pressed alternately, without first stopping tape motion. When the desired tape position is reached, press the STOP pushbutton (if tape runs off either reel, operation will automatically stop). Either fast-winding mode can also be entered from the stop or play modes.

3-21 To enter the RECORD mode from the fast-winding modes, the STOP pushbutton must be pressed first.

3-22 A tape-lifter (removing the tape from head contact) automatically actuates in both fast-winding modes. For fast-winding audio monitoring, actuate and hold the lifter lever at DEFEAT position. In the DEFEAT position, the tape remains in contact with the record and erase heads. Avoid unnecessary use of this lever to minimize wear on the heads and scrape flutter idler.

SECTION IV

ROUTINE MAINTENANCE

SECTION IV

ROUTINE SYSTEM MAINTENANCE

4-1 EIGHTH-HOUR CLEANING

4-2 HEADS

4-3 Clean heads, and all other components in the tape threading path, after each recording session. This is to remove the oxide (deposited from the magnetic tape) which will degrade equipment performance as it accumulates. Clean each head thoroughly with a cotton-tipped applicator dampened with Ampex Head Cleaner, 050-104.

CAUTION

WHEN CLEANING THE HEADS, USE ONLY THE RECOMMENDED SOLVENT, TO AVOID DAMAGING THE HEADS. KEEP SOLVENT OFF OF PLASTIC FINISHES. DO NOT USE METAL TOOLS WHICH MIGHT SCRATCH THE HEADS.

4-4 TAPE GUIDE ELEMENTS

4-5 Use isopropyl alcohol to clean all tape guiding elements, the capstan, and the capstan idler.

CAUTION

IF OIL GETS ON THE IDLER RUBBER TIRE, IMMEDIATELY REMOVE IT WITH ISOPROPYL ALCOHOL.

4-6 SCRAPE-FLUTTER IDLER

4-7 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.

4-8 EIGHTH-HOUR DEMAGNETIZING

4-9 Heads and other magnetic components in the tape threading path can acquire permanent magnetization that increases signal noise and distortion, and partially erases high frequencies on recorded tapes. Demagnetize components after each eight hours of operation, or oftener if required, using an Ampex Bulk Tape and Head Degausser 650-166, or equivalent, as follows:

a. Turn equipment power OFF, and remove any recorded tape near the transport (tape could be partially erased by the degausser).

b. Open cover over the heads.

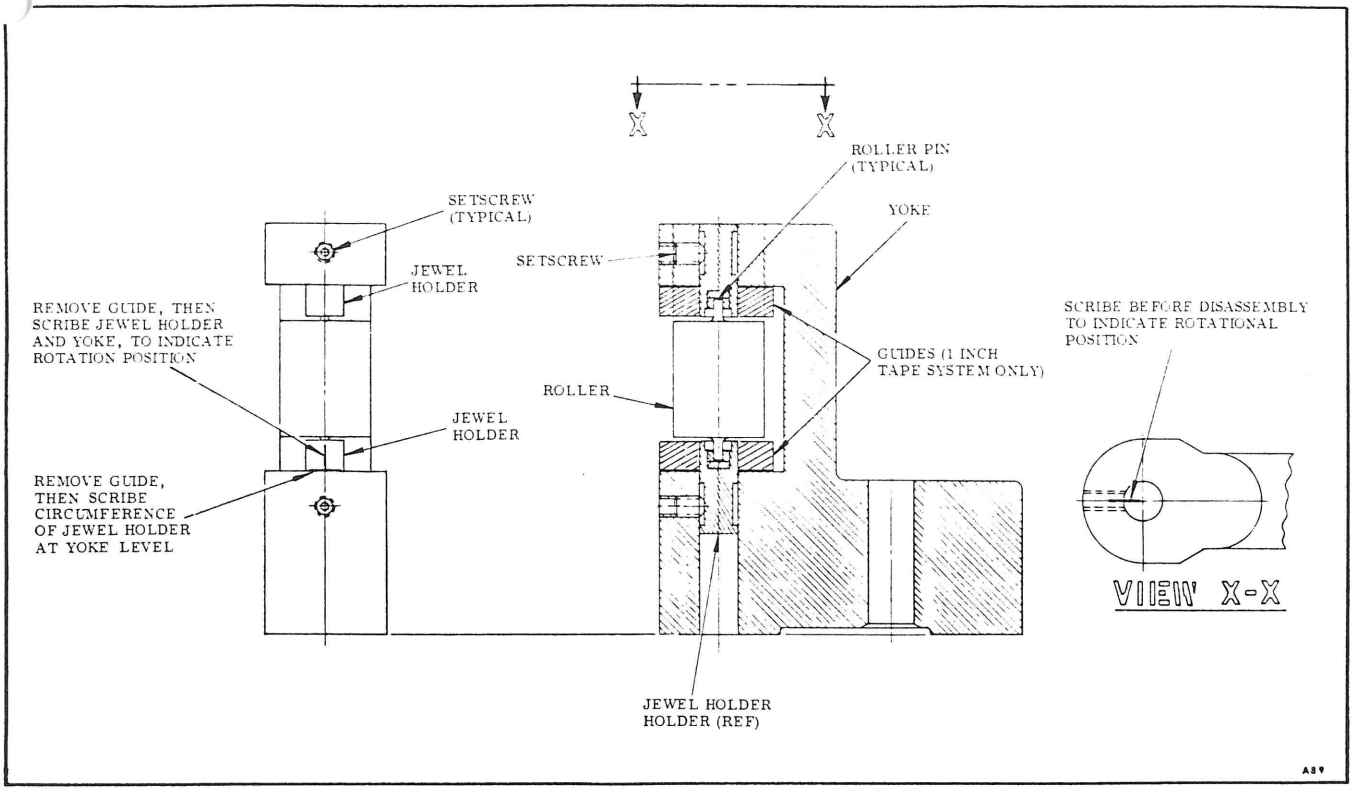


Figure 4-1. Scrape-Flutter Idler

c. With the demagnetizer at least three-feet from the recorder, connect it to a 110-120 volt ac power source (auxiliary power outlet).

d. Slowly move degausser toward the tape-path component. Hold the degausser parallel to the component at all times. With a slow even motion, move it up and down the component several times. Slowly withdraw the degausser (slow withdrawal is required for effective demagnetization).

e. Repeat step d at each tape-path component (including the guide on the tape tension arm).

f. Move the degausser at least three-feet from the recorder, then de-energize it.

g. Close cover over the heads.

4-10 IDLER YEARLY LUBRICATION (See Figure 4-1)

4-11 Ultrasonically clean and lubricate the scrape-flutter idlers once a year, or after each 2,000 hours of operation (whichever occurs first). This may be done by a local jeweler or watchmaker, who would usually have the ultrasonic cleaner and special jewel oil required. Disassemble, oil, and assemble the idler as follows:

4-12 DISASSEMBLY/LUBRICATION. Disassemble and lubricate the idlers as follows:

a. The idler is secured to the top plate by one screw, a flat washer, and lockwasher. Remove screw and lift idler off. Retain screw and washers for future use.

b. To indicate correct positioning scribe-mark the holder at the setscrew centerlines (see Figure 4-1); upper holder on the top circular surface, and the lower holder on the periphery.

c. Remove the two jewel holders and the roller, by loosening the two setscrews at the front and sliding the holders out of the yoke using .035 Hex head wrench.

d. Ultrasonically clean the two holders and the roller.

NOTE

If cleaning does not remove all traces of oxide from the roller shafts, polish oxide off with jewler's rouge (or equal). After polishing, re-clean the roller ultrasonically.

e. Lubricate each jewel bearing with one drop of jewel oil (or Ampex precision instrument oil No. 087-239) applied with a No. 21 gauge hypodermic needle.

4-13 REASSEMBLY. Assemble the idlers with great care as follows:

a. Apply a light coat of grease to contact surfaces of holders.

b. Align the scribe-marks with the centerline of the setscrews as shown in Figure 4-1 and slide each holder into place.

c. Tighten the setscrew on the lower jewel holder.

d. Slide upper holder down over roller pin.

e. Apply slight finger pressure on the upper holder, to eliminate end-play, then tighten the upper setscrew.

f. Check that the idler rotates freely. If it does not, readjust setscrews to reduce friction.

CAUTION

OVERTIGHTENING OF SETSCREWS CAN DISTORT HOLDER AND BIND THE ROLLER PINS.

4-14 PARTS REPLACEMENT

4-15 COVER REMOVAL

4-16 The electronics assembly covers must be removed for access to components inside. To remove the cover, turn power off, and remove the two screws at each end. Remove the screw from the center recess in the cover top, then pull the cover off the chassis.

CAUTION

DISCONNECT SYSTEM POWER BEFORE CHANGING COMPONENTS.

4-17 ELECTRONIC COMPONENTS

4-18 Required tools and materials for replacing electrical components are:

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

2. Solder, 60-40, rosin core

3. Non-corrosive soldering flux with rosin-alcohol base

4. Piece of small-diameter shielding braid; if available, use a plunger-type solder remover instead of the soldering flux and shielding braid.

4-19 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 the soldering 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 removable without using force.

4-20 To install the replacement part, bend the leads to fit in the mounting holes, insert the leads through the holes, then bend them flat against the foil path. Use the soldering pencil and 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.

4-21 After replacing a diode or transistor, allow the board to cool approximately five minutes before reinstalling it.

RESIDUAL HEAT FROM THE SOLDERING PROCESS COULD CAUSE THERMAL RUNAWAY, IF POWER IS APPLIED TO A SEMICONDUCTOR DEVICE BEFORE IT HAS COOLED FOR FIVE MINUTES.

4-22 ELECTRONICS UNIT INDICATOR LAMPS

4-23 READY/RECORD. The Ready/Record lamps are mounted in a spring clip. To replace either lamp, remove the top cover from the record/reproduce unit, pull the wired sockets from the lamps with long nose pliers, then press the two clip extrusions together and remove the clip--being careful not to let the pliers slip. Remove the lamp (now free) through the front of the assembly. Install a lamp in reverse to removal procedures, then press the clip against the panel to secure the lamp.

4-24 VU METER

4-25 To remove a VU meter lamp, remove the record/reproduce unit bottom cover. Pull the wired sockets from the lamp then pull the lamp out of the meter housing. Install lamps in the reverse order to removal procedures.

4-26 MASTER CONTROL INDICATOR LAMPS

4-27 PUSHBUTTONS. Remove pushbutton indicator lamps as follows:

a. Pull the plastic lens assemblies outward from the panel front for access to the lamps.

b. Remove a lamp from the transport control pushbuttons by pushing in and turning the lamp counterclockwise.

c. Remove a lamp from the Speed Selector, Remote/Local, or Master Mode control pushbuttons by snapping it out.

d. Install lamps and plastic cover in the reverse order of removal.

4-28 RECORD LAMPS. Remove record indicator lamps as follows:

a. Remove the vinyl-covered end bells mounted (with two #10-32 screws each) at the bottom of the frame near the casters.

b. Remove the master control panel (four mounting screws) two on each end of the control panel (accessible from the inside of the frame).

c. Disconnect the two Cannon connectors and remove the panel.

d. Pull the wired socket off of the defective lamp(s).

e. Use long-nose pliers to press the retaining-clip flanges together and remove the clip.

f. Remove the lamp from the panel front and install the new lamp.

g. Install parts in reverse order of removal.

4-29 TAPE TRANSPORT

4-30 ROLLER GUIDES. There are two high speed roller guides on each MM-1000 transport. If a machine is the convertible type, there are four of these guides. After continued use at high speed the bearings in the guides may become noisy and need replacement. Replace bearings as follows:

a. Remove the guide by using an Allen wrench to turn the capscrew counterclockwise.

b. Slide the base off and then grasp the 1/4-inch shaft very tightly.

c. Turn the cap screw out of the top (it is locked in very tightly) and remove the cap and the spring inside.

d. Pull the aluminum roller outward, along with the top bearing and reload ring.

e. Pull the lower bearing off.

f. Install the new bearings and reassemble the guide with the preload ring's protruding portion against the bearing.

g. Reinstall the guide on the machine. If a 2-inch guide is being replaced, keep pulling upwards on the guide while screwing it on, so the screw in the plate does not turn.

4-31 DAMPED FLYWHEEL BEARINGS. There are two ball bearings in the damped flywheel assembly. If dirt should get into these bearings they could become noisy and cause flutter. To check for noisy bearings, spin the assembly. If a grinding sound is heard, proceed as follows:

a. From the rear of the machine, remove the heavy flywheel and spacer.

CAUTION

DO NOT DROP THE FLYWHEEL - IT HAS DELICATE BEARINGS INSIDE.

b. From the bottom of the deck, remove two #6-32 cap screws holding the housing to its plate. Remove the housing.

c. Pull the aluminum hub out of the housing.

d. With retaining-ring pliers, remove the ring that holds the lower bearing.

e. Slide out both bearings and reinstall new ones.

f. Reassemble in reverse order of the disassembly procedure.

4-32 CAPSTAN (See Figure 4-2)

4-33 The MM-1000 capstan system consists of a two -speed hysteresis-synchronous motor and a flywheel-stabilized capstan which is driven by a mylar belt. Instability can result from the presence of dirt, oil, and other foreign matter on the surfaces of the belt and pulleys. Ampex 55571-01, mylar belt, is the only replacement belt that can be used. The capstan assembly 55575-03 (less the motor) must be replaced as a unit in case of damage to the capstan shaft or its bearings.

4-34 SPECIAL TOOLS

4-35 The only special tool required is a torque screwdriver, two to three inch-pounds range (to adjust belt tension).

4-36 CAPSTAN OVERHAUL

4-37 To disassemble the capstan system for cleaning or parts replacement, turn power OFF, then proceed as follows:

a. Protect the capstan shaft from possible damage during procedures by heavily wrapping it with masking tape and/or other suitable cushioning material.

CAUTION

NICKS AND DAMAGE TO THE SHAFT CAN REQUIRE REPLACEMENT OF THE ENTIRE FRAME.

b. Remove head cover assembly.

c. Disconnect harness from capstan terminal strip.

d. With one assistant, remove the capstan mounting screws from the top of the top plate, and guide the capstan out through the bottom of the machine. Carefully note the positions of any shims between the capstan frame and top plate; they must be installed in exactly the same positions.

e. Remove both covers from the capstan frame, loosen the four motor-mounting screws (to release belt tension) and remove the belt. Do not crease or otherwise distort the belt if it is to be reinstalled.

f. Carefully use low-pressure air to blow dust and dirt from inside the capstan frame, directing the air blast away from personnel and the capstan shaft and bearings.

g. If the capstan belt is to be reused, moisten a clean cloth with fresh alcohol and wipe clean.

h. With the moistened cloth, remove all traces of foreign matter from the pulleys.

i. Position the motor to eliminate initial belt tension, then replace the belt.

NOTE

The original belt may be reused if it has no evidence of cracks, creases, or other distortion. If in doubt replace the belt with Ampex part number 55571-01.

j. Thread a 10-32 screw in tapped hole in the motor shaft exposed end.

k. Hold the capstan shaft stationary and turn the screw with the 2-3 inch-pound torque screwdriver. Position the motor so the belt begins to slip with 2 to 3 inch-pounds applied to the screwdriver; do not exceed this value under any circumstances.

l. Re-install covers on the capstan frame assembly.

m. With one assistant, re-position the capstan assembly against the base plate with special care to avoid capstan shaft damage. Re-install any removed shims exactly as originally installed and secure the assembly with the mounting screws.

n. Reconnect the harness.

o. Remove the protective material from the capstan shaft and clean the shaft with a clean cloth moistened with kerosene (to remove masking-tape gum), then use alcohol to remove all traces of kerosene.

CAUTION

DO NOT CONTACT THE CAPSTAN IDLER WITH THE CLEANING FLUIDS: BOTH FLUIDS DETERIORATE RUBBER.

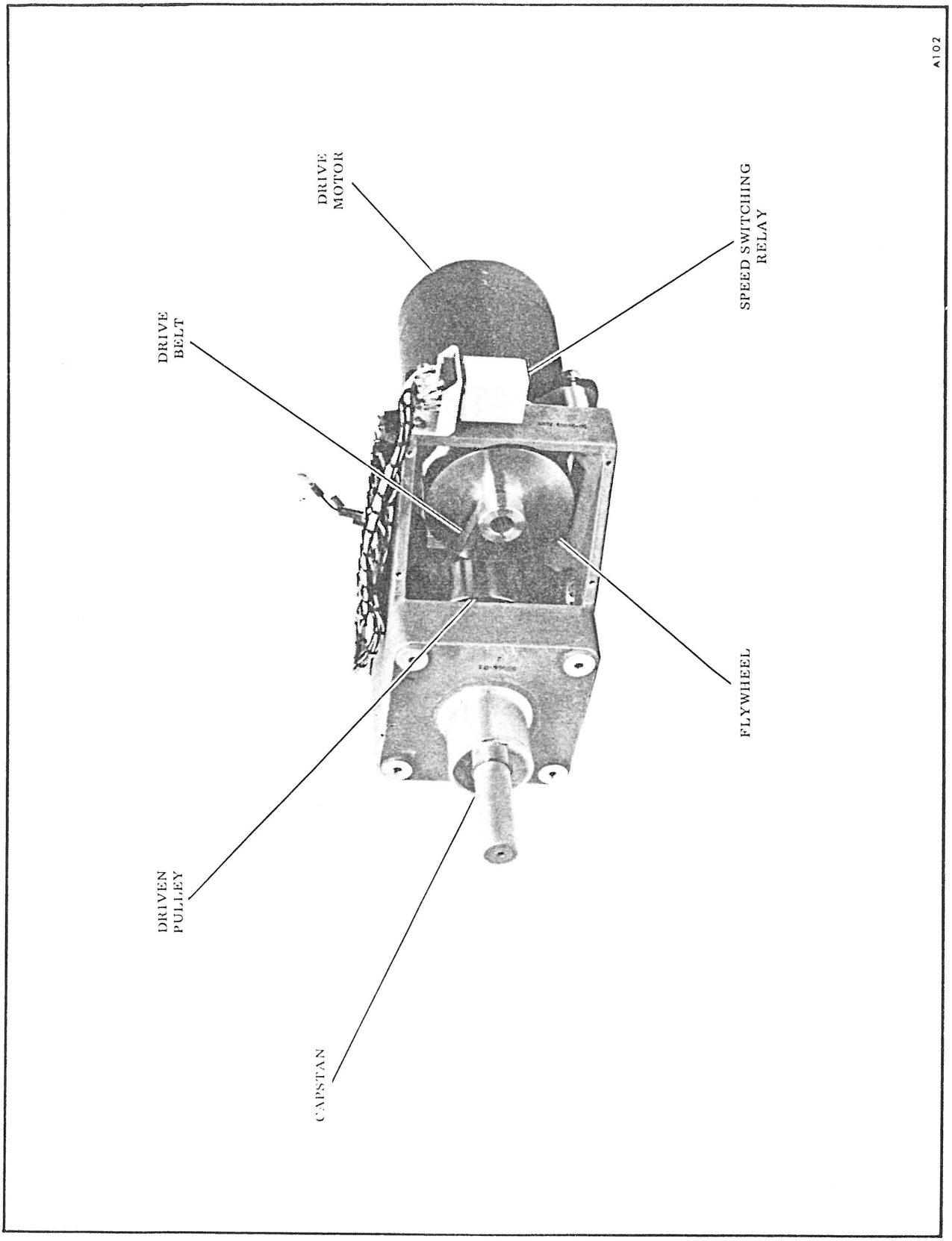


Figure 4-2. Capstan Drive Assembly

SECTION V

ELECTRONIC CHECKS AND MAINTENANCE

SECTION V

ELECTRONICS CHECKS AND MAINTENANCE

5-1 PERFORMANCE CHECKOUTS

5-2 GENERAL

5-3 These checkouts should be regularly scheduled to determine when tape transport adjustment/alignment is required. Electronic adjustment/alignment procedures are given later in this section, to be performed after all maintenance is completed. Erased tape or blank tape can be used for the performance checks or recorded tape can be erased during the recording portion of the procedure. Reproducer checkout is explained at the start of each checkout procedure.

NOTE

Always bulk-erase any tape that was recorded on equipment with a different head configuration, to make sure that it is completely erased.

5-4 TEST EQUIPMENT

5-5 Obtain the following test equipment, or equivalent:

1. Signal Generator, Hewlett-Packard Model 200D.

2. Vacuum Tube Voltmeter, AC, Hewlett-Packard Model 400D.

3. Wave analyzer (if available).

4. Flutter Meter, Micom, Model B8100.

5. Ampex Standard Alignment and Flutter Test Tapes for the tape speeds used.

6. Noise Filter (see Figure 5-1) or ASA "A" Curve Filter (see Figure 5-2).

7. Technicians tools.

5-6 TEST TAPE REQUIREMENTS

5-7 Standard test tapes 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:

a. Clean and demagnetize equipment heads and other tape-handling components before installing the test tape (refer to paragraphs 4-2 and 4-8).

b. Never store test tapes in areas where there are temperature or humidity extremes.

5-8 TAPE DEGRADATION. After extensive use of test tapes 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.

5-9 TEST CONDITIONS

5-10 Check that the following test conditions are met:

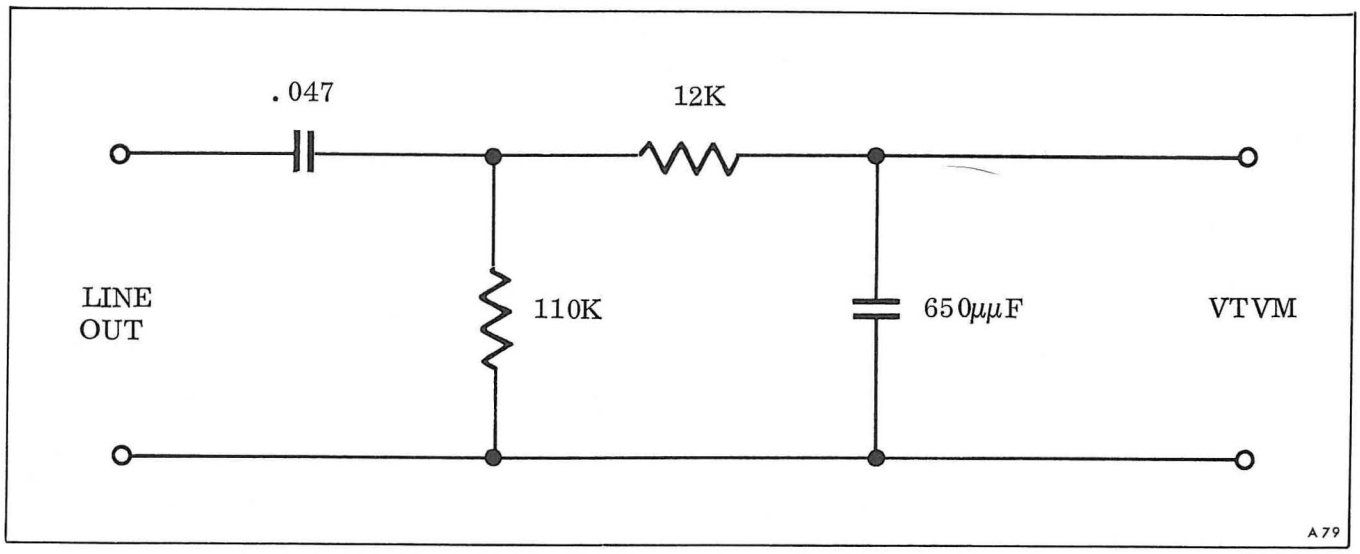


Figure 5-1. Noise Filter Schematic

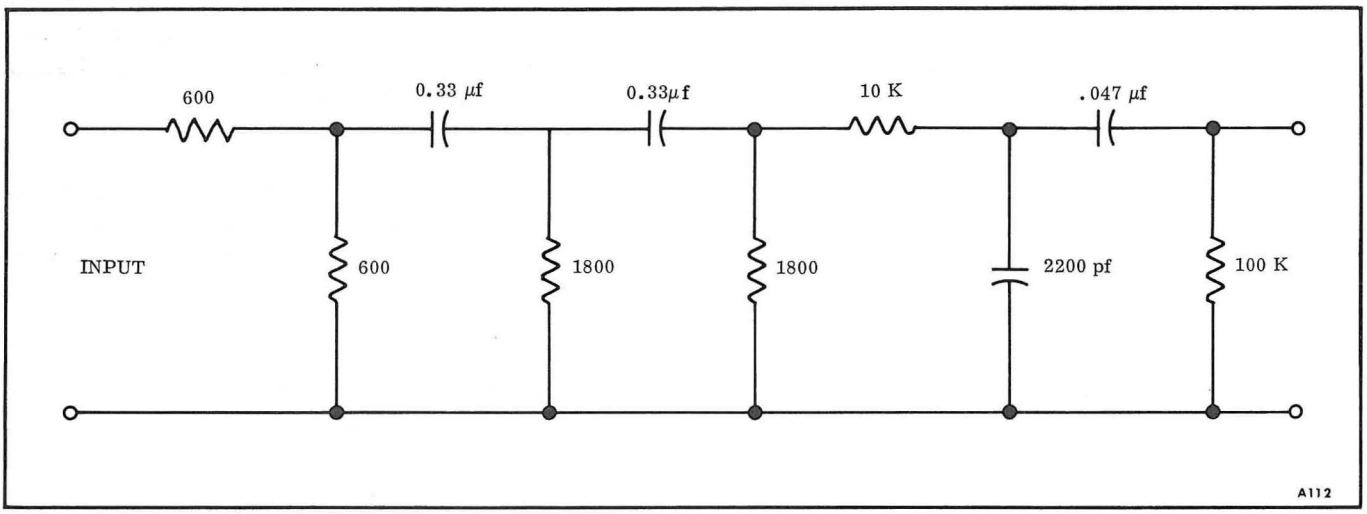


Figure 5-2. ASA "A" Curve Filter Schematic

a. If the recorder is not terminated in the console, set LINE TERMINATION switch (on back of electronics assemblies) at ON, to terminate equipment.

b. Dummy plug in INPUT ACCESS socket (instead of accessory transformer or preamp).

c. Components cleaned and demagnetized per paragraphs 4-1 and 4-8.

d. Top and bottom covers installed on electronic assemblies.

e. Low-noise tape, Ampex Series 434 or equal, installed.

5-11 FREQUENCY RESPONSE

5-12 REPRODUCER. Check the frequency response of a reproducer with a tape recorded

on a correctly-adjusted recorder with the same head configuration as the reproducer. If such a tape is unavailable, use a standard tape per paragraph 5-13, steps a through i. When using full-track tape on a multitrack system, keep in mind the low-frequency limitations.

5-13 RECORDER/REPRODUCER. This check of frequency response is made using an Ampex Standard Alignment Test Tape, a signal generator, and the equipment VU meter(s). The check can be made simultaneously on all channels since the test tape is recorded full-track.

a. Apply power and set tape speed.

b. Thread the applicable standard alignment tape on the transport.

c. Start the tape in motion to find the level-set tone on the tape. (At 7-1/2 ips, only the last tone on the tape is at the standard operating level.)

d. During level-set tone reproduction, adjust REPRODUCE LEVEL control(s) for a 0 VU meter indication and set memory dials, to that position.

e. Reproduce the test tone series from the recorded test tape (which starts with the highest frequencies). Adjust the appropriate HIGH FREQ control (at the front of reproduce board) as necessary for the flattest possible response, within specifications.

f. Wind tape back to its original reel and remove the reel.

g. Connect the signal generator to the INPUT connector(s), then set it for a nominal 1-volt rms output at 1,000 Hz (15 ips), or 500 Hz (7-1/2 ips).

h. Thread blank tape on transport and start it in motion, with the test channel(s) in the record mode.

i. Set OUTPUT SELECTOR to NORMAL and adjust the RECORD LEVEL control(s) for a 0 VU meter(s) indication.

j. Set OUTPUT SELECTOR at SET UP, while still recording and reproducing. Change the frequency of the signal generator in uniform steps across the frequency band of the tape speed being used (refer to Overall Frequency Response Specification, Table 1-1). Check the response indicated on the VU meter(s).

NOTE

A complete final check and alignment is given in paragraph 5-71.

5-14 SIGNAL-TO-NOISE

5-15 RECORDER/REPRODUCER. This check requires a noise filter or an ASA "A"-curve filter to attenuate noise outside of the audible frequencies. Schematic diagrams of the filters are given in Figures 5-1 and 5-2. With the noise filter, signal-to-noise ratio is conventionally computed from a peak record level at 6 dB above normal operating level. Therefore, on equipment strapped for a +8 dBm operating level, the vtvm noise indication must be increased in magnitude by 14 dB (i.e., a vtvm reading at -46 becomes -60 dB). On equipment strapped for a +4 dBm operating-level output, the vtvm indication must be increased in magnitude by 10 dBm. When an "A" weighted-curve noise measurement is being made, using the ASA filter, increase the vtvm indication by 10 dB for a +8 dBm output, or 6 dB for a +4 dBm output. Check signal-to-noise ratio of the recorded reproducer as follows:

a. Apply power, and thread blank tape on transport. Set tape speed.

b. Connect the signal generator to the INPUT receptacle, then set it to 500 Hz at a nominal 1-volt rms level.

c. Connect the chosen filter to the OUTPUT receptacle, then connect the vtvm to the filter output.

d. Set OUTPUT SELECTOR at NORMAL. Adjust the RECORD LEVEL for a vtvm indication of +14 dBm (if strapped for a +8 dBm output) or +10 dBm (if strapped for a +4 dBm output).

e. Place the tape in motion, with the test channel in the record mode (be sure the head gate is closed). Record a section of tape with the input shorted.

f. Stop the tape and rewind it to the beginning of the recording just made.

g. Disconnect the signal generator from the INPUT receptacle. Set OUTPUT SELECTOR to SET UP.

h. Start the tape in motion (with the test channel in the record mode), but with record level at zero (be sure the head gate is closed). The noise level (while thus erasing) will be indicated on the vtvm.

i. Repeat steps d through h at second tape speed.

j. Repeat the procedure for each additional channel.

5-16 REPRODUCER. To check reproducer noise, remove the tape and connect the vtvm through the noise filter to the OUTPUT receptacle. With pressure-sensitive tape, or a rubber band, secure the takeup tension arm away from the safety switch. Press the PLAY pushbutton, the signal-to-noise should be as shown in Table 5-1 (the figures are also computed from peak level, as explained in the overall check).

5-17 DISTORTION

5-18 For accurately checking distortion, use a wave analyzer which measures individual distortion products (instruments that measure total harmonic distortion are affected by tape noise and modulation noise). Also, to avoid error, use a signal generator with less than 0.1% distortion.

5-19 RECORDER/REPRODUCER. Record a 500-Hz signal on blank tape, at normal operating level, then reproduce the signal. The second harmonic content should not exceed 0.2%, and the third should be 0.6 to 1.1%.

5-20 REPRODUCER. Check reproducer distortion with a tape recorded on a unit that is correctly adjusted, and has a head track configuration identical to the reproducer.

5-21 FLUTTER

5-22 This check must be made with Ampex Standard Flutter Test Tapes (refer to Table 1-2). These tapes, recorded on very precise equipment, have inherent flutter below 0.03% rms--which can be ignored. Flutter test tapes must be used only at the speed they are made for. For storage and handling of standard tapes refer to paragraph 5-6. Flutter measurement is the same for the reproducer and the record/reproduce units.

5-23 Flutter meters are sensitive to amplitude modulation that results from poor head-to-tape contact or from signal dropouts.

Table 5-1. Reproduce Signal/Noise from Peak Record Level With Noise Filter

TAPE SPEED	HEAD TPYE	REPRODUCE CIRCUIT SIGNAL/NOISE	VTVM READING
7-1/2 ips	8 or 16 Track	64 dB	-54 dB
15 ips	8 or 16 Track	64 dB	-54 dB

Therefore components must be cleaned and demagnetized per paragraph 4-1 and 4-8 before flutter tests are made.

5-24 This procedure applies to the use of the Micom Model B8100 flutter meter. If a different flutter meter is used, the manufacturer's instructions should be followed. Check tape flutter as follows, on any correctly aligned reproduce channel:

a. Connect reproduce channel OUTPUT connector to the flutter meter SIGNAL INPUT connector.

b. Set the flutter meter FLUTTER WEIGHTING control to NAB UNWTD; the DEMOD INPUT SELECT to 100 MV -5V EXT SIGNAL; the METER SELECT to DEMOD; and FLUTTER % FULL SCALE to 0.1% or 0.3% (corresponding to tape speed).

c. Apply power to the recorder and the flutter meter.

d. Thread the flutter-test tape on the tape transport, with the tape reel on the takeup turntable. Rewind the tape to a reel on the supply turntable. Set tape speed to conform to the test tape.

e. Start the test tape in motion in the reproduce mode (NORMAL lamp on flutter meter should light, otherwise there is no reproduce output to the meter, or the DEMOD INPUT SELECT is incorrectly positioned, or lamp circuit is defective).

f. Read indication on the FLUTTER meter, and if necessary, reposition the FLUTTER % FULL SCALE control. Flutter should meet the specification given in Table 1-1.

g. Allow the flutter-test tape to completely unwind from the supply reel.

NOTE

For flutter troubleshooting aids refer to paragraph 5-41.

5-25 TROUBLESHOOTING AND CORRECTIVE ACTION

5-26 GENERAL TROUBLESHOOTING

5-27 The following general troubleshooting procedures should be used to help locate/eliminate troubles:

a. Check that all wiring is sound, not contacting moving parts, and connectors are correctly mated.

b. 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 diagrams, as an aid in locating malfunctions. Circuit schematic diagrams are given in Section 8 for the recorder/reproducer electronics, reproducer electronics control system, and power systems.

c. Use extender boards so the components are accessible for testing/adjustment (the extended circuit boards must be mechanically supported).

d. Signal voltages and dc voltages are shown on some schematic diagrams. With circuit boards on extender cards, check the given voltages to quickly isolate the fault to a specific stage or component.

5-28 INPUT POWER AND INDICATORS

5-29 RECORDER/REPRODUCER. When power is ON, the transport STOP lamp, and the record/reproduce unit VU meter lamps should light (with tape installed).

a. If the STOP lamp does not light, check the 24V power supply and refer to the schematic in Section VIII.

b. If the STOP lamp lights, but the VU meter lamps do not, set the RECORD SELECTOR switch to READY. If the READY lamp lights, one of the VU meter lamps is probably defective (these

lamps are connected in series). Replace any defective meter lamps per paragraph 4-24.

c. If the READY lamp does not light, check fuse F1 on the back panel of the record/reproduce unit. If the fuse is sound, check fuse F701 on the transport 39V supply box. If both fuses are sound, use a dc voltmeter to check any receptacle J701 through J704 (on the power supply box) across pins 9 (positive) and 5. The 39-volt-dc power should be present across those pins; if not, check for voltage on the power supply board (see schematic diagram in Section 8). If the voltage is present, check the interconnecting cable, and internal wiring, then correct any defects.

d. If the POWER and VU meter lamps light and the READY lamp does not, when the SELECTOR switch is at READY, replace the lamp per paragraph 4-23.

e. If the VU meter and the READY lamps light, and the RECORD lamp does not, when the record mode is initiated, set OUTPUT SELECTOR to BIAS (in the record mode). If the VU meter indicates normal bias, replace the lamp per paragraph 4-23.

f. If bias is not indicated on the VU meter, check the relay per paragraph 5-31.

5-30 REPRODUCER. Troubleshoot the reproducer power supply as follows:

a. If it is suspected that operating power is not available, use a dc voltmeter to check across pins 9 (positive) and 5 on any receptacle J701 through J704 (on the transport power supply box). If the +39-volt dc power is not present, check fuse F701 on the power supply box.

b. If voltage is absent and the fuse is sound, check the power supply circuit board (see schematic diagram in Section 8).

c. If voltage is present, install the reproduce board on an extender card and check for the +39-volt power at any convenient point (see schematic diagram in Section 8). If voltage is absent, check the interconnecting power cable, and internal wiring; correct any defects.

5-31 RECORD RELAY

5-32 Troubleshoot the record relay circuit as follows:

a. If the record relay is suspected to be inoperative, remove the dust cover from the relay. Hold the supply tension arm away from the safety switch, set the record selector to READY, and place the desired channel selector at record. Press and release the play and record pushbuttons. If the relay actuates and holds in the energized position, check contacts. If the contacts are dirty, rub them clean with bond paper or a contact-burnishing tool.

b. If the relay does not actuate and hold, remove it from receptacle. Check the dc resistance of the coil across relay terminals 13 and 14; resistance should be approximately 650 ohms. If the coil is open or shorted, replace it.

c. If the relay is not at fault, remove the interconnecting power cable at J11 (on the record/reproduce unit). Initiate the play mode and use a dc voltmeter to check across cable plug pins 10 (positive) and 8; the 24-volt dc holding power should be present. Connect the dc voltmeter across cable plug pins 4 (positive) and 8. Press and hold the PLAY and RECORD pushbutton. The 24-volt power should be present across the pins. If power is absent at either checkpoint, check wiring continuity to the transport 24-volt power supply.

d. If the holding and energizing voltages are both present, remove the relay from its receptacle (leave the J11 receptacle open). Use an ohmmeter to check the diode across pin 4 of J11 to relay receptacle pin 14. Check the other diode across relay receptacle pins 14 and 13. Check resistor

4R77 across relay receptacle pins 14 and 12. Check actuation of the RECORD SELECTOR switch, by connecting the ohmmeter from pin 8 of J11 to relay receptacle pin 13 and switching the record selector from SAFE (open) to READY (closed).

e. If voltage was present and no faulty component is found, the relay is probably defective (despite its coil testing correctly); replace the relay.

5-33 POWER SUPPLY (See Figures 5-3 and 5-4)

5-34 The power supply voltage-regulator adjustment is given in paragraph 5-60.

a. The power supply 39 (-1/2, +1) volts dc power should be present at three pins of any of the receptacles J701 through J704 (on the power supply box). Initiate the reproduce mode, then use a dc voltmeter to check between pins 9 (positive) and 5 of one open receptacle. Select high speed (in the reproduce mode) then use the dc voltmeter to check across pins 7 (positive) and 5 for the high-speed equalization switching voltage. Select low speed, then check across pins 6 (positive) and 5 for the low-speed equalization switching voltage. The regulated dc voltage should be present at all three check points. If power is present across pins 9 and 5, and not present at either one of the other points, check the SPEED switch, or continuity of the cabling and internal wiring; correct any defects. If voltage is present, but is excessively high, proceed to step f.

WARNING

DANGEROUS VOLTAGE IS PRESENT ACROSS THE FUSE POST AND ACROSS THE TRANSFORMER LEADS. USE SPECIAL CARE WHEN MAKING THE FOLLOWING CHECKS.

b. If no voltage is present, check fuse F701 on the power supply box. If the fuse is sound, open the power supply box and mount the power supply board on the extender board.

c. With all record/reproduce units connected, set all channels to the record mode. Use the dc voltmeter to check across CR706, CR705, and R707; with the voltmeter positive lead at the CR706 innermost end, and the negative lead to the R707 outermost end. The voltage present depends on applied load and the power and component tolerances; therefore, these values are only nominal: during single channel operation, 72 volts; two channels, 66 volts; three channels, 60 volts; and four or more channels, 54 volts.

d. If voltage is absent or is excessively low, turn power OFF and use an ohmmeter to check CR706, CR705, and R707 on the power supply board. If component values are correct, remove the transport power supply box. On the box mounting side, check capacitor C707, resistor R706, and the diodes CR701 through CR704 (which make up the full wave bridge rectifier). If they are sound, remove the heat sink panel with power transistor Q705. Connect the box to the transport and apply power. See the WARNING, then use an ac vtvm to check voltages at the primary (white/black) lead and secondary (red/red) leads of the power transformer (T702).

e. If the voltage is correct in step c, check transistors Q706 (shorted), Q704, (open), and Q703 (open). Then check all other components in their immediate circuits (all are on power supply board). Also check capacitor C706 (shorted) and power transistor Q705 (open) on the heat sink.

f. If voltage is present in a, but is excessively high, adjust the regulator per paragraph 5-60. If the regulator will not adjust within tolerance, remove the power supply board from the box. Use the ac vtvm to check transistors Q706 (open), Q704 (shorted), and Q703 (shorted) and all components in their immediate circuits. Check

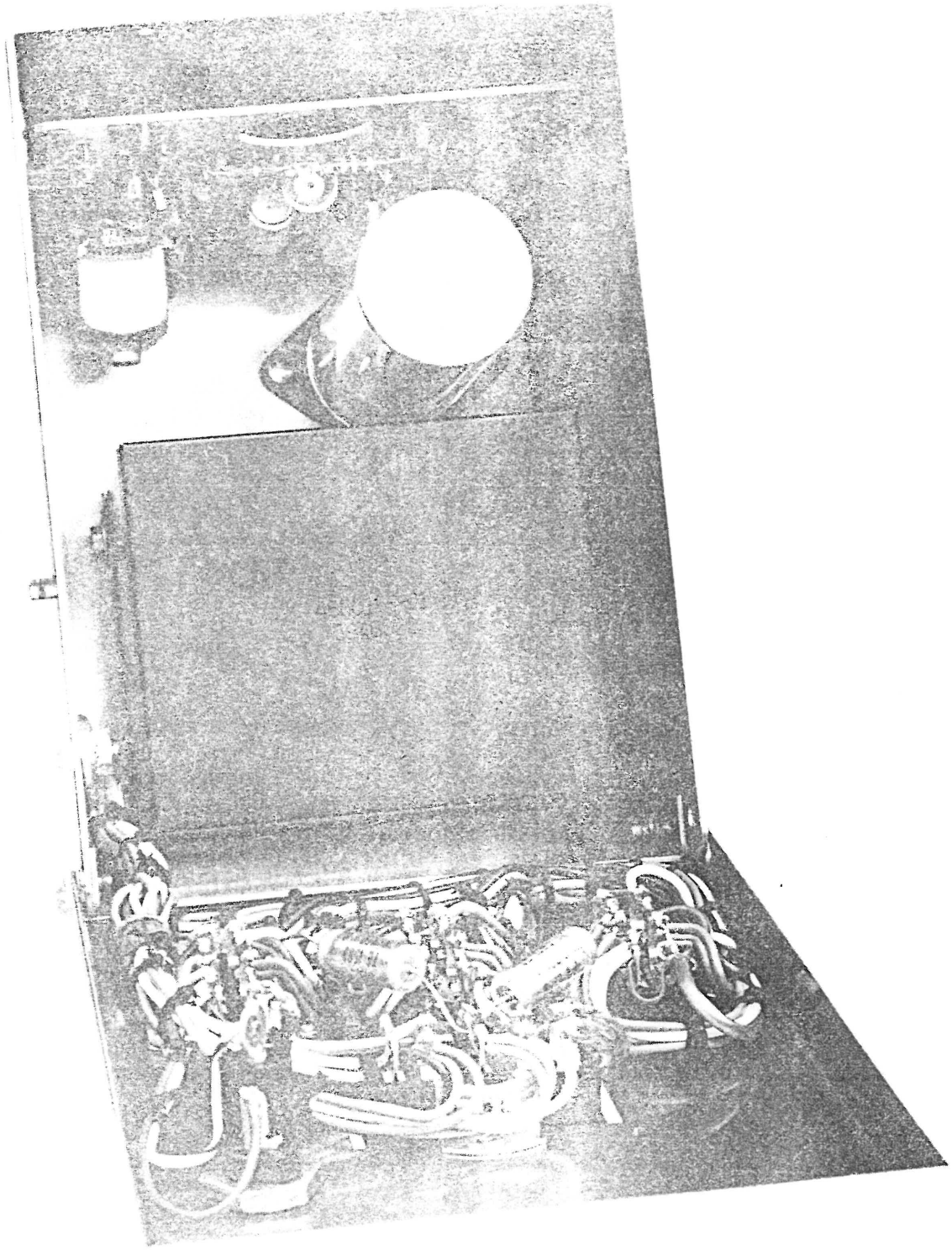


Figure 5-3. Power Supply Box (Open)

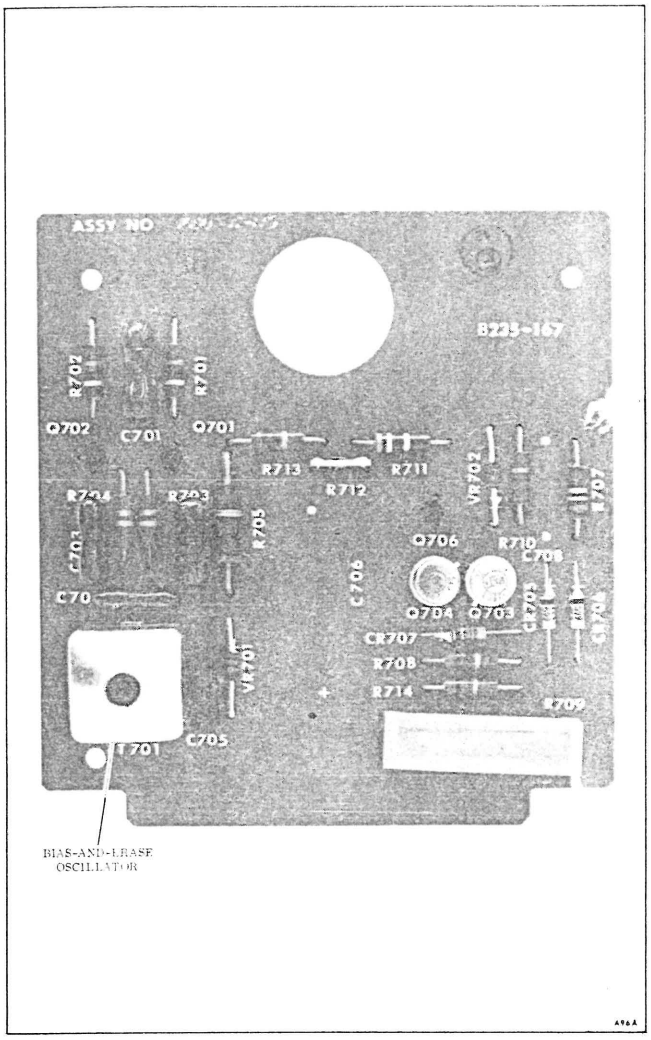


Figure 5-4. Power Supply Regulator (Typical)

power transistor Q705 (shorted), on the box mounting side.

5-35 BIAS CIRCUITS

5-36 Troubleshoot the bias circuits as follows:

a. If trouble is found in the recorder/reproducer bias or erase circuit, the malfunction could be in the master bias oscillator (on the power supply regulator #1 circuit board) or the bias amplifier module. On multi-channel equipment with trouble indicated on all channels, the master bias oscillator is probably defective; if the trouble is on only one channel, that channel's bias amplifier is probably defective.

b. Isolate trouble to any one circuit by moving its bias amplifier out on the extender board and measuring the bias input with an ac vtvm connected across resistors 3R90 and 3R91; bias voltage should be as shown on the schematic diagram in Section 8. If this voltage is correct, the trouble is probably in the bias amplifier module; if it is incorrect, the master bias oscillator is probably defective.

WARNING

DANGEROUS VOLTAGES ARE PRESENT ACROSS THE FUSE POST AND AT THE TRANSFORMER LEADS IN THE POWER SUPPLY. USE SPECIAL CARE WHEN CHECKING THE MASTER BIAS OSCILLATOR.

c. Bias and dc voltages are shown at key points on the schematic diagram in Section 8. Initiate the record mode and check these voltages to quickly isolate trouble to a particular stage or component. The dc voltage is applied to the bias oscillator with the power supply circuit board on an extender board.

5-37 RECORD/REPRODUCE CIRCUITS (See Section 8 Schematics)

5-38 If a tape does not play back correctly on the machine which recorded it, the record and/or reproduce circuit could be defective. Check the circuit functions by playing back a tape known to have been recorded correctly. If the tape reproduces normally, the record circuit is defective; if it does not, the reproduce circuit is defective. When trouble is evidenced, check power per paragraph 5-33 and check circuit continuity; refer to the schematic diagram in Section 8.

5-39 RECORD CIRCUIT. If trouble is suspected or evidenced in the record circuit, check that the record head and signal input are correctly connected and that the dummy plug (or accessory) is in the input accessory socket (on the record/reproduce unit back panel).

a. To check the bias voltage, initiate the record mode and set the output selector to BIAS; if the bias voltage is not normal, check it per paragraph 5-35.

b. Check the record relay per paragraph 5-31.

c. Connect headset or speaker amplifier to the PHONES jack to monitor the record signal, as an aid to troubleshooting.

d. Check signal circuits and dc voltages against those shown on the schematic diagram, using the extender board for the record circuit.

e. Initiate the record mode and set the output selector to NORMAL. Check that the VU meter indicates a normal signal input. If not, the trouble is probably in stage 2Q9 or the plug-in equalizer board. If the VU meter indication is normal, the trouble is in stages 2Q10 through 2Q15.

f. Transistor 2Q10 conducts only when the low tape speed is selected; 2Q11 conducts only when the high tape speed is selected.

g. If the output selector is at NORMAL, and the VU meter indication seems normal for the record line input, the fault is in stages 1Q1 through 1Q4. If the indication is not normal, stages 1Q5 through 1Q8 are defective.

5-40 REPRODUCE CIRCUIT. If trouble is evidenced or suspected in the reproduce circuit, check that the reproduce head and the output line are correctly connected. Connect headset to the phones jack (on the unit front); if the signal is normal, the output transformer or output line is defective. Check signal and dc voltages against those shown on the schematic diagram, using the extender board for the reproduce circuit.

5-41 FLUTTER TROUBLESHOOTING AIDS

5-42 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 5-2 for an indication of the cause of trouble.

5-43 If flutter is caused by the supply motor, the frequency will start low and will increase as the tape quantity gets smaller on the reel. The takeup motor seldom causes noticeable flutter, because it is isolated from the heads by the operating capstan and capstan idler. If it is the cause of flutter, the flutter frequency is high when there is a small tape pack on the takeup reel, and decreases as the pack increases.

Table 5-2. Rotational Rates

	TAPE SPEED	
	7-1/2 ips	15 ips
Drive Motor (Capstan)	10.0 Hz	20.0 Hz
Capstan Idler	1.2 Hz	2.4 Hz
Reel Idler	1.6 Hz	3.2 Hz

5-44 TRANSISTOR CHECKING

5-45 For test purposes, transistors conduct current like two back-to-back diodes.

WARNING

DO NOT CHECK COMPONENTS WHEN THE CIRCUIT IS ENERGIZED.

CAUTION

USE HIGH-RESISTANCE SCALES OF A LOW-VOLTAGE (3V MAX.) OHMMETER TO AVOID TRANSISTOR DAMAGE FROM EXCESSIVE CURRENT DISSIPATION.

a. Determine the electrical characteristics of any unfamiliar transistor or similar electronic device to be tested. Make sure that ohmmeter voltage will not exceed the rated voltage of the device.

CAUTION

DO NOT TEST HIGH-FREQUENCY TRANSISTORS, OR DIFUSSED-BASE POWER TRANSISTORS WHICH HAVE LOW REVERSE CONDUCTION.

b. If a resistor or inductor is connected in parallel to the transistor, disconnect it before tests.

c. Connect ohmmeter probes from base to emitter (negative probe to PNP base, and positive probe to NPN base); check resistance, which should be from 10 to 150 ohms. Vary the applied voltage by moving the ohmmeters range switch from X1000 to X100; diode action should occur (non-linear ohmic readings to voltage changes).

d. Connect the ohmmeter probes in reverse; resistance should be tens of thousands of ohms, and diode action should not occur when voltage is varied.

e. Connect probes from collector to emitter (negative probe to collector, base left floating); resistance should be tens of thousands of ohms. Vary the voltage;current change should be linear to voltage change (indicating required leakage).

f. Connect the ohmmeter probes in reverse. Results should be similar to those in step e, but the resistance values should not be identical. If the resistance is identical, the device under test should be replaced.

NOTE

Gain characteristics of a transistor are most likely correct if normal diode action or rectification is evident in tests.

g. Reconnect any disconnected circuit components.

5-46 CORRECTIVE PROCEDURES

5-47 Corrective procedures for most troubles are indicated in Table 5-3 along with troubles, their categories, and their probable causes.

5-48 POST-MAINTENANCE CHECKS

5-49 After performing maintenance on any system circuit proceed as follows:

a. Check that all components, circuit boards and connectors are correctly and securely installed.

b. Check for continuity and correct voltages in reworked circuits.

c. Check functioning of the reworked circuits according to the applicable check-out procedures in the front of this section.

5-50 ELECTRONIC ALIGNMENT

5-51 INTRODUCTION

5-52 The system's reproduce function is aligned while playing an Ampex Standard Alignment Test Tape, and the record circuit is then adjusted with the reproduce circuit as a reference.

5-53 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.

5-54 All tones on 15-ips 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.

5-55 TEST EQUIPMENT

5-56 Obtain the following test equipment, or equivalent:

1. Voltmeter, dc, 20,000 ohms-per-volt, 2% accuracy F.S.

2. Vacuum Tube Voltmeter, ac, Hewlett-Packard Model 400D.

3. Signal Generator, Hewlett-Packard Model 200CD.

4. Noise Filter, (see Figure 5-1) or ASA "A" Curve Filter (see Figure 5-2).

5. Ampex Standard Alignment Tapes that apply (see Table 1-2).

6. Technician's tools.

5-57 TEST CONDITIONS. Check for the following test conditions:

a. LINE TERMINATION switch at ON.

b. Dummy plug, instead of accessory transformer or preamp, in INPUT ACCESS socket.

c. Heads cleaned and demagnetized.

d. Covers installed on electronic units.

e. Magnetic tape of low-noise type, Series 434, or equivalent.

5-58 PROCEDURES INTRODUCTION

5-59 The following procedures will usually correct deficient operation. Sel-Sync adjustments are described in paragraph 5-78.

5-60 POWER SUPPLIES
(See Figures 5-3 and 5-4)

5-61 There are two main power supplies on the 8 channel MM-1000 and four power supplies on the 16 channel machine. For each machine one bias-and-erase oscillator is mounted with one of the power supplies. Each power supply has a regulator on a plug-in printed circuit board in the power supply box at the rear of the machine. The bias-and-erase oscillator is mounted with the power supply No. 1 regulator. The bias oscillator frequency has been adjusted at the factory for 150 kHz with all electronics and cables connected; however, if a conversion kit (from 8 to 16 channels) is installed, it may be necessary to readjust the oscillator frequency to ensure sufficient bias and erase power.

5-62 Power supply 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. With the equipment operating in the reproduce mode, the voltmeter should indicate 39 (-1/2, +1) volts.

Table 5-3. Corrective Procedures

TROUBLE	CATEGORY: Heads	Tape	Tension	Motors	Adjustment (Electronic)	Other	CAUSE	CORRECTIVE PROCEDURE
POOR FREQUENCY RESPONSE	X						Dirty/magnetized head(s)	4-2/8
	X						Heights unequal (1-inch only)	6-28
	X						Azimuth misadjusted (1-inch)	5-65
					X		Bias level or leakage (Sel-Sync)	5-85
					X		Reproduce equalization	5-75
					X		Record calibration	5-69
					X		Record equalization	5-78
			X				Playback tape tension	6-15 and 6-19
					X		Signal generator (adjust for flat output)	Adjust
EXCESSIVE NOISE	X						Dirty/magnetized head(s)	4-2/8
		X					Low-grade tape	Replace
						X	External magnetic fields (shield or isolate equipment such as motors, generators, etc.)	Shield/isolate
						X	Rubbing of head cables	Eliminate
	X						Azimuth misadjusted (1-inch)	5-65
	X						Heights unequal (1-inch only)	6-28
	X						Zenith misadjusted (1-inch)	6-30
					X		Record/reproduce level	5-71
					X		Low erase current	Increase current
						X	Head gate open	Close gate
EXCESSIVE WOW OR FLUTTER	X						Dirty head(s)	4-2
						X	Contamination in balance of tape-handling path	4-3/4
				X			Capstan motor: bearing defective, motor shaft bent, defective capacitor or windings	Replace defective part(s)
NOTE				X			Supply/takeup motor defective	Replace defective part(s)
For troubleshooting aids, see paragraph 5-41.			X				Excessive supply holdback tension	6-15
						X	Capstan idler: pressure incorrect, or defective tire/bearing	Replace defective part(s)
						X	Tension arm: guide shaft bent or bearing defective	Replace defective part(s)
	X	X					Poor tape guiding	Check and correct
		X					Tape scrape from defective reels or incorrect turntable height	Replace defective reel(s) Adjust/replace reels
						X	Capstan slipping from being polished or oily	Clean, 4-4, or replace
						X	Motion-sensing unit defective	Repair/replace
						X	Scrape flutter idler	Oil, 4-10
SIGNAL DISTORTION								
Second Harmonic	X						Magnetized head(s)	4-8
					X		Malfunction in: (1) bias oscillator; (2) bias amplifier; (3) record amplifier; (4) reproduce amplifier	Correct/replace
Third Harmonic		X					Low-grade tape	Replace
NOTE	X						Record and playback heads not at same height (1-inch only)	6-28
At operating level, most tape distorts 0.6-1.1% at 500 Hz.					X		Misadjusted: (1) bias level; (2) operating level	5-71

5-63 If the adjustment is necessary, open the cover on the power supply box (see Figure 5-3).

WARNING

FULL LINE VOLTAGE IS PRESENT IN THE BOX. DO NOT TOUCH THE FUSE POST OR TRANSFORMER LEADS WHILE THE SYSTEM IS ENERGIZED.

5-64 With the voltmeter connected as previously described, place the equipment in the reproduce mode, then adjust R712 for an indication of 39 (-1/2, +1) volts.

5-65 1-INCH REPRODUCE/RECORD HEAD AZIMUTH (See Figure 5-5)

5-66 The VU meter on each record/reproduce unit can be simultaneously used to measure the output of each head. This simultaneous metering facilitates determination of the optimum setting. For a reproducer, use a vtvm for each head track, or use one vtvm to adjust one head and then another-working back and forth to reach an optimum setting.

5-67 Standard alignment tapes for the 15 ips speed have all tones recorded at normal operating level, while standard tapes for slower speeds have all tones (except the last) recorded at 10 dB below operating level. Make the normal-operating-level adjustment at the 15 ips speed. If speed is set at 7-1/2 ips, it will probably be necessary to turn the REPRODUCE LEVEL control full clockwise (do not exceed a VU meter indication of 0) in step g. For a reproducer, adjust the level control for any convenient vtvm indication.

