

3M Brand

Professional Audio Recorder

SERIES 500



INSTRUCTION MANUAL

MINNESOTA MINING AND MANUFACTURING COMPANY

300 SOUTH LEWIS ROAD CAMARILLO, CALIFORNIA 93010

PROFESSIONAL AUDIO TAPE RECORDERS

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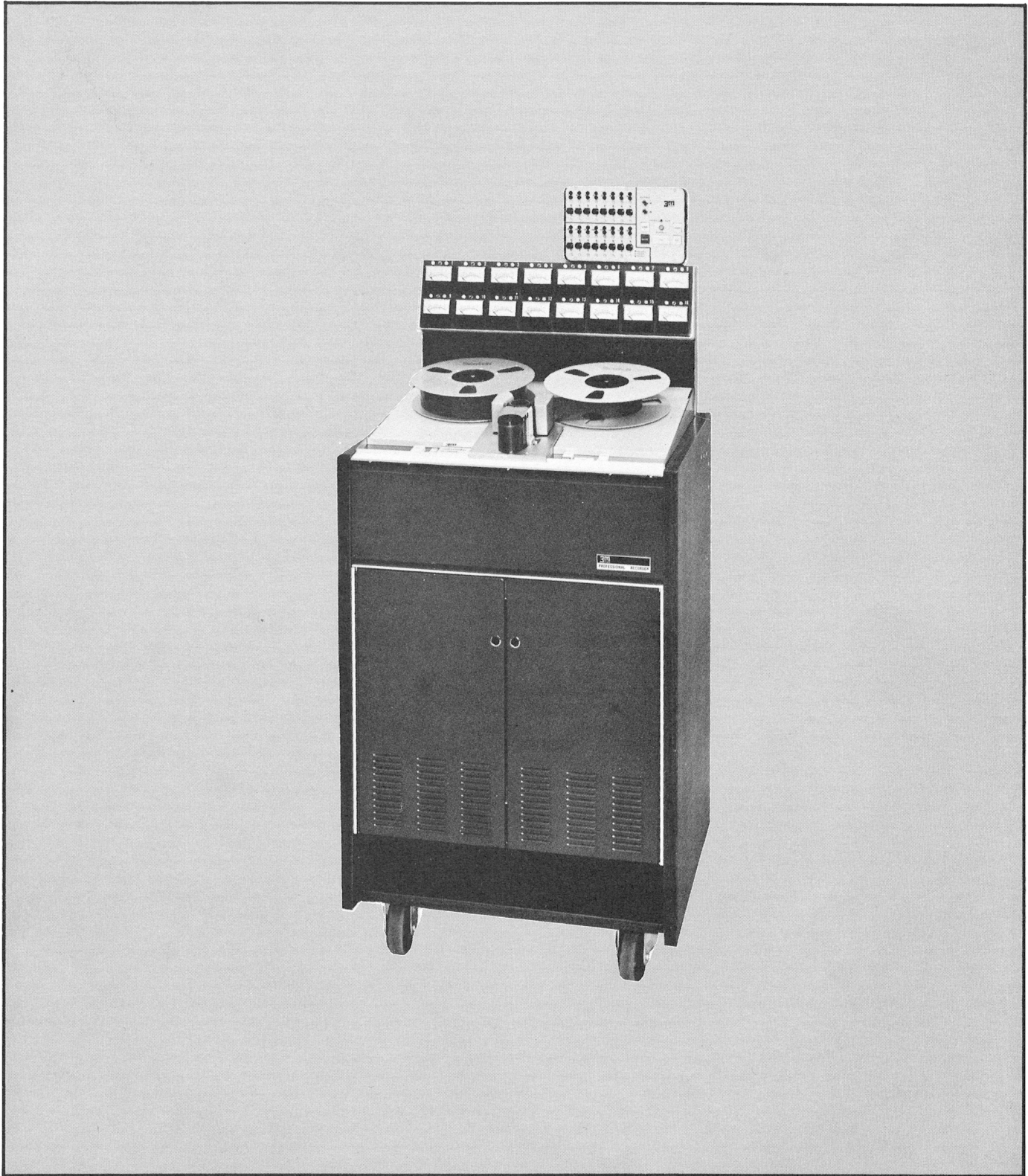


Figure 1. 3M Brand Professional Audio Recorder

GENERAL DESCRIPTION

GENERAL

The 3M Brand Series 500 Professional Audio Recorder (Part No. 56000A000) is manufactured by the Mincom Division of the 3M Company in Camarillo, California.

FUNCTION

The recorder fulfills a requirement in the professional recording industry for a versatile, multi-channel, compact magnetic tape recorder for producing superior quality master recording tapes. The recorder features up to 16 track record/reproduce performance with full remote control operation, including synchronous overdub. The patented Isoloop tape drive system has been incorporated in a 2 inch tape transport which provides the Series 500 line of recorders all the flexibility, ease of threading, and tape handling performance enjoyed by other 3M Brand Professional Audio Recorders. A new standard of timing accuracy has been attained in the Series 500 tape transports as a result of an entirely new capstan drive design.

Coupled with these features, the recorder incorporates packaging concepts providing greatly improved accessibility of components for alignment and maintenance purposes. The exclusive use of silicon solid-state devices throughout the electronic circuits of the Series 500 recorders provide greater stability and long-term reliability.

EQUIPMENT DESCRIPTION

Three tape recorder configurations are available in the 3M Brand 500 Series: 1) a 16 track version; 2) an 8 track version; 3) an 8 track convertible version, capable of conversion to a 16 track system by inserting additional plug-in circuit cards and replacing the 8 track heads with 16 track heads.

Physically, each version consists of a tape transport pivot mounted in the top of rectangular plastic-laminated wood console (see figure 1). Below the

transport is a signal electronics module assembly containing the record/playback electronics and operating mode switching circuits. A meter display panel mounted above the transport provides selective input/output signal monitoring of each channel. The system is completed by the addition of a self-contained solid-state power supply fastened to the floor of the console and a remote control unit which is detachable from its mounting position on top of the meter panel, allowing the recorder to be operated up to 25 feet from the console.

Tape Transport

A 2 inch tape transport is used in the 16 track and 8 track convertible versions of the Series 500 recorders (see figure 2). The tape guides on the transport are adjustable to accommodate either 1 or 2 inch tape. A 1 inch transport is provided with the 8 track version. The transport will accommodate 10-1/2 inch diameter NAB reels for the 1 inch width tape (8 track version), and semi-precision video tape reels when using 2 inch width tape (16 track version). The tape transport operates at either of two electrically selectable tape speeds. The most common speeds are 7-1/2 and 15 ips; however, other speeds are available (see table 1).

The tape transport contains the tape motion and tape handling controls; plus, it performs certain electrical command functions common to each channel of the record/reproduce electronics. The POWER button on the transport controls power to the entire system.

Isoloop Tape Drive

The tape transport mechanism of the 3M Brand Professional Audio Recorder is derived from designs used in instrumentation recorders, where standards of timing accuracy and wow and flutter are even more demanding than they are in audio recording. The heart of the patented Isoloop tape drive is the differential capstan, which maintains a constant tape tension within the drive and positive contact of the

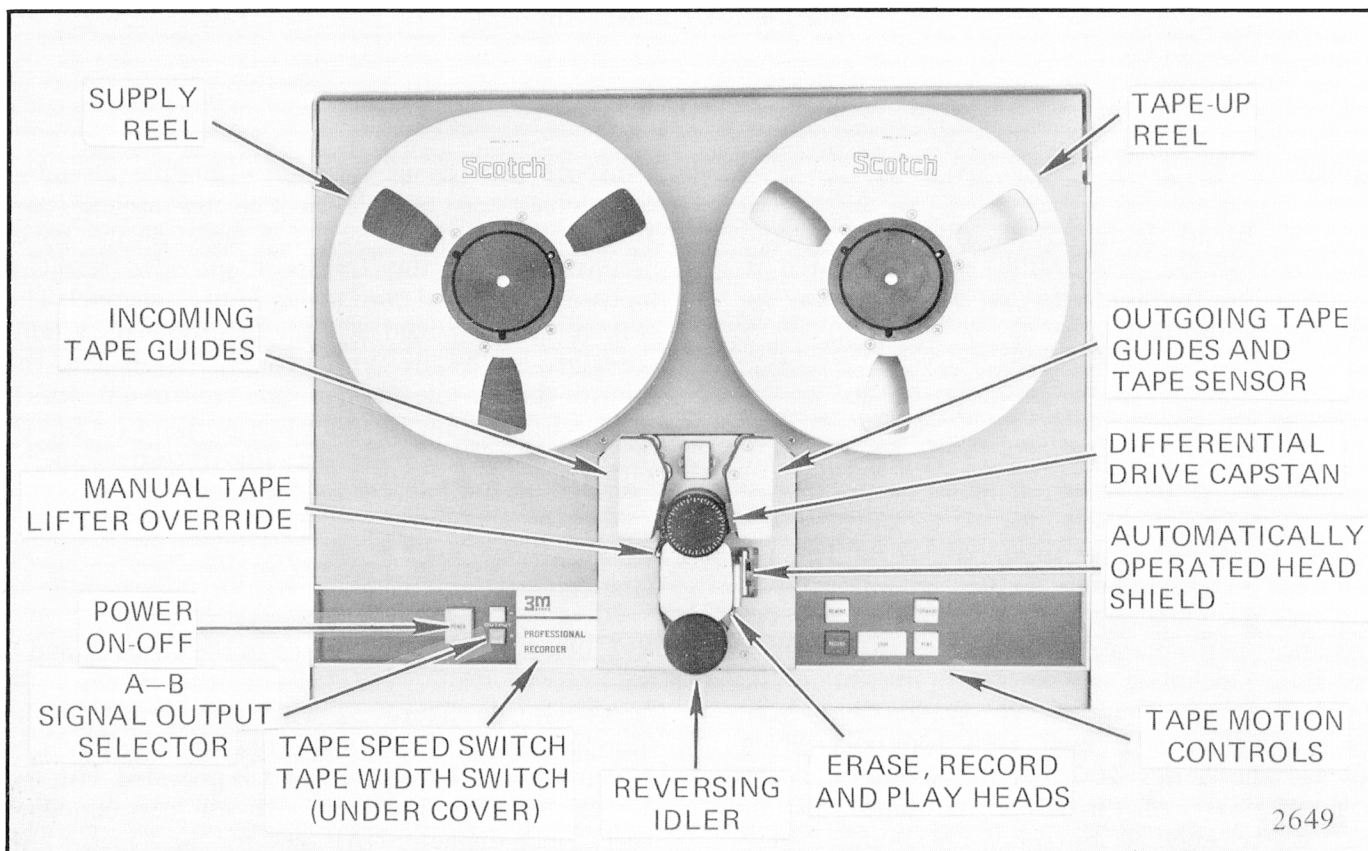


Figure 2. Tape Transport

Table 1. List of Components

Component	Description
TAPE TRANSPORT	
BASIC TAPE TRANSPORT 56013B100-1	Consists of basic 2 inch tape transport equipped for 7.5 and 15 ips, 60 Hz power. Less head assemblies and mounting hardware.
56013B100-2	Same as 56013B100-1 but equipped with 7.5 and 15 ips, 50 Hz capstan motor.
56013B100-3	Same as 56013B100-1 but equipped with 15 and 30 ips, 60 Hz capstan motor.
56013B100-4	Same as 56013B100-1 but equipped with 15 and 30 ips, 50 Hz capstan motor.

