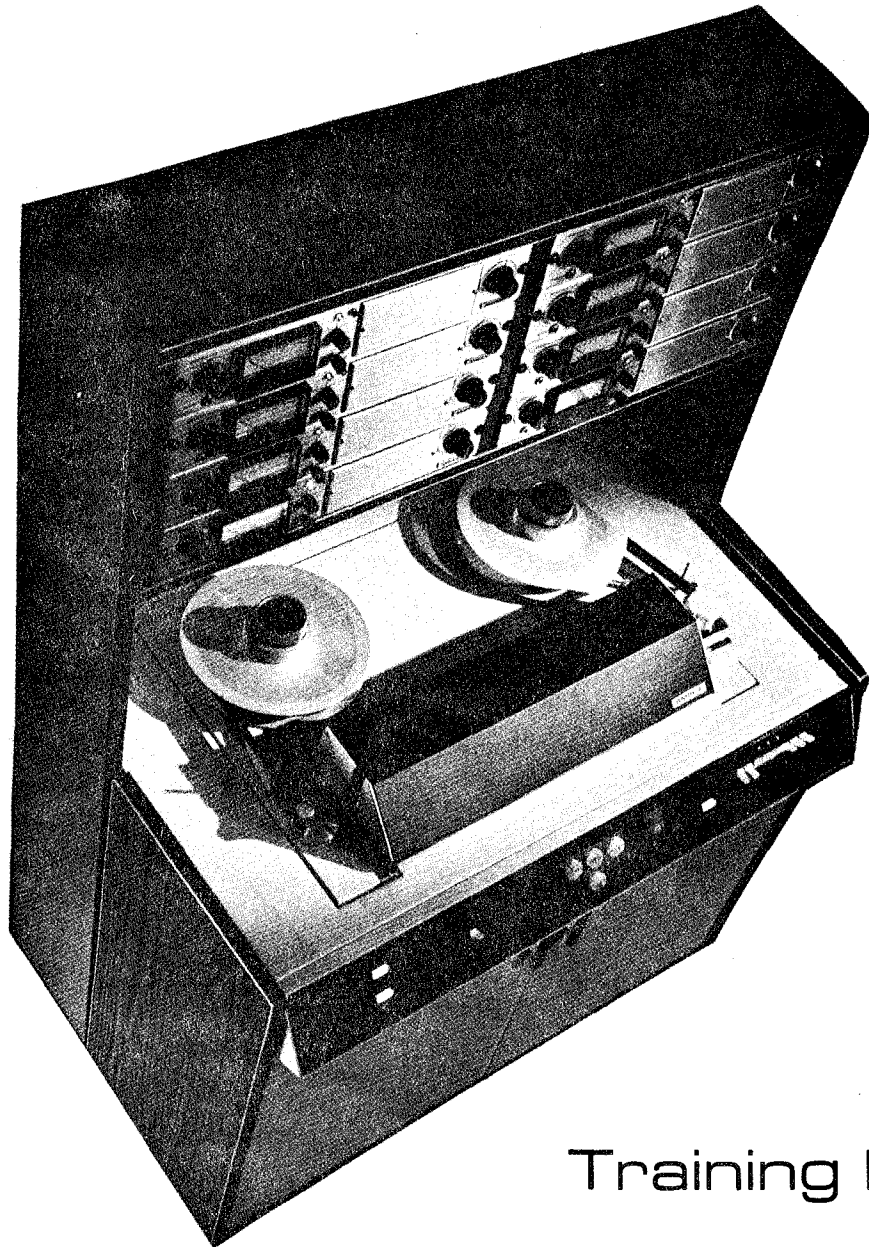


AMPEX MM-1000 MASTER-MAKER SERIES



Training Manual

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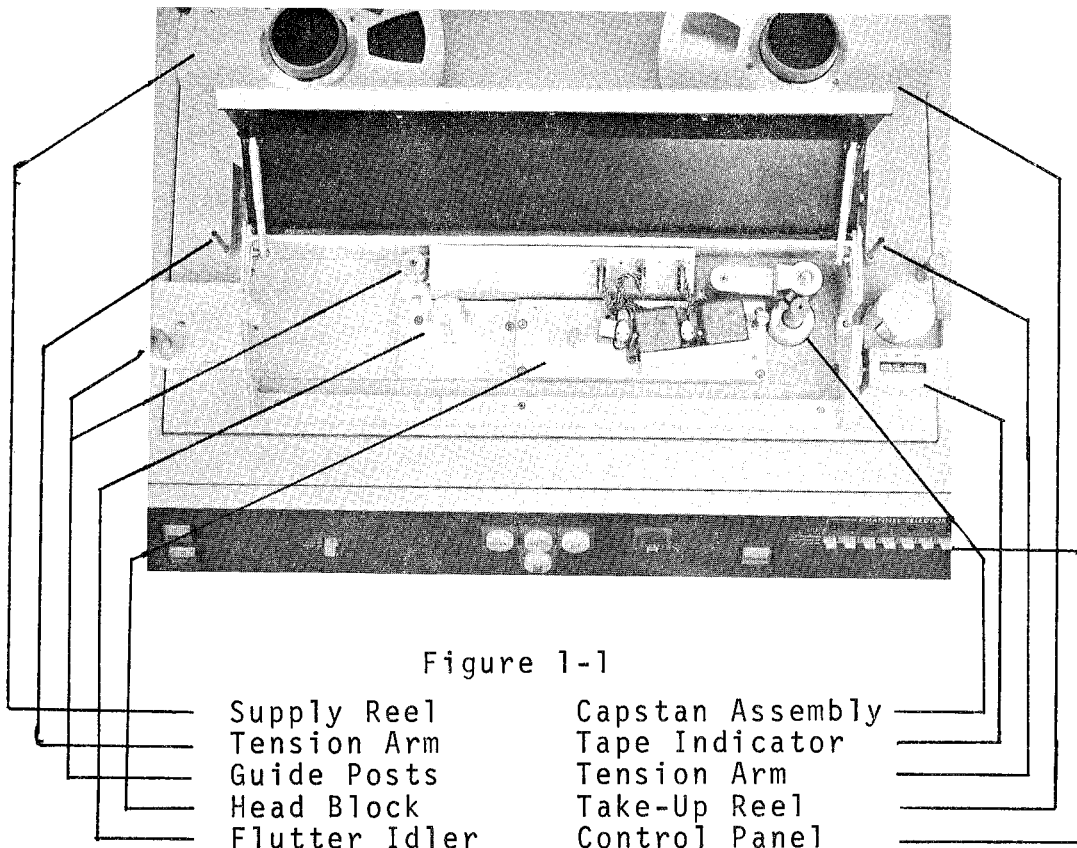
SECTION I
DESCRIPTION

1.1 GENERAL

The MM-1000, Master Maker, Series of recorders is designed to provide all master recording studios, television studios and motion picture production studios with a complete multi-channel recording and reproducing facility. The MM-1000 is available in 8, 16 or 24 channel configurations all, with solid state electronics for maximum quieting. Television audio, at its most spectacular, may now be recorded synchronously with video recorders, eliminating the shaky dependence upon a single audio track. Artists or musicians who were not present at any other recording session can be added and mixed at any convenient time or complete plays can be assembled, one actor at a time as, all tracks have the same base-time reference through the "Sel-Sync" system. Actual performance time can be greatly shortened at any given session as mixing, balance and blending can be accomplished subsequently by the director and engineer. All channels have Sel-Sync (Selective Synchronization) to utilize record heads as playback devices thus enabling the artist to listen to any other prerecorded track while recording other tracks, all having an exact time relationship. No switching transients are present when switching Sel-Sync in or out.

1.2 TAPE TRANSPORT (FIGURE 1-1)

The tape transport was designed specifically for the heavy duty of transporting wide tape and will handle one inch or two inch tape smoothly, well within the confines of its specifications. A rigid die cast base is used to mount all components of the tape transport to assure machine-precision movement of the tape. Mechanical features allow changing from one tape width to the other in a matter of a few minutes.



The transport speeds are 7-1/2 and 15 IPS. Speed selection is made on a single push switch having a lighted display of the speed being used. Equalization is automatically switched at the same time. Machines with speeds of 15 and 30 IPS are available upon request.

Each turntable is driven by its own inductive motor with electrically controlled tensions. Brakes are electrical-mechanical. Turntables will accept NAB hubs only and will accommodate reels or pancakes of up to 14" in diameter. Motion sensing is included to insure smooth transition from one operating mode to another. Automatic tape lifters extend during fast mode operation; defeatable for fast editing. An optional motor drive amplifier can be used to achieve special effects or to change pitch.

Scrape flutter is practically non-existent due to jeweled bearing scrape flutter idlers (Figure 1-2). The record and reproduce heads are completely enclosed in MU metal shields to exclude external signals. Head shields open completely for cleaning and deguassing. The entire head and capstan assembly is enclosed in a lift top housing to minimize dust accumulation.

SCRAPE
FLUTTER
IDLERS

TAPE
LIFTERS

HEAD
SHIELDS

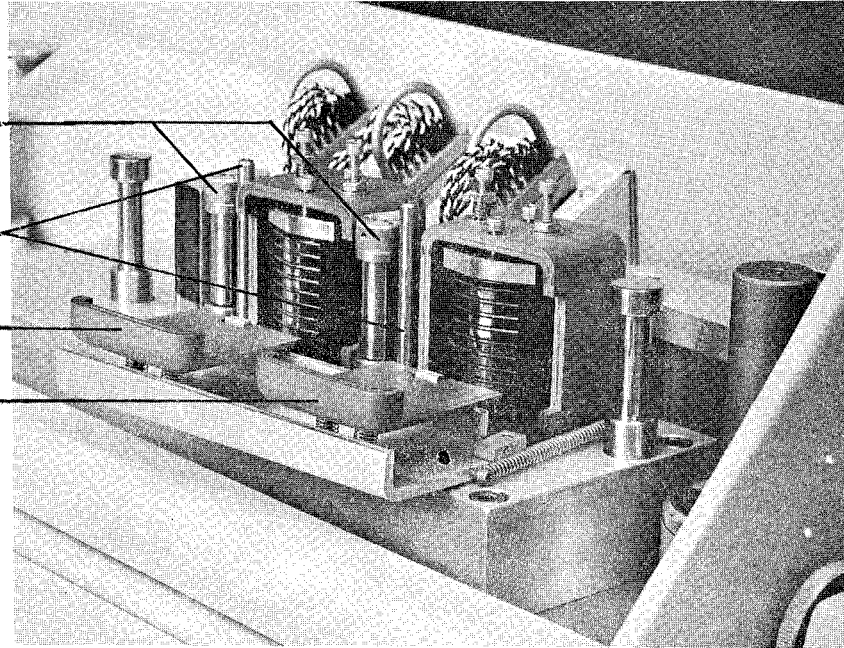


FIGURE 1-2

The tape path also includes a viscous damped flutter idler and two silicone damped tape tension arms. Tension arms, (Figure 1-1), when moved to their respective outboard positions, release the brakes on the adjacent turntable to facilitate rotating the table by hand. Dash pots ease the return to neutral when the arms are released. (Figure 1-3). A tape position index reads hours, minutes and seconds with repeat accuracy of $\pm 0.1\%$ at 15 IPS.

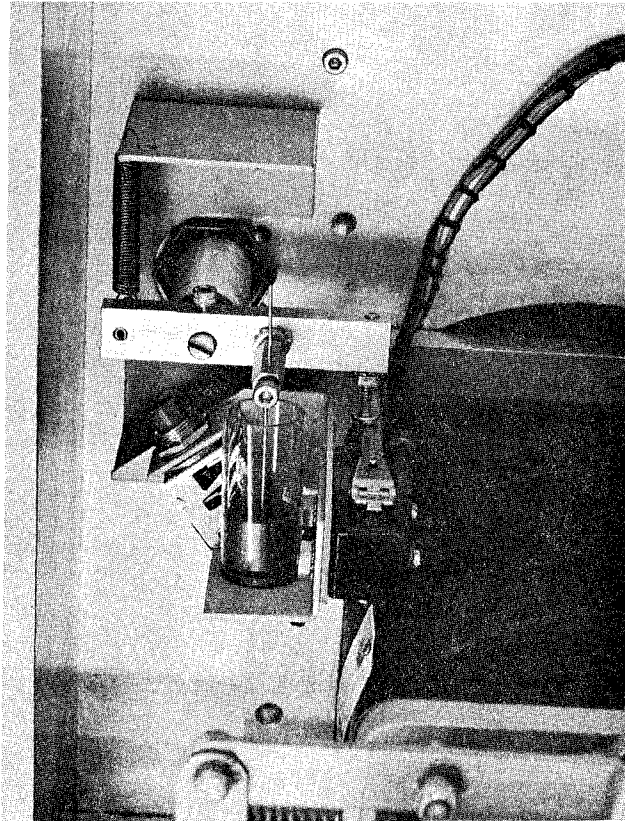


FIGURE 1-3
DASH POT ASSEMBLY

1.3 RECORD/REPRODUCE ELECTRONIC UNIT (FIGURE 1-4)

One record/reproduce electronic unit is required for each channel. The unit consists of an electronic chassis, switching, and three plug-in printed circuit modules for record, reproduce and bias amplification. A modular plug-in circuit board for equalization (NAB or CCIR) is an appendage to the reproduce module. Alignment points are accessible from the front of each unit and are concealed by one cover plate. The record/reproduce units are interchangeable between electronic units, in whole or in part, to minimize down time.

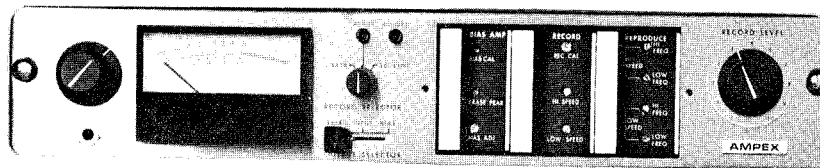


FIGURE 1-4
ELECTRONIC UNIT

A single bias oscillator supplies all channels, eliminating any possibility of interchannel beats. Bias and erase frequency is 150 KHz.

Front panel controls are Record Level, Reproduce Level, Record Selector and Output Selector. A large VU meter monitors all the functions of the unit.

Cabling is extended from the rear of each electronic unit to a central patch panel, lower right hand rear of console, for easy access.

Internal strapping provides either +4 dBm or +8 dBm output levels, easily changeable. The machine is shipped with a dummy plug in the accessories socket providing 100 K Ω unbalanced bridging input for each electronic unit. A 20 K Ω balanced line input is also provided for each electronics unit.

1.4 CONFIGURATIONS (FIGURE 1-5)

The MM-1000 comes with three basic electronic configurations: 8, 16, 24. Two console configurations allow maximum flexibility. The expandable version contains 8 channels in

the console overbridge. In 16 channel versions the additional 8 are housed in the console base. For 24 channel set ups 8 more channels are housed in a side rack (Figure 1-5A). A single console 24 channel version is also available (Figure 1-5B).

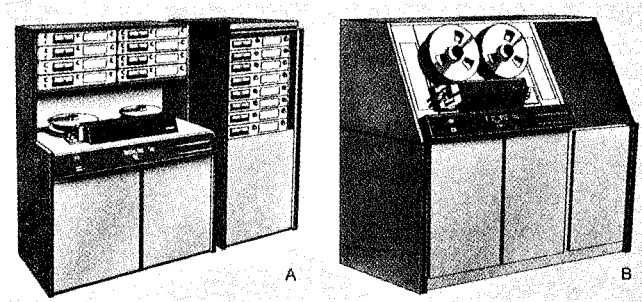


FIGURE 1-5
CONSOLE CONFIGURATIONS

1.5 HEAD ASSEMBLY (FIGURE 1-2)

Heads are mounted on a rigid machine milled block to retain alignment and allow quick head changes without disturbing alignment. Tape guides and scrape flutter idlers are also mounted on the head block. Grip handle plugs are used for electronic hook up of heads.

TABLE 1-1
SPECIFICATIONS

Tape Widths	1".....8 track 2".....16 or 24 track
Tape Speeds	7.5 & 15 IPS (15 & 30 IPS, 1" or 2" available on special order)
Reel Size	NAB hub only up to 14" diameter
Inputs	100K ohms unbalanced. Convertible to 20K ohm balanced with supplied bridging transformer. Accepts line levels from -17 dBm to produce operating level.
Outputs	600 ohms balanced or unbalanced with nominal output levels of +4 dBm or +8 dBm.
Equalization	Automatic switching with speed change. Unit shipped with NAB plug-in equalization circuits; CCIR plug-in circuits are available.
Electronics	All electronics are solid state. Plug-in printed circuit boards for record, reproduce, equalization and bias amplifiers. Regulated power supplies: 24V DC 39V DC
Motion Sensing	Silicone damped relay system to smoothly regulate changes from one transport mode to another to preclude spilling or stretching tape. Switching directly from fast mode to play is permissible.

Overall Frequency	15 IPS <u>+2</u> db 30Hz - 18kHz 7.5 IPS <u>+2</u> db 30Hz - 15kHz
Signal to Noise Ratio	7.5 or 15 IPS. 60 db or better, 8 and 16 channel. Peak record level to unweighted noise (30 Hz - 18kHz). Includes bias, erase and playback amplifier noises. (Based on using Ampex 404 tape or equivalent.)
Third Harmonic Distortion	7.5 or 15 IPS. Below 1.1% at normal operation level.
Bias/Erase Freq.	150kHz. Selective erasure on each channel.
Flutter	15 IPS below 0.08% RMS 7.5 IPS below 0.1% RMS Percentage of total flutter is measured by the methods of the ASA 257.1-1-1954, in a band 0.52200 Hz, while reproducing an Ampex flutter test tape (flutter on test tape less than 0.03%).
Cross Talk	-50 db minimum, 8 & 16 channels at 500 Hz.
Timing Accuracy	<u>+0.1%</u> (<u>+1.8</u> seconds in 30 minute record time) for a reel of tape recorded, rewound and reproduced on the same unit; <u>+0.2%</u> from unit to unit.
Tape Position Index	Reads hours, minutes and seconds with repeat accuracy of <u>+0.1%</u> at 15 IPS.
Timing Reference	AC line is standard. Optional motor drive amplifier allows capstan to be driven from external frequency standard or from internal variable frequency oscillator.

Heads Eight track stacks have adjustable azimuth, zenith and height. 16 and 24 stack heads are fixed.

Start Time To full speed, 7.5 or 15 IPS in 0.5 seconds.

Rewind Time 1.4 minutes for 10.5 inch reel of 1.5 mil tape.

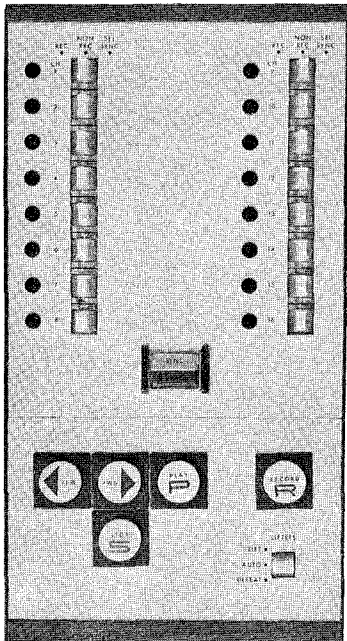
Power Requirements 117 volts AC, 60 Hz (50 Hz units with multi-tapped power input transformers are available on special order).

MM-1000-8 1.7 KVA Max.
MM-1000-16 1.9 KVA Max.
MM-1000-24 2.1 KVA Max.

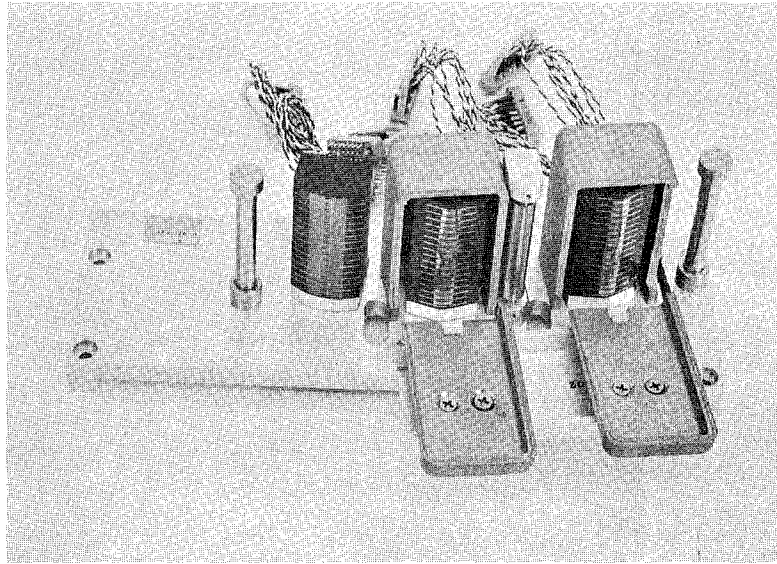
Dimensions Height: 42.5" plus overbridge, total 65 inches
8 or 16 Channels Width: 42.3"
Depth: 27.5"
Weight: 8 channel approximately 500 lbs.
16 channel approximately 630 lbs.

TABLE 1-2
ACCESSORIES
FIGURE 1-6

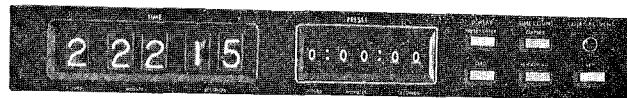
<u>DESCRIPTION</u>	<u>AMPEX PART NO.</u>
Capstan Motor Drive Amplifier	4940147-01
Remote Transport Control	4940148-01
Remote Sel-Sync System Control	
8 channel	4940149-01
16 channel	4940149-02
24 channel	4940149-03
Electronic Timer	
Timer Readout With Control Panel	1805179-01
Readout Only	1805325-01
Conversion Kits	
8 to 16 channels	4940150-01
8 to 24 channels	4940150-02
16 to 24 channels	4940150-03
Head Assemblies - Includes	
8 channel	4952309-01
Erase, Record & Reproduce	4952398-01
16 channel	
24 channel	4952518-01
Plug-In Units	
Microphone Preamplifier	4010066-01
Balanced Bridging Transformer	4580200-01
Line Matching Transformer	4580200-02
Extender Boards	
Reproduce	4020151-01
Record	4020152-01
Bias Amplifier	4020153-01
Power Supply	4020154
CCIR Equalization Module	4020269-03
Alignment Tape	
15 IPS NAB, Full Track	4690005-01
1" 15 IPS, 8 Track	4690006-01
7.5 IPS NAB, 8 Track	4690007-01
2" 15 IPS, 16 Track	4690018-01
15 IPS, 24 Track	4690019-01
Low Noise Mastering Tape	
10-1/2" NAB Reel 434 - 2" x 2500' x 1.5 mil	973311
(Other Configurations Available)	
444 - 2" x 3600' x 1.0 mil	973111



REMOTE CONTROLS



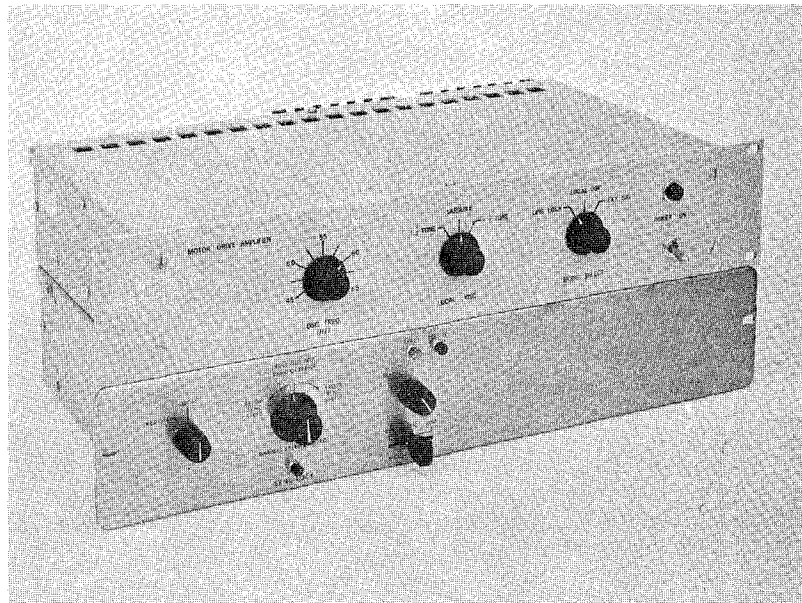
HEAD ASSEMBLIES



ELECTRONIC TIMER

FIGURE 1-6
ACCESSORIES

MOTOR
DRIVE
AMPLIFIER
AND
SYNC LOCK



SECTION 2 INSTALLATION

2.1 UNPACKING

2.1.1 General

Examine equipment for any signs of damage. Inventory the shipment with the packing list to determine that all items shipped have been received. Immediately report any damage or shortages to BOTH the Ampex representative and the transporting company.