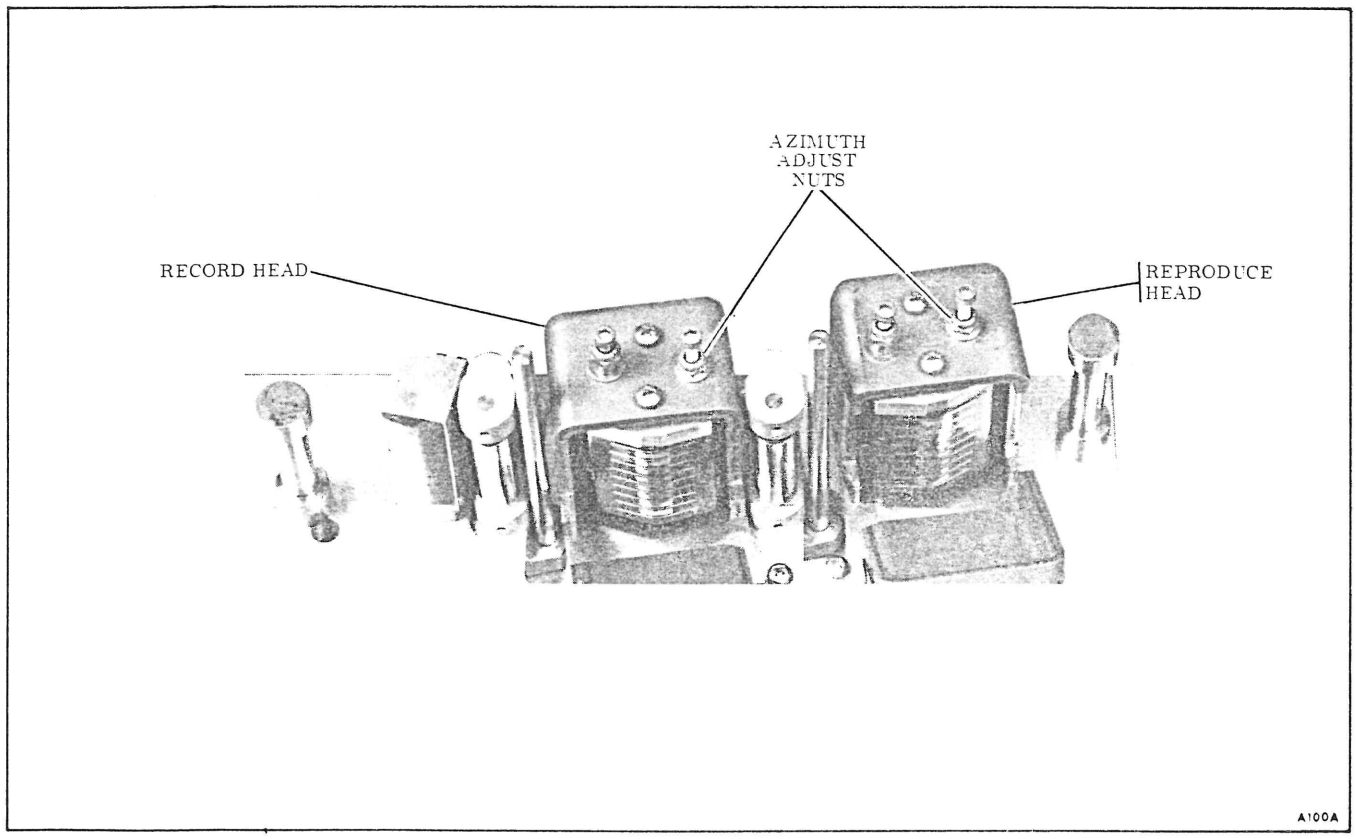


Figure 5-5. Reproduce and Record Heads

CAUTION

DO NOT ADJUST ANY NUT OR SCREW ON THE HEAD ASSEMBLY EXCEPT THE AZIMUTH ADJUSTMENT NUT. SEE FIGURE 5-5.

5-68 REPRODUCE ADJUST. Adjust the reproduce head azimuth as follows:

a. Apply power to equipment. Set tape speed (15 ips is desirable).

b. Set MODE SELECTOR switches on all record/reproduce units to NON-RECORD (this prevents accidentally entering the record mode and erasing the test tape).

c. Set MASTER MODE switch to PLAY.

d. Set OUTPUT SELECTOR switches on all record/reproduce units to NORMAL.

e. Thread the correct-speed test tape on the transport. If this is a reproducer, connect the vtvm(s) to the output connector(s).

NOTE

Voice announcements on the test tape can be monitored through headsets, or by an amplifier/speaker connected to the phones jack, or to the output.

f. Start the test tape in motion in the reproduce mode.

g. For adjustments at 15 ips tape speed, adjust the REPRODUCE LEVEL control on each record/reproduce unit for a vu meter indication of 0, as the first tape tone is reproduced. (Any convenient indication on the vtvm is used for a reproducer.) If a slower speed is being used, and it is impossible to achieve this level, set the REPRODUCE LEVEL control to the full-clockwise position.

h. The second tone on the test tape is the azimuth adjustment tone, 15 kHz. As this tone reproduces, adjust the reproduce head azimuth adjustment nut (not the screw) for a maximum output indication on the VU meters (or vtvms). On multi-channel equipment the individual tracks of a head do not necessarily all peak at the same setting, adjust for the highest compromise output on the VU meters.

5-69 RECORD ADJUST. Adjust the record head azimuth as follows, or as described in the next paragraph.

a. Initiate the Sel-Sync mode by setting MASTER MODE at SYNC.

b. Adjust the record head azimuth using the 15 kHz tone according to step h above. (The erase head is fixed-base and need not be adjusted.)

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.

5-70 RECORD ADJUST (ALTERNATE). This alternate adjustment (similar to the reproduce head azimuth adjustment) is made while simultaneously recording and reproducing. The record head azimuth is adjusted to coincide with the reproduce head (previously adjusted to a reference position). This procedure does not apply to a reproducer.

CAUTION

DO NOT ADJUST ANY HEAD ASSEMBLY NUT OR SCREW, EXCEPT THE NUT FOR AZIMUTH ADJUSTMENT ON THE RECORD HEAD.

a. Set the machine for the play mode.

b. Connect all INPUT connectors in parallel then connect signal generator lead to the common input connection.

c. Apply power to equipment and set tape speed.

d. Set the signal generator controls to obtain an output of 1-volt rms at 15,000 Hz.

e. Thread blank tape on equipment.

f. Set MODE SELECTOR switch for each channel to RECORD.

g. Set OUTPUT SELECTOR switch for each channel to NORMAL. Then adjust RECORD LEVEL control(s) for the VU meter indication in Table 5-4 (the level depends on tape speed, and whether equipment is strapped for +8 dBm operating level output).

h. Set OUTPUT SELECTOR switch for each channel to SET UP, then start tape in motion with all channels operating in the record mode.

i. While thus simultaneously recording and reproducing, adjust REPRODUCE LEVEL control(s) for 0 VU meter(s) indication. If adjustment is being made at 7-1/2 ips, and it is impossible to reach the 0 level, set the REPRODUCE GAIN control at full-clockwise position.

j. Adjust record head azimuth nut (not the screw) for maximum output indications on the VU meter(s). If all tracks do not peak at the same setting, adjust for overall optimum output.

NOTE

Minor peaks may appear on each side of the correct setting. Correct adjustment, however, is indicated by a definitely higher output.

k. Return the reproduce level to normal operating condition and change the frequency of the signal generator to 500 Hz.

l. While simultaneously recording and reproducing, set OUTPUT SELECTOR switch to NORMAL, set up and adjust the RECORD LEVEL control for a 0 VU meter indication. Then set OUTPUT SELECTOR switch to SET UP and adjust REPRODUCE LEVEL control for a 0 VU meter indication.

5-71 REPRODUCE/RECORD ALIGNMENT (See Figure 5-6)

5-72 The first alignment run should be made at the speed at which the equipment is usually used. For a reproducer, perform only steps a through i (for reproduce equalization) using a vtvm.

a. Remove cover from record/reproduce unit front panel (or reproducer electronics tray).

Table 5-4. Record Level Setting

OUTPUT STRAPPING	TAPE SPEED	SET FOR VU INDICATION OF
+8 dBm	15 ips	0 dBm
	7-1/2 ips	-10 dBm
+4 dBm	15 ips	-4 dBm
	7-1/2 ips	+4 dBm

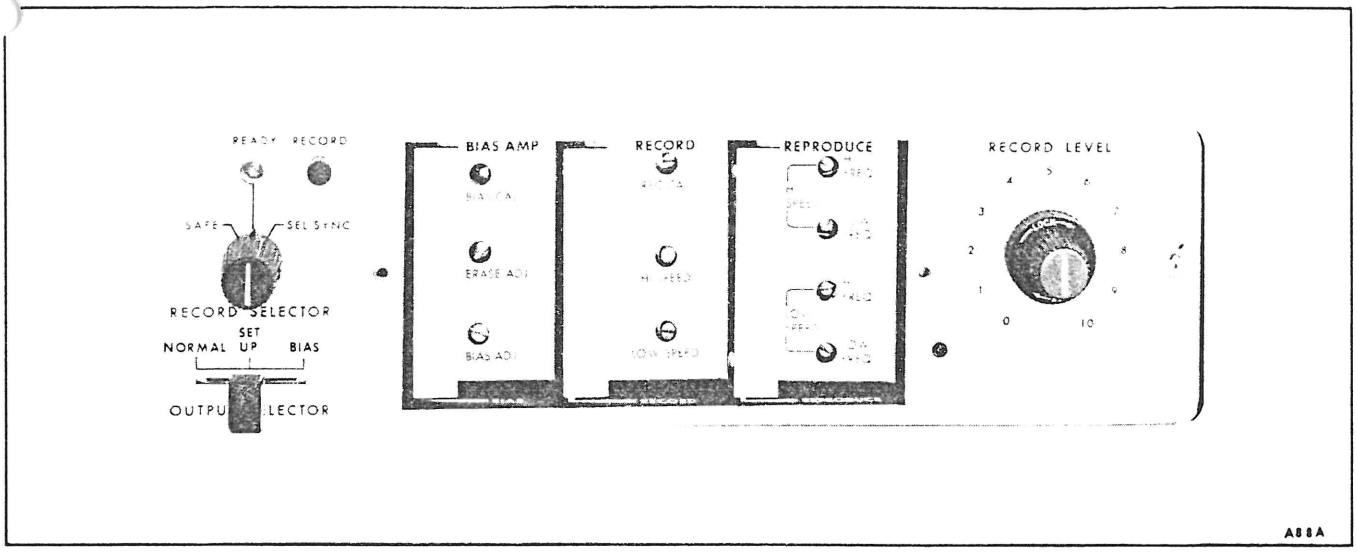


Figure 5-6. Electronics Unit (Panel Off)

b. Apply power to equipment. Set tape speed.

c. Set MODE SELECTOR switches on all record/reproduce units to NON-RECORD (this prevents accidentally entering the record mode and thus erasing the standard tape).

d. Set OUTPUT SELECTOR switch of record/reproduce channel under test to NORMAL.

e. Connect vtvm to OUTPUT connector of the channel under test.

f. Thread correct-speed test tape on transport.

g. Start test tape in motion in the reproduce mode. As the first tone reproduces, adjust REPRODUCE LEVEL control for the output level indication shown on Table 5-5. Set memory dial to that position.

h. Reproduce the test tone series from the recorded test tape (starting with the highest frequencies). Adjust the appropriate HIGH FREQ control (at the front of reproduce board) as necessary for flattest possible response, within specifications,

Table 5-5. Reproduce Equalization Output

OUTPUT STRAPPING	TAPE SPEED	SET AT VTVM INDICATION
+8 dBm	15 ips	+8 dBm
	7-1/2 ips	-2 dBm
+4 dBm	15 ips	+4 dBm
	7-1/2 ips	-6 dBm

but do not move response more than ±2 dBm from the theoretical response curve (refer to Figure 5-9 and to paragraph 5-73). If further adjustment is indicated, there is trouble in the record/reproduce process not correctable by equalization adjustment.

NOTE

The test tape is recorded full track. When reproduced by a half-track or multi-track head, the "fringing" effect produces invalid response at frequencies below 700 Hz (15 and 7-1/2 ips). This effect, which results in high indications in the lower frequencies, does not occur when tapes are recorded and reproduced with heads mounted in the same configuration.

i. For tests at 7-1/2 ips tape speed, as the last tone is reproduced, adjust the REPRODUCE LEVEL control for a vtvm indication of +8 dBm, or +4 dBm (depending on equipment strapping). The VU meter should indicate 0 (±3/4 dB).

NOTE

This completes the reproduce equalization adjustment and reproduce level setting, as required for record calibration. Do not change this reference level until after step q.

j. Wind the test tape on its original reel in the reproduce mode and remove the reel.

k. Connect the signal generator to the INPUT connector, with the vtvm still connected to the output.

l. Set the signal generator to provide a nominal 1-volt rms output at the frequency that applies: at 15 ips, 1,000 Hz; at 7-1/2 ips, 500 Hz.

m. Thread blank tape on transport. Set OUTPUT SELECTOR switch to BIAS, and MODE SELECTOR switch to RECORD. Start the tape in motion, with the test channel operating in the record mode.

n. Adjust the ERASE ADJ control, (at bias amplifier module front) for a VU meter peak indication, then readjust the BIAS CAL control as necessary to keep the VU meter indicator on scale.

o. Set OUTPUT SELECTOR switch to SET UP. Adjust BIAS ADJ control for maximum output indication on vtvm, turning it clockwise.

p. Reset OUTPUT SELECTOR to BIAS. Adjust BIAS CAL control for a 0 VU meter indication.

q. Reset OUTPUT SELECTOR switch to SET UP. Set the signal generator for a 500 Hz output. Adjust RECORD LEVEL control for a vtvm indication of +8 or +4 dBm, depending on equipment output strapping.

r. Set OUTPUT SELECTOR switch to NORMAL. Adjust REC CAL control (at record module front) for a 0 VU meter indication.

s. Disconnect the signal generator from INPUT connector.

t. Repeat steps b through i for the second tape speed, using the correct speed test tape and adjusting the applicable HIGH FREQ control as necessary.

u. Repeat the complete procedure for each channel (steps a through t).

5-73 RESPONSE CURVE CHECK

5-74 Setups for response curve checks are given in Figure 5-7 and 5-8. Response curves for record and reproduce are shown in Figure 5-9. To check these curves proceed as follows:

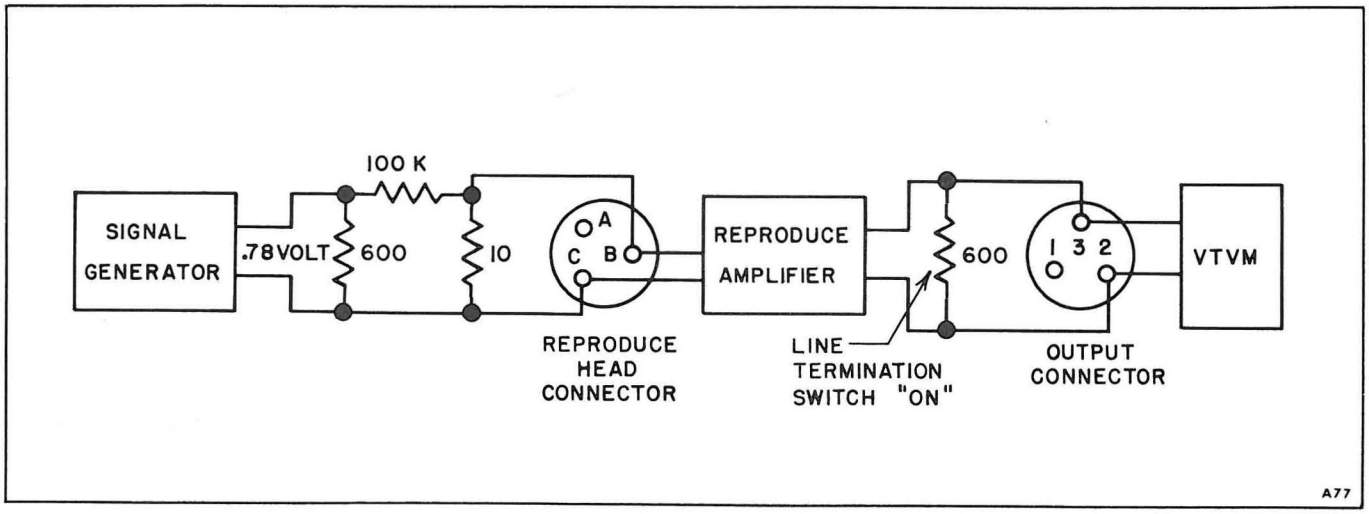


Figure 5-7. Reproduce Response Check Setup

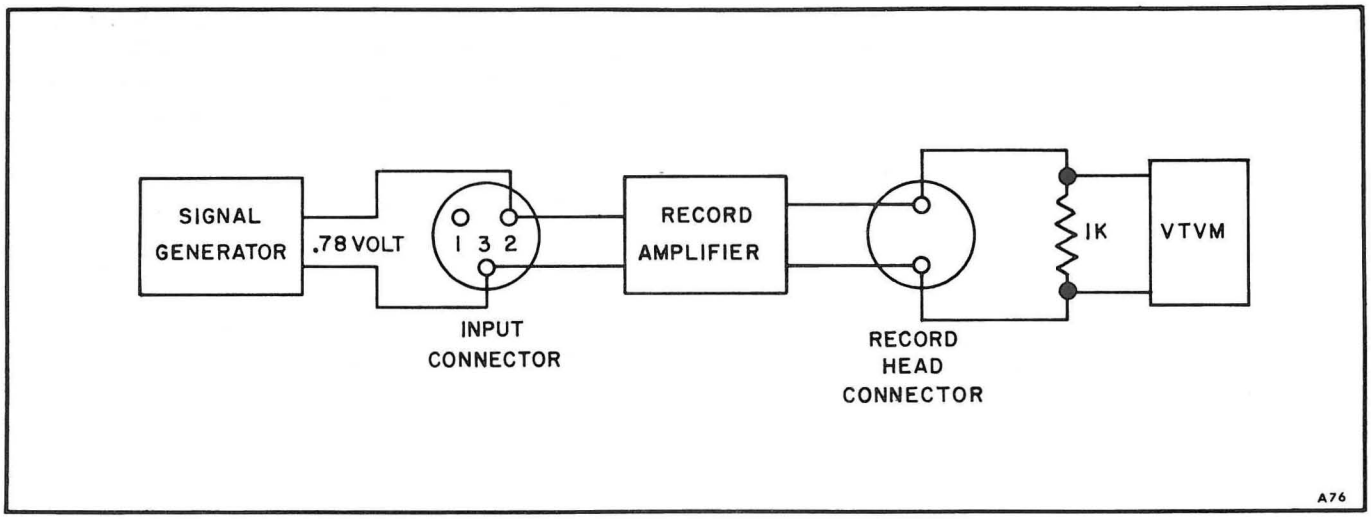


Figure 5-8. Record Response Check Setup

a. Disconnect the head cables, input cable, and output cable from the receptacles.

b. Connect the signal generator and the vtvm as shown in Figure 5-7 or 5-8.

c. Set the generator for a 0.78-volt (0-dBm) output.

d. To check the record amplifier curve, remove the bias amplifier plug-in circuit board. Secure the end of the tape tension arm in position away from the safety switch, and initiate the record mode.

e. To check the reproduce amplifier curve, turn power ON, then operate the

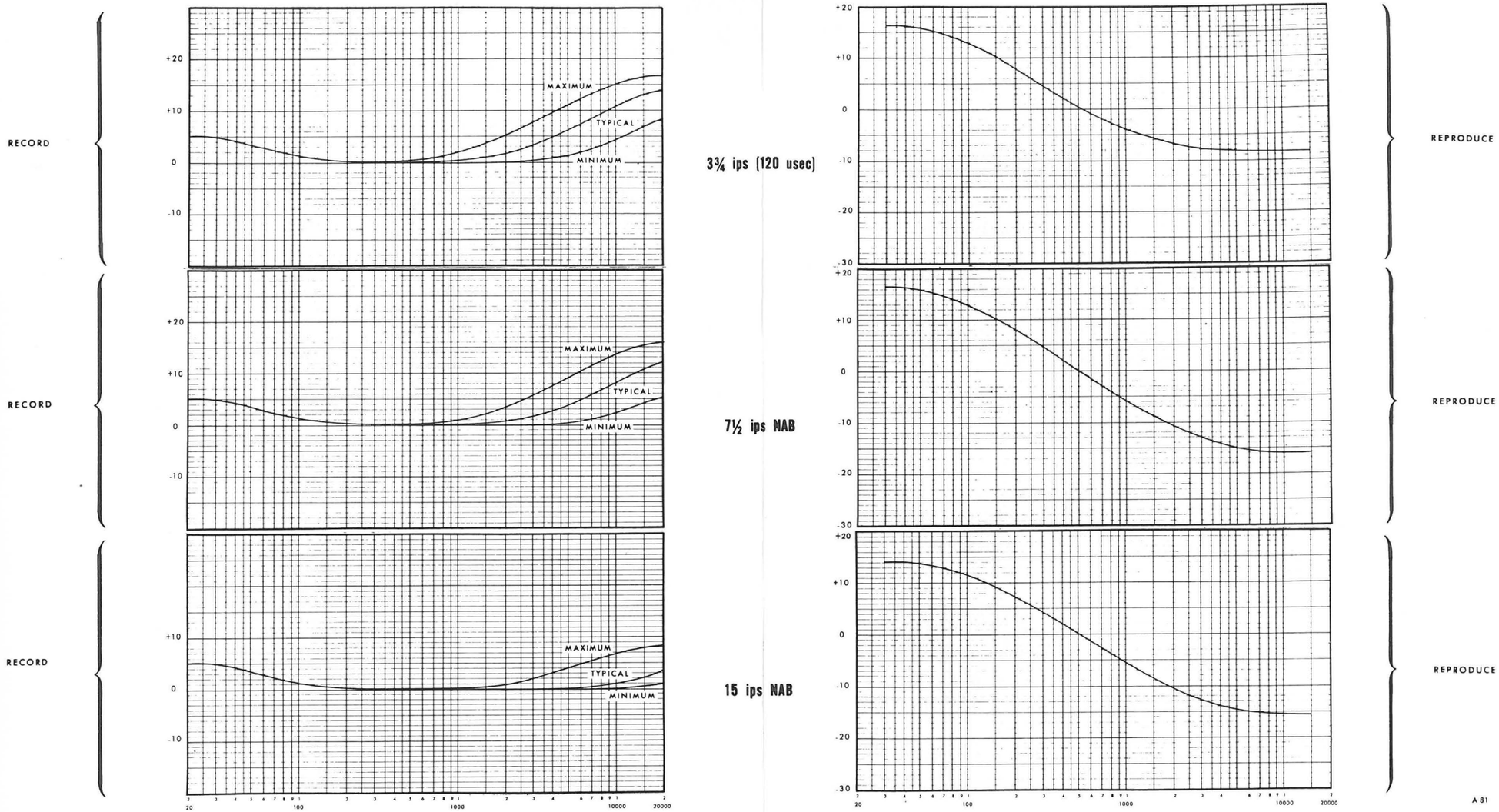
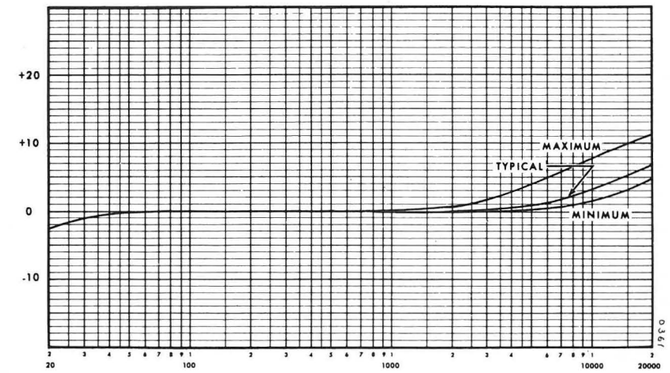
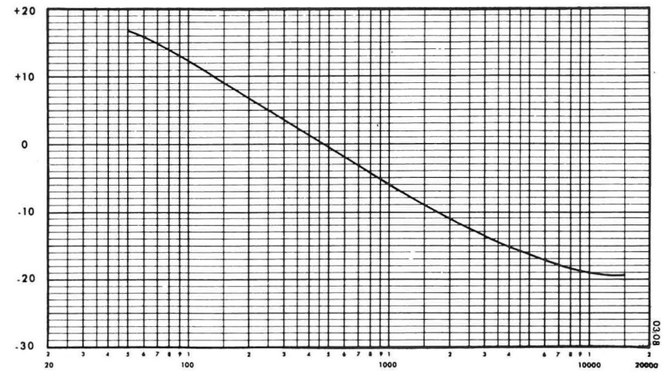


Figure 5-9. Response Curves
(Sheet 1 of 2)

RECORD

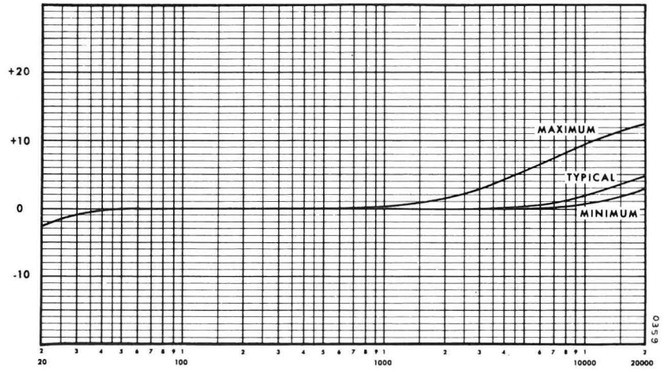


15 ips CCIR

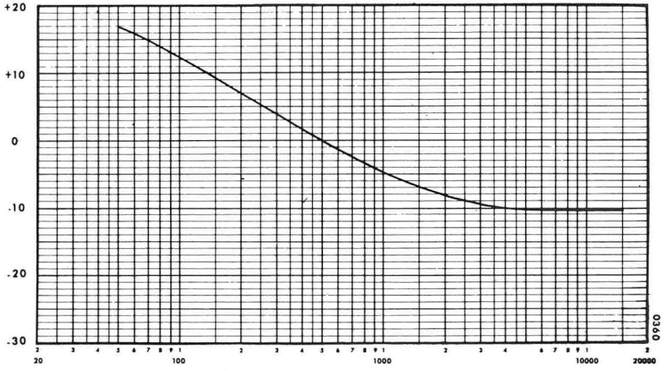


REPRODUCE

RECORD



7½ ips CCIR



REPRODUCE

A 62

Figure 5-9. Response Curves
(Sheet 2 of 2)

generator in small uniform steps over the specified frequency range for the set tape speed. Adjust the equalization controls to set the amplifiers to the applicable response curve.

f. Reinstall the bias amplifier board and reconnect the cables.

5-75 LOW-FREQUENCY REPRODUCE EQUALIZATION

5-76 This procedure will seldom be required. The cover must be removed from the front panel of the reproduce/record unit (front cover on the reproduce electronic tray).

5-77 The reproduce circuit is adjusted to compensate for head "bumps" which occur at low frequencies. The adjustment of a reproducer requires that the head track configuration be the same as on the recorder that made the tape.

a. Connect the vtvm to the OUTPUT connector.

b. Connect the signal generator to the INPUT connector and set it to 500 Hz at a nominal 1-volt rms level.

c. Apply power to equipment. Set tape speed.

d. Thread blank tape on equipment.

e. Set OUTPUT SELECTOR switch to SET UP, and adjust the RECORD LEVEL control as necessary for a normal record level (+8 dBm or +4 dBm, depending on equipment output strapping) as indicated on the vtvm.

f. Set OUTPUT SELECTOR switch to SET UP, and start the tape in motion with the test channel operating in the record mode.

g. Adjust REPRODUCE LEVEL control as necessary for a normal operating level (+8 dBm or +4 dBm, depending on equipment output strapping) as indicated on the vtvm.

h. While thus simultaneously recording and reproducing, vary signal generator frequency from 250 Hz to 30 kHz, and note the magnitude of any positive-going or negative going head "bumps".

i. Adjust the applicable LO FREQ control (at front of reproduce board) for the flattest possible response, within specifications. This is done by adjusting head "bump" excursions for an equal magnitude above or below the reference frequency of 500 Hz.

j. Repeat steps h and i for the second tape speed.

k. Repeat the complete procedure for each channel.

5-78 RECORD EQUALIZATION

5-79 Remove the small cover over the record/reproduce plug-in modules and proceed as follows:

a. Perform steps a through d of the previous paragraph.

b. Set OUTPUT SELECTOR switch to SET UP, and adjust the RECORD LEVEL control for the vtvm indication shown in Table 5-6 (this establishes the 500 Hz reference level).

c. Change the frequency of the signal generator to conform to the tape speed: at 15 ips, 18,000 Hz; at 7-1/2 ips, 15,000 Hz.

d. Start the tape in motion, with the test channel operating in the record mode.

e. Set OUTPUT SELECTOR switch to SET UP.

f. While thus simultaneously recording and reproducing, change the signal generator frequency in uniform steps over the upper half of the response spectrum for the applicable tape speed. Adjust HI SPEED or LOW SPEED control (at front of recordboard) for the flattest possible high-frequency

Table 5-6. Record Equalization Level

TAPE SPEED	OUTPUT STRAPPING	SET FOR VTVM INDICATION
15 ips	+8 dBm	+8 dBm
	+4 dBm	+4 dBm
7-1/2 ips	+8 dBm	-10 dBm
	+4 dBm	-14 dBm

response, referenced to 500 Hz, conforming to specifications.

g. Repeat steps c through f for the second tape speed.

h. Repeat the complete procedure for each additional channel.

5-80 SEL-SYNC ADJUSTMENTS (See Figure 5-10)

5-81 Sel-Sync adjustments are not applicable to the reproducer.

5-82 TEST EQUIPMENT: Obtain the following equipment:

1. Ampex Standard Alignment Tape (see Table 1-2).

2. Technician's tools.

5-83 TEST CONDITIONS. Check for the following test conditions:

a. If the recorder is not terminated in the console, set LINE TERMINATION switch (on back of record/reproduce unit) to ON.

b. Dummy plug (not the accessory transformer or preamp) in INPUT ACCESS socket.

c. Heads cleaned and demagnetized.

d. Covers installed on electronic units.

5-84 SEL-SYNC LEVEL. Adjust the Sel-Sync level as follows:

a. Set RECORD SELECTOR switch on each record/reproduce unit to READY and MODE CONTROL to NON-RECORD (this prevents entering the record mode accidentally and thus erasing the tape).

b. Apply equipment power and set tape speed.

c. Thread the correct-speed standard alignment tape on the transport.

d. Set OUTPUT SELECTOR switches to NORMAL and MASTER MODE switch to PLAY.

e. Run the standard alignment tape to the operating-level tone (first tone on 15 ips tape, and last tone on a tape for slower speeds).

f. As the operating-level tone reproduces, adjust REPRODUCE LEVEL controls for 0 VU meter indications.

g. Rewind tape to beginning of the operating-level tone. Set MASTER MODE to SYNC.

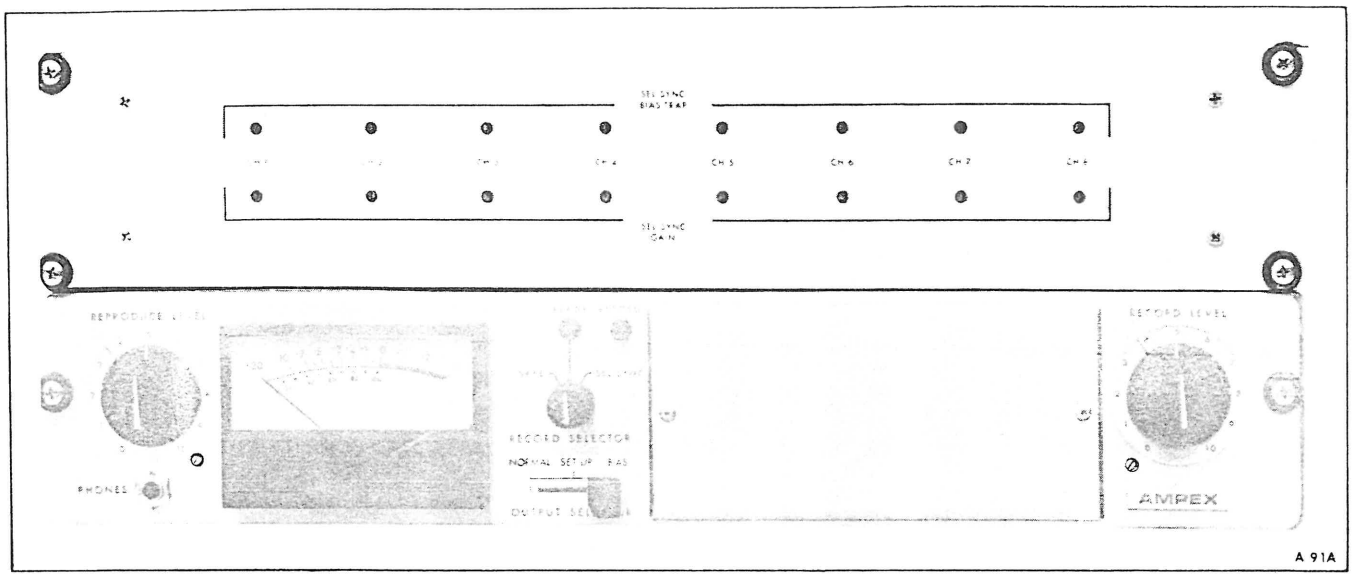


Figure 5-10. Sel-Sync Adjustments

h. Place tape in motion in the reproduce mode. As the operating level tone reproduces, adjust SEL-SYNC GAIN controls (on SEL-SYNC relay unit of recorder/reproducer) for 0 VU meter indication.

i. Wind tape on original reel and remove reel.

5-85 SEL-SYNC BIAS TRAP. When operating with Sel-Sync, the bias from one recording channel could leak into another. Nothing would be recorded on the latter channel, but VU meter monitoring could be masked, so a trap is provided to minimize the leakage.

5-86 The bias trap (adjusted at the factory) usually requires no readjustment. If the bias from recording channels affects VU meter indications for other channels, adjust as follows:

a. Remove tape from machine and secure the end-of-tape tension arm in position so the transport will operate.

b. Set MASTER MODE to PLAY.

c. On electronics assemblies, check that all OUTPUT SELECTOR switches are at SET UP.

d. On the Sel-Sync control panel, set the channel to be tested to SEL-SYNC and all others to RECORD.

e. Press PLAY and RECORD buttons.

f. Adjust the operating Sel-Sync BIAS TRAP control (on SEL-SYNC relay unit) to null the VU meter indication.

g. Repeat the procedure for each channel.

NOTE

If CHANNEL SELECTOR switch accidental actuation removes a channel from the record mode, and the channel is reset to RECORD, it is necessary to actuate the transport PLAY and RECORD buttons simultaneously to return to this test mode.

SECTION VI

TRANSPORT MAINTENANCE

SECTION VI

TRANSPORT ADJUSTMENT

6-1 INTRODUCTION (Figure 6-1)

6-2 Adjustment of the tape transport to bring brakes and tape tensions within specifications varies between a transport for 1-inch tape and for 2-inch tape. Any transport type may be modified to be convertible between 1 and 2-inch tape with the conversion kits listed in Table 6-1. A checklist of adjustments is given in Table 6-5 (on foldout page).

6-3 TEST EQUIPMENT

6-4 Obtain the following equipment, or equivalent:

a. Spring scale, 0-2 lb. Ampex 650 - 105.

b. Spring scale, 0-10 lb. Ampex 650 - 104.

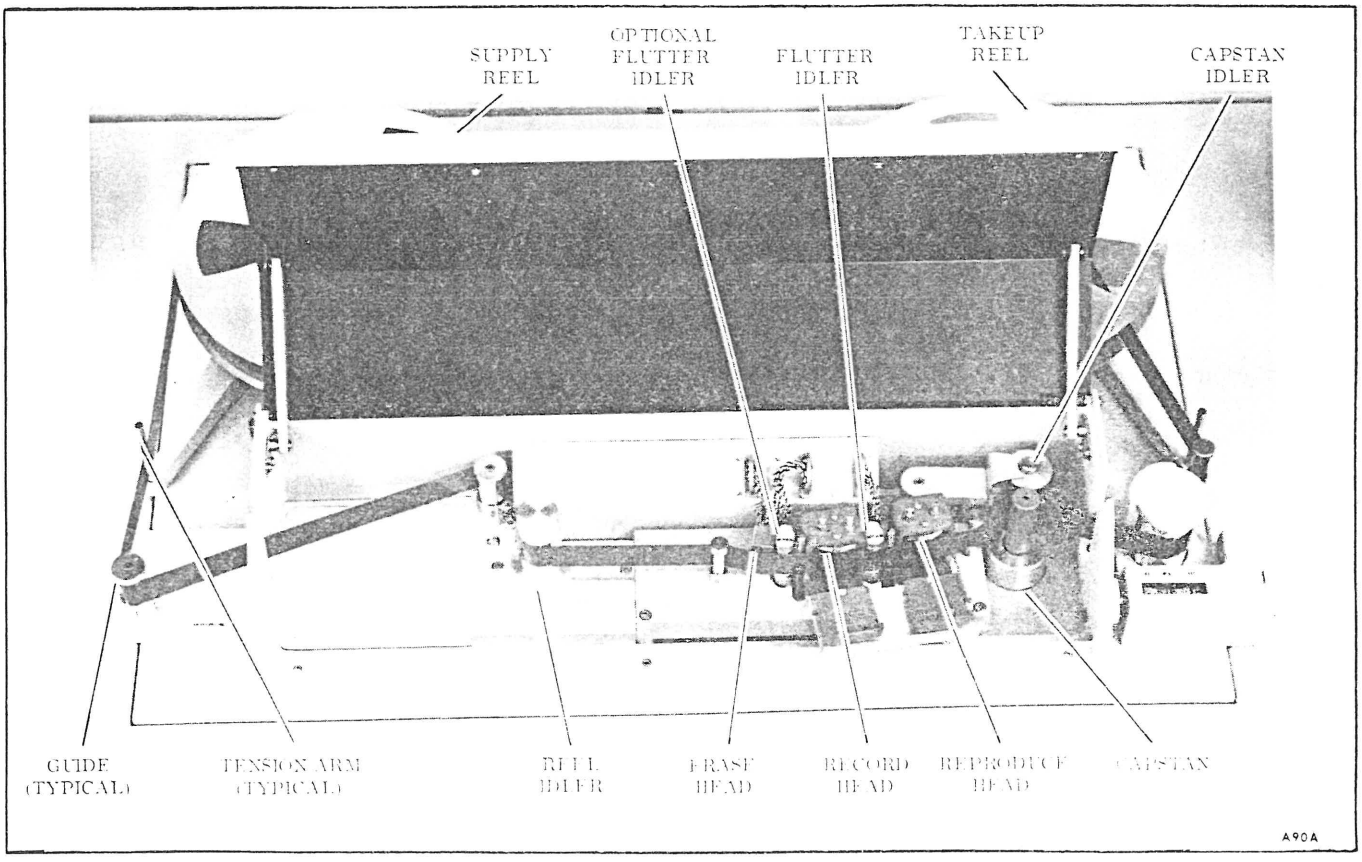


Figure 6-1. Tape Transport

Table 6-1. Transport Tape-Width Conversion Kits

ORIGINAL TRANSPORT TYPE	1-INCH/2-INCH CONVERSION KITS
1-inch	4940150-02 (must be installed by Ampex personnel)
2-inch	4940187-01

c. Four feet of nylon cord, with a 1- to 2-inch loop in each end.

d. Three feet of magnetic recording tape (width equal to that in use).

6-5 ACCESS (See Figure 6-2)

6-6 To gain access to the adjustment points, and for general servicing, remove the rear screens. Each screen is secured to the recorder frame with four 1/4-turn captive screws.

6-7 BRAKE ADJUSTMENT (See Figure 6-3)

6-8 The brake system stops reel rotation and maintains tape tension when the equipment is removed from any operating mode. A brake differential is necessary to maintain tension while stopping; the brake force is therefore higher for the tape-feeding reel in every case. Braking functions are checked with power OFF and no tape installed.

6-9 TAKEUP REEL BRAKES (See Figure 6-3)

6-10 Adjust the takeup reel brakes as follows:

a. On 1- to 2-inch convertible systems only, install 1-inch tape remove the high (2) and low (1) brake spacers.

b. Wrap all of nylon cord CCW (counterclockwise) on takeup reel and insert hook of the 0-2 lb. scale in cord loop.

c. Hold scale parallel to floor and as close as possible to reel, then pull scale (takeup turntable rotates CCW).

d. Tap reel to ensure a correct reading, then pull cord steadily and read scale indication. Repeat this procedure until scale reading has been the same several times. The scale should indicate the value given in Table 6-2.

Table 6-2. Transport Brake Torques

TAPE SIZE	SUPPLY REEL		TAKEUP REEL	
	REWIND (CW)	FORWARD (CCW)	REWIND (CW)	FORWARD (CCW)
1-inch	12-20 oz.	4-1/2 (±1/2) lb	4-1/2 (±1/2) lb	12-20 oz.
2-inch	20-28 oz.	7-1/2 (±1/2) lb	7-1/2 (±1/2) lb	20-28 oz.

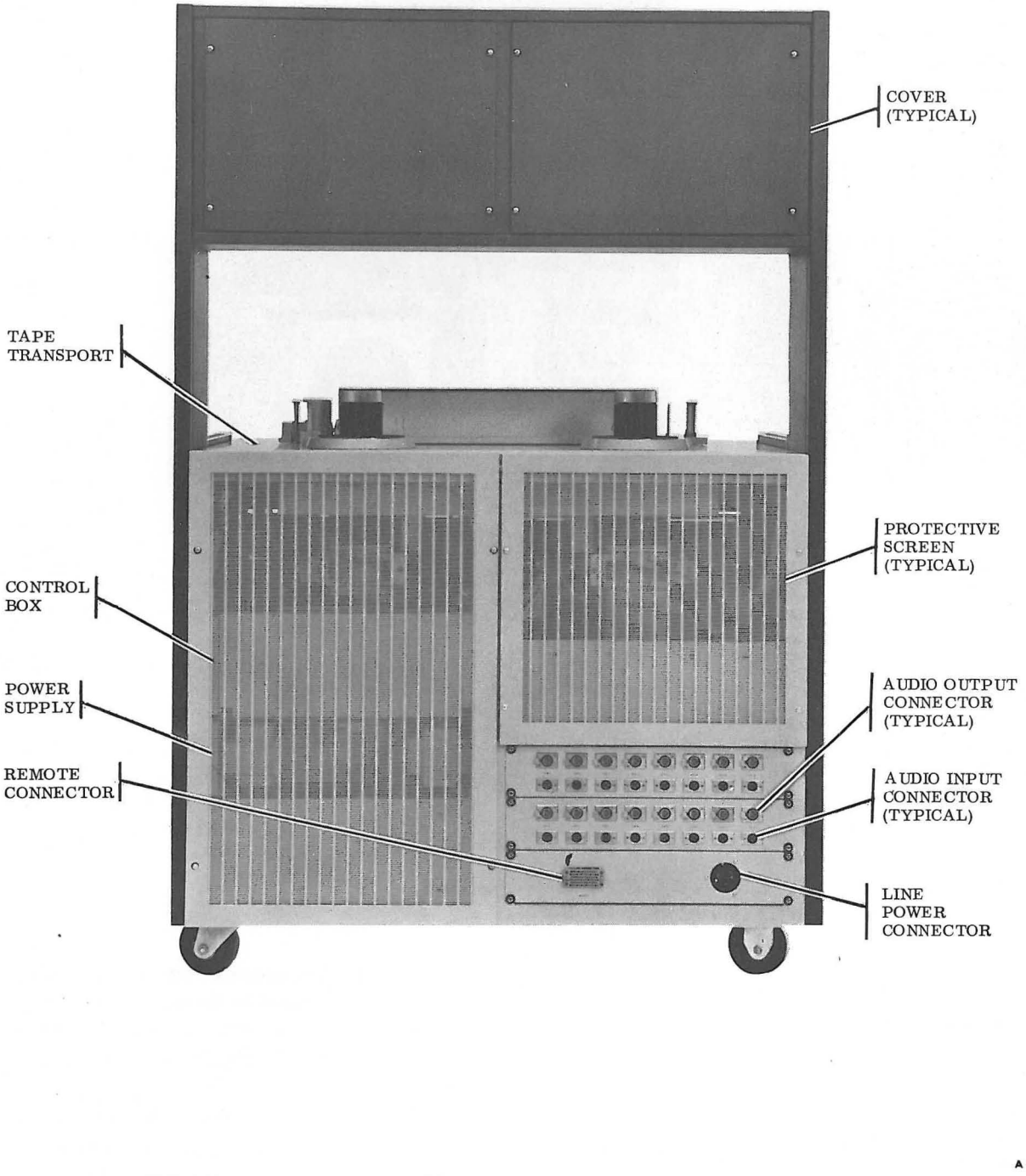


Figure 6-2. MM-1000 (Rear)

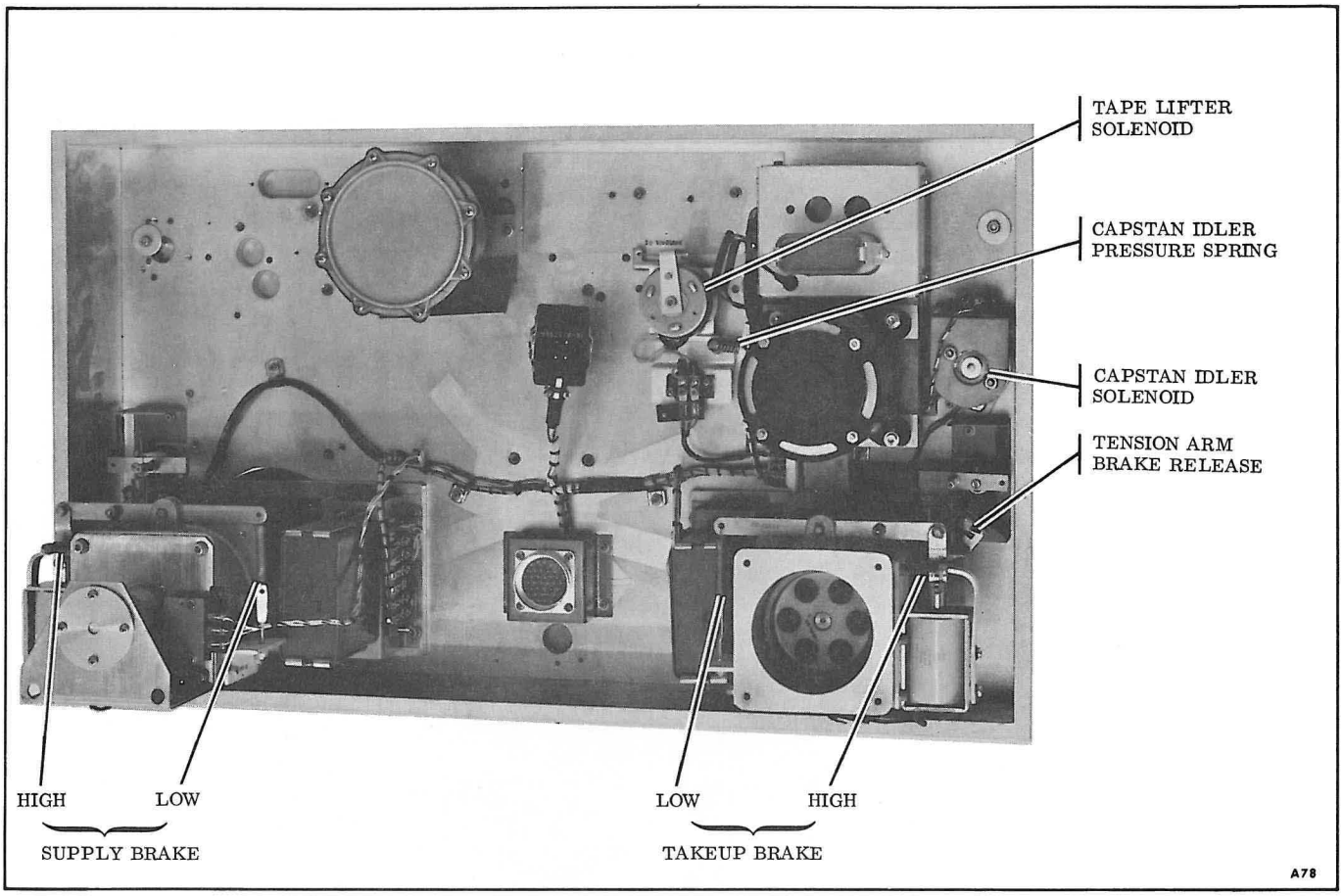


Figure 6-3. Transport-Adjust Points

e. If the reading is not within limits, slightly turn takeup reel brake adjustment nut (CW increases braking), then repeat procedures beginning with step c.

f. Wrap all of the cord CW on reel, and insert hook of the 0-10 lb scale in cord loop.

g. Hold scale parallel to floor and as close as possible to reel, then pull the scale (takeup turntable rotates CW).

h. Tap reel, to ensure a correct reading, then pull cord steadily and read scale indication. Repeat this procedure until scale reading has been the same several times. The scale should indicate the value given in Table 6-2.

i. If the reading is not within limits, slightly adjust nuts on each side of brake solenoid an equal number of turns (CW increases braking), then repeat procedures beginning with step g.

NOTE

If the tension varies while the cord is being pulled at a steady rate, the tensions of the springs may be unequal.

j. On convertible systems, reinstall brake spacers removed in step a, install 2-inch tape and repeat the procedures beginning at step b.

k. Remove scale and cord from transport.

6-11 SUPPLY REEL BRAKES (See Figure 6-3)

6-12 Adjust the supply reel brakes as follows:

a. On 1- to 2-inch convertible systems only, install 1-inch tape and remove the high (2) and low (1) brake spacers.

b. Wrap all of nylon cord CW (clockwise) on reel and insert hook of the 0-2 lb. scale in cord loop.

c. Hold scale parallel to floor and as close as possible to reel, then pull scale (takeup turntable rotates CW).

c. Tap reel to ensure a correct reading, then pull cord steadily and read scale indication. Repeat this procedure until scale reading has been the same several times. The scale should indicate the value given in Table 6-2.

e. If the reading is not within limits, slightly turn takeup reel brake adjustment nut (CW increases reading), then repeat procedures beginning with step c.

f. Wrap all of the cord CCW on reel, and insert hook of the 0-10 lb scale in cord loop.

g. Hold scale parallel to floor and as close as possible to reel, then pull the scale (takeup turntable rotates CCW).

h. Tap reel to ensure a correct reading, then pull cord steadily and read scale indication. Repeat this procedure until scale reading has been the same several times. The scale should indicate the value given in Table 6-2.

i. If the reading is not within limits, slightly adjust nuts on each side of brake solenoid an equal number of turns (CW increases braking), then repeat procedures beginning with step g.

NOTE

If the tension varies while the cord is being pulled at a steady rate, the tensions of the springs may be unequal.

j. On convertible systems, reinstall brake spacers removed in step a, and install 2-inch tape, repeat the procedures beginning at step b.

k. Remove scale and cord from transport.

6-13 TAPE TENSION (See Figures 6-4 and 6-5)

6-14 Tape tension is determined indirectly by measuring the torque of both tape reel motors. Required tension adjustments are made by positioning sliders on the resistors under a cover on the back of the transport control box. The resistors, and what they adjust are listed in Tables 6-3 and 6-4. In the following steps the cord (or twine) is wrapped so it is pulled onto the reel being checked. The spring scale is hooked into the cord (or twine) loop and held stationary against the reel torque, the reel is tapped (to ensure a true reading), and the tension value is read on the scale.

a. Turn power OFF.

b. Remove control box from frame (four mounting screws).

c. Remove relay cover from control box (four pan head screws).

d. Rotate the control box outward to a stable position.

e. Remove perforated panel over resistors (four pan head screws).

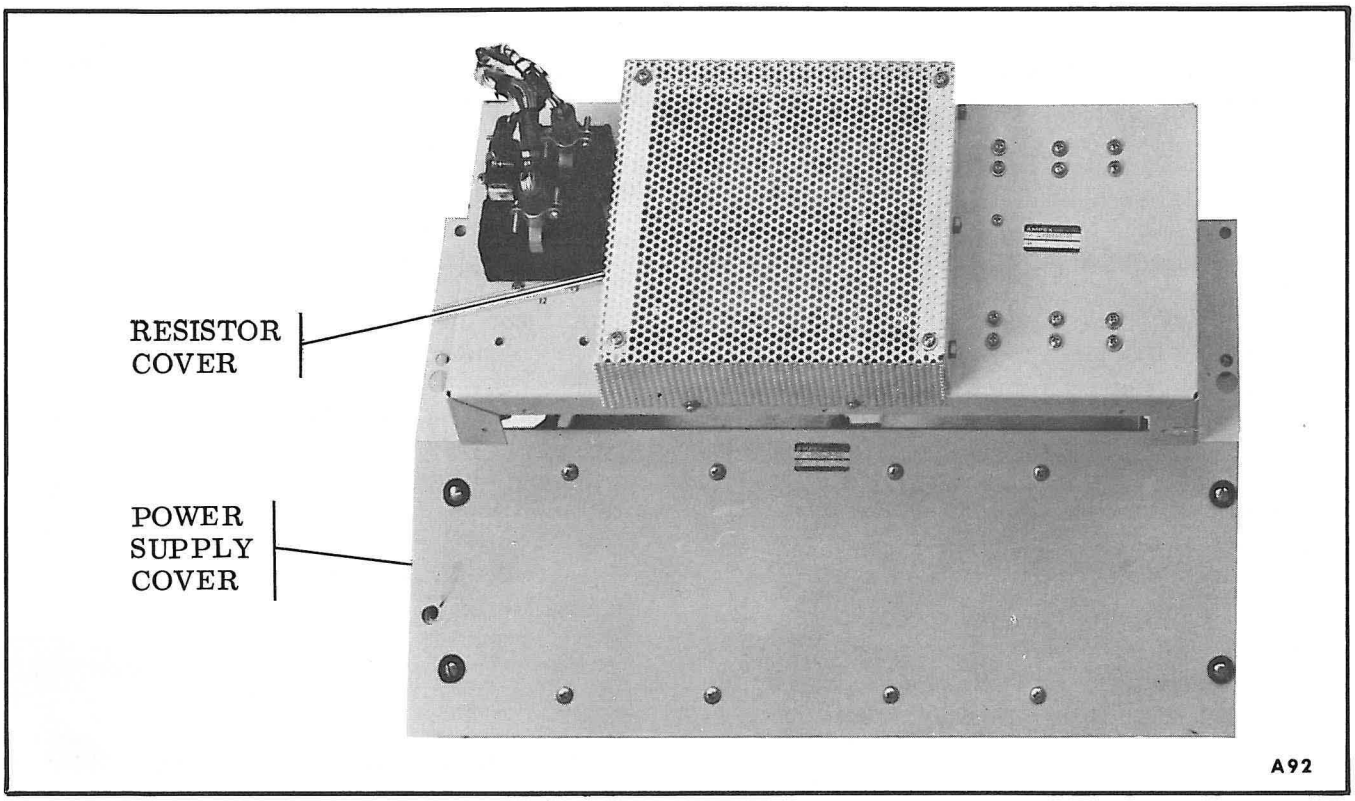


Figure 6-4. Control Box (Rotated Outward)

Table 6-3. 1-Inch Tape Tension Requirements

TENSION ADJUSTED	REQUIREMENT	RESISTOR
Play Holdback	9 to 11 oz.	R2
Fast Holdback	3 to 4 oz.	R1
Play Takeup	15 to 17 oz.	R3, slider with red/white lead
Play Boost	50 to 60 oz.	R3, slider with orange/ white lead

Table 6-4. 2-Inch Tape Tension Requirements

TENSION ADJUSTED	REQUIREMENT	RESISTOR
Play Holdback	9 to 11 oz.	R2
Fast Holdback	1 to 2 oz.	R1
Play Takeup	23 to 25 oz.	R3, slider with red/white lead
Play Boost	50 to 60 oz.	R3, slider with orange/ white lead

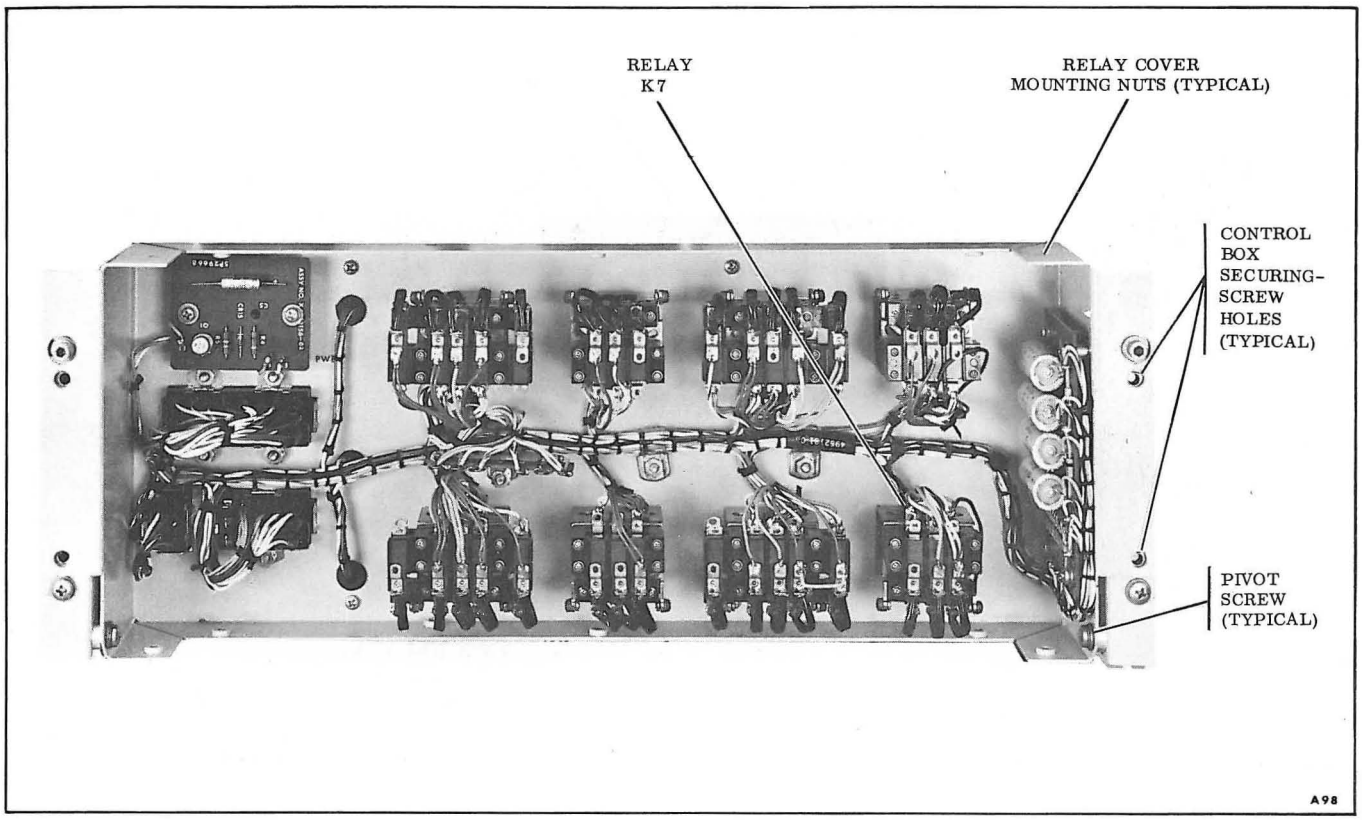


Figure 6-5. Control Box (Open)

6-15 PLAY HOLDBACK TENSION
(See Figures 6-6 and 6-7)

6-16 Adjust play holdback as follows:

a. On convertible systems, set Tape Width switch (on control box) at correct position for tape on transport.

b. On the reel guide for the supply turntable, thread the cord through the guide and one cord loop to fasten the cord to the reel guide. Wrap 2 or 3 turns of cord CCW (counterclockwise) around the reel hub, and hook the 0-2 lb scale to the free loop.

c. Hold scale parallel to floor and away from tape transport, with the nylon cord taut.

d. Turn power ON and press PLAY button.

e. As cord winds on reel, allow the scale to follow. Keep the cord at the tension that just balances the holdback torque, then read the scale. Repeat this procedure until several readings of the same value have been made. The scale should indicate 9 to 11 oz. Press STOP button.

f. If the reading is beyond limits, turn power OFF and adjust the slider on R2 (red lead for 2-inch tape or brown/white for 1-inch). Rewind cord on reel, then repeat procedures beginning with step c.

g. On convertible systems install the the other width tape then repeat the entire procedure.