Table 1. List of Components (Cont.)

Component	Description															
TAPE TRANSPORT (Cont.)																
<p>TAPE SPEED KIT (Capstan Motor)</p> <table border="0" style="width: 100%;"> <thead> <tr> <th style="width: 15%;"></th> <th style="width: 20%;">Speed (ips)</th> <th style="width: 20%;">Power (Hz)</th> </tr> </thead> <tbody> <tr> <td>56013A910-1</td> <td>15-30</td> <td>60</td> </tr> <tr> <td>56013A910-2</td> <td>7.5-15</td> <td>50</td> </tr> <tr> <td>56013A910-3</td> <td>15-30</td> <td>50</td> </tr> <tr> <td>56013A910-4</td> <td>7.5-15</td> <td>60</td> </tr> </tbody> </table> <p>HEAD ASSEMBLIES</p> <p>56119A100 (8 Track)</p> <p>56119A100 (16 Track)</p>		Speed (ips)	Power (Hz)	56013A910-1	15-30	60	56013A910-2	7.5-15	50	56013A910-3	15-30	50	56013A910-4	7.5-15	60	<p>Consists of capstan motor assembly, including capacitor and connector.</p> <p>Includes playback head door shield, and erase, record, and playback head stacks mounted on bolt-on precision plate, with connectors.</p>
	Speed (ips)	Power (Hz)														
56013A910-1	15-30	60														
56013A910-2	7.5-15	50														
56013A910-3	15-30	50														
56013A910-4	7.5-15	60														
RECORD/REPRODUCE ELECTRONICS																
<p>ELECTRONIC MODULE ASSY</p> <p>56059B100-1 (16 Track)</p> <p>56059B100-2 (8 Track)</p> <p>ELECTRONIC ASSEMBLY (PC) BOARDS</p> <p>16 CHANNEL BOARD SET</p> <p>56059A900</p> <p>8 CHANNEL BOARD SET</p> <p>56059A910</p> <p>INDIVIDUAL BOARDS:</p> <p>BIAS AND ERASE BOARD (1)</p> <p>23059B020</p> <p>RECORD AMPLIFIER BOARD (4)</p> <p>23059B040</p> <p>LINE DRIVER AMPLIFIER BOARD (6)</p> <p>23059A060</p> <p>PREAMPLIFIER WITH OVERDUB BOARD (7/9)</p> <p>23059B090</p>	<p>Consists of the basic electronics chassis less all plug-in printed circuit boards</p> <p>These boards may be obtained individually or in sets to accommodate either the 8 or 16 track machine versions.</p> <p>Consists of 64 plug-in printed circuit boards and one extender board.</p> <p>Consists of 32 plug-in printed circuit boards and one extender board.</p> <p>One each of four boards required for each channel of record and reproduce.</p> <p>Part of the record circuit.</p> <p>Part of the record circuit.</p> <p>Part of the reproduce circuit.</p> <p>Part of the reproduce circuit.</p>															

Table 1. List of Components (Cont.)

Component	Description
RECORD/REPRODUCE ELECTRONICS (Cont.)	
<p>EXTENDER BOARD 23059A110</p>	<p>Used as an aid in troubleshooting; allows circuit board to operate in an extended position outside its slot, providing access to both sides of the board.</p>
<p>METER PANEL ASSEMBLY 56038A100-1 (16 Track) 56038A100-2 (8 Track)</p>	<p>Consists of 8 or 16 VU meters panel mounted as well as their associated monitor select switches and indicator lamps with interconnecting cable and connector.</p>
<p>REMOTE CONTROL ASSEMBLY 56017A100-1 (16 Track) 56017A100-2 (8 Track)</p>	<p>Consists of a control box with a 25 foot cable and connector containing controls and indicators appropriate for providing remote control of either an 8 or 16 track recorder.</p>
<p>POWER SUPPLY ASSEMBLY 56031A900</p>	<p>Consists of a 28 volts dc regulated power supply with cable and connector assembly.</p>

tape against the heads (see figure 3). In addition, the unsupported tape path is extremely short in comparison to standard design tape recorders. This short path reduces longitudinal oscillation to a new low and eliminates the need for a series of tape guides to maintain a proper tape path.

The tape tension required to minimize flutter and hold the tape against the heads is generated within the closed loop by the differential drive capstan. The tape drive surface of the capstan is divided into regions of two different diameters. The incoming idler roller is contoured so as to press the tape firmly into the matching "grooves" (of the smaller diameter) of the capstan. The outgoing idler roller is shaped so as to press the tape firmly against the "ridges" (of the larger diameter) of the capstan. This differential of capstan diameters constantly tries to extract more tape than is being fed into the loop and creates the necessary tension due to the slight elasticity of the tape itself. This tape tension is always kept safely within its elastic limits.

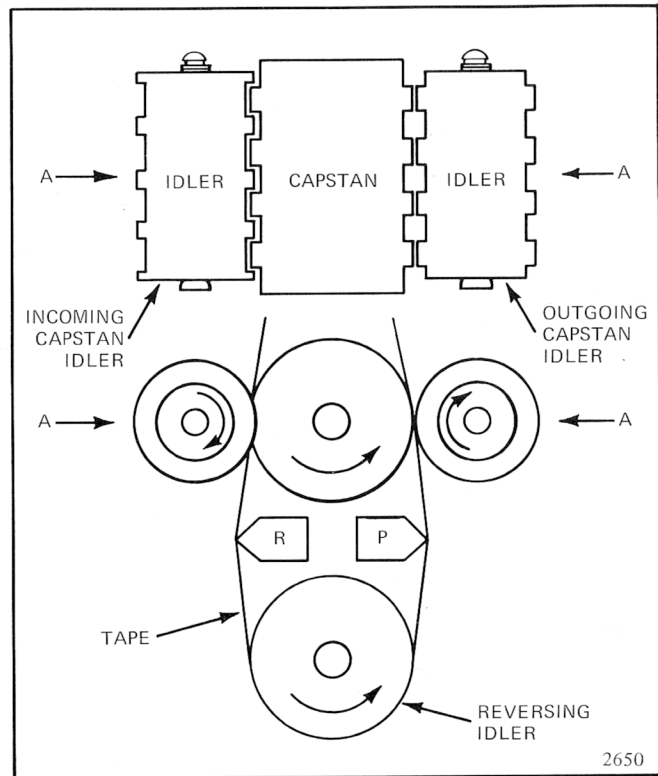


Figure 3. Isoloop Tape Drive

Signal Electronics Assembly

The signal electronics assembly located below the tape transport (see figure 4) consists of three rows of printed circuit plug-in boards and two rows of adjustment controls. The top and bottom rows of the 16 track or 8 track convertible versions will accept 24 boards each; eight channels of record and reproduce boards are grouped in each row by track sequence rather than function, in order to provide a more logical means of locating the circuit boards associated with each channel. The center row contains either 8 or 16 tracks of bias/erase amplifier boards, as required by the machine configuration.

In the two open spaces between the rows of plug-in boards are the control components which consist of three plug-in relays per track for record, sync, and input/output monitor select; two potentiometers for RECORD LEVEL control and SYNC LEVEL calibration; and two plug-in transistors for the relay logic circuits. The erase current adjustment controls and erase current monitoring jacks are also located in the center row.

The signal electronics assembly is accessible through two doors on the front of the console, allowing access to all of the circuit boards, adjustments, and control components. The input and output signal connectors, function control input connector, meter monitoring output connector, and input (dc) power connector are located on the rear of the signal electronics assembly which is accessible from the rear of the console.

Display Panel

The 16 track and 8 track convertible recorder configured versions contain 16 VU meters mounted on the display panel. See figure 7. Each meter is numbered for channel identification. Above each meter are two lamps which indicate the signal being monitored, input A or output B, and a selector switch which allows the selection of the signal monitored on the meter, A or B.