Remove all packing materials and masking tape, rubber bands, etc., used to hold moveable parts during transit.

Inspect casters and caster mountings for damage and freedom of movement.

2.1.2 Console Mounted Equipment

Equipment ordered with the console is shipped factory mounted with cable connections completed. Make sure connectors are firmly in place. Plug-in electronic modules are in place behind a front cover plate on each electronic assembly. Remove plates and press in on module handles to ensure firm seating and contact.

2.1.3 Head Cable Connections

Head cables are of a special plug-in type. Press on the plug to ensure firm seating.

2.1.4 Unmounted Equipment

Equipment not ordered with consoles is shipped separately. Extra care should be taken during unpacking to guard against loss of any mounting hardware. MM-1000 electronic assemblies may also be mounted in a standard 19 inch rack; 3-1/2" vertical space is required for each unit.

2.2 CONNECTING UNITS

2.2.1 AC Connection

Units should not be connected to AC sources of less capacity than those shown in Specifications Table 1-1.

2.2.2 Signal Connections

Signal connections are located on the rear of the console, lower right, and are standard 3 pin XL receptacles with opposite genders for input and output. Mate the supplied connectors to them.

2.2.3 Balanced Line

Signal input and output connections are the same.

Balanced line: 2 conductors with shield:

Pin 1 = shield

Pin 2 = signal ground

Pin 3 = signal

This hook up results in:

1. The dummy (octal) plug shipped in the unit produces a 100K ohm unbalanced input.
2. The bridging transformer, supplied as a plug-in unit, will replace dummy plug to produce a 20K ohm balanced input.
3. The optional line matching transformer provides a balanced line input with a gain of approximately 14 db and input impedance of 600 ohms.

2.2.4 Unbalanced Line

An unbalanced line has only one conductor and a shield. Pins 1 and 2 of the XL connector should be strapped together to produce results shown in 2.2.3 with plug-in accessories.

2.2.5 Line Termination (Figure 2-1)

The two position switch is usually in the OFF position except for test and adjustment procedures. If, however, the equipment is used to drive a high impedance load, 2K ohms or more, the switch MUST be in the ON position.

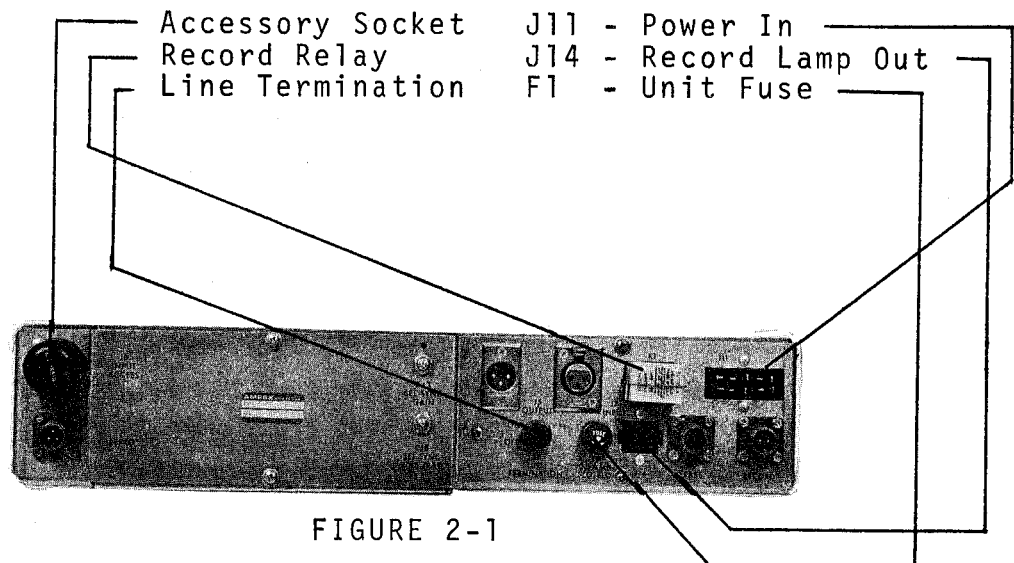


FIGURE 2-1
ELECTRONICS UNIT, REAR

2.3 OUTPUT STRAPPING

Record/reproduce units have provisions for output levels of +4 dBm and +8 dBm. They are shipped with the strap in the +8 dBm position. To restrap to +4 dBm:

- Step 1. Remove top cover from electronic unit.
- Step 2. Locate terminal strip TB3 toward the rear on the right hand panel. The jumper wire between terminals 2 and 3 is connected for +8 dBm. Reconnect this wire between terminals 1 and 2 for +4 dBm.
- Step 3. Recalibrate the record, reproduce and bias levels per Section 4.

2.4 INSTALLING ACCESSORIES

2.4.1 Microphone Preamp

To record directly from a microphone, the optional microphone preamp (Ampex Part #4010066) must be installed in the accessory socket.

2.4.2 Remote Control Units

Installation and checkout procedures accompany remote control units when shipped.

2.4.3 Capstan Motor Drive Amplifier

Installation and checkout procedures accompany MDA units when shipped. The MDA has an adjustable frequency range from 45 Hz to 65 Hz.

2.4.4 Conversion Kits

Conversion kits contain the head assembly, additional channels of electronics, harness and complete instructions for hook up.

2.4.5 Head Assemblies

Additional head assemblies are desirable. Converting to a different number of tracks or changing tape size requires a minimum of time.

2.4.6 Electronic Timer

When shipped, this unit contains complete installation instructions and can be ordered in two configurations: timer readout with control panel; readout only.

2.4.7 Extender Boards

Used to extend plug-in modules outside their housing to allow work and measurements to be made on live circuits.

SECTION 3
OPERATION

3.1 TAPE TRANSPORT, FIGURE 3-1

Controls and Indicators

- 3.1.1 Main Power Switch Supplies power to all functions.
Lights should appear in:
All VU meters
Speed switch
Local - remote switch
Lift - defeat switch
Stop switch
Master Sel Sync switch
All channel selector switches
- 3.1.2 Speed Switch An alternate action push button
to change play/record speed.
When button is pressed, one half
the push button lights up to
indicate the selected speed.
- 3.1.3 Local-Remote
Switch Alternate action push button with
lighted indicator showing remote
or local. It is used to switch
transport control from the console
to a remote switch. Local-remote
switch locks out controls not
lighted in the indicator whether
or not remote switching unit is
plugged in.
- 3.1.4 Lift-Defeat Switch Illuminated 3 position switch to
control tape lifters as follows:
Lift: Tape is lifted from heads
regardless of operating mode
Auto: Tape is automatically lifted
in either fast mode
Defeat: Tape will not lift in any
mode

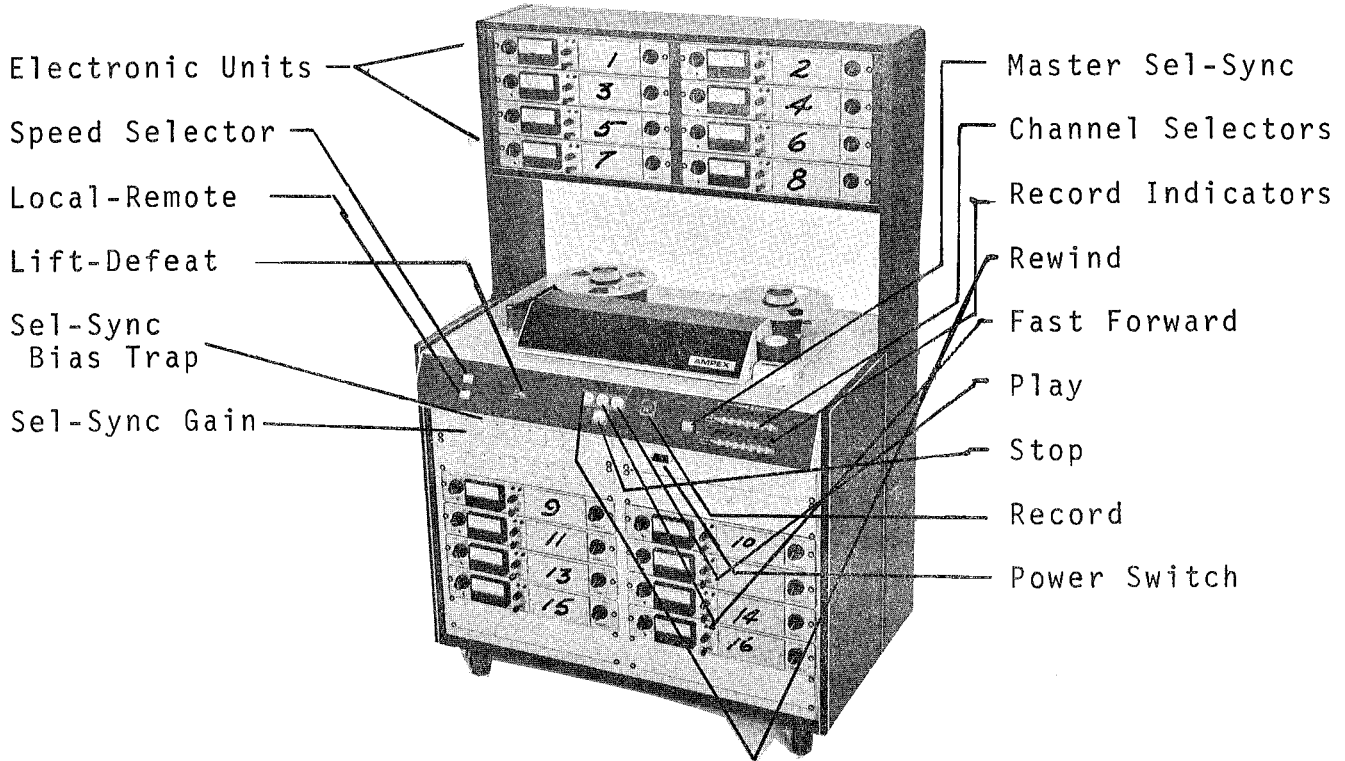


FIGURE 3-1
CONTROL LOCATIONS

- 3.1.5 Rewind A push button holding relay that illuminates when engaged. Moves tape onto supply reel at fastest speed. It activates tape lifters when lift-defeat switch is in AUTO. It disengages when any other tape motion switch is pressed; i.e., fast forward, play, stop.
- 3.1.6 Fast Forward Same operation as REWIND in opposite direction, onto take-up reel.
- 3.1.7 Play Illuminated push button holding relay to put the transport in Play mode at speed selected on speed switch. Pressing any of the other three tape motion switches will disengage it.
- 3.1.8 Stop Stops all tape transport and record functions.
- 3.1.9 Record Starts the record function on channels selected for record. Must be used in conjunction with or after Play switch has been engaged.
- NOTE: Accidental or erroneous activating of the Record switch can result in unwanted erasures. Plan ahead!

3.2 ELECTRONIC SWITCHES ON MAIN CONTROL PANEL

Although they control functions within the electronics units, the following switches are located on the main console control panel:

- 3.2.1 Master Sel-Sync Switch
Alternate action push button with illuminated indicator. In Sel Sync position all channels are in Sel Sync except those channels actually in record at time switch was thrown
- 3.2.2 Channel Selector Switches
Individual channel selector switches allow separate channel selection of the following:
- Record: A red indicator lights up for selected channel after record button is pressed. Channel is then recording.
- Non-Record: Electronics are set for reproduce.
- Sel-Sync: Record heads serve as reproduce heads.

3.3 RECORD/REPRODUCE ELECTRONICS UNIT, FIGURES 3-2, 3-3

One unit is required for each channel. Unit is made up of plug-in circuit boards containing: record amplifier, reproduce amplifier, bias amplifier. Alignment controls are located on the front of each plug-in board.

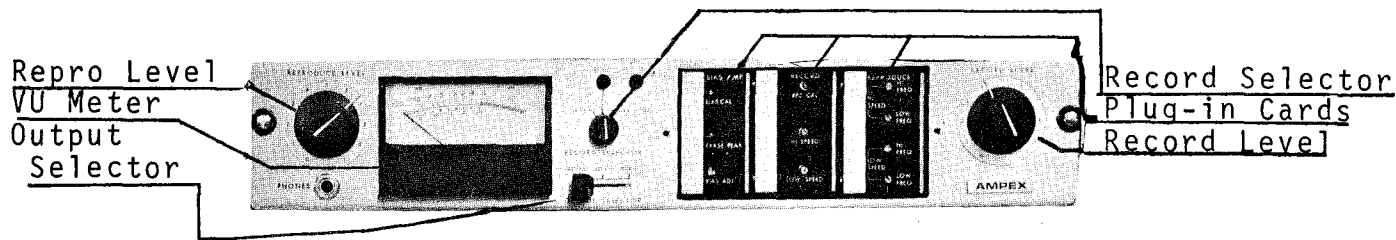


FIGURE 3-2

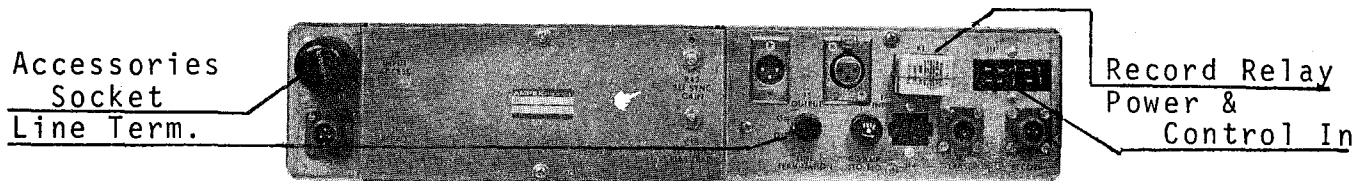


FIGURE 3-3

Controls

- | | | |
|-------|-----------------|---|
| 3.3.1 | Reproduce Level | To set produce volume. |
| 3.3.2 | Head Phone Jack | For monitoring. |
| 3.3.3 | VU Meter | To read level of record. |
| 3.3.4 | Record Selector | Rotary knob on the front of electronic unit. Place in READY position and leave it. Control is then vested in CHANNEL SELECTOR switches. |
| 3.3.5 | Output Selector | Three position lever switch having the following functions:
Repro: The signal coming from the tape is connected to the VU meter, monitor and output lines.
Input: The signal to be recorded is connected to the VU meter, the monitor and the output lines.
Bias: Bias signal, when unit is in record mode, is connected to the meter. |

3.3.6 Record Level Rotating knob to establish record level.

3.4 REAR CONTROLS AND CONNECTIONS, FIGURE 3-3

Have all been remoted to other locations on console for convenience except Accessories Socket, J8, and line terminations switch.

3.4.1 Accessories Socket J8 An octal socket for plug-in input units; microphone preamp, balanced bridging transformer, line matching transformer and dummy plug.

3.4.2 Record Relay, K1 Switches electronics into record function on channels selected by CHANNEL SELECTORS. Activates from RECORD button on Transport Control Panel. Powered from 24V DC supply.

3.4.3 Power and Control Input, J11 Ten pin Cinch-Jones plug. Provides electronics unit with: 39V DC to electronics, 24V DC to record relay, bias and transport common.

3.4.4 Line Termination S3 Two position rotary switch to terminate output in 600 ohm balance line. Usually in OFF position except for alignment procedures or when output is fed to a high (2000 + ohms) impedance.

3.5 SAFETY SWITCH

Located on supply tension arm. Automatically stops tape motion and record function is tape should run out or break.

3.6 OPERATION

NOTE 1: Always bulk erase prerecorded tape prior to re-recording. It may have been previously recorded with a different head configuration, and the selective erase head of the MM-1000 might miss part of the old recording.

NOTE 2: Clean and degauss the heads and tape path prior to use of the machine or after each 8 hours of use.

NOTE 3: Allow 15-30 minute warm up period prior to use or prior to check out. After warm up the machine will be more stable both electrically and mechanically.

3.6.1 Threading Tape Use low-noise tape; Ampex 400 Series or equivalent. The tape path is shown in Figure 3-4. Turn power on. Place full reel on supply turntable, hold supply tension arm to left to release supply brake and pull off approximately 36" tape. Open head cover and head shield cover, thread tape, and reset tape indicator. Close head gates and cover.

3.6.2 To Record Select channels to be recorded on channel selector switches. Note reading on tape indicator. Select transport speed. Local remote switch positioned to desired control location. Tape lifters to AUTO. Master Sel Sync to PLAY. All record selector switches on channel electronics to READY. (They should be left in READY at all times.) Record level to desired operating level. Monitor set up as required. Push PLAY and RECORD simultaneously. Check red indicator lights on channel selectors for record indication. Monitor VU meters on recording channels.

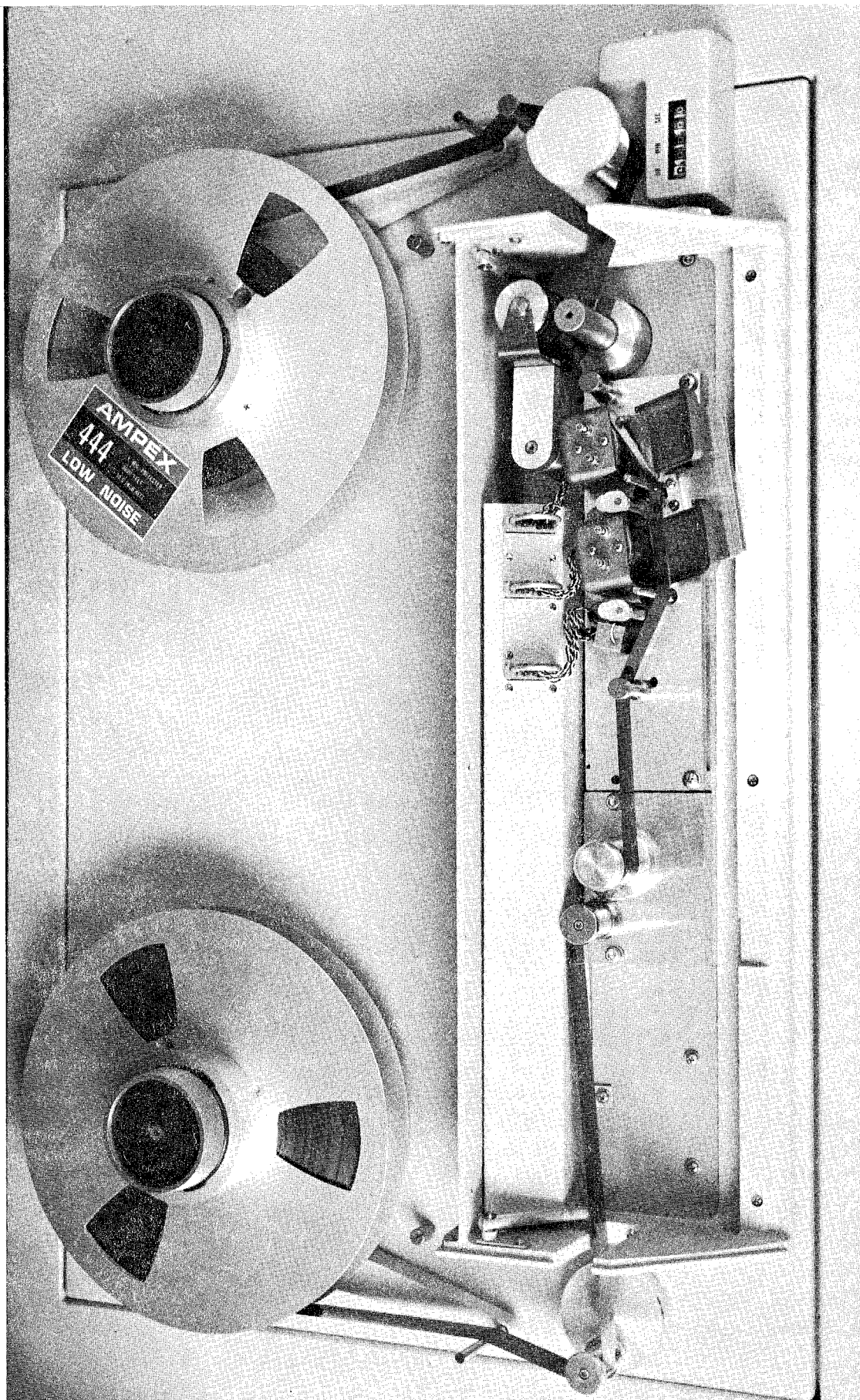


FIGURE 3-4
TAPE THREADING PATH

3.6.3 To Reproduce

Channel selectors to NON-RECORD. Set transport speed. Set local-remote switch as required. Tape lifters may be defeated for fast edit, but should be returned to AUTO for reproduction. Master Sel Sync switch to PLAY. Output selectors on channel electronics to REPRO. Reproduce level set as required. Push PLAY button. PLAY button may be pushed while operating in either of the fast modes. Motion sensing will take the transport through the stop cycle and into play automatically.

3.6.4 Use of Sel Sync

Sel Sync (Selective Synchronization) switches the reproduce function onto the record head of channels as selected. This gives the same time base relationship for channels being reproduced and recorded. Set channel selectors in record for channels to be recorded (added to existing recorded channels). Start record function. Push Sel Sync master switch. All channels not actually recording will be switched to the record head for reproducing. Channels thus recorded will have the same time reference as those pre-recorded. Using Sel Sync does not disturb the pre-recorded tracks.

SECTION 4 MAINTENANCE

4.1 ALIGNMENT PROCEDURES AND CHECKOUT

Tape transport checkout and adjustment. It is suggested that a form similar to those shown in Figures 4-8, 4-9 be produced and used for a permanent record.