6-17 FAST MODES HOLDBACK TENSION
(See Figures 6-6 and 6-7)

6-18 With the cord wound on the supply reel and power ON (as in the preceeding paragraph), proceed as follows:

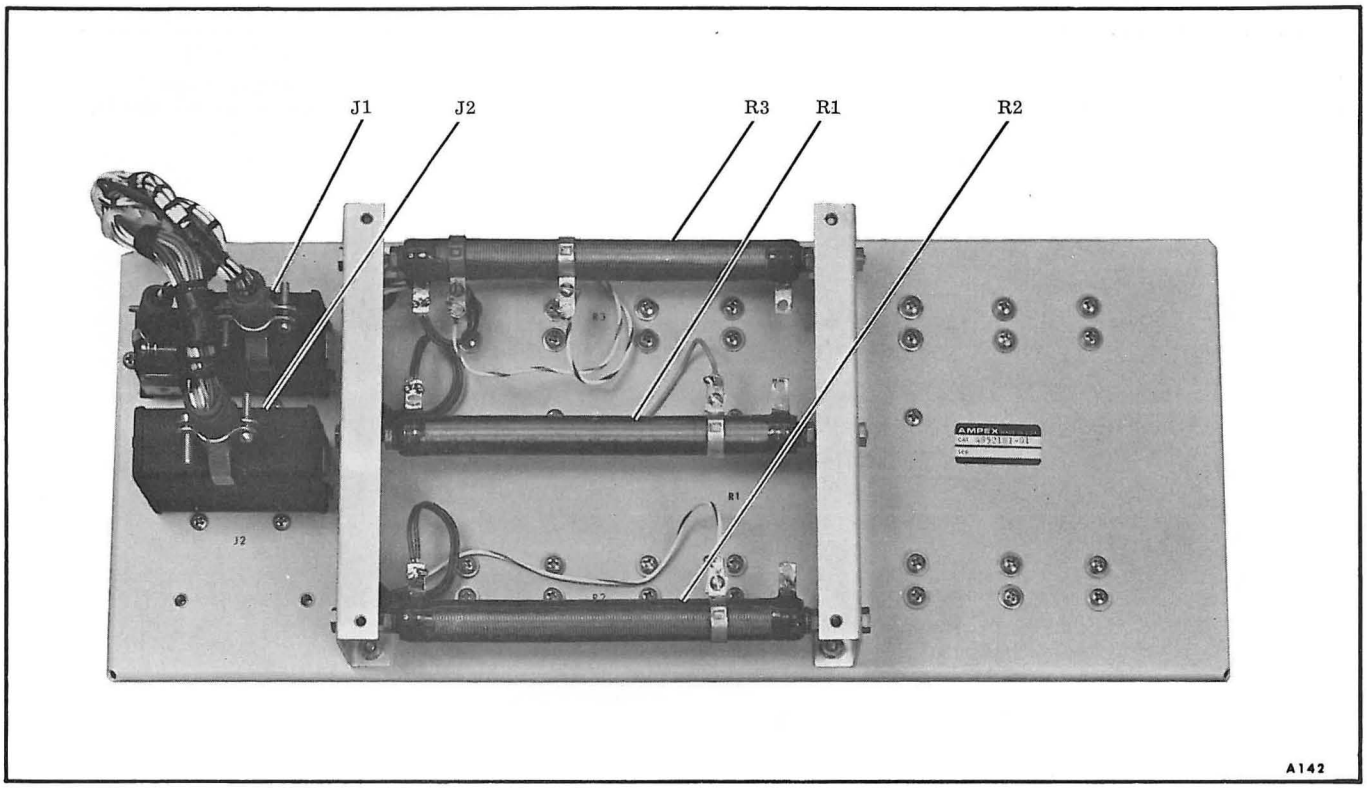


Figure 6-6. Tension-Adjust Resistors

a. Hold scale parallel to floor and away from tape transport, with the nylon cord taut.

b. Press FAST FWD button.

c. As the cord winds on the reel, allow the scale to follow. Keep the cord at the tension that just balances the holdback torque, then read the scale. Repeat this procedure until several readings of the same value have been made. The scale should indicate 1 to 2 oz. Press STOP button.

d. If the reading is beyond limits, turn power OFF and adjust the slider on R1 (green lead for 2-inch tape, or orange for 1-inch). Turn power ON, rewind cord on reel, then repeat procedures beginning with step a.

NOTE

Resistor R1 also sets the REWIND mode holdback torque.

e. On convertible systems, install the other width tape, set Tape Width switch to other position, rewind cord on reel, then repeat the entire procedure.

f. Remove cord and scale.

6-19 PLAY TAKEUP TENSION (See Figures 6-6 and 6-7)

6-20 With power ON (as at the end of the preceeding paragraph) proceed as follows:

a. Swing the supply compliance arm fully to the left, and secure it in that position (use masking tape or other suitable method).

b. On convertible systems, set Tape Width switch (on control box) at correct position for tape on transport.

c. On the reel guide for the takeup turntable, thread the cord through the guide

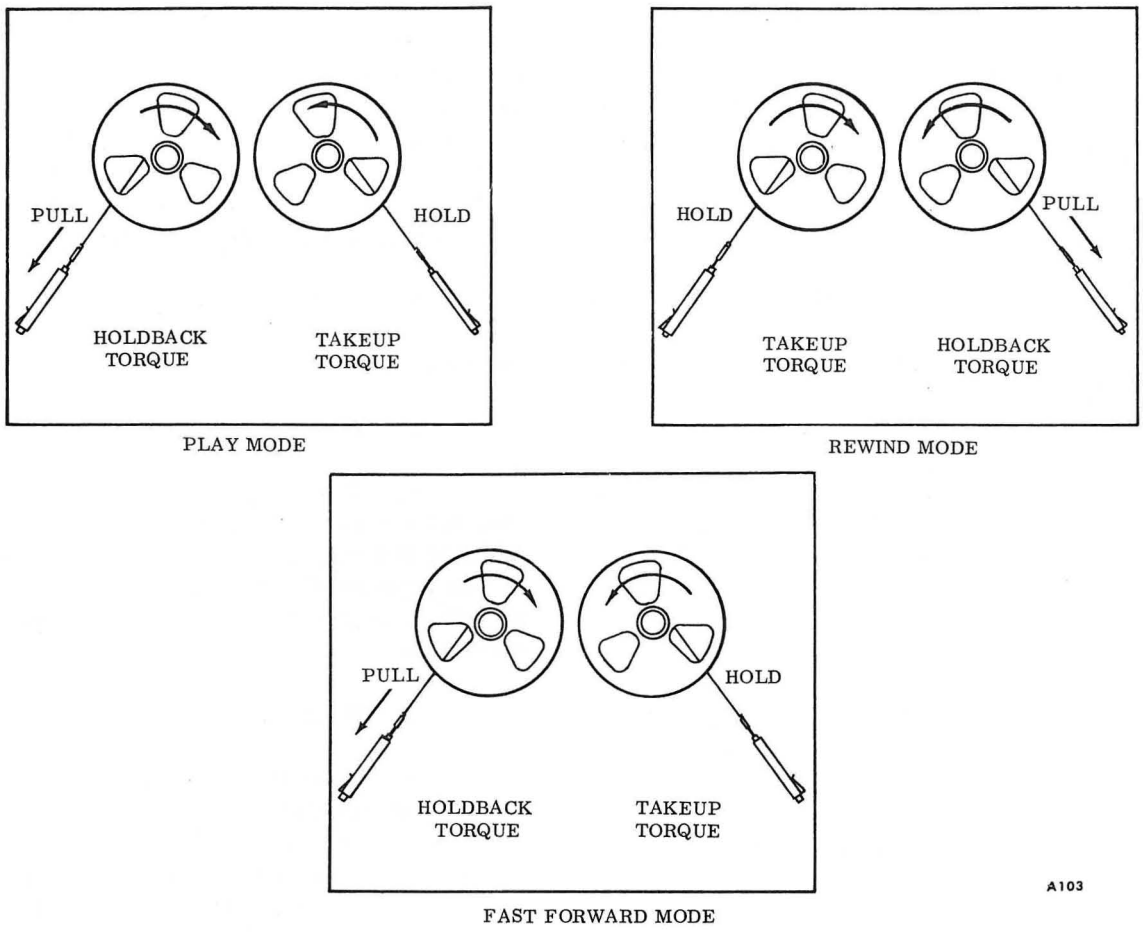


Figure 6-7. Turntable Torque Measurements

and one cord loop to fasten the cord to the reel guide. Wrap 2 or 3 turns of cord CW around the reel hub, and hook the 0-2 lb scale to the free loop.

d. Hold scale parallel to floor and away from tape transport, with the nylon cord taut.

e. Press PLAY pushbutton.

f. As cord winds on reel, allow the scale to follow, but keep the cord at the tension that just balances the holdback torque. After 1.5 seconds (boost torque drops out) read scale. Repeat this procedure until several readings of the same value have been made. The scale should indicate 15 to 17 oz. for 1-inch tape, or 23 to 25 oz. for 2-inch tape. Press STOP button.

g. If the reading is beyond limits, turn power OFF and adjust the slider on R3 (red/white lead for 1-inch tape, or yellow for 2-inch tape). Turn power ON, rewind cord on reel, then repeat procedures beginning with step d.

h. On convertible systems, install the other width tape. Set Tape Width switch to other position, rewind cord on reel, then repeat procedures starting with step d.

i. Remove material used to secure supply compliance arm.

6-21 BOOST TORQUE (See Figure 6-6)

6-22 This procedure checks the boost torque (present for the first 1.5 seconds of the Play or Record modes). With the cord wound on the takeup reel and power ON (as in the proceeding paragraph) proceed as follows:

a. Set Tape Width switch (on control box) to correct position for tape on transport.

b. With a piece of cardboard, block relay K7 closed (actuated position). K7 is in the far-right bottom of the relay control box.

c. Hold the 0-10 lb scale parallel to the floor and away from the tape transport with the nylon cord taut.

d. Press the PLAY pushbutton.

e. As the cord winds on the reel allow the scale to follow, but keep the cord at the tension that just balances the boost torque, then read the scale. Repeat this procedure until several readings of the same value have been made. The scale should indicate 50 to 60 oz. Press STOP button.

f. If the reading is not within the limits, turn power OFF, then adjust the slider on R3 (orange/white lead), turn power ON, and repeat procedures beginning with step c.

g. Turn power OFF, then remove the cardboard from relay K7 and the cord from the reel.

h. Reinstall removed items in reverse order to procedures in paragraph 6-7.

6-23 CAPSTAN IDLER (See Figure 6-3)

6-24 The capstan idler force against the moving capstan is determined by the capstan solenoid spring. The force is adjusted by a lock nut on the capstan solenoid bolt shown in Figure 6-3.

6-25 As the solenoid temperature rises, its resistance also rises. When power line regulation is poor, allow 30 minutes or more for warm-up (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 90 volts (cold) and 105 volts (hot).

a. Remove dummy plug from underside of transport (this prevents rotation of the capstan).

b. Turn power ON.

c. Thread a 10-15 inch length of magnetic tape through the tape path in the area of the capstan. Tie a loop in the end of the tape so that the 0-10 lb scale may be attached to pull the tape in the play mode direction.

d. Press the PLAY button.

e. Hold the capstan (to prevent it from turning) then pull the spring scale until tape just starts to slip between the capstan and idler, then read the scale. Repeat this measurement until several readings of the same value have been made. The reading should be between 2-1/2 and 3 lb. Press STOP button.

f. If the reading is beyond limits, turn power OFF, adjust the stop nut under the transport (see Figure 4-28), then repeat procedures starting with step b.

g. Measure clearance between the capstan and capstan idler (with system in Stop mode). Clearance should not be less than 1/8 inch. Adjust clearance as necessary.

h. Reinstall transport dummy plug.

6-26 HEADS, 1-INCH SYSTEMS (See Figure 6-8)

6-27 One-inch record and reproduce heads are adjustable in height, zenith and azimuth.

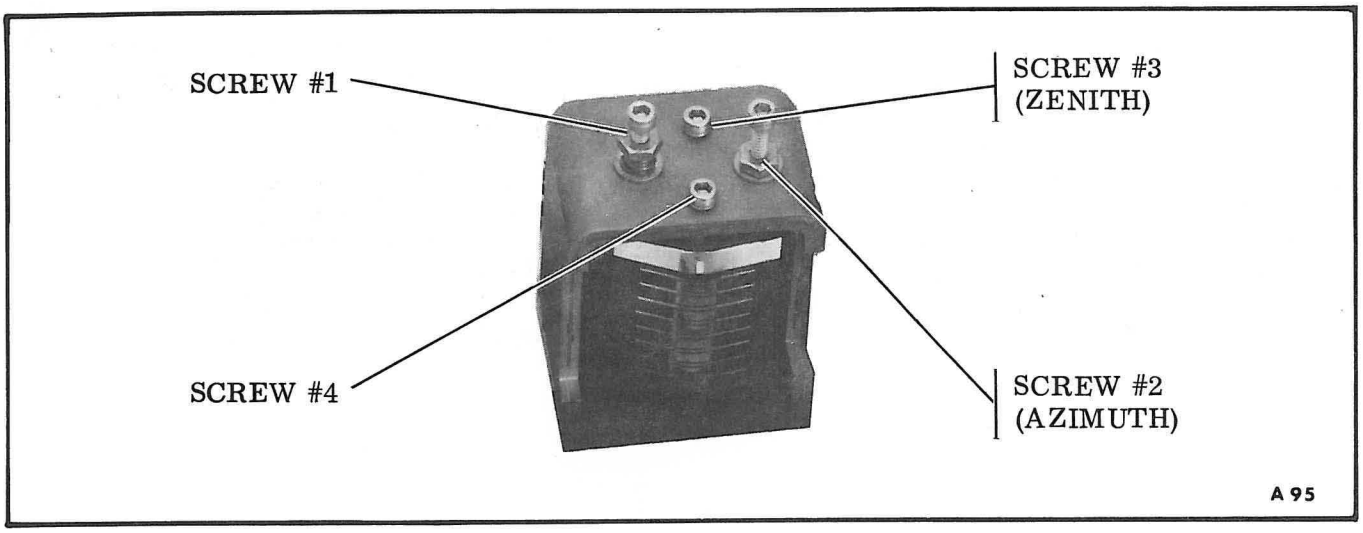


Figure 6-8. Head (1-Inch) Adjustments

The heads are factory aligned and should normally never require readjustment, however if misalignment is suspected, the following procedures may be used.

NOTE

Ampex is not responsible for heads misaligned by customer adjustment.

6-28 HEIGHT

6-29 Adjust heads for 1-inch tape as follows:

a. Unscrew hex nut #1 three turns to relieve the pressure spring.

b. Index-mark a spot on the periphery of screws #3 and #4, and nut #2, for starting-point reference.

c. Turn each index-marked screw and nut clockwise, one turn at a time, until the lower track laminations are seen at the bottom edge of the moving tape.

d. Turn each of the same screws and the nut counterclockwise the same fraction of a turn until the lower track laminations barely appear at the bottom edge of the tape.

e. Counting the number of turns, continue turning each screw (#3 and #4) and nut (#2) one turn at a time, until the upper track laminations just appear above the tape.

f. Turn screws (#3 and #4) and nut (#2) clockwise, a fraction of a turn at a time, until the upper track laminations barely appear above the tape. Subtract this fraction from the turns counted in step e. Divide the result by two.

g. Turn each screw (#3 and #4) and nut (#2) clockwise the number of turns figured in step f.

h. Readjust zenith and azimuth per next paragraph.

6-30 ZENITH AND AZIMUTH

6-31 Since each head is also a tape-guiding surface, the tape pressure must be equal at the top and bottom of the head. The zenith of one head must be approximately correct in order to adjust the other head. To adjust head zenith without changing the head proceed as follows:

a. Initiate Play mode.

b. Adjust rear-most screw (#3) in increments of 1/4 turn while adjusting nut (#2) 1/8 turn in the same direction. Continue process until the tape passes the heads without side pressure on any guiding surface, especially the scrape flutter idler guides. Adjust until the tape only occasionally touches a side guiding surface.

c. Adjust head azimuth per Section 5.

d. Screw nut (#1) downward to completely compress the spring.

CAUTION

AVOID OVERTIGHTENING OF THE NUT, TO PREVENT SPRING BUCKLING.

Table 6-5. Transport Adjustments Checklist

ITEM	FUNCTION AND PROCEDURE	MODE	ADJUST POINT	TAPE SIZE	REQUIREMENT	ACTUAL SETTING
Supply Reel	*High Brake Torque, 6-11	OFF	Two nuts, adjust equally (tightening increases braking)	1" 2"	70 ± 8 oz. 120 ± 4 oz.	
	*Low Brake Torque, 6-11	OFF	Nut opposite brake drum	1" 2"	16 ± 2 oz. 24 ± 2 oz.	
	*Holdback Tension, 6-15 (Play and reproduce modes)	Play	**R2 (brown/white lead) R2 (red lead)	1" 2"	10 ± 1 oz. 10 ± 1 oz.	
	*Holdback Tension, 6-17 (Fast modes)	Fast Fwd	**R1 (orange lead) R1 (green lead)	1" 2"	3-1/2 ± 1/2 oz. 1-1/2 ± 1/2 oz.	
Takeup Reel	*High Brake Torque, 6-9	OFF	Two nuts, adjust equally (tightening increases braking)	1" 2"	70 ± 8 oz. 120 ± 4 oz.	
	*Low Brake Torque, 6-9	OFF	Nut opposite brake drum	1" 2"	16 ± 2 oz. 24 ± 2 oz.	
	* Takeup Tension, 6-19 (allow boost torque to drop out)	Play	**R3 (red/white lead) R3 (yellow lead)	1" 2"	16 ± 1 oz. 24 ± 1 oz.	
	*Boost (Initial) Torque, 6-21	Play	**R3 (orange/white leads) with K7 held closed	1" 2"	75 ± 5 oz. 75 ± 5 oz.	
Capstan Idler	Pressure, 6-23 (measured with scrap tape pulled between idler and stalled capstan)	Play (capstan motor disconnected and capstan held, after 30 + minutes warmup)	Capstan solenoid-spacing locknut	1" 2"	44 ± 4 oz. 44 ± 4 oz.	
Heads, 1" Systems, Record and Reproduce only	Height, 6-25	OFF	All four head-adjust screws	1"	Record and reproduce heads equal and 0.370" above mounting plate	
	Zenith, 6-30	OFF	Rear-most screw	1"	Perpendicular to mounting plate	
	Azimuth, 6-30	OFF	Farthest-right screw	1"	Parallel to mounting plate	

*All torques/tensions measured with cord pulled from reel with hook of spring scale.

**Increased electrical resistance reduces torque.

SECTION VII

THEORY OF OPERATION

SECTION VII

THEORY OF OPERATION

7-1 TAPE TRANSPORT

7-2 GENERAL

7-3 The tape 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. Figure 7-1 shows major items of the transport. A simplified schematic diagram is shown in Figure 7-2.

7-4 TAPE SUPPLY AND TAKEUP SYSTEMS

7-5 A separate motor drives the supply and takeup turntables. The motors are connected so that if power is applied, with no tape installed, the turntables rotate in opposite directions (supply turntable clockwise and the takeup turntable counterclockwise).

7-6 In the play or record modes, the capstan controls tape speed; it pulls tape from the supply reel (whose opposing torque helps to maintain tape tension) and delivers it to the takeup reel, which, similarly, helps to maintain correct tape tension. The motor torque, and therefore tape tension, is adjustable at resistors R2 (supply) and R3 (takeup).

7-7 During fast-forward or rewind operation, the tape is released from the capstan. The power of one motor is reduced, the other motor operates at full power. The turntable under full power winds the tape against the torque of the other turntable (which provides required tape tension).

7-8 A solenoid-controlled brake is mounted on each of the two torque motors. Whenever the tape is placed in motion in any mode, both solenoids are energized to release the brakes. To prevent the formation of tape loops when tape motion is stopped, the reverse-rotation brake force is adjusted to about five times the forward-direction force. This differential prevents tape spillage if the tape breaks.

7-9 TAPE DRIVE SYSTEM (Figure 8-13)

7-10 The capstan belt is driven from a hysteresis-synchronous motor. The capstan drives the tape when a solenoid-controlled capstan idler clamps the tape to it.

7-11 The two speed capstan drive motor has separate field windings for each speed. A speed pushbutton switch selects the desired tape speed, and also automatically switches in the correct equalization circuit. The drive motor operates continuously when power is on and a tape is correctly threaded.

7-12 When the system is in the play or record mode, solenoid K5 actuates and moves the capstan idler to clamp the tape against the rotating capstan, and the brake solenoids K3 and K4 release the brakes from the reel turntables. The capstan then drives the tape across the head assembly at the selected speed.

7-13 REEL IDLER. A reel idler assembly with a damping flywheel minimizes any tape motion transients caused by the supply assembly. The idler pulley flywheel damps transients in tape speed that could result from torque motor cogging, and uneven tape wrap on the supply reel.

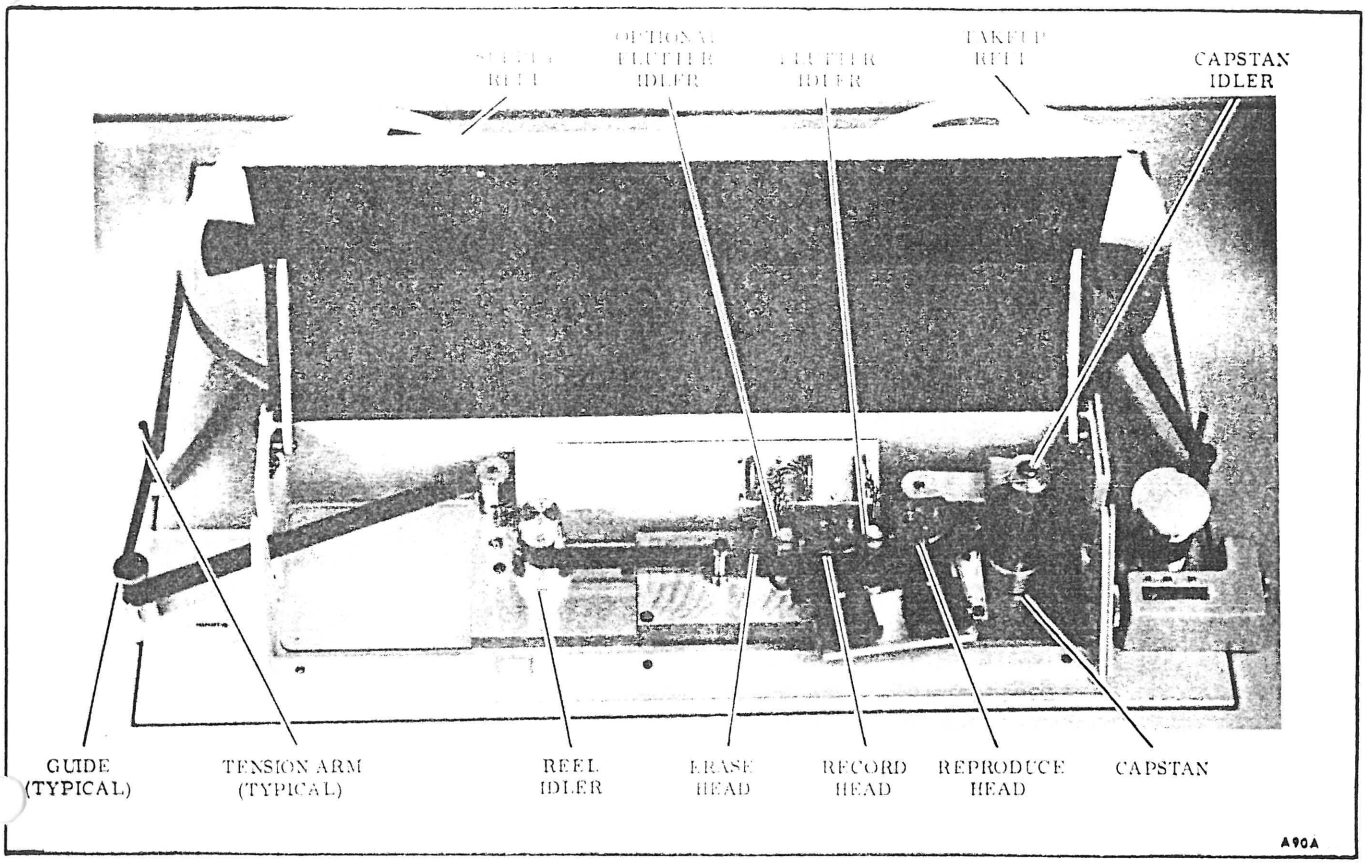


Figure 7-1. Tape Transport

7-14 TENSION ARMS. The tape tension arms function to maintain a small tape reserve to prevent tape breaking or stretching during start and stop. The supply tension arm actuates safety switch S51, to stop operation if a tape loop forms, if the tape breaks, or if the supply reel runs out of tape. A pneumatic cylinder and plunger, attached to each arm, damps the return of the arm to the at-rest position to ensure smooth starts. When the tape is correctly threaded it is held in tension even though stopped. If it is desired to release the tape, either tension arm may be swung to the outer limit and the tape will fall free, through release of the brakes.

7-15 TAPE LIFTER. Solenoid-operated tape lifter assembly moves the tape from contact with the heads during fast-forward or rewind modes. When either fast mode starts, solenoid K2 energizes and moves the tape lifter mechanism. The tape lifter may be manually defeated or actuated by means of tape lifter switch S25.

7-16 In the fast-forward or rewind mode, the tape-lifting arms do not retract instantly when the STOP button is pressed. An electronic delay is provided so that the tape stops completely before contacting the head, which avoids the high-peak signal that results when a moving recorded tape contacts the heads.

7-17 MOTION SENSING. The motion sensor makes it permissible to switch directly from fast mode to play mode without undue stress on the tape. While the system is in the fast-forward or rewind mode, the motion sensing system prevents K6 from energizing when the PLAY button is pressed; K4 will energize immediately, but K6 can energize only after the tape stops coasting.

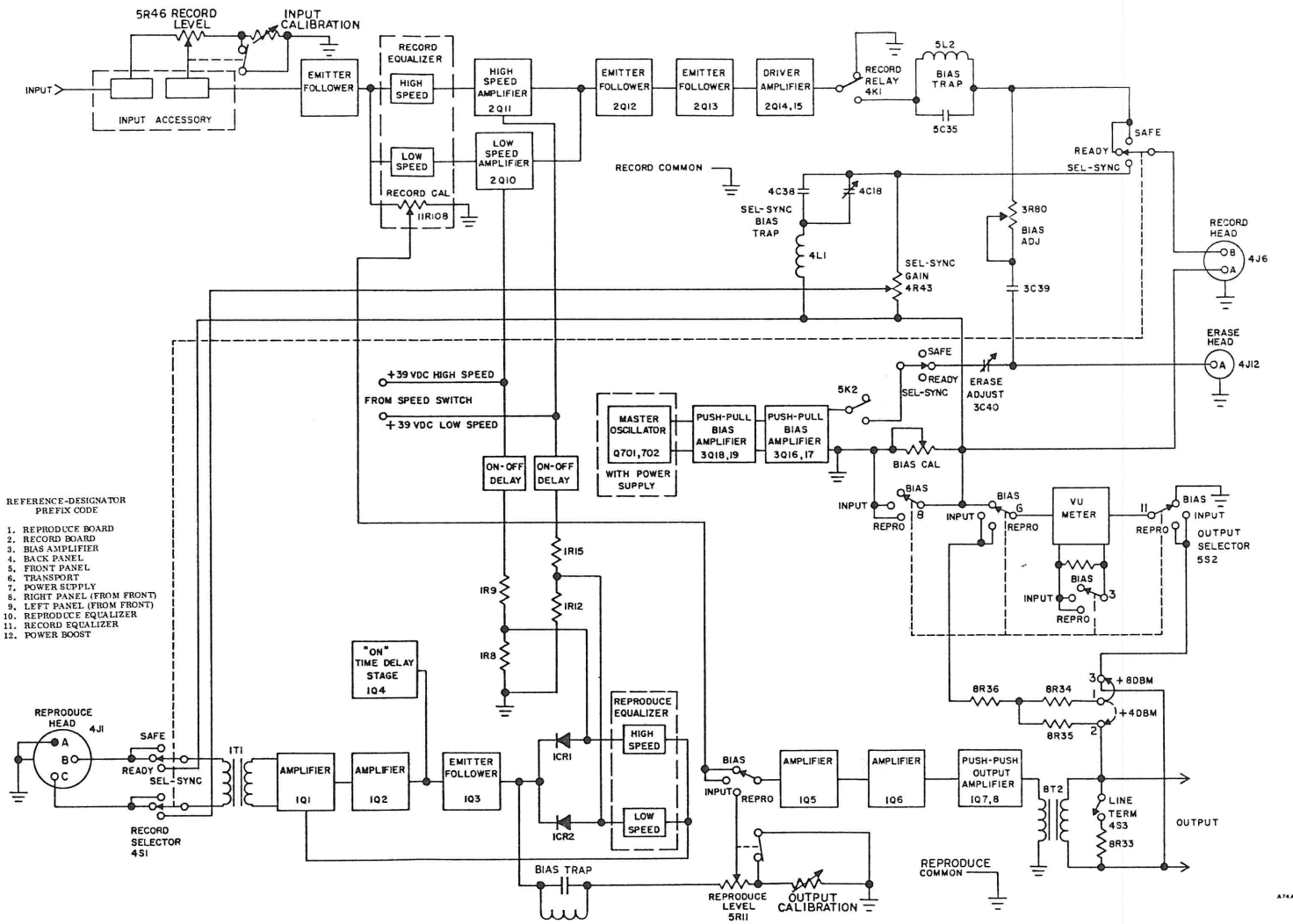


Figure 7-2. Record and Reproduce Block Diagram

7-18 CONTROL CIRCUITS

7-19 GENERAL. There are five modes of operation: fast-forward, rewind, play, record, and stop. From the stop mode, play mode is entered by pressing the PLAY button; this energizes relay K4 (in the transport control unit), and, in turn, relay K6. In addition, Stop relay K3 energizes to drop-out any mode that was previously engaged. When the REWIND button is pressed, relay K2 is energized to initiate the rewind mode. When the FAST-FORWARD button is pressed, relay K1 is energized to initiate the fast-forward mode. To operate in the record mode, the PLAY and RECORD pushbuttons must be pressed simultaneously; this energizes relays K4, K5, and K6.

7-20 PLAY MODE. When tape is correctly threaded and power is applied, the capstan rotates at the speed selected at the speed switch (see Figure 8-5 and Figure 8-13). Pressing the PLAY pushbutton then energizes relay K4, contacts 6 and 7, completes a holding circuit. Other contacts apply ac power (through the tension-adjust resistors) to the takeup and rewind supply motors. The relay also completes the energizing circuit to the capstan idler solenoid and the supply and takeup brake solenoids. Thus the brakes release, the turntable motors operate, and the tape (pressed against the rotating capstan) is driven at the selected speed. A takeup-reel torque boost is provided by the time-delay circuits energizing relay K7.

7-21 FAST-FORWARD MODE. With power on and tape threaded, pressing the FAST-FORWARD pushbutton energizes fast-forward relay K1, holding contacts lockup the relay. The relay opens the 24-volt dc to the play circuit. Relay contacts also connect full ac power to the takeup motor and reduced ac power (through resistor R1) to the rewind motor. Other contacts open the 24-vdc circuit to the rewind relay, and close the 24-vdc circuit to tape-lifter solenoid K2. Another contact set energizes the brake solenoids. The takeup motor therefore operates at full torque and the rewind motor at reduced torque; tape is lifted from head contact, the brakes are released, and the tape rapidly winds from the supply to the takeup reel.

7-22 REWIND MODE. With power on and tape threaded, pressing the REWIND pushbutton energizes rewind relay K2. Relay contacts complete a holding circuit, connect full ac power to the rewind motor, and connect reduced ac power (through a resistor) to the takeup motor. Other contacts break the 24-vdc circuit to the play and fast-forward circuit, connect 24-vdc to the tape-lifter solenoid, and energize the brake solenoids.

7-23 Thus, the rewind motor operates at full torque, the takeup motor operates at reduced torque, the brakes are released, tape is lifted from contact with the heads, and tape rewinds from the takeup reel to the supply reel.

7-24 Tape lifter action in the rewind mode, as in the fast-forward mode, can be defeated by actuating the tape lifter switch to DEFEAT.

7-25 RECORD MODE. To initiate the record mode, the PLAY and RECORD pushbuttons are pressed simultaneously to energize the record relay and set the tape in motion.

7-26 When record relay K5 is energized, its contacts complete all transport recording circuits and open the automatic tape-lifting circuit.

7-27 TAPE SCRAPE-FLUTTER SYSTEM

7-28 Tape scrape-flutter can be likened to the drawing of a bow across a violin string: the string vibrates at its resonant frequency --which is determined by the 'free' length of the string, its tension, and its size.

7-29 On a tape transport, the magnetic head acts as the bow, and the tape as the violin string, but instead of drawing the head across the tape, the tape is drawn across the head. As it moves across the head, the tape

vibrates at its resonant frequency. For a certain tape and tension, that frequency depends upon the 'free' length of tape between the reel idler and the capstan. This frequency is usually in the range to which the human ear is most sensitive, from 1,000 to 6,000 Hz. For example, the scrape-flutter frequency on this transport, without a tape scrape-flutter idler, would be about 3,500 Hz.

7-30 The supplied tape scrape-flutter idler is mounted between the reel idler and capstan; therefore, the length of 'free' (unsupported) tape is shortened. This practically doubles the scrape-flutter frequency to about 7,000 Hz, which is out of the range of greatest ear sensitivity. This higher frequency also automatically drops the volume, so the effect of tape scrape-flutter is therefore reduced to about 25% of its former value.

7-31 If the second 1-inch tape scrape-flutter idler (optional accessory) is installed on a transport, the flutter frequency is again raised--to approximately 10,000 Hz. This, and the resultant lowering of volume, practically nullifies tape scrape-flutter and its effects.

7-32 ELECTRONIC CIRCUITS
(See Figure 7-2)

7-33 POWER SUPPLY

7-34 Components for the system regulated power supplies (refer to Figure 8-11 or 8-12) are mounted on printed circuit boards. Power supply #1 also contains a bias oscillator. For power supplies 2, 3, and 4, the bias oscillator is omitted. The printed circuit boards plug into the electronics power supply boxes (at the back of the transport). The series-regulating transistor (Q705) is mounted on the power supply chassis.

7-35 AC power is delivered to the power supplies from the circuit-breaker panel. It is fused by fuse F701, rectified by the bridge rectifier formed by diodes CR701 through CR704, and filtered by capacitor C707. It is then connected to the voltage regulator.

7-36 In the regulator, a reference voltage is established by zener diode VR702. A sampling voltage is taken across the output line at variable resistor R712 (in a voltage-divider circuit with resistors R711 and R712). Voltage adjustment is made at R712. When the output voltage tends to vary with load, it affects the conductance of transistors Q706. This, in turn, changes the conductance of transistors Q704 and Q705 (connected in a Darlington circuit) to maintain the voltage at normal level.

7-37 Transistor Q703 acts as a constant-current source for Q704 and Q706. Overload protection is also provided by this transistor in conjunction with diode CR707 and resistor R709. If a serious overload occurs, the increased voltage across R709 also appears across resistor R708, through diode CR707. This will bias transistor Q703 to cutoff. Deprived of their current source, Q704 and Q706 will cutoff, removing the bias on Q705. The power will be automatically shut off until the overload is removed.

7-38 The regulator is adjusted to provide +39 (-1/2, +1) vdc to the electronic assemblies. It is also connected back to the tape transport speed selector, which switches the +39 vdc (through the power supply box) to one of the transport's two equalization-switching circuits.

7-39 A separate 24 volt dc regulated power supply is provided to supply operating power to the solenoids, relays and panel lamps. The schematic diagram is shown in Figure 8-16.

7-40 BIAS OSCILLATOR AND AMPLIFIER CIRCUITS

NOTE

These circuits are provided with recorder/reproducer systems, and not with reproduce only systems.

7-41 The master bias oscillator is mounted on the same card as the electronic power supply #1 (refer to Figure 8-11). This is a

capacitively-coupled push-pull oscillator, operating at a nominal frequency of 150,000 Hz. Operating power of +39 vdc is direct from the power supply, so the oscillator operates continuously when power is on. The bias signal from the output of transformer T701 is supplied on a balanced line to each of the record bias amplifiers.

7-42 Two push-pull bias amplifier stages are mounted on a plug-in circuit board for each record/reproduce unit. Operating power is applied to these stages through contact set 3-7-11 of the energized record relay K1. The circuits, therefore, operate only during the record mode.

7-43 The push-pull bias input from the oscillator is connected at pins 1 (shield), 2, and 3 of receptacle 4J11 (see Figure 8-9). It is connected to the amplifier circuit board, and routed to the bases of transistors 3Q18 and 3Q19. This circuit plus the following circuit (3Q16 and 3Q17) provide push-pull amplification of the bias signal. 3Q16 and 3Q17 operate class B to eliminate the need for a bias symmetry adjustment (an unsymmetrical bias waveform causes magnetization of the record heads, and high second-harmonic distortion).

7-44 A sinewave output is obtained when the signal from the transformer 3T3 is resonated with the record head, by adjusting the erase-adjust (3C40) to peak erase head current. The output is also taken through bias-adjust resistor 3R80, and mixed with the record signal. The bias trap consisting of 5L2 and 5C35 keeps the bias signal from the record amplifier. A third output is through bias-calibrate resistor 3R44, through the output-selector switch, and then to the VU meter. A contact set on the output-selector switch shorts the bias-calibrate resistor 3R44, except when the switch is at BIAS; this removes the rf signal from the line, to reduce rf induction into other circuits during the record or reproduce modes. The contacts of relay 5K2 remove the rf source from the erase and record heads when they are not in use to prevent the bias signal from an adjacent head being coupled into a non-recording channel.

7-45 RECORD AMPLIFIER CIRCUIT

7-46 A schematic diagram of the record amplifier circuit is given in Figure 8-8. The record amplifier is provided only with recorder/reproducer systems.

7-47 The signal to be recorded is connected to input connector 4J7, and then is routed through the input accessory (or dummy plug) in receptacle 4J8. Receptacle 4J8 is wired so that during optional microphone preamplifier use, the record-level control is connected between the two stages in the preamplifier. This effectively makes the preamplifier a variable-gain amplifier for use with most types of professional-type microphones.

7-48 From the input accessory socket, the signal is applied to emitter-follower stage 2Q9. From there it proceeds to the record calibrate control, 11R108, on the equalizer board. From that control, the signal (through output-selector switch contacts) connects to the reproduce amplifier circuit to the output line and the VU meter (for record monitoring and record level measurement).

7-49 The high-speed and low-speed equalizers receive the signal from stage 2Q9. Each equalization circuit consists of a variable capacitor (11C53 for low speed, 11C54 for high speed) in parallel with a fixed resistor (2R51 for low speed, 2R52 for high speed). The capacitor is then adjusted to provide the correct high-frequency response.

7-50 From the equalizer, the signal goes through equalizer amplifier 2Q10 or 2Q11. If low speed is selected, +39 vdc is applied to pin 6 of receptacle 4J11. This voltage is applied, through resistor 2R64, to the emitter circuit of 2Q11, biasing that transistor to cutoff. In low speed, therefore, transistor 2Q10 conducts and amplifies the signal. When high speed is selected, the +39 vdc is applied to pin 7 of 4J11. The voltage is connected to cutoff transistor 2Q10, so stage 2Q11 thus acts as the high-speed equalization amplifier.

7-51 When the record mode is entered or stopped, time-constant circuits provide a switching delay to minimize popping. The low-speed delay circuit (in the emitter circuit of 2Q10) consists of 2C26 and 2R57 ("on" delay) and 2C26 and 2R55 ("off" delay). The high-speed circuits consist of 2C29 and 2R64 ("on" delay) and 2C29 and 2R60 ("off" delay). The time delay is longer when entering the record mode than it is when leaving.

7-52 The output signal from the equalizer amplifier goes through two emitter-follower stages, 2Q12 and 2Q13, to the output-driver stage formed by 2Q14 and 2Q15. The output-driver stage is a high-impedance constant-current amplifier. Transistor 2Q15 acts as an active-load resistance for the collector of 2Q14, thus providing a relatively low dc resistance and a relatively high ac resistance. In the audio frequency range, therefore, transistor 2Q14 impedance is then high enough to provide the constant-current source for the record head, but still allows full utilization of the available dc operating voltage.

7-53 The signal, through circuit board connectors 7 and 8, proceeds through the record-relay contact-set 1-5-9. It is mixed with the bias frequency, following the bias trap (5C35 and 5L2), and then proceeds through the RECORD-SELECTOR switch (in the READY position) to the record head.

7-54 Record relay 4K1 (after the 4Q20 circuit delay) is energized by pushing the transport RECORD and PLAY pushbuttons. It is held energized by contacts of the play relay (in the tape transport circuit). Energizing voltage is connected at 4J11 pin 4, and the holding voltage at pin 10. Contact set 1-5-9, when 4K1 is energized, removes record amplifier output from ground, and routes the output to the record head.

7-55 Diode 4CR6, in the record relay circuit, restricts the record mode to electronics units set to READY at the time the RECORD pushbutton was pressed. Therefore, a record/reproduce unit previously set to SAFE (or Sel-Sync) will not record should the MODE SELECTOR switch be set at RECORD (either intentionally or by accident).

7-56 REPRODUCE AMPLIFIER CIRCUIT

7-57 The reproduce circuit for record/reproduce units and reproduce units is essentially the same except that no VU meter is supplied with the latter. Refer to schematic diagram 8-7. A monitor jack for reproducers is mounted on the back panel of the module.

7-58 The signal from the reproduce head is applied through the RECORD-SELECTOR switch to the reproduce amplifier-input transformer 1T1 (see Sheet 2). Transistors 1Q1-1Q2 amplify the reproduce signal then the signal is applied through emitter follower 1Q3 to the REPRO LEVEL control. The equalize circuit selection is made by forward biasing 1CR2 when low speed is selected or 1CR1 when high speed is used, the selection being made by the positioning of SPEED switch S23 contacts 11, 12, and 14. The equalizing signal is from the emitter of 1Q3 through 1C6 to the diode switch then through the selected equalizer to input transistor 1Q1 emitter.

7-59 Transistor 1Q4 is used in a time delay circuit to supply operating power to the input amplifier circuits. When the power is applied to the circuit the time constant provided by the RC circuit of 1R36 and 1C8 turns 1Q4 on expotentially eliminating VU meter overload and poping in the reproduced signal.

7-60 The signal from 1Q2 proceeds through the emitter of emitter-follower 1Q3 to the reproduce equalization circuits and back to the emitter of Q1. Equalization is selected by energizing diode 1CR2 (low speed) or 1CR1 (high speed) to allow them to pass the signal. At low speed, +39 vdc goes to pin 6 of receptacle 4J11. At high speed, the +39 vdc goes to pin 7 of that receptacle. A time-constant circuit is again inserted in both +39 lines, to protect the VU meter and prevent popping sounds when the speed is switched.

7-61 When a speed is first selected, the "on" time-constant is determined by a 100-mF and a 35-mF capacitor contained in capacitor 9C9. When that speed is turned off (the other speed selected) the 100-mF capacitor is out of the circuit, and the delay is determined by the 35-mF capacitor. Thus, the "on" time-delay, when a speed is selected, is greater than the "off" time-delay for the same speed.

7-62 If low speed is selected, the positive voltage from the time delay circuit is connected through 1R15 to diode 1CR2, biasing that diode so that it will conduct the signal from the emitter of 1Q3 to the low-speed equalizer. If high speed is selected, the positive voltage, connected through 1R14, causes diode 1CR1 to conduct the signal to the high-speed equalizer. Thus the low-speed or the high-speed equalizer is connected from the emitter circuit of 1Q3 back to the emitter of 1Q1.

7-63 From the emitter of 1Q3 the equalized signal is also routed through capacitor 1C7, the reproduce level control, and the output-selector switch, to the base of amplifier stage 1Q5 (where the record monitor is connected). Capacitor 1C10, in the base circuit of 1Q5, provides an rf bypass, while 1C12 decouples the dc bias to stage 1Q5. Capacitor 1C14, in the collector circuit is inserted to permit attaining high levels before clipping.

7-64 The signal at the collector of 1Q5 is direct coupled to driver stage transistor 1Q6 which then drives the output stages formed by complementary transistors 1Q7-1Q8 which provide a single ended output signal from the junction of 1Q7-1Q8 emitters.

7-65 The output signal is connected to the phones-jack and line transformer 8T2. LINE TERM switch 4S3 connects a terminating resistor 8R33 across the 600 ohm output line for use when testing or when a high impedance device is connected to OUTPUT jack 9J5. The secondary of the output transformer is connected to the VU meter and the OUTPUT connector through a strapping circuit for a +8 dBm or a +4 dBm normal operating level (see Figure 7-3). Equipment strapped for a +8 dBm output has resistors 8R34 and 8R35 connected as a voltage divider across the transformer with 8R36 connected to their junction for the VU meter input. Strapping for +4 dBm has resistors 8R34 and 8R35 connected in parallel on one side of the line, and series resistor 8R36 in the input circuit to the VU meter.

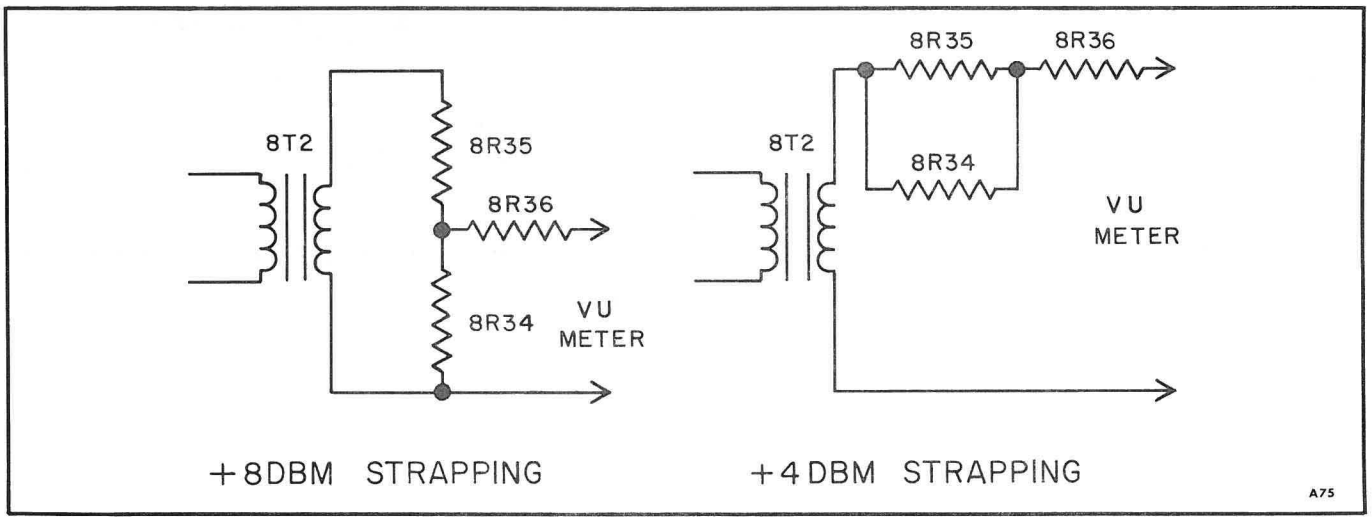


Figure 7-3. Strapping Circuit

7-66 SEL-SYNC (See Figure 7-4)

7-67 The Sel-Sync circuit is given in Figure 8-29. With the SYNC/PLAY switch at SYNC, the reproduce and record heads are disconnected from their amplifiers, and the record head is connected to the reproduce amplifier. The record head reproduces the signal from the tape and delivers it to the reproduce amplifier for amplification for monitoring purposes.

7-68 In the MM-1000 system, instead of using the Sel-Sync gain control and bias trap on each electronics unit, the corresponding controls (R1 and bias trap L1, C1 and C2) on the Sel-Sync unit are used for each channel (the RECORD SELECTOR switch 5S1 is always set at READY in the MM-1000 system).

7-69 In the Sel-Sync mode, therefore, the record head acts as a reproduce head for monitoring purposes. Another record head in the same stack (on a different track) can then be used to record that track synchronously with the first.

7-70 The relay switching circuit shown in Figure 8-10 provides a time delay of the switching function to permit the mute circuits to become operative before the Sel-Sync relays actuate. The time delay prevents switching noise from being reproduced by the playback amplifier.

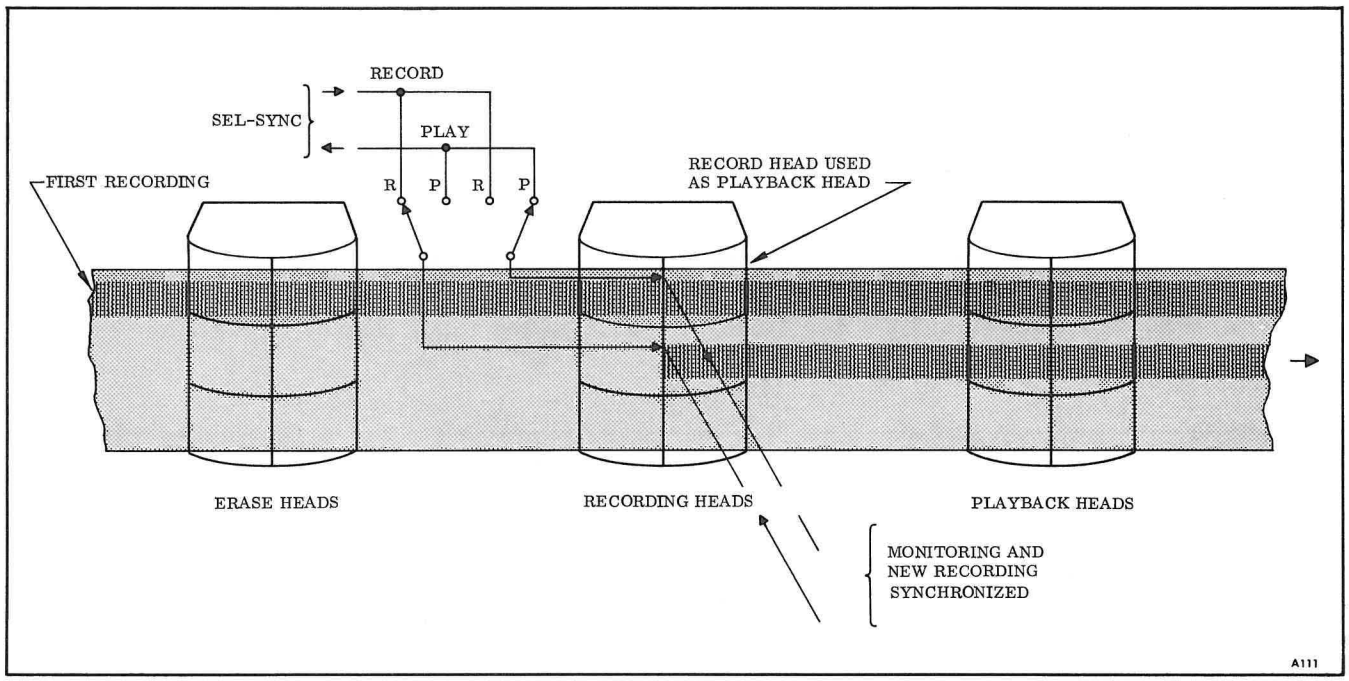


Figure 7-4. Sel-Sync Process

SECTION VIII

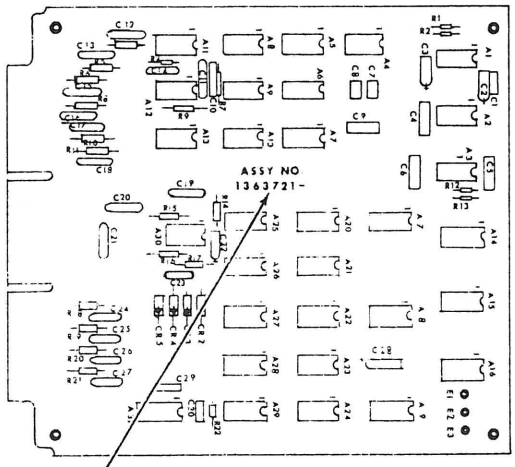
SCHEMATIC DIAGRAMS

SECTION VIII

SCHEMATIC DRAWINGS

This section contains all the necessary schematic diagrams. When applicable a note on the schematic will reference it to the appropriate assembly drawing. The schematic pertinent to any assembly is listed on the LM of that assembly (see the following section). The section has a two-part index, one listing the drawings in alphabetical order and one listing them in numerical order. Alphabetical listings are generally in direct reading order; e.g., "High Gain Amplifier", not "Amplifier, High Gain."