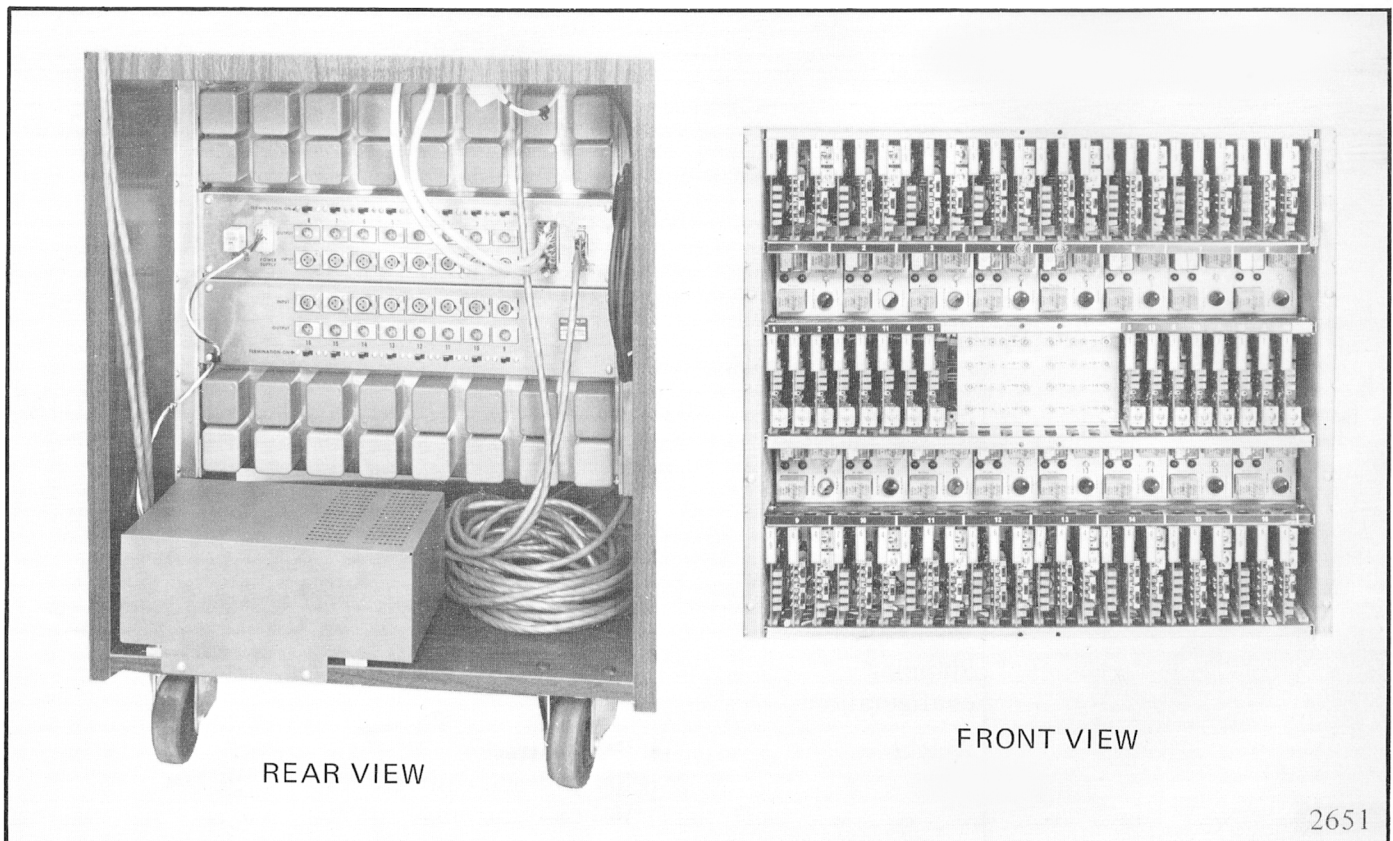


Figure 4. Signal Electronics Assembly

Remote Control

The remote control box, figure 8, is divided into two groups of controls and indicators. The right-hand group of back lighted pushbutton control switches are common to the tape motion controls on the transport and provide identical control at a remote location when desired. A tape RUNOUT indicator lamp is also included in this group, along with two pushbutton switches that provide simultaneous transfer of the output monitor function (A or B) of all channels. The output monitor switches are also common to identical switches on the transport. The left-hand group of switches are common to the remote control box only, and allow the mode of operation of each channel to be preselected to fit the need of any particular technique of recording desired. Sixteen 3-position lever switches accomplish this function, allowing the selection of any one of three modes of operation (READY-SAFE-SYNC) for each channel. In addition to these switches, a Program Select switch is

provided which allows two modes of logic (NORM/CUE) when cuing up on a prerecorded sync track.

Power Supply

The record/reproduce electronics and their associated control circuits are energized by a common solid-state regulated power supply fastened to the floor of the console.

SPECIFICATIONS

Specifications for the 3M Brand Professional Tape Recorder are presented in table 2. These specifications are based upon operation and maintenance in accordance with the procedures and conditions presented in this manual. Deviation from these procedures, use of other than recommended magnetic tapes, or modification of the equipment may result in degradation of the equipment performance. These specifications are subject to change without notice.

Table 2. Specifications

Characteristics	Specifications																
GENERAL																	
Power Requirements	<p>115 ±10 volts single phase, 60 Hz nominal.</p> <p>Transport: 500 watts maximum.</p> <p>Signal Electronics: 200 watts maximum (8 track) 400 watts maximum (16 track)</p> <p>Alternate input power provisions</p> <p>Transport: May be operated at 115 ±10 volts single phase, 50 Hz with tape speed kits 56013A910-2 or 56013A910-3 (50 Hz capstan drive motor kits).</p>																
Size and Weight	<table border="1"> <thead> <tr> <th></th> <th><u>Height</u></th> <th><u>Width</u></th> <th><u>Depth</u></th> </tr> </thead> <tbody> <tr> <td>Operating configuration</td> <td>53¾ in.</td> <td>27 in.</td> <td>22½ in.</td> </tr> <tr> <td>Shipping configuration</td> <td>43 in.</td> <td>27 in.</td> <td>22½ in.</td> </tr> <tr> <td>Weight</td> <td colspan="3"> 304 lbs (16 track) 256 lbs. (8 track convertible) 241 lbs. (8 track only) </td> </tr> </tbody> </table>		<u>Height</u>	<u>Width</u>	<u>Depth</u>	Operating configuration	53¾ in.	27 in.	22½ in.	Shipping configuration	43 in.	27 in.	22½ in.	Weight	304 lbs (16 track) 256 lbs. (8 track convertible) 241 lbs. (8 track only)		
	<u>Height</u>	<u>Width</u>	<u>Depth</u>														
Operating configuration	53¾ in.	27 in.	22½ in.														
Shipping configuration	43 in.	27 in.	22½ in.														
Weight	304 lbs (16 track) 256 lbs. (8 track convertible) 241 lbs. (8 track only)																

Table 2. Specifications (Cont.)

Characteristics	Specifications															
GENERAL (Cont.)																
	Remote Control 6½ lbs. (16 track with 25 foot cables and connectors) 4¾ lbs. (8 track with 25 foot cables and connectors)															
TRANSPORT																
Tape Speeds Speed Accuracy Tape Width Reel Size Recording Time Start Time Stopping Time Rewind Time Flutter Isoloop Drive	<p>Each transport is provided with two electrically switchable tape speeds. Standard machines are equipped for 7½ and 15 ips. 15 and 30 ips speeds are available on special order.</p> <p>±0.10% measured relative to line frequency. Specification does not include line frequency variations.</p> <p>1 or 2 inch.</p> <p>1 inch tape: Standard 10½ inch reel with NAB hub. 2 inch tape: 10½ inch semiprecision video type reel.</p> <p>2400 ft. tape</p> <p style="padding-left: 100px;">60 minutes at 7½ ips 30 minutes at 15 ips 15 minutes at 30 ips</p> <p>1.0 second maximum in play or record mode at 15 ips.</p> <p>1.0 second from play or record mode.</p> <p>1¾ minutes for 2400 feet.</p> <table border="1"> <thead> <tr> <th><u>Speed (ips)</u></th> <th><u>Flutter Band (Hz)</u></th> <th><u>Maximum % Flutter (rms)</u></th> </tr> </thead> <tbody> <tr> <td>15</td> <td>0.5 to 200</td> <td>0.06</td> </tr> <tr> <td>15</td> <td>0.5 to 5000</td> <td>0.08</td> </tr> <tr> <td>7½</td> <td>0.5 to 200</td> <td>0.13</td> </tr> <tr> <td>7½</td> <td>0.5 to 5000</td> <td>0.16</td> </tr> </tbody> </table> <p>All measurements of flutter are made by recording a tone on the machine under test, rewinding the tape, and measuring the flutter on replay. The maximum additive phase case is accepted as maximum flutter.</p> <p>A closed loop positive drive, universal capstan, pinch rollers, and reversing idler for 1 and 2 inch tape. Tape guides are adjustable for 1 or 2 inch tape.</p>	<u>Speed (ips)</u>	<u>Flutter Band (Hz)</u>	<u>Maximum % Flutter (rms)</u>	15	0.5 to 200	0.06	15	0.5 to 5000	0.08	7½	0.5 to 200	0.13	7½	0.5 to 5000	0.16
<u>Speed (ips)</u>	<u>Flutter Band (Hz)</u>	<u>Maximum % Flutter (rms)</u>														
15	0.5 to 200	0.06														
15	0.5 to 5000	0.08														
7½	0.5 to 200	0.13														
7½	0.5 to 5000	0.16														

Table 2. Specifications (Cont.)

Characteristics	Specifications
TRANSPORT (Cont.)	
Operating Controls	<p>Two control groups on the transport control system operation.</p> <p>Group I Located on lower left corner of transport: Power: On/Off (backlighted pushbutton) Speed: High/Low (slide switch) Tape Width: Wide/Narrow (slide switch)</p> <p>Group II Located on lower right corner of transport: Backlighted pushbuttons for PLAY FORWARD RECORD* REWIND STOP</p> <p>All controls are electrically interlocked to prevent possible damage to tape or transport due to operator error.</p> <p>*PLAY and RECORD button must be pressed at the same time to place the transport and associated signal electronics in the record mode of operation.</p>
Braking	Dynamic braking is provided from all modes to stop.
Tape Sensing	Photocell sensor stops transport motion when tape runout or tape breakage occurs.
SIGNAL ELECTRONICS	
Tape Type	Specifications herein are based on the use of Scotch Brand Dynarange magnetic recording tapes, Type 202 or 203.
Equalization	Each signal electronics channel contains two (2) speed adjustable equalization networks. Transfer of equalization networks are automatic when transport tape speed is changed. Normally, machines are equalized for NAB 7½ and 15 ips speeds. Other speeds and forms of equalization are available on special order.
Bias and Erase Oscillator	A master oscillator on the tape transport supplies 120 kHz through a low impedance bus to individual bias and erase amplifiers for each channel.
Phasing	Signal input to output phase is held to less than 90° on all channels.

Table 2. Specifications (Cont.)

Characteristics	Specifications												
SIGNAL ELECTRONICS (Cont.)													
Channel Separation	Channel-to-channel crosstalk separation is greater than 50 dB at 500 Hz (zero VU).												
Degree of Erasure	A 1 kHz signal at 3% distortion level is reduced 72 dB or more by the erase head provided for NAB standard operation.												
Input Impedance	20,000 ohm balanced or unbalanced line. -10 dBm to +8 dBm signal on 600 ohm line.												
Output Impedance	600 ohm terminated or unterminated by selector switch. 150 ohm output tap is provided on the output transformer. Nominal line level +4 dBm.												
Frequency Response (Record/Reproduce)	<p>15 ips NAB Equalization</p> <table> <tr> <td>±2 dB</td> <td>100 Hz to 15 kHz</td> </tr> <tr> <td>+2 -3 dB</td> <td>50 to 99 Hz</td> </tr> <tr> <td>+2 -4 dB</td> <td>30 to 49 Hz</td> </tr> </table> <p>7½ ips NAB Equalization</p> <table> <tr> <td>±2 dB</td> <td>100 Hz to 10 kHz</td> </tr> <tr> <td>+2 -3 dB</td> <td>50 to 99 Hz</td> </tr> <tr> <td>+2 -4 dB</td> <td>30 to 49 Hz</td> </tr> </table>	±2 dB	100 Hz to 15 kHz	+2 -3 dB	50 to 99 Hz	+2 -4 dB	30 to 49 Hz	±2 dB	100 Hz to 10 kHz	+2 -3 dB	50 to 99 Hz	+2 -4 dB	30 to 49 Hz
±2 dB	100 Hz to 15 kHz												
+2 -3 dB	50 to 99 Hz												
+2 -4 dB	30 to 49 Hz												
±2 dB	100 Hz to 10 kHz												
+2 -3 dB	50 to 99 Hz												
+2 -4 dB	30 to 49 Hz												
Signal-to-Noise Ratio	For standard 8 or 16 track NAB equalized recording systems, the S/N ratio is maintained at 65 dB, or greater, with a machine speed of 15 ips. S/N ratio is measured with reference to the level of 6 dB above the 700 Hz reference signal on a standard NAB alignment tape.												
Harmonic Distortion	Distortion reduction circuits hold total harmonic distortion to less than 1.0 percent at input signal levels up to 6 dB above the 700 Hz reference signal on a standard NAB alignment tape.												
Monitoring	The input or output signal of each channel is displayed on a 2½ inch VU meter.												