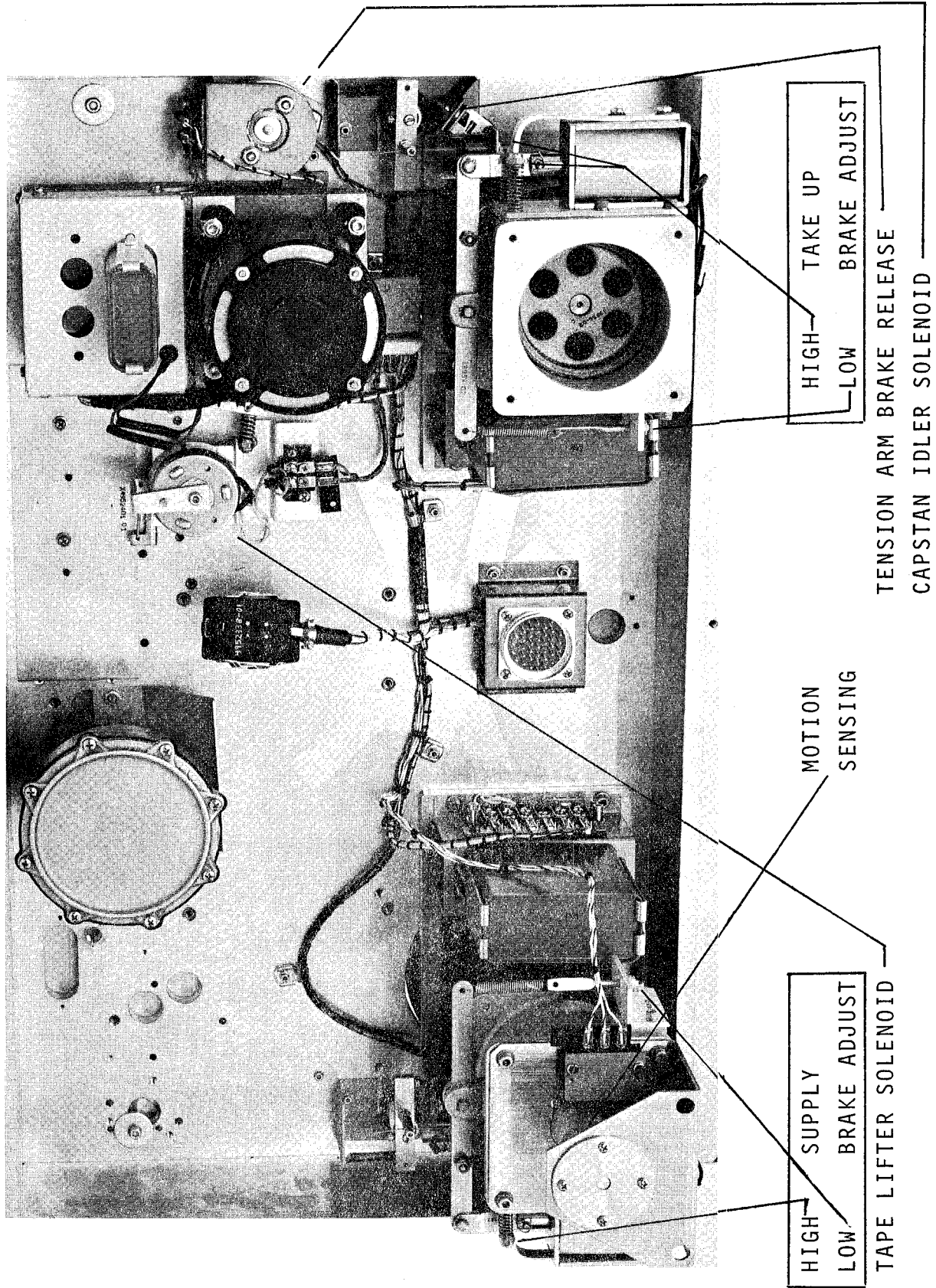
- 4.2 Transport checkout and adjustment procedures should be made in order presented here to preclude having to repeat certain procedures. Incorrect tensions on some assemblies can influence measurements being taken on other assemblies.

Equipment required:

0-2 lb., 0-10 lb. Spring scales, Standard NAB reel, 3-4 foot length of nylon cord with small loop tied in one end, precision rule, small precision square, technicians tools and Ampex test tapes as required.

ADJUSTMENT	ADJUSTMENT POINT	INPUT	OUTPUT	OPERATING MODE	ADJUST TO
<p>4.2.1 SUPPLY BRAKE HIGH BRAKE TENSION</p>	<p>Figure 4-1 Tighten nuts to tighten brakes & vice versa.</p>			<p>Power Off</p>	<p>Wind cord clockwise on reel. Pull with spring scale 0-10 lb. Read while in steady motion 70+8 oz. for 1" 120 + 4 oz. for 2" Adjust 2 nuts equally & recheck. Unsteady reading during steady pull indicates unequal adjustment.</p>
<p>4.2.2 SUPPLY BRAKE LO BRAKE TENSION</p>	<p>Figure 4-1</p>			<p>Power Off</p>	<p>Wind cord counter clockwise 0-2 lb. scale 16 + 2 oz. for 1", 24 + 2 oz. for 2". Adjust single nut position on opposite side of brake drum.</p>
<p>4.2.3 TAKE UP BRAKE HIGH TENSION LOW TENSION</p>	<p>Figure 4-1</p>				<p>Same procedures. Wind cord counter clockwise for high tension, clockwise for low. 70 oz + 8 = high 1" 120 oz + 4 = high 2" 16 oz + 2 = low 1" 24 oz + 2 = low 2"</p>

CAPSTAN IDLER SOLENOID ADJUST



HIGH
LOW
SUPPLY
BRAKE ADJUST
TAPES LIFTER SOLENOID

MOTION
SENSING

HIGH
LOW
TAKE UP
BRAKE ADJUST

TENSION ARM BRAKE RELEASE
CAPSTAN IDLER SOLENOID

FIGURE 4-1

ADJUSTMENT	ADJUSTMENT POINT	INPUT	OUTPUT	OPERATING MODE	ADJUST TO
4.2.4 SUPPLY HOLD BACK TORQUE PLAY	Figure 4-2 R2 Mounted on hinged drop out, front side of relay control box, machine rear. Figure 4-5 Increase resistance = decrease torque			Play	Tape or block supply tension arm away from rest position to defeat auto shut off. Wind cord counter clock- wise on supply reel, 0-2 lb. scale. Press play button. Adjust R2 for 9-11 oz. for 1" 9-11 oz. for 2".
4.2.5 SUPPLY HOLD BACK TORQUE FAST FORWARD	Figure 4-2 R1			Fast Forward	3-4 oz. for 1" 1-2 oz. for 2"
4.2.6 TAKE UP TORQUE PLAY	Figure 4-2 R3 Red & White Wire			Play	Reel on take up turntable wind cord clockwise. 0-2 lb. scale. Press play button, wait a few seconds for boost torque to drop out. 15-17 oz. for 1" 23-25 oz. for 2"

ADJUSTMENT	ADJUSTMENT POINT	INPUT	OUTPUT	OPERATING MODE	ADJUST TO
4.2.7 BOOST TORQUE	Figure 4-2 R3 Orange & White Wire With a piece of cardboard block K7 closed (actua- te position) Lower right hand relay, relay control box Figure 4-3			Play	Reel on take-up turntable, wind cord clockwise. 0-10 lb. scale. Press play button. 70-80 oz.
4.2.8 CAPSTAN IDLER PRESSURE	Lock nut on capstan sole- noid spacing bolt Figure 4-1			Play	Allow 30 minute warm up in play mode as tension will change due to increased solenoid resistance from heat. Remove plug on capstan motor. Figure 4-4 Tie 0-10 lb. scale to a length of tape. Put machine in play & place tape between capstan & idler. Hold cap- stan from turning, pull tape through. Required tension = 40-48 oz.

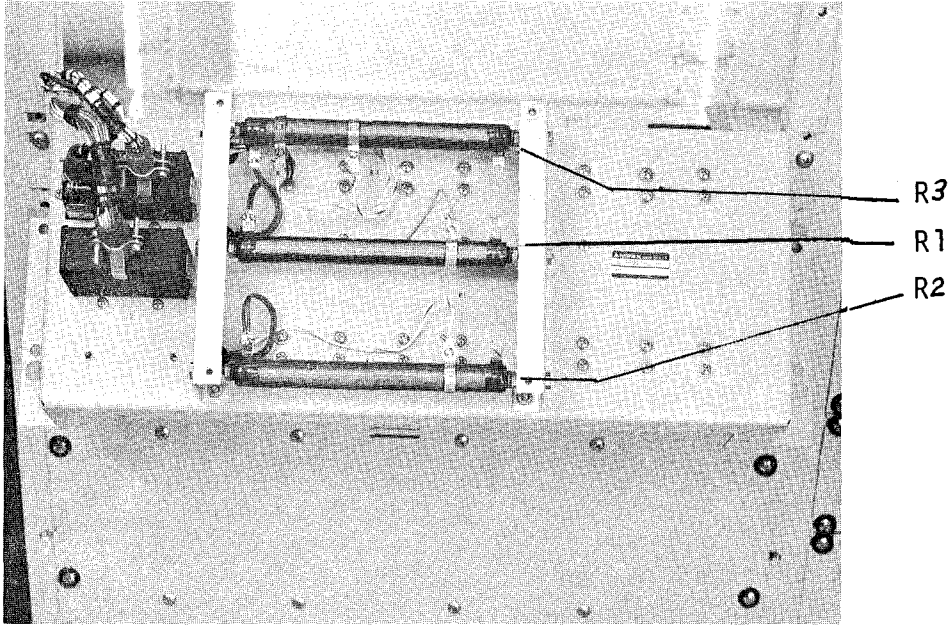


FIGURE 4-2
TORQUE ADJUSTMENTS

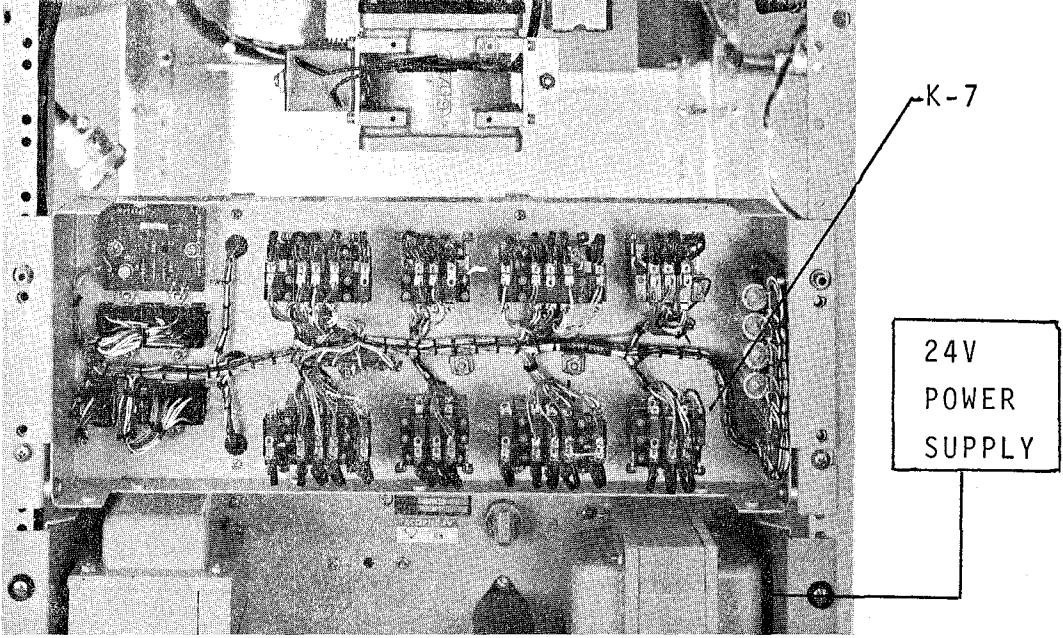


FIGURE 4-3
CONTROL RELAY BOX

ADJUSTMENT	ADJUSTING POINT	INPUT	OUTPUT	OPERATING MODE	ADJUST TO
4.2.9 HEAD ADJUSTMENTS 8 TRACK HEIGHT RECORD & REPRODUCE HEADS	Height adjust screw Figure 4-5			Power Off	Measure with precision rule bottom of lowest track (channel 8) is .370" above head mounting plate.
4.2.10 RECORD & REPRODUCE ZENITH	Zenith adjust screw Figure 4-5			Power Off	Remove head shield gate. Place small precision square on head mounting plate and against the face of the head, check for perpendicularity. There is an interaction between height and zenith adjustments. Recheck & readjust as necessary.

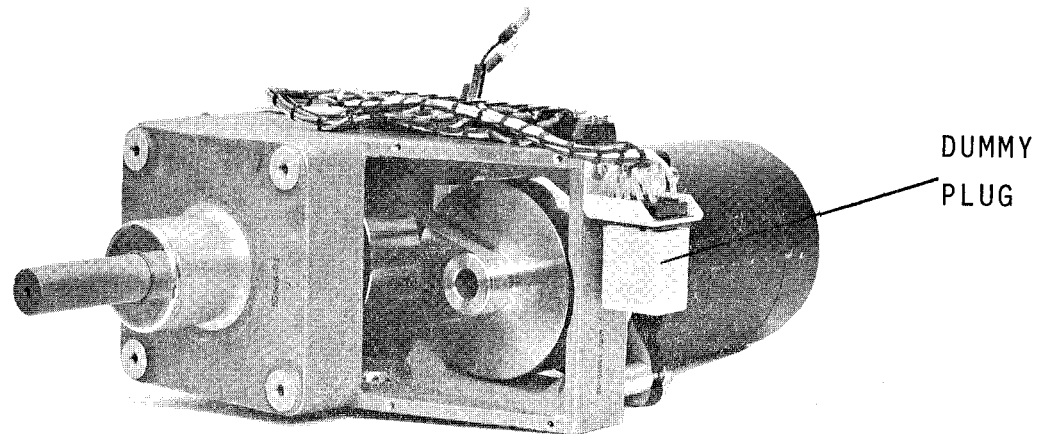


FIGURE 4-4
CAPSTAN DRIVE ASSEMBLY

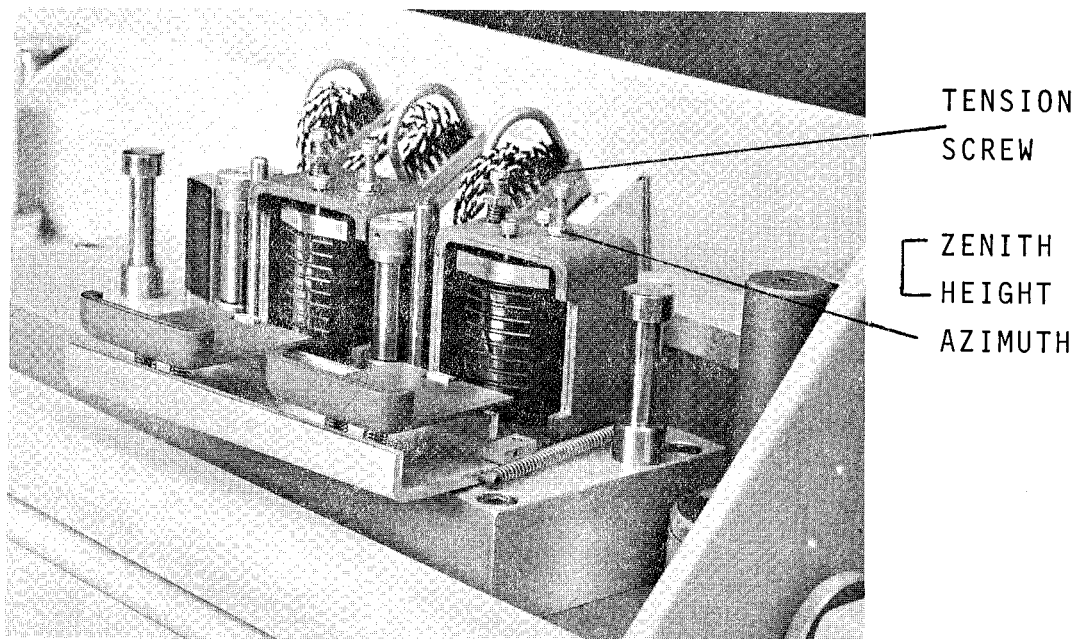


FIGURE 4-5
HEAD ADJUSTMENTS

ADJUSTMENT	ADJUSTING POINT	INPUT	OUTPUT	OPERATING MODE	ADJUST TO
<p>4.3 ELECTRICAL AND ELECTRONICS ADJUSTMENTS</p> <p>EQUIPMENT REQUIRED:</p> <p>DC Voltmeter, 20,000 ohm/volt. VTVM, Hewlett Packard Model 400D or equivalent. Signal generator, Hewlett Packard Model 400D or equivalent. Noise filter (see Figure 4-7). One of following Ampex Standard Alignment Tapes:</p>					
<p>TAPE SPEED</p> <p>15 IPS Full Track 15 IPS 8 Track 7.5 IPS 8 Track</p>		<p>TYPE OF EQUALIZATION</p>	<p>NAB NAB NAB</p>	<p>AMPEX STOCK NUMBER (Specify 1" or 2")</p>	<p>4690005-01 4690006-01 4690007-01</p>
<p>Technicians hand tools, interconnect cables</p>					
<p>4.3.1 39V POWER SUPPLY (TO ELECTRONICS)</p>	<p>R712 Figure 4-6</p>	<p>There is one 39 VDC Power Supply for each 4 sets of electronics, located rear wall, bottom. #1, extreme right side, also contains master bias oscillator.</p>	<p>Play</p>		<p>Each power supply must be checked individually with reproduce loading. Measure between Pin 9 (Positive) and Pin 5 (Negative) on any of the 4 output receptacles (10 pin Cinch Jones) 39V ± 1/2 Volt.</p>

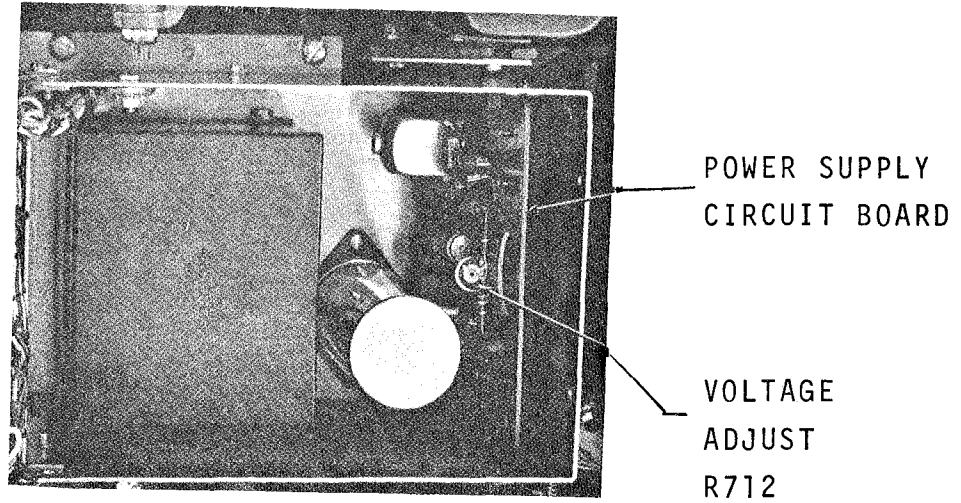


FIGURE 4-6
POWER SUPPLY ADJUST

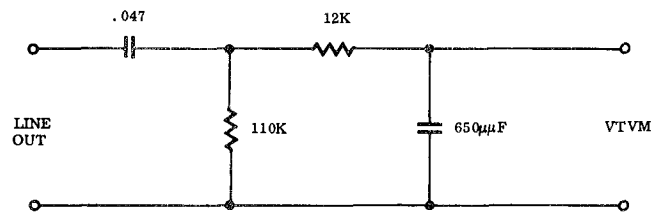


FIGURE 4-7
BAND PASS FILTER

ADJUSTMENT	ADJUSTMENT POINT	INPUT	OUTPUT	OPERATING MODE	ADJUST TO
4.3.2 24V DC POWER SUPPLY	Pre-set at factory. Figure 4-3			All channels Sel-Sync, Play.	This places max. load on 24 volt supply. All functions should remain in steady operation.
4.3.3 REFERENCE LEVEL	Reproduce level, each electronics Figure 3-2	Ampex test tape	Output Selector to Repr.	Record selector on electronic units to Ready. Channel selector to non-record.	Monitor any channel; earphones or speaker amp to follow signals on test tape. First tone is reference tone at 700 Hz. Adjust all Reproduce Level controls to Zero VU for 15 IPS tape, -10 VU for 7.5 IPS tape.
4.3.4 REPRODUCE AZIMUTH	Azimuth adjust nut, right side, top of reproduce head. Figure 4-5 Use 1/4" nut driver.	Test tape	Same	Same	Peak to max. VU, all channels. This may require small compromise if all channels don't peak the same. NOTE: If Azimuth adjust is far off, minor peaks may occur. Look for minor peaks on either side of true peak. True peak will be higher than minor peaks.

ADJUSTMENT	ADJUSTMENT POINT	INPUT	OUTPUT	OPERATING MODE	ADJUST TO
4.3.5 RECORD HEAD AZIMUTH ALIGNMENT	Record Head Azimuth adjust Figure 4-5	Test tape	Output selector to Reproduce	Master channel selector to Sel-Sync. Figure 3-1 15 IPS.	Repeat procedure for Reproduce Azimuth alignment using 7500 Hz signal of test tape. (5th tone on tape.)
4.3.6 REPRODUCE EQUALIZATION EITHER TRANSPORT SPEED REPEAT PROCEDURE FOR OTHER SPEED USING APPROPRIATE TEST TAPE	Reproduce Equalization Pots Figure 3-2	Test tape	Output selector to Reproduce	Channel selectors to non-record. Play Mode.	With 1st tone on reference tape establish zero reference on VU, 15 IPS or -10dB for 7.5 IPS. Adjust appropriate pots on equalizer board to achieve flat response from remaining tones on test tape. Readjust if necessary to meet specification. Repeat for remaining channels. Repeat entire procedure for other speed using appropriate tape and VU reference.
4.3.7 SEL-SYNC GAIN	Sel-Sync gain. Left front of console. Figure 3-1	Test tape	Output selector to Reproduce.	Channel selectors on non-record. Master channel selector to Sel-Sync Play mode 15 IPS.	Using 1st tone on test tape, 700 Hz reference level, adjust Sel-Sync gain to zero VU on each channel. REMOVE TEST TAPE FROM MACHINE.

ADJUSTMENT	ADJUSTMENT POINT	INPUT	OUTPUT	OPERATING MODE	ADJUST TO
4.3.8 RECORD EQUALIZATION	Record Equalization (high speed or low speed). Figure 3-2	500 Hz at -2dBm input.	Output selector to Reproduce.	Record, all channels.	Note VU reading at 500 Hz. Increase to 5 KHz and compare reading to 500 Hz. Adjust for flattest response. Repeat for other tape speed.
4.3.9 SEL-SYNC BIAS TRAP	Sel-Sync Bias Trap Figure 3-1	No input.	Output selector to Reproduce.	Record, all channels except one. No input.	Place all channels in record with channel selectors EXCEPT the one being adjusted. Put this channel in Sel-Sync with Master Sel-Sync button. Adjust Sel-Sync Bias Trap for that channel to MINIMUM on VU meter.
4.3.10 FLUTTER MEASUREMENTS		3000 Hz output from Flutter Bridge.		Record-Play	Record several seconds of 3 KHz output from flutter bridge. Play back and measure flutter - .08% @ 15 IPS; .1% @ 7.5 IPS. If outside specs, check entire transport for: Loose bolts, loose or binding bearings, uneven motor pull, condition of belt on capstan, chattering breaks, solenoids not bottomed, tape lifters not fully retracted, etc.