ALPHABETICAL INDEX TO SCHEMATICS



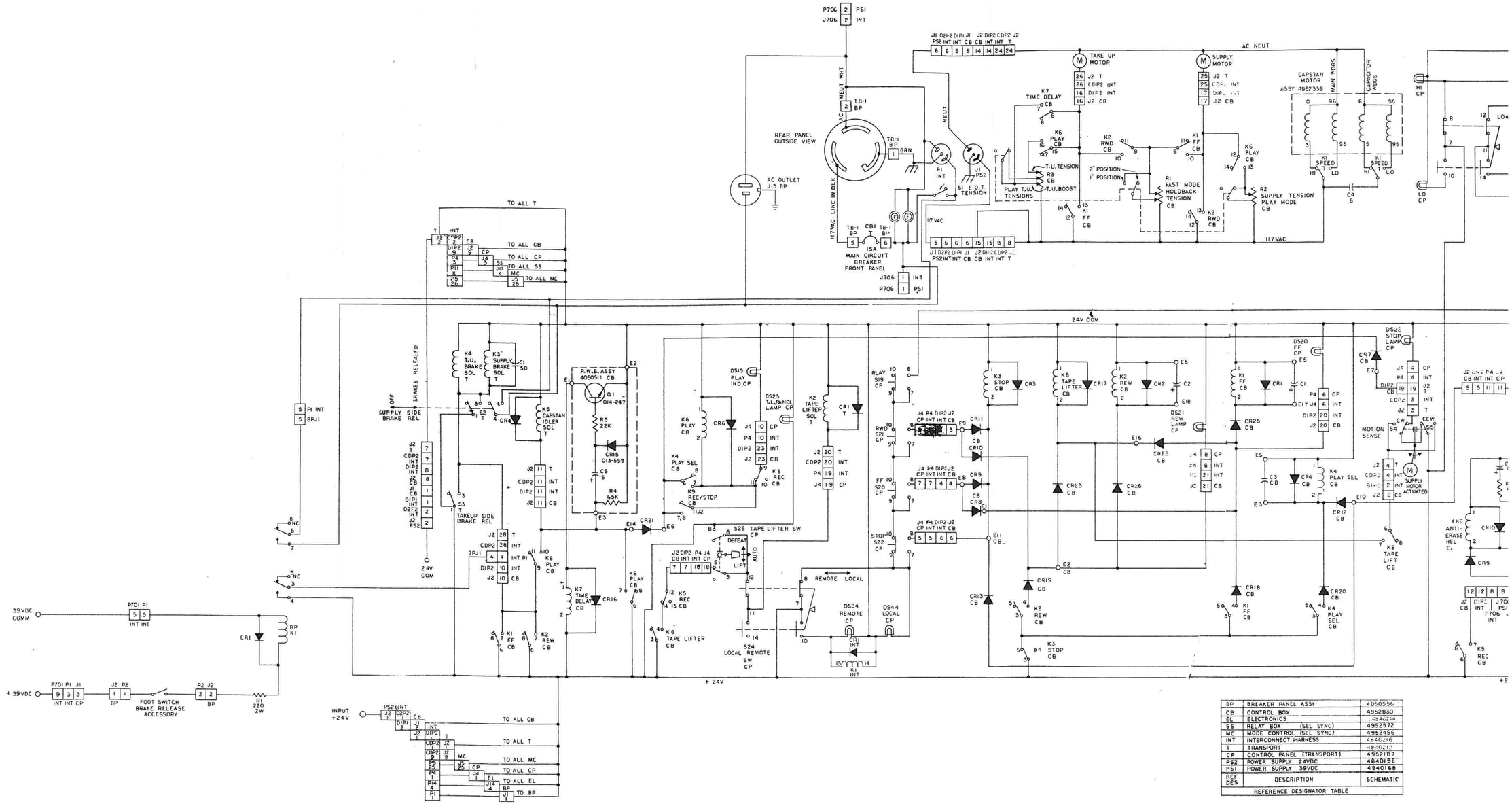
NUMERICAL INDEX TO SCHEMATICS

V 9112 A

ALPHABETICAL INDEX TO SCHEMATICS

NUMERICAL INDEX TO SCHEMATICS
(By Assembly Number)

Assembly No.	Schematic No.	Title	Figure No.	Page
4020260	4840214	Electronics	8-2	8-3
4050556	4840213	Breaker Panel	8-11	8-27
4940139	4840039	Power Supply, 39 VDC	8-14	8-33
4940139	4840168	Power Supply with Oscillator	8-13	8-31
4940139	4840215	MM-1000 System	8-1	8-1
4940139	4840216	MM-1000 System Control Wiring Diagram (8 Channels)	8-9	8-19
4940139	4840218	MM-1000 Supplementary Control Wiring Diagram (16 Channels)	8-10	8-23
4940149	4952346	Remote Control Unit	8-15	8-35
4952161	4952830	MM-1000 Control Box	8-4	8-9
4952183	4952187	Control Panel	8-3	8-7
4952222	4952572	Sel-Sync Unit	8-8	8-17
4942406	4952284	Mode Control, Channel 9 to 16	8-6	8-13
4952406	4952456	Mode Control, Channels 1 to 8	8-5	8-11
4952583	4840212	MM-1000 Transport	8-7	8-15
4952890	4840196	Power Supply, 24 VDC	8-12	8-29

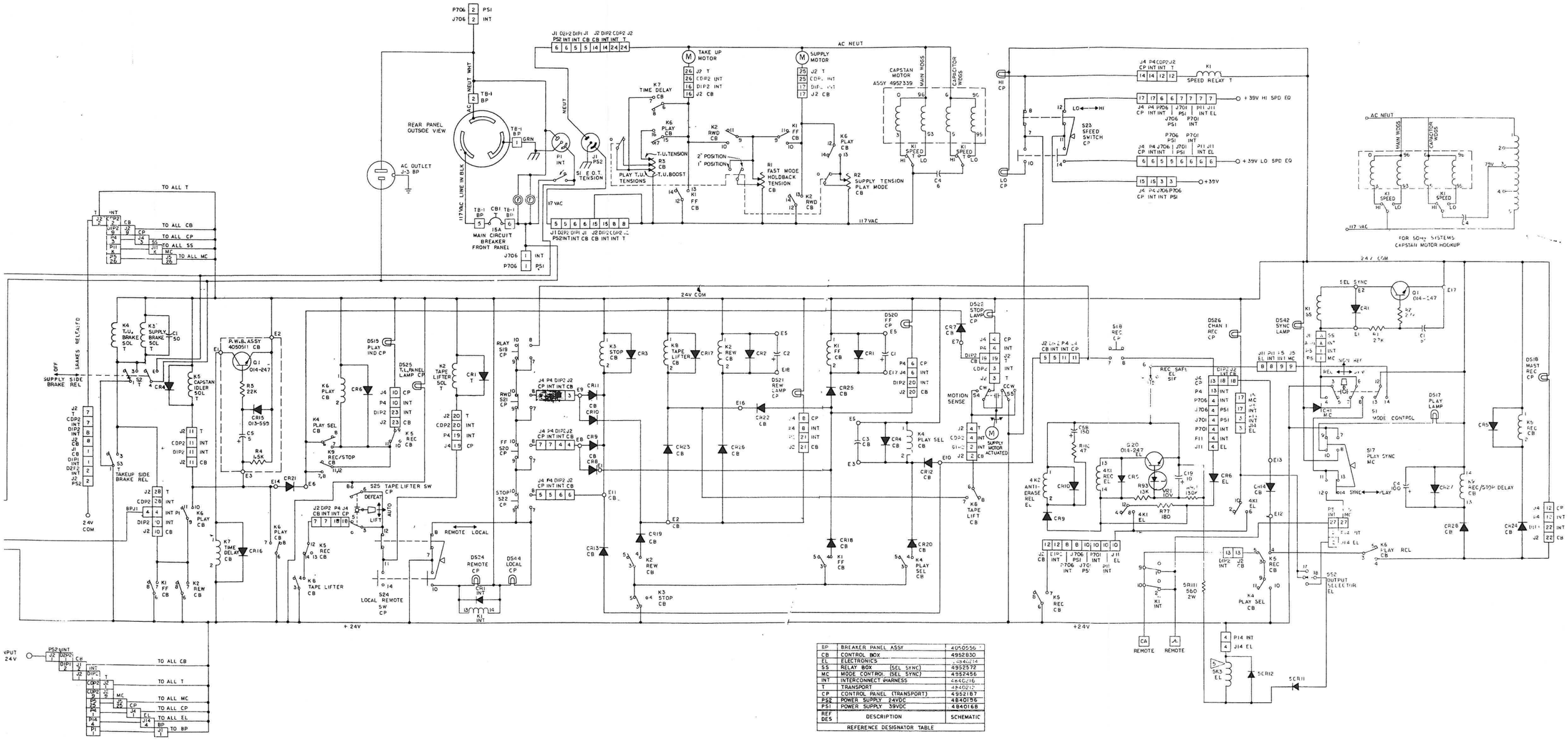


BP	BREAKER PANEL ASSY	4950556
CB	CONTROL BOX	4952830
EL	ELECTRONICS	4840214
SS	RELAY BOX (SEL SYNC)	4952572
MC	MODE CONTROL (SEL SYNC)	4952456
INT	INTERCONNECT HARNESS	4840216
T	TRANSPORT	4840212
CP	CONTROL PANEL (TRANSPORT)	4952187
PS2	POWER SUPPLY 24VDC	4840136
PS1	POWER SUPPLY 39VDC	4840168
REF DES	DESCRIPTION	SCHEMATIC

REFERENCE DESIGNATOR TABLE

Schematic No. 4840215B
(Ref. Assy. No. 4940139)

CHANGED OCT. 1970



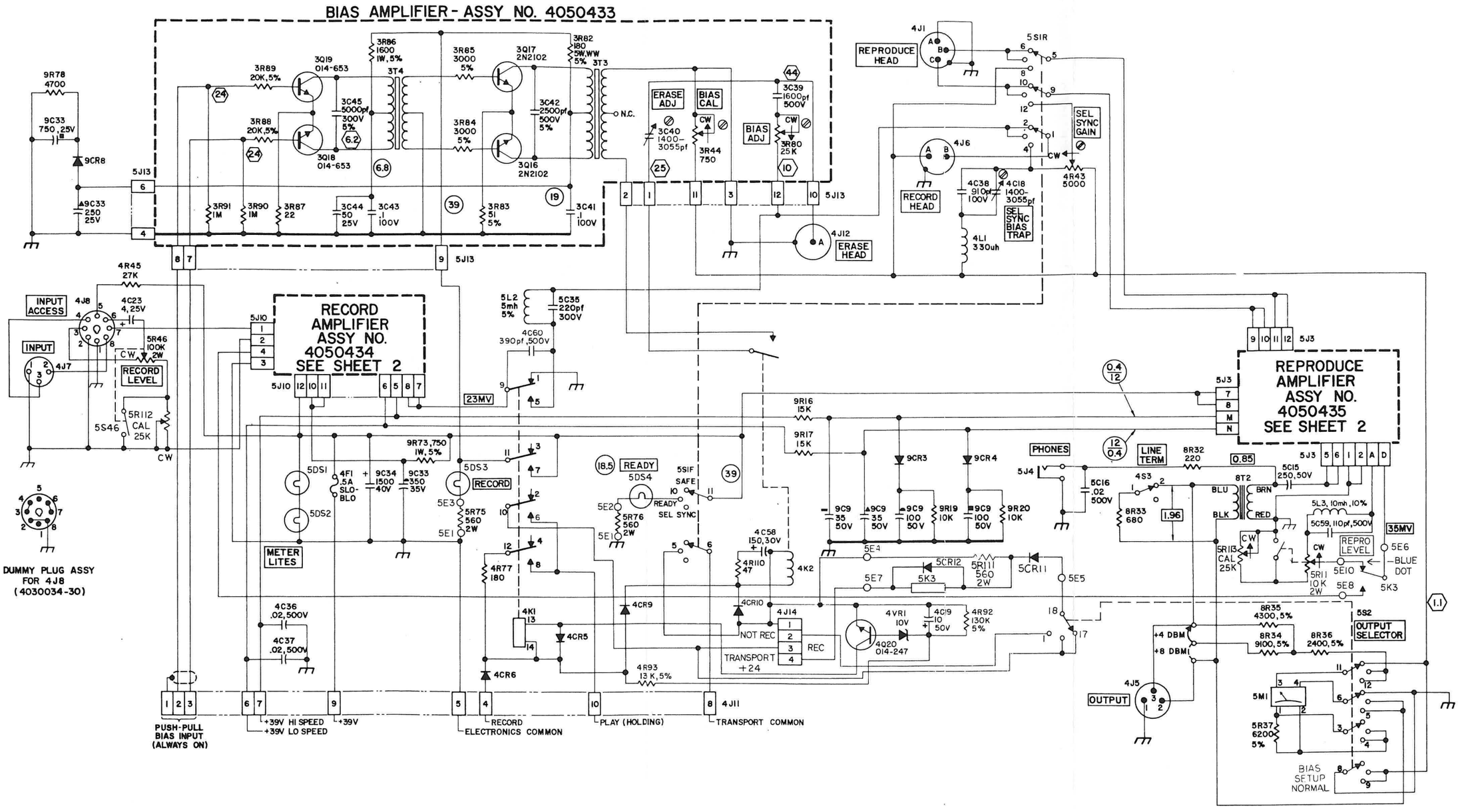
REF DES	DESCRIPTION	SCHEMATIC
BP	BREAKER PANEL ASSY	4050556
CB	CONTROL BOX	4952830
EL	ELECTRONICS	4954214
SS	RELAY BOX (SEL SYNC)	4952572
MC	MODE CONTROL (SEL SYNC)	4952456
INT	INTERCONNECT HARNESS	4840216
T	TRANSPORT	4840212
CP	CONTROL PANEL (TRANSPORT)	4952187
PS2	POWER SUPPLY 24VDC	4840196
PS1	POWER SUPPLY 39VDC	4840168

REFERENCE DESIGNATOR TABLE

Schematic No. 4840215B
(Ref. Assy. No. 4940139)

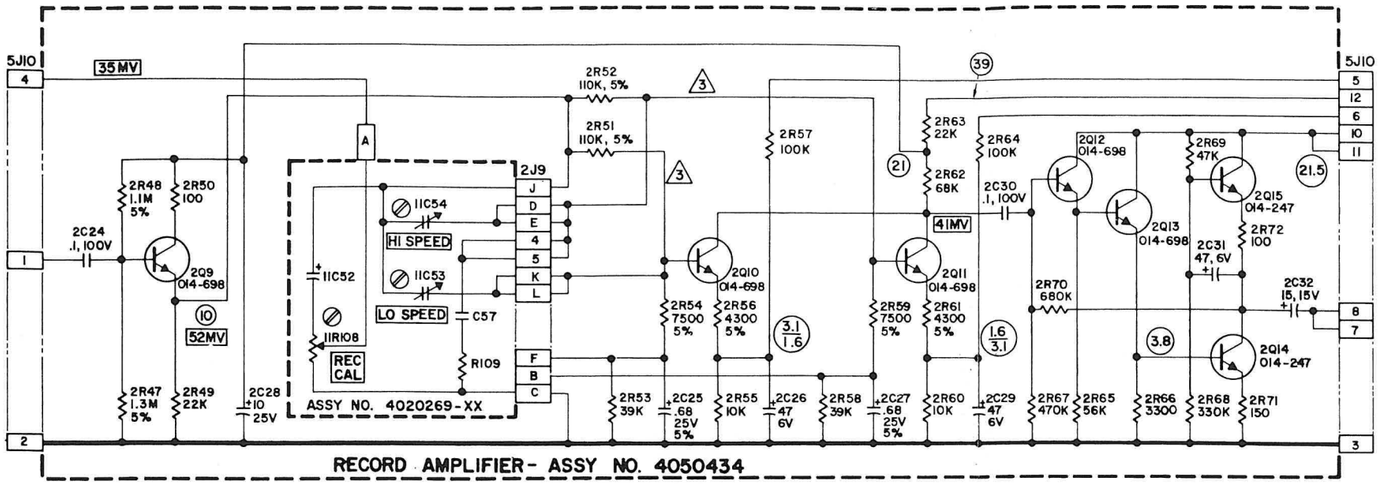
CHANGED OCT. 1970

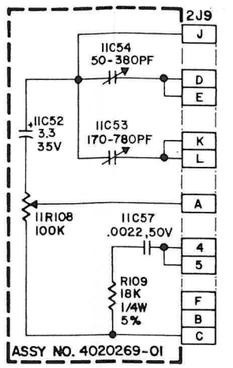
Figure 8-1. MM-1000 System Schematic



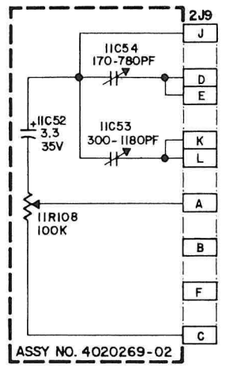
Schematic No. 4840214—
(Ref. Assy. No. 4020260)

Figure 8-2. Electronics Schematics (Sheet 1 of 2)

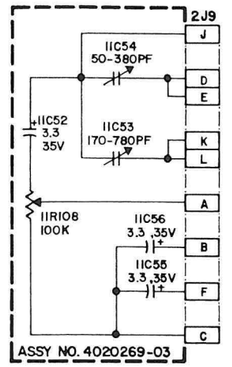




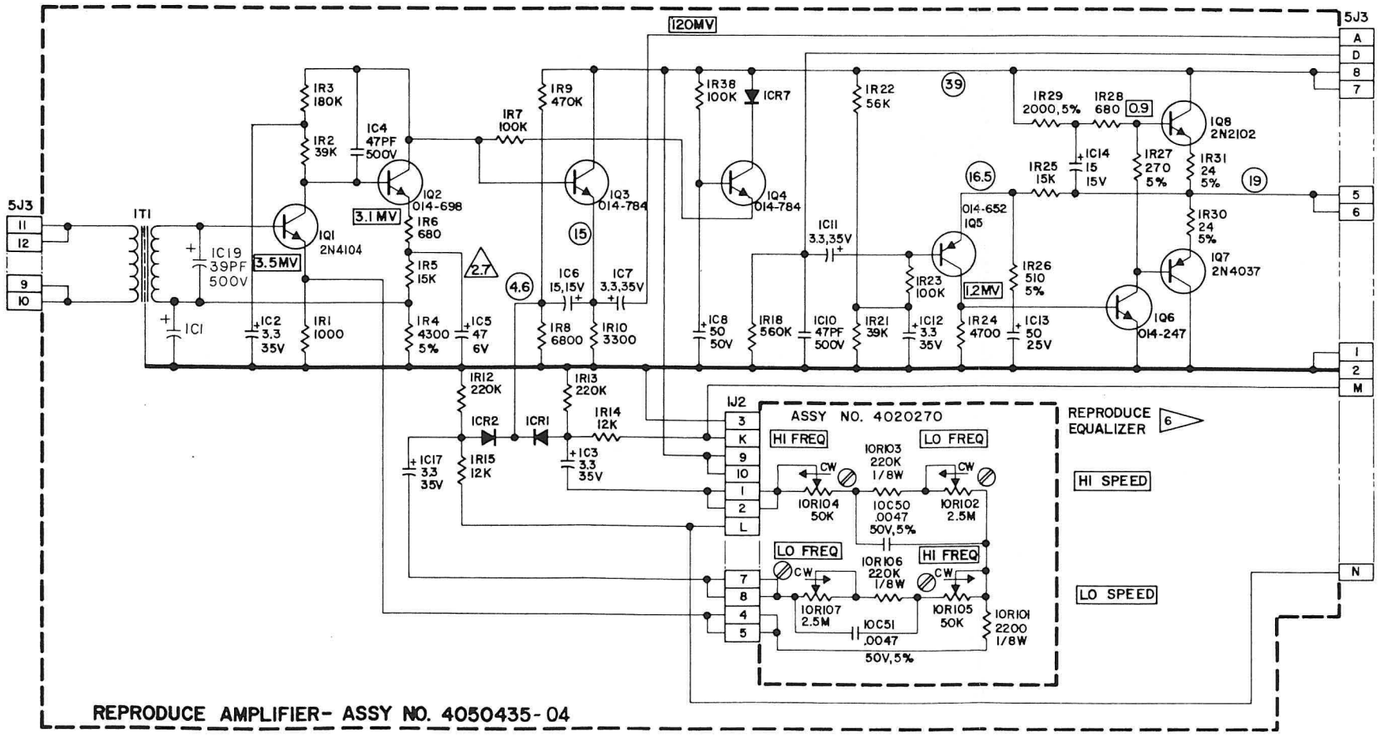
7 1/2 - 15 IPS NAB
(RECORD EQUALIZER)



3 3/4 - 7 1/2 IPS NAB
(RECORD EQUALIZER)



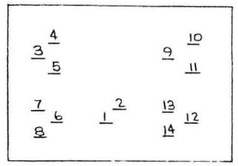
7 1/2 - 15 IPS I.E.C. (CCIR)
(RECORD EQUALIZER)



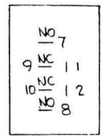
3 3/4 - 7 1/2 IPS I.E.C. (CCIR)
(RECORD EQUALIZER)

Schematic No. 4840214—
(Ref. Assy. No. 4020260)

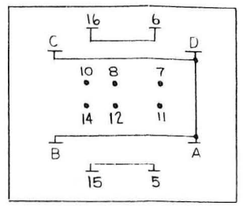
Figure 8-2. Electronics Schematics (Sheet 2 of 2)



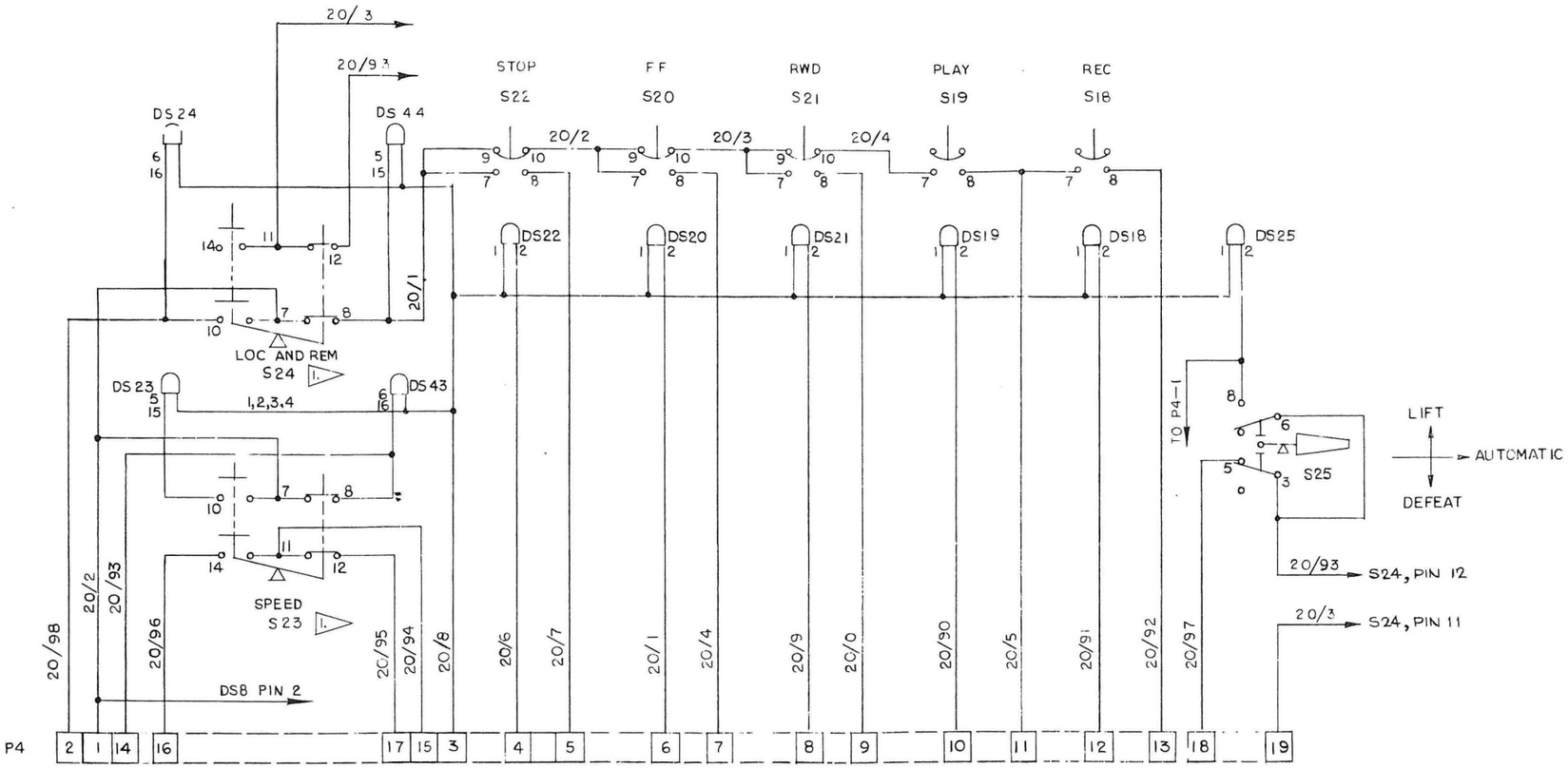
BACK VIEW
S25



S18 THRU S22



S23, S24



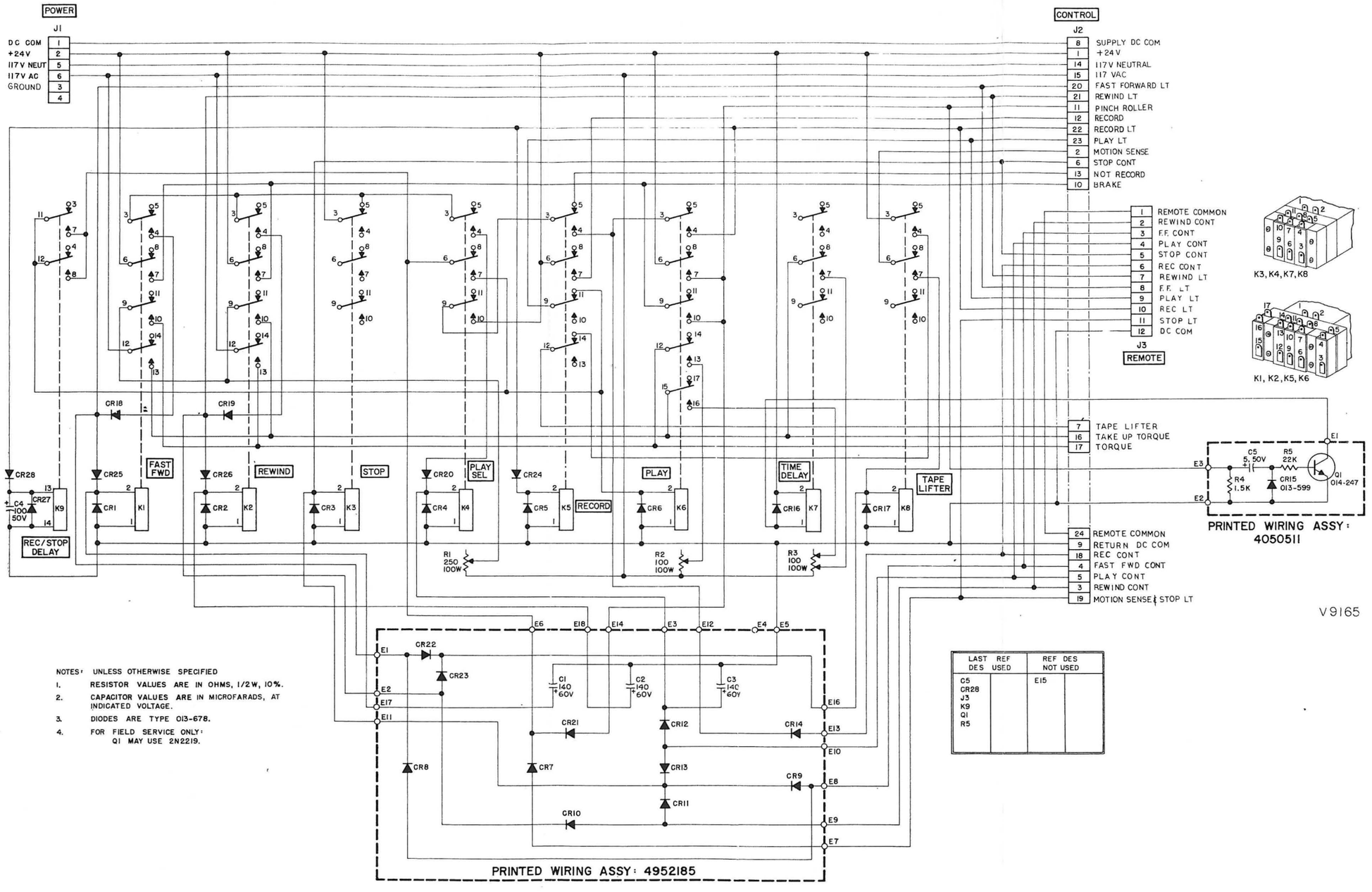
NOTES

1. S24 SHOWN IN LOCAL.
   S23 SHOWN IN HI.

LAST REF DES USED	REF DES NOT USED
DS 44 P4 S 25	

Schematic No. 4952187C
(Ref. Assy. No. 4952183)

Figure 8-3. Control Panel Schematic



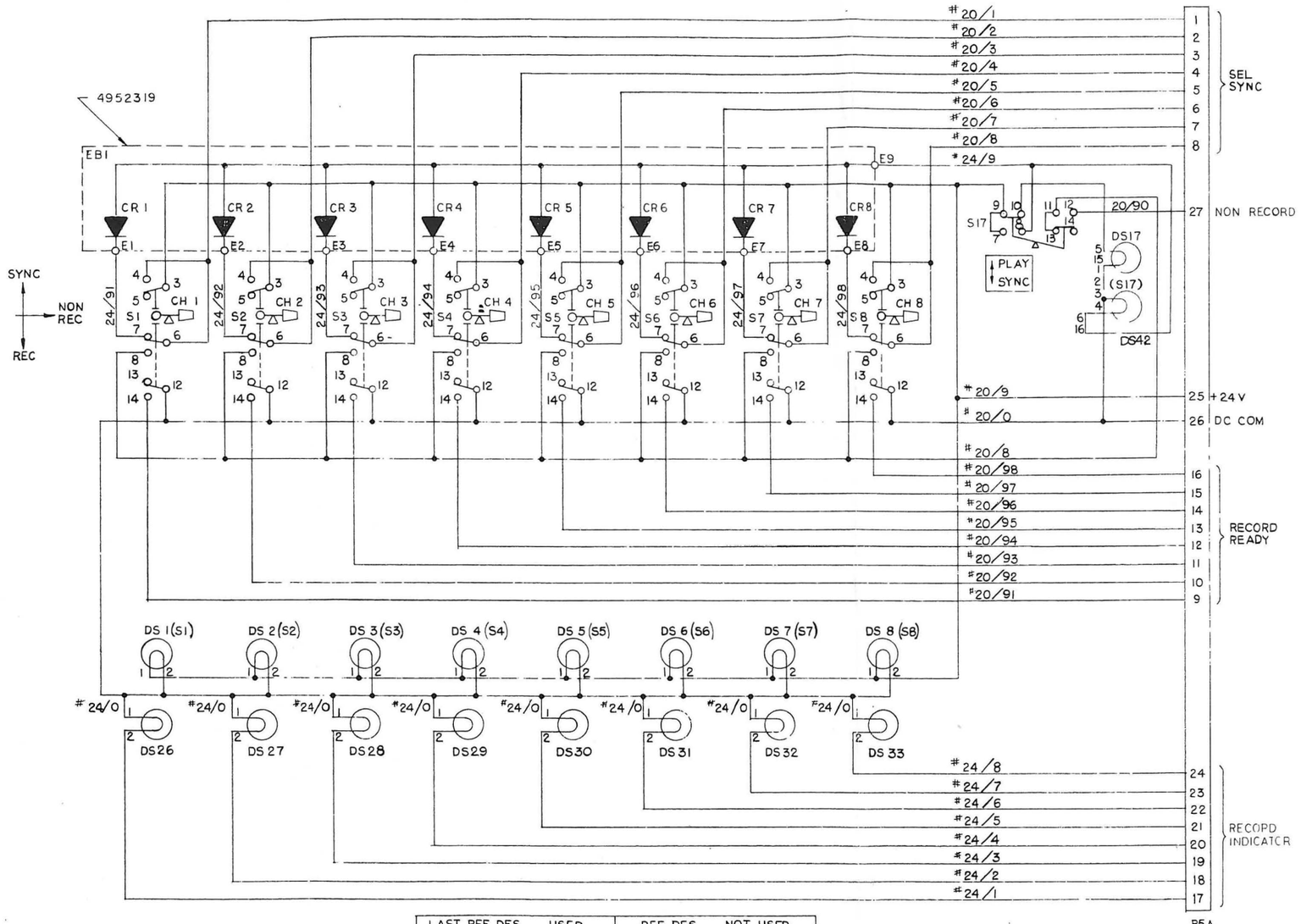
NOTES: UNLESS OTHERWISE SPECIFIED

1. RESISTOR VALUES ARE IN OHMS, 1/2W, 10%.
2. CAPACITOR VALUES ARE IN MICROFARADS, AT INDICATED VOLTAGE.
3. DIODES ARE TYPE 013-678.
4. FOR FIELD SERVICE ONLY: Q1 MAY USE 2N2219.

LAST REF DES USED		REF DES NOT USED	
C5		E15	
CR28			
J3			
K9			
Q1			
R5			

Schematic No. 4952830D
(Ref. Assy. No. 4952161)

Figure 8-4. MM-1000 Control Box Schematic



LAST REF DES USED	REF DES NOT USED
CR 8 DS 44 S 25 P5A EB1	P1, P2, P3 P5B CR9-16 DS9-16 DS34-41 S9-16

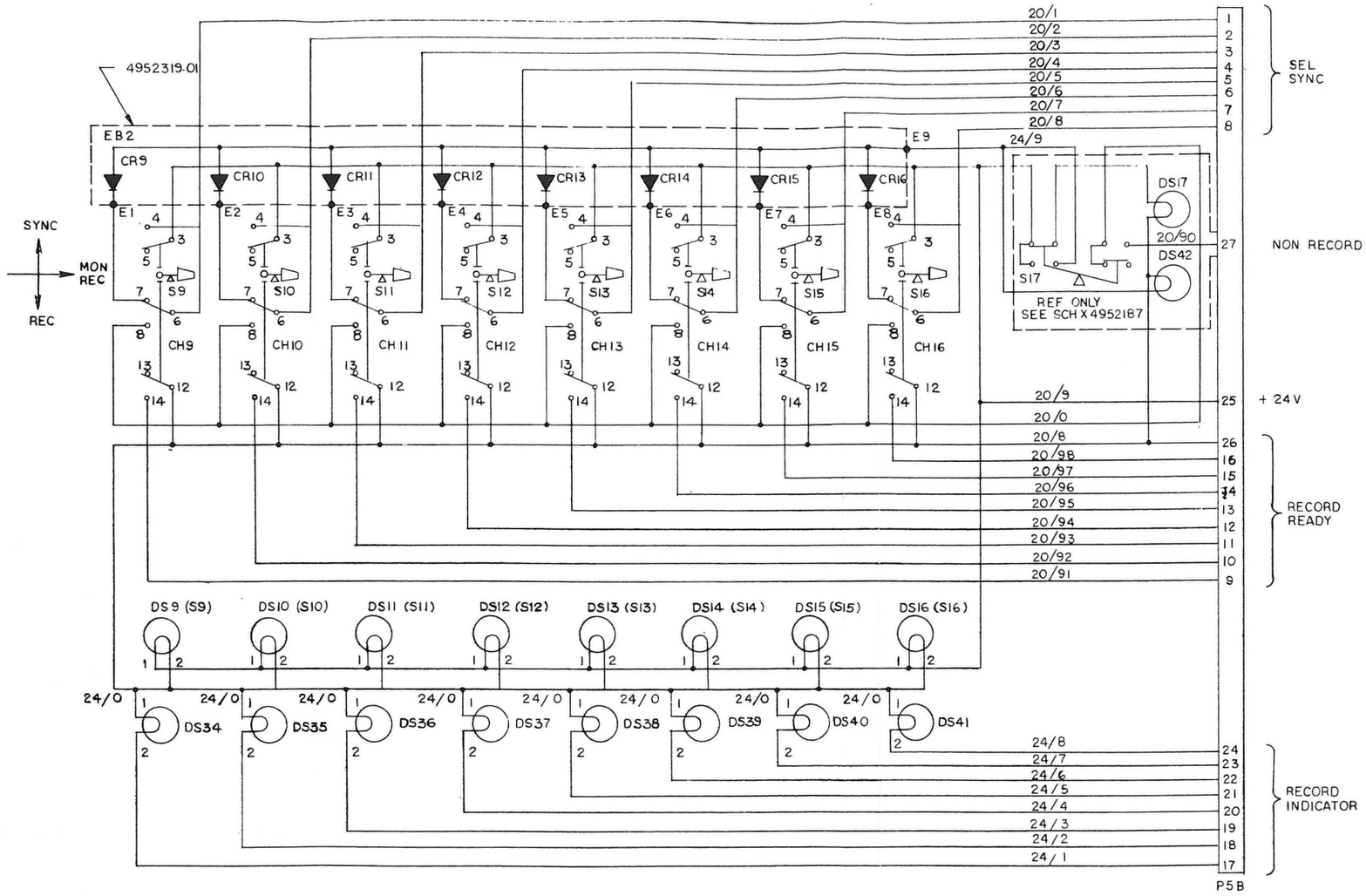
NOTES

UNLESS OTHERWISE SPECIFIED

1. ALL DIODES ARE 013-678

Schematic No. 4952456C
(Ref. Assy. No. 4952406)

Figure 8-5. Mode Control, Channels 1 to 8 Schematic



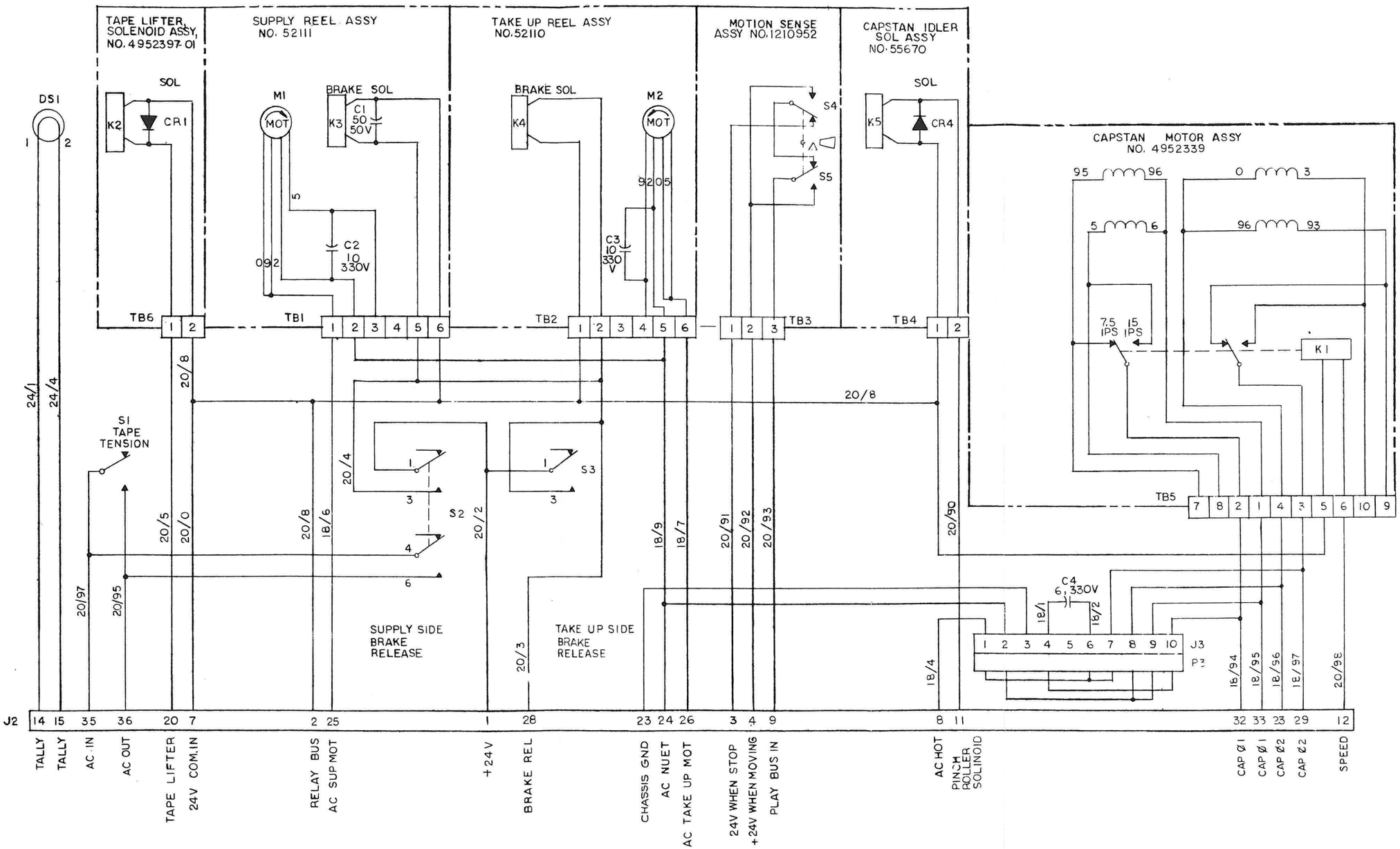
NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL DIODES ARE PART NO. 013-678

LAST REF DES USED	REF DES NOT USED
CR16 DS44 S25 P5B EB2	P1, P2, P3

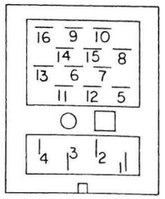
Schematic No. 4952284A
(Ref. Assy. No. 4952406)

Figure 8-6. Mode Control, Channels 9 to 16 Schematic

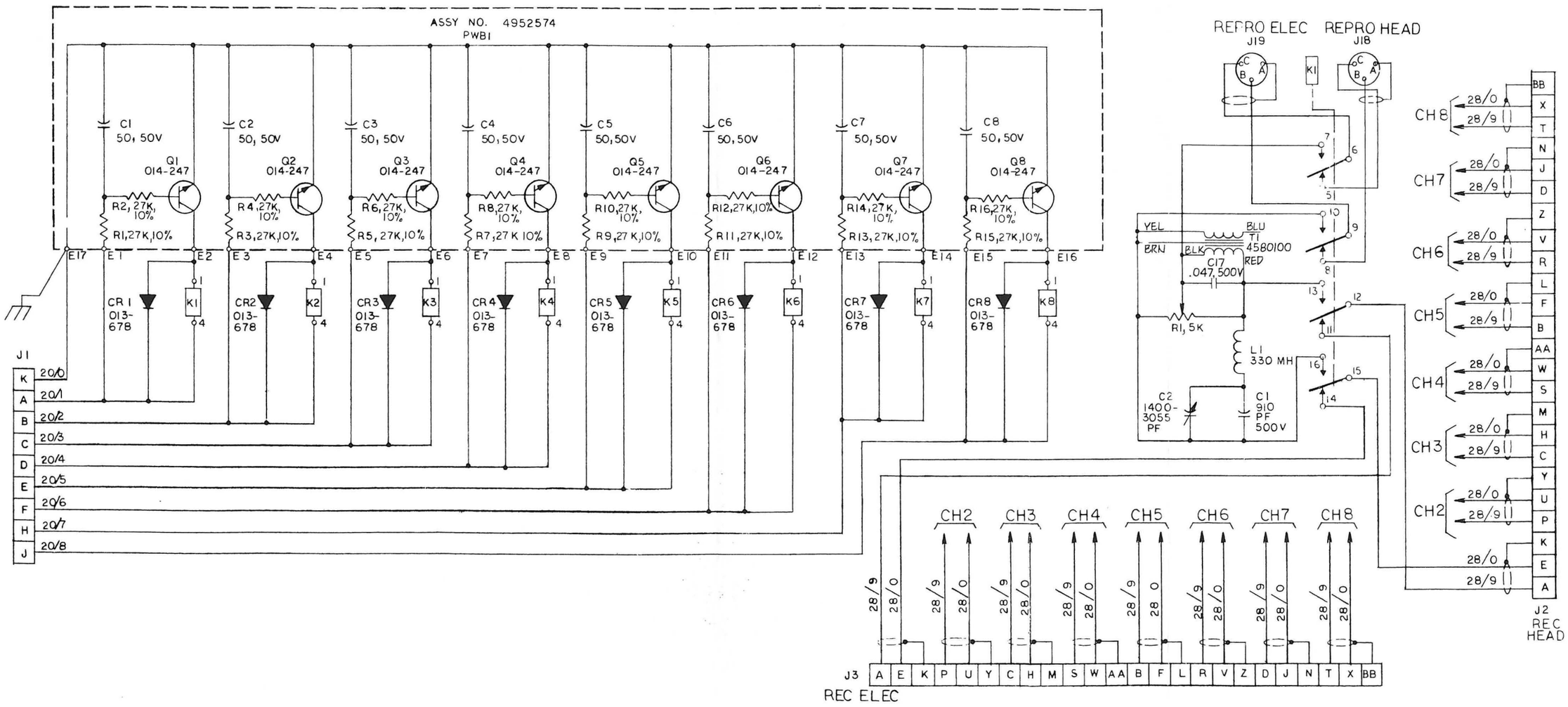


Schematic No. 4840212A
(Ref. Assy. No. 4952583)

Figure 8-7. MM-1000 Transport Schematic

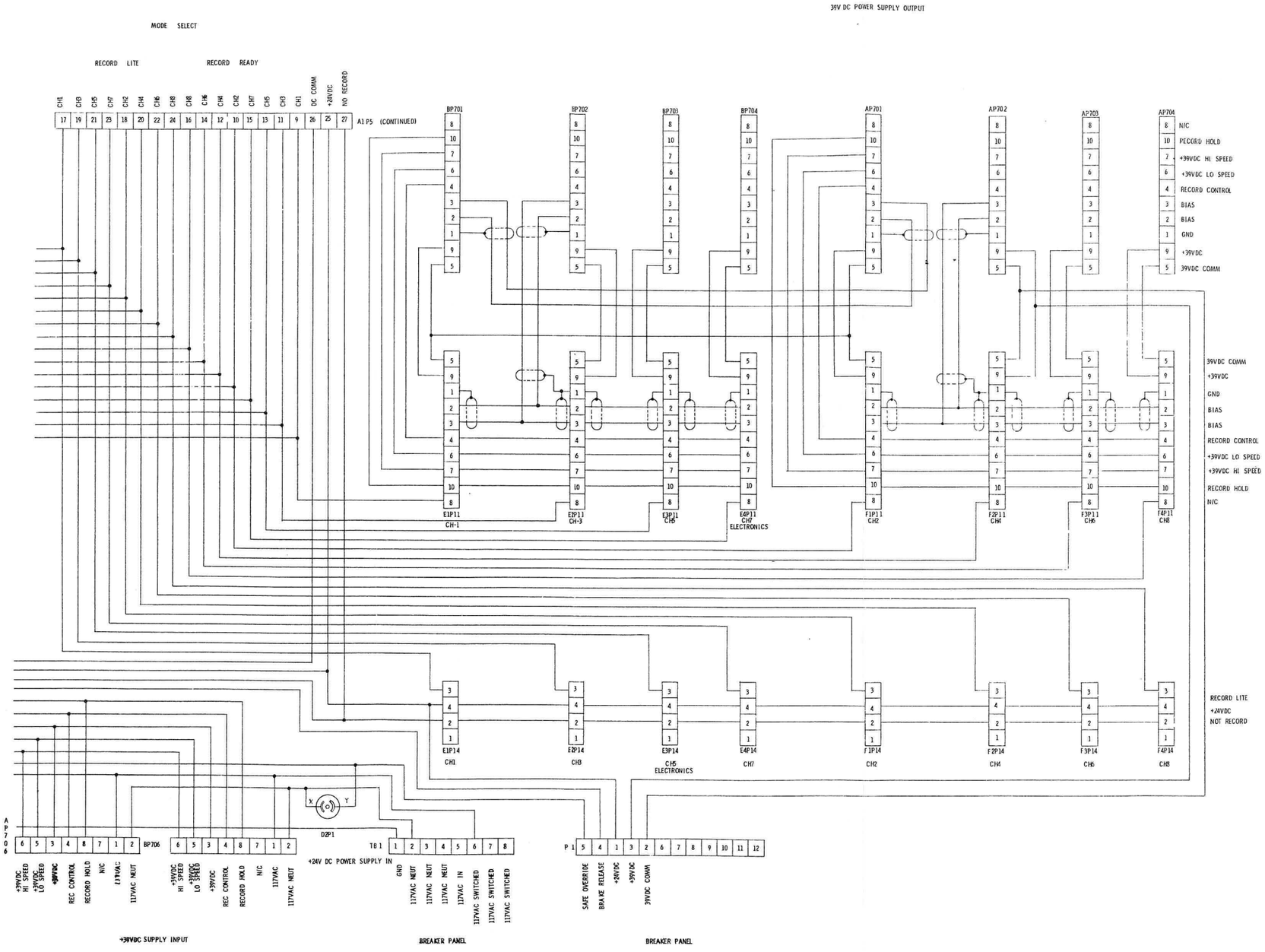


REAR VIEW
RELAY CONTACTS



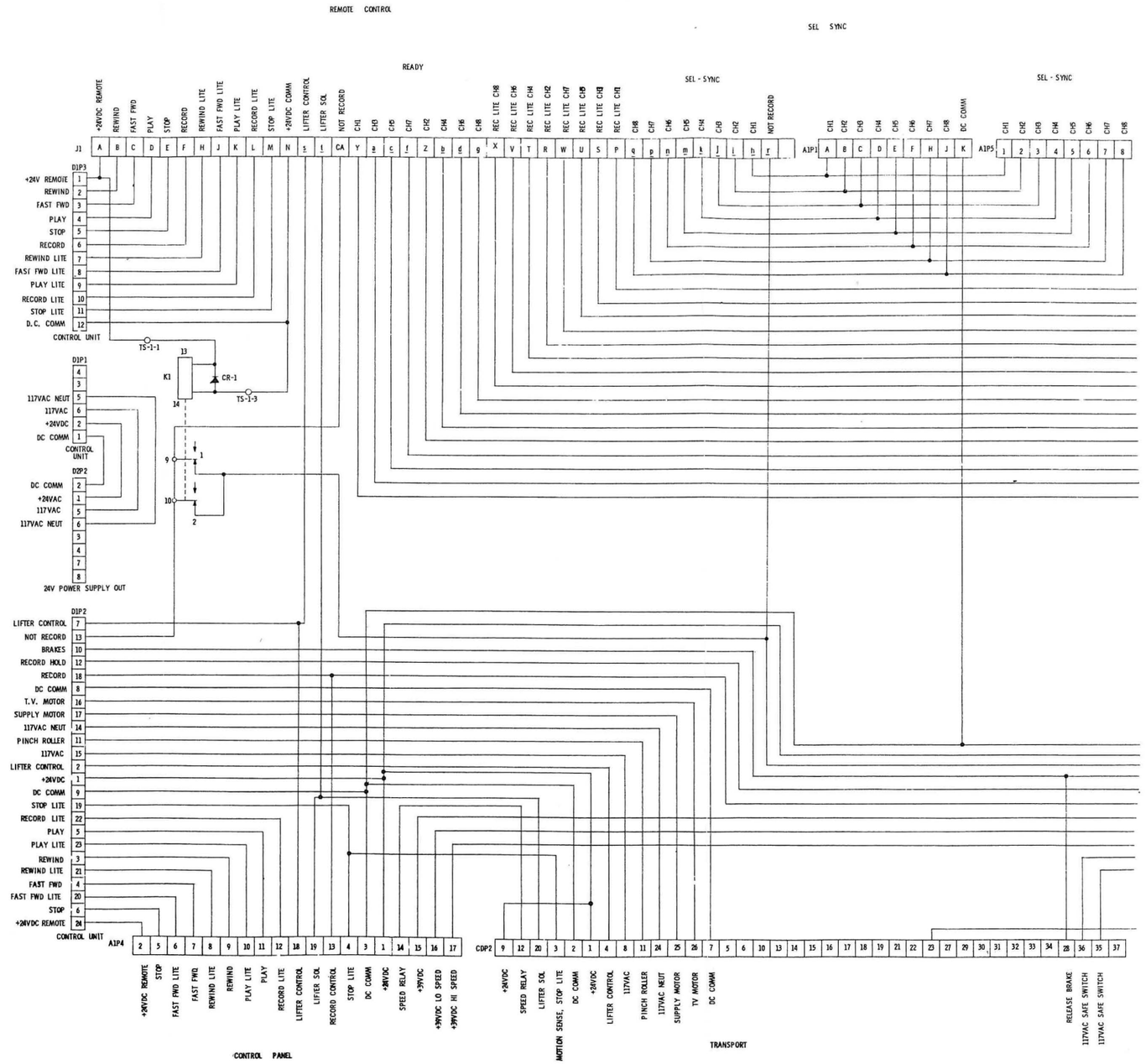
Schematic No. 4952572D
(Ref. Assy. No. 4952222)

Figure 8-8. Sel-Sync Unit Schematic



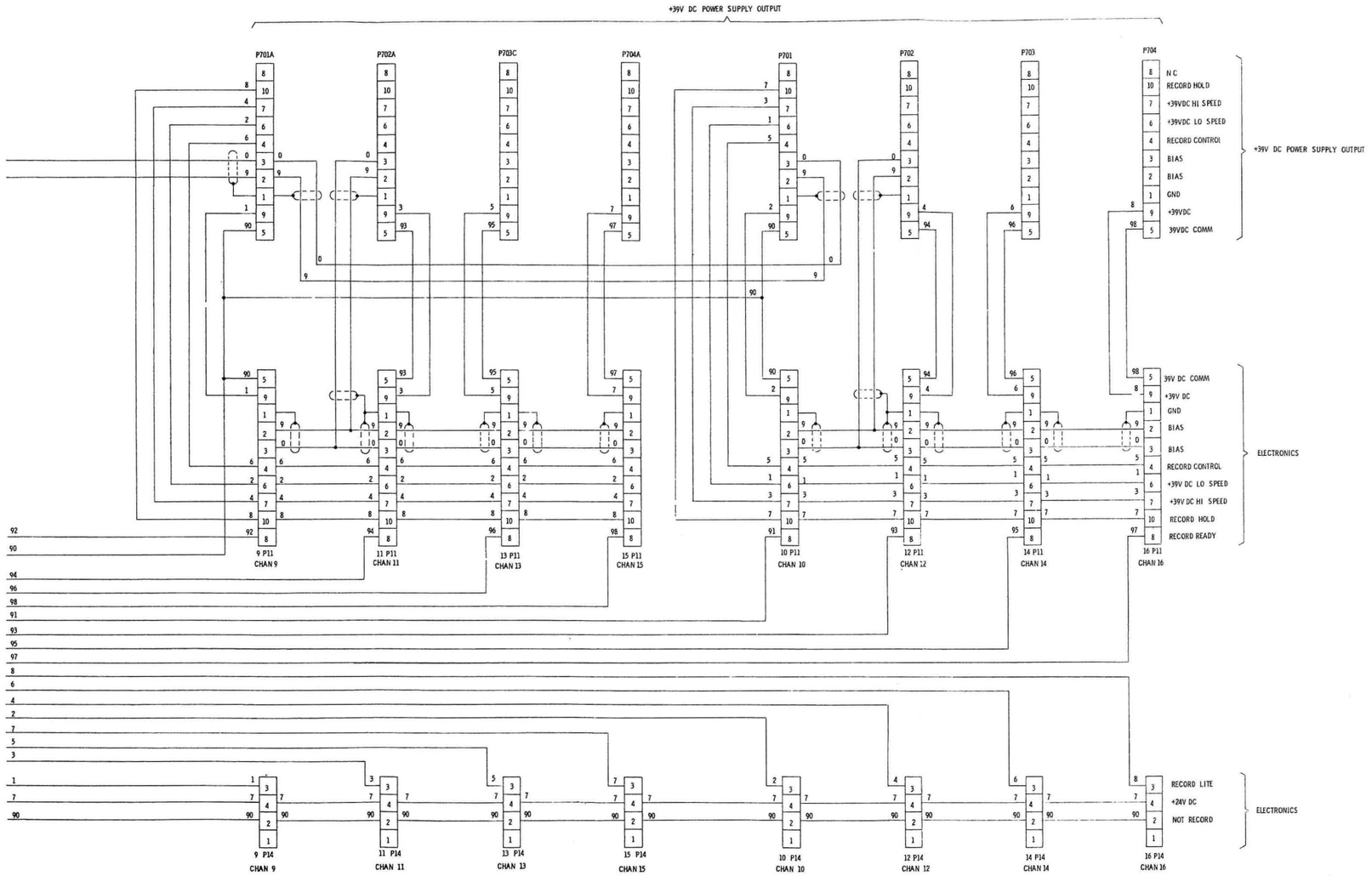
Schematic No. 4840216B
(Ref. Assy. No. 4940139)

Figure 8-9. MM-1000 System Control Wiring Diagram (Sheet 1 of 2)



Schematic No. 4840216B
(Ref. Assy. No. 4940139)

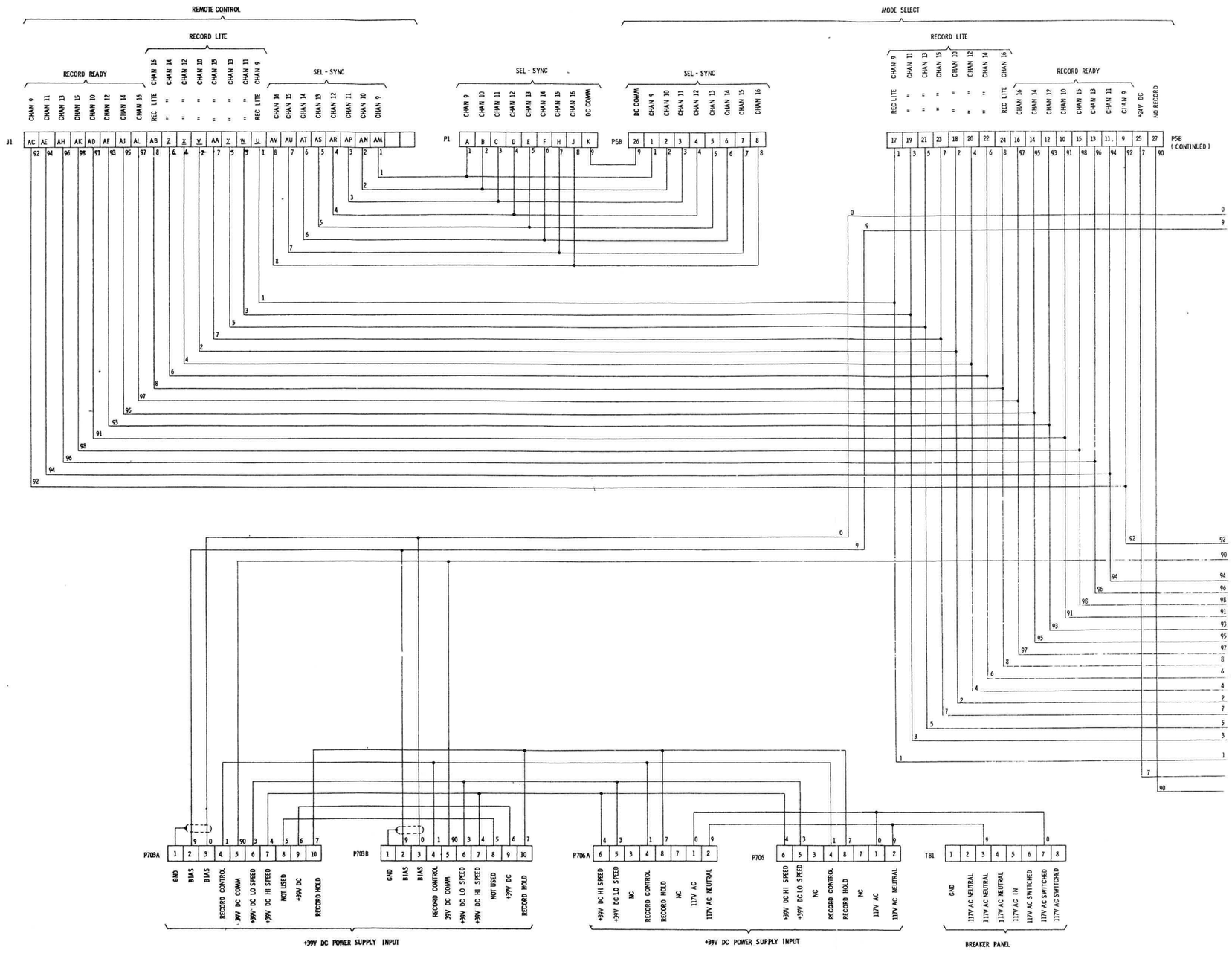
Figure 8-9. MM-1000 System Control Wiring Diagram (Sheet 2 of 2)



Schematic No. 4840218—
(Ref. Assy. No. 4940139)