Table 2. Specifications (Cont.)

Characteristics	Specifications
SIGNAL ELECTRONICS (Cont.)	
Operating Controls	<p>Remote Control Box:</p> <p>Tape Motion Controls (identical function with controls on tape transport).</p> <p>Output Select Pushbuttons A–B (identical function with controls on tape transport).</p> <p>Mode Select switches, READY-SAFE-SYNC (one 3-position switch for each channel).</p> <p>Program Select switch, NORM-CUE.</p> <p>Electronic Module Assembly:</p> <p>Input Level (one for each channel)</p> <p>Meter Panel:</p> <p>A–B Monitor Select switches (one for each channel).</p>

INSTALLATION

RECEIPT INSPECTION

The 3M Series 500 Brand Professional Audio Recorder was inspected, completely checked out, and adjusted before leaving the factory. Immediately upon receipt, inspect the equipment for any shipping damage. If any damage is noticed, notify the carrier immediately. If everything is normal, proceed with the installation.

LOCATION CONSIDERATIONS

The tape recorder can be installed in almost any location as long as reasonable judgement is used. The recorder should not be installed in an extremely dusty or damp location. Strong magnetic fields should be avoided, such as from power transformers and tape degaussers. Dimensions of the console are given in figure 5.

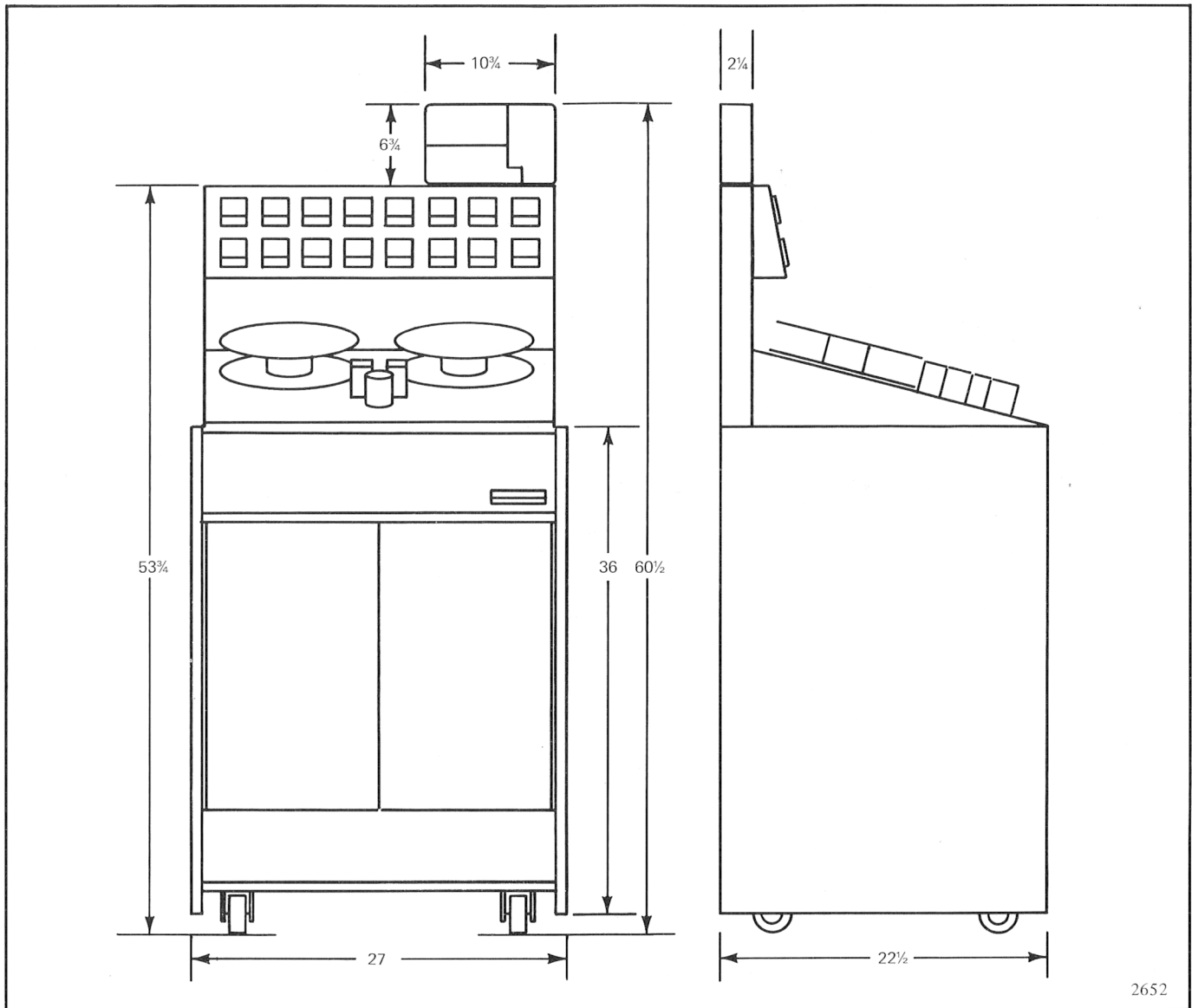


Figure 5. Outline Dimensions

INITIAL SET-UP

When the console is uncrated, the following steps should be taken to prepare the recorder for operation:

1. Remove the meter panel from the rear compartment of the console by removing 10 screws, three on each side of the console cabinet, and two each on the left and right sides on the rear of the console. The remote control box is shipped attached to the top right hand side of the meter panel. Two captive screws are located under the top flange of the meter panel which allows removal of the control box for remote use.
2. Place the meter panel in the upright position; slide the bottom section of the panel down and over the rear sides of the cabinet. Secure the panel by replacing the screws removed in step 1.
3. Connect the input and output signal lines to their proper jacks, as marked on the rear of the signal electronics assembly. Type XL 3 wire standard audio plugs (not supplied) are required for both input and output connections. See figure 6 for plug wiring details.
4. The termination slide switches, located either above or below each output jack, should be placed in either the left-hand position (600 ohm termination), or the right-hand position (unterminated), depending on the termination required. Taps are available on each output transformer for 150 ohm output.
5. Inspect all connectors on the rear of the signal electronics assembly and underside of the tape transport to ensure that all are properly engaged.

6. Open the doors on the front of the console; inspect each circuit board within the electronics assembly to ensure that all are properly engaged.
7. Rotate by hand the reversing idler, capstan, take-up reel hub, and the supply reel hub. There should be no binding; each should turn freely and smoothly with very little torque applied.
8. Connect the 3 conductor power cord between the receptacle located on the underside of the tape transport and a 115 volt, 60 Hz power source. A ground terminal is furnished on the transport frame. It may sometimes be desirable to connect this to a good earth ground to minimize electrical noise, although this is generally unnecessary if the power cord ground is sufficiently noise-free.

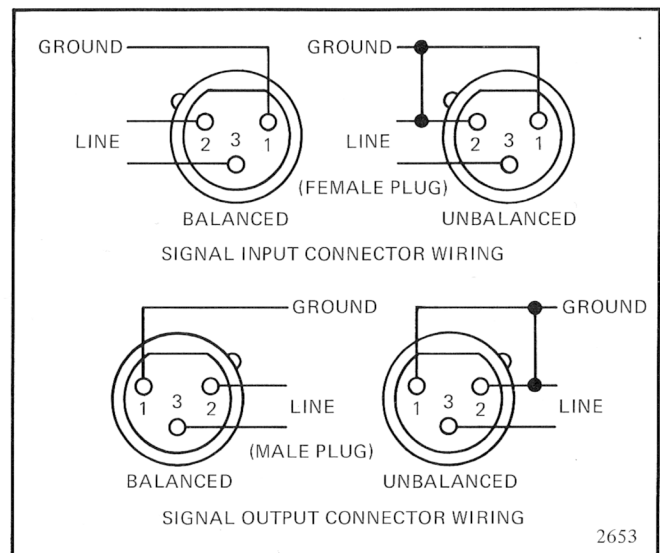


Figure 6. Input/Output Connector Wiring

OPERATING INSTRUCTIONS

GENERAL INFORMATION

The 3M Brand Series 500 Professional Audio Recorder may be operated at the console or up to 25 feet from the console, using the remote control provided with the recorder. The tape motion

controls are conveniently grouped on the tape transport and remote control box so as to provide a minimum of movement by the operator. All controls and indicators are identified in figures 7 and 8 with a complete description of each control function tabulated in table 3.