ADJUSTMENT	ADJUSTMENT POINT	INPUT	OUTPUT	OPERATING MODE	ADJUST TO
4.3.11 ERASE PEAK	Erase peak adjust, Bias amplifier plug in card. Figure 3-2	500 Hz level of +8dBm at input.	Output selector on Bias, all electronics.	Record. All channel selectors set on Record and recording.	Adjust for peak using Ampex 434 tape.
4.3.12 BIAS ADJUST	Bias adjust. Bias amplifier plug-in card. Figure 3-2	500 Hz +8dBm at input.	Output selector to Reproduce.	Record	Adjust Bias for maximum output, all channels.
4.3.13 RECORD CAL.	Record Cal. Front of Record plug-in card. Figure 3-2	500 Hz +8dBm at input.	Output selector to Input.	Record	Adjust to zero VU, all channels.
4.3.14 BIAS CAL.	Bias Cal. Front of Bias amp plug-in board. Figure 3-2	500 Hz at +8dBm input.	Output selector to Bias.	Record - all channels.	Adjust to zero VU, all channels.

ADJUSTMENT	ADJUSTMENT POINT	INPUT	OUTPUT	OPERATING MODE	ADJUST TO
4.3.15 SIGNAL TO NOISE		500 Hz Signal at 1 volt RMS	Output selector to Input. Connect band pass filter and VTVM to Output. Termination Switch On. Set Record level to 6db above operating level.	Record	Record 30-40 seconds of 500 Hz signal. Rewind, re-record same section of tape with no input. With output selector in Reproduce, measure signal to noise. Pass output through 30Hz - 18KHz filter into VTVM. Figure 4-7 -60db.
Check Effect of Silent Switching	Step 1. Step 2. Step 3. Step 4. Step 5. Step 6.	With no input, monitor each output in turn with a speaker-amplifier at maximum volume.	Set Record Control to maximum.	Start machine with channel selector and record switch, switch in and out of record a few times, running each for a few seconds.	Replay this tape and listen for clicks or pops. Repeat using Sel-Sync - Play positions. If pops or clicks occur it indicates a defect in the timing circuit for the record relay, a printed circuit board in the transport relay box, or defective timing for the bias reed relay. If it occurs only in the Sel-Sync mode, it indicates a malfunction in the timing circuit on the Sel-Sync relay.

MM-1000 CHECKOUT DATA

DATE _____

TRANSPORT _____

SERIAL NO _____

ENGINEER _____

RUNNING TIME SINCE LAST CHECK OUT _____

FIGURE 4-8

	SUPPLY TURNTABLE			TAKE UP TURNTABLE		
	1 INCH	2 INCH	ACTUAL	1 INCH	2 INCH	ACTUAL
BRAKES HIGH	70±8 ounces	120±8 ounces		70±8 ounces	70±8 ounces	
BRAKES LOW	16±4 ounces	24±4 ounces		16±4 ounces	24±4 ounces	
PLAY TENSION	10±1 ounces	10±1 ounces		16±1 ounces	24±1 ounces	
BOOST TENSION				75±5 ounces	75±5 ounces	
HOLDBACK TENSION	3-4 ounces	1-2 ounces		3-4 ounces	1-2 ounces	
HEAD HEIGHT, 1" ONLY			SPECIFICATION .370 INCH	MEASURED ERASE HD.	MEASURED RECORD HD	MEASURED RECORD HD.
HEAD ZENITH 1" ONLY			SPECIFICATION 90° to base	RECORD HD	REPRO HD	ERASE HEAD
CAPSTAN IDLER, MEASURED BY PULLING TAPE THROUGH CAPSTAN				SPECIFICATION 40-48 ounces	MEASURED	
FLUTTER	SPEC. 15 IPS	MEASURED	SPEC. 7.5 IPS	MEASURED		
DEGAUSSING ACCOMPLISHED ✓	HEADS	CAPSTAN ASSEMBLY	TAPE PATH			

DATE _____ SERIAL NO. _____
 ENGINEER _____ RUNNING TIME SINCE LAST CHECK OUT _____

FIGURE 4-9 MM-1000 CHECKOUT DATA ELECTRONICS

SPEC	CHANNEL NUMBER																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
REPRO LEVEL																	
SEL-SYNC LEVEL																	
REP. FREQ. RESP. 7.5 IPS +2dB 30Hz-15kHz																	
REP. FREQ. RESP. 15 IPS +2dB 30Hz-18kHz																	
ERASE PEAK																	
BIAS PEAK																	
RECORD LEVEL																	
BIAS LEVEL																	
SEL-SYNC BIAS TRAP																	
OVERALL FREQ. RESP. 7.5 IPS +2dB 30Hz-15kHz																	
OVERALL FREQ. RESP. 15 IPS +2dB 30Hz-18kHz																	
2nd HARMONIC DISTORTION																	
3rd HARMONIC DISTORTION																	
S/N STANDBY																	
S/N REC. SHORTED INPUT																	
SWITCHING TRANSIENTS																	

4.4 CAPSTAN ASSEMBLY, FIGURE 4-4

4.4.1 General.

The MM-1000 capstan assembly consists of a two speed hysteresis synchronous motor and a flywheel stabilized capstan, 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.

4.4.2 Special Tools and Parts Required.

It should be emphasized that a torque screwdriver capable of indicating torques in the region of two to three inch-pounds MUST BE USED to properly tension the belt. Ampex part number 55571-01, Belt, Mylar, is the only replacement belt that can be used.

4.4.3 Capstan Frame Assembly.

This is the capstan assembly less the motor, and must be replaced entirely in case of damage to the capstan shaft or its bearings. Ampex part number 55575-03.

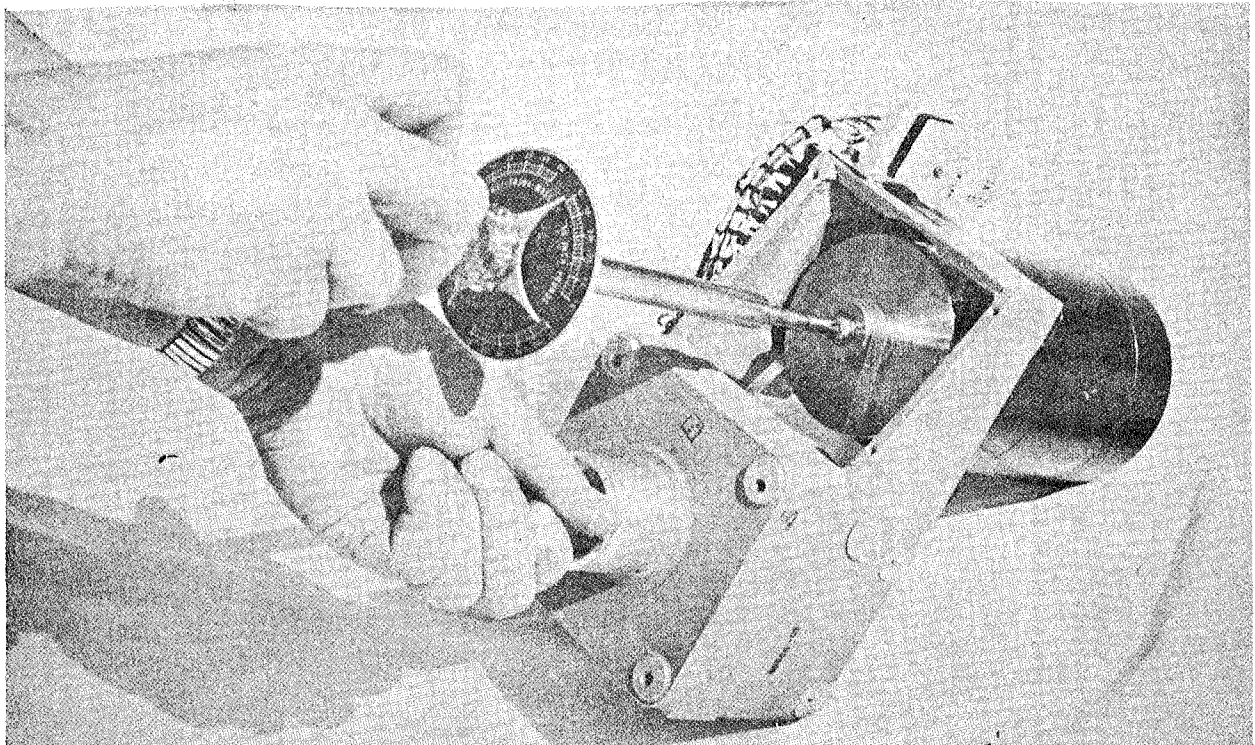
4.4.4 Capstan Maintenance.

Step 1. Carefully protect the exposed surface of the capstan shaft from possible damage during removal and re-installation by wrapping it liberally with masking tape or other suitable cushioning material. Nicks or other physical damage to the shaft will require replacement of the entire frame assembly.

Step 2. Remove the head block cover assembly.

Step 3. With the help of an assistant, disconnect the harness from the capstan terminal strip, remove the capstan mounting screws from the top of the top plate, and guide the capstan out through the bottom of the machine. Pay particular attention to any shims that may be between the capstan frame and top plate. THEY MUST BE REPLACED EXACTLY AS THEY CAME OUT.

- Step 4. Remove both protective covers from the capstan frame, loosen the four motor mounting screws to remove tension from the belt, and remove the belt. Take care not to crease or otherwise distort the belt if you intend to re-use it.
- Step 5. Remove dust and dirt from the inside of the capstan frame assembly using low pressure compressed air. Direct the air blast away from, rather than toward, the capstan shaft and bearings. Moisten a clean cloth with alcohol and clean the capstan belt if it is to be re-used. Clean the surfaces of the pulleys with alcohol, removing all traces of foreign matter.
- Step 6. With the motor positioned to eliminate initial tension, replace the belt. The original belt may be re-used if it does not show evidence of cracks, creases, or other distortion. If there is any doubt, it is better to replace the belt with a new one at this time.
- Step 7. Adjust belt tension as follows, referring to Figure 4-8:



- Step 8. Insert a 10-32 screw in the tapped hole in the exposed end of the motor shaft. Hold the capstan shaft stationary and turn the screw with a torque screwdriver. Increase tension by repositioning the motor until the belt begins to slip with a torque of 2 to 3 inch-pounds applied to the screwdriver. This is the proper tension, and this figure should not be exceeded under any circumstances.
- Step 9. Re-install the covers on the frame assembly. Again, a two-man job...Carefully re-install the capstan assembly to the transport, taking special care to avoid damage to the shaft. Replace any shims between the capstan frame and the bottom of the top plate exactly as they were originally installed.
- Step 10. Reconnect the harness. Remove the protective coating from the capstan shaft and clean the shaft first with kerosene to remove the gum of the masking tape, then with alcohol to remove the vestiges of the kerosene. Do not permit the kerosene to come in contact with the capstan idler as kerosene will attack rubber.

SECTION 5 THEORY OF OPERATION

5.1 Transport

The transport was designed to efficiently handle two inch tape, time/use proven on video recorders. Each turntable is driven by a separate inductive motor turning in opposite directions. Reducing torque on these individual motors provides hold back tensions for both turntables.

5.1.1 Braking

Braking is through solenoid operated differential type brakes. A 5-1 differential (approximately) insures that the trailing turntable has more braking torque than the leading turntable, thus eliminating spilling of tape. Both brakes are applied in stop mode. Either may be released by moving the tape tension arms outboard.

5.1.2 Tape Drive

Tape drive is accomplished by a solenoid operated capstan idler pressing against the capstan. The capstan is driven from a two speed synchronous motor. Both motor speeds are variable through an optional motor drive amplifier to achieve special effects.

5.1.3 Transport Control

Transport control is achieved through solenoid controlled push buttons. Motion sensing locks out other controls until transport comes to a stop when changing modes. Momentary high boost torque is supplied to the take-up reel for fast starting.

5.2 ELECTRONICS

5.2.1 Power Supply, Figure 5-1

The electronics units are powered by regulated 39V power supplies, one for each set of four electronics. AC power is delivered to the power supplies when the main power switch is on, rectified by the bridge rectifier formed by diodes CR701 through CR704 and filtered by R706 and C707, then connected to the voltage regulator.

In the regulator, a reference voltage is established by Zener diode VR702. A sampling voltage is taken at variable resistor R712, which is in a voltage divider circuit with resistors R711 and R712 across the output line. Voltage adjustment is made at R712. If the output voltage tends to vary with load, it will affect the conductance of transistor Q706. This will, in turn, change the conductance of transistors Q704 and Q705, which are connected in a Darlington circuit, and the voltage will be maintained at normal level.

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

The regulator is adjusted to provide a +39 vdc ($-1/2+1$ vdc) to the electronic assemblies. It is also connected back to the speed selector on the tape transport. That selector switches the +39 vdc to one of two lines, which are then returned, through the power supply box, to the solid state equalization switching circuits in the electronics.

5.2.2 Bias Oscillator and Amplifier Circuits

The master bias oscillator is mounted in the same box as power supply number 1. This is simply a capacitively-coupled push-pull oscillator, operating at a nominal frequency of 150,000 Hz. Operating power of +39 vdc is taken directly from the power supply, so the oscillator operates continuously whenever power is applied to the equipment. Its transformer-coupled output is delivered to the bias amplifiers in each electronic assembly.

Two push-pull bias amplifier stages are mounted on a plug-in printed circuit board for each electronic assembly. Operating power is delivered to these stages through contact set 3-7-11 of record relay K1, when that relay is energized. The circuits, therefore, operate only when the equipment is placed in the record mode.

The push-pull bias input from the oscillator is connected at pins 1 (shield), 2, and 3 of receptacle 4J11 (see Figure 6-11). It is connected to the amplifier printed circuit board, and routed to the bases of transistor 3Q18 and 3Q19. Both this circuit and the following (3Q16 and 3Q17) provide normal, push-pull amplification of the bias frequency. They do, however, operate at clipping level to eliminate the need for a bias symmetry adjustment (an unsymmetrical bias waveform causes magnetization of the record heads and high second harmonic distortion). A fully acceptable sine wave is achieved at the output when transformer 3T3 is resonated with the record head, by adjusting the bias adjust control (3C40) to peak the current output to the erase head. The output is also taken through bias adjust resistor 3R80, routed through the bias trap of capacitor 5C35 and inductor 5L2, and then mixed with the record signal before being delivered to the record head. A third output is through bias calibrate resistor 3R44, the output selector switch, and thence to the VU meter; note that a contact set on the output selector switch shorts bias calibrate resistor 3R44 except when that switch is placed in the bias position. This is done to remove the rf from the line and thus reduce the amount of rf being induced into other circuits during the record or reproduce modes.

5.2.3 Record Amplifier Circuit

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. Note that 4J8 is wired so that when the optional microphone preamplifier is employed, the record level control is connected between the two stages in the preamplifier. This effectively makes the preamplifier a variable gain device which will accommodate a wide variety of professional-type microphones.

From the input accessory socket, the signal enters the plug-in printed wiring board circuit, first encountering emitter-follower stage 2Q9. From there it proceeds to the plug-in record equalizer circuit. Note that the record calibrate control, 11R108, is on the equalizer board but is connected before equalization is applied. From that control the signal is wired, through contacts of the output selector switch, to stage 1Q5 in the reproduce amplifier circuit. It proceeds through the reproduce circuit to the output line and the VU meter so that record monitoring is possible and record level can be measured.

Both the high speed and low speed equalizers receive the signal from stage 2Q9. Equalization consists of placing 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.

From the equalizer, the signal is routed through one of the two equalizer amplifiers, 2Q10 or 2Q11. Note that if the low speed is selected at the tape transport, +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 the low speed, therefore, transistor 2Q10 passes 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, and stage 2Q11 thus acts as the high speed equalization amplifier. In both 2Q10 and 2Q11, a low frequency boost is realized, by inserting 2R54 and 2C25 (2Q10) and 2R59 and 2C27 (2Q11) in the base circuits.

Time constant circuits in both stages provide a delay in the record on-off function, to minimize popping when the equipment enters or leaves the record mode. The low speed circuit, in the emitter circuit of 2Q10, consists of 2C26 and 2R57 ("on" time delay) and 2C26 and 2R55 ("off" time delay). For high speed the circuit consists of 2C29 and 2R64 ("on" time delay) and 2C29 and 2R60 ("off" time delay). In both cases the time delay in entering record is longer than it is in leaving record.

From the equalizer amplifier the signal is routed 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 d-c resistance and a relatively high a-c resistance. In the audio frequency range, therefore, transistor 2Q14 works into an impedance which is sufficiently high to provide the constant current source for the record head, yet allows full utilization of the d-c operating voltage available.

The signal leaves the printed circuit board at connectors 7 and 8, and proceeds through contact set 1-5-9 of the record relay. It is mixed with the bias frequency following the bias trap (5C35 and 5L2), and proceeds through the record selector switch, in the ready position, to the record head.

Record relay 4K1 is energized by pushing the RECORD pushbutton on the tape transport after the equipment has been started in the play mode. It is held energized (refer to Figure 6-11) by contacts of the play relay, in the tape transport circuit, through resistor R601. Energizing voltage is connected at pin 4, and the holding voltage at pin 10, of receptacle 4J11. Contact set 1-5-9, when energized, removes ground from the record amplifier output, and routes that output to the record head. Contact set 3-7-11 connects the +39 vdc operating voltage to transistors 2Q12, 2Q13, 2Q14, and 2Q15, which can then conduct (they cannot operate until the equipment is placed in the record mode).

Diode 4CR6 in the record relay circuit, isolates the record mode to electronic assemblies which were in the ready condition when the record pushbutton was pressed. For example, if one electronic assembly was in the safe condition when the record mode was started, it will not go into record if its record selector were inadvertently turned from the safe or Sel-Sync to the ready position.

5.2.4 Reproduce Amplifier Circuit

From the reproduce head, the signal reproduced from the tape is routed through contacts of the recorded selector switch, then enters the circuitry on the reproduce printed circuit board. It first passes through transformer 1T1. In some special applications

it may be necessary to alter the head output at high frequencies, so blank terminals are provided across the secondary winding of the transformer.

After the input transformer, the signal is connected to the base of amplifier stage 1Q1; base bias on this transistor is derived from the current through resistor 1R4, which is filtered by capacitor 1C1. Following 1Q1 is another amplifier stage, 1Q2. D-C feedback is applied through 1R3, bypassed by 1C4 and 1C2, from the collector of Q2 to the collector of Q1. Collector voltage for both 1Q1 and 1Q2 is delivered through transistor 1Q4; those stages cannot operate until 1Q4 conducts. A time constant circuit (1C8 and 1R38) delays conduction of Q4, so that application of power to the equipment does not result in pegging the VU meter needle, or causing pops at the output.

The signal path from 1Q2 proceeds through emitter follower stage 1Q3. Reproduce equalization is connected from the emitter of that stage back to the emitter of Q1. Either high speed or low speed equalization is selected by turning on diode 1CR2 (low speed) or 1CR1 (high speed) and thus allowing them to pass the signal. At low speed, +39 vdc is delivered to pin 6 of receptacle 4J11. At high speed, the +39 vdc is delivered to pin 7 of that receptacle. A time constant circuit is inserted in both +39 vdc lines, again to protect the VU meter and prevent pops when the speed is switched. Note that when a speed is first selected, the "on" time constant is determined by both a 100 mfd and a 35 mfd capacitor (all contained in capacitor 9C9). When that speed is turned off (other speed selected) the 100 mfd capacitor is not in the circuit, and the delay is determined only by the 35 mfd capacitor. Thus the "on" time when a speed is selected is greater than the "off" time for that speed.

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 and pass the signal from the emitter of 1Q3 to the low frequency equalizer. If high speed is selected, the positive voltage, connected through 1R14 causes diode 1CR1 to conduct and pass the signal to the high speed equalizer. Thus either the low speed or high speed equalizer is connected from the emitter circuit of 1Q3 back to the emitter of 1Q1.

From the emitter of 1Q3 the equalized signal is routed through capacitor 1C7, the reproduce level control, and contacts of the output selector switch, to the base of amplifier stage 1Q5. (Note that this is the stage where the record monitor is connected, refer to paragraph 5.2.3). 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 realization of high levels, without clipping.

After 1Q5, the signal is connected to stage 1Q6, which provides drive for the push-push output stage formed by the complementary pair of transistors 1Q7 and 1Q8. The output is taken at the emitter junction of those two transistors, and leaves the printed circuit board.

The output signal is connected to the phones jack, and through transformer 8T2 to the output connector. Line termination switch 4S3 is connected directly across the output line to terminate the equipment during checks and adjustments.

The secondary of the output transformer is connected to the VU meter through a strapping circuit that allows the equipment to be calibrated for either +8 dBm or

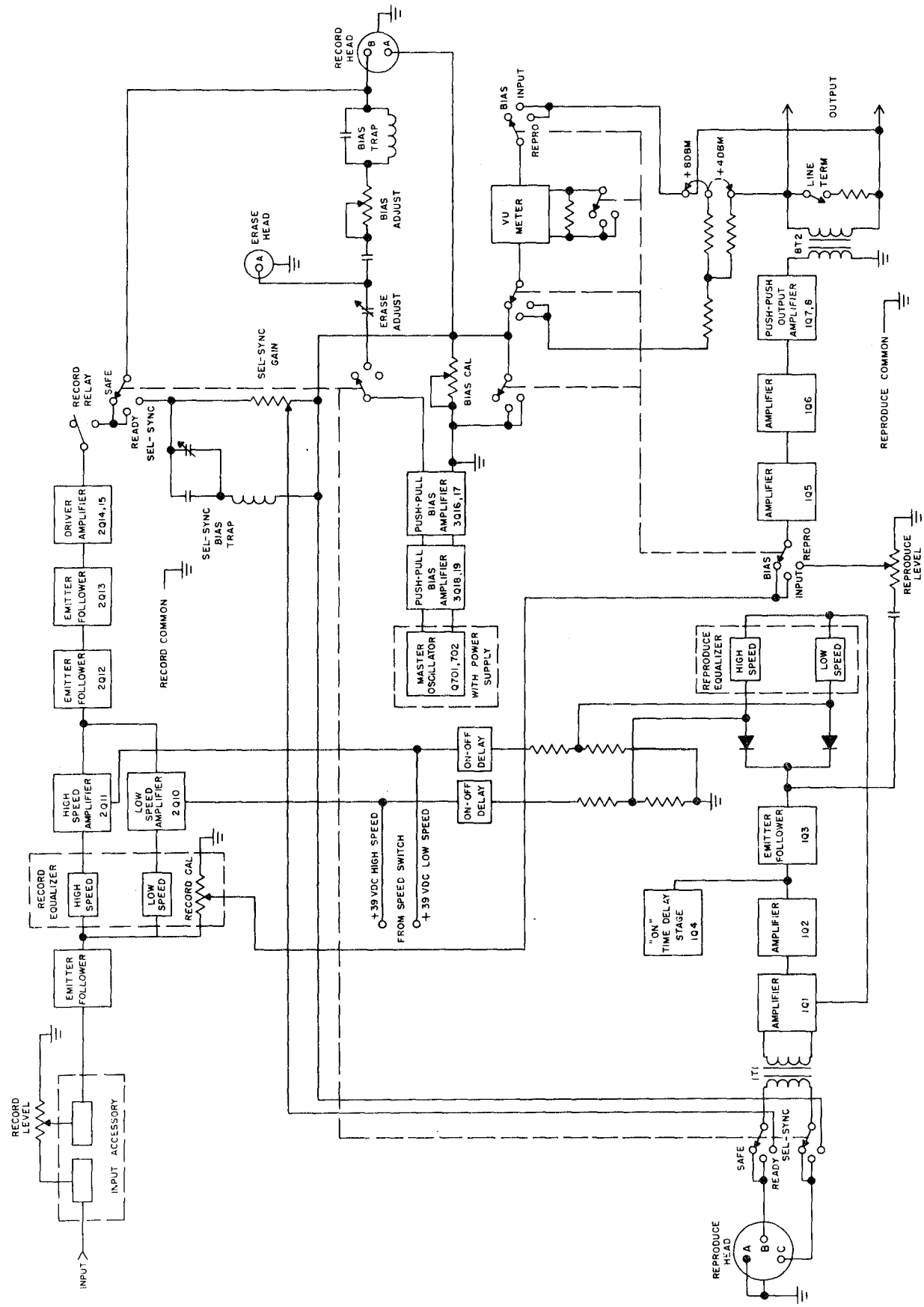


FIGURE 5-1
ELECTRONICS, BLOCK DIAGRAM

+4 dBm normal operating level (see Figure 5-2). When the equipment is strapped for a +8 dBm output, resistors 8R34 and 8R35 are connected as a voltage divider across the transformer, with 8R36 connected to their junction to feed the VU meter. When the strapping is for +4 dBm, resistors 8R34 and 8R35 are connected in parallel with one side of the line, with series resistor 8R36 feeding the VU meter.