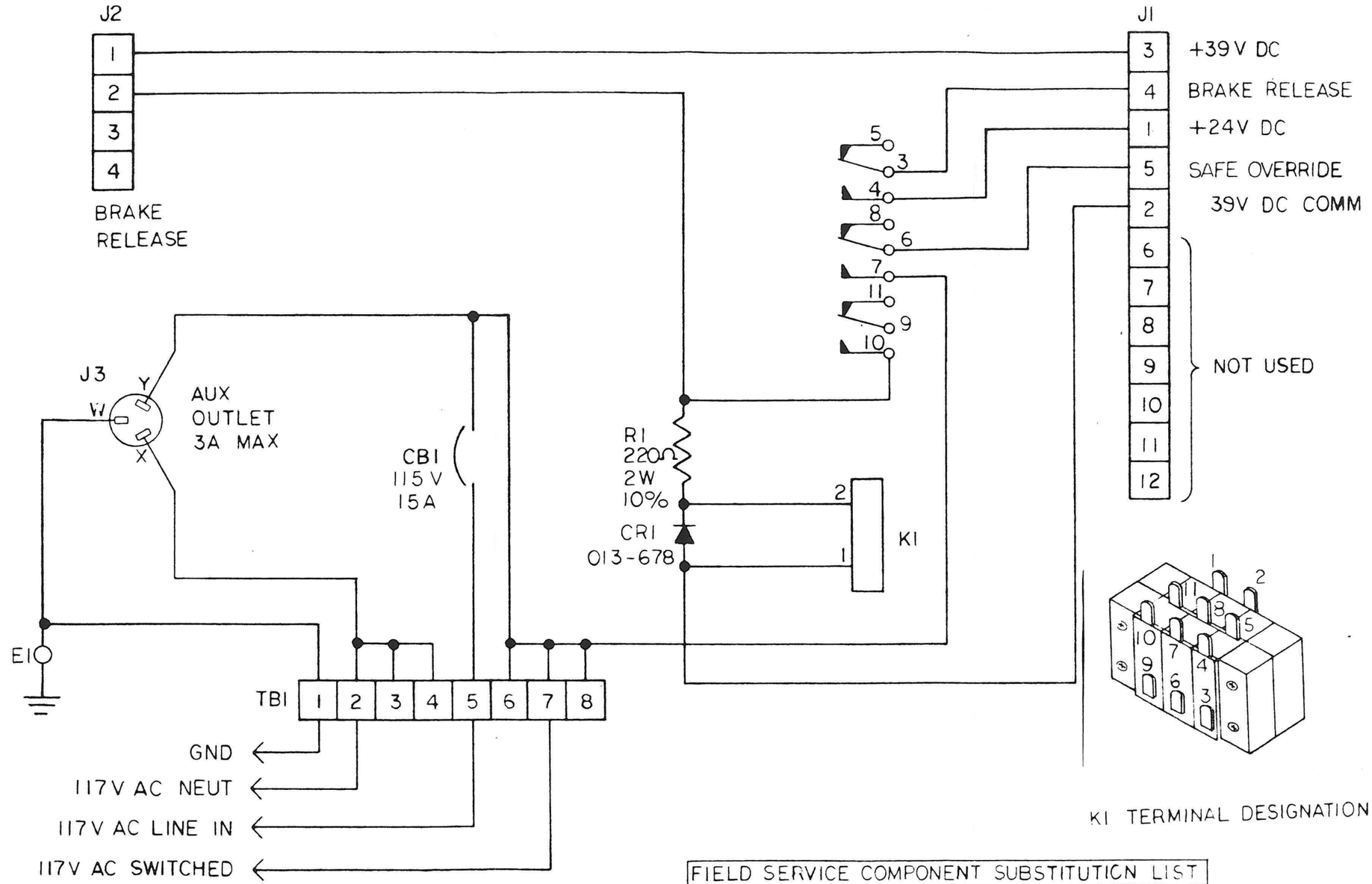
Figure 8-10. MM-1000 Supplementary Control Wiring Diagram (16 Channels) (Sheet 1 of 2)

CHANGED OCT. 1970



Schematic No. 4840218—
(Ref. Assy. No. 4940139)

Figure 8-10. MM-1000 Supplementary Control Wiring Diagram (16 Channels) (Sheet 2 of 2)

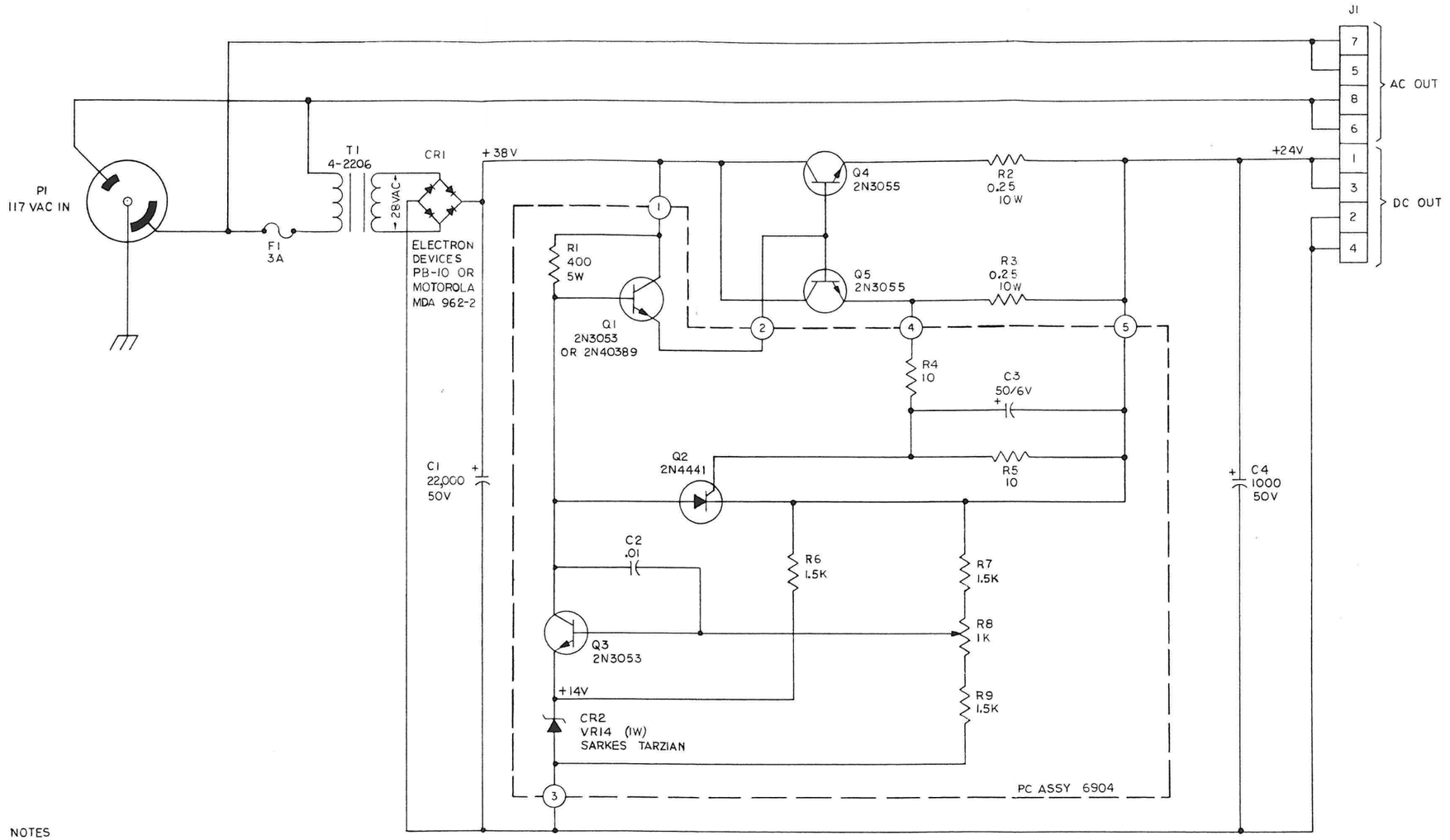


K1 TERMINAL DESIGNATION

FIELD SERVICE COMPONENT SUBSTITUTION LIST	
AMPEX PART NO.	NEAREST COMMECIAL EQUIV.
013-678	IN4385

Schematic No. 4840213—
(Ref. Assy. No. 4050556)

Figure 8-11. Breaker Panel Schematic

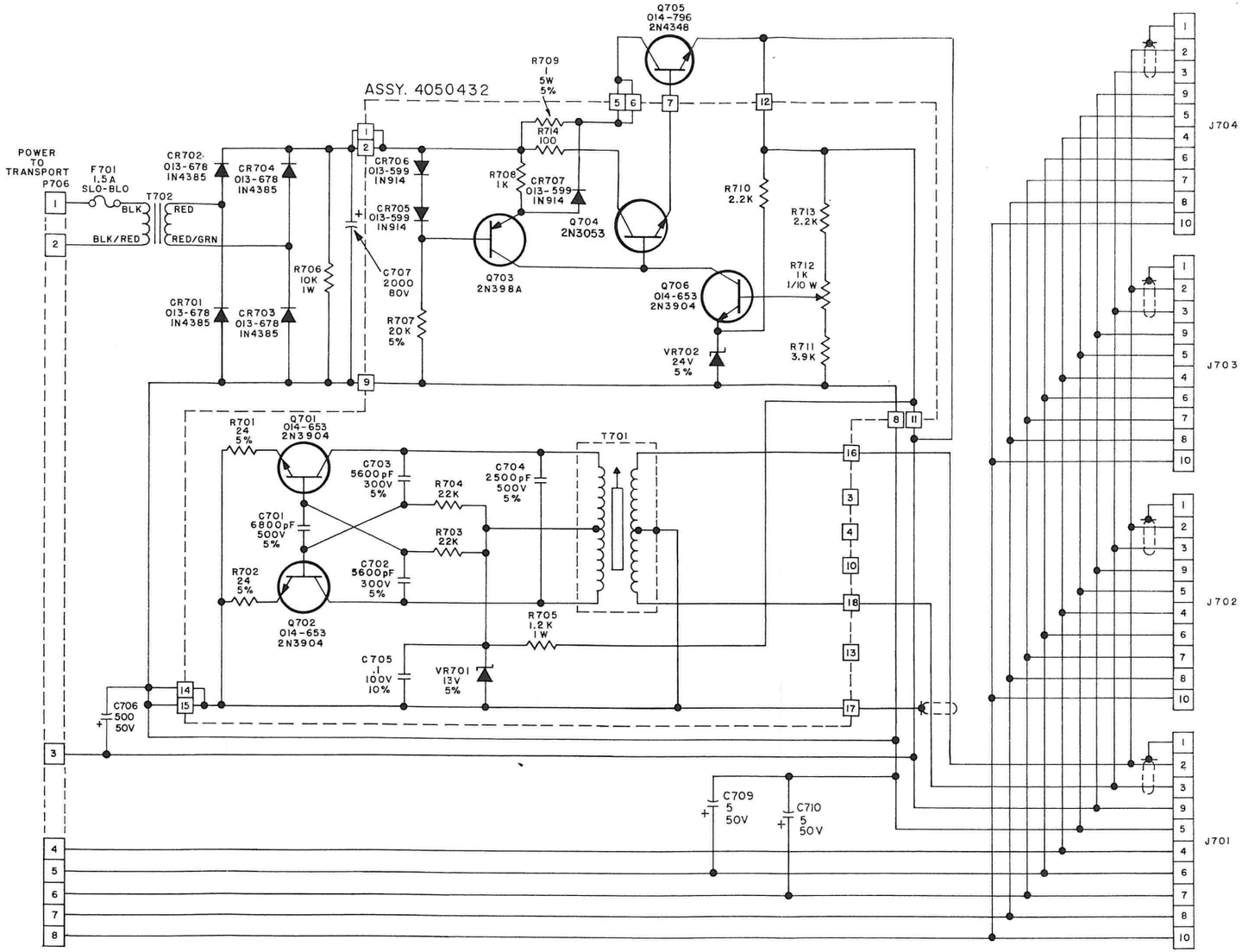


NOTES

1. THE CURRENT LIMIT CIRCUIT IS A LATCHING TYPE. TO RESET, THE POWER MUST BE INTERRUPTED LONG ENOUGH FOR C1 TO DISCHARGE BELOW A VOLTAGE SUFFICIENT TO MAINTAIN SUSTAINING CURRENT IN Q2 (APPROX 20 SECONDS).
2. UNLESS OTHERWISE STATED ALL RESISTANCES ARE IN OHMS, ALL CAPACITANCE IS IN MICROFARADS.
3. VOLTAGES LISTED ARE WITH NO LOAD ON THE OUTPUT & 20K/V VOM. UNLESS OTHERWISE NOTED, VOLTAGES ARE REFERENCED TO C1 MINUS.
4. POWER SUPPLY MANUFACTURED BY CONSOLTRONICS ASSOC, INC. PART NO. 6902.

Schematic No. 4840196—
(Ref. Assy. No. 4952890)

Figure 8-12. Power Supply, 24 VDC

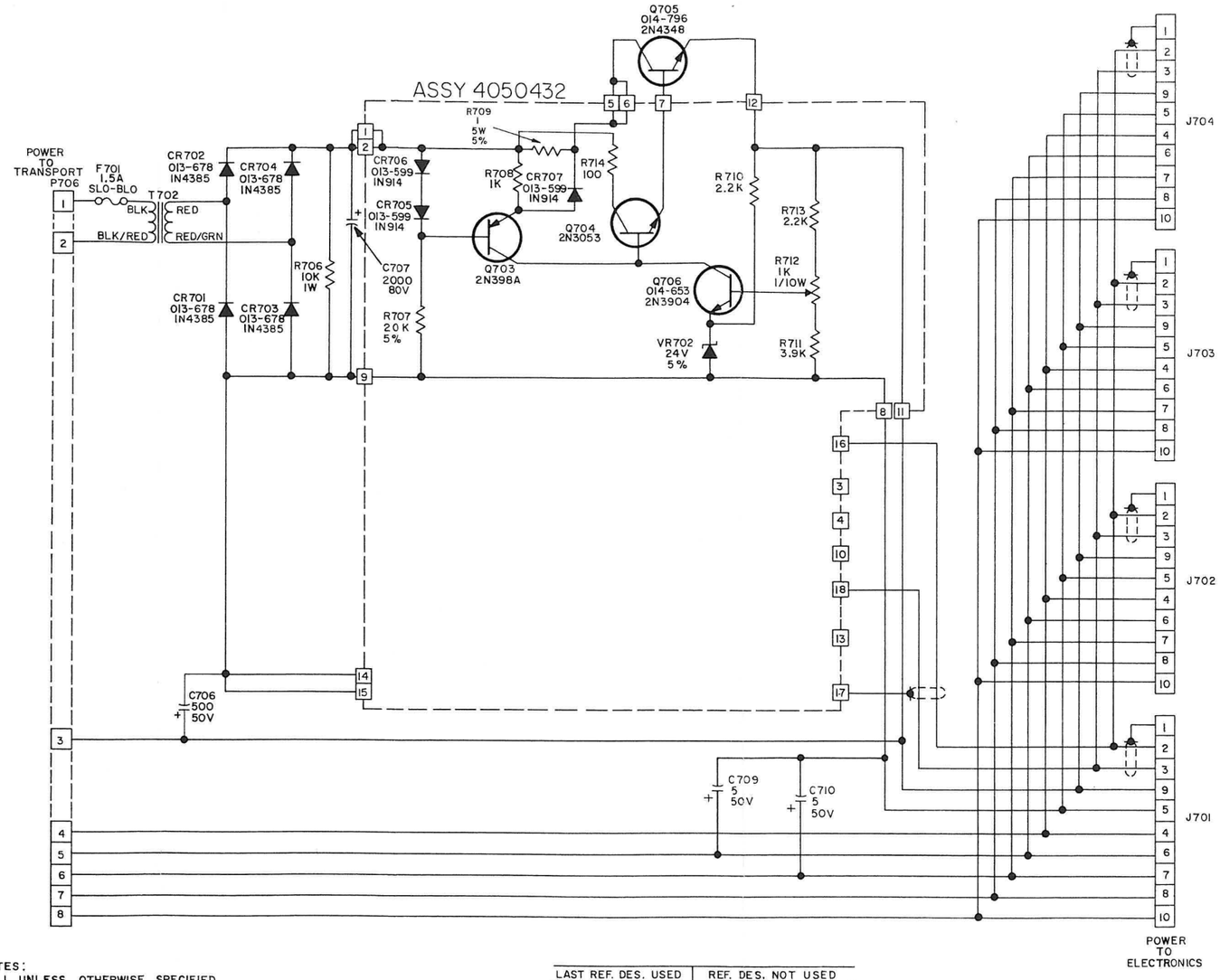


NOTES:
UNLESS OTHERWISE SPECIFIED
1. ALL CAPACITOR VALUES ARE IN MICROFARADS, RATINGS AS INDICATED.
2. ALL RESISTORS VALUES ARE IN OHMS, 1/2 WATT, 10%.

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

Schematic No. 4840168G
(Ref. Assy. No. 4940139)

Figure 8-13. Power Supply with Oscillator

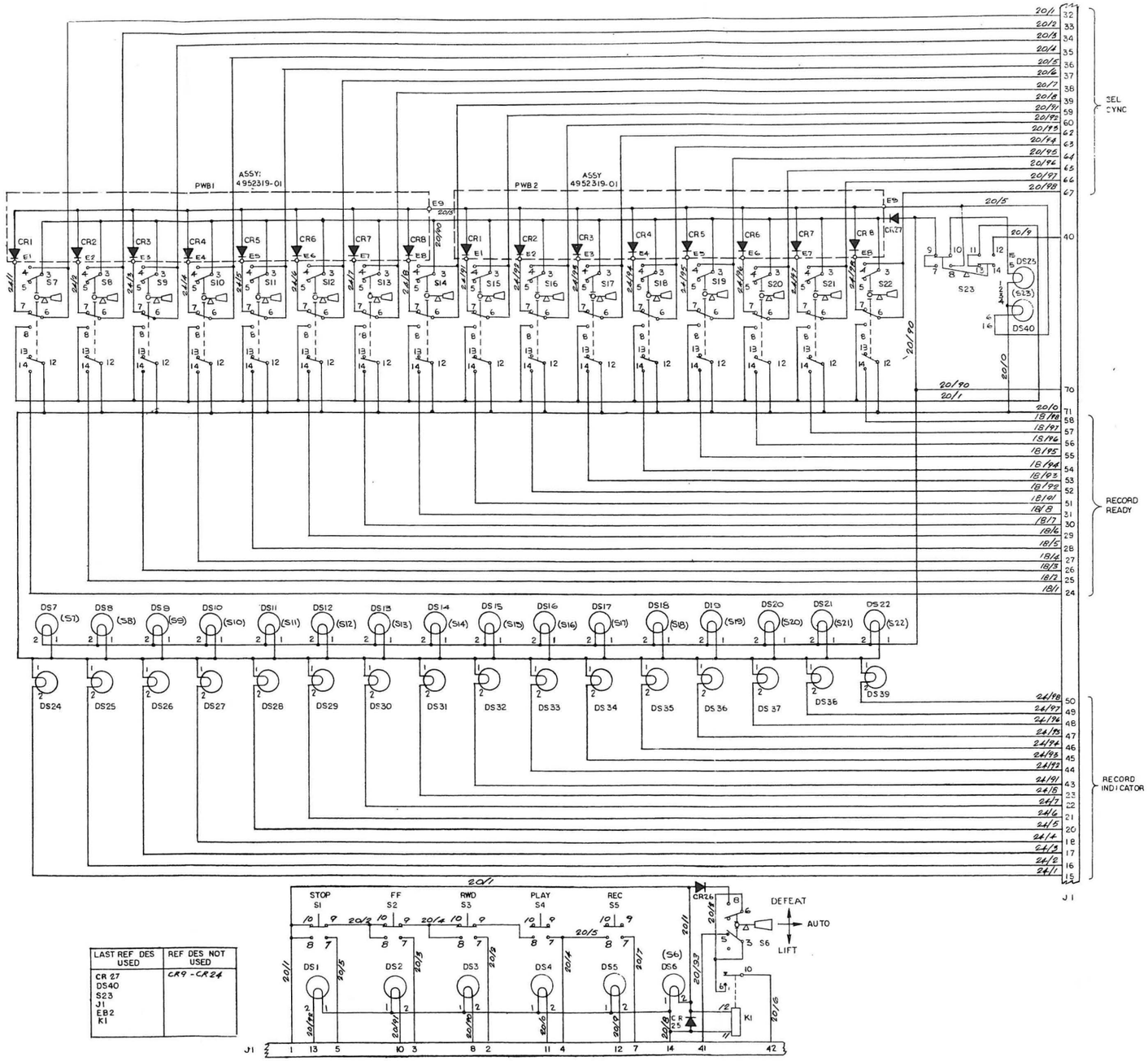


NOTES:
1. UNLESS OTHERWISE SPECIFIED
   ALL CAPACITOR VALUES ARE IN MICROFARADS, RATINGS AS INDICATED.
   ALL RESISTOR VALUES ARE IN OHMS, 1/2WATT, 10%

LAST REF. DES. USED	REF. DES. NOT USED
C710	C701 TO C705 C708
CR 707	
Q706	Q701, 702
VR 702	VR701
T 702	T 701
R714	R701 TO R705

Schematic No. 4840039E
(Ref. Assy. No. 4940139)

Figure 8-14. Power Supply, 39 VDC



LAST REF DES USED	REF DES NOT USED
CR 27 DS40 S23 J1 E82 K1	CR9 - CR24

Schematic No. 4952346C
(Ref. Assy. No. 4940149)

Figure 8-15. Remote Control Unit Schematic

AMPEX

4890304-02

VOL. II

Master Maker 1000 Recorder/Reproducer

Operation and Maintenance Manual

ISSUED: DECEMBER 1969

CHANGED: OCTOBER 1970

A101A

SECTION IX

PARTS LISTS AND DRAWINGS

SECTION IX

ASSEMBLY DRAWINGS AND LISTS OF MATERIALS

This section contains assembly drawings and lists of materials pertaining to the equipment described in this manual.

This introduction describes the arrangement of the material in the section and its use. The section has a two-part index, one listing the assembly drawings in alphabetical order and one listing them in numerical order. Alphabetical listings are generally in direct-reading order (i.e., "High Gain Amplifier," not "Amplifier, High Gain").

Each item of a typical LM is explained below. The key number preceding each item corresponds to the same key number on the sample LM, shown on the page immediately following.

(1) Assembly Title. This is the title assigned the assembly by the Ampex Engineering Department.

(2) Catalog Number of Assembly. This number corresponds to the number stamped on, or affixed to, the assembly during manufacture.

(3) Item Number. This number is assigned to parts to aid in identifying and locating the parts on the LM or assembly drawing.

(4) Ampex Part Number. These are Ampex's document and part control numbers.

(5) Vendor or Military Number. This is the identification number that Ampex used to purchase the part from a vendor. Any suitable equivalent may be used in the procurement of parts so identified.

(6) Schematic Reference. This number is assigned to electrical components on the schematic drawings.

(7) Part Description. This is an abbreviated explanation of each part used in the complete assembly, to assist the user in identifying parts. Where the same part is listed more than one time on an LM, the statement "Same As . . . "may be given, and refers to the description given for the first listing of the part.

(8) MFR CODE (Manufacturer's Code) This number is the Federal Supply code of the manufacturer of purchased items.

(9) Quantity Required Per Version. This number indicates the quantity of each part required in the complete assembly.

(10) Sheet _ of _. This figure indicates the number of pages comprising the complete list of materials for the assembly.

(11) NHA (Next Higher Assembly). If applicable, indicates which assembly this LM is subordinate to and upon which LM it may be found.

(12) Date. This area of the page will contain the date that the LM page

has been changed, since the manual was issued. Where no changes have been made, there will be no date given.

(13) Control Number. Shows the drawing revision current at time of publication.

(14) Page Number. This is the page number assigned to each page, as listed in the indexes. In the sample page number 10-178, the 10 signifies the tenth section of the manual, and the -178 indicates the 178th page of the Section.

An explanatory figure on the second page following illustrates how to find a part number or name by cross-referencing the item key numbers between the LM's and the assembly drawings and schematic diagrams.

ELECTRONIC EGG TIMER ASSEMBLY (1) (2) CATALOG NO. 1984269 SHEET 1 OF 1 (10)

NHA 1776204 (11)

(3) ITEM NO.	AMPEX PART NO. (4)	VENDOR OR MIL. NO. (5)	SCHEMATIC REFERENCE (6)	PART DESCRIPTION (7)	MFR CODE (8)	QUANTITY REQUIRED PER VERSION (9) -04	-05
1	1985229-02			PRINTED WIRING ASSEMBLY		1	1
2	212-345	2N5227	Q1, 2, 4	TRANSISTOR	24567	3	3
3	150-142		Ref Q1, 2, 4	SOCKET, Transistor Mounting	29765	3	3
4	210-967		R1-R16	RESISTOR, 50k, 1/2W, 5%		16	16
5	210-957		R17	RESISTOR, 25k, 1/2W, 5%		1	-
6	210-945		R17	RESISTOR, 15k, 1/2W, 5%		-	1
7	114-789	1N6452	CR1-8	DIODE		8	8
8	113-946	1N6784	VR1	DIODE, Zener, 4.6V, 5%	18665	1	-
9	113-687	1N3582	VR1	DIDOE, Zener, 3.8V, 5%	18665	-	1
10	1210987-05			PROBE, Egg Temperature, white egg		1	-
11	1210987-06			PROBE, Egg Temperature, brown egg		-	1
12	1921346-02			READOUT, Digital, egg temperature		1	1
14	711-269	#381		LAMP, Miniature, 6V, T-1-3/4		2	2
15			1066974	SCHEMATIC		REF	-
16			1066993	SCHEMATIC		-	REF
17	401-611	3N99	Q3	CHOPPER	56734	1	1
18	1122334-60			PANEL, Housing		1	1
19	509-391			SCREW, Self-tapping, #6 x 1/2"		12	12
20	589-112			WASHER, Flat		12	12
21	8763224-01			HARNESS		1	-
22	8763224-02					-	1
23	6000000-09			...ication		1	-
24	6000000-10			LABEL, Identification		-	1
25	1669222-01			HOLDER, Egg, size AA		1	1
26	1669222-02			HOLDER, Egg, size A		1	1
30	347-899			WATER		A/R	A/R

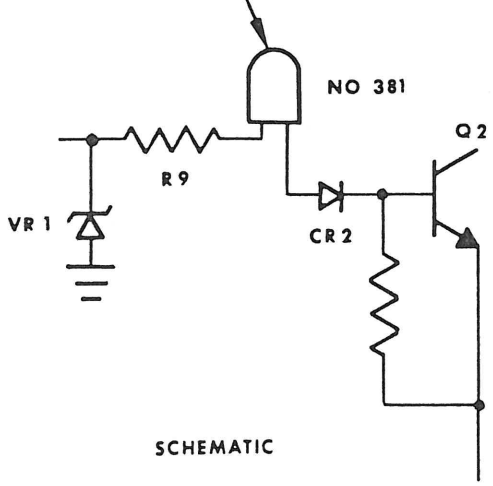
VERSION	USED ON
-04	White eggs
-05	Brown eggs

(13) 1984269C

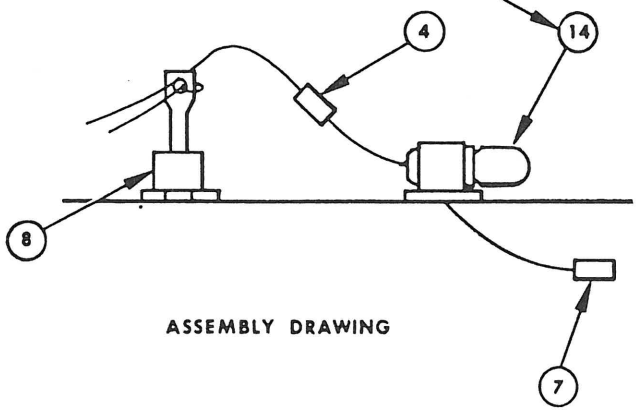
CHANGED 30 FEBRUARY 1969 (12)

6.2-178 (14)

		[illegible]	Q1, 2, 4		24567	3	3
3	150-142		Ref Q1, 2, 4	SOCKET, Transistor Mounting	29765	3	3
4	210-967		R1-R16	RESISTOR, 50k, 1/2W, 5%		16	16
5	210-937		R17	RESISTOR, 25k, 1/2W, 5%		1	-
6	210-945		R17	RESISTOR, 15k, 1/2W, 5%		-	1
7	114-789	1N6452	CR1-8	DIODE		8	8
8	113-946	1N6784	VR1	DIODE, Zener, 4.6V, 5%	18665	1	-
9	113-687	1N3582	VR1	DIDOE, Zener, 3.8V, 5%	18665	-	1
10	1210987-05			PROBE, Egg Temperature, white egg		1	-
11	1210987-06			PROBE, Egg Temperature, brown egg		-	1
12	1921346-02			READOUT, Digital, egg temperature		1	1
14	711-269	#381		LAMP, Miniature, 6V, T-1-3/4		2	2
15			1066974	SCHEMATIC		REF	-
16			1066993	SCHEMATIC		-	REF
17	491-611	3N99	Q3	CHOPPER	56734	1	1
18	1122334-60			PANEL, Housing		1	1
19	309-[illegible]91			SCREW, Self-tapping, #6 x 1/2"		12	12
20	589-11[illegible]			WASHER, Flat			



SCHEMATIC



ASSEMBLY DRAWING

V08638

ALPHABETICAL INDEX TO ASSEMBLIES

ALPHABETICAL INDEX TO ASSEMBLIES (Continued)

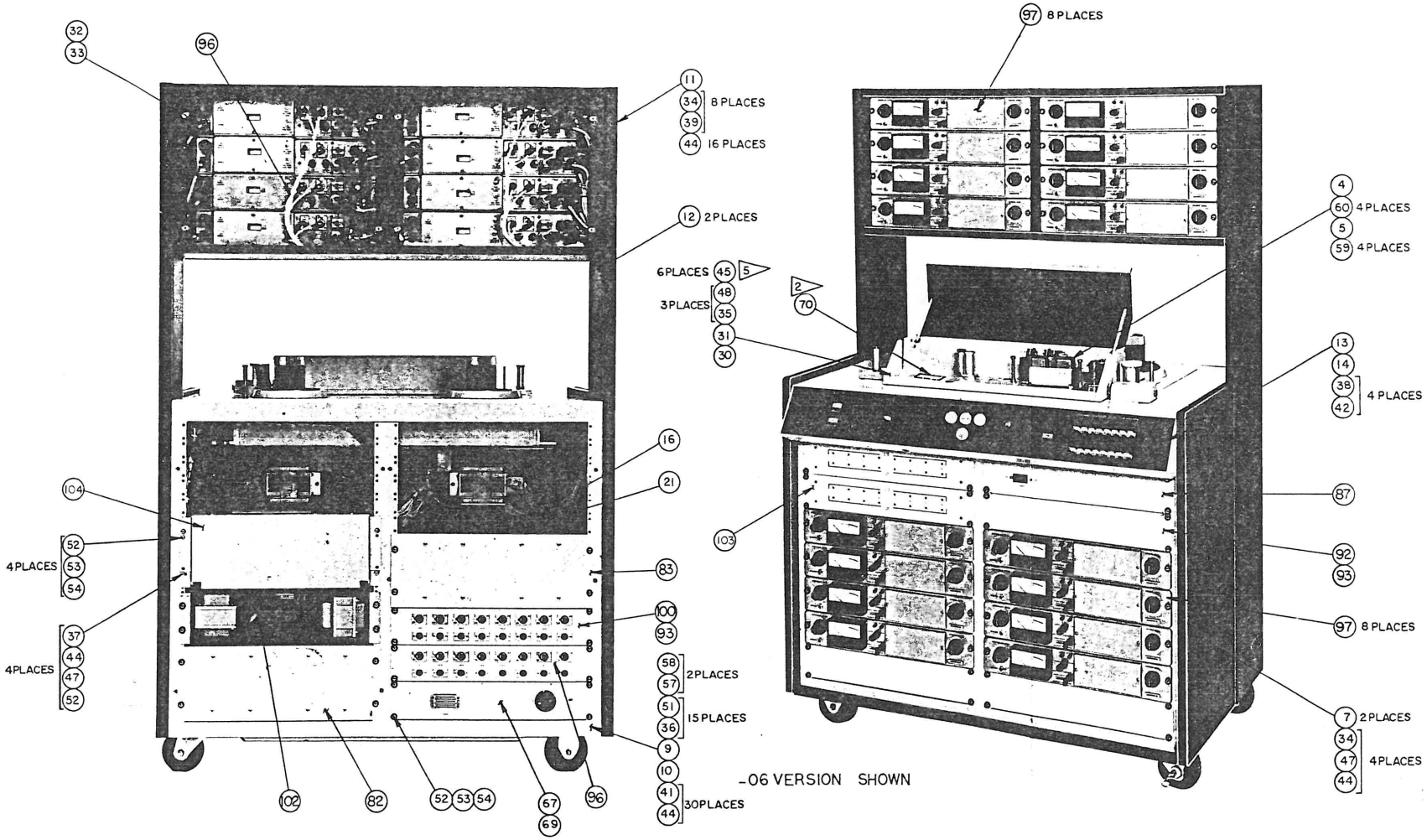
ALPHABETICAL INDEX TO ASSEMBLIES (Continued)

NUMERICAL INDEX TO ASSEMBLY DRAWINGS AND LISTS OF MATERIALS

NUMERICAL INDEX TO ASSEMBLY DRAWINGS
AND LISTS OF MATERIALS (Continued)

MASTER MAKER RECORDER/REPRODUCER, 60 HZ — CATALOG NO. 4940139 — SHEET 1 OF 1 — NHA CAT

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -07	-08
4	4940177-02			HEAD ASSEMBLY, 8 Channel		1	-
5	4940178-02			HEAD ASSEMBLY, 16 Channel		-	1
61	4952193-02			HARNESS ASSEMBLY, Signal		1	1
62	4952286-02			HARNESS, Supplemental Signal		-	1
64	4952768-01			MISCELLANEOUS PARTS KIT		1	-
65	4952768-02			MISCELLANEOUS PARTS KIT		-	1
73	4952192-05			SYSTEM CONTROL HARNESS		1	1
74	4952282-04			SUPPLEMENTARY CONTROL HARNESS		-	1
82	4020307-01			POWER SUPPLY WITH OSCILLATOR		1	1
83	4020307-02			POWER SUPPLY WITHOUT OSCILLATOR		-	1
96	4952195-02			HARNESS ASSEMBLY, Input/Output		1	1
100	4952287-02			CABLE HARNESS, Supplementary Input/Output		-	1
102	4952890-01			POWER SUPPLY, 24V		1	1
105	4850121-01			KIT, Hardware		1	1
112	4952201-06			ELECTRONICS ASSEMBLY		8	16
113	087-720	Dow Corning #200 50,000 cs		SILICONE FLUID, 4cc		1	1



Master Maker Recorder/Reproducer, 60 Hz
Drawing No. 4940139T

MASTER MAKER RECORDER/REPRODUCER, 50 HZ

CATALOG NO. 4940171

SHEET 1 OF 1

NHA CAT.

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -06	-07	-08	-09
1	4020307-01			POWER SUPPLY WITH OSCILLATOR		1	1	1	1
2	4020307-02			POWER SUPPLY WITHOUT OSCILLATOR		-	1	-	1
20	4940177-01			HEAD ASSEMBLY, 8 Channel		1	-	1	-
21	4940178-01			HEAD ASSEMBLY, 16 Channel		-	1	-	1
34	4952195-02			HARNESS ASSEMBLY, Input/Output		1	1	1	1
35	4952193-02			HARNESS ASSEMBLY, Signal		1	1	1	1
41	4952287-02			CABLE HARNESS, Supplementary, input/output		-	1	-	1
42	4952286-02			HARNESS, Supplemental Signal		-	1	-	1
47	4952768-01			MISCELLANEOUS PARTS KIT		1	-	1	-
48	4952768-02			MISCELLANEOUS PARTS KIT		-	1	-	1
50	4952890-01			POWER SUPPLY, 24V		1	1	1	1
97	4952201-06			ELECTRONICS ASSEMBLY		-	-	8	16
98	4952201-07			ELECTRONICS ASSEMBLY		8	16	-	-
99	4952192-05			SYSTEM CONTROL HARNESS		1	1	1	1
100	4952282-03			SUPPLEMENTARY CONTROL HARNESS		-	1	-	1
101	087-720	Dow Corning #200 50,000 cs		SILICONE FLUID, 4 cc		1	1	1	1

Versions: -01 16-channel, 60 Hz
-02 16-channel, 60 Hz
-03 24-channel, 60 Hz
-04 8-channel, 50 Hz
-05 16-channel, 50 Hz
-06 24-channel, 50 Hz

MASTER MAKER, PLAYBACK ONLY — CATALOG NO. 4010046 — SHEET 1 OF 1 — NHA FINAL

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION					
						-01	-02	-03	-04	-05	-06
1	4020150-04			REPRODUCE MODULE		8	16	24	8	16	24
2	4020305-01			HEAD ASSEMBLY, 8 Channel Playback		1	-	-	1	-	-
3	4020307-02			POWER SUPPLY		-	1	1	-	1	1
4	4020307-03			POWER SUPPLY		1	-	1	1	-	1
5	4020308-01			HEAD ASSEMBLY, 16 Channel		-	1	-	-	1	-
6	4020308-02			HEAD ASSEMBLY, 24 Channel		-	-	1	-	-	1
15	4050531-01			HARNESS ASSEMBLY, Head to Electronics		1	1	1	1	1	1
16	4050531-02			HARNESS ASSEMBLY, Head to Electronics		-	1	1	-	1	1
17	4050531-03			HARNESS ASSEMBLY, Head to Electronics		-	-	1	-	-	1
18	4050532-01			HARNESS ASSEMBLY, Signal Output, 8 channel		1	-	-	1	-	-
19	4050532-02			HARNESS ASSEMBLY, Signal Output, 24 channel		-	-	1	-	-	1
20	4050533-01			CABLE, Power Supply		4	8	12	4	8	12
34	4020270-01			REPRODUCE EQUALIZER		8	16	24	8	16	24
35	4050534-04			HARNESS ASSEMBLY, System Control		1	-	-	1	-	-
36	4050534-05			HARNESS ASSEMBLY, System Control		-	1	-	-	1	-
37	4050534-06			HARNESS ASSEMBLY, System Control		-	-	1	-	-	1
46	4952768-03			PARTS KIT, Miscellaneous		1	-	-	1	-	-
47	4952768-04			PARTS KIT, Miscellaneous		-	1	-	-	1	-
48	4952768-05			PARTS KIT, Miscellaneous		-	-	1	-	-	1
49	4952890-01			POWER SUPPLY, 24 Volt		1	1	1	1	1	1
50	4850121-01			KIT, Hardware		1	1	1	1	1	1
128	087-720	Dow Corning #200 50,000 cs viscosity		SILICONE FLUID, 4 cc		1	1	1	1	1	1

REPRODUCE MODULE

CATALOG NO. 4020150

SHEET 1 OF 1

NHA 4010046

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -03	-04
1	4030269-03		J3	CONNECTOR ASSEMBLY, 12 Contact		1	1
2	4050087-01			CABLE ASSEMBLY, Interconnecting		1	1
3	4050435-03			PRINTED WIRING BOARD, Reproduce Amplifier		1	-
9	4520151-01		R11	POTENTIOMETER, 50K		1	1
10	4550147-05		C9	CAPACITOR, Electrolytic, 35/35/100/100		1	1
11	4580193-01		T2	TRANSFORMER, Output		1	1
12	4620172-10		S3	SWITCH, Low End Equalization		1	1
15	034-177		C17	CAPACITOR, 100pF, 500V, 5%		1	1
16	013-599		CR3,4	DIODE, Silicone, switching		2	2
17	031-131		C16	CAPACITOR, 500mF, 50V		1	1
18	031-126		C15	CAPACITOR, 250mF, 50V		1	1
19	041-046		R33	RESISTOR, 680 Ohm, 1/2W, 10%		1	1
20	041-060		R19,20	RESISTOR, 10K Ohm, 1/2W, 10%		2	2
21	041-062		R16,17	RESISTOR, 15K ohm, 1/2W, 10%		2	2
22	143-008		J1	CONNECTOR, Receptacle, male, 3 contact		1	1
23	147-999		J4	CONNECTOR, Audio Receptacle, 3 pin XLR-3		1	1
41	030-001		C18	CAPACITOR, .02μF, 500V		1	1
42	041-040		R34	RESISTOR, Fixed, 220 ohm, 1/2W, 10%		1	1
47	4050435-06			PRINTED WIRING BOARD, Reproduce Amplifier		-	1

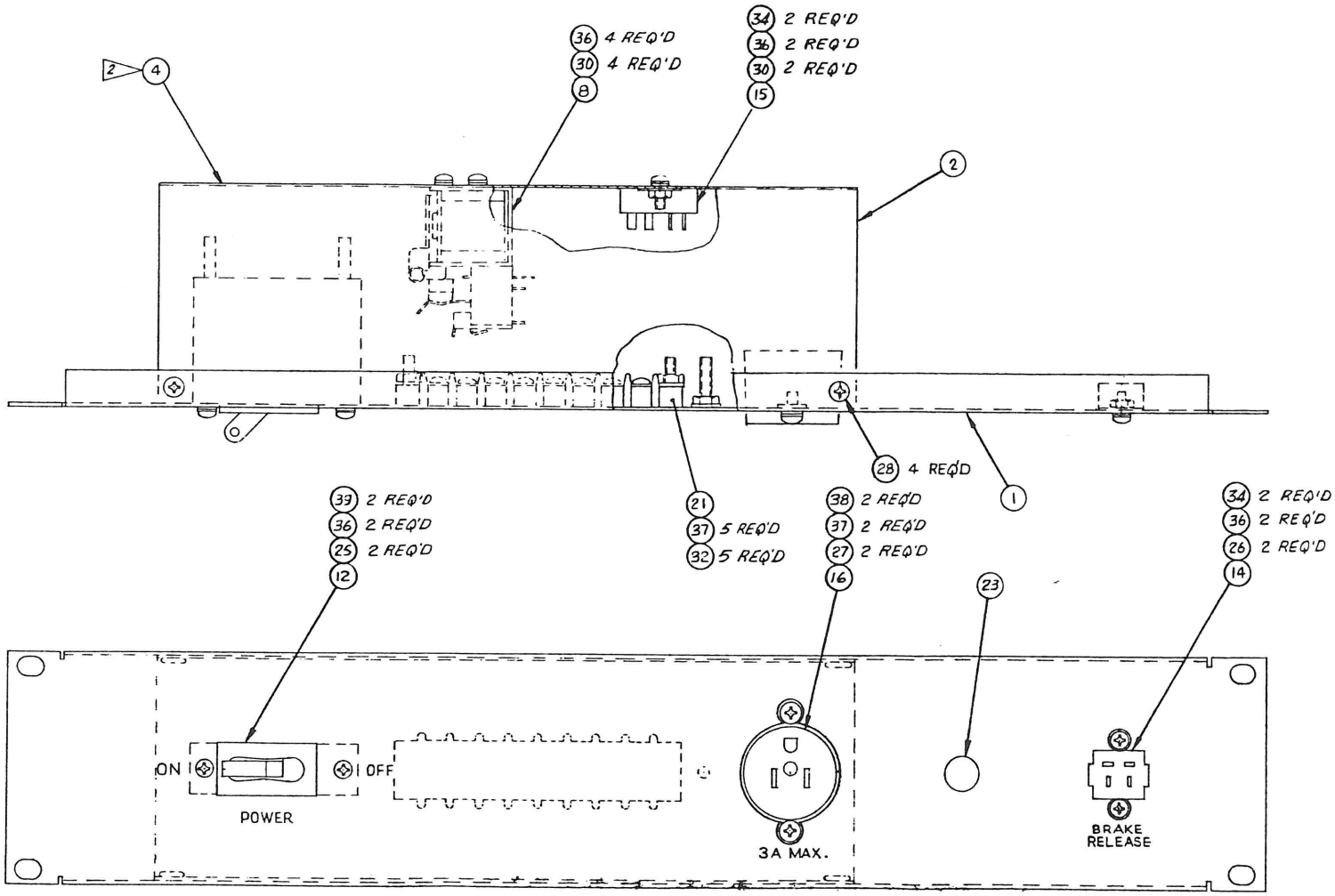
BREAKER PANEL ASSEMBLY

CATALOG NO. 4050556

SHEET 1 OF 1

NHA 4940139

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -01
6	013-678			DIODE, Silicone, large signal, rectangular		1
8	020-034		K1	RELAY, Armature, 3 pole		1
10	041-195			RESISTOR, 220 ohm, 2W		1
12	126-019		CB1	CIRCUIT BREAKER, 15 Amp		1
14	146-005		J2	CONNECTOR, Rectangular Receptacle, 4 socket		1
15	146-009		J1	CONNECTOR, Rectangular Receptacle, 12 socket		1
16	146-175		J3	CONNECTOR, Power Receptacle Outlet		1
21	180-005		TB1	TERMINAL STRIP, 8 Dual Terms		1



NOTES:

1. PART NO. IS 4050556-01.
2. MARK PART NO. & SERIAL NO. PER BD1-1.

Breaker Panel Assembly
Drawing No. 4050556—

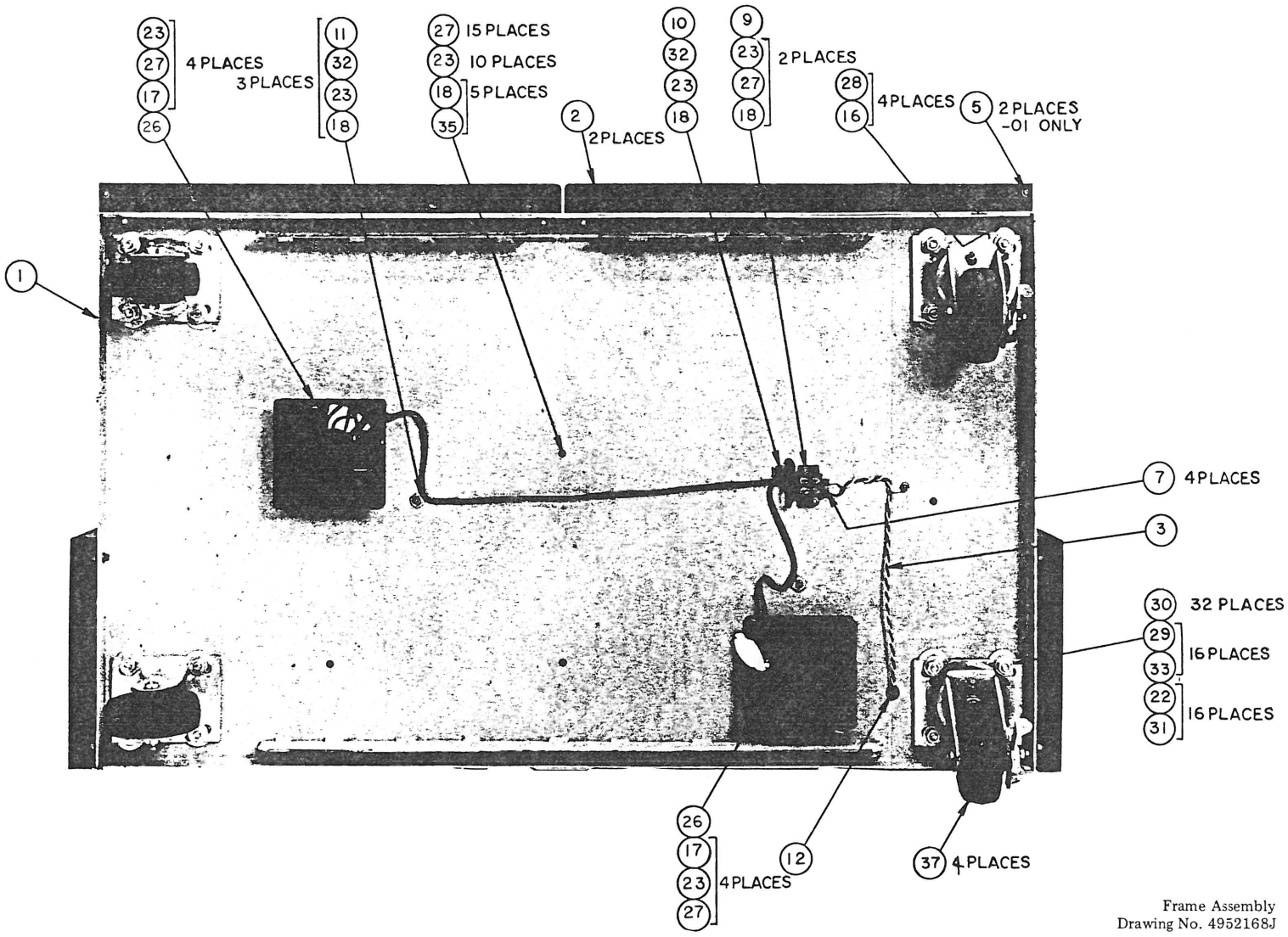
FRAME ASSEMBLY

CATALOG NO. 4952168

SHEET 1 OF 1

NHA 4940139

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -01	-02
26	591-126			FILTER FAN		2	2



Frame Assembly
Drawing No. 4952168J

POWER SUPPLY PANEL ASSEMBLY

CATALOG NO. 4020307

SHEET 1 OF 1

NHA 4010046, 4940139

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION						
						-01	-02	-03				
1	4020274-03			POWER SUPPLY		1	-	-				
2	4020274-04			POWER SUPPLY		1	2	1				

ELECTRONICS ASSEMBLY

Versions: -03 Recorder/Reproducer
-04 Reproducer

POWER SUPPLY ASSEMBLY — CATALOG NO. 4020274 — SHEET 1 OF 1 — NHA 4020307

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -03	-04
5	4050443-01			HARNESS ASSEMBLY, Power Supply		1	1
10	4550147-03		C707	CAPACITOR, Electrolytic, 2000μF, 80V		1	1
12	4580156-01		T702	TRANSFORMER, Power		1	1
13	4050432-05			PRINTED WIRING ASSEMBLY, Regulator and Oscillator		1	-
14	4050432-06			PRINTED WIRING ASSEMBLY, Regulator and Oscillator		-	1
15	031-945		C706	CAPACITOR, 500 mF, 50V		1	1
17	013-678		CR701-704	DIODE		4	4
19	014-796	2N4348	Q705	TRANSISTOR		1	1
21	031-205			CAPACITOR, 5μF, 50V		2	2
22	041-158		R706	RESISTOR, 10K Ohm, 1W, 10%		1	1
23	070-075		F701	FUSE, 1.5 Amp, 125V, slo-blo		1	1
24	085-001			FUSE HOLDER, Short Body		1	1
25	143-307			CONNECTOR, Printed Wiring Board, 18 contacts		1	1
26	145-013		P706	CONNECTOR, 8 Pin, male		1	1

REGULATOR AND OSCILLATOR PRINTED WIRING ASSEMBLY

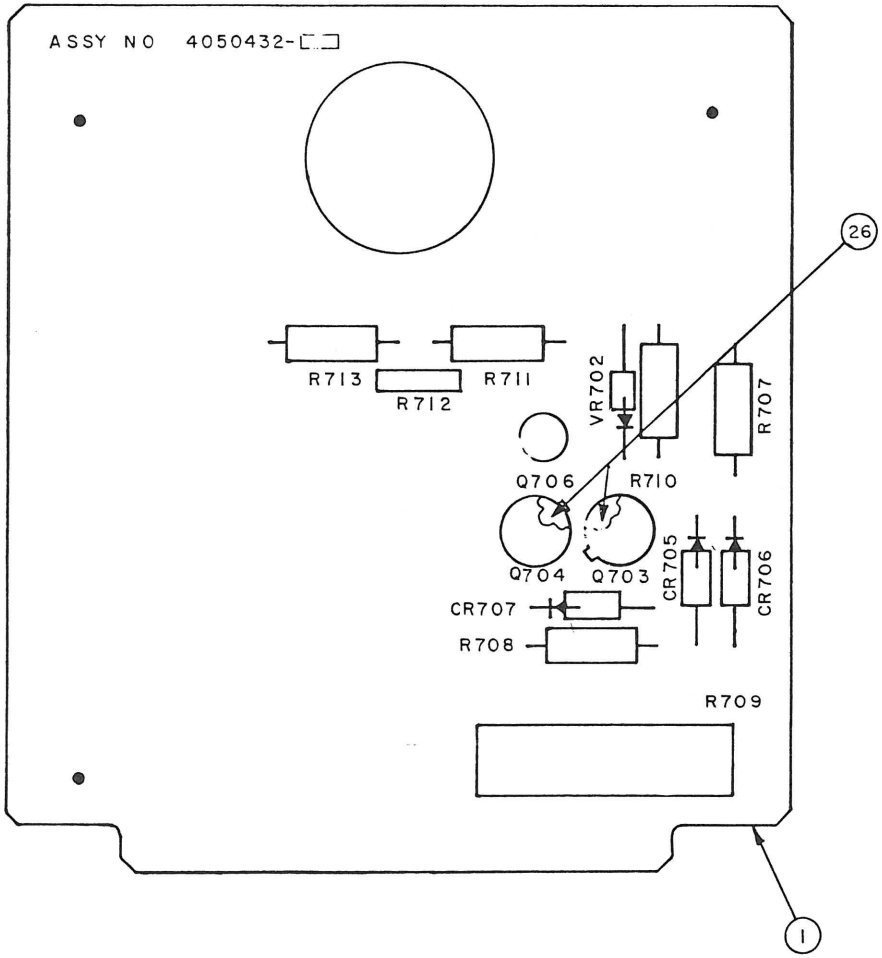
CATALOG NO. 4050432

SHEET 1 OF 1

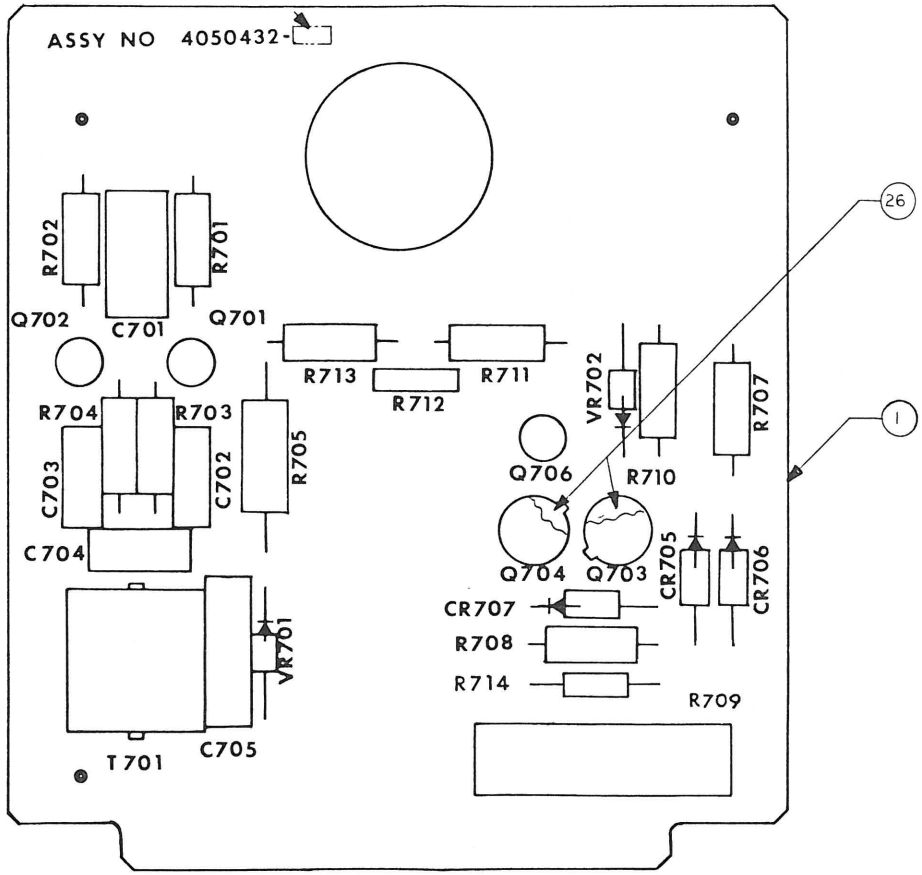
NHA 4020274

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -05	-06
2	4580123-01		T701	BIAS OSCILLATOR COIL		1	-
3	013-599		CR705-706,707	DIODE		3	3
4	013-712		VR702	ZENER, 24V, 5%		1	1
5	013-747		VR701	ZENER, 13 V, 5%		1	-
6	014-590	2N3053	Q704	TRANSISTOR		1	1
7	014-653		Q701,702,706	TRANSISTOR		3	1
9	014-704	2N398A	Q703	TRANSISTOR		1	1
11	034-994		C704	CAPACITOR, Mica, 2500pF, 500V, 5%		1	-
12	034-507		C702-703	CAPACITOR, Mica, 5600pF, 300V, 5%		2	-
13	041-048		R708	RESISTOR, Fixed, 1K ohm, 1/2W, 10%		1	1
14	041-052		R710,713	RESISTOR, Fixed, 2.2K ohm, 1/2W,10%		2	2
15	041-055		R711	RESISTOR, Fixed, 3.9K ohm, 1/2W, 10%		1	1
16	041-064		R703,704	RESISTOR, Fixed, 22K ohm, 1/2W, 10%		2	-
18	041-147		R705	RESISTOR, Fixed, 1.2K ohm, 1W, 10%		1	-
19	041-533		R701,702	RESISTOR, Fixed, 24 ohm, 1/2W, 5%		2	-
20	044-370		R712	RESISTOR, Variable, 1K ohm, 1/10W		1	1
21	055-106		C705	CAPACITOR, Mylar, 0.1μF, 100V, 10%		1	-
22	056-108		C701	CAPACITOR, Mica, 6800pF, 500V, 5%		1	-
23	059-016		R709	RESISTOR, 1 Ohm, 5W, 5%		1	1
24	041-529		R707	RESISTOR, 20K Ohm, 1/2W, 5%		1	1
27	041-038		R714	RESISTOR, Fixed, 100 ohm, 1/2W, 10%		1	1