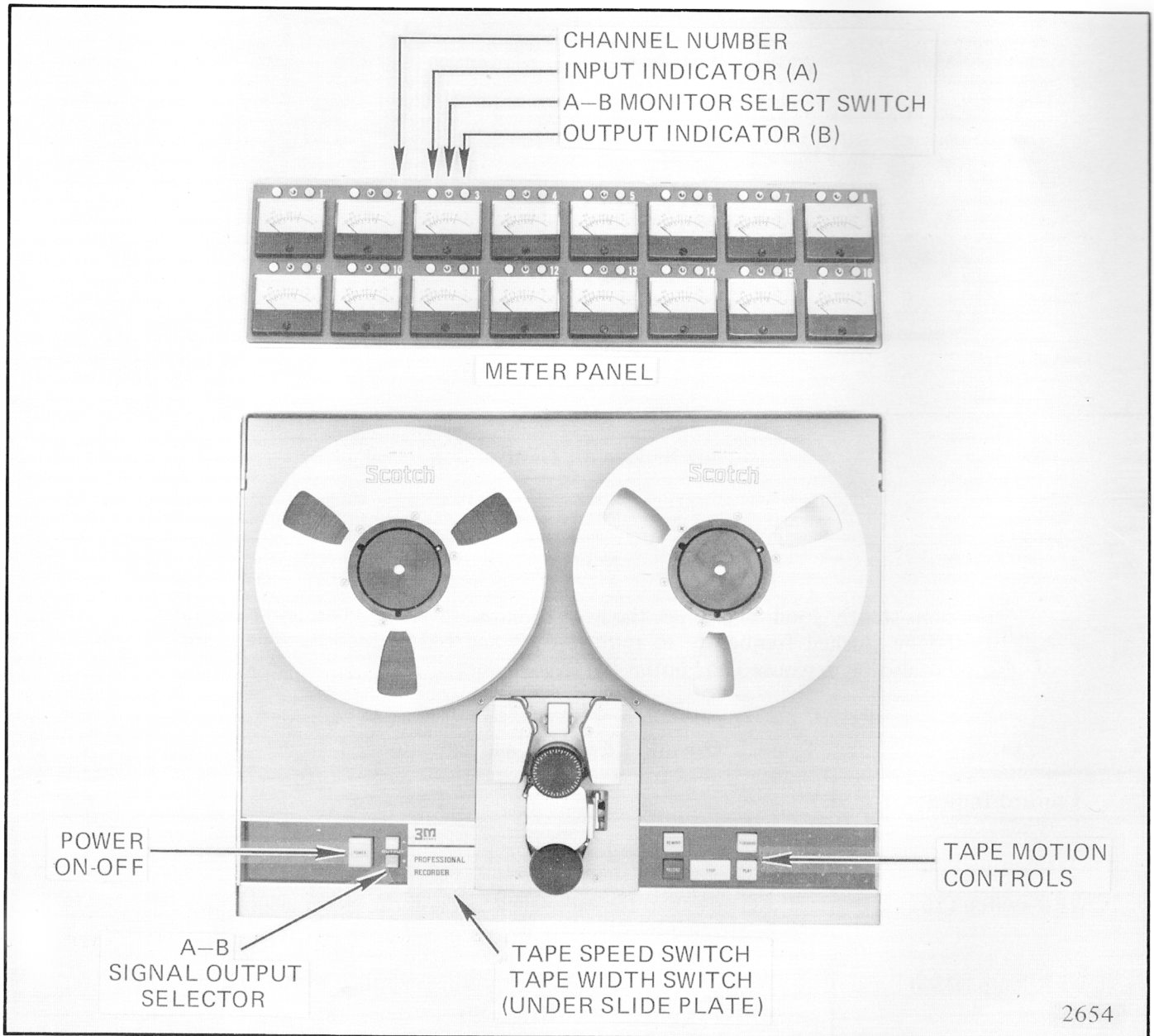


Figure 7. Console Operating Controls

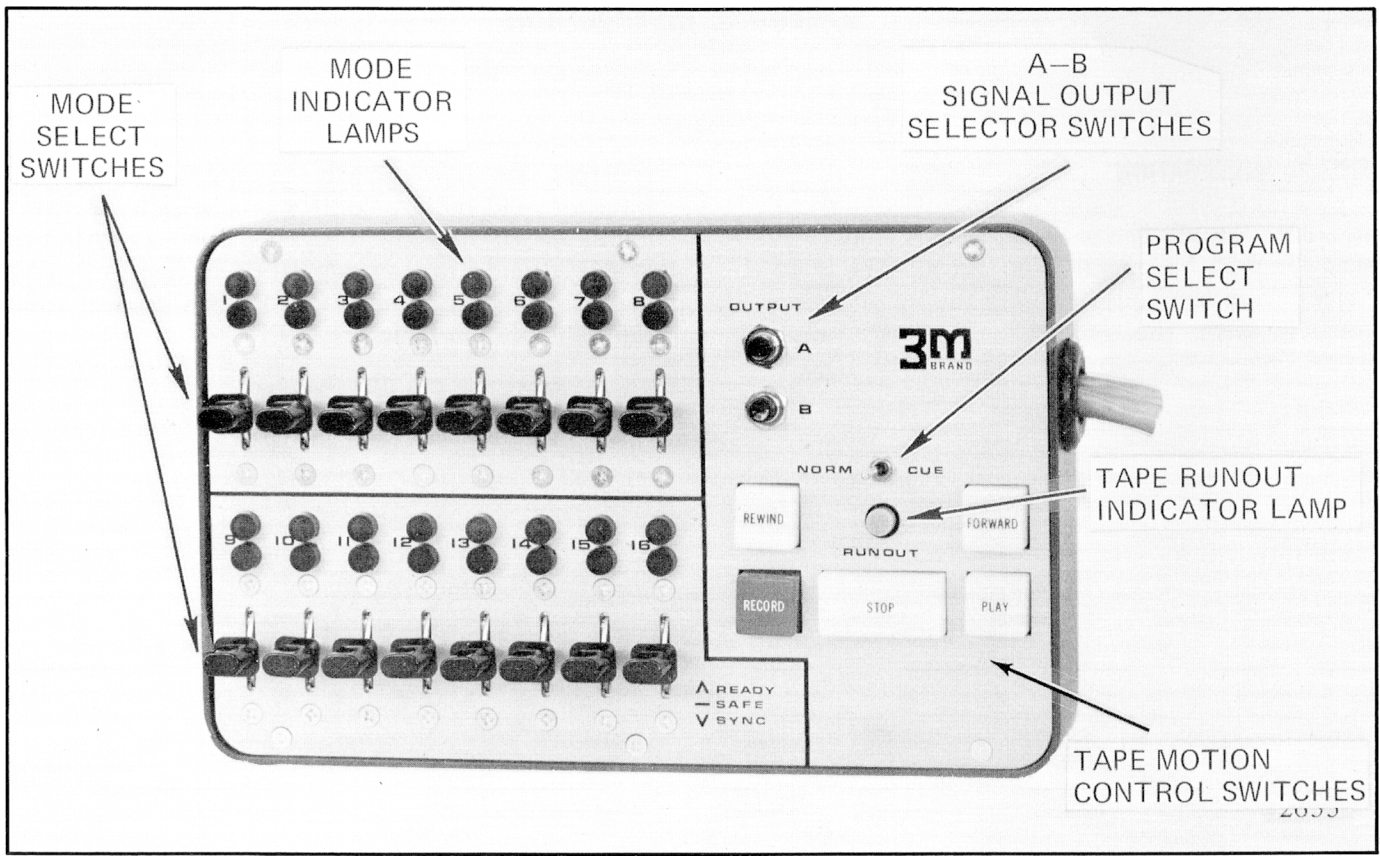


Figure 8. Remote Control Box

NOTE

For consistently good recordings, the heads, guides, reversing idler, and capstan should be cleaned frequently to remove dust and oxide deposits. The heads should also be degaussed for optimum performance.

Table 3. Operating Controls and Indicators

Control/Indicator	Function
TAPE TRANSPORT	
POWER switch (S6)	AC power to the tape transport and the signal electronics assembly is controlled by this switch.
POWER lamp (DS6)	When lighted, indicates ac power is applied to the system. The indicator lamp back lights (S6).
STOP switch (S3)	Stops tape motion from any mode of operation.

Table 3. Operating Controls and Indicators (Cont.)

Controls/Indicators	Function
TAPE TRANSPORT (Cont.)	
STOP lamp (D53)	When lighted, indicates tape motion has stopped, tape is threaded, and the transport is ready to operate. The indicator lamp back lights (S3).
PLAY switch (S5)	Causes the transport to move the tape at the selected playback speed, and activates the logic circuits in the signal electronics assembly.
PLAY lamp (DS5)	When lighted, indicates the transport is in the playback mode of operation. The indicator lamp back lights (S5).
RECORD switch (S1)	Causes the transport to move the tape at the selected record speed, and activates the logic circuits in the signal electronics assembly when the RECORD and PLAY pushbuttons are pressed simultaneously.
RECORD lamp (DS1)	When lighted, indicates the transport is in the record mode of operation. The indicator lamp back lights (S1).
FORWARD switch (S4)	Causes the transport to move the tape at high speed in the forward direction.
FORWARD lamp (DS4)	When lighted, indicates the transport is moving the tape in the high speed forward direction. The indicator lamp back lights (S4).
REWIND switch (S2)	Causes the transport to move the tape at high speed in the rewind direction.
REWIND lamp (DS2)	When lighted, indicates the transport is moving the tape at high speed in the rewind direction. The indicator lamp back lights (S2).
SPEED switch (S8)	Selects HIGH or LOW capstan motor speed, usually 7.5 or 15 ips. Selects proper equalization circuit in the signal electronics assembly.
TAPE WIDTH switch (S7)	Selects the proper reel motor torque for 1 or 2 inch width tape.
OUTPUT A switch (S10)	Switches all input signals simultaneously to the VU monitor meters and the OUTPUT signal jacks of their respective channels.
OUTPUT B switch (S11)	Switches all playback signals simultaneously to the VU monitor meters and the OUTPUT signal jacks of their respective channels.
METER PANEL	
VU Meter	Monitors the signal input recording level or the signal output playback level of each track.
A-B Monitor Selector	Selects the input or playback signal for monitoring on the VU meter.

Table 3. Operating Controls and Indicators (Cont.)

Control/Indicator	Function
METER PANEL (Cont.)	
Input Indicator	Indicates the input signal is being monitored on the VU meter when illuminated.
Output Indicator	Indicates the playback signal is being monitored on the VU meter when illuminated.
REMOTE CONTROL BOX	
<p>Tape Motion Controls</p> <p>OUTPUT A/B switches</p> <p>RUNOUT lamp (DS6)</p> <p>Mode Select Switch (READY-SAFE-SYNC)</p> <p>Program Select Switch (S8) (NORM/CUE)</p>	<p>Same function as the tape motion controls on tape transport.</p> <p>Same function as the OUTPUT A–B switches on tape transport.</p> <p>Lamp illuminates when all the tape has been run off the supply or take-up reels, or when the tape is unthreaded from its running path.</p> <p>READY position — Causes the signal electronics circuits of the respective channel to operate in the record mode when the RECORD and PLAY buttons are pressed simultaneously.</p> <p>SAFE position — Causes the signal electronics of the respective channel to lock out the record circuits, preventing accidental erasure of prerecorded material. Normal playback of any material on the track can be monitored with the transport in either the RECORD or PLAYBACK mode when the Mode Select Switch is in this position.</p> <p>SYNC position — Causes the signal electronics of the respective channel to playback a prerecorded signal, utilizing the record head rather than the playback head, thus providing a synchronized signal for use in dubbing in additional material on an adjacent track or tracks in sync with the prerecorded program material. Activation of the SYNC mode is programmed by the position of the program select switch described below.</p> <p>NORM position — Causes the SYNC mode to be activated on any preselected channel only when the transport is placed in the RECORD mode of operation.</p> <p>CUE position — Causes the SYNC mode to be activated on any preselected channel when the transport is in the record, play or stop mode.</p>
SIGNAL ELECTRONICS ASSEMBLY	
RECORD LEVEL	Adjusts the input signal recording level.

TAPE THREADING

Threading the recorder is extremely simple, as there are no compliance arms or other mechanical devices in the tape path. Also, there is no tension on the tape until it breaks the light path of the photoelectric circuit in the Isoloop assembly.

The use of Scotch Brand Dynarange recording tape, Type 202 or 203, is recommended, although adjustable bias and equalization permits accommodation of a wide range of tape characteristics.