5.2.5 Sel-Sync Circuit

The Sel-Sync circuit is shown between the record and reproduce heads on Figure 6-11. Note that when the record selector switch is placed in the Sel-Sync position, the reproduce head is disconnected from the reproduce amplifier. The record head is disconnected from the record amplifier and connected to the input of the reproduce amplifier. The record head will reproduce the signal from the tape and deliver it to the reproduce amplifier, where it is amplified for monitoring purposes.

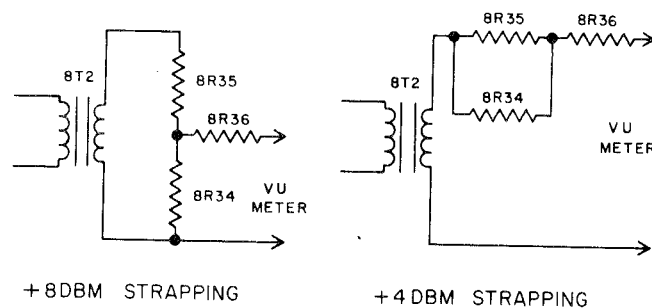
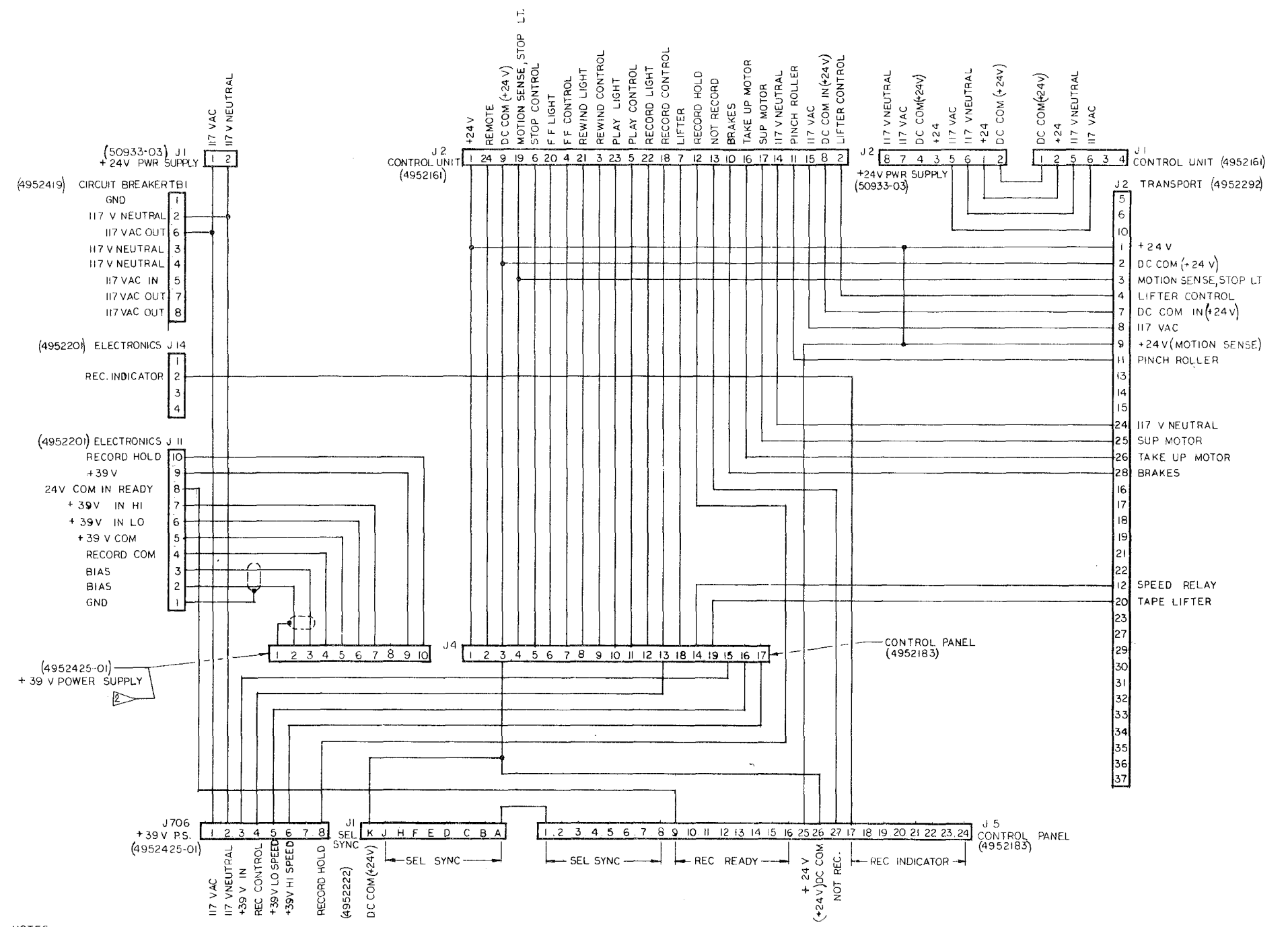


FIGURE 5-2
STRAPPING CIRCUIT, SIMPLIFIED

A Sel-Sync gain control allows the level to be set for monitoring purposes, and a series bias trap is tuned to prevent bias leakage from a channel operating in the record mode. Both are located at left front of the console. Note that other contact sets of the record selector open the leads from the bias amplifier to the record head, and the negative return to the record relay.

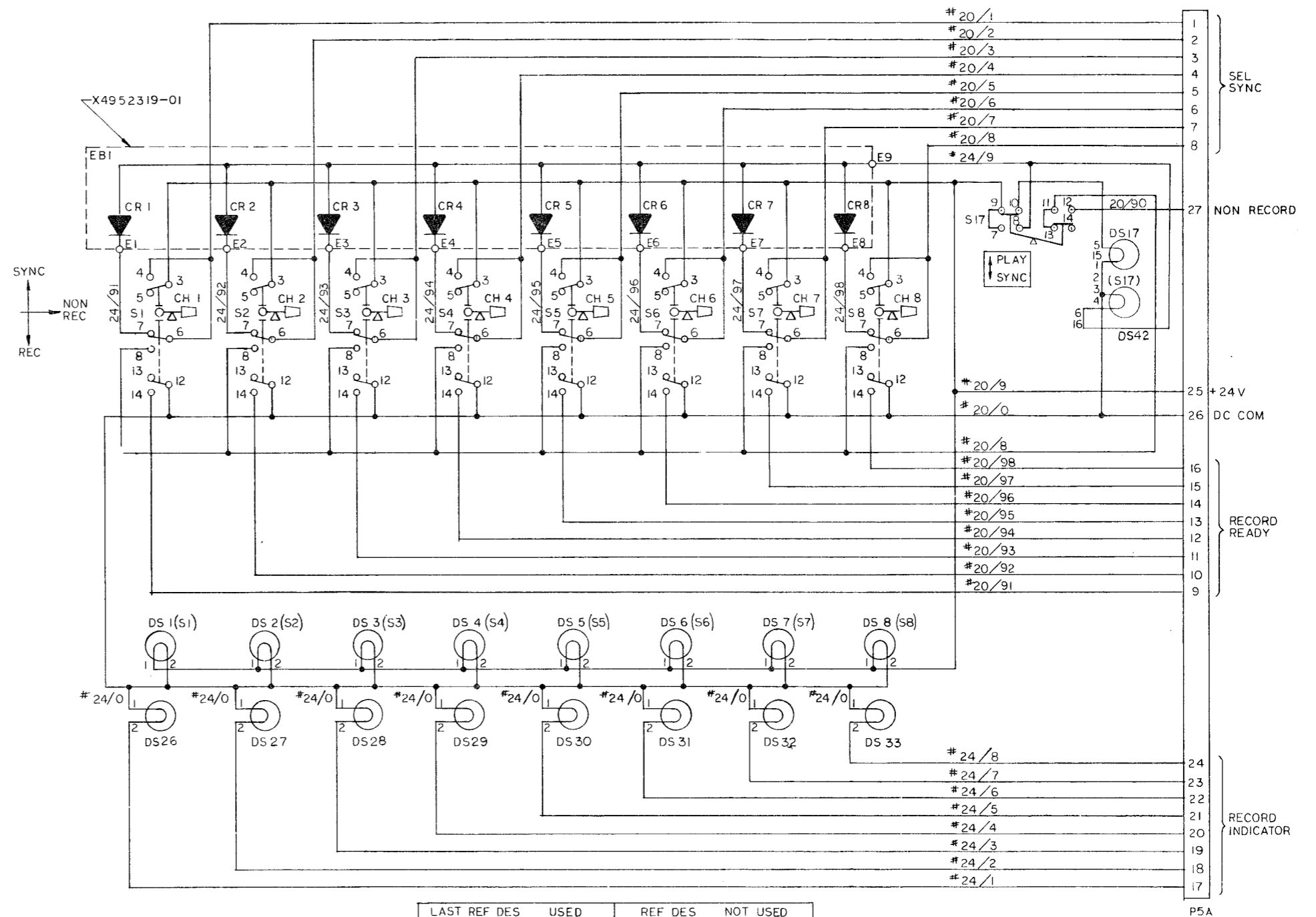
In the Sel-Sync mode, the record head acts as a reproduce head for monitoring purposes. Another record head in the same stack but operating on a different track can be used to record that track synchronously with the first.



NOTES

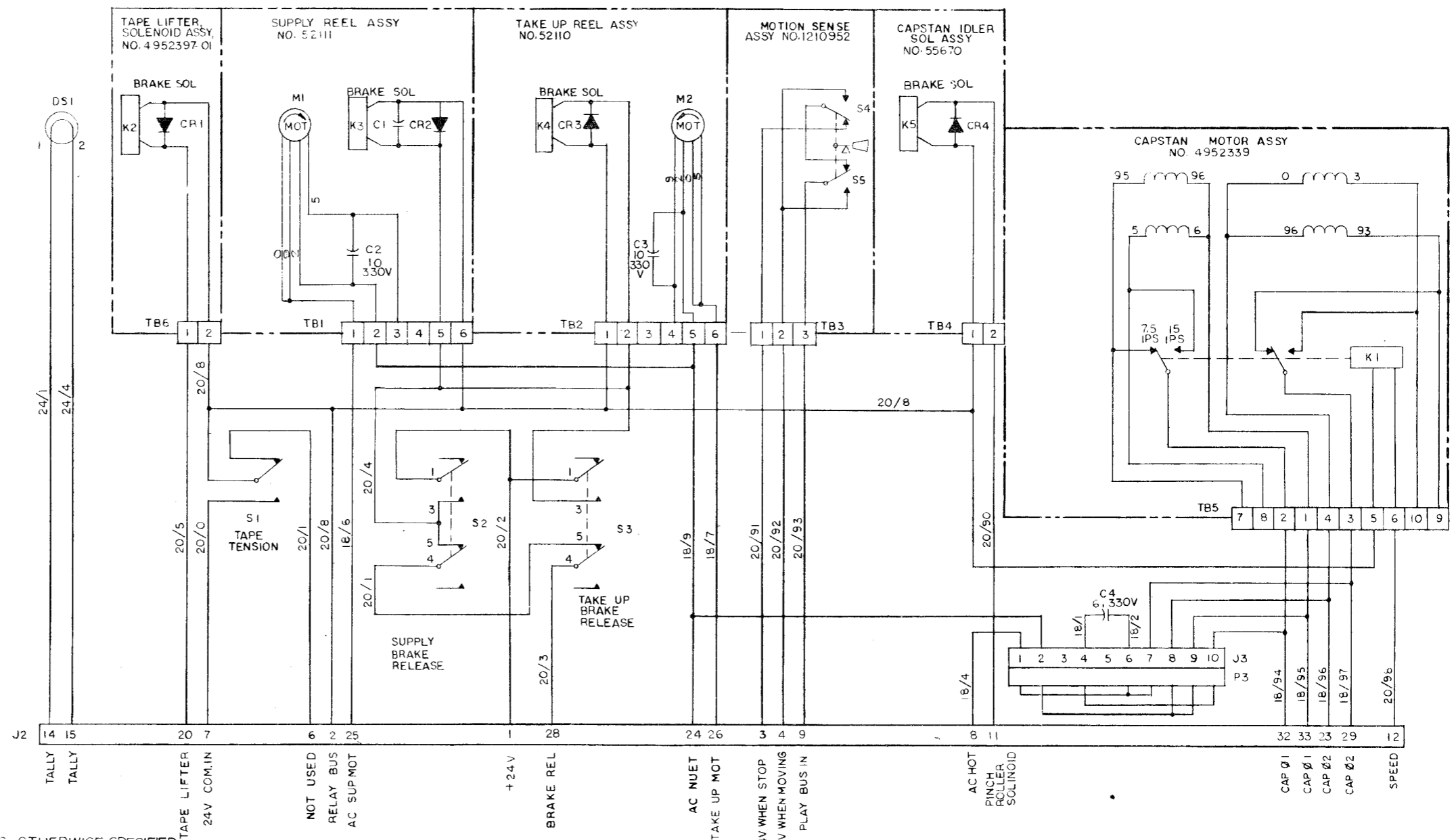
- 1 ONLY ONE CHANNEL SHOWN FOR CLARITY.
- 2 MAY BE ON DIFFERENT CONNECTORS (J701 THRU J704) DEPENDING ON CHANNEL NO.
- 3 REMOTE CONNECTORS NOT SHOWN.

FIGURE 6-1
MM1000 SYSTEM CONTROL
SCHEMATIC



NOTES
 UNLESS OTHERWISE SPECIFIED
 1. ALL DIODES ARE 013-678

FIGURE 6-2
 MM1000 CONTROL PANEL
 PARTIAL SCHEMATIC



NOTES UNLESS OTHERWISE SPECIFIED

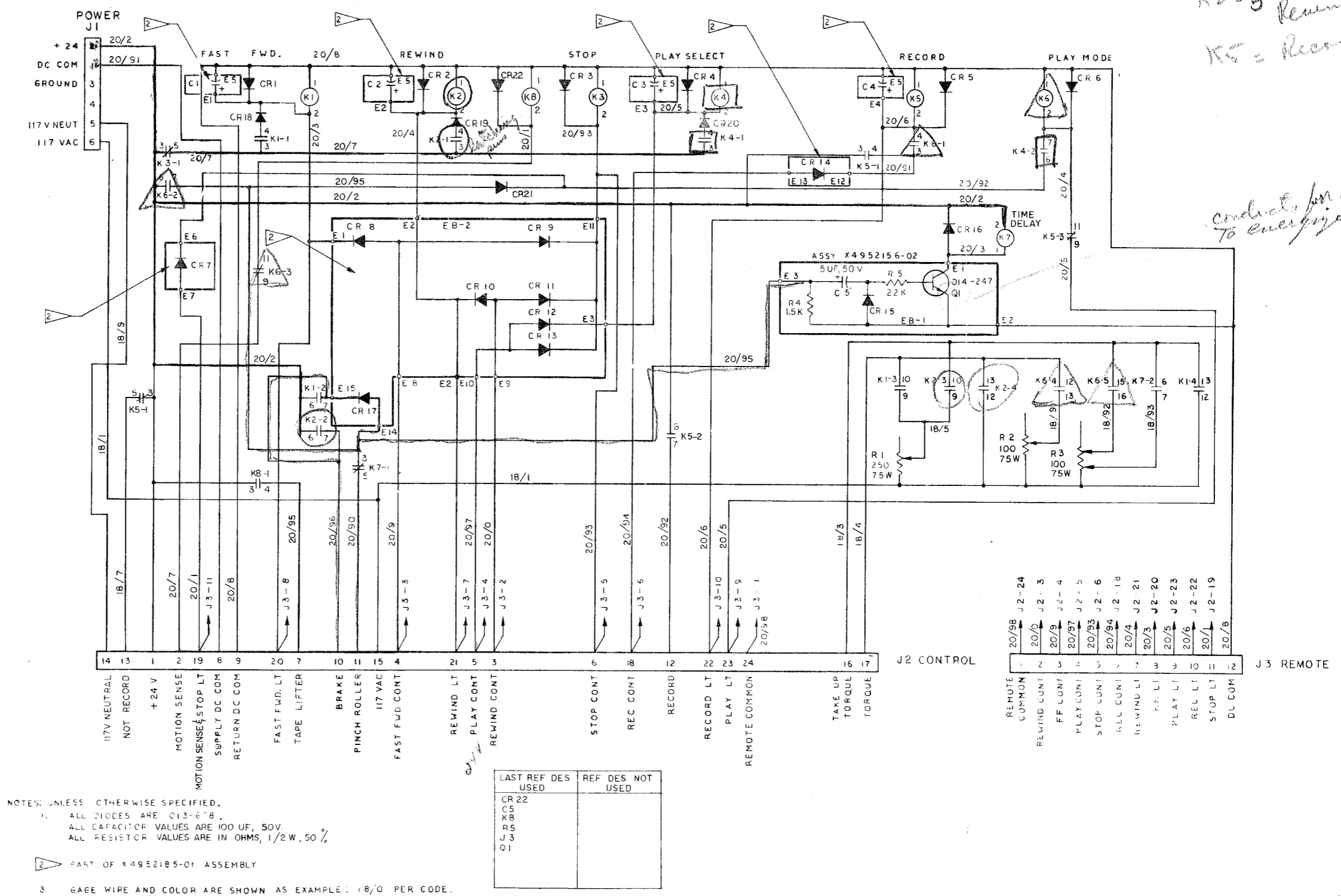
1. ALL CAPACITOR VALUES ARE IN MICROFARADS.
2. ALL DIODES ARE PART NO 013-678.
3. S1 SHOWN WITH NO TAPE THREADED.
4. S2 AND S3 SHOWN IN NORMAL TENSION ARM POSITION
5. S4-S5 SHOWN WITH NO MOTION

LAST REF DES USED	REF DES NOT USED
K5	P1, P2
C5	J1
CR4	
C4	
TB6	
J3	
P3	
DS1	

FIGURE 6-3
MM1000 TRANSPORT SCHEMATIC

K1 = Fast Forward
 K2 = Rewind
 K5 = Record

conduct with 1.5 sec
 to energize K7



NOTES: UNLESS OTHERWISE SPECIFIED.
 1. ALL DIODES ARE 013-E7B.
 ALL CAPACITOR VALUES ARE 100 UF, 50V.
 ALL RESISTOR VALUES ARE IN OHMS, 1/2W, 50%
 2. PART OF X4952185-01 ASSEMBLY
 3. GAGE WIRE AND COLOR ARE SHOWN AS EXAMPLE: 18/0 PER CODE.

LAST REF DES USED	REF DES NOT USED
CR 22	
C 5	
X 8	
R 5	
C 4	
Q 1	

FIGURE 6-4
 MM1000 CONTROL BOX SCHEMATIC

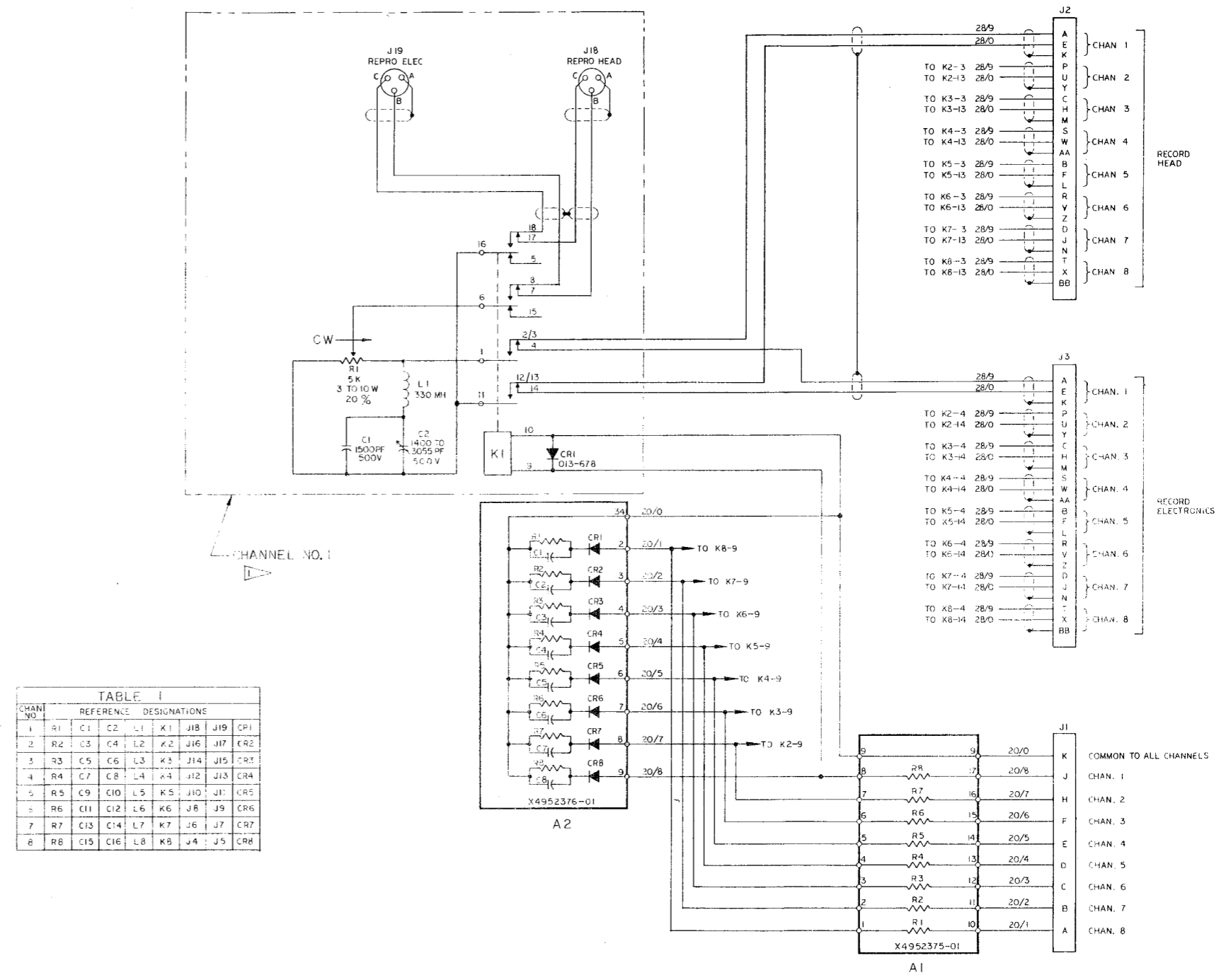
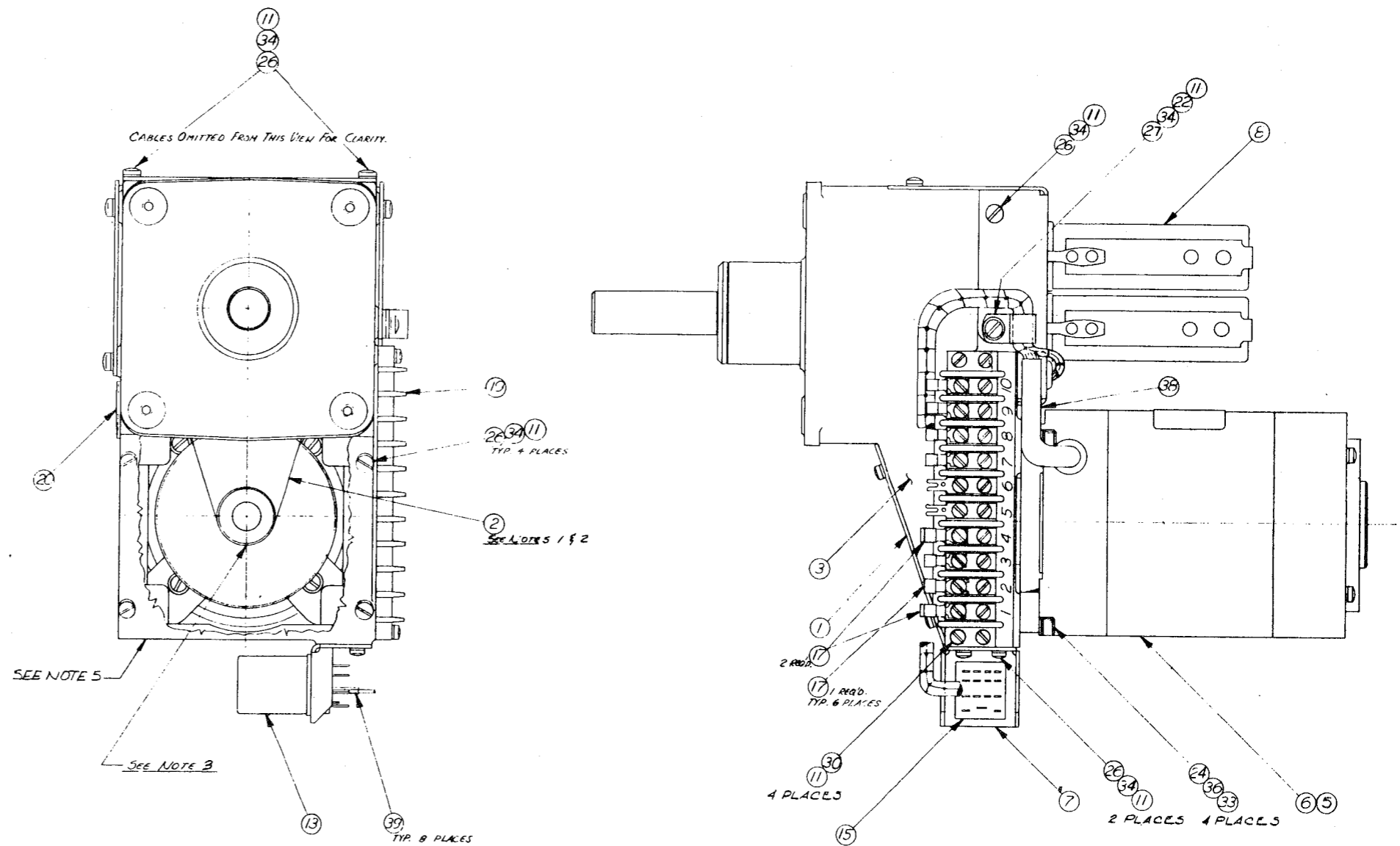