-06



-05

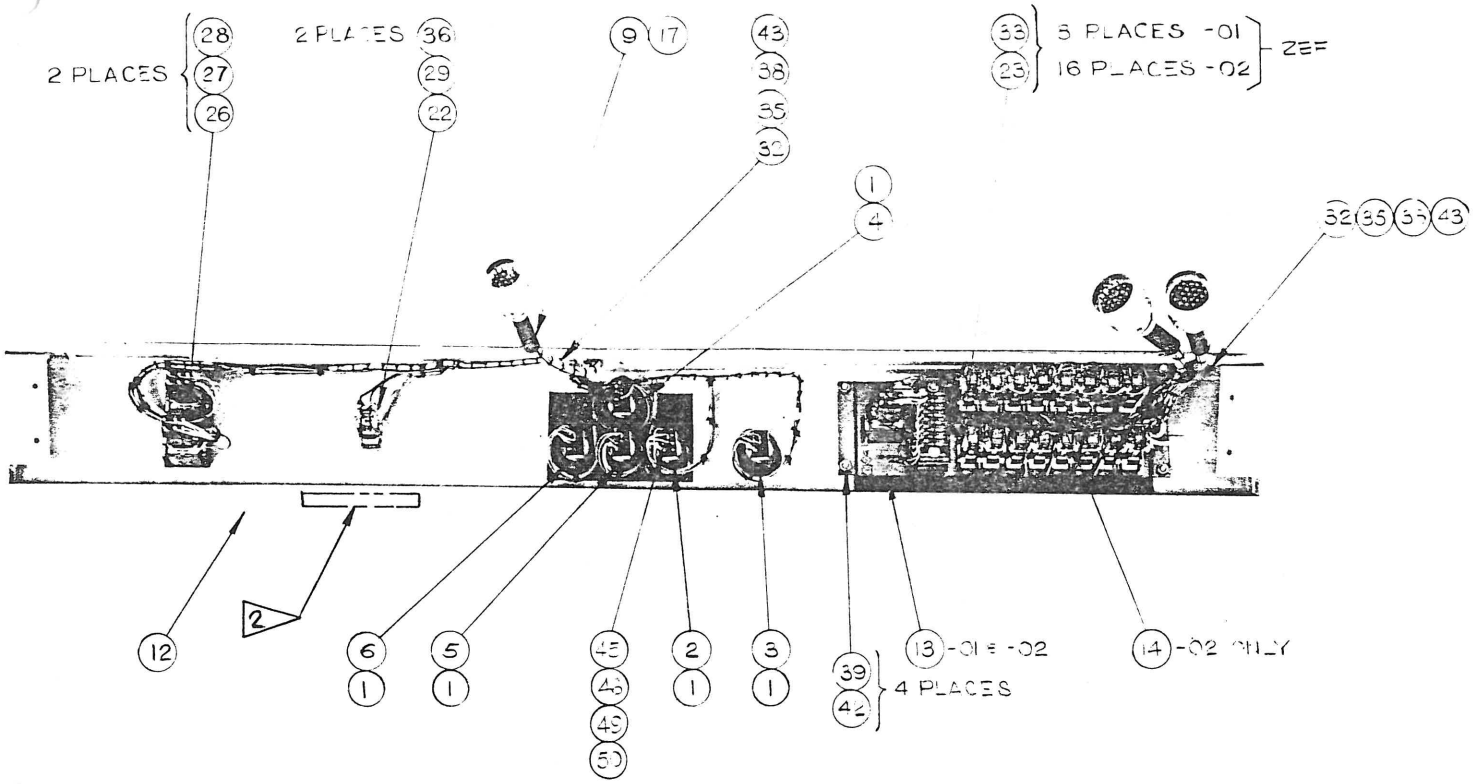


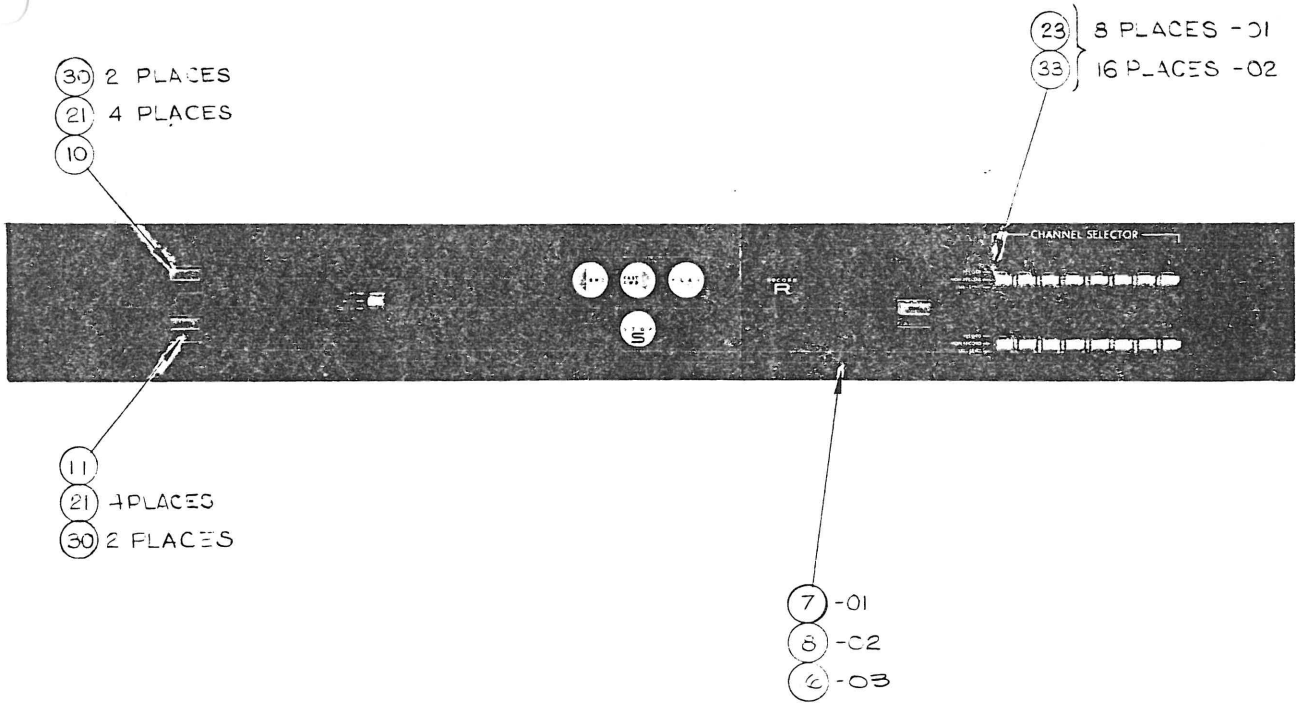
Regulator and Oscillator Printed Wiring Assembly
Drawing No. 4050432H

Versions: -04 8-Channel, -05 16-Channel,
-06 Reproduce

CONTROL PANEL ASSEMBLY — CATALOG NO. 4952183 — SHEET 1 OF 1 — NHA 4010046

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -04	-05	-06
9	4952186-01			HARNESS ASSEMBLY, Cluster		1	1	-
17	4952186-02			HARNESS ASSEMBLY, Playback Control Panel		-	-	1
21	060-019		DS23, 24, 43, 44	LAMP, Incandescent, 28V, clear		8	8	8
22	060-070		DS25	LAMP, Incandescent, 28V, screw base		1	1	1
23	060-079		DS26-33	LIGHT, Indicator, incandescent, 24V, red		8	-	-
			DS26-41	LIGHT, Indicator, incandescent, 24V, red		-	16	-
26	120-145		S23, 24	SWITCH, Unit DPDT		2	2	2
27	120-146			INDICATOR		2	2	2
29	120-852		S25	SWITCH, Lever, illuminated, DPDT, non-locking		1	1	1
30	121-035			BARRIER MOUNTING, Switch		4	4	4
52	4030309-01		S19	SWITCH, Play		1	1	1
53	4030309-03		S18	SWITCH, Record		1	1	-
54	4030309-02		S22	SWITCH, Stop		1	1	1
55	4030309-04		S20	SWITCH, Fast Forward		1	1	1
56	4030309-05		S21	SWITCH, Rewind		1	1	1





-02 SHOWN

Control Panel Assembly
Drawing No. 4952183H

MODE CONTROL UNIT

CATALOG NO. 4952406

SHEET 1 OF 1

NHA 4952183

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION						
						-02	-04	-05				
1	4952190-01			HARNESS, Mode Control, channels 1-8		1	1	2				
4	4952319-01		EB1	DIODE BOARD, Printed Wiring Assembly		-	1	2				
4	4952319-01		EB2	DIODE BOARD, Printed Wiring Assembly		1	1	2				
12	060-019		DS17, 42	LAMP, Incandescent, 28V, flange		-	4	4				
13	060-070		DS1-8	LAMP, Incandescent, 28V, screw base		-	8	16				
13	060-070		DS9-16	LAMP, Incandescent, 28V, screw base		8	8	16				
15	120-144			BARRIER MOUNTING, Switch		-	2	2				
16	120-145		S17	SWITCH, Unit, 2 - SPDT		-	1	1				
17	120-146			INDICATOR, Switch, barrier mounting		-	1	1				
18	120-255			LENS, Switch, 3 piece long split, blue, yellow		-	1	1				
19	120-829		S1-8	SWITCH, Lever, illuminated, DPDT, 3 position		-	8	16				
19	120-829		S9-16	SWITCH, Lever, illuminated, DPDT, 3 position		8	8	16				

MODE CONTROL PRINTED WIRING ASSEMBLY

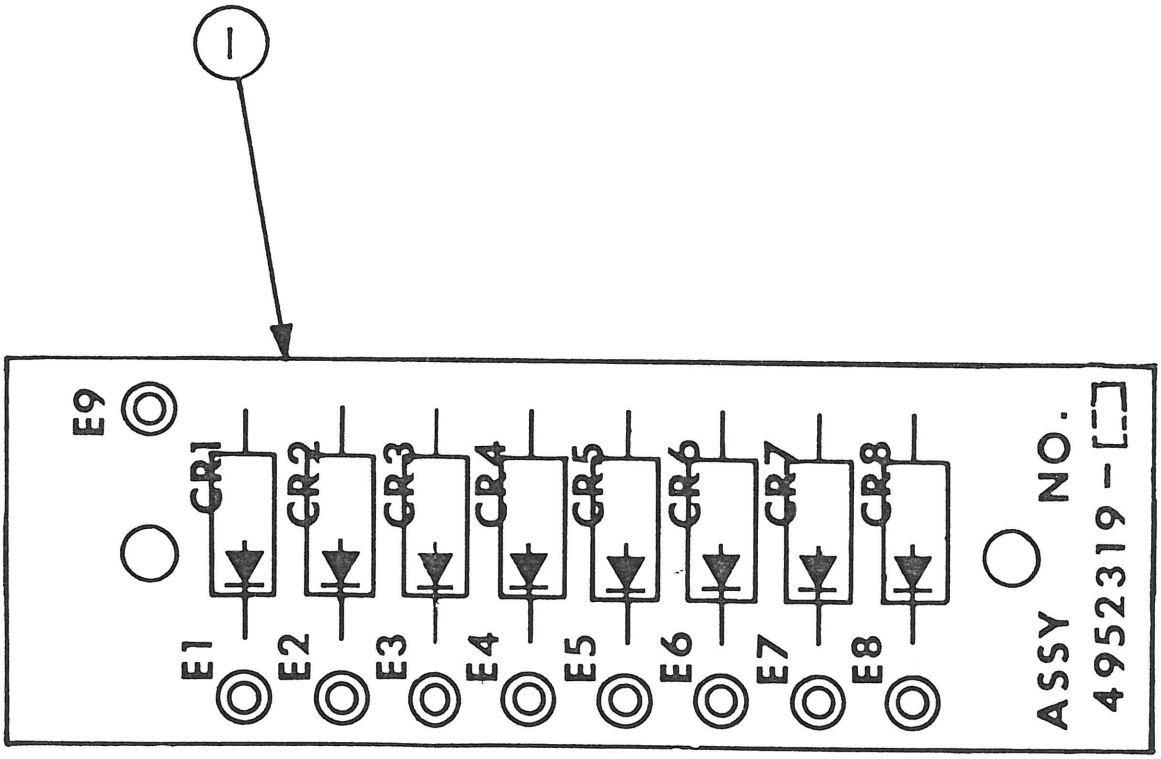
CATALOG NO. 4952319

SHEET 1 OF 1

NHA 4952406

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -01						
7	013-678		CR1-8	DIODE, Silicone		8						

4952319A



Mode Control Printed Wiring Assembly
Drawing No. 4952319A

ELECTRONICS ASSEMBLY

CATALOG NO. 4020260

SHEET 1 OF 1

NHA 4952201

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -05	-07	-08
1	4030034-30			DUMMY PLUG ASSEMBLY		1	1	1
2	4030269-01		J10	CONNECTOR ASSEMBLY, 12 Contact		1	1	1
3	4030269-02			CONNECTOR ASSEMBLY, 12 Contact		1	1	1
4	4030269-03			CONNECTOR ASSEMBLY, 12 Contact		1	1	1
13	4050435-03			PRINTED WIRING ASSEMBLY, Reproduce Amplifier		1	-	-
14	4050437-03			HARNESS ASSEMBLY		1	1	-
27	4050434-01			PRINTED WIRING ASSEMBLY, Record		1	1	1
28	031-126		C15	CAPACITOR, Electrolytic, 250MF, 50V		1	1	1
29	041-455		R37	RESISTOR, 6.2K ohm, 1/2W, 5%		1	1	1
52	4050435-06			PRINTED WIRING ASSEMBLY, Reproduce Amplifier		-	-	1
54	4050433-04			PRINTED WIRING BOARD, Bias Amplifier		-	-	1
55	4050433-05			PRINTED WIRING ASSEMBLY, Bias Amplifier		1	1	-
57	4050435-05			PRINTED WIRING ASSEMBLY, Reproduce Amplifier		-	1	-
60	4050437-04			HARNESS ASSEMBLY		-	-	1

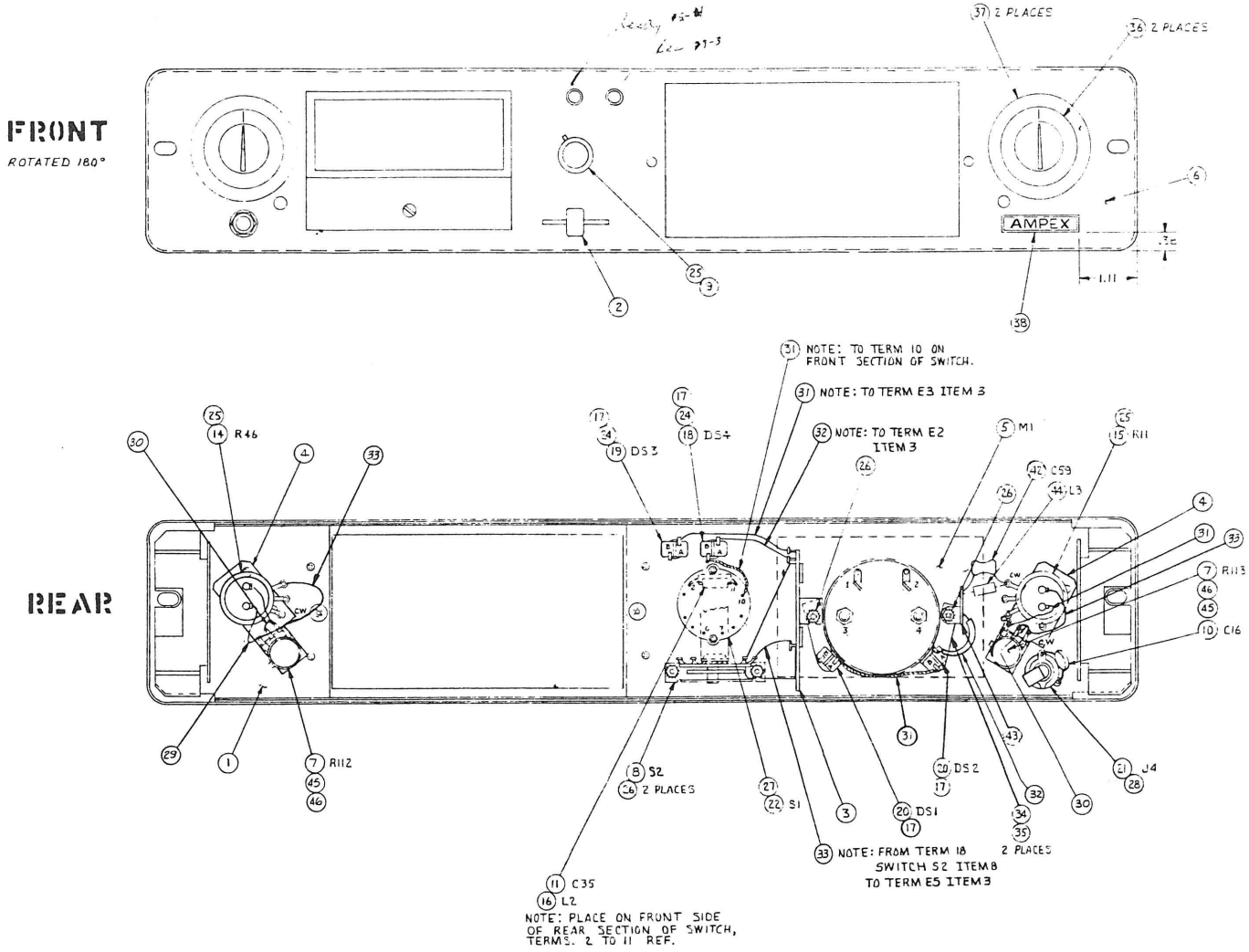
FRONT PANEL ASSEMBLY

CATALOG NO. 4050554

SHEET 1 OF 1

NHA 4020260

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -01
2	4100102-02			KNOB, Key Tab		1
3	4050555-01			PRINTED WIRING BOARD ASSEMBLY, Monitor Relay		1
5	4140020-02		M1	METER, VU		1
7	4520146-30		R112,113	RESISTOR, Variable, 25K ohm, CTS type 200		2
8	4620198-01		S2	SWITCH, Lever		1
10	030-001		C16	CAPACITOR, Ceramic, .02μF, 500V		1
11	034-358		C35	CAPACITOR, Mica, 220pF, 300V, 5%		1
12	041-455		R37	RESISTOR, 6200 ohm, 1/2W, 5%		1
14	044-992		R46	RESISTOR, Variable, carbon, 100K ohm, 2W, 10%		1
15	058-594		R11	RESISTOR, Variable, carbon, 10K ohm, 2W, 20%		1
16	051-342		L2	CHOKE, 5mH, 5%		1
22	4620049-02		S1	SWITCH, Selector		1
37	4040350-02			RESET INDICATOR ASSEMBLY		2
42	034-938			CAPACITOR, Mica, 110pF, 500V, 5%		1
44	540-055		L3	INDUCTOR, 10mH, 10%		1
			DS-1 DS-2	Lamp, Clear, Meter	060-5[illegible]43	
			DS-3	Lamp, Rec, (Red)	132-100	
			DS-4	Lamp, Ready (Amber)	132-099	



Front Panel Assembly
Drawing No. 4050554—

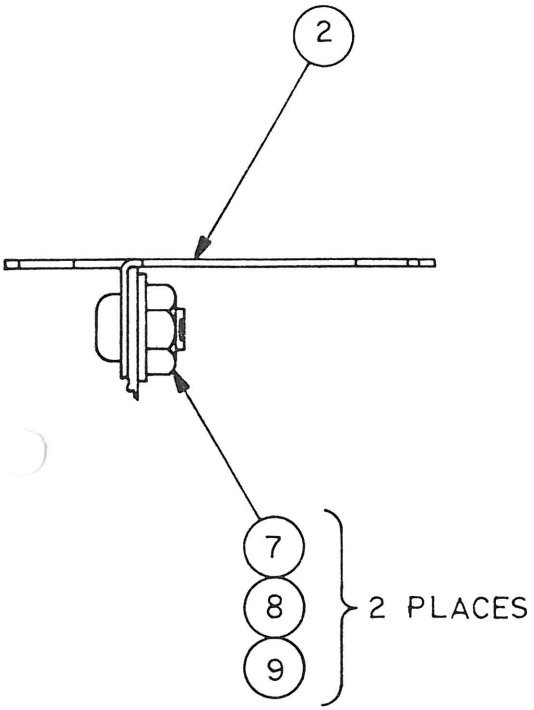
MONITOR RELAY PRINTED WIRING ASSEMBLY

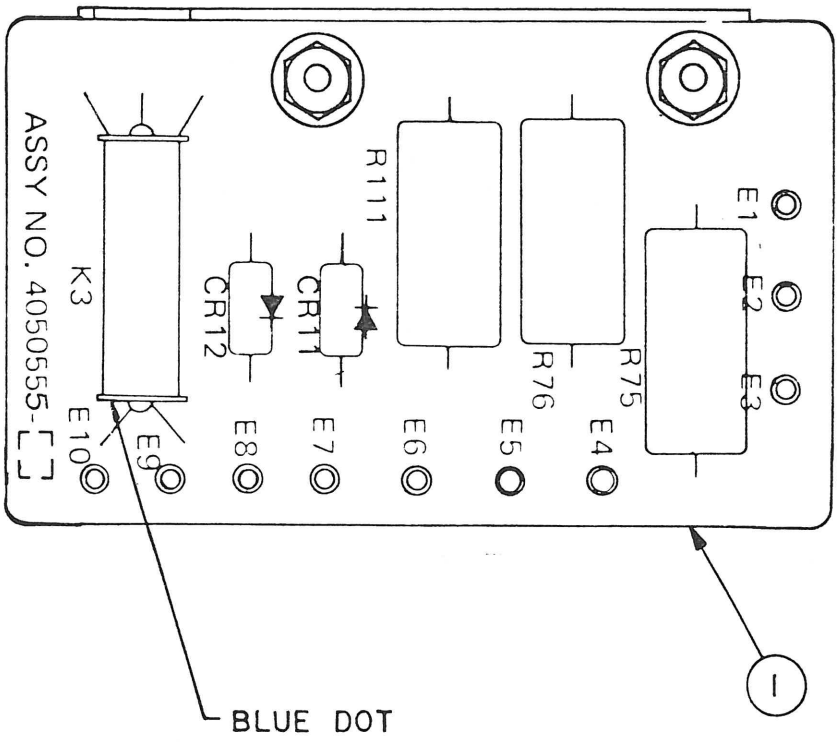
CATALOG NO. 4050555

SHEET 1 OF 1

NHA 4050554

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -01						
4	013-678		CR11,12	DIODE		2						
5	020-642		K3	RELAY, Reed		1						
6	041-200		R75,76,111	RESISTOR, 560 Ohm, 2W, 10%		3						





Monitor Relay Printed Wiring Assembly
Drawing No. 4050555—

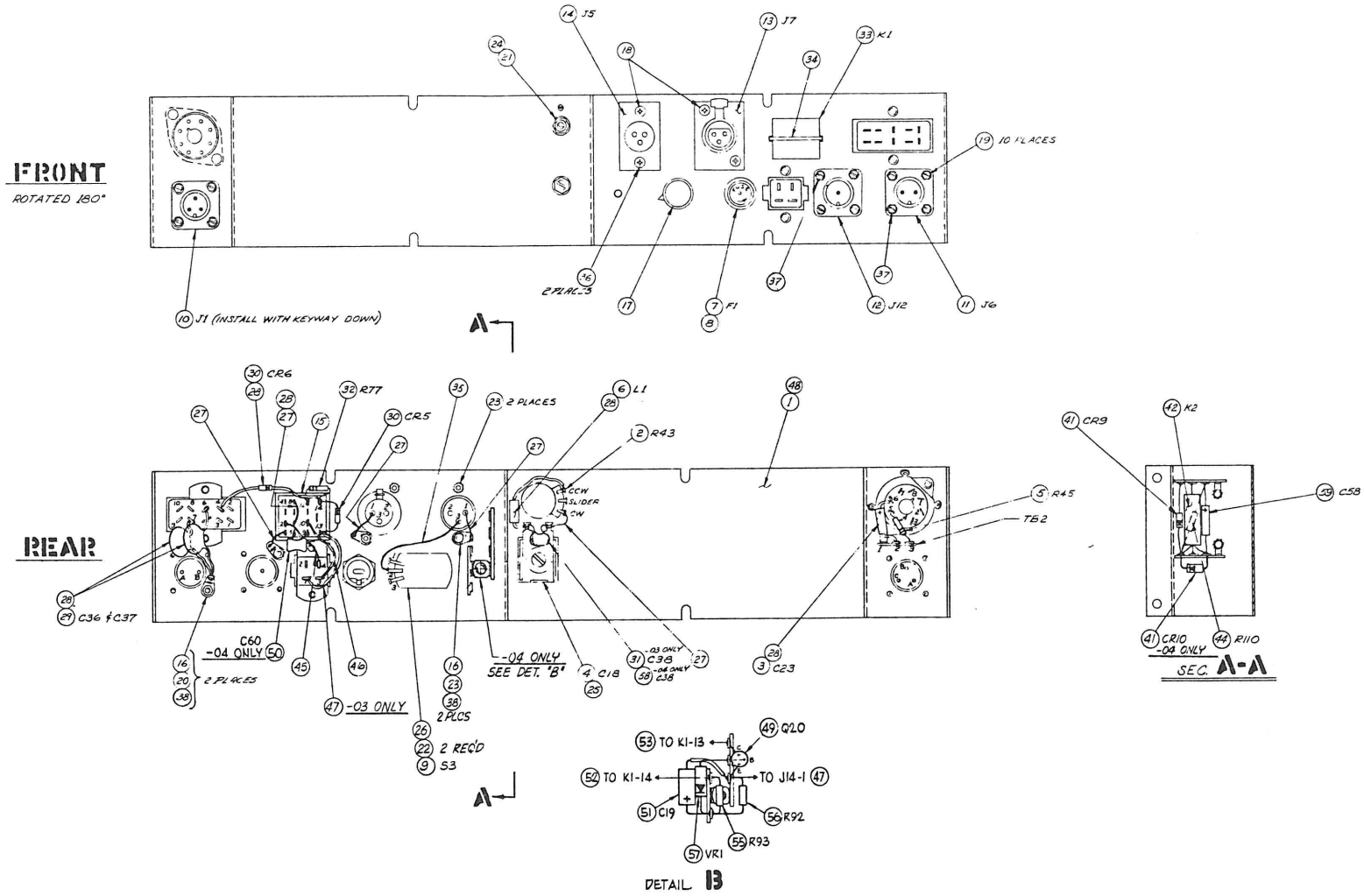
ELECTRONICS ASSEMBLY, REAR PANEL

CATALOG NO. 4050439

SHEET 1 OF 1

NHA 4020260

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -03	-05
2	4520154-02		R43	POTENTIOMETER, 5K Ohm		1	1
3	031-309		C23	CAPACITOR, Electrolytic, 4mF, 25V		1	1
4	038-011		C18	CAPACITOR, Variable, 1400-3055pF		1	1
5	041-065		R45	RESISTOR, Fixed, 27K ohm, 1/2W, 10%		1	1
6	540-030		L1	CHOKE, 330mH, 5%		1	1
7	070-026		F1	FUSE, Slo-Blo, 0.5 amp, 125V		1	1
8	085-001			FUSE HOLDER		1	1
9	122-016		S3	SWITCH ROTARY, 1 Pole, 2 throw		1	1
10	143-008		J1	CONNECTOR, Receptacle, 3 contact, male		1	1
11	143-009		J6	CONNECTOR, Receptacle, 2 contact, male		1	1
12	143-010		J12	CONNECTOR, Receptacle, 1 contact, male		1	1
13	146-998		J7	CONNECTOR, Audio Receptacle, 3 socket		1	1
14	147-999		J5	CONNECTOR, Audio Receptacle, 3 pin		1	1
15	150-119			SOCKET, Relay		1	1
17	230-008			KNOB, Black With Pointer		1	1
29	030-001		C36,37	CAPACITOR, Ceramic, 0.02μF, 500V		2	2
32	041-257		R77	RESISTOR, Composition, 180 ohm, 10%		1	1
33	020-144		K1	RELAY, 24V, 650 ohm, 4P2T		1	1
41	013-678		CR5,6,9,10	DIODE		3	4
42	020-592		K2	RELAY, Reed, SPST		1	1
44	041-034		R110	RESISTOR, 47 Ohm, 1/2W, 10%		1	1
49	014-247		Q20	TRANSISTOR		-	1
50	034-056		C60	CAPACITOR, Mica, 390pF, 500V, 5%		-	1
51	063-045		C19	CAPACITOR, Aluminum, 10μF, 50V		-	1
55	041-477		R93	RESISTOR, Composition, 13K ohm, 1/2W, 5%		-	1
56	041-546		R92	RESISTOR, Composition, 130K ohm, 1/2W, 5%		-	1
57	013-450		VR1	DIODE, Zener, 10V		-	1
58	034-386		C38	CAPACITOR, Mica, 910pF, 100V, 5%		-	1
59	037-117		C58	CAPACITOR, Tantalum, 150μF, 30V, 20%		1	1



Electronics Assembly, Rear Panel
Drawing No. 4050439R

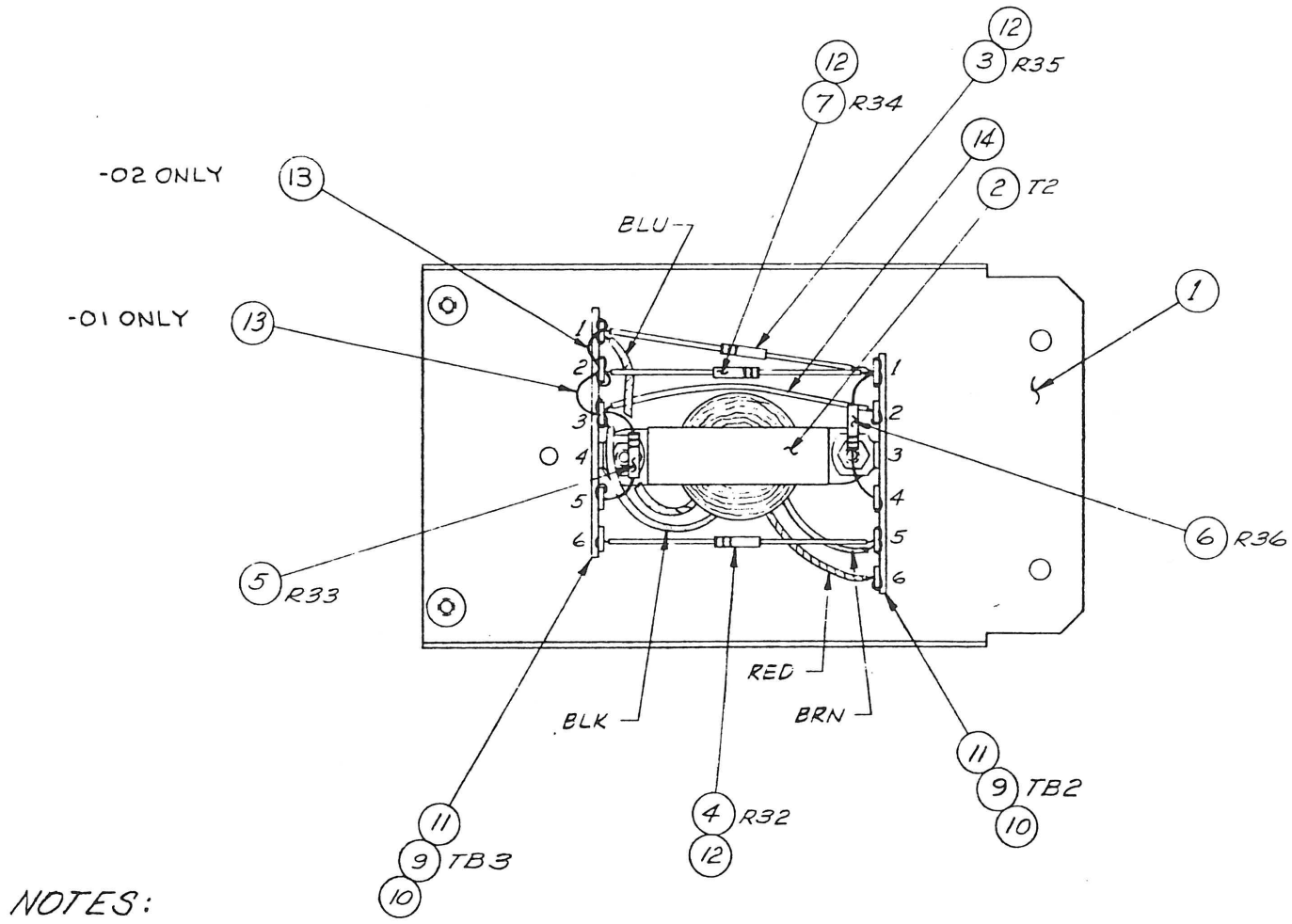
PANEL ASSEMBLY, RIGHT SIDE

CATALOG NO. 4050441

SHEET 1 OF 1

NHA 4020260

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -01	-02
2	4580193-01		T2	TRANSFORMER, Output		1	1
3	041-012		R35	RESISTOR, Composition, 4.3K ohm, 1/2W, 5%		1	1
4	041-040		R32	RESISTOR, Fixed, 220 ohm, 1/2W, 10%		1	1
5	041-046		R33	RESISTOR, Fixed, 680 ohm, 1/2W, 10%		1	1
6	041-316		R36	RESISTOR, Fixed, 2.4K ohm, 1/2W, 5%		1	1
7	041-373		R34	RESISTOR, Composition, 9.1K ohm, 1/2W, 5%		1	1
9	180-994		TB2, 3	TIE POINT, A1, A1, G, A1, A1, A1		2	2



NOTES:

1- ASSY NO. TO BE 4050441-XX

Panel Assembly, Right Side
Drawing No. 4050441B

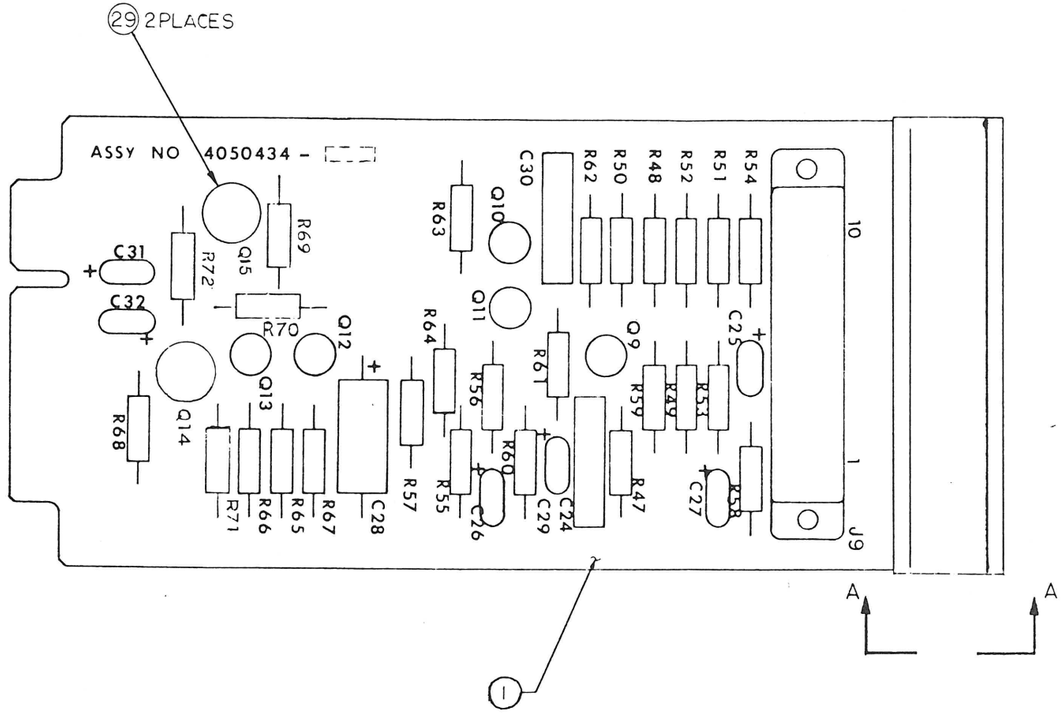
RECORD AMPLIFIER PRINTED WIRING ASSEMBLY

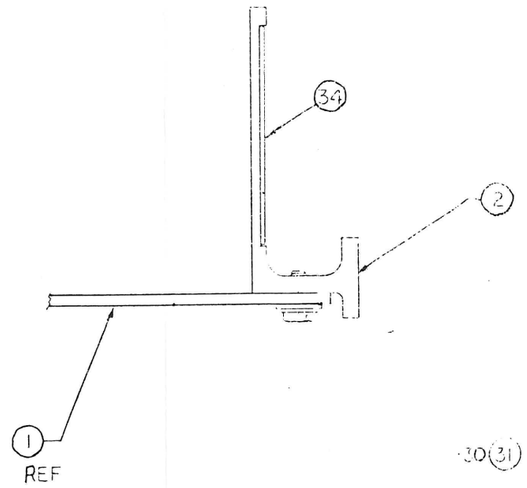
CATALOG NO. 4050434

SHEET 1 OF 1

NHA 4020260

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -01
3	041-247		Q14,15	TRANSISTOR, Silicone		2
4	014-698		Q9-13	TRANSISTOR, Silicone		5
5	031-148		C28	CAPACITOR, Electrolytic, 10μF, 25V		1
6	037-446		C32	CAPACITOR, Tantalum, 15μF, 15V, 20%		1
7	037-494		C26,29,31	CAPACITOR, Tantalum, 47μF, 6V, 20%		3
8	037-495		C25,27	CAPACITOR, Tantalum, 0.68μF, 25V,5%		2
9	055-106		C24,30	CAPACITOR, Mylar, 0.1μF, 100V, 10%		2
10	041-012		R56,61	RESISTOR, Fixed, 4.3K ohm, 1/2W, 5%		2
11	041-024		R51,52	RESISTOR, Fixed, 110K ohm, 1/2W, 5%		2
12	041-038		R50,72	RESISTOR, Fixed, 100 ohm, 1/2W, 10%		2
13	041-054		R66	RESISTOR, Fixed, 3.3K ohm, 1/2W, 10%		1
14	041-060		R55,60	RESISTOR, Fixed, 10K ohm, 1/2W, 10%		2
15	041-064		R49,63	RESISTOR, Fixed, 22K ohm, 1/2W, 10%		2
16	041-067		R53,58	RESISTOR, Fixed, 39K ohm, 1/2W, 10%		2
17	041-068		R69	RESISTOR, Fixed, 47K ohm, 1/2W, 10%		1
18	041-069		R65	RESISTOR, Fixed, 56K ohm, 1/2W, 10%		1
19	041-070		R62	RESISTOR, Fixed, 68K ohm, 1/2W, 10%		1
20	041-072		R57,64	RESISTOR, Fixed, 100K ohm, 1/2W, 10%		2
21	041-078		R68	RESISTOR, Fixed, 330K ohm, 1/2W, 10%		1
22	041-080		R67	RESISTOR, Fixed, 470K ohm, 1/2W, 10%		1
23	041-082		R70	RESISTOR, Fixed, 680K ohm, 1/2W, 10%		1
24	041-241		R71	RESISTOR, Fixed, 150 ohm, 1/2W, 10%		1
25	041-361		R54,59	RESISTOR, Fixed, 7.5K ohm, 1/2W, 5%		2
26	041-377		R47	RESISTOR, Fixed, 1.3 megohm, 1/2W,5%		1
27	041-898		R48	RESISTOR, Fixed, 1.1 megohm, 1/2W,5%		1
32	4030270-01		J9	CONNECTOR, Assembly, 10 pin		1





VIEW A-A

Record Amplifier Printed Wiring Assembly
Drawing No. 4050434E

9-57/58

REPRODUCE AMPLIFIER PRINTED WIRING ASSEMBLY — CATALOG NO. 4050435 — SHEET 1 OF 2 — NHA 4020150

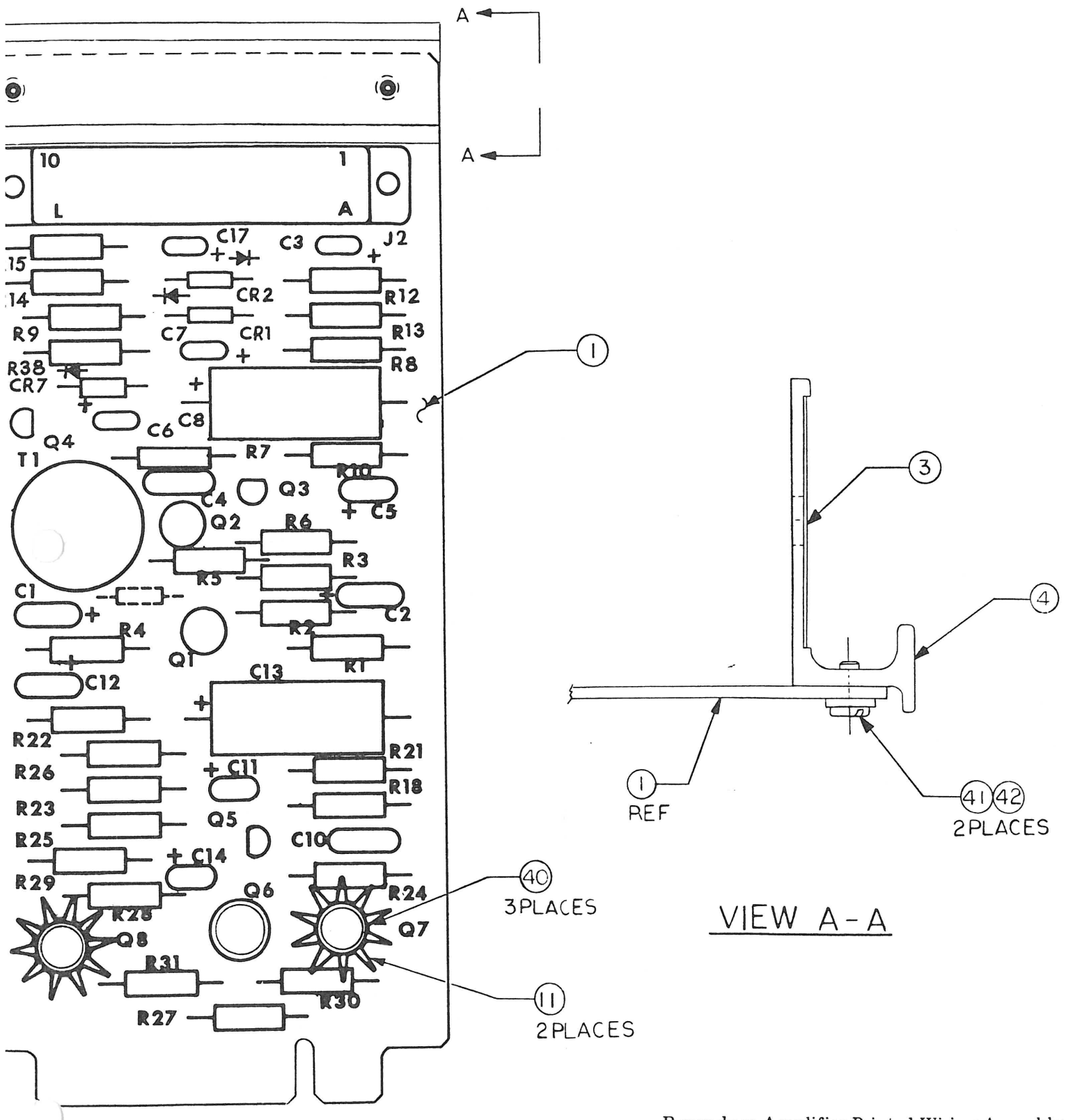
ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -03	-05	-06
2	4030270-02		J2	CONNECTOR ASSEMBLY, 10 Contact		1	1	1
5	4580199-01		T1	TRANSFORMER INPUT		1	1	1
6	013-599		CR1,2,7	DIODE 3		3	3	3
7	014-247		Q6	TRANSISTOR, NPN		1	1	1
8	014-652		Q5	TRANSISTOR		1	1	1
9	014-784		Q3,4	TRANSISTOR		2	2	2
10	014-698		Q1,2	TRANSISTOR, NPN		2	2	-
12	014-723	2N4037	Q7	TRANSISTOR		1	1	1
13	014-329	2N2102	Q8	TRANSISTOR		1	1	1
14	031-187		C8	CAPACITOR, Electrolytic, 50mF, 50V		1	1	1
15	031-190		C13	CAPACITOR, Electrolytic, 50mF, 25V		1	1	1
16	034-181		C4,10	CAPACITOR, Mica, 47pF, 500V, 5%		2	2	2
17	037-654		C2,3,7,11, 12,17	CAPACITOR, Tantalum, 3.3mF, 35V, 20%		6	6	6
18	037-446		C6,14	CAPACITOR, Tantalum, 15mF, 15V, 20%		2	2	2
19	037-494		C1,5	CAPACITOR, Tantalum, 47mF, 6V, 20%		2	2	2
20	041-012		R4	RESISTOR, Composition, 4.3K ohm, 1/2W, 5%		1	1	1
21	041-533		R30,31	RESISTOR, Fixed, 24 ohm, 1/2W, 5%		2	2	2
22	041-273		R27	RESISTOR, Fixed, 270 ohm, 1/2W, 5%		1	1	1
23	041-046		R6,28	RESISTOR, Fixed, 680 ohm, 1/2W, 10%		2	2	2
24	041-048		R1	RESISTOR, Fixed, 1K ohm, 1/2W, 10%		1	1	1
25	041-010		R29	RESISTOR, Fixed, 2.0K ohm, 1/2W, 5%		1	1	1
26	041-054		R10	RESISTOR, Fixed, 3.3K ohm, 1/2W, 10%		1	1	1
27	041-056		R24	RESISTOR, Fixed, 4.7K ohm, 1/2W, 10%		1	1	1
28	041-058		R8	RESISTOR, Fixed, 6.8K ohm, 1/2W, 10%		1	1	1
29	041-061		R14,15	RESISTOR, Fixed, 12K ohm, 1/2W, 10%		2	2	2
30	041-062		R5,25	RESISTOR, Fixed, 15K ohm, 1/2W, 10%		2	2	2
31	041-067		R2,21	RESISTOR, Fixed, 39K ohm, 1/2W, 10%		2	2	2
32	041-069		R22	RESISTOR, Fixed, 56K ohm, 1/2W, 10%		1	1	1
33	041-072		R7,23,38	RESISTOR, Fixed, 100K ohm, 1/2W, 10%		3	3	3
34	041-076		R12,13	RESISTOR, Fixed, 220K ohm, 1/2W, 10%		2	2	2
35	041-075		R3	RESISTOR, Fixed, 180K ohm, 1/2W, 10%		1	1	1
36	041-080		R9	RESISTOR, Fixed, 470K ohm, 1/2W, 10%		1	1	1
37	041-081		R18	RESISTOR, Fixed, 560K ohm, 1/2W, 10%		1	1	1
38	041-404		R26	RESISTOR, Composition, 510 ohm, 1/2W, 5%		1	1	1

REPRODUCE AMPLIFIER PRINTED WIRING ASSEMBLY

CATALOG NO. 4050435

NHA 4020150

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION						
						-03	-05	-06				
39	580-135	2N4104	Q1	TRANSISTOR		-	-	1				
40	280-131			TRANSISTOR, Pad, 0.200 diameter		3	3	3				
43	034-180		C19	CAPACITOR, Mica, 500V, 39pF, 5%		-	1	1				

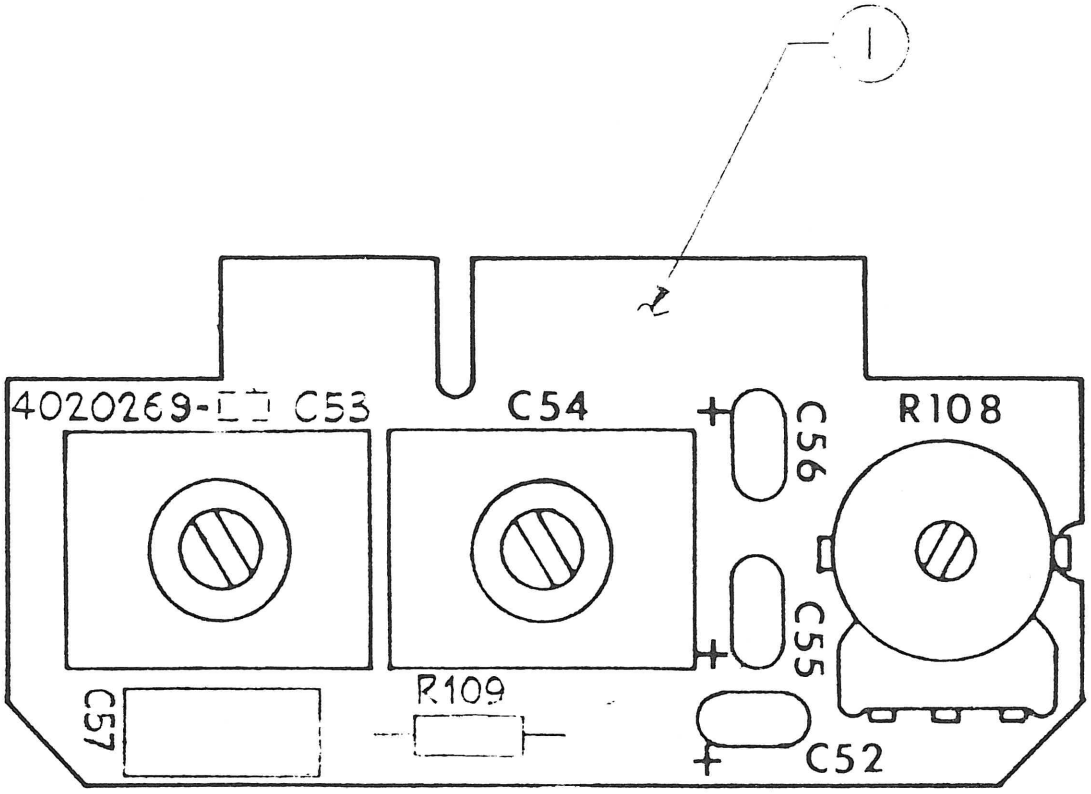


Reproduce Amplifier Printed Wiring Assembly
Drawing No. 4050435K

Versions: -01 7-1/2 to 15 ips NAB; -02 3-3/4 to 7-1/2 ips NAB;
-03 7-1/2 to 15 ips CCIR; -04 3-3/4 to 7-1/2 ips CCIR

RECORD EQUALIZER PRINTED WIRING ASSEMBLY — CATALOG NO. 4020269 — SHEET 1 OF 1 — NHA 4050434

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -01	-02	-03	-04
2	4520153-01		R108	RESISTOR, Variable, 100K ohm		1	1	1	1
3	4540314-02		C54	CAPACITOR TRIMMER, 50-380pF		1	-	1	-
4	4540314-03		C53	CAPACITOR TRIMMER, 170-780pF		1	-	1	-
5	4540314-03		C54	CAPACITOR TRIMMER, 170-780pF		-	1	-	1
6	4540314-04		C53	CAPACITOR TRIMMER, 300-1180pF		-	1	-	1
7	037-654		C52	CAPACITOR, Tantalum, 3.3μF, 35V, 20%		1	1	1	1
8	037-654		C55, 56	CAPACITOR, Tantalum, 3.3μF, 35V, 20%		-	-	2	-
10	055-164		C57	CAPACITOR, Mylar, 0.0022μF, 50V, 10%		1	-	-	-
11	041-436		R109	RESISTOR, Fixed, 18K ohm, 1/4W, 5%		1	-	-	-
12	037-654		C56	CAPACITOR, Tantalum, 3.3μF, 35V, 20%		-	-	-	1



Record Equalizer Printed Wiring Assembly
Drawing No. 4020269C

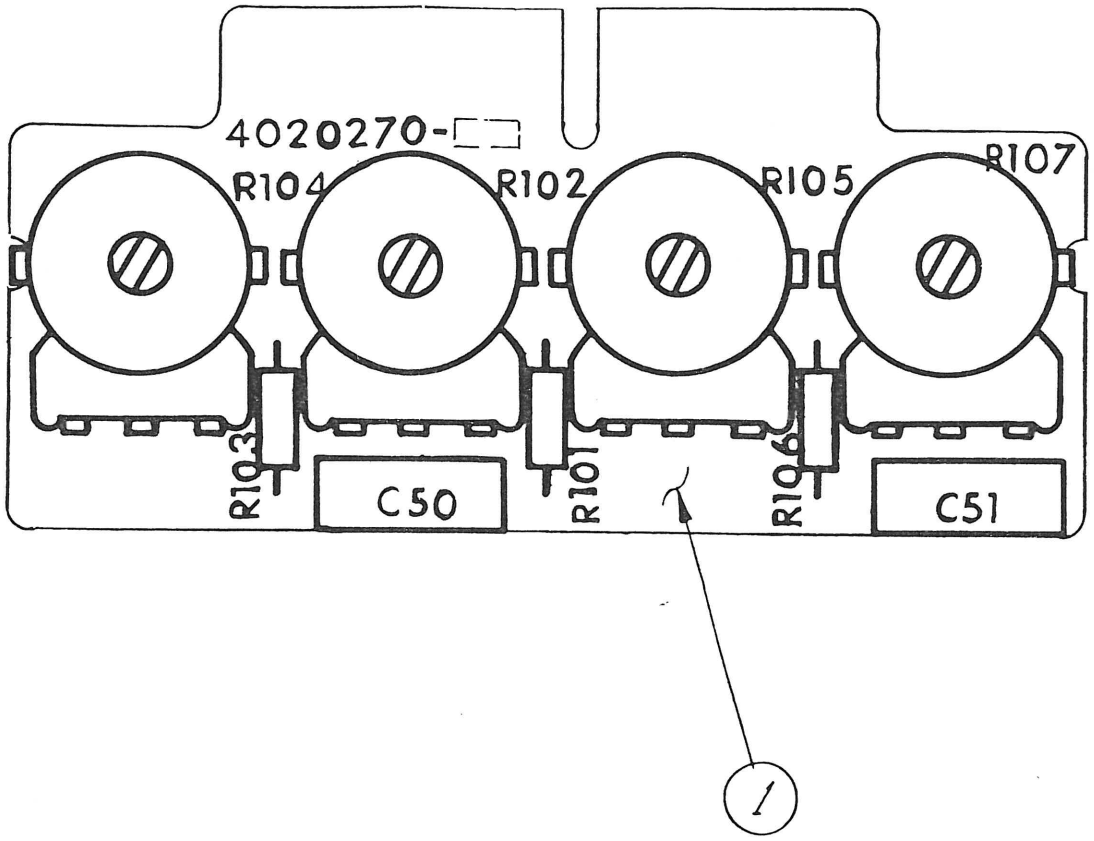
REPRODUCE EQUALIZER PRINTED WIRING ASSEMBLY

CATALOG NO. 4020270

SHEET 1 OF 1

NHA 4050435

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -01						
2	4520152-01		R104,105	POTENTIOMETER, 50K Ohm		2						
3	4520152-02		R102,107	POTENTIOMETER, 2.5 Megohm		2						
4	049-528		R103,106	RESISTOR, 220K ohm, 1/8W, 10%		2						
5	049-527		R101	RESISTOR, 2.2K ohm, 1/8W, 10%		1						
6	055-222		C50,51	CAPACITOR, 0.0047mF, mylar		2						



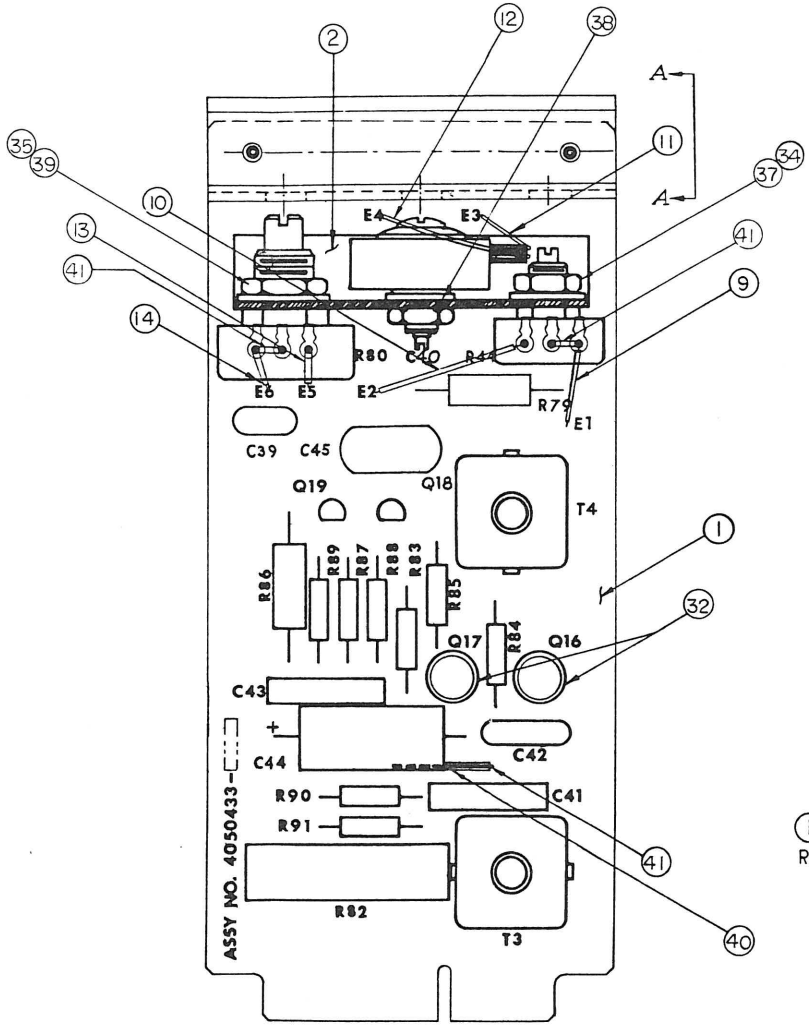
Reproduce Equalizer Printed Wiring Assembly
Drawing No. 4020270B

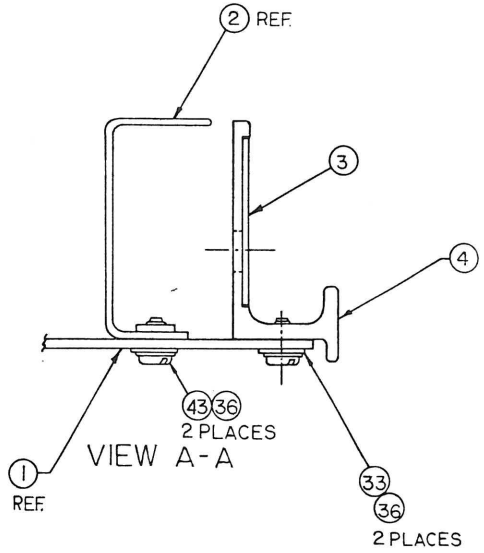
BIAS AMPLIFIER

CATALOG NO. 4050433

NHA 4020260

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -04	-05					
5	4520154-01		R44	POT, Bias Calibrate, 750 ohm		1	1					
6	4520145-20		R80	POT, Bias Adjust, 25K ohm		1	1					
7	4580123-01		T3,4	COIL, Oscillator		2	2					
15	034-291		C39	CAPACITOR, Mica, 0.0016μF,500V, 5%		1	-					
18	014-329	2N2102	Q16,17	TRANSISTOR		2	2					
19	014-653		Q18,19	TRANSISTOR, NPN		2	2					
20	031-190		C44	CAPACITOR, Electrolytic, 50mF, 25V		1	1					
21	034-994		C42	CAPACITOR, Mica, 2500pF, 500V, 5%		1	1					
22	034-960		C45	CAPACITOR, Mica, 5000pF, 300V, 5%		1	1					
24	041-031		R90,91	RESISTOR, Fixed, 1 megohm, 1/2W, 10%		2	2					
25	041-033		R87	RESISTOR, Composition, 22 ohm, 1/2W, 10%		1	1					
26	041-345		R83	RESISTOR, Composition, 51 ohm, 1/2W, 5%		1	1					
27	041-353		R86	RESISTOR, Fixed, 1.6K ohm, 1W, 5%		1	1					
28	041-475		R84,85	RESISTOR, Composition, 3K ohm, 1/2W, 5%		2	2					
29	041-529		R88,89	RESISTOR, Fixed, 20K ohm, 1/2W, 5%		2	2					
30	055-106		C41,43	CAPACITOR, Mylar, 0.1mF, 100V, 10%		2	2					
31	059-017		R82	RESISTOR, Wirewound, 180 ohm, 5W, 5%		1	1					
42	034-928		C39	CAPACITOR, Mica, 620pF, 500V, 5%		-	1					
44	038-011		C40	CAPACITOR, Variable, 1400 -3055pF, 250V		1	1					