To thread the tape, refer to figure 9 and proceed as follows:

1. Slide the cover plate, located on the transport bearing the 3M Brand trademark, to the left, exposing two slide switches. Set the SPEED switch to either HIGH or LOW, as desired. Set the TAPE WIDTH switch to the WIDE position when using 2 inch tape, or the NARROW position when using 1 inch tape.

CAUTION

The SPEED switch should not be operated with the capstan motor running.

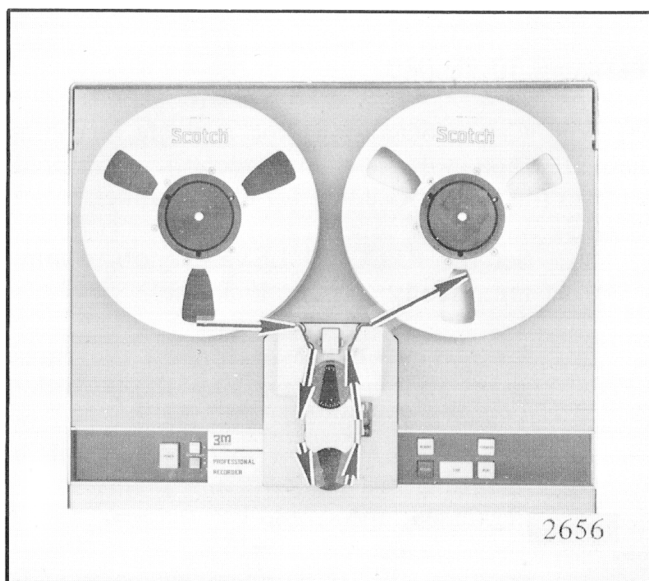


Figure 9. Tape Threading

2. With the thumb and index finger, rotate the incoming and outgoing tape guides to the proper position for the tape size to be used.
3. Press the POWER button; the input indicator lamps on the meter panel should come on. The tape sensor lamp should come on, the head shield cover will open, and the POWER button should illuminate, indicating power is applied to the transport and signal electronic assembly.
4. Place a reel of tape on the left-hand spindle in such a manner that the reel rotates counterclockwise when tape is unwound. Unwind about two feet of tape from the supply reel and drop it on the inside of the incoming tape guides, between the capstan idler and the capstan, past the erase and record head, around the reversing idler, past the play head, between the right-hand capstan idler and the capstan, past the outgoing tape guides on to the take-up reel. Thread the tape on the take-up reel hub so that it will wind in a counterclockwise direction. As the tape breaks the photoelectric light path at the exiting tape guides a slight reverse torque will be applied to the reel motors which takes up any slack in the tape threaded through the Isoloop. The STOP button should also illuminate at this time indicating the transport is ready to operate.

TRANSPORT TAPE MOTION OPERATION

Upon initial operation of the transport, observe each mode of operation to gain familiarity with the mechanical actions of the transport as follows:

1. Press the PLAY button and observe that the capstan starts, the capstan idlers pull in and tape starts to move in the forward direction at the selected speed, and the head shield cover closes.
2. Press the STOP button and observe the capstan idlers release their tension, the capstan stops, the head shield cover drops back, and the tape comes to a smooth stop.

3. Simultaneously press the PLAY and RECORD buttons and observe that the PLAY and RECORD buttons both illuminate and that the transport mechanical functions are the same as in step 1. Press the STOP button and allow the tape to stop.
4. Press the FORWARD button and observe the tape lifters lift the tape away from the heads, the head shield cover remains open, and the tape rapidly accelerates in the forward direction.
5. Press the STOP button; the tape motion will come to a smooth, rapid stop and the tape lifters will drop back. Press the REWIND button and observe that the transport mechanical functions are the same as step 4 except the motion will be in the rewind direction. Press the STOP button and allow the tape to stop.
6. Observe that in standby (STOP button illuminated), the head shield cover will remain open or closed when operated manually. Note that the head shield cover, if closed in the standby mode, will open when the tape is lifted from its running path between the right-hand tape guides.

NOTE

With the tape in motion, it is necessary to stop the tape in order to change the mode of operation of the transport only when selection of the record mode is desired and the transport is operating in the forward or rewind modes. The tape motion controls may be pressed in any sequence at any time with complete safety to the tape and transport.

MONITORING

Signals that are to be recorded or reproduced are monitored on the meter panel above the transport. External monitoring equipment can be connected to the output jacks at the rear of the electronics assembly.

NOTE

The auxiliary output adapter described at the end of this section (figures 10 and 11) is recommended when additional output lines are desired for local monitoring or studio distribution.

Output/Monitor Switching

OUTPUT select buttons A and B provide simultaneous switching of the output and meter monitoring circuits of all channels to either the input signal being recorded or the reproduced signal from the recorded tape. Button A selects the input signal; button B the output (playback) signal.

Individual switching for each channel is provided by the A-B monitor select switches above each VU meter. These switches allow either the input or output of any one channel to be selected independently of all other channels.

If the A-B OUTPUT select function is not desired from the transport or remote control box, open the console front doors and position the upper slide switch on the line amplifier board (No. 6) of the desired channel to the OFF position. A-B switching for this channel is then solely under the control of the corresponding channel A-B monitor select switch on the meter panel.

PREPARING TO RECORD

The following procedure is for a single recording channel. When multiple channel recording is desired, perform the same procedure for each channel.

1. Set the RECORD LEVEL knob to minimum (fully counterclockwise).
2. Press the POWER button on the transport, applying power to the recorder. Thread a reel of tape through the Isoloop as previously described. For critical recording applications, new or previously degaussed tape should be used.
3. Position the program select switch to NORM, and the mode select switch of the particular channel being recorded to READY.

4. Press OUTPUT select button A, and slowly increase the RECORD LEVEL control until the meter peaks at +2 VU on the loudest peaks of the input program material.
5. To start recording, simultaneously press the PLAY and RECORD buttons on the transport or remote control box.
6. Press OUTPUT select button B; the playback signal monitored on the VU meter should be approximately the same level as the input signal being recorded. Alternately press the A and B OUTPUT buttons to ascertain that the input and output signals are at the same level. Listen critically on a good monitor speaker or headphone system to be certain the signals sound identical with the switch in both the A and B positions.
7. To stop recording, press the STOP button on either the transport or remote control box. The tape will stop. The STOP button will light, placing the recorder in the standby mode.

CAUTION

Care should be taken not to switch from READY to SAFE when the recorder is operating in the record mode. First stop the transport. This will prevent the possibility of a thump being recorded on the tape and possible magnetization of the record head.

PLAYBACK

When the recorder is to be used to playback prerecorded tape, the following procedure should be followed.

1. Place the mode select switch in the SAFE position.
2. Press the B OUTPUT select button.
3. Press the PLAY button to start the recorder in the playback mode of

operation. The playback output level of the prerecorded tape monitored at the VU meter or output jack will represent the true amplitude level of the signal recorded on the tape. This is established by the calibrated adjustment of the reproduce level control located on the reproduce preamplifier board in the electronic module assembly. This control should only be adjusted when performing the playback alignment adjustments covered in the maintenance section.

OVERDUBBING

The overdub feature provides a means of adding one or more audio tracks in synchronism with a first track or set of tracks previously recorded on the tape.

Consider a tape which has had an orchestra previously recorded on track No. 1. It is desired to add a synchronized vocal on track No. 2 which has been left unrecorded. To accomplish the synchronized dubbed-in vocal recording on track No. 2, the following procedure should be followed.

1. Thread the prerecorded tape on the transport in the normal manner.
2. Place the program select switch in the NORM position.
3. Place the channel No. 1 mode select switch in the SYNC position.
4. Position the A-B monitor select switch above the channel No. 1 VU meter to the right momentarily. The B output indicator lamp should illuminate.
5. Connect an appropriate headphone monitoring set to the output of channel No. 1.
6. Place the channel No. 2 mode select switch in the READY position.
7. With the vocalist listening in the headphones, start the recorder in the record mode. The orchestra previously recorded on track No. 1 will be heard in the

phones, and the voice of the vocalist will be recorded on track No. 2 in synchronism with orchestra on track No. 1.

8. After an overdub selection has been recorded, the same tape can be replayed in the normal playback mode by pressing the PLAY button without resetting any switches. If a second recording attempt is necessary, starting the recorder in the record mode will again activate the previously selected sync and record tracks.
9. If it is desirable to listen to a prerecorded track for cuing purposes before the recorder is activated in the record mode, the program select switch should be placed in the CUE position. Monitoring of the sync track will now be obtained in the play and stop mode as well as the record mode. The program select switch should be returned to the NORM position when

the overdub recording is played back, otherwise the prerecorded track and the overdub track will not be in sync.

AUXILIARY OUTPUT ADAPTER

The auxiliary output adapter shown in figures 10 and 11 is recommended if additional signal output connections are desired at the console for monitoring or studio line connection. The adapter is simple to construct by the user and requires no special parts or hardware. The adapter is inserted in the meter panel cable between connector P2 and J2. When installed, the output signal cables from the adapter are connected in parallel with their respective output channels; as such, the termination impedance of the auxiliary output lines should be considered when connected to monitoring equipment or studio lines in the same manner as the regular output lines from the XL connectors at the rear of the electronics assembly.