TABLE I

CHAN. NO.	REFERENCE	DESIGNATIONS
1	R1 C1 C2 L1 K1 J18 J19 CP1	
2	R2 C3 C4 L2 K2 J16 J17 CR2	
3	R3 C5 C6 L3 K3 J14 J15 CR3	
4	R4 C7 C8 L4 K4 J12 J13 CR4	
5	R5 C9 C10 L5 K5 J10 J11 CR5	
6	R6 C11 C12 L6 K6 J8 J9 CR6	
7	R7 C13 C14 L7 K7 J6 J7 CR7	
8	R8 C15 C16 L8 K8 J4 J5 CR8	

NOTES
 ▽ FOR APPROPRIATE REFERENCE DESIGNATIONS OF COMPONENTS FOR CHANNELS 2 THRU 8 SEE TABLE I

FIGURE 6-5
 MM1000 SEL-SYNC SCHEMATIC



- NOTES:**
1. CLEAN SURFACE OF PULLEYS & BELT BEFORE INSTALLING.
 2. INSTALL BELT TO 5 LBS TENSION.
 3. TOTAL EDGE RUNOUT OF BELT DUE TO CAMBERED EDGE SHALL NOT EXCEED .050 ON MOTOR PULLEY.
 4. TOTAL RMS FLUTTER FROM 0.6 CPS TO 250 CPS NOT TO EXCEED THE FOLLOWING, WHEN INSTALLED ON A VR 1000 SERIES TRANSPORT:
 AT 7 1/2 IPS : 0.15%
 AT 15 IPS : 0.10%
 5. MARK PERMANENTLY, ASSY. 55570-D1 OR ASSY 55570-02, WHICHEVER APPLICABLE, APPROXIMATELY AS SHOWN.

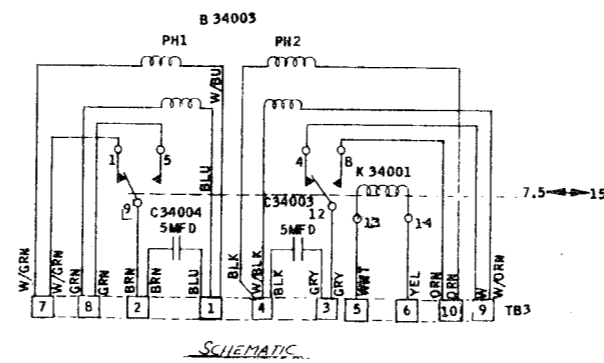
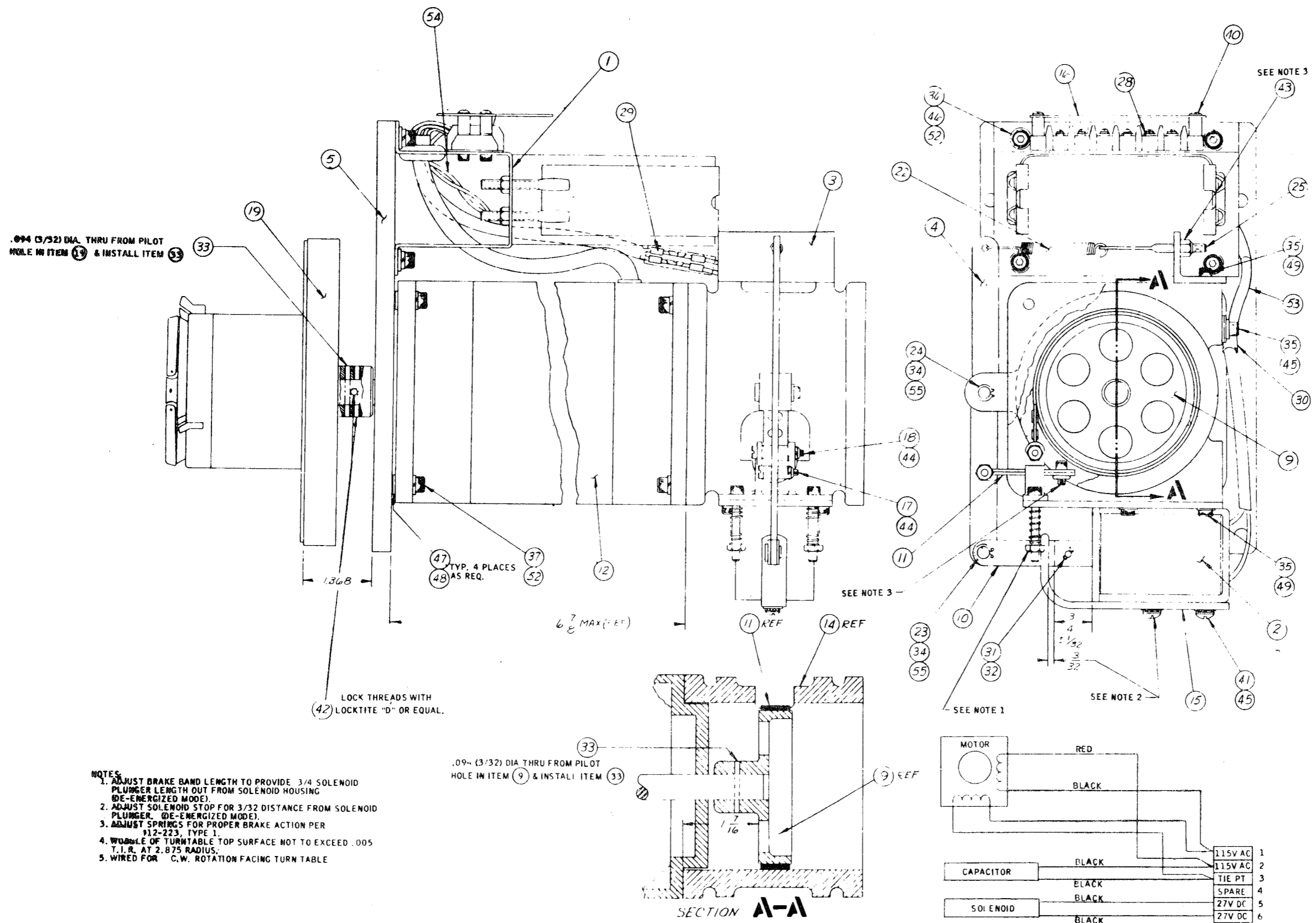


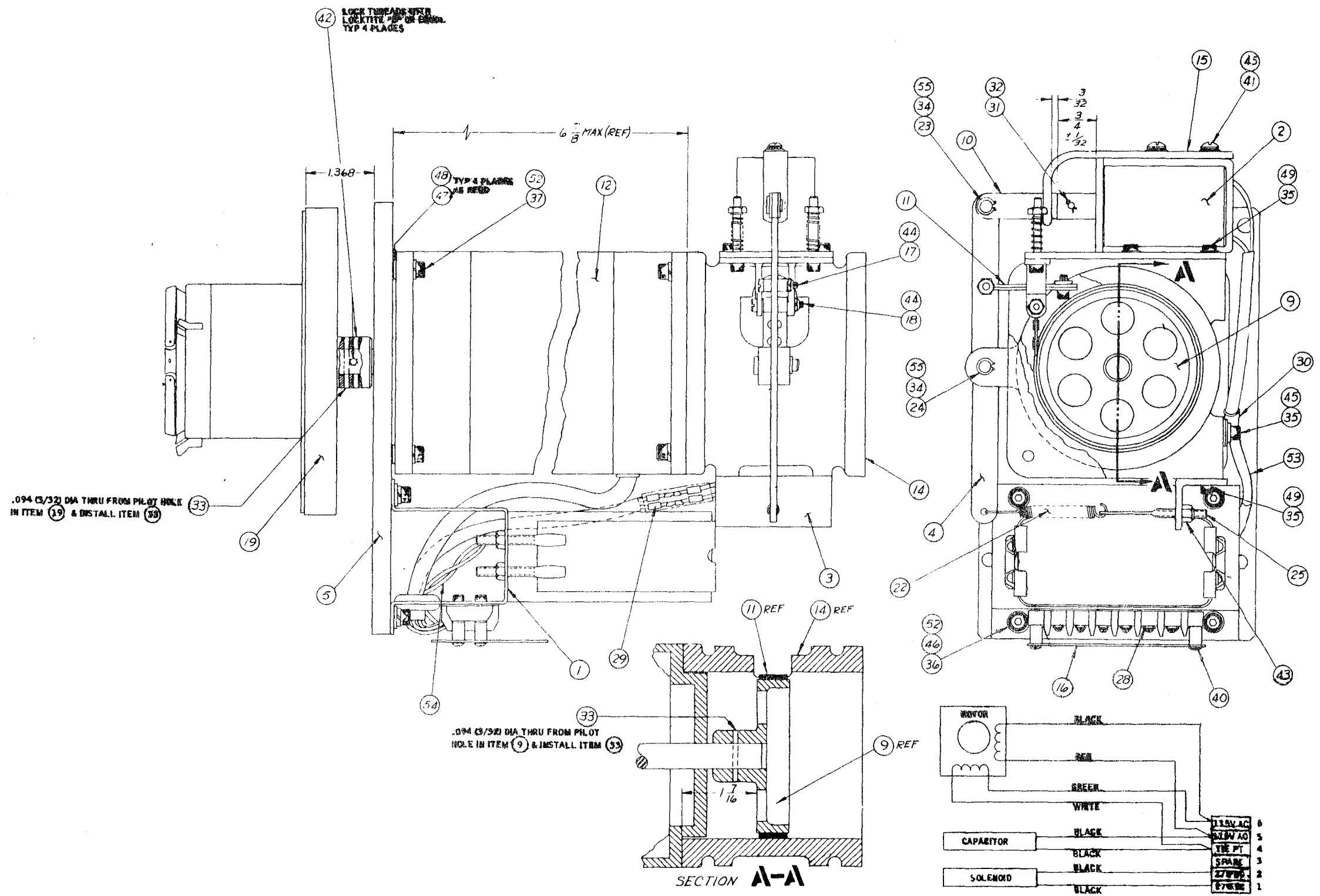
FIGURE 6-6
CAPSTAN MOTOR ASSEMBLY



MATERIALS LIST			
QTY	ITEM NO.	AMPEX PART NO.	DESCRIPTION
1	1	C-13952-01	BRACKET ASSY.
1	2	B-13954-01	SOLENOID ASSY.
1	3	A-13958-01	PLATE, BRAKE SPRING
1	4	B-13959-01	LEVER, BRAKE
1	5	C-13961-01	FLANGE, MOTOR
1	6		
1	7		
1	8	B-13964-01	PAD, TURNTABLE
1	9	B-13966-01	DRUM, BRAKE
2	10	A-13968-01	LINK, SOLENOID
1	11	B-14331-01	BRAKE BAND ASSY.
1	12	D-14349-01	MOTOR, TORQUE
1	13		
1	14	D-14418-01	HOUSING, BRAKE
1	15		STOP, SOLENOID
1	16	A-50236-01	GUARD, TERM. STRIP
1	17	B-50630-01	PIN, BRAKE LOOP
1	18	B-50630-02	PIN, BRAKE LOOP
1	19	D-52120-01	KNOB ASSY - REEL HOLD DOWN
1	20		
1	21		
1	22	B-52172-01	SPRING, BRAKE ADJ.
1	23	B-52173-01	PIN, LINK
1	24	B-52173-02	PIN, LINK
1	25	B-52174-01	BOLT, EYE
1	26		
1	27		
6	28	171-001	SOLDERLESS CONNECTOR
2	29	171-009	SOLDERLESS CONNECTOR
1	30	302-007	CLAMP, CABLE 1/4 I.D. PLASTIC
1	31	400-009	PIN, CLEVIS 1/8 DIA X 17/32 LONG
1	32	401-007	PIN, COTTER 1/16 DIA X 1/2 LNG.
2	33	406-012	PIN, ROLL PIN .094 DIA X 1 LNG.
2	34	430-004	RING, RETAINING
7	35	470-029	SCREW, CAP, #8-32 X 1/2 LONG
4	36	470-037	SCREW, CAP, #10-32 X 7/16 LONG
8	37	470-040	SCREW, CAP, #10-32 X 3/4 LONG
1	38		
1	39		
4	40	471-563	SCREW, MACH. #6-32 X 3/16 LONG
2	41	475-038	SCREW, SEM. #8-32 X 1/16 LONG
1	42	477-067	SCREW, SET #8-32 X 1/4 LONG
1	43	493-00F	NUT, SELF LOCKING #10-32
2	44	493-009	NUT, SELF LOCKING #6-32
3	45	501-010	WASHER, FLAT, #8
1	46	501-011	WASHER, FLAT #10
A/R	47	501-054	WASHER-SHIM, .001 THK
A/R	48	501-064	WASHER-SHIM, .003 THK
8	49	502-003	WASHER, LOCK, #8 SPRING
1	50		
1	51		
12	52	502-004	WASHER, LOCK #10 SPRING
A/R	53	600-011	TUBING #6 (.166 I.D.) B&K. PLASTIC
A/R	54		WIRE - #20 AWG (BLACK)
A/R	55		GREASE-AVIATION #1 STD OR EQUIV.

- NOTES
1. ADJUST BRAKE BAND LENGTH TO PROVIDE 3/4 SOLENOID PLUNGER LENGTH OUT FROM SOLENOID HOUSING (DE-ENERGIZED MODE).
 2. ADJUST SOLENOID STOP FOR 3/32 DISTANCE FROM SOLENOID PLUNGER. (DE-ENERGIZED MODE).
 3. ADJUST SPRINGS FOR PROPER BRAKE ACTION PER #12-223, TYPE 1.
 4. WOBBLE OF TURNTABLE TOP SURFACE NOT TO EXCEED .005 T.I.R. AT 2.875 RADIUS.
 5. WIRED FOR C.W. ROTATION FACING TURN TABLE

FIGURE 6-7
SUPPLY REEL ASSEMBLY



MATERIALS LIST

QTY	ITEM NO.	AMPEX PART NO.	DESCRIPTION
1	1	C-13952-01	BRACKET ASSY.
1	2	B-13954-01	SOLENOID ASSY.
1	3	A-13958-01	PLATE, BRAKE SPRING
1	4	B-13959-01	LEVER, BRAKE
1	5	C-13961-01	FLANGE, MOTOR
	6		
	7		
1	8	B-13964-01	PAD, TURNABLE
1	9	B-13966-01	DRUM, BRAKE
2	10	A-13968-01	LINK, SOLENOID
1	11	B-14331-01	BRAKE BAND ASSY.
1	12	D-14349-01	MOTOR, TORQUE
	13		
1	14	D-14418-01	HOUSING, BRAKE
1	15	A-14585-01	STOP, SOLENOID
1	16	A-50236-01	GUARD, TERM. STRIP
1	17	B-50630-01	PIN, BRAKE LOOP
1	18	B-50630-02	PIN, BRAKE LOOP
1	19	D-52120-01	KNOB ASSY - REEL HOLD DOWN
	20		
	21		
1	22	B-52172-01	SPRING, BRAKE ADJ.
1	23	B-52173-01	PIN, LINK
1	24	B-52173-02	PIN, LINK
1	25	B-52174-01	BOLT, EYE
	26		
	27		
4	28	171-001	SOLDERLESS CONNECTOR
2	29	171-009	SOLDERLESS CONNECTOR
1	30	302-007	CLAMP, CABLE 1/4 I.D. PLASTIC
1	31	400-009	PIN, CLEVIS 1/8 DIA X 17/32 LONG
1	32	401-007	PIN, COTTER 1/16 DIA X 1/2 LMG.
2	33	406-012	PIN, ROLL PIN .094 DIA X 1 LMG.
2	34	430-004	RING, RETAINING
7	35	470-029	SCREW, CAP, #8-32 X 1/2 LONG
4	36	470-037	SCREW, CAP, #10-32 X 7/16 LONG
8	37	470-040	SCREW, CAP, #10-32 X 3/4 LONG
	38		
	39		
4	40	471-563	SCREW, MACH. #6-32 X 3/16 LONG
2	41	475-038	SCREW, SEM, #8-32 X 5/16 LMG.
4	42	477-067	SCREW, SET #8-32 X 1/4 LONG
1	43	493-008	NUT, SELF LOCKING #10-32
2	44	493-009	NUT, SELF LOCKING #6-32
3	45	501-010	WASHER, FLAT, #8
1	46	501-011	WASHER, FLAT #10
A/R	47	501-054	WASHER-SHIM, .005 THK.
A/R	48	501-064	WASHER-SHIM, .003 THK.
8	49	502-004	WASHER, LOCK, #8 SPRING
	50		
	51		
12	52	502-005	WASHER, LOCK #10 SPRING
A/R	53	606-011	TUBING #6 (1.60 I.D.) BLK. PLASTIC
A/R	54		WIRE - #20 AWG BLACK
A/R	55		GREASE-AVIATION #1 S'CO OR EQUIV.