Bias Amplifier
Drawing No. 4050433G

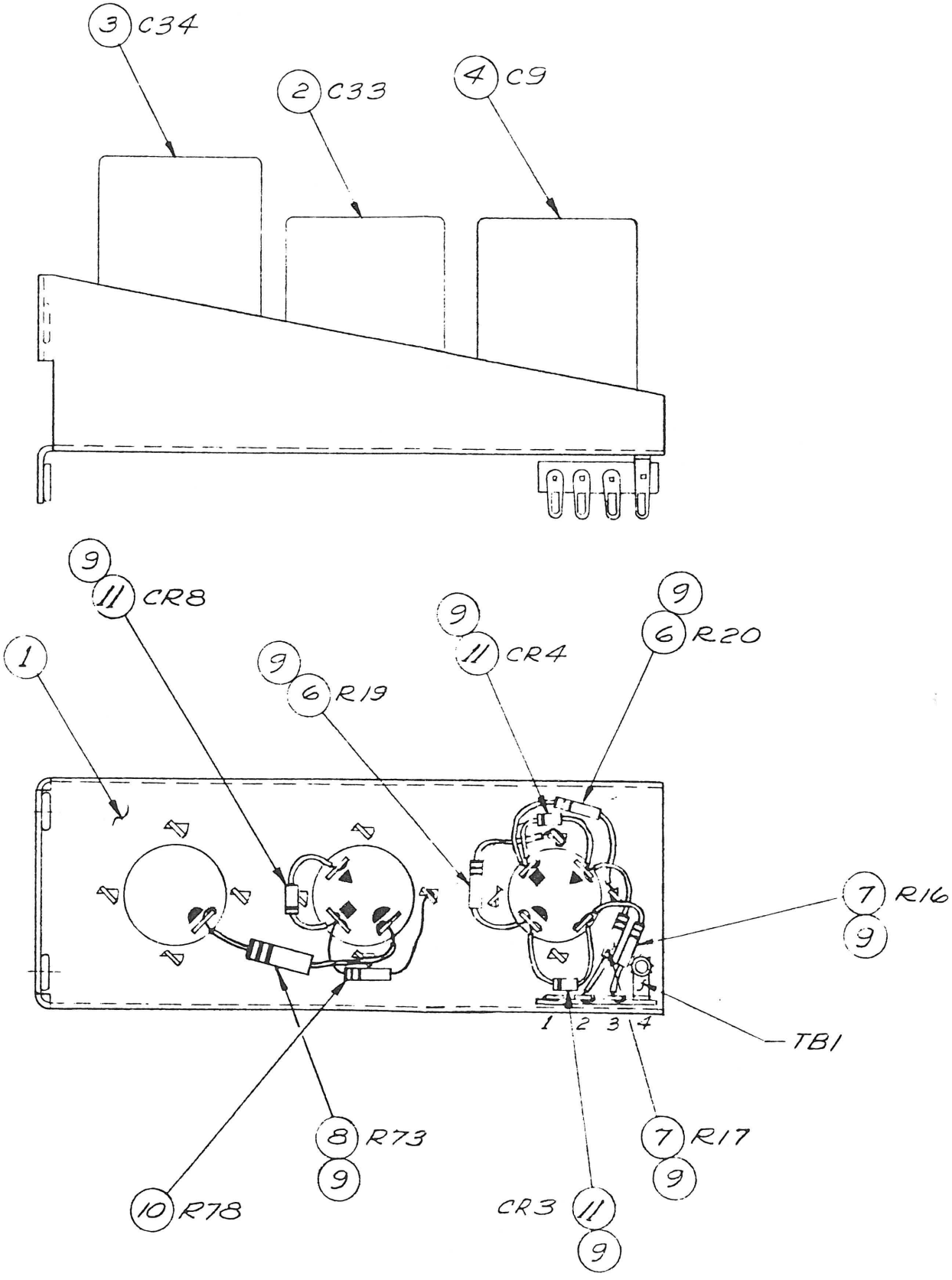
CAPACITOR MOUNTING BRACKET ASSEMBLY

CATALOG NO. 4050440

SHEET 1 OF 1

NHA 4020260

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -02						
2	4550147-07		C33	CAPACITOR, 350,750,250mF/25,25,25V		1						
3	4550147-04		C34	CAPACITOR, 1500mF, 40V		1						
4	4550147-05		C9	CAPACITOR, 100,100,35,35mF/50V		1						
6	041-060		R19,20	RESISTOR, 10K ohm, 1/2W, 10%		2						
7	041-062		R16,17	RESISTOR, 15K ohm, 1/2W, 10%		2						
8	041-833		R73	RESISTOR, 750 ohm, 1W, 5%		1						
10	041-056		R78	RESISTOR, 4700 ohm, 1/2W, 10%		1						
11	013-678		CR3,4,8	DIODE		3						



Capacitor Mounting Bracket Assembly
Drawing No. 4050440C

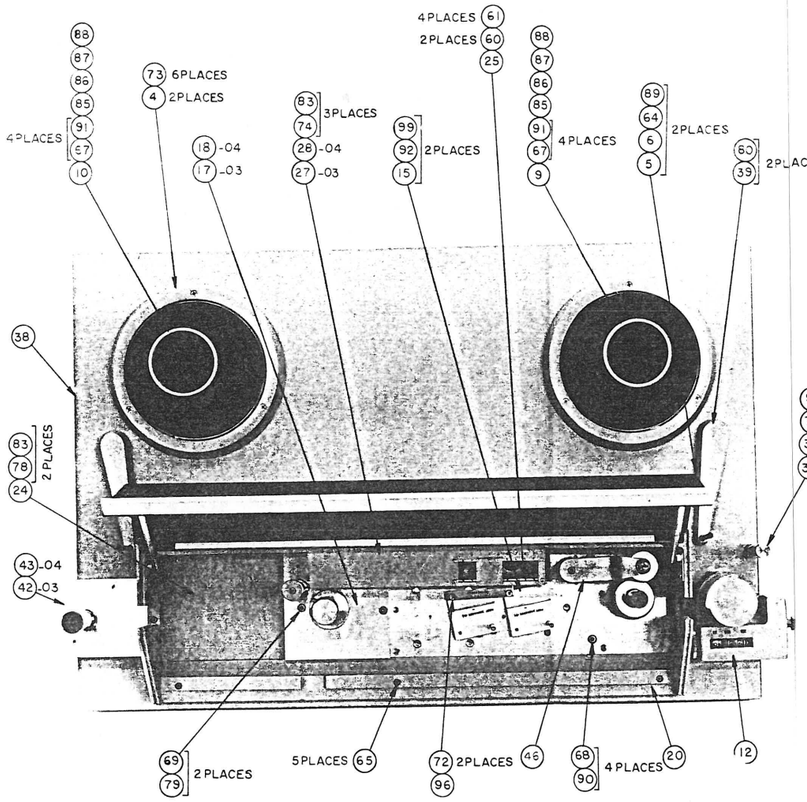
TRANSPORT ASSEMBLY

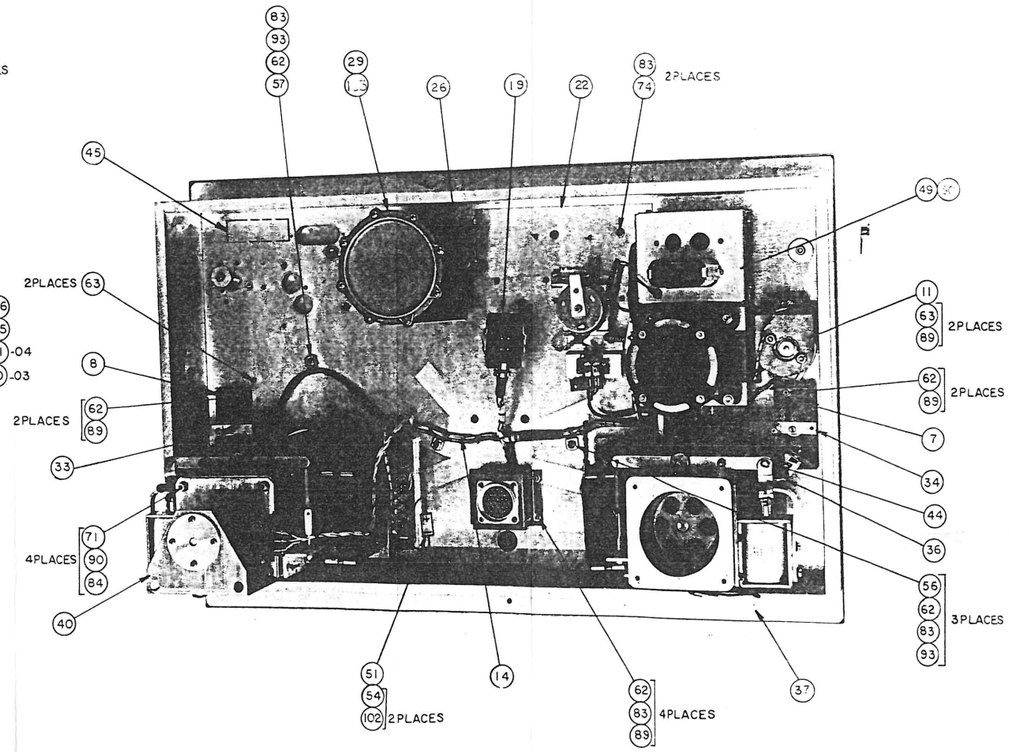
Versions: -11 1-inch Tape, 60 Hz; -12 2-inch Tape, 60 Hz
-13 1-inch Tape, 50 Hz; -14 2-inch Tape, 50 Hz

TRANSPORT ASSEMBLY — CATALOG NO. 4952583 — SHEET 1 OF 1 — NHA 4010046

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -11	-12	-13	-14
9	52110-03			TAKEUP REEL ASSEMBLY		1	1	1	1
10	52111-03			SUPPLY REEL ASSEMBLY		1	1	1	1
11	55670-02			CAPSTAN SOLENOID ASSEMBLY		1	1	1	1
12	59102-05			TAPE TIMER ASSEMBLY		1	1	1	1
19	4952338-01			PLUG, Dummy		1	1	1	1
21	4952397-01			SOLENOID ASSEMBLY		1	1	1	1
40	4952601-01 4952610-01			MOTION SWITCH ASSEMBLY		1	1	1	1
49	4952339-03 4952339-04			CAPSTAN MOTOR ASSEMBLY		1	1	1	1
50	4952339-05			CAPSTAN MOTOR ASSEMBLY		1	1	1	1
51	031-622			CAPACITOR, Aluminum, 50μF, 50V, -10 +75%		1	1	1	1
52	4952295-04			TRANSPORT HARNESS ASSEMBLY		1	1	1	1
54	171-001			CONNECTOR, Solderless, slotted tongue		2	2	2	2
106	087-072			OIL		A/R	A/R	A/R	A/R

4952583S

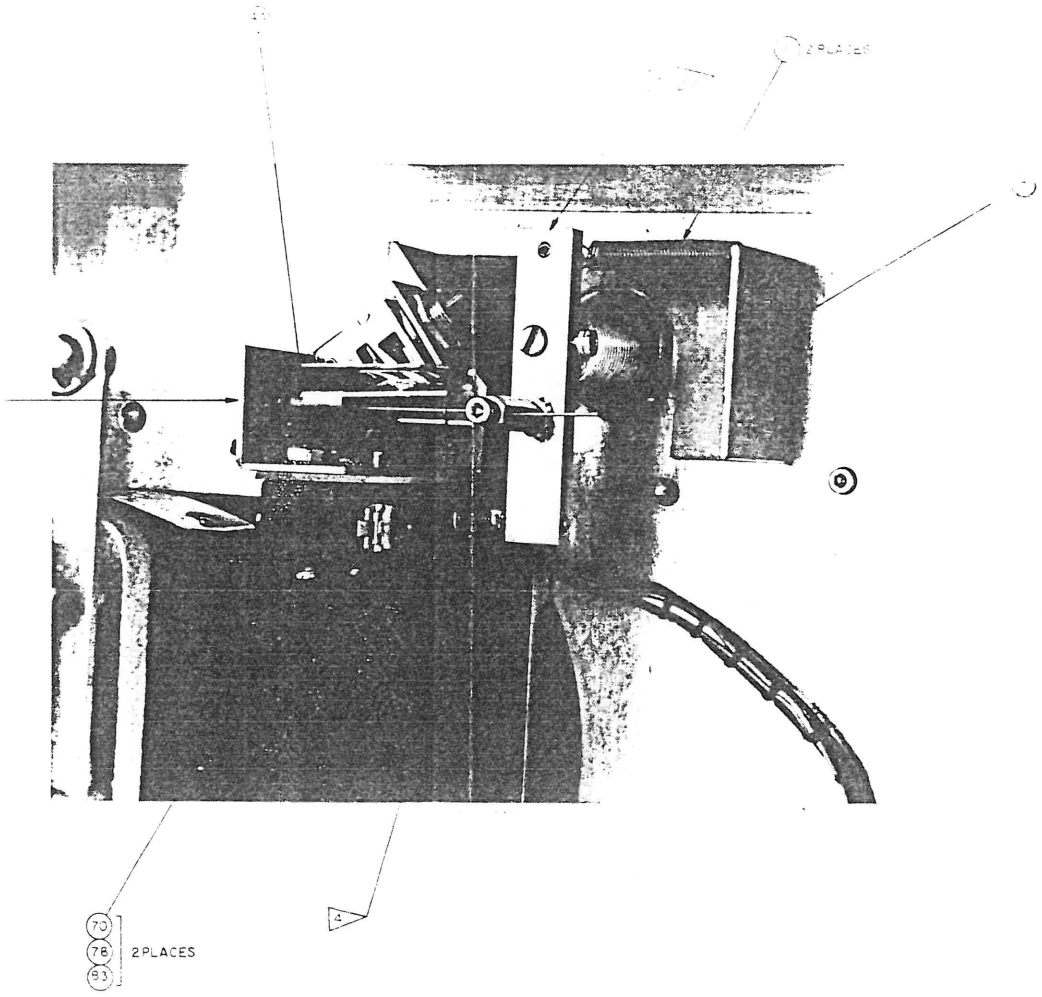




Transport Assembly
Drawing No. 4952583S (Sheet 1 of 2)

CHANGED OCT. 1970

9-81/82



Transport Assembly
Drawing No. 4952583S (Sheet 2 of 2)

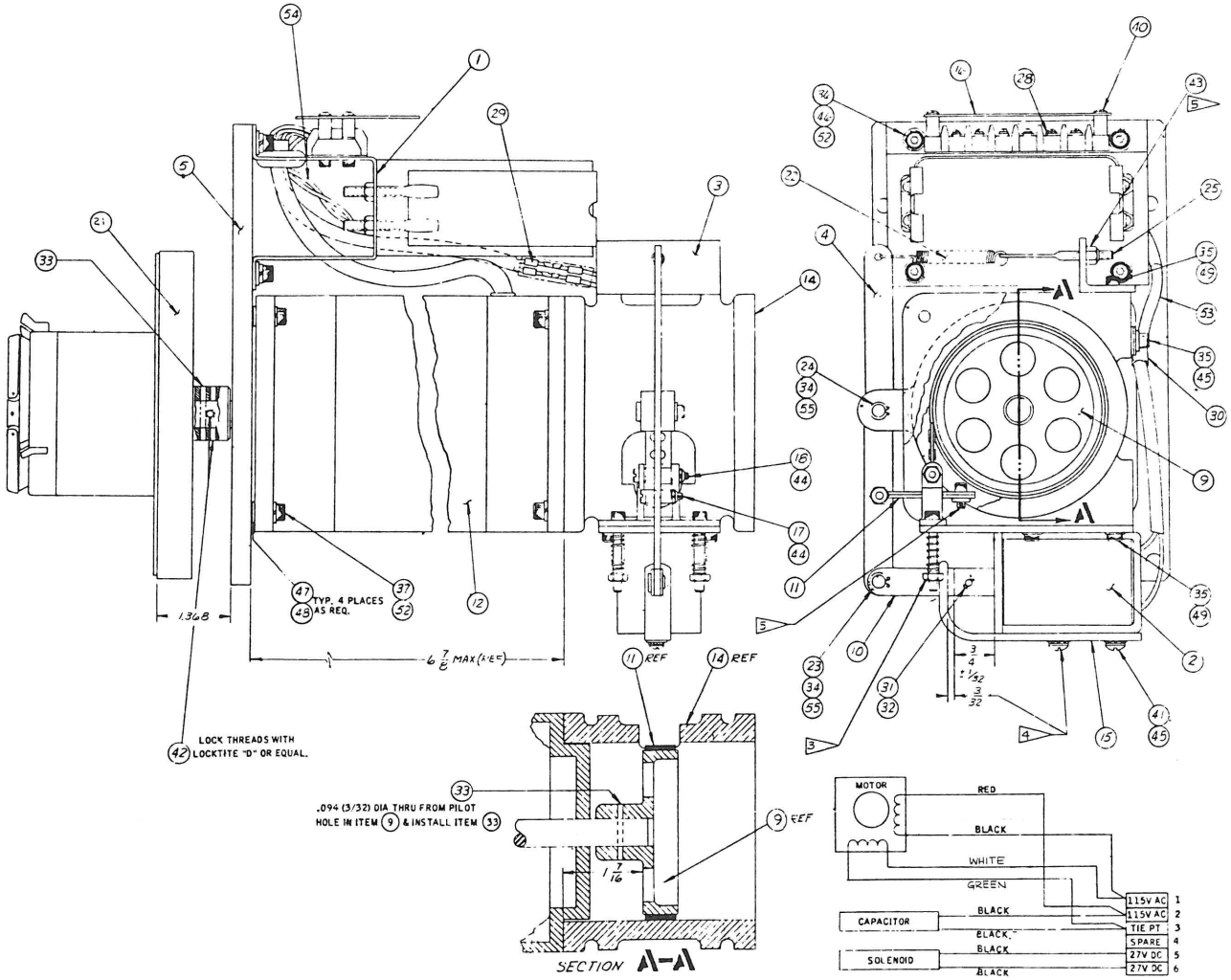
SUPPLY REEL ASSEMBLY

CATALOG NO. 52111

SHEET 1 OF 1

NHA 4952583

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -03						
2	13954-01			SOLENOID ASSEMBLY		1						
12	14349-01			MOTOR, Torque		1						



Supply Reel Assembly
Drawing No. 52111G

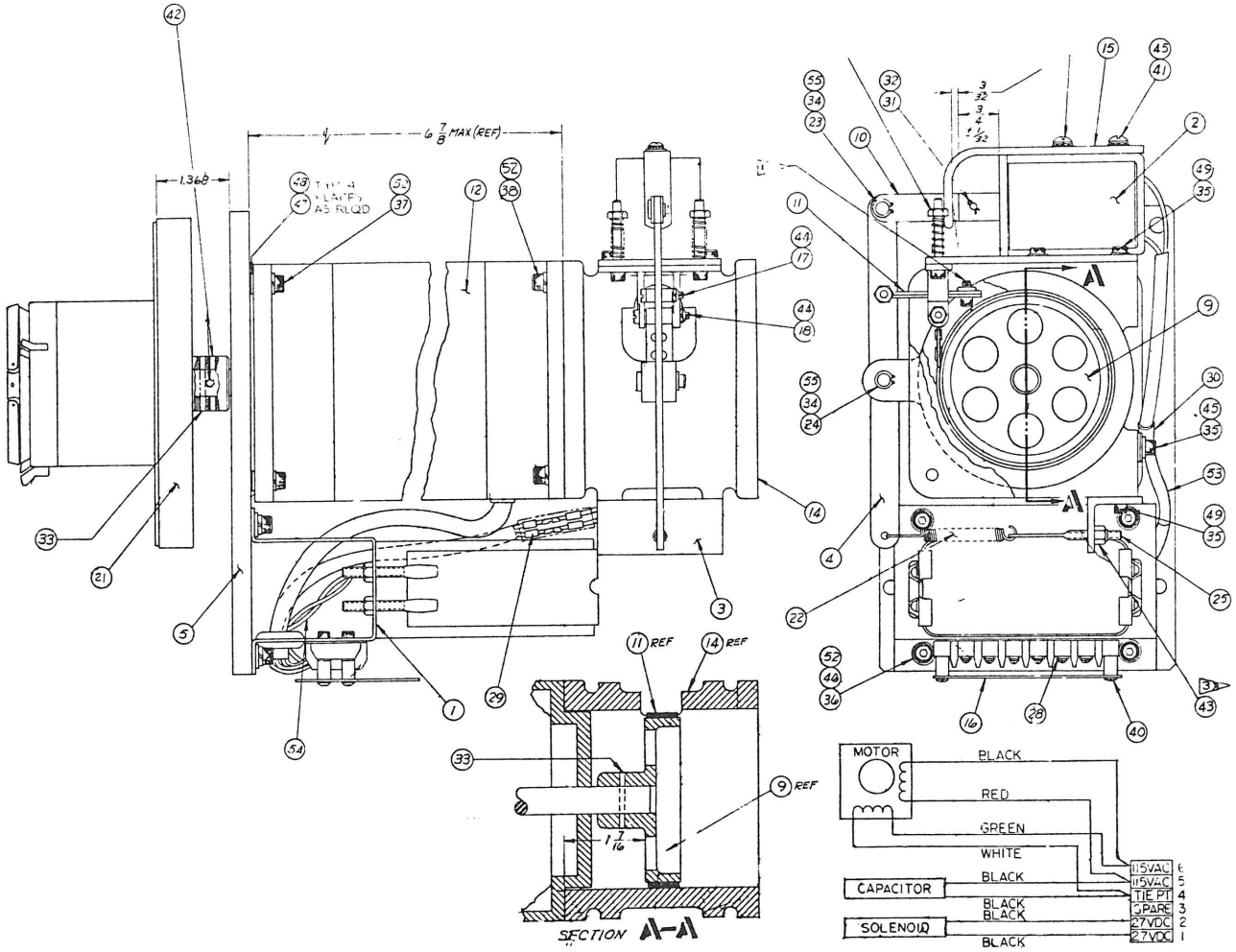
TAKE-UP REEL ASSEMBLY

CATALOG NO. 52110

SHEET 1 OF 1

NHA 4952583

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -03
2	13954-01			SOLENOID ASSEMBLY		1
12	14349-01			MOTOR, Torque		1



Take-up Reel Assembly
Drawing No. 52110J

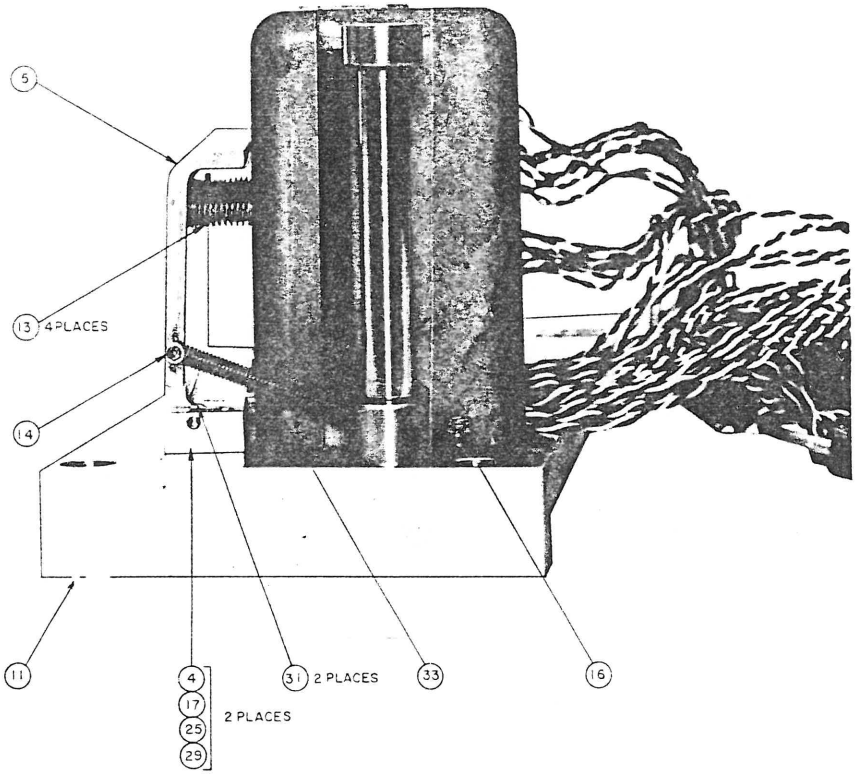
16-TRACK RECORD/REPRODUCE HEAD ASSEMBLY

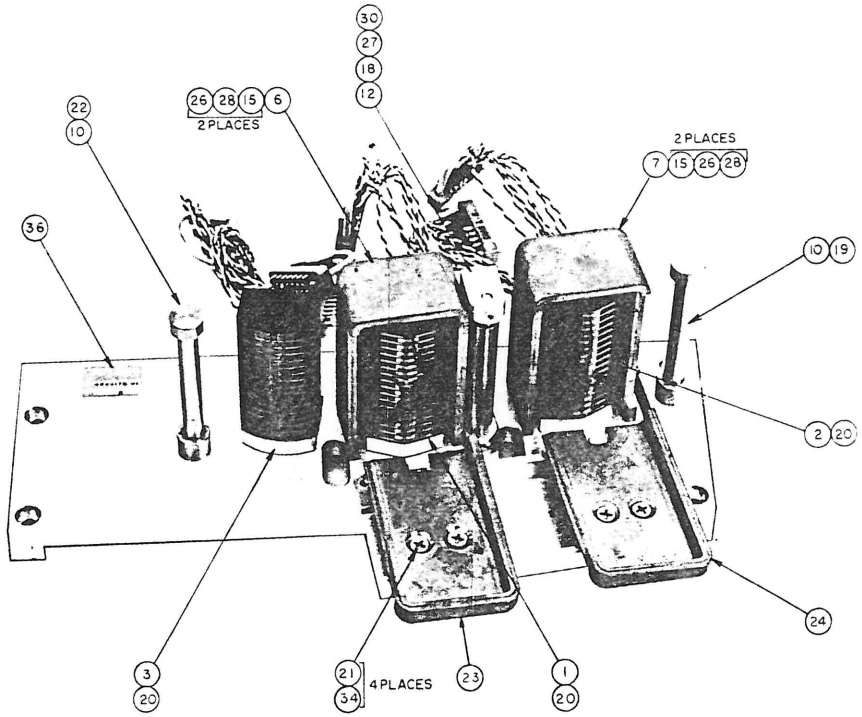
CATALOG NO. 4940178

SHEET 1 OF 1

NHA 4940150

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -02						
1	4350102-02			STACK ASSEMBLY, Record		1						
2	4350102-01			STACK ASSEMBLY, Reproduce		1						
3	4350101-01			STACK ASSEMBLY, Erase		1						





16-Track Record/Reproduce Head Assembly
Drawing No. 4940178F

16/24-TRACK PLAYBACK HEAD ASSEMBLY

CATALOG NO. 4020308

SHEET 1 OF 1

NHA 4010046

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -01	-02
3	4350102-01			STACK ASSEMBLY, Reproduce		1	
4	4350100-01			STACK ASSEMBLY, Reproduce			1

8-TRACK RECORD/REPRODUCE HEAD ASSEMBLY

CATALOG NO. 4940177

SHEET 1 OF 1

NHA 4940187

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -02						
1	1231917-01			STACK ASSEMBLY, 8 Channel, reproduce		1						
2	1231917-02			STACK ASSEMBLY, 8 Channel, record		1						
14	1232483-02			ERASE HEAD STACK, 8 Channel		1						

8-TRACK PLAYBACK HEAD ASSEMBLY				CATALOG NO. 4020305		SHEET 1 OF 1						
						NHA 4010046						
ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION						
						-01						
1	1231917-01			STACK ASSEMBLY, 8-Channel Reproduce		1						

HARNESS TRANSPORT ASSEMBLY

CATALOG NO. 4952295

SHEET 1 OF 1

NHA 4952583

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -04
4	144-058			CONNECTOR, Rectangular Plug, 10 socket		1
5	147-265			CONNECTOR, Circular Receptacle, 37 pin, female shell		1
6	120-062			SWITCH, Sensitive, lever		1
7	120-074			SWITCH, Sensitive, pushbutton		2
8	171-009			TERMINAL, Quick Disconnect, splice		2
10	013-678			DIODE, Silicon		1
11	185-009		TB1, 5	TERMINAL STRIP, Fanning, 6 terminal, left		2
12	185-010		TB2	TERMINAL STRIP, Fanning, 6 terminal, right		1
13	185-139		TB4, 6	TERMINAL STRIP, Fanning, 2 terminal, left		2
14	185-140		TB3	TERMINAL STRIP, Fanning, 3 terminal, right		1

MOTION SWITCH ASSEMBLY

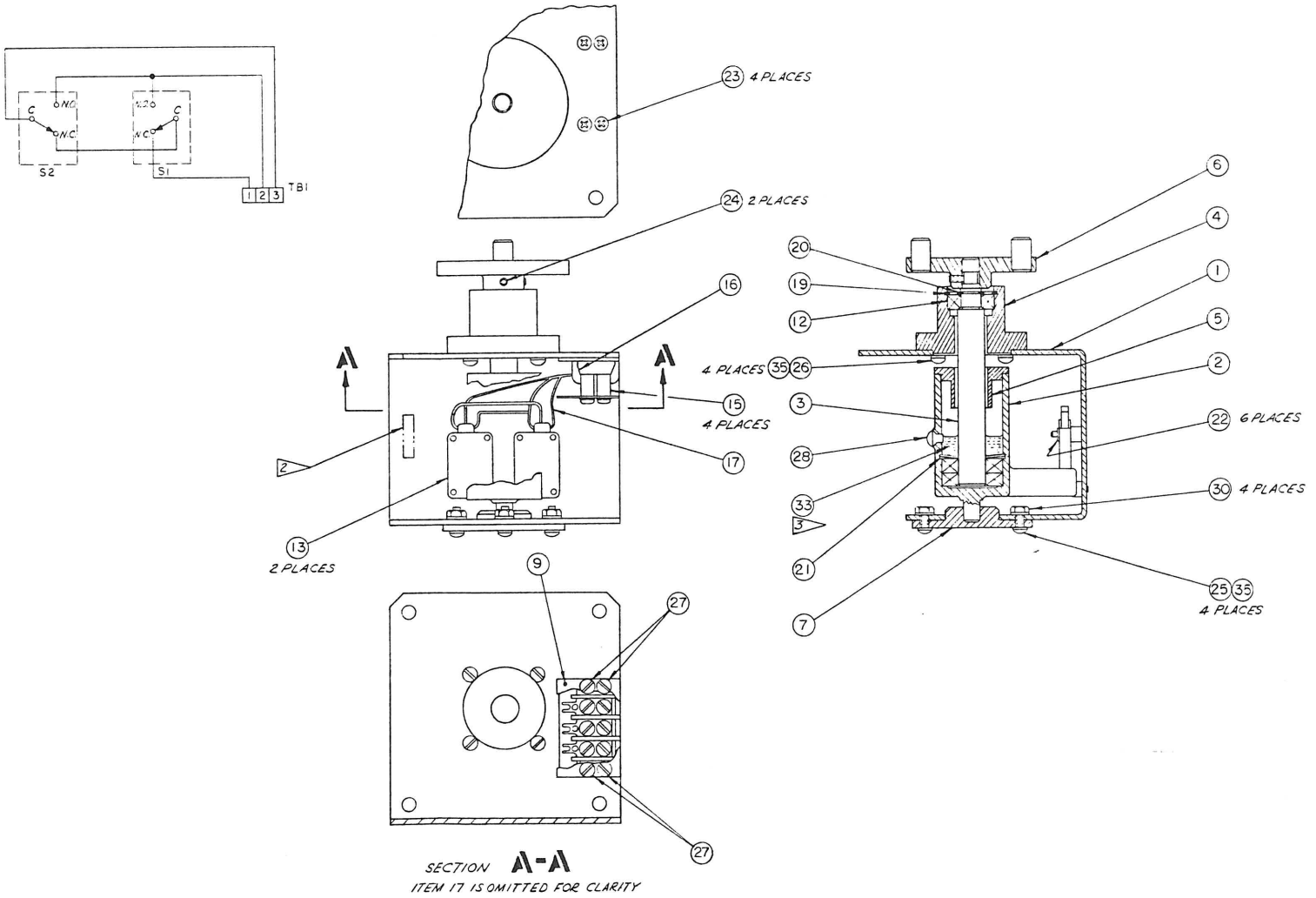
CATALOG NO. 4952610

SHEET 1 OF 1

NHA 4952583

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -01
13	120-607		S1,2	SWITCH		2
16	180-422	KULKA 600 3/4ST-3		TERMINAL BLOCK, 3 Terminal, with marker strip		1
33	087-720	DOW CORNING #200 50000 cs		SILICON, Fluid, 4cc		A/R

4952610A



Motion Switch Assembly
Drawing No. 4952610A

SOLENOID ASSEMBLY

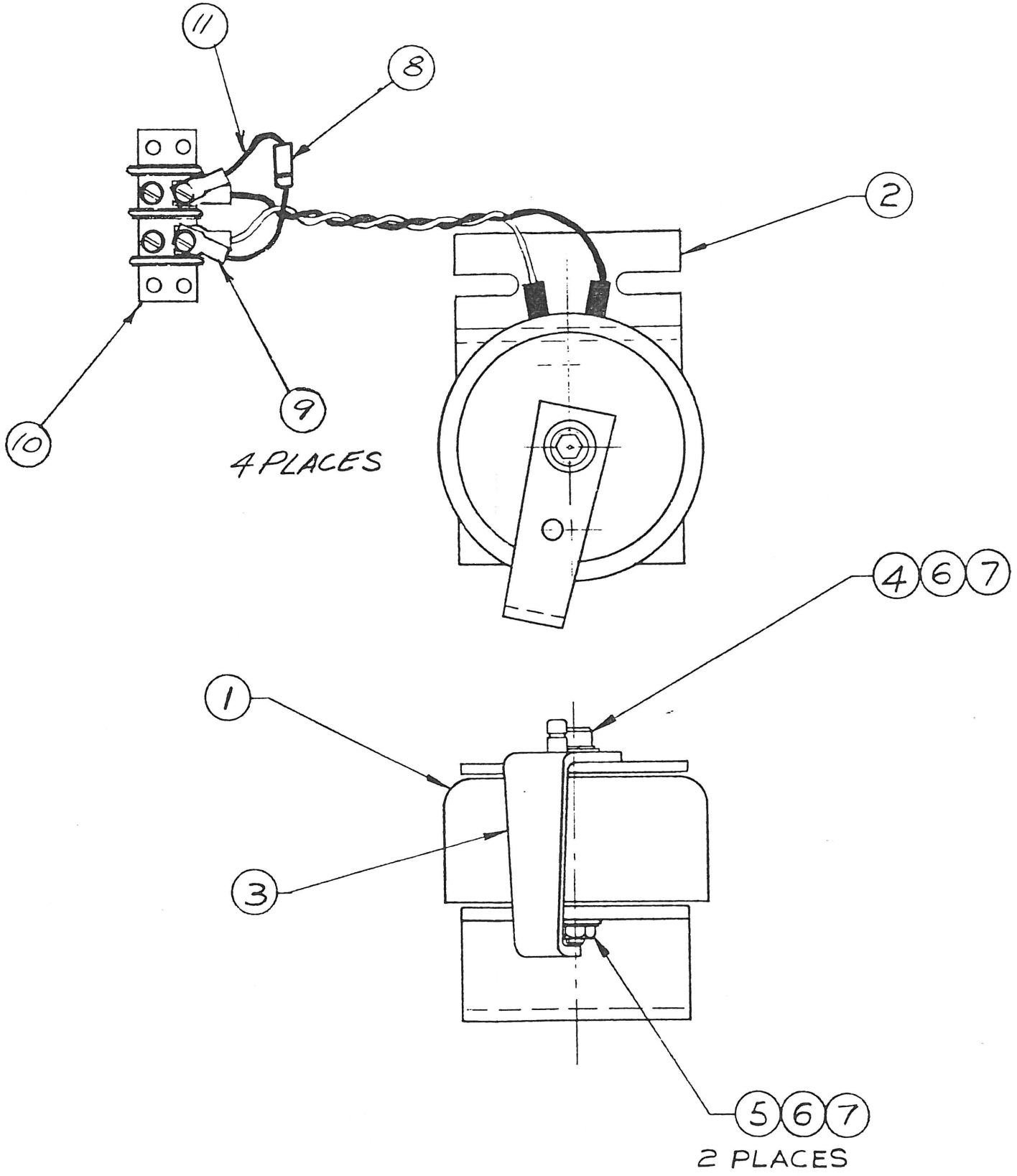
CATALOG NO. 4952397

SHEET 1 OF 1

NHA 4952583

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -01						
1	4950035-04			SOLENOID, Rotary		1						
8	013-678			DIODE, Silicon, large signal		1						
10	180-226			TERMINAL STRIP, Barrier, 2 terminals		1						

4952397B



Solenoid Assembly
Drawing No. 4952397B

CAPSTAN SOLENOID ASSEMBLY

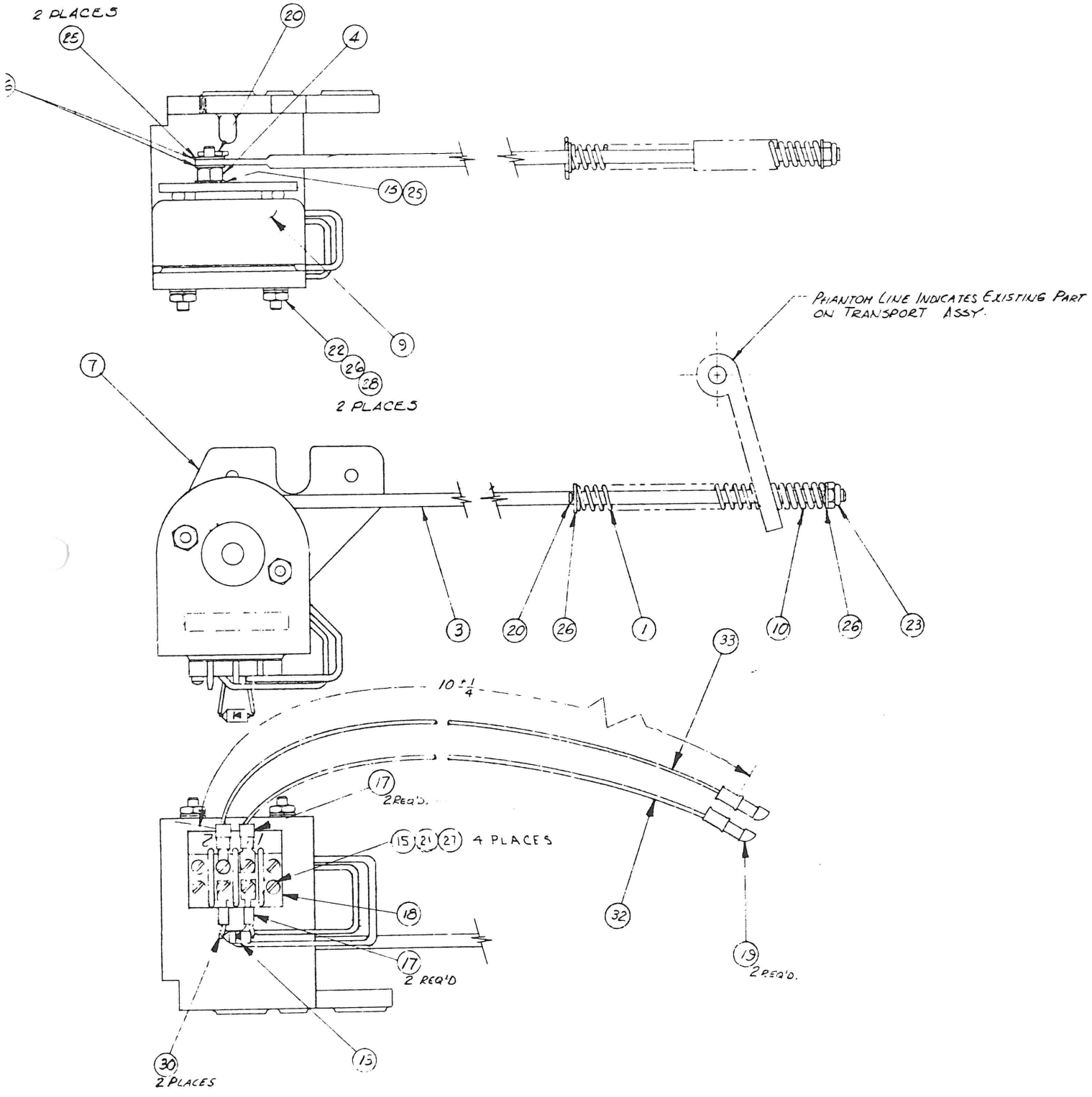
CATALOG NO. 55670

SHEET 1 OF 1

NHA 4952583

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION						
						-02	-03					
9	1380008-01			SOLENOID, Specification Drawing		1	1					
13	013-198	1N2071		DIODE		1	-					
18	180-075			TERMINAL STRIP, Barrier, 2 terminal		1	1					

55670K



Capstan Solenoid Assembly
Drawing No. 55670K

CAPSTAN MOTOR ASSEMBLY

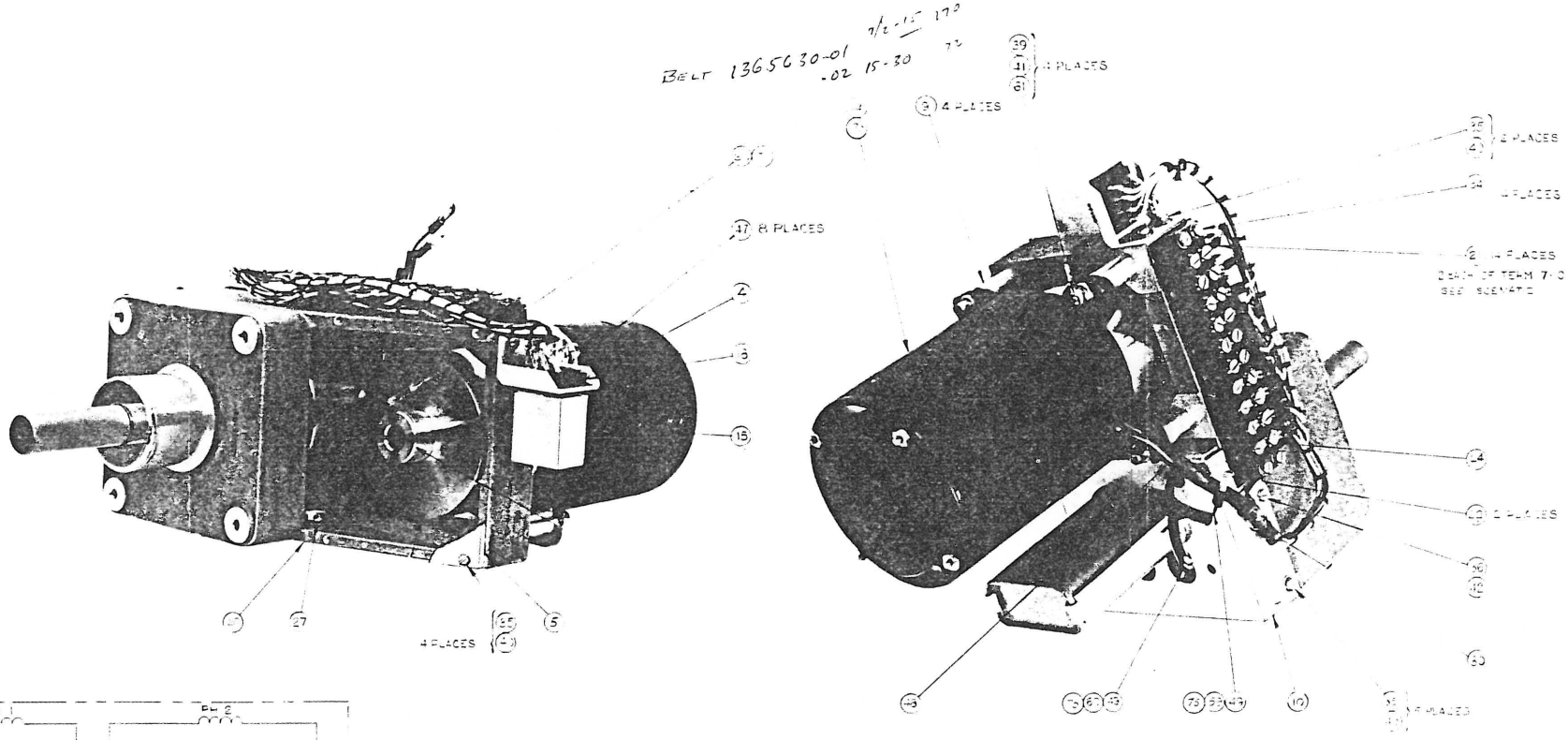
CATALOG NO. 4952339

SHEET 1 OF 1

NHA 4952583

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION						
						-03	-05					
15	020-988			RELAY, 4 Pole, 2 throw		1	1					
24	180-073			TERMINAL STRIP, Barrier, 10 terminal		1	1					
73	4030285-01			MOTOR AND FLYWHEEL SUBASSEMBLY, 60 Hz		1	-					
74	4030285-02			MOTOR AND FLYWHEEL SUBASSEMBLY, 50 Hz		-	1					

4952339F



SCHEMATIC

Capstan Motor Assembly
Drawing No. 4952339F

DUMMY PLUG, TRANSPORT

CATALOG NO. 4952338

SHEET 1 OF 1

NHA 4952583

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -01						
3	143-250			CONNECTOR, Rectangular Plug, 10 pin		1						

TAPE TIMER ASSEMBLY

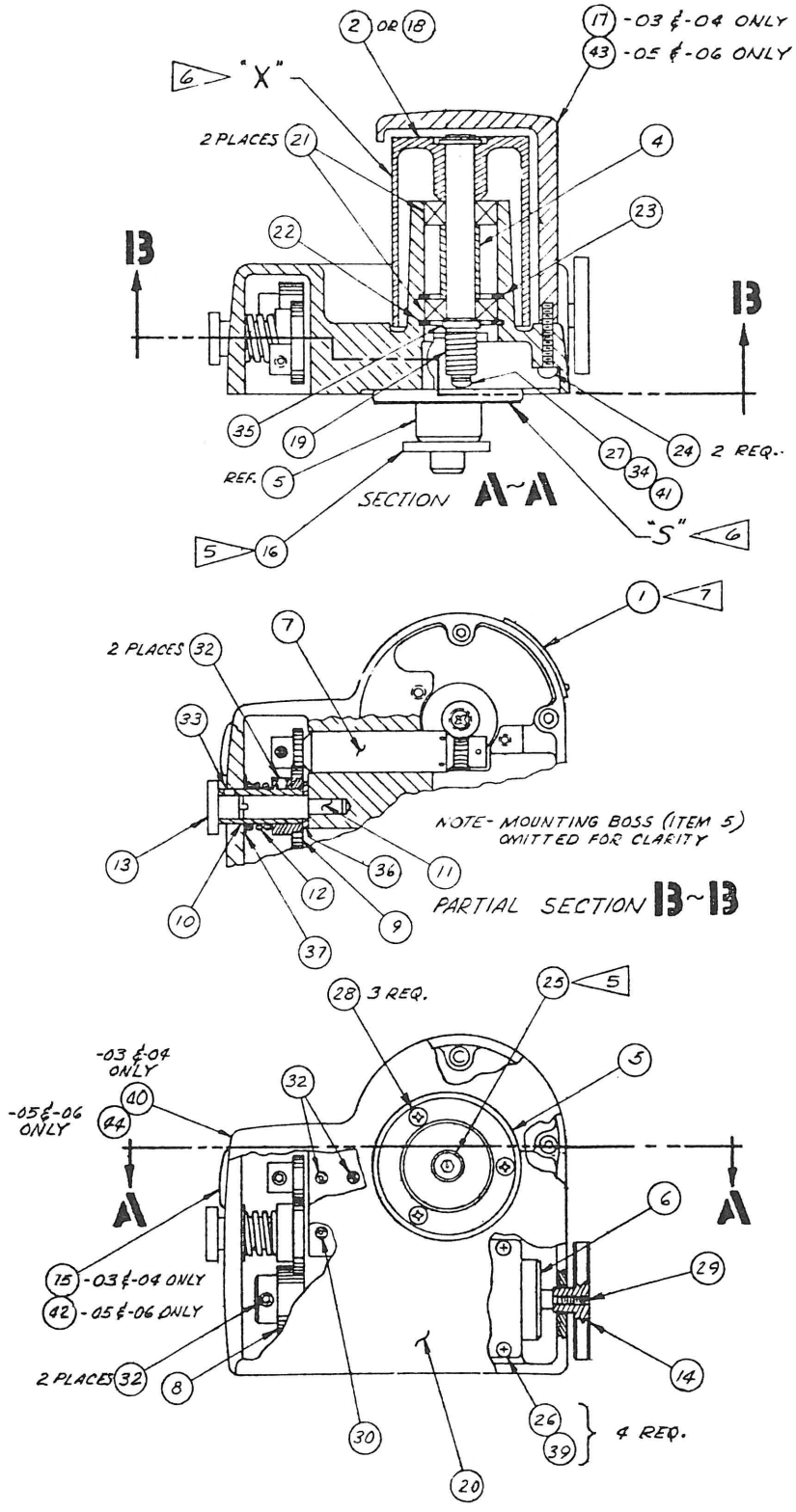
CATALOG NO. 59102

SHEET 1 OF 1

NHA 4952583

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION						
						-03	-04	-05	-06			
2	51305-01			IDLER SUBASSEMBLY, 60 Cycle Version		1	-	1	-			
18	51305-02			IDLER, Subassembly, 50 cycle version		-	1	-	1			

59102H



-03,-04,-05,-06

Tape Timer Assembly
Drawing No. 59102H

SEL-SYNC ASSEMBLY

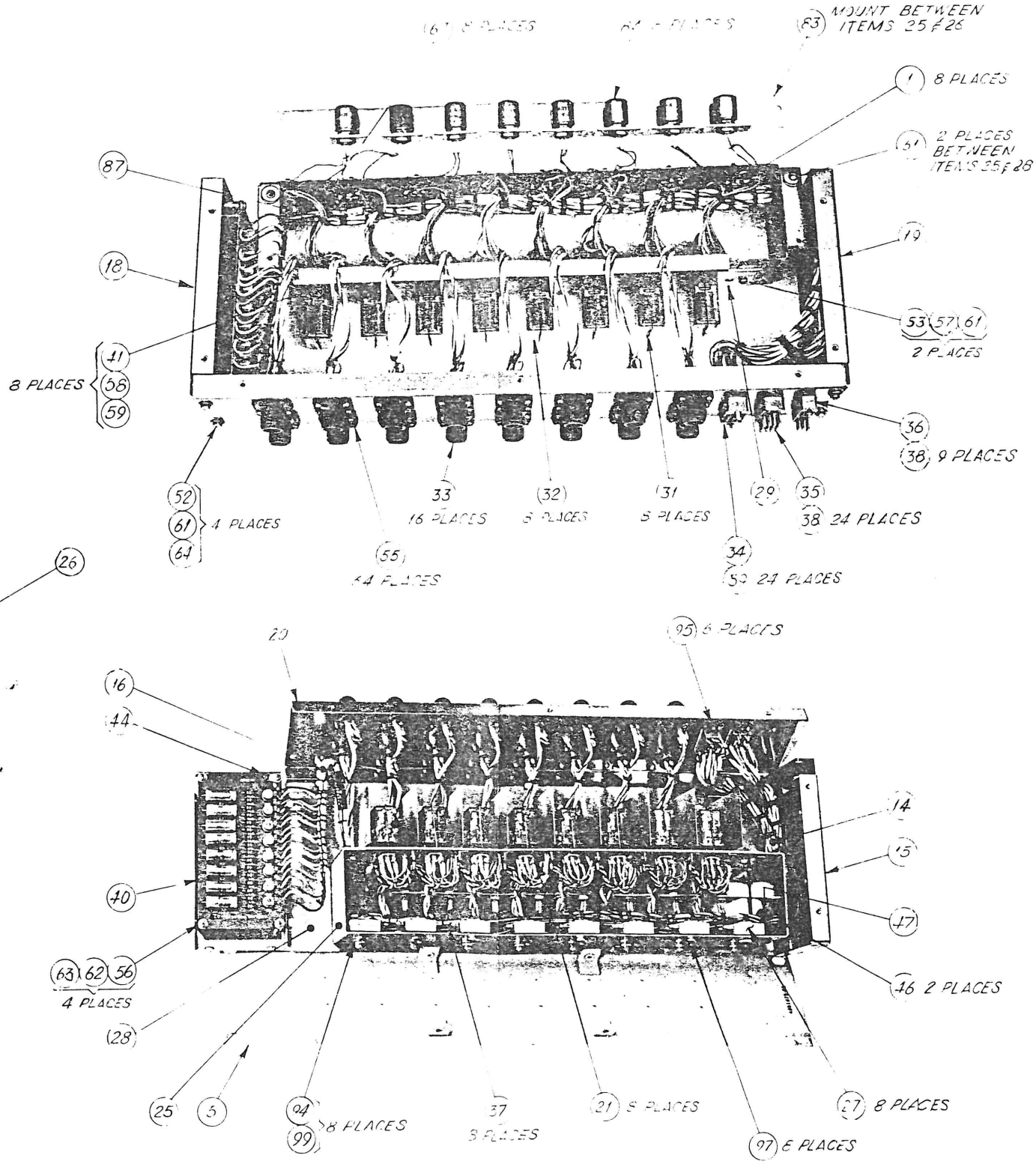
SEL-SYNC ASSEMBLY

CATALOG NO. 4952222

SHEET 1 OF 1

NHA 4940139 and 4940150

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -04
1	4520154-02		R1-8	POTENTIOMETER, Bias Calibrate		8
14	4952379-02			HARNESS, Signal		1
16	4952374-03			HARNESS, Control		1
21	013-678		CR1-8	DIODE, Silicone		8
27	038-011		C2,4,6,8,10, 12,14,16	CAPACITOR, Variable, mica, 1400-3055pF, 250V		8
32	020-629		K1-8	RELAY, Armature, 4P, DT		8
33	143-008		J4-19	CONNECTOR, Circular Receptacle, 3 pin		16
34	146-263		J3	CONNECTOR, Rectangular Receptacle, 26 socket		1
35	169-084		J2	CONNECTOR, Rectangular Receptacle, 26 pin		1
36	169-082		J1	CONNECTOR, Rectangular Receptacle, 20 pin		1
37	034-217			CAPACITOR, 910pF, 100V, 5%		8
40	4952574-02			PRINTED WIRING ASSEMBLY, Time Delay		1
67	540-030		L1-8	INDUCTOR, 330μH, 5%		8
84	4580184-01			TRANSFORMER, Input		8
87	055-069			CAPACITOR, .047MF, 50V, 5%		8



Sel-Sync Assembly
Drawing No. 4952222K

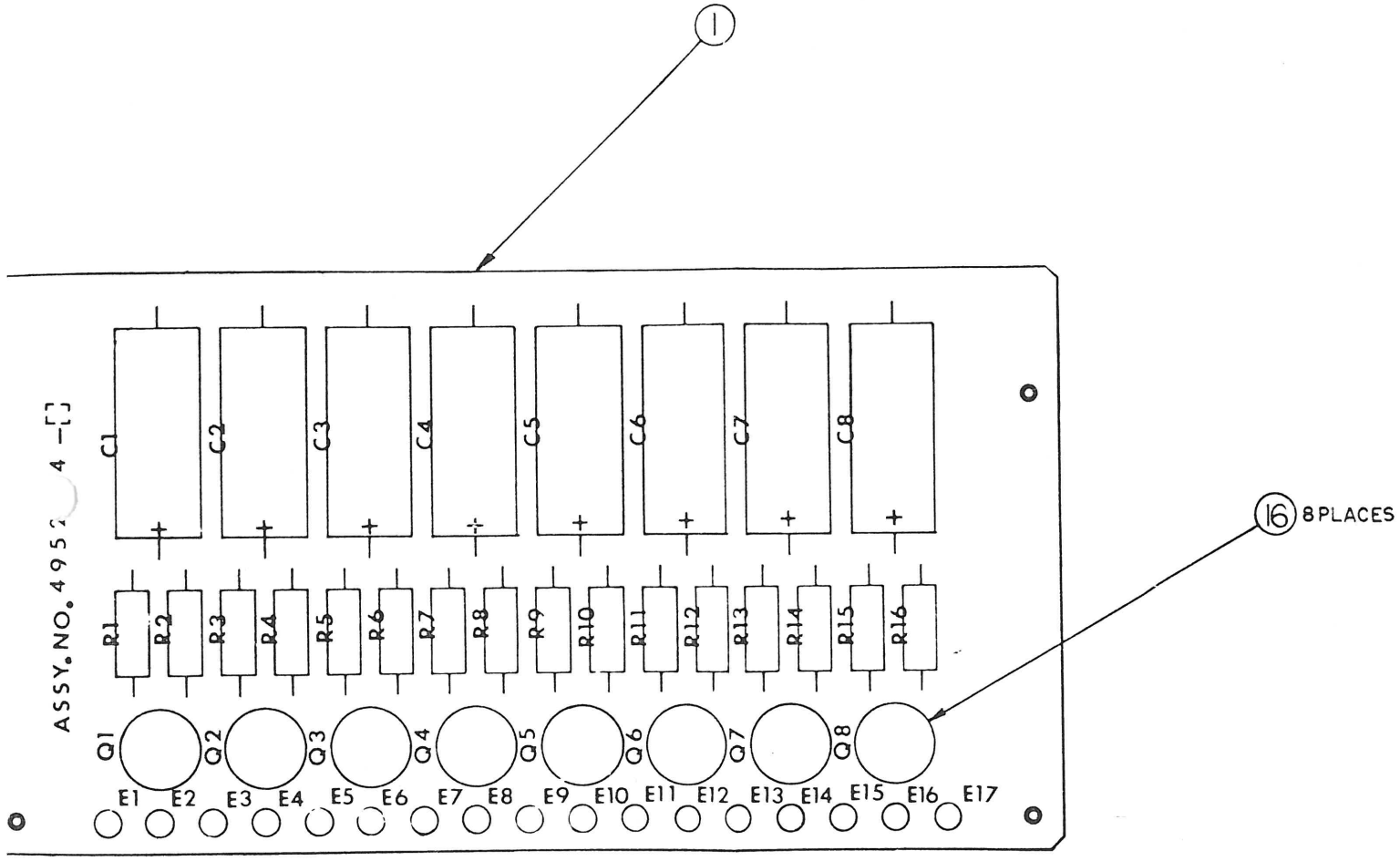
TIME DELAY PRINTED WIRING ASSEMBLY

CATALOG NO. 4952574

SHEET 1 OF 1

NHA 4952222

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -02
4	014-247		Q1-8	TRANSISTOR, Silicone, NPN		8
7	031-915		C1-8	CAPACITOR, Aluminum, 50μF, 50V		8
11	041-065		R1-16	RESISTOR, Composition, 27K ohm, 1/2W, 10%		16