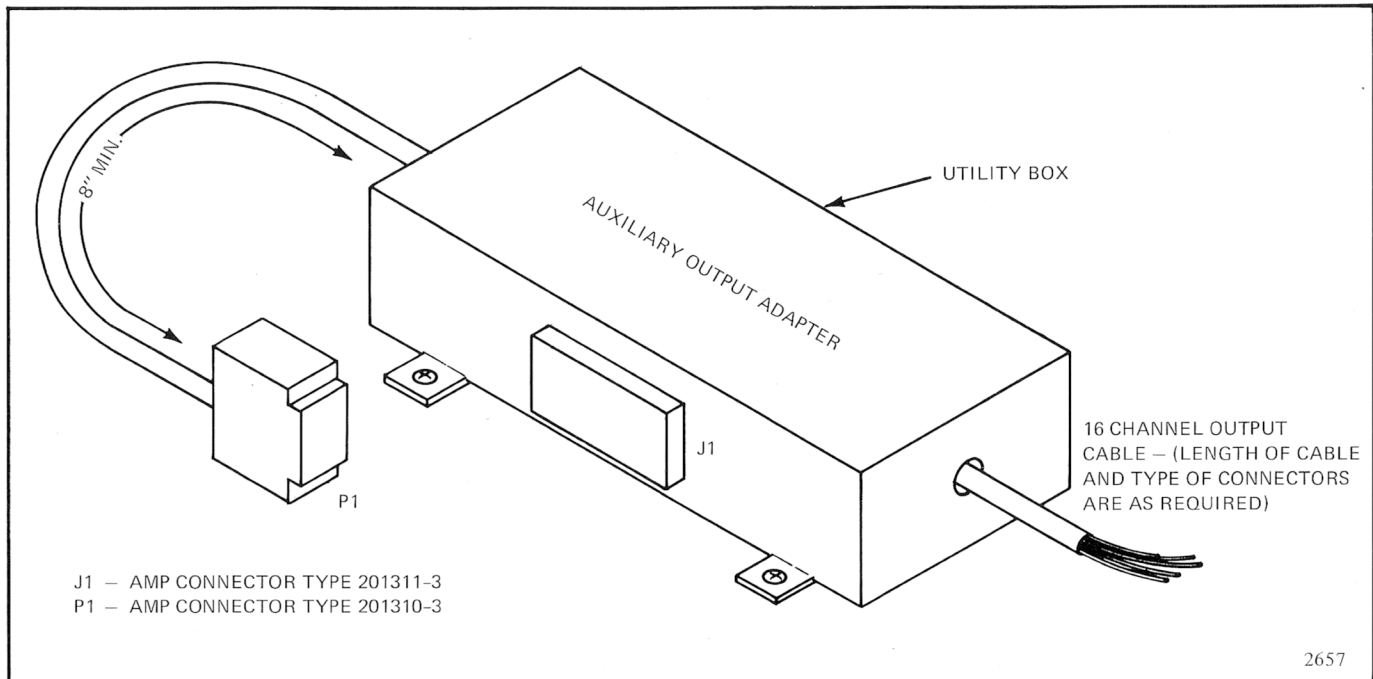
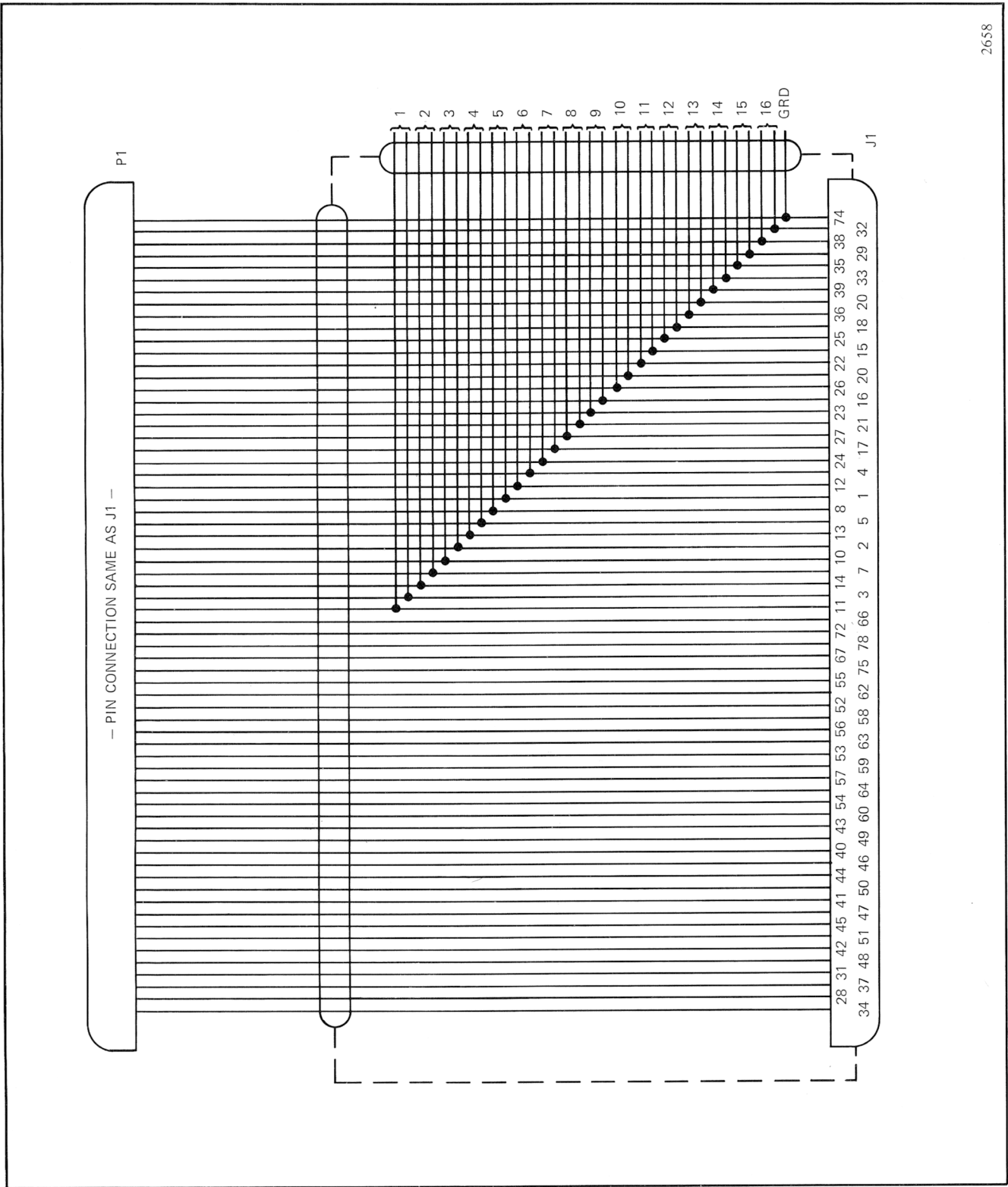


Figure 10. Auxiliary Output Adapter



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Figure 11. Auxiliary Output Adapter Schematic

MAINTENANCE

GENERAL

Maintenance is of prime importance for reliability and useful life of all magnetic tape systems. Maintenance consists of: preventive maintenance, to help prevent breakdowns; and corrective maintenance, to correct the malfunction when a breakdown occurs.

FIELD SERVICE

Regularly scheduled maintenance service is available from the Mincom Sales and Service Office on a contract basis, or service may be obtained on an emergency basis through the same office. In either case, every effort is made to provide the needed service in the minimum amount of time.

TEST EQUIPMENT

Test equipment recommended for alignment and troubleshooting of the Series 500 tape recorders is listed in table 4 which follows.

PREVENTIVE MAINTENANCE

Perform the following inspections at intervals considered necessary, based upon the operation and environment in which the recorder is operated.

1. Watch for excessive wear of moving surfaces, such as capstan, capstan idlers, reversing idler, tape guides, etc.

Table 4. Test Equipment

Equipment	Function
Flutter Meter, D & R Ltd, or equivalent	Measure percentage of flutter in reproduced output.
Wave Analyzer, HP 302A or equivalent	Measure percentage of harmonic distortion.
Oscilloscope, Tektronix RM504 or equivalent	Measure phase and observe test signals.
VTVM, HP 400LR or equivalent	Measure voltages and continuity.
Audio Oscillator, HP 200CDR or equivalent	Provide test and alignment signals.
Frequency Counter, HP5233L or equivalent	Measure bias frequency.
7 1/2 ips (1 inch) NAB calibration tape, Ampex catalog number 46-90007-01	To provide standard NAB reproduce alignment signals.
15 ips (1 inch) NAB calibration tape, Ampex catalog number 46-90006-01	To provide standard NAB reproduce alignment signals.
15 ips (2 inch) NAB calibration tape, Ampex catalog number 46-90024-01	To provide standard NAB reproduce alignment signals.

2. Observe that the two cooling fans mounted below the transport are operating and that there is no obstruction to keep air from circulating.
3. Check all connectors for security and tight fit, and tighten if necessary.
4. Inspect input and output cables for broken or frayed leads, and repair if necessary.
5. Inspect printed circuit logic board at the rear of transport for broken leads, burnt or damaged components, broken or shorted conductor tracks and pads. Check that all relays on this board are mounted securely in their sockets and the retaining clamps are positioned over each relay.
6. Check that all circuit boards in the signal electronics assembly are engaged properly. Also, check that the A/B and SYNC transistors, and their associated relays are well seated in their sockets. The RECORD relays should also be checked for proper seating in their sockets.

CAUTION

Should any of the SYNC relays be removed from their sockets, care should be used when replacing these relays due to the fragile nature of the contact pins. Hold the relay at an angle so that one lower bank of pins start to engage their proper contacts in the relay socket; then, carefully pivot the relay about its lower edge so that the remaining pins progressively engage their contacts in the socket.

7. The brushes on each reel drive motor should be checked for length. Any brush less than 1/4 inch should be replaced.
8. The capstan speed should be checked by using a neon or fluorescent light. With the light projected on the marked capstan, the marks should appear to stand still if the

capstan is rotating at the proper speed. The belt tension adjustment in this section should be performed if the capstan speed is not constant or appears to be slow.

NOTE

Reel motor bearings are sealed and have been lubricated to last the useful life of the motor.

Cleaning

The tape handling surfaces should be cleaned periodically. The time between cleaning will depend on the amount of use and the environment, since increased temperature, dust and humidity will cause the tape handling surfaces to become dirty more quickly. The best precaution is to clean the surfaces just prior to a recording session.

To clean the guides, capstan, and reversing idler use a cotton swab dipped in a Freonxylene cleaner (Mincom catalog number 83-9830-0075), or equivalent. Caution must be used when applying this solvent because it damages plastic and rubber surfaces, and excessive amounts that could get into the bearing surfaces can dissolve the lubricants, causing bearing problems.

To clean the capstan idlers, use a dry cotton swab on the rubber idlers lightly pressing while the transport is in the RUN mode. If an extra amount of cleaning is necessary, use a swab lightly dipped in Freon TF, but do not apply the swab while the transport is in the RUN mode because some of the fluid may be splashed on other surfaces and may cause damage. After cleaning with Freon TF, allow the idlers to dry and then use a dry swab on the rubber idlers with the tape transport in the PLAY mode. This process will clean the surfaces of fingerprints that may accumulate.

CORRECTIVE MAINTENANCE

Corrective maintenance involves procedures for the correction of malfunctions and possible adjustments that are required when assemblies are changed or replaced because of wear or damage.

The Series 500 recorder has been factory adjusted for peak performance. With use, it will occasionally be necessary to make certain adjustments to maintain optimum performance. The following information provides a procedure for a thorough performance check and adjustment of the recorder system.

Tape Transport Adjustments

Before attempting mechanical or circuit adjustments on the tape transport, a thorough understanding of the transport operation is necessary. Review the equipment specifications, mechanical and electrical descriptions, and the circuit diagrams in the Schematics Section. Location of the transport adjustments is shown in figures 12 and 13.

Power Supply Check

Before performing any adjustments on the transport the following power supply voltage and regulation checks should be made.

1. Connect the input power cord to the output of a 7-1/2 amp Variac. Set the Variac for zero volts output.
2. Connect the positive test lead of a dc voltmeter (50 volt scale) to TP-1 and the negative lead to TB1-1.
3. Press the POWER button on the transport and increase the Variac output voltage; at approximately 90 volts, the POWER button should light, the tape sensor lamp should come on, and the RUNOUT indicator lamp on the Remote Control Box should come on, indicating K1 has operated. Both cooling fans in the transport should also be running at this time, and the A/B indicator lamps on the meter panel should be on. If these indications do not occur, return the Variac to zero, press the POWER button again, and increase the Variac output as before. If the proper indications are not observed, refer to the troubleshooting table in this section.
4. Continue to increase the Variac output voltage to 115 volts. The dc voltage at TP-1 should be between 26 and 28 volts dc.

5. Place a piece of opaque material in the tape path between the tape sensor light and the tape-threaded sensor cell. This will be referred to hereafter as the "tape sensor mask." The STOP button should light. The take-up motor should rotate at approximately 200 rpm in a counter-clockwise direction. The rewind motor should rotate approximately 200 rpm in a clockwise direction.
6. Press the PLAY button, then press the FORWARD button, and then the REWIND button. The voltage at TP-1 should remain between 26 and 28 volts. The voltage at TP-1 should not drop below 26 volts dc until the Variac output voltage is below 105 volts ac.
7. Remote the tape sensor mask. The STOP button should go out.

Capstan Speed

Set the Variac to 115 volts ac, and reinsert the tape sensor mask. Place the capstan motor SPEED switch to HI. Press the PLAY button and observe that the capstan runs at high speed. Press the STOP button, and move the SPEED switch to the LO position. Press the PLAY button. The capstan should run at half speed in the same direction. Remove the tape sensor mask, and move the SPEED switch to the HI position.

Transport Cover Plate Removal

Access to the adjustments located on the top area of the transport shown in figure 13 is obtained by removing the transport cover plate. If reels are on the machine, they should be removed. The cover plate is fastened to the transport by twelve screws; four of these screws are located on the top of the cover plate, and four each are located at the right- and left-hand sides of the transport. These screws secure the side trim plate as well as the flange of the top cover plate. After removing these screws, lift the cover plate up from the rear until the reel hubs clear the holes in the plate. Then slide the cover to the rear until the retaining clip on the front edge of the cover is disengaged. The cover plate can now be completely removed from the transport.

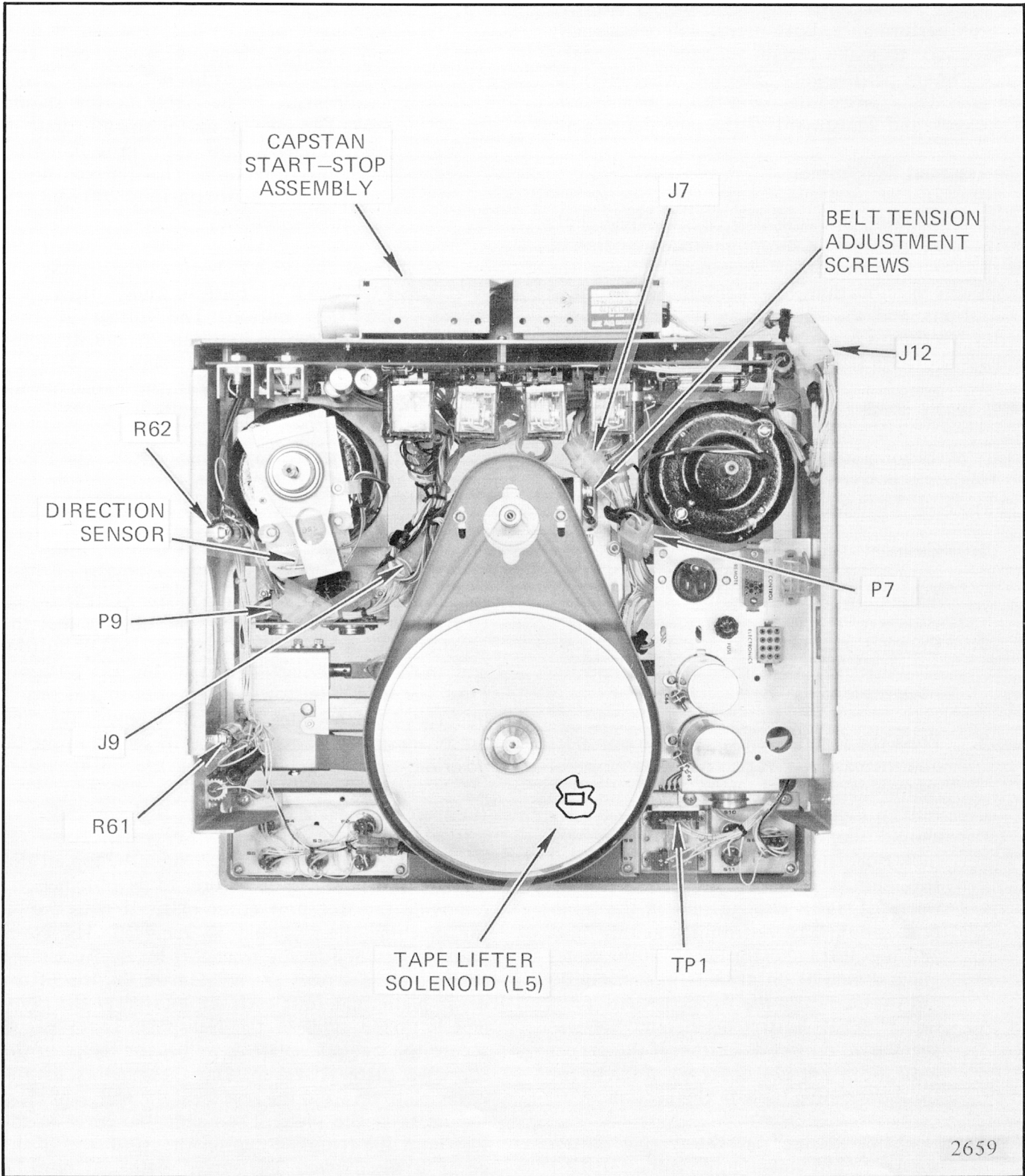


Figure 12. Transport Adjustments, Bottom View

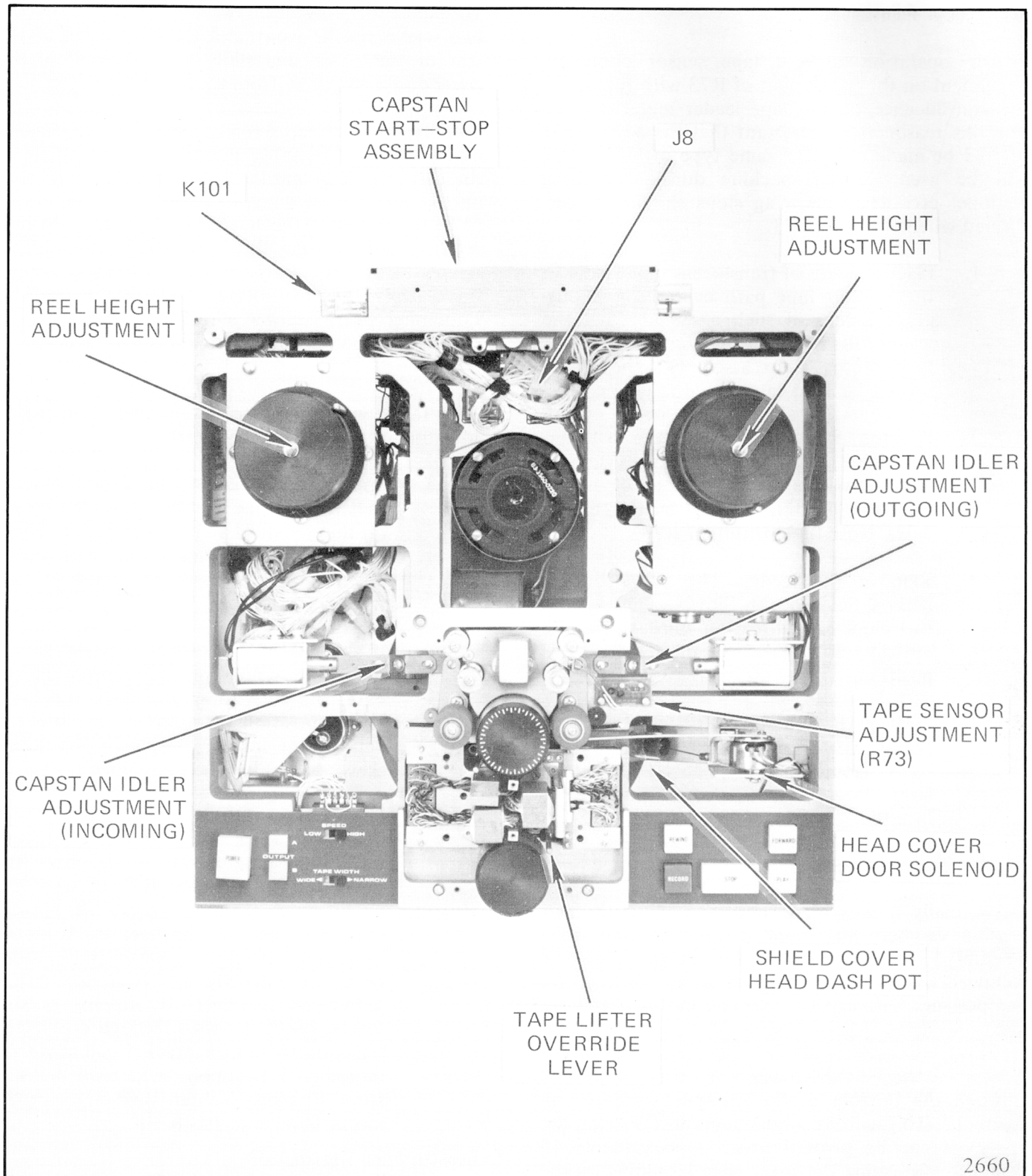


Figure 13. Transport Adjustments, Top View

Tape Sensor Adjustment

Proper operation of the tape sensor circuit is dependent on the adjustment of R73 with respect to the translucence of the tape leader material used. For this reason it is important that the adjustment of R73 be made using the same type of leader that will be used on the machine during recording sessions, etc. The following steps should be performed when adjusting R73.

1. Place a length of translucent tape leader in the normal tape path over the two outgoing guides in such a manner that the leader falls between the photocell and the tape sensor lamp assembly. The leader should be held taut over the tape guides.
2. Position R73 to the extreme counter-clockwise position (maximum resistance); then slowly adjust R73 in the clockwise direction until the STOP button illuminates. Note the position of R73.
3. Remove the leader. The STOP button lamp should go out. Slowly adjust R73 in the clockwise direction until