FIGURE 6-8
TAKE-UP REEL ASSEMBLY

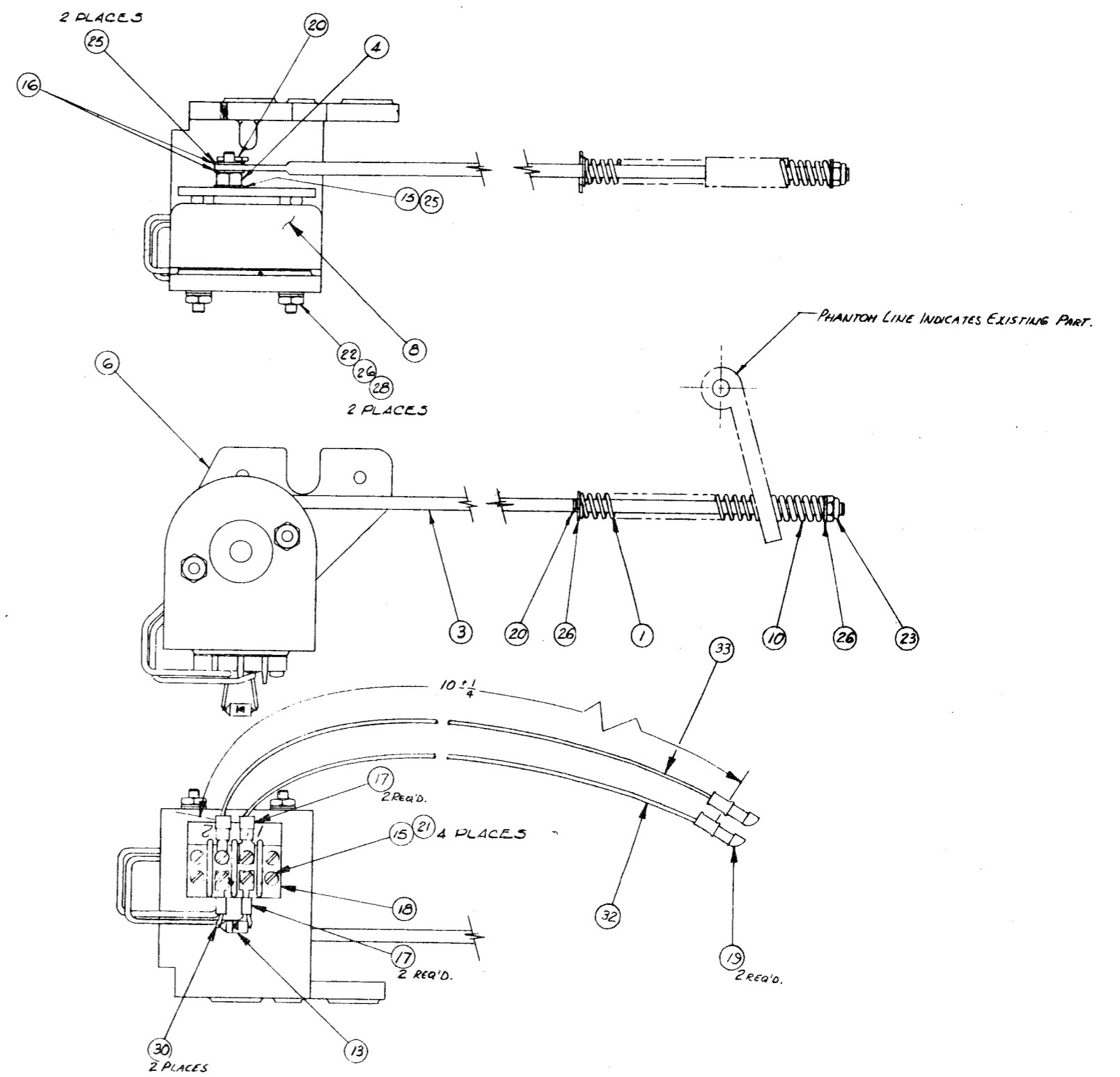
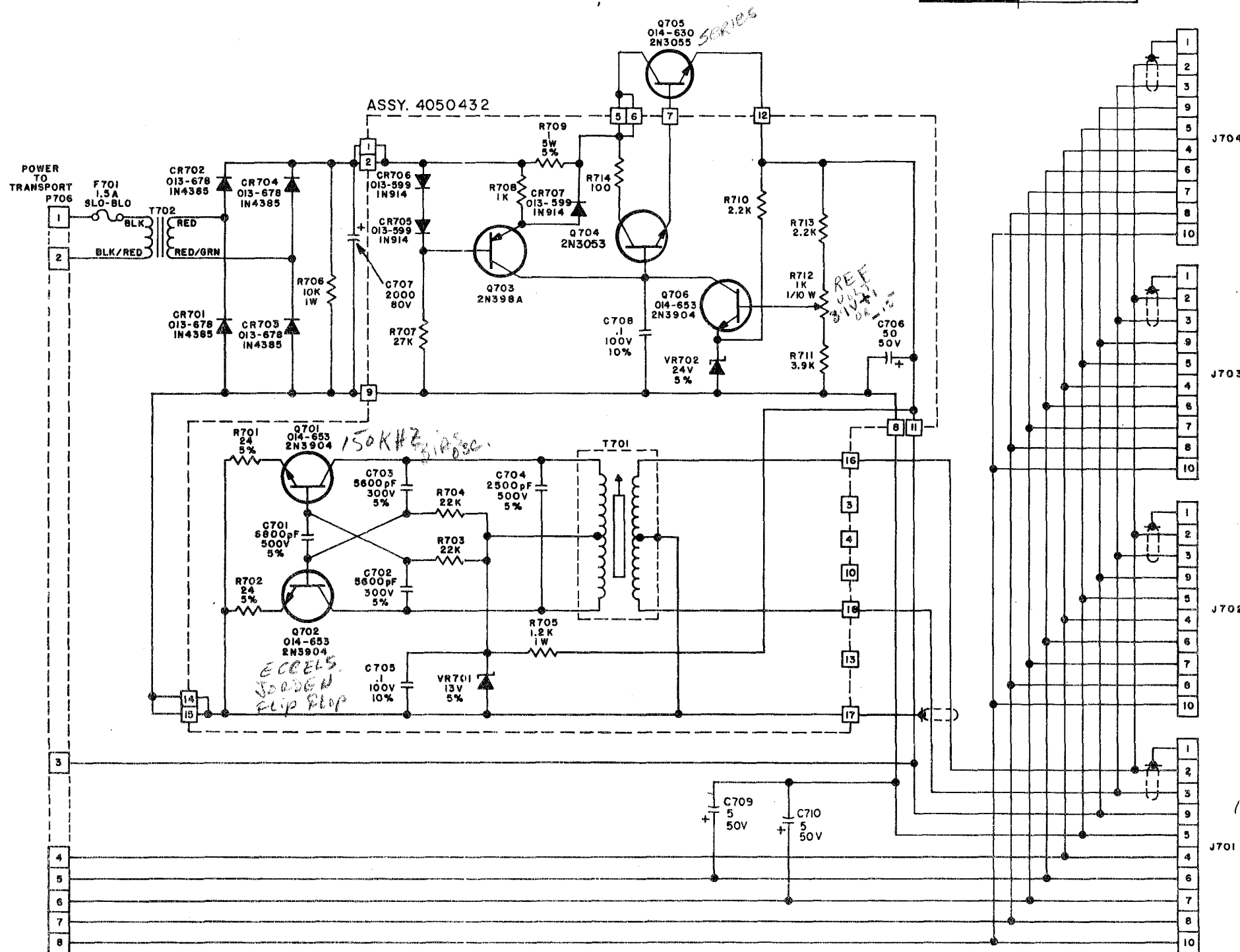


FIGURE 6-9
CAPSTAN SOLENOID ASSEMBLY

RECORD/REPRODUCE
POWER SUPPLY ASSEMBLY
CATALOG NO. 4020274-01

Ref. No.	Qty	DESCRIPTION	Ampex Part No.
C701	1	Capacitor, mica; 6800 pfd, ±5%, 500 vdcw	056-108
C702	2	Capacitor, mica; 5600 pfd, ±5%, 300 vdcw	034-507
C703	-	Same as C702	
C704	1	Capacitor, mica; 2500 pfd, ±5%, 500 vdcw	034-994
C705	2	Capacitor, mylar; 0.1 mfd, ±10%, 100 vdcw	055-106
C706	1	Capacitor, electrolytic; 50 mfd, -10+75%, 50 vdcw	031-187
C707	1	Capacitor, electrolytic; 2000 mfd, -10+250%, 80 vdcw	* 4550147-03
C708	-	Same as C705	
C709	2	Capacitor, electrolytic; 5 mfd, -10+75%, 50 vdcw	031-205
C710	-	Same as C709	
CR701	4	Diode, silicon, large signal rectifier	* 013-678
CR702	-	Same as CR701	*
CR703	-	Same as CR701	*
CR704	-	Same as CR701	*
CR705	3	Diode, silicon, small signal switching	* 013-599
CR706	-	Same as CR705	*
CR707	-	Same as CR705	*
F701	1	Fuse, slo-blo; 1.5 amp, 125v	* 070-075
J701	4	Connector, receptacle; 10 sockets, female	* 146-018
J702	-	Same as J701	*
J703	-	Same as J701	*
J704	-	Same as J701	*
P706	1	Connector, plug; 8 pins, male	* 145-013
Q701	3	Transistor, silicon	014-653
Q702	-	Same as Q701	
Q703	1	Transistor, Germanium, 2N398A	014-704
Q704	1	Transistor, silicon; 2N3053	014-590
Q705	1	Transistor, silicon, power	014-630
Q706	-	Same as Q701	
R701	2	Resistor, fixed, comp; 24 ohms, ±5%, 1/2w; RC20GF240J	041-533
R702	-	Same as R701	
R703	2	Resistor, fixed, comp; 22,000 ohms, ±10%, 1/2w; RC20GF223K	041-064
R704	-	Same as R703	
R705	1	Resistor, fixed, comp; 1,200 ohms, ±10%, 1w; RC32GF122K	041-147
R706	1	Resistor, fixed, comp; 10,000 ohms, ±10%, 1w; RC32GF103K	041-158
R707	1	Resistor, fixed, comp; 27,000 ohms, ±10%, 1/2w; RC20GF273K	041-065
R708	1	Resistor, fixed, comp; 1,000 ohms, ±10%, 1/2w; RC20GF102K	041-048
R709	1	Resistor, fixed, wirewound; 1 ohm, ±5%, 5w	059-016
R710	2	Resistor, fixed, comp; 2,200 ohms, ±10%, 1/2w; RC20GF222K	041-052
R711	1	Resistor, fixed, comp; 3,900 ohms, ±10%, 1/2w; RC20GF392K	041-055
R712	1	Resistor, variable, comp; 1,000 ohms, ±30%, 1/10w	044-370
R713	-	Same as R710	
R714	1	Resistor, fixed, comp; 100 ohms, ±10%, 1/2w; RC20GF101K	041-038
T701	1	Coil, bias oscillator	4580123-01
T702	1	Transformer, power supply	* 4580156-01
VR701	1	Diode, silicon, zener; 13 volt, ±5%	013-747
VR702	1	Diode, silicon, zener; 24 volt, ±5%	013-712
	2	Card Guide	530-102
	1	Fuse holder, short body	085-001
	1	Kit, transistor mounting (for Q705)	014-630
	2	Pad, transistor (for Q703, Q704)	280-131

NOTE: All items except those marked * are on printed circuit board

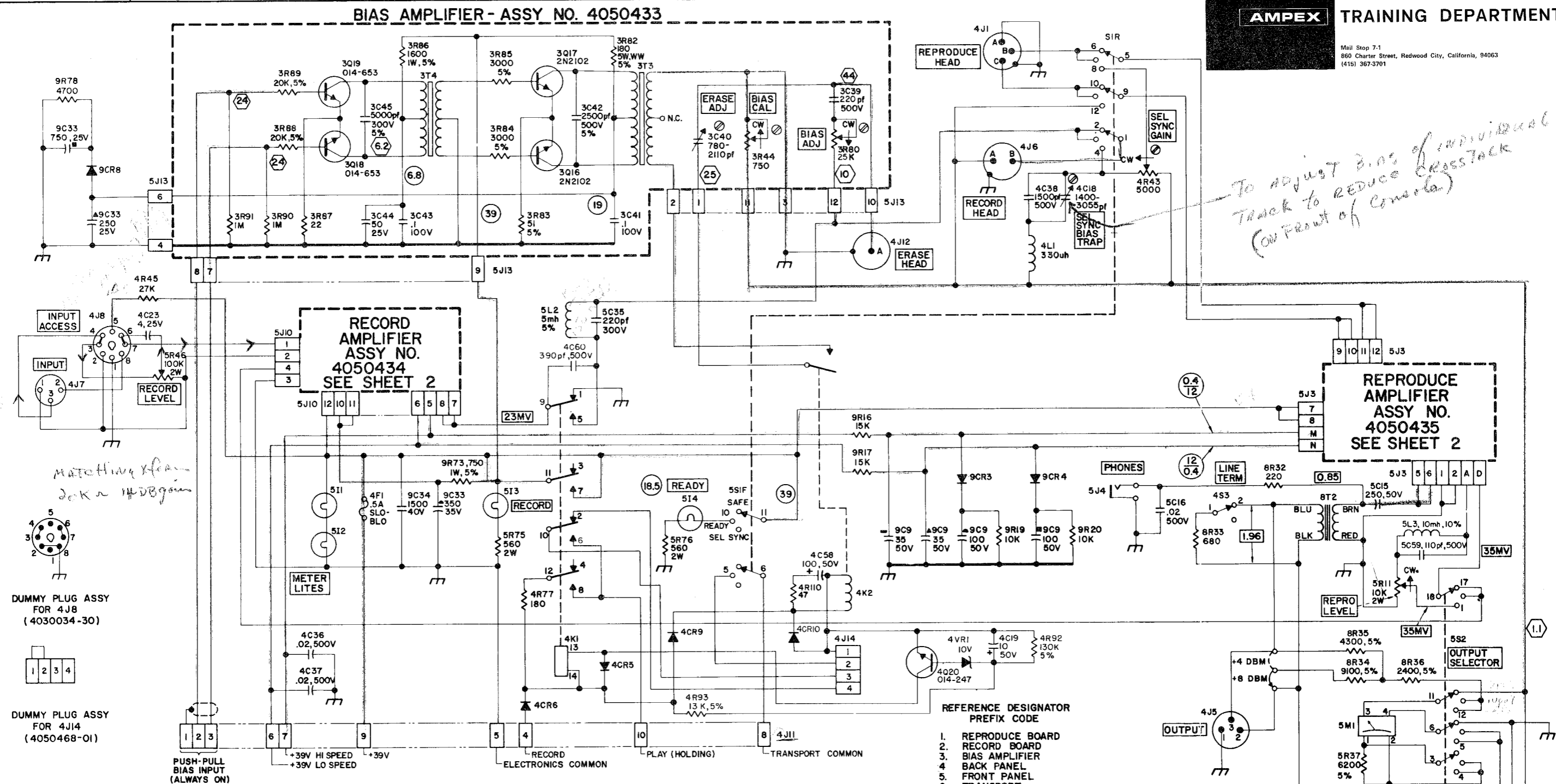


NOTES:
UNLESS OTHERWISE SPECIFIED
1. ALL CAPACITOR VALUES ARE IN MICROFARADS, RATINGS AS IND' CATED.
2. ALL RESISTORS VALUES ARE IN OHMS, 1/2 WATT, 10%.

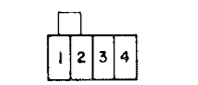
LAST REF. DES. USED	REF. DES. NOT USED
C710	
CR707	
Q706	
VR702	
T702	
R714	

FIGURE 6-10
POWER SUPPLY SCHEMATIC,
RECORD/REPRODUCE

To adjust bias of individual track to reduce crossstack (on front of console)



DUMMY PLUG ASSY FOR 4J8 (4030034-30)



DUMMY PLUG ASSY FOR 4J14 (4050468-01)

PUSH-PULL BIAS INPUT (ALWAYS ON)
+39V HI SPEED
+39V LO SPEED

- NOTES: UNLESS OTHERWISE SPECIFIED
- ALL RESISTOR VALUES ARE IN OHMS, 1/2W, 10%.
 - ALL CAPACITOR VALUES ARE IN MICROFARADS, AT INDICATED VOLTAGE.
 - ALL DIODES ARE TYPE 013-678.
 - SEE TABLE I FOR FIELD SERVICED TRANSISTORS.
 - PROVISION IS MADE TO PAD HEAD OUTPUT AT HIGH FREQUENCIES.
 - REPRODUCE EQUALIZER 402070-01 CAN BE ADJUSTED TO NAB AND/OR CCIR.
 - SHIELD DESIGNATIONS OMITTED TO PRESERVE DRAWING CLARITY.
 - ⊗⊗ INDICATES VOLTS D.C. MEASURED WITH A 20,000 Ω/V METER.

- ⊗⊗ INDICATES VOLTS D.C. MEASURED WITH A HIGH IMPEDANCE VTVM.
- ⊗⊗ INDICATES VOLTS R.M.S. MEASURED WITH A HIGH IMPEDANCE VTVM AT OPERATING LEVEL OF 1000HZ.
- ⊗⊗ INDICATES VOLTS R.M.S. MEASURED WITH A HIGH IMPEDANCE VTVM AT BIAS FREQUENCY.

TABLE I FOR FIELD SERVICE ONLY

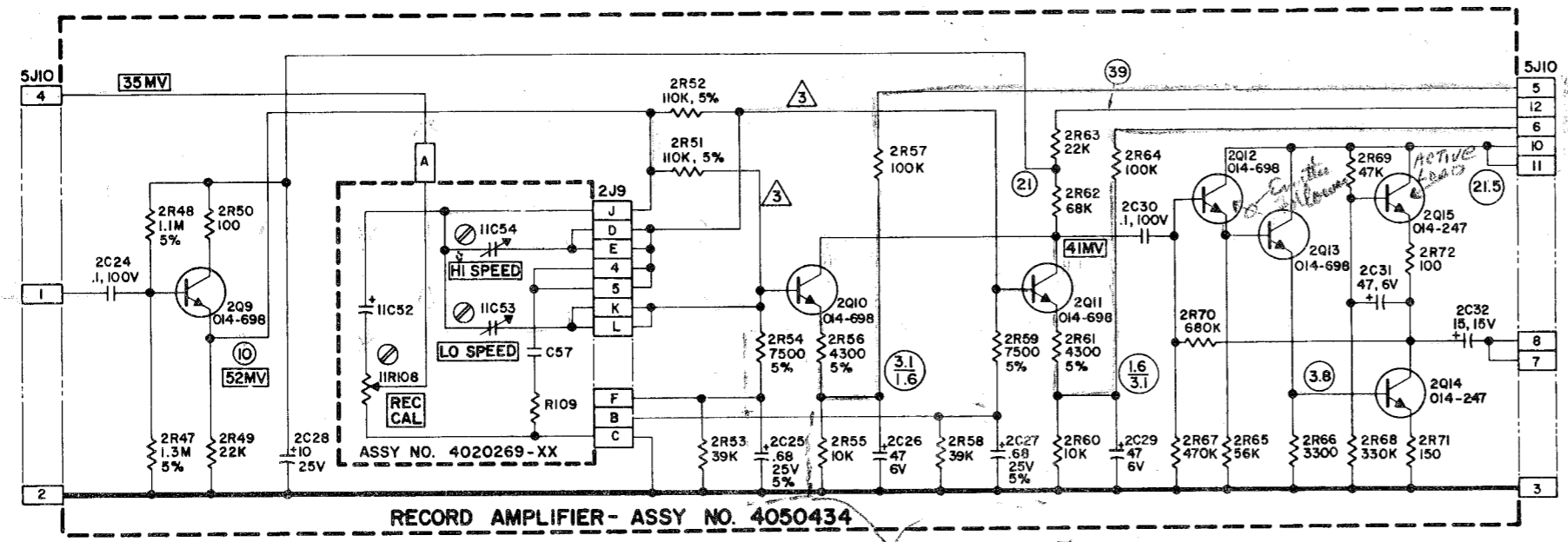
TRANSISTORS	MAY USE
1Q1, 1Q2, 2Q9 THRU 2Q13	2N3117 OR 2N5088
1Q3, 1Q4	2N4946
1Q5	2N3906
1Q6, 2Q14 THRU 3Q17, 4Q20	2N2219
3Q18, 3Q19	2N3904

LAST REF DES USED	REF DES NOT USED
C60	R39-42
CR10	R81
F1	R74
I4	R94-
J14	100
K2	C20-22
L3	R79
M1	C46-49
Q20	J2
R10	C38
S3	
T4	

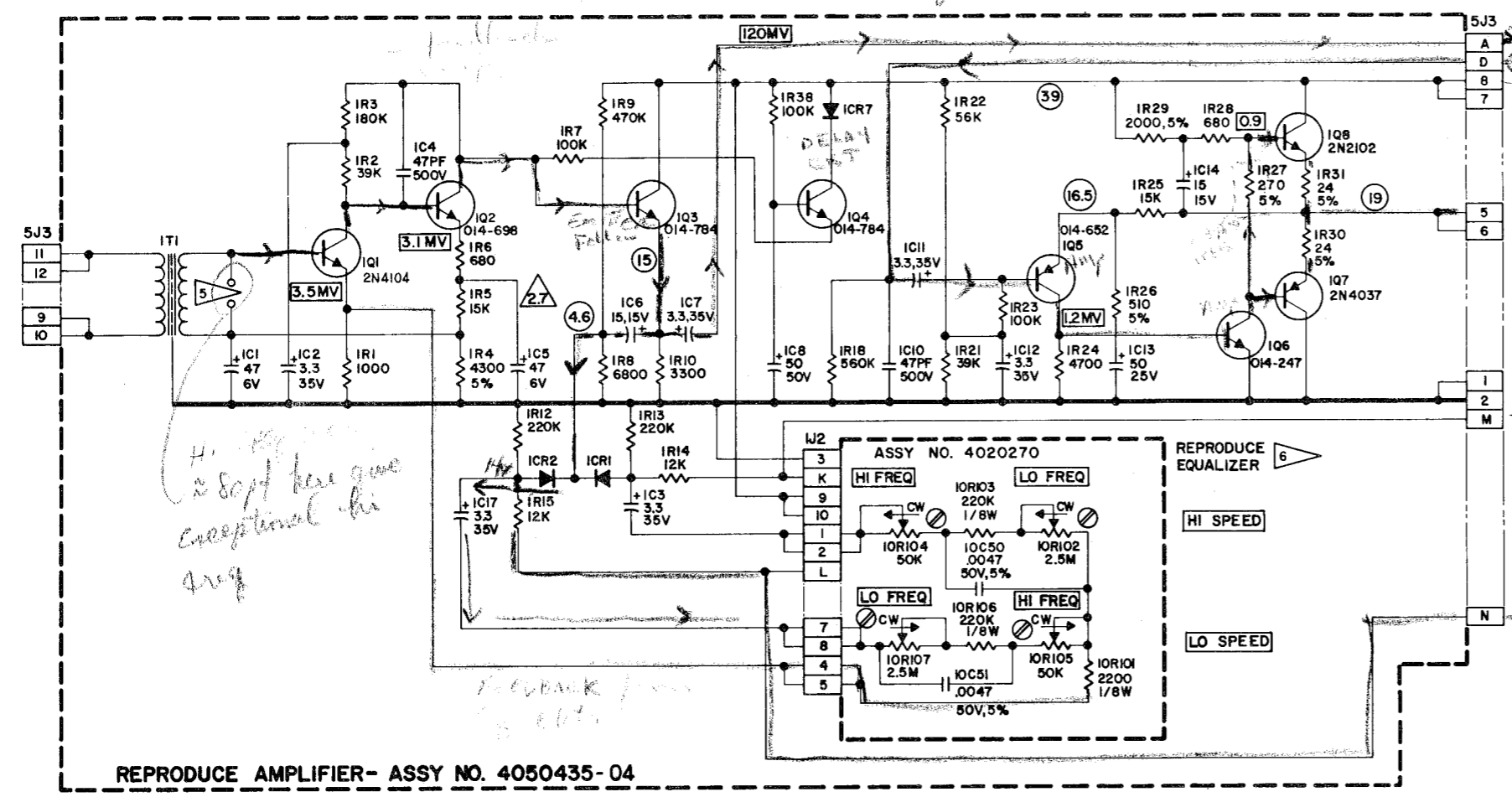
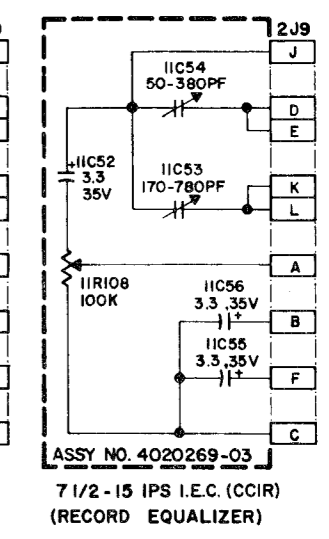
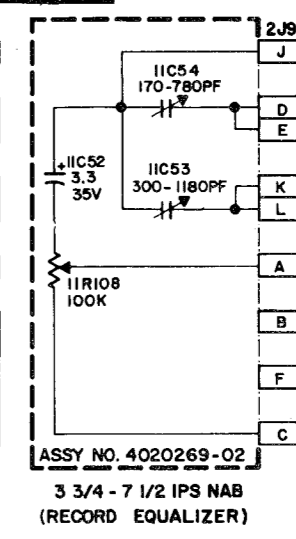
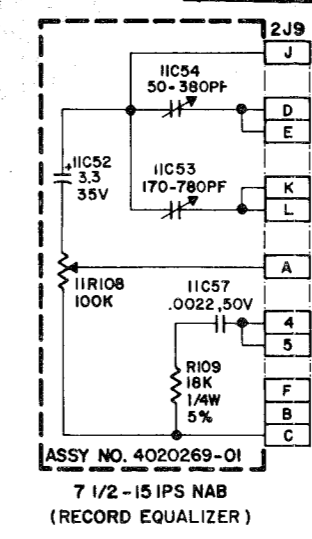
- REFERENCE DESIGNATOR PREFIX CODE
- REPRODUCE BOARD
 - RECORD BOARD
 - BIAS AMPLIFIER
 - BACK PANEL
 - FRONT PANEL
 - TRANSPORT
 - POWER SUPPLY
 - RIGHT PANEL (FROM FRONT)
 - LEFT PANEL (FROM FRONT)
 - REPRODUCE EQUALIZER
 - RECORD EQUALIZER
 - POWER BOOST

FIGURE 6-11 (1)
SCHEMATIC DIAGRAM
MM-1000 ELECTRONICS

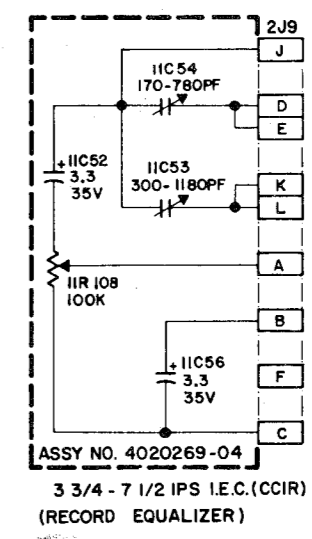
Mail Stop 7-1
860 Charter Street, Redwood City, California, 94063
(415) 367-3701



RECORD AMPLIFIER - ASSY NO. 4050434
Lo Freq Boost



REPRODUCE AMPLIFIER - ASSY NO. 4050435-04



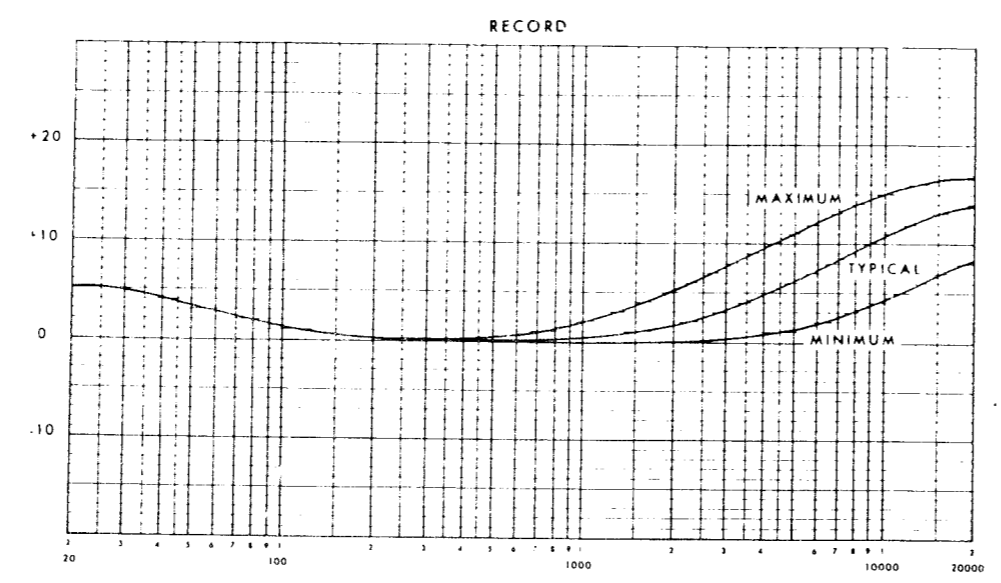
*Hi Freq boost
2 soft bias give
exceptional hi
freq*

*NOTE: 2 soft bias from HI
speed sol.
100% hi speed*

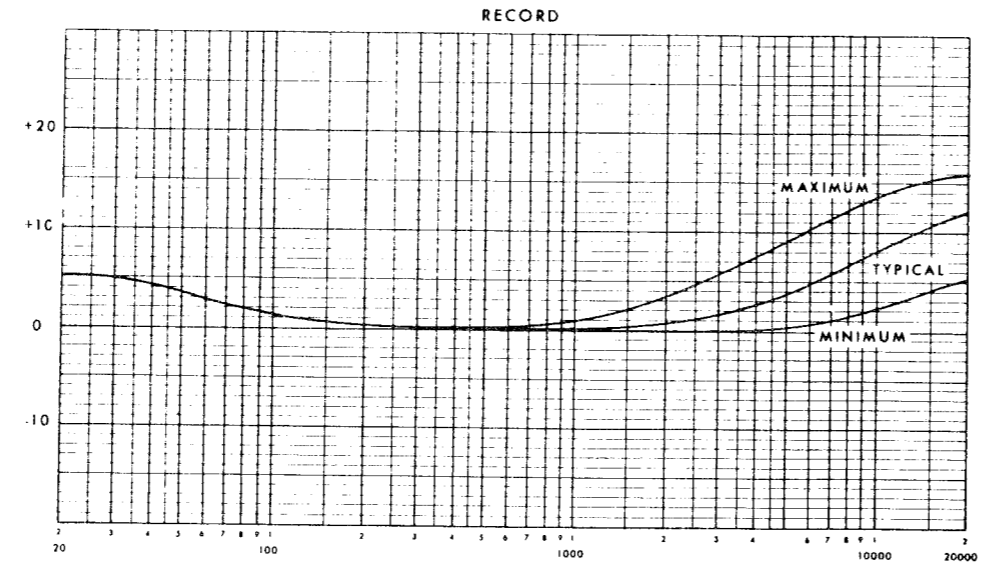
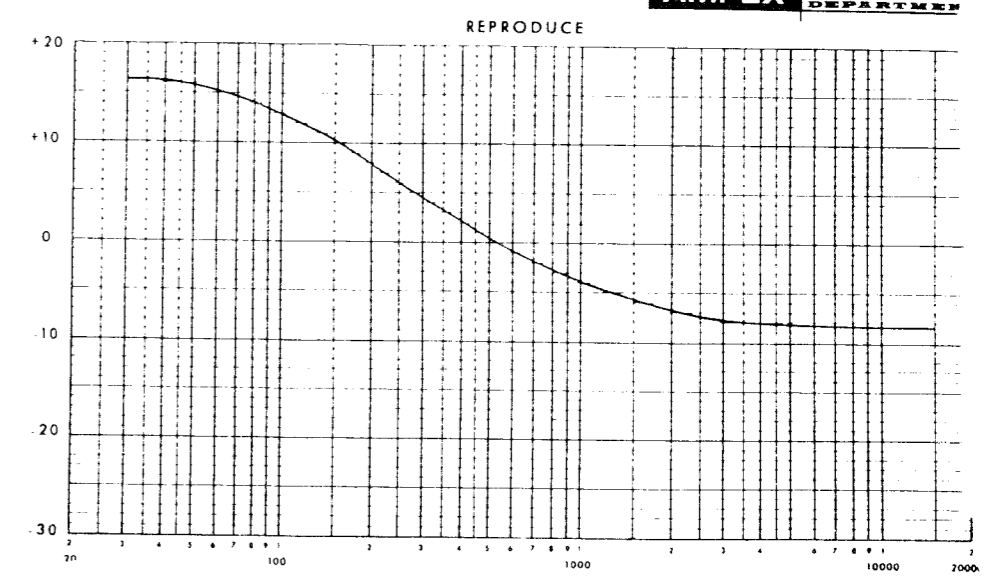
*NOTE: If the out 9.0dB will
not be ok*

NOTES:
SEE SHEET 1.

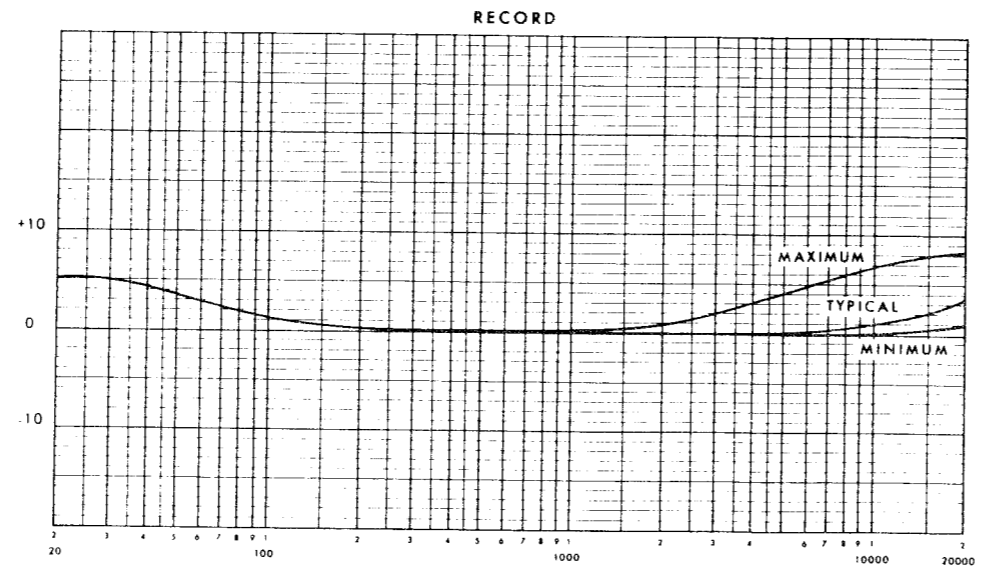
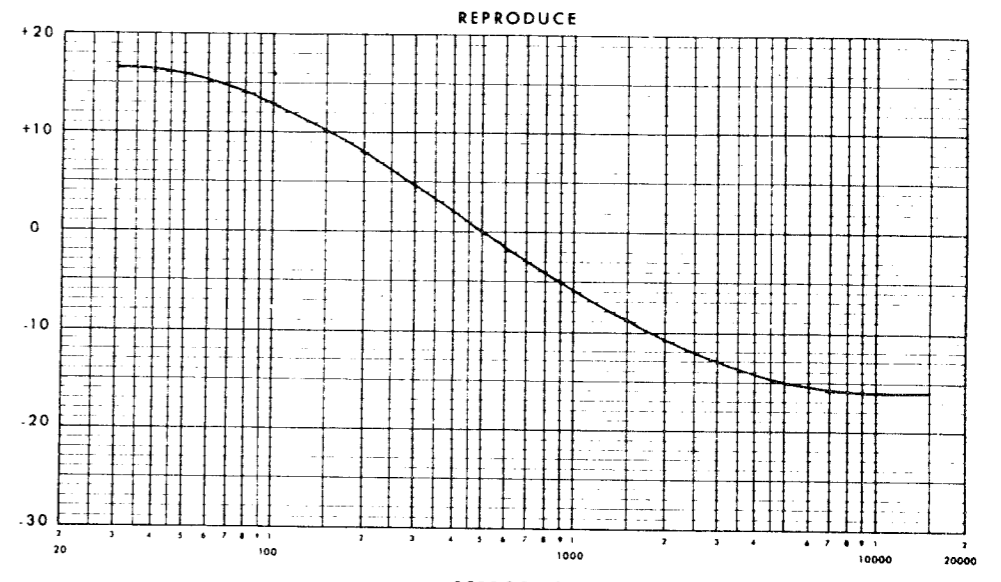
FIGURE 6 - 11 (2)
**SCHEMATIC DIAGRAM
MM-1000 ELECTRONICS**



3 1/4 ips (120 usec)



7 1/2 ips NAB



15 ips NAB

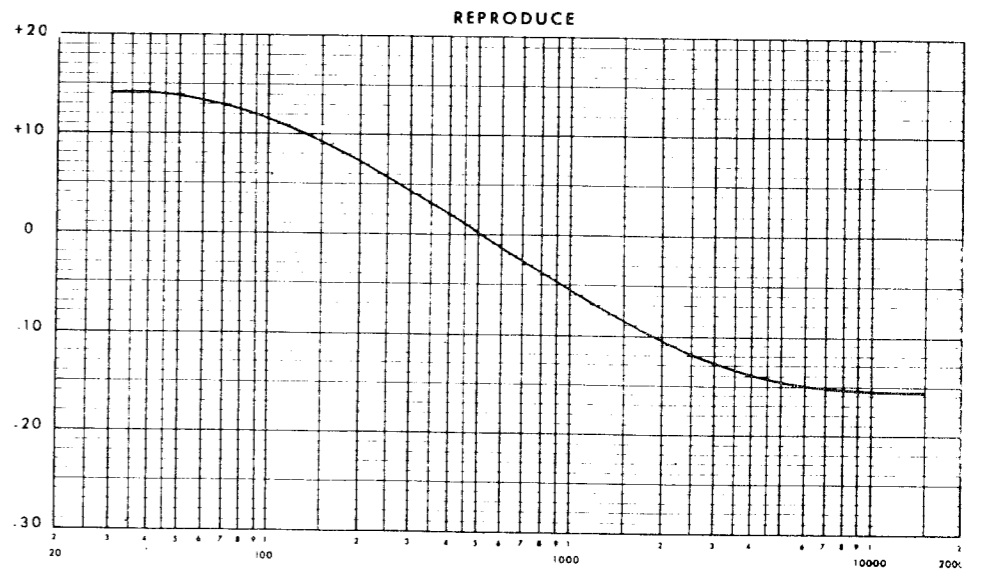
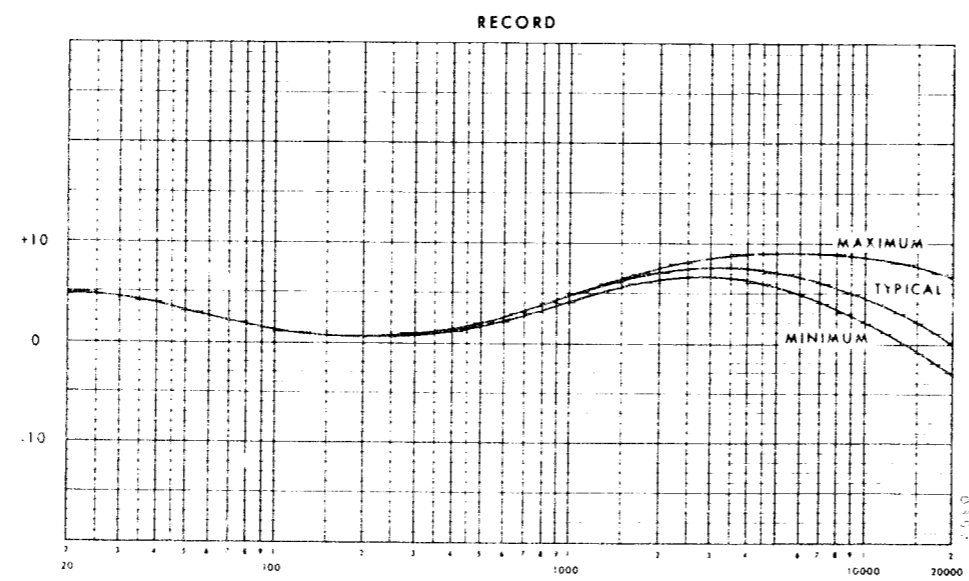
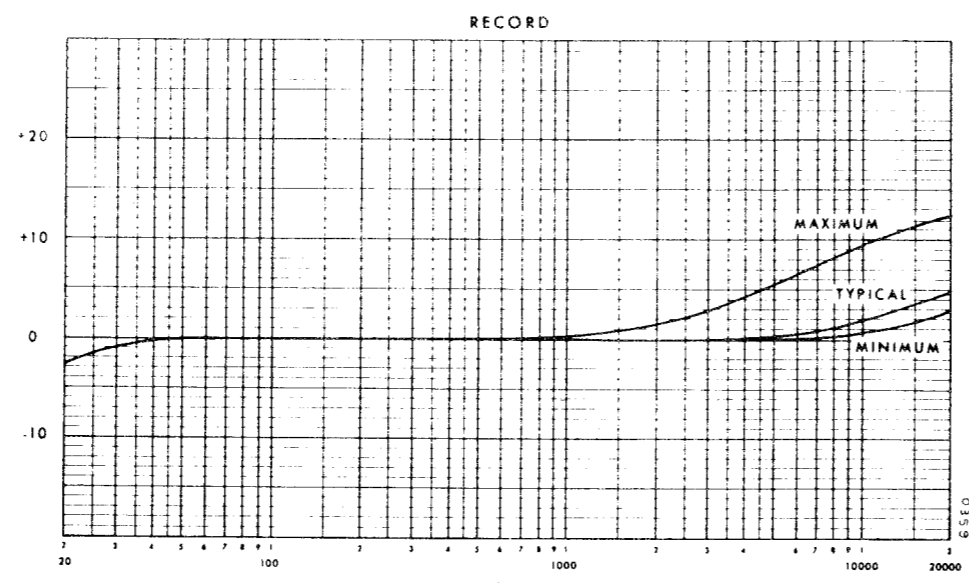
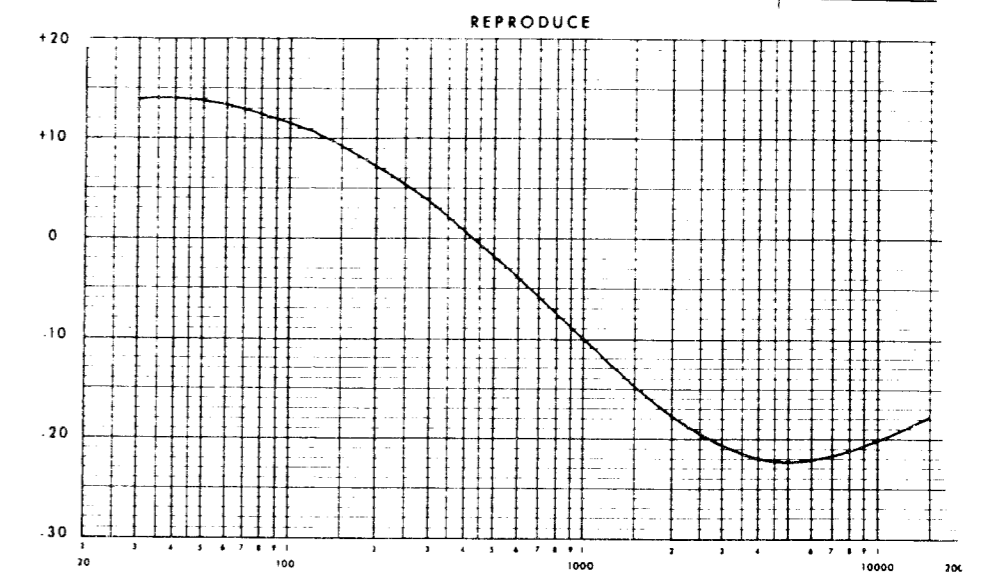


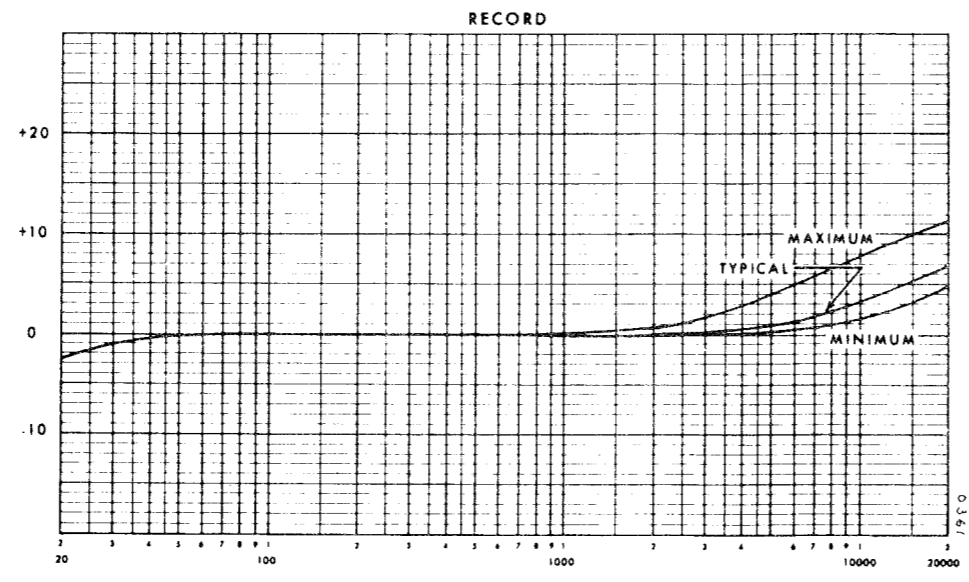
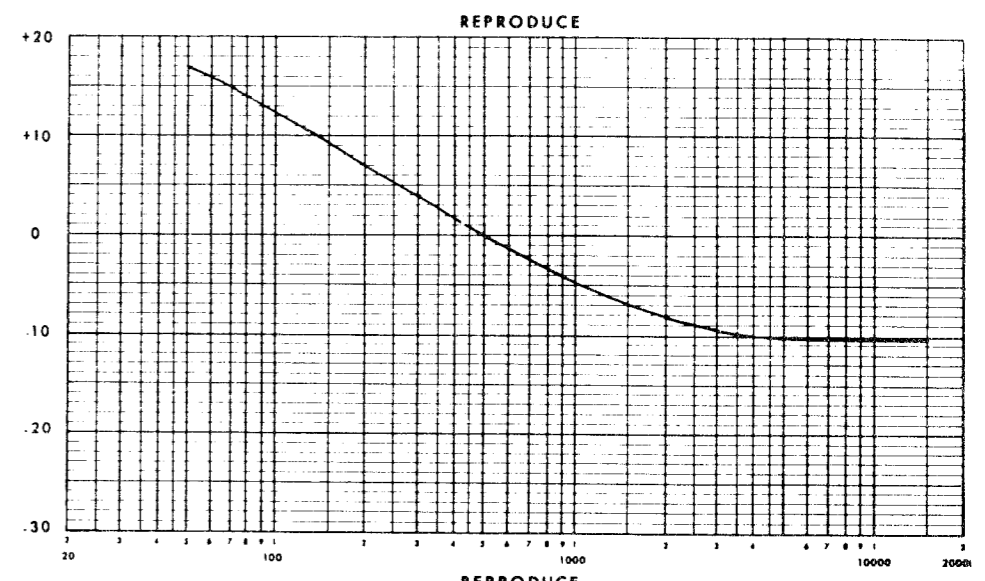
FIGURE 6-12
RESPONSE CURVES, SHEET



15 ips AME



7 1/2 ips CCIR



15 ips CCIR

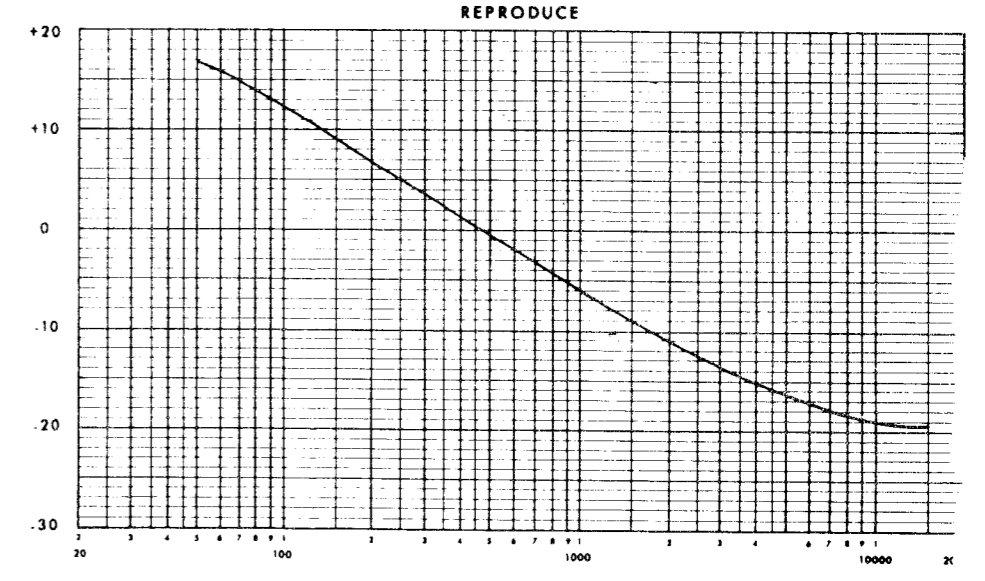


FIGURE 6-13
RESPONSE CURVES, SHEET