Time Delay Printed Wiring Assembly
Drawing No. 4952574A

CONTROL UNIT AND POWER SUPPLY

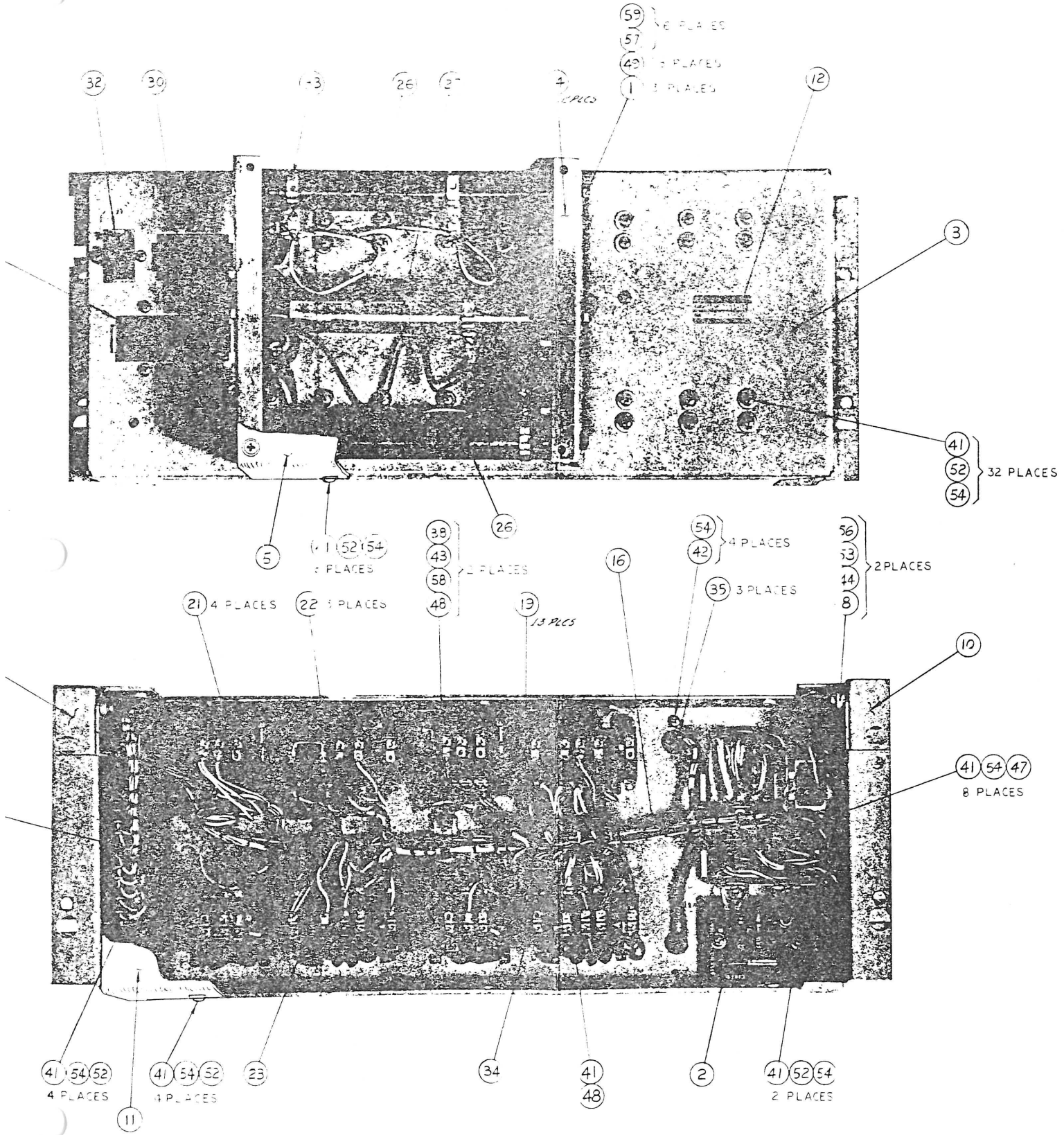
CONTROL UNIT

CATALOG NO. 4952161

SHEET 1 OF 1

NHA 4940139, 4010046, 4940171

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -04
2	4050511-01			DIFFERENTIATOR, Printed Wiring Board Assembly		1
18	4952185-03			DIODE BOARD, Printed Wiring Assembly		1
19	013-678		CR1-6, 16-20, 24-28	DIODE, Silicone		16
20	4952181-05			HARNESS ASSEMBLY, Control Unit		1
21	020-034		K3, 4, 7, 8	RELAY, Armature, 3P		4
23	020-036		K1, 2, 5, 6	RELAY, Armature, 5P2T		4
24	020-144		K9	RELAY, Armature, 4P2T		1
26	040-996		R2, 3	RESISTOR, Adjustable, wirewound, 100 ohm, 100W		2
27	040-038		R1	RESISTOR, Adjustable, wirewound, 250 ohm, 100W, 10%		1
28	031-831		C4	CAPACITOR, 100μF, 50V		1
29	171-349			TERMINAL, Quick Disconnect, female		7
30	146-002		J3	CONNECTOR, Rectangular Receptacle, 15 socket		1
31	146-979		J2	CONNECTOR, Rectangular Receptacle, 24 socket		1
32	147-011		J1	CONNECTOR, Rectangular Receptacle, 6 pin		1
34	180-089			TERMINAL STRIP, 7 Terminal		1
37	180-027			TERMINAL STRIP, D, A1		2



Control Unit Assembly
Drawing No. 4952161L

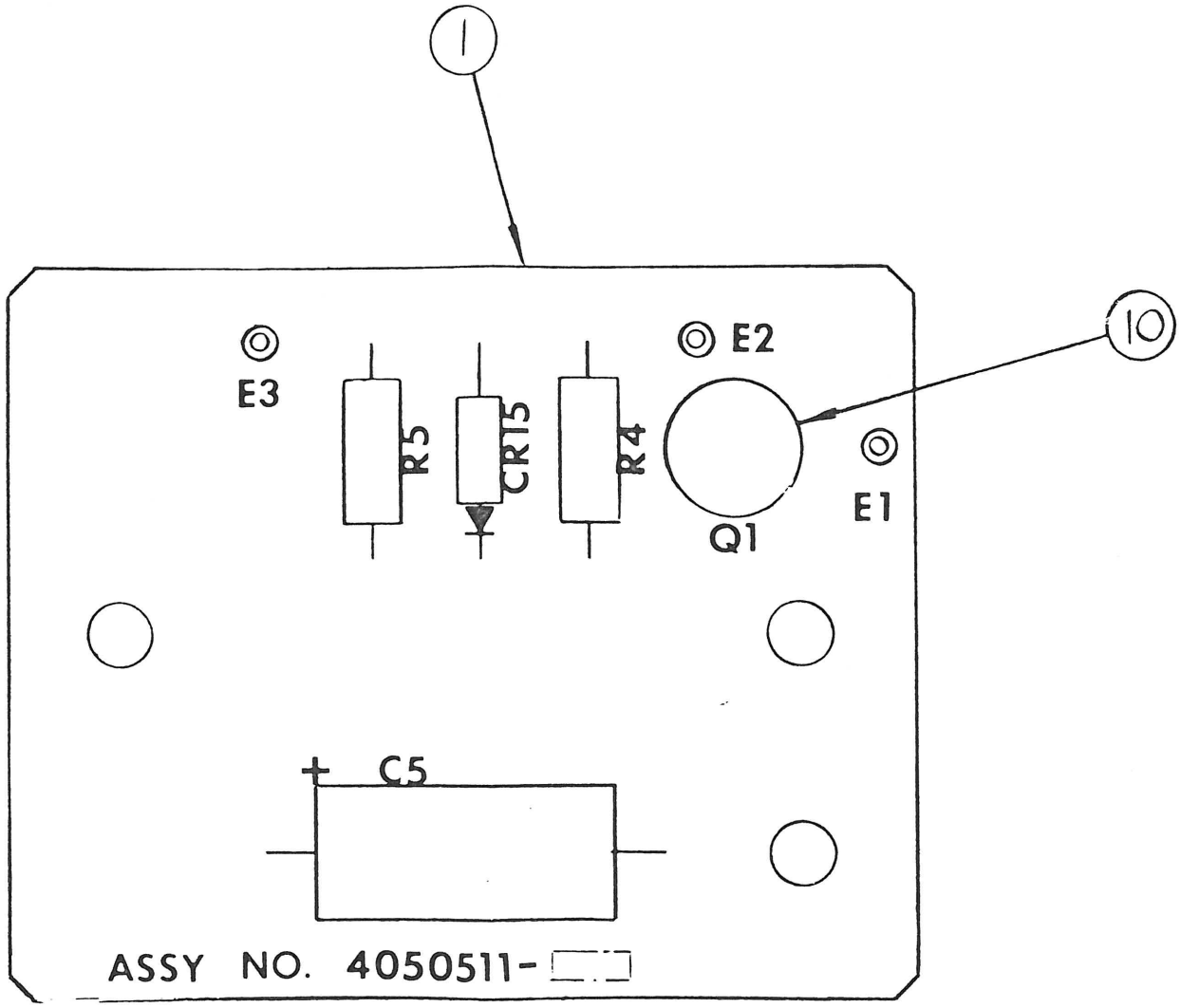
DIFFERENTIATOR PRINTED WIRING ASSEMBLY

CATALOG NO. 4050511

SHEET 1 OF 1

NHA 4952161

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -01
5	013-599		CR15	DIODE		1
6	014-247		Q1	TRANSISTOR		1
7	031-205		C5	CAPACITOR, Aluminum, 5μF, 50V		1
8	041-064		R5	RESISTOR, Composition, 22K ohm, 1/2W, 10%		1
9	041-050		R4	RESISTOR, Composition; 1.5K ohm, 1/2W, 10%		1



Differentiator Printed Wiring Assembly
Drawing No. 4050511—

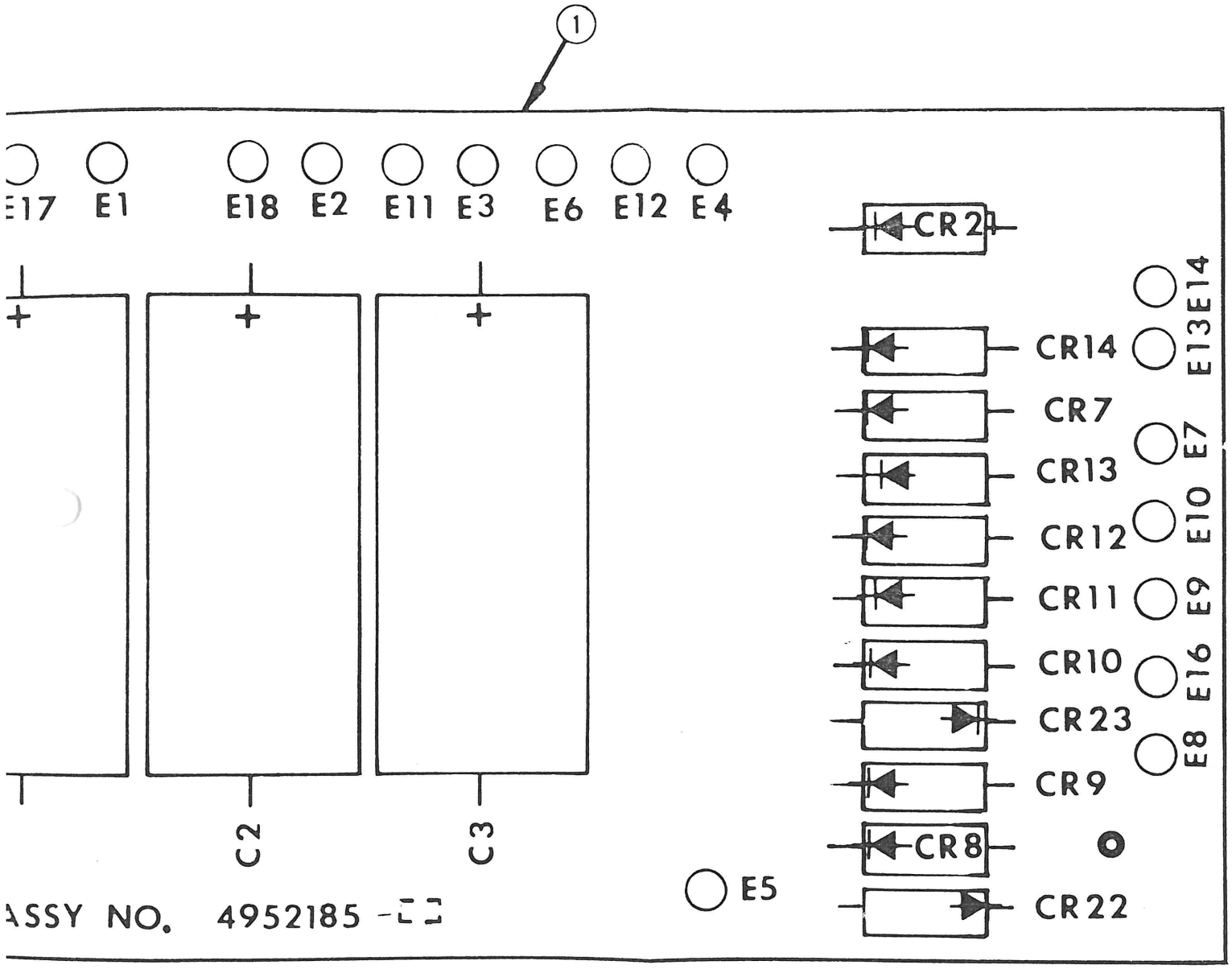
DIODE BOARD PRINTED WIRING ASSEMBLY

CATALOG NO. 4952185

SHEET 1 OF 1

NHA 4952161

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -03						
3	013-678		CR7-14, 21-23	DIODE, Silicone		11						
4	037-442		C1-3	CAPACITOR, Aluminum, 140μF, 60V		3						



Diode Board Printed Wiring Assembly
Drawing No. 4952185J

CONVERSION KITS AND MISCELLANEOUS

16-CHANNEL RECORD/REPRODUCE CONVERSION KIT — CATALOG NO. 4940150 — SHEET 1 OF 1 — NHA CAT.

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -06
1	168272-01			IDLER ASSEMBLY		2
3	4952182-02			CONTROL PANEL OVERLAY		1
9	4952406-02			MODE CONTROL UNIT		1
11	4952560-02			GUIDE, Takeup		1
12	4952286-02			HARNESS, Supplementary Signal		1
13	A2573			REEL, 2"		1
14	4940178-02			HEAD ASSEMBLY, 16 Channel		1
15	060-079			LIGHT, Indicator, incandescent		8
18	310-105			CLIP, Cartridge, lamp		2
21	472-043			SCREW, Flat Head, 6-32 x 5/8		2
27	4952287-02			HARNESS, Supplementary Input/Output		1
28	4020307-02			POWER SUPPLY, 39V Assembly		1
31	4952222-04			SEL SYNC UNIT		1
32	4952282-03			HARNESS, Supplementary Control		1
33	4952201-06			ELECTRONICS		8
34	4850126-02			LABEL KIT, 9 Thru 16		1
37	4952284			SCHEMATIC, Mode Control Unit		REF
38	4290573-05			PANEL, Blank, 3-1/2"		3
39	4580200-01			TRANSFORMER, Input		8
40	4600008-10			SHIELD, Head		24
41	4952775-01			SPACER, Low Brake		2
42	4952776-01			SPACER, High Brake		4
43	4952805-01			SWITCH ASSEMBLY, Control Unit		1
44	1365797-01			PACKAGING ASSEMBLY, 16 Channel Kit		1
45	1365784-01			PACKAGING ASSEMBLY, Head Assembly		1
47	310-582			CLIP, Nut, #10-32		16
48	430-016			RING, Retaining for .875 diameter		24
49	470-041			SCREW, 10-32 x 7/8, Cap, hex socket head		4
50	471-470			SCREW, 6-32 x 1-1/2, pan head, cross-recessed		4
51	472-578			SCREW, 10-32 x 3/4, Oval head, cross-recessed		16
52	501-702			WASHER, #10, finishing, black		16

2" TO 1" CONVERSION KIT (REPRODUCE)

CATALOG NO. 4010137

SHEET 1 OF 1

NHA CAT.

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION -01
1	A 1471			REEL, 1 Inch		1
2	4020305-01			HEAD ASSEMBLY, 8 Track Playback		1
4	4890223			INSTRUCTION SHEET		1
7	4952218-01			IDLER ASSEMBLY, 1 Inch		2
8	4952254-01			RING, Holddown		2
9	4952560-01			GUIDE, Take Up		1
10	4952563-01			ADAPTER RING, Lower Assembly		2
11	4952775-01			SPACER, Low Brake		2
12	4952776-01			SPACER, High Brake		4
13	4952805-01			SWITCH ASSEMBLY, Control Unit		1
17	470-110			SCREW, Cap, hex socket, 10-32 x 1-1/4		4
18	471-470			SCREW, Cross-recessed pan head, 6-32 x 1-1/2		2
19	718-037			BAG, Plastic, 3" x 3"		8
20	718-081			JIFFY BAG, 4" x 8"		6
21	1365784-02			CARTON, Packaging Assembly		1
22	1367804-01			CARTON, Final Packaging Assembly		1

2" TO 1" CONVERSION KIT (RECORD/REPRODUCE) CATALOG NO. 4940187

SHEET 1 OF 1

NHA CAT.

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION						
						-03	-04					
1	A1471			REEL, 1"		1	1					
3	4952218-01			IDLER ASSEMBLY, 1"		2	2					
4	4952254-01			RING, Holddown		2	2					
5	4952560-01			GUIDE, Takeup		1	1					
6	4952563-01			ADAPTER RING, Lower Assembly		2	2					
7	4952775-01			SPACER, Low Brake		2	2					
8	4952776-01			SPACER, High Brake		4	4					
9	4952805-01			SWITCH ASSEMBLY, Control Unit		1	1					
10	4940177-02			HEAD ASSEMBLY, 8 Track		1	1					
14	470-110			SCREW, Cap, hex socket, 10-32 x 1-1/4		4	4					
15	471-470			SCREW, Cross-Recessed, pan head, 6-32 x 1-1/2		2	2					
17	650-223			SCALE, 0-6 pound		1	-					
21	4890224			INSTRUCTION SHEET		1	1					
22	718-037			BAG, Plastic. 3" x 3"		8	8					
23	718-081			JIFFY BAG, 4" x 8"		6	6					
24	1365784-02			CARTON, Packaging Assembly		1	1					
25	1367804-01			CARTON, Final Packaging Assembly		1	1					

MISCELLANEOUS PARTS KIT

CATALOG NO. 4952768

SHEET 1 OF 1

NHA 4940171

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	MFR CODE	QUANTITY REQUIRED PER VERSION						
						-01	-02	-03	-04	-05		
1	A 1471			REEL, 1 Inch		1	-	1	-	-		
2	A2571			REEL, 2 Inch		-	1	-	1	1		
3	53094-01			POWER CORD		1	1	1	1	1		
4	4580200-01			INPUT TRANSFORMER		8	16	-	-	-		
5	4952254-01			RING, Holddown		2	-	2	-	-		
6	4952563-01			ADAPTER RING, Reel Lower		2	-	2	-	-		
7	1206867-01			CARTON, 23" x 15" x 11-3/4"		1	1	1	1	1		
8	4890304			MANUAL		1	1	1	1	1		
10	144-003			CONNECTOR, Audio Plug, 3 socket		8	16	8	16	24		
11	145-009	Cannon XLR-3-12C		CONNECTOR, Audio Plug, 3 pin		8	16	-	-	-		
12	147-053	Rodale 5266		CONNECTOR, Power Plug Cap, 3 male contacts		1	1	1	1	1		
15	718-006			BAG, 12" x 14"		1	1	1	1	1		
16	718-010			BAG, 4" x 8"		2		1				
17	718-022			JIFFY BAG, #7		2	2	2	2	2		
18	718-037			BAG, 3" x 3"		1	1	1	1	1		
19	718-081			JIFFY BAG, 4" x 8"		8	16					
20	718-082			BAG, 24" x 36"		1	1	1	1	1		
21	718-086			BAG, 8" x 10"			2		1	1		
22	718-087			BAG, 6" x 6"		1		1				
23	719-105			DUNNAGE		A/R	A/R	A/R	A/R	A/R		

MOTOR DRIVE AMPLIFIER				CATALOG NO. 4940147		MFR CODE	SHEET 1 OF 2 NHA 4940139, 4940171							
ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION			QUANTITY REQUIRED PER VERSION							
A1-		PKM-4P1	C.D.E.	.1MFD/400V	C1, C3									
		36D362F150CC	SPRAGUE	3600 MFD/150V	C2									
		6RS21SA7D7	G.E.	THYRECTOR	CR1, CR2, CR3, CR4									
		MDA-952-3	MOTOROLA	BRIDGE RECTIFIER										
		32-R2111T	LEECRAFT	115VAC LAMP	DS1									
		4551	USECO	TERMINAL	E1, E2									
		865	H.H.SMITH	TERMINAL STRIP	E3									
		3AG		3A SLO-BLO	F1									
		160-5	AMPHENOL	LINE IN	J1									
		SO-239	AMPHENOL	EXT IN	J2									
		MS3102A-14S-2S	AMPHENOL	OUTPUT	J3									
		DTS 423	DELCO	NPN	Q1, Q2, Q3, Q4									
		PH25-200	DALE	200 OHM, 25W	R1, R4									
		RC42GF123K		12K, 2W	R2									
		BWH		1 OHM, 1W	R3, R5									
		53C3-20K-S	CLAROSTAT	20K OHM, 2W POTENTIOMETER		R6								
		ST52K	C.H.	TOGGLE SWITCH	S1									
		PA-1002	CENTRALAB	WAFER SWITCH	S2, S3									
		T821	* IERE	TRANSFORMER	T1, T2									
		342004	LITTLEFUSE	FUSE HOLDER	XF1									
		4-2153	TRANEX	TRANSFORMER	T3									
		TE1160	SPRAGUE	50 MFD/15V	C1									
		150D105X9035A2	SPRAGUE	1 MFD/35V	C2									
		150D474X0035A2	SPRAGUE	.47/35V	C3									
		BR500-25	CDE	500 MFD/25V	C4									
		150D107X0010R2			C5									
		TD712	G.E.	TUNNEL DIODE	CR2									
		1N4002	EDI	RECTIFIER DIODE	CR3, CR4, CR6, CR8, CR9									
		1N4745A	MOTOROLA	ZENER DIODE	CR5									
		1N4734A	MOTOROLA	ZENER DIODE	CR7									
		NF-207	WAKEFIELD	HEAD SINK	HS1									
		2N3638	FAIRCHILD	PNP	Q1, Q3, Q4									
		2N3566	FAIRCHILD	NPN	Q2									
		2N1306	R.C.A.	NPN	Q5									
		2N3053	R.C.A.	NPN	Q6									
		UA710C	FAIRCHILD	Q7										
		SN7472N	SPRAGUE	Q8										
		RC20GF472J		4.7K OHM, 1/2W	R1, R3, R4, R5									
		RC20GF184J		180K OHM, 1/2W	R2									
		RC20GF222J		2.2K OHM, 1/2W	R6									
		RC20GF103J		10K OHM, 1/2W	R7									
		RC20GF102J		1K OHM, 1/2W	R8, R21									
		RC20GF122J		1.2K OHM, 1/2W	R9, R10, R13, R14 R17									
		RC20GF680J		68 OHM, 1/2W	R11, R12									
		3005P-1-502	BOURNS	5K OHM, 1W POTENTIOMETER		R20								
				NOT USED	R15									

* Industrial Electronic Research Enterprises, 2700 Bay Road, Redwood City, CA 94063

MOTOR DRIVE AMPLIFIER — CATALOG NO. 4940147 — SHEET 2 OF 2 — NHA 4940139, 4940171

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION		MFR CODE	QUANTITY REQUIRED PER VERSION
		RC20GF333J		33K OHM, 1/2W	R16		
		RC20GF680J		68 OHM, 2W	R18		
				NOT USED	R19		
		RC32GF151J		150 OHM, 1W	R22		
		20147	TRANEX	TRANSFORMER	T1		
A3-		TE1208	SPRAGUE	35 MFD/25V	C1		
		192P15492	SPRAGUE	.15 MFD/200V	C2		
				SELECT	C3		
		TE1160	SPRAGUE	50 MFD/15V	C4		
		TE1130	SPRAGUE	20 MFD/12V	C5		
		192P33392	SPRAGUE	.033/200V	C6, C7		
		150D105X9035A2	SPRAGUE	1 MFD/35V	C8		
		1N4002	E.D.I.	RECTIFIER DIODE	CR1, CR2, CR3, CR4, CR5		
		2N2646	G.E.	UNIJUNCTION	Q1		
		2N3638	FAIRCHILD	PNP	Q2, Q6, Q7		
		2N3566	FAIRCHILD	NPN	Q3, Q5		
		SN7472N	SPRAGUE	Q4			
		SN7273N	SPRAGUE	Q8			
		3005P-1-203	BOURNS	20K OHM, 1W POTENTIOMETER	R1, R2, R3		
		RC20GF273J		27K OHM, 1/2W	R4		
		RC20GF153J		15K OHM, 1/2W	R5		
		RC20GF103J		10K OHM, 1/2W	R13, R15, R16		
		RC20GF470J		47 OHM, 1/2W	R6		
		RC20GF392J		3.9K OHM, 1/2W	R7		
		RC20GF472J		4.7K OHM, 1/2W	R8, R12, R17, R18, R20		
				SELECT	R9		
		RC20GF911J		910 OHM, 1/2W	R10		
		RC20GF101J		100 OHM, 1/2W	R11		
		RC20GF4R7J		4.7 OHM, 1/2W	R14		
		RC20GF122J		1.2K OHM, 1/2W	R19, R21, R24, R25		
		RC20GF680J		68 OHM, 1/2W	R22, R23		

Table 7-1. Cross Reference Part Number List

AMPEX PART NUMBER	MILITARY OR COMMERCIAL PART NUMBER
BEARING ASSEMBLY, BALL	
421-289	MINTR Precision S6632FCHHE
CAPACITORS	
030-001	Sprague 33C60A
030-008	" 29CGA
030-057	" CO23B101F103M
030-062	" CO23B101H253M
030-101	" 5CO23474X O250B3
030-102	Erie 811-527-Y5P-222K
030-465	Sprague 33C115A GRP2
031-022	Sprague TVA 1310
031-051	C.D.AA0174 (UPN-10097)
031-126	Sprague TVA 1312
031-134	C.D.BR500-50
031-142	Sprague TE-1129
031-148	" 30D106G025BB4
031-187	" 30D506G050DD4
031-190	" 30D506G025CC4
031-205	" 30D505G050BB4
031-211	" 30D356G025DC4
031-213	" 30D256G025DB4
031-271	" 30D107G015DC4
031-309	" 30D405G025BA4
031-454	Nashville Elect. 32-875P1K-35D65
031-622	Sprague 30D506G050DHO
031-624	G.E. 43F7364AA1
031-795	Sprague 30D267G015DF4
031-831	" 30D107G050DH4
031-881	" 30D106F150DD2
031-915	" 30D2108

Table 7-1. Cross Reference Part Number List (Cont.)

AMPEX PART NUMBER	MILITARY OR COMMERCIAL PART NUMBER
CAPACITORS (Cont.)	
031-945	Sprague TVA 1315
033-299	PAKTRON MF1125
034-056	Sangamo RR5E391JO
034-153	C.D.CD19FD102J03
034-177	C.D.CD15FD101J03
034-181	Sangamo D155E470JO
034-182	C.D.CD15ED560J03
034-216	C.D.CD19FD182J03
034-217	Sangamo D151F911JO
034-283	C.D.CD15F821J300
034-291	Sangamo D195F162JO
034-319	C.D.CD15FD271J03
034-358	CM15D221JN3
034-386	Sangamo D151F911JO
034-507	" D193F562JO
034-928	" D195F621JO
034-938	" D155F111JO
034-960	C.D.CD19F502J300
034-970	C.D.CD19FD152J03
034-994	Sangamo D195F252JO
035-598	G.E.65F12AC 473
035-734	G.E.6510AC103
035-893	G.E.65F13AC104
037-117	Sprague 109D157X0030T2
037-393	U.S.Semcor TSD-1-35-105
037-398	Components. Inc..TSD1-6-106
037-446	" " TSD2-15-156
037-450	" " TSD1-25-224
037-451	" " TSD5-20-686
037-452	" " TSD2-6-396

Table 7-1. Cross Reference Part Number List (Cont.)

AMPEX PART NUMBER	MILITARY OR COMMERCIAL PART NUMBER
CAPACITOR (Cont.)	
037-486	Components. Inc., TSD5-25-226
037-494	" " TSD3C-6-476
037-495	" " TSD1-25-684B
037-589	" " TSD2C-6-276
037-654	Sprague 196D335X0035FB
037-788	U.S.Semcor TSD1-15-475
037-790	" " TSD1-20-225
037-791	" " TSD1-35-474
038-011	Elmenco 315 (TY.30)
055-069	TRW 608
055-102	G.E. 75F1R1C562
055-103	G.E..75F1RC682
055-104	G.E. 75F1R1C822
055-106	G.E.75F3R1A104
055-108	G.I. 117E474M
055-157	G.E. 75F2R5A104
055-160	G.E. 75F1R5A153
055-164	G.E. 75F1R5A222
055-167	G.E. 65F10AC332
055-192	G.E. 75F6R5A474
055-222	G.E. 75F1R5C472
055-258	G.E. 75F1R1C103
055-268	G.E. 75F1R5A223
055-385	MIDWEC 3X1-104.5C
055-491	G.E. 75F2R5C104
055-492	G.E. 75F3R5C184
055-537	MIDWEC 301-393.5C
055-708	G.E. 75F3R2A104
056-021	Use 034-970
056-108	C.D.CD20F682J500

Table 7-1. Cross Reference Part Number List (Cont.)

AMPEX PART NUMBER	MILITARY OR COMMERCIAL PART NUMBER
CAPACITORS (Cont.)	
056-292	C.D. CD15F501J500
063-023	Sprague 30D156G050CB2
063-029	" 30D105G050BA2
063-040	" 30D106G015BA2
063-045	" 30D106G050CB2
CASTERS, SWIVEL	
082-036	Nutting Truck and Caster WB-30-4150-RC-RB
CLIP, LAMP	
310-105	Dialco 515-0051
435-069	Eldema Q-081-905
435-144	Augat. Inc. 6027-2A
CONNECTORS	
139-040	AMPHENOL 143-018-01-1007
139-041	" 143-018-01-1009
139-042	" 143-018-01-1014
139-057	" 143-018-01-1016
141-057	Winchester MRAC104-P-J6
143-008	MS3102A10SL-3P
143-009	MS3106A10SL-4S
143-010	MS3108B18-10S
143-250	Cinch-Jones. P-310-CCT-K
143-307	Winchester 8B365-929
143-308	" 8B24S
143-309	" 8B20D
143-841	Switchcraft 3501-FP
143-846	" 60KD4M
143-927	" 3501FR
143-956	Winchester SRM20SF0000

Table 7-1. Cross Reference Part Number List (Cont.)

AMPEX PART NUMBER	MILITARY OR COMMERCIAL PART NUMBER
CONNECTORS (Cont.)	
144-003	Cannon XLR-3-11C
144-058	Jones S-310-CCT-L
144-093	Hubbell 7484
145-009	Cannon XLR-3-12C
145-013	H.B.Jones P-308-CCT-L
145-057	Hubbell 7102
145-243	Winchester MRAC75-P-J6
146-002	Jones S-315-AB
146-175	Hubbell 5258
146-263	Winchester MRAC26-S-J6
146-979	Cinch-Jones S324-AB
146-998	Cannon XLR-3-31
147-011	H.B.Jones P-306-AB
147-012	Cinch P-302-AB
147-053	Hubbell 5266
147-079	Hubbell 7486
147-265	Cannon FK-37-32S
147-999	Cannon XLR-3-32
148-015	Switchcraft 11
166-088	Molex Prod. 1625-9P-1
166-092	" " 1800-221
168-082	Precision Conn. 64A-062-18
169-077	Winchester MRAC Series 100-1016P
169-078	" MRAC Series 100-1020P
169-084	" MRAC 26-P-J6
169-117	" MRAC Series 100-1016S
169-143	" MRAC 100-1022P
169-144	" MRAC 100-1022S
169-818	" 3386
171-008	AMP 31777

Table 7-1. Cross Reference Part Number List (Cont.)

AMPEX PART NUMBER	MILITARY OR COMMERCIAL PART NUMBER
CONNECTORS (Cont.)	
171-009	AMP 320555
CRYSTALS	
017-093	JTEDS---CR-50A/U
DIODES	
013-172	Motorola CD32
013-198	1N4385
013-257	Motorola CD32
013-450	1N961B
013-599	1N914
013-600	Motorola MDA942-3
013-603	" CD467
013-650	I.T.T.CD498
013-678	1N4385
013-712	U.S.SEMCOR LMZX-24.0A
FAN	
591-053	Rotron. Whisper Venturi Fan
FUSES	
070-002	Littelfuse 313003
070-021	" 313004
070-026	" 313.500
070-075	F02B125V1-1/2A
FUSE HOLDER	
085-001	Littelfuse 342012

Table 7-1. Cross Reference Part Number List (Cont.)

AMPEX PART NUMBER	MILITARY OR COMMERCIAL PART NUMBER
HEATSINK, TRANSFORMER	
014-706	Wakefield ENG. NF 204
INDUCTORS	
051-342	J.W. Miller 9220-62
540-030	Nytronics WEE 330
540-055	Stanwyck, Dink-10, 000
INTEGRATED CIRCUITS	
586-102	Motorola MC724P
586-150	" MC791P
KEY, POLARIZING	
169-818	Winchester 3386
KNOB	
230-008	Harry Davies 1400
LAMPS	
060-011	G.E. 1829
060-019	MS25237-327
060-070	G.E. 335
060-079	Dialite 507-3917-0331-500
132-099	Eldema CF03-ACS-1762
132-100	" CF03-RCS-1762
MOUNTING KITS, TRANSISTOR	
150-142	Motorola MK-15
PADS, TRANSISTOR	
280-131	Milton Ross 10160

Table 7-1. Cross Reference Part Number List (Cont.)

AMPEX PART NUMBER	MILITARY OR COMMERCIAL PART NUMBER
PADS, TRANSISTOR (Cont.)	
280-998	Delbert Blinn TP501
PHONE JACK	
148-015	Switchcraft 11
PLUNGER, SPRING	
310-591	VlierM54N
RECTIFIERS	
013-603	Motorola CD467
580-999	Radio Receptor C44S2B1S1G
RELAYS	
020-034	Phillips-Advance Control 33BDC-24-3C-13
020-035	Phillips-Advance Control 33BDC-24-4C-13
020-036	Phillips Advance Control 33BDC-24-5C-13
020-133	C.D.A104D1-110V
020-144	C.D.A104D0-24V
020-394	Omega 200-2CY-24DC
020-507	Potter and Brumfield GM11D
020-592	Phipps Precision OF-1A-24
020-988	Potter and Brumfield PW5LS
RESISTORS	
040-038	Ohmite 0960B
040-996	Tru-Ohm AR-100
041-006	RC20GF621J
041-009	RC20GF182J
041-010	RC20GF202J

Table 7-1. Cross Reference Part Number List (Cont.)

AMPEX PART NUMBER	MILITARY OR COMMERCIAL PART NUMBER
RESISTORS (Cont.)	
041-012	RC20GF432J
041-014	RC20GF103J
041-015	RC20GF273J
041-016	RC20GF223J
041-024	RC20GF114J
041-028	RC20GF334J
041-029	RC20GF474J
041-031	RC20GF105K
041-032	RC20GF100K
041-033	RC20GF220K
041-034	RC20GF470K
041-035	RC20GF560K
041-037	RC20GF820K
041-038	RC20GF101K
041-040	RC20GF221K
041-041	RC20GF271K
041-042	RC20GF331K
041-044	RC20GF471K
041-045	RC20GF561K
041-046	RC20GF681K
041-047	RC20GF821K
041-048	RC20GF102K
041-049	RC20GF122K
041-050	RC20GF152K
041-052	RC20GF222K
041-053	RC20GF272K
041-054	RC20GF332K
041-055	RC20GF392K
041-056	RC20GF472K
041-058	RC20GF682K

Table 7-1. Cross Reference Part Number List (Cont.)

AMPEX PART NUMBER	MILITARY OR COMMERCIAL PART NUMBER
RESISTORS (Cont.)	
041-059	RC20GF822K
041-060	RC20GF103K
041-061	RC20GF123K
041-062	RC20GF153K
041-064	RC20GF223K
041-065	RC20GF273K
041-067	RC20GF393K
041-068	RC20GF473K
041-069	RC20GF563K
041-070	RC20GF683K
041-072	RC20GF104K
041-073	RC20GF124K
041-075	RC20GF184K
041-076	RC20GF224K
041-078	RC20GF334K
041-080	RC20GF474K
041-081	RC20GF564K
041-082	RC20GF684K
041-088	RC20GF335K
041-143	RC32GF681K
041-147	RC32GF122K
041-158	RC32GF103K
041-200	RC42GF561K
041-240	RC32GF151K
041-241	RC20GF151K
041-245	RC20GF102K
041-254	RC20GF153J
041-257	RC20GF181K
041-271	RC20GF270K
041-273	RC20GF271J

Table 7-1. Cross Reference Part Number List (Cont.)

AMPEX PART NUMBER	MILITARY OR COMMERCIAL PART NUMBER
RESISTORS (Cont.)	
041-278	RC20GF272J
041-316	RC20GF242J
041-325	RC07GF304K
041-345	RC20GF510J
041-353	RC32GF162J
041-361	RC20GF752J
041-362	RC20GF361J
041-373	RC20GF101J
041-377	RC20GF135J
041-404	RC20GF511J
041-408	RC07GF103J
041-409	RC07GF153J
041-410	RC07GF102J
041-412	RC07GF472J
041-427	RC07GF331J
041-431	RC07GF154J
041-436	RC07GF183J
041-455	RC20GF622J
041-475	RC20GF302J
041-477	RC20GF133J
041-482	RC07GF123J
041-529	RC20GF203J
041-533	RC20GF240J
041-546	RC20GF134J
041-550	RC07GF302J
041-578	RC32GF121K
041-625	RC07GF124K
041-626	RC07GF104K
041-630	RC07GF223K
041-631	RC07GF153K

Table 7-1. Cross Reference Part Number List (Cont.)

AMPEX PART NUMBER	MILITARY OR COMMERCIAL PART NUMBER
RESISTORS (Cont.)	
041-633	RC07GF103K
041-635	RC07GF682K
041-636	RC07GF472K
041-637	RC07GF392K
041-638	RC07GF332K
041-641	RC07GF391K
041-666	RC07GF120J
041-742	RC07GF361J
041-744	RC07GF132J
041-753	RC07GF623J
041-758	RC07GF204J
041-760	RC07GF274J
041-761	RC07GF304J
041-833	RC32GF751J
041-898	RC20GF115J
041-968	RC07GF105K
041-979	RC07GF102K
043-156	Ohmite 1506
043-809	" 1502
043-839	PRC 54A
044-002	A.B.JA1N056S253UZ
044-015	A.B.JA1N056S104AZ
044-233	RC42GF103K
044-285	A.B.RP252U
044-370	Centralab YAH004-22F
048-128	I.R.C.CEC
048-142	" "
048-404	" "
048-758	" "
048-794	" "

Table 7-1. Cross Reference Part Number List (Cont.)

AMPEX PART NUMBER	MILITARY OR COMMERCIAL PART NUMBER
RESISTORS (Cont.)	
048-813	I.R.C. CEC
048-880	" "
049-005	RC07GF272K
049-008	RC07GF470K
049-333	RC07GF101K
049-335	RC07GF182K
049-355	RC07GF224K
049-356	RC07GF474K
049-365	RC07GF154K
049-371	RC07GF333K
049-372	RC07GF473K
049-374	RC07GF184K
049-376	RC07GF151K
049-396	RC07GF501K
049-514	RC07GF684K
049-516	RC07GF564K
049-517	RC07GF221K
049-524	RC07GF274K
049-527	RC07GF222K
049-528	RC07GF224K
049-569	RC07GF225K
057-208	I.R.C. CCA
057-457	" CEC
057-694	" "
058-060	C.T.S. UHT-201
058-386	Polaris Electr. LDR-C1
058-419	Clarostat 380/AE-21
059-016	I.R.C. PW5A
059-017	INTL RESISTANCE PW5A
062-038	I.R.C. CEC

Table 7-1. Cross Reference Part Number List (Cont.)

AMPEX PART NUMBER	MILITARY OR COMMERCIAL PART NUMBER
RETAINING RINGS	
430-003	Truarc 5100-18-C
430-068	" 5133-15-S
SOCKET, LIGHT	
132-098	Eldema 2M
SOCKET, RELAY	
150-119	Potter and Brumfield 27E006
150-256	Parelco, Inc. A10-2
150-992	Potter and Brumfield 27E006
SOLENOIDS	
022-148	Ledex 810-380-538
SPRING, HOLDDOWN	
020-492	Potter and Brumfield 9KH3
020-584	Parelco P28-2
SWITCHES	
120-008	Cutler Hammer 7615K2
120-062	Unimax 2HBT 215-1
120-074	Microswitch 2PB12
120-139	Continental Wirt SW-326
120-144	Microswitch Mtg. Bar. 2B3
120-145	Microswitch 2D26
120-146	" Op. Ind. 2C3
120-255	" 2A57
120-448	Licon 01-145530
120-607	Acro Div ICMD1-2AXX-77
120-829	Switchcraft 27312L

Table 7-1. Cross Reference Part Number List (Cont.)

AMPEX PART NUMBER	MILITARY OR COMMERCIAL PART NUMBER
SWITCHES (Cont.)	
120-848	Int. Elect Exchange 4XD-17, 5DV-BL-2U-OA
120-849	" " 1XD(D-0003-001) DVBL2UOA
120-852	Switchcraft 27312
120-884	Cherry Elec. Prod. E22-50HX
120-980	Licon 01-210004
120-981	Licon 01-210005
121-035	Microswitch 2B7
122-016	OAK 159016-23
TERMINAL STRIPS	
180-016	Cinch-Jones 8-170
180-026	" " 51
180-027	" " 51B
180-073	" " 10-141W/MS-10-141
180-075	" " 2-140-3/4W/MS-2-140
180-089	Cinch 332-14-07-153
180-153	" Jones 2-141
180-226	" " 2-140
180-256	Permonite 8020-5
180-422	Kulka 600-3/4 ST-3
185-009	Cinch-Jones 6-161-L
185-010	" " 6-161-R
185-139	Kulka 650-L-2
185-140	" 650-R-3
TERMINALS, QUICK DISCONNECT	
187-036	Molex Prod. 1560
187-037	" " 1561

Table 7-1. Cross Reference Part Number List (Cont.)

AMPEX PART NUMBER	MILITARY OR COMMERCIAL PART NUMBER
THYRISTOR	
580-091	Triac 40525
TRANSISTORS	
014-247	2N2219
014-329	2N2102
014-587	R.C.A.40250
014-590	2N3053 RCA
014-611	Fairchild 2N3638
014-652	2N3906
014-653	2N3901
014-698	2N5089
014-704	2N398A
014-723	2N4037 RCA
014-742	R.C.A. 40409
014-757	T.I..2N3819
014-784	2N5210
014-796	R.C.A. 2N4348
014-820	Delco DTS-410
014-969	G.E. 2N5305
580-135	2N4104T1

APPENDIX

MOTOR DRIVE AMPLIFIER
IERE MODEL 6827

APPENDIX

MOTOR DRIVE AMPLIFIER ACCESSORY *

IERE MODEL 6827

A-1 DESCRIPTION (See Table A-1)

A-2 The Motor Drive Amplifier provides two symmetrical square wave outputs in quadrature. The two output voltages are 270 volts peak-to-peak amplitude and each has a 75 volt-ampere drive capability. The amplifier is intended for use as a variable frequency driver for two-phase synchronous motors.

A-3 The output frequency is variable, via front panel control of an internal oscillator, from 45 to 65 Hz with no deviation in the 90° output phase relationship; in addition, two fixed preset-frequency positions are provided by the LOCAL OSCILLATOR mode switch. A Line Lock mode of operation is also provided which establishes the outputs at the line frequency of 60 Hz.

A-4 The amplifier may also be driven from an external frequency source, provided that the source is four times higher than the desired output frequency level of 45 to 65 Hz. Electronic protection is provided against inadvertent amplifier overload and/or loss of proper drive signal.

Table A-1. MDA Specifications

CHARACTERISTIC/TITLE	DATA
Output Voltages	Two outputs in quadrature (90°) 270 volts peak-to-peak ±10%, symmetrical square waves
Output Power	75 volt-amperes, maximum, each output
Power Factor	0.7 maximum
Output Frequency	45 Hz to 65 Hz
Front Panel Controls	Power - on/off
	MODE SELECT switch for: 1. Line Lock 2. Local Oscillator 3. External Signal
	LOCAL OSCILLATOR switch to select the following (with MODE SELECT switch set at Local Oscillator):

* For Latest Information, Refer to the Manual for Model 6827
Industrial Electronic Research Enterprises, 2700 Bay Road, Redwood City, California 94063, Phone 415-366-8281

Table A-1. MDA Specifications (Continued)

CHARACTERISTIC/TITLE	DATA
	1. +1/2 Tone (65 Hz) 2. Variable 3. -1/2 Tone (55 Hz) OSCILLATOR FREQUENCY control, with indicated range of 45 to 65 Hz (operational when local oscillator switch is set at VARIABLE)
Local Oscillator Stability	Within ±1%
External Input Drive Requirements	0.5 to 10 volts, peak-to-peak sine or square wave. Frequency must be four times the desired output frequency level of 45 to 65 Hz (i.e., input frequency range of 180 to 260 Hz)
Power Input	115 volts ±10%, 60 Hz
Protection	Overload and open-circuit protection provided, as well as protection against inadequate input-signal amplitude or frequency. If limits are exceeded, the amplifier drive circuitry is disabled (to reset, momentarily interrupt the power line input).
Dimensions	3.5 inches high by 17 inches wide by 11 inches deep, including connectors (mount in standard 19-inch rack).

A-5 CONNECTING AND SETUP

A-6 Connect the load, at connector J3 on the rear panel and AC IN connector to J1, then select the desired mode of operation with the MODE SELECT switch on the front panel.

A-7 If the unit is to be driven from an external signal source, ensure that the proper input signal is present at the EXT IN connector (J2) on the rear panel, then actuate the POWER ON switch (the input frequency must have a 4:1 relationship to the desired output frequency).

A-8 OPERATION (Figure A-1)

A-9 To drive the amplifier in the LOCAL OSCILLATOR mode, set the frequency as desired by the LOCAL OSC switch. For other than +1/2 TONE (65 Hz) or -1/2 TONE (55 Hz) operation, set the LOCAL OSC switch at VARIABLE and adjust the OSC FREQ control to the desired operating frequency. In LINE LOCK operating mode, the output frequency of the amplifier is phase-locked to the 60-Hz line.

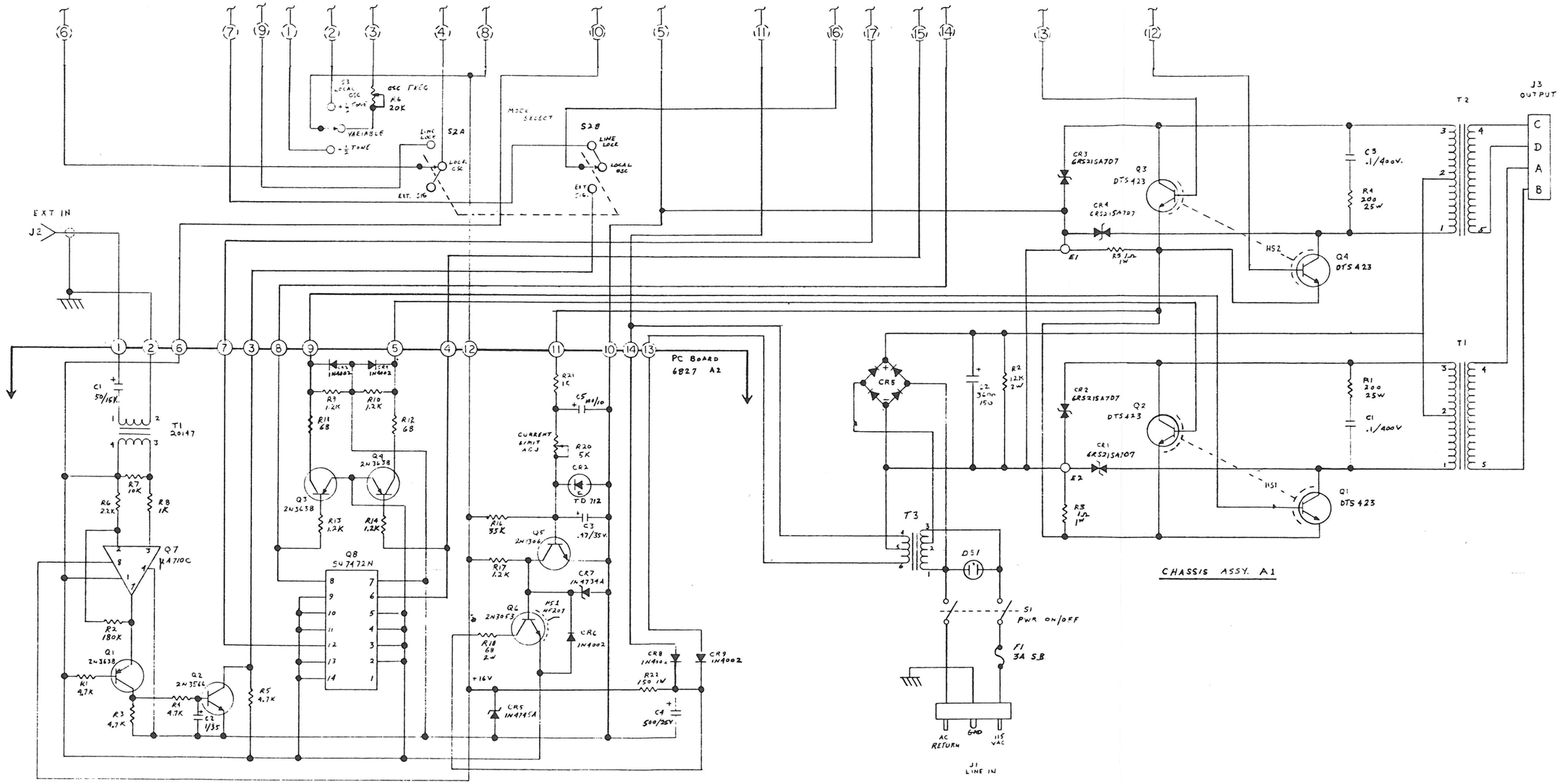


Figure A-1. Motor Drive Amplifier
(Sheet 1 of 2)

NOTE:

1. INTERPRET THIS DWG PER SPEC MIL-D-1000 & MIL-STD-100 AND ALL STANDARDS & SPECIFICATIONS CONTAINED THEREIN.

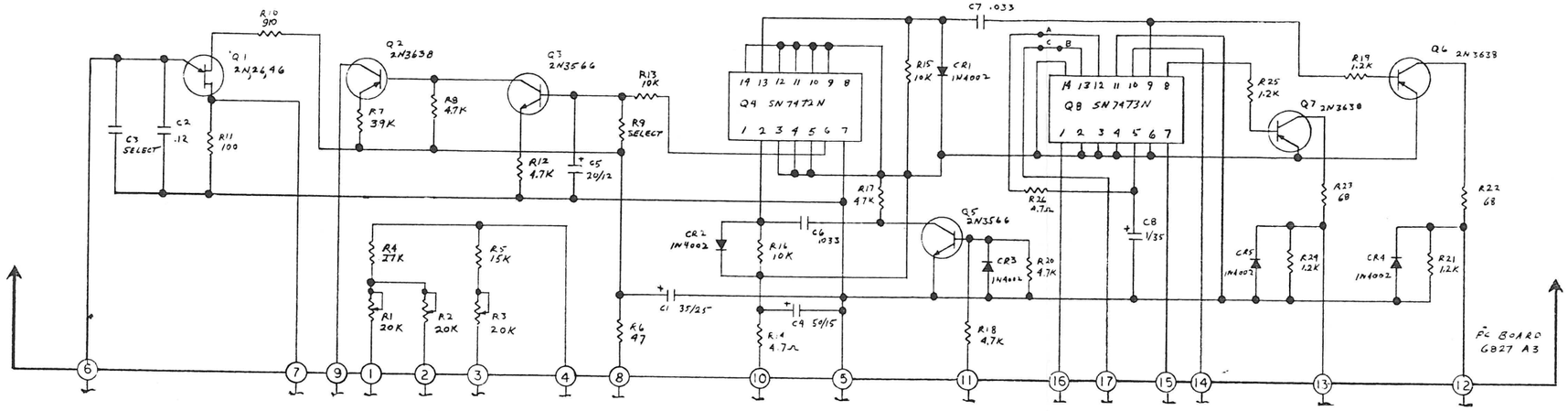


Figure A-1. Motor Drive Amplifier
(Sheet 2 of 2)

A-10 OVERLOAD AND RESETTING

A-11 When the protection circuitry actuates, due to overload or improper input signals, there will be no output. Reset the unit by momentarily interrupting the line power.

WARNING

THE CIRCUITRY IN THE ENCLOSURE IS REFERENCED TO THE 115-VOLT LINE. THE UNIT SHOULD BE OPENED ONLY BY QUALIFIED SERVICE PERSONNEL.

A-12 SERVICING

A-13 Use standard audio troubleshooting techniques to isolate faults to a certain stage or component. Check the schematic diagrams as an aid in locating malfunctions. Check that all wiring is sound, not contacting chaffing parts, and connectors are correctly mated.

WARNING

1) THE POWER SUPPLY FOR THE OUTPUT TRANSISTORS IS DIRECTLY FROM THE 115-VOLT LINE VOLTAGE. USE EXTREME CAUTION IN SERVICING OR ADJUSTING THIS EQUIPMENT.

2) THE LOW-LEVEL CIRCUITRY SHARES A COMMON RETURN WITH THE POWER AMPLIFIER STAGE, SO IT ALSO IS AT POWER-LINE POTENTIAL RELATIVE TO CHASSIS GROUND. USE ONLY TEST EQUIPMENT THAT HAS TRUE FLOATING INPUTS WHICH ARE ISOLATED FROM GROUND.

A-14 THEORY OF OPERATION (Refer to Schematic)

A-15 The Motor Drive Amplifier is basically two push-pull switching-type power amplifiers driven by square wave signals. The output power transformers are operated in a non-saturated mode to minimize RFI and to enhance efficiency.

A-16 The drive signals to the two power amplifiers are phased at 90° from each other. Phasing is near absolute and thus independent of frequency. This is accomplished by halving a frequency source equal to four times the desired operating frequency in a flip-flop circuit (half of Q8, in A3) which establishes absolute symmetry. The output of flip-flop A2 toggles two more flip-flops (the other halves of Q8 in A3 and Q8 in A2) in anti-phase to provide output signals equal to the desired frequency and phased 90° apart. These output signals are then fed to the driver stages (Q3 and Q4 of A2, and Q6 and Q7 of A3) which in turn supply required base drive to the final power transistors (Q1, Q2, Q3 and Q4 of A1).

A-17 When operating the amplifier from a times-four external frequency source (connected to J2), the signal is processed by a regenerative comparator circuit (Q7 of A2) into a square wave of constant amplitude. This square wave drives the toggle input of Q8 of A3, via the interfacing stages (Q1 and Q2 of A2) and the MODE SELECT switch S2B.

A-18 When operating in the LOCAL OSCILLATOR or LINE LOCK mode, the times-four frequency source is provided by the unijunction oscillator stage (Q1 of A3) via the MODE SELECT switch S2B. In the LOCAL OSC mode, timing of the unijunction stage is preset by R1, when in the -1/2 TONE position of the LOCAL OSC switch (S3); or by R2, when in the +1/2 TONE position.

In the VARIABLE position, timing is set by the OSC FREQ control, which is calibrated by R3 of A3.

A-19 In the LINE LOCK position of the MODE SELECT, the frequency of the unijunction is determined by the collector current of Q2 of A3 through the timing capacitors C2 and C3. The magnitude of Q2 collector current is a function of the base voltage of Q3, which is provided by the output of the phase detector Q4. Q4 functions as an RS flip-flop which is set by a pulse from the 60-Hz line-reference shaping amplifier Q5.

A-20 Reset is provided by a pulse from Q8 which represents the phase of the amplifier output. The circuit-constants of amplifiers Q2 and Q3 are chosen so a Q4 output-duty cycle of 50% provides an average voltage to the base of Q3 (via filter network R13-C5) which is the proper magnitude for a 60-Hz amplifier output frequency. When the oscillator frequency tends to increase, Q4 is reset sooner, which reduces the average voltage at the base of Q3; this results in less collector current from Q2, thus decreasing oscillator frequency. Conversely, if the oscillator frequency tends to decrease, the current from Q1 increases, which increases the oscillator frequency.

A-21 The thyrectors (CR1, CR2, CR3, and CR4 of A1) provide voltage spike-clamping for protection of the output transistors. The network comprised of R1-C1 and R4-C3 affords further protection for the output transistors (1) by absorbing energy fed back from a reactive load or (2) when the amplifier is operated with no load. The voltage for the output stages is derived from the 115-volt line via autoformer T3 and fullwave bridge CR5 of A1, and the filter-capacitor component C2.

A-22 Low-level power is provided by transformer T3 of A1. The +16 volts is set by the zener diode CR5 and the +5 volts is supplied from the voltage-setting emitter follower Q6 of A2.

A-23 Circuit overload protection is accomplished by sensing the current in the output transistor emitters by the proportional voltage across R3 and R5 of A1. When the current reaches approximately 1.5 amperes, the voltage developed across R3 and R5 supplies peak-point current into tunnel diode CR2, via R20 and R21 of A2. When CR2 switches to high voltage state, Q5 conducts and drops the base voltage of Q6 to near zero. The +5 volts developed at the emitter of Q6 then drops to zero, and the drive voltage to the output transistors is turned off. Sustaining current for the tunnel diode is supplied by R16 from the +16 volt supply which ensures latch-up. When the fault is corrected, the tunnel diode is reset by momentary power interruption.

A-24 IN-PHASE OPERATION MODIFICATION

A-25 Provision is made for modifying the amplifier to provide single-phase dual outputs rather than the normal two-phase quadrature output. This is accomplished by strapping point C of A3 (near Q8) to point A instead of to point B. The output divider circuits are then driven in phase.

A-26 PARTS LIST

A-27 A parts list for the MDA accessory is given on page 9-93 and 9-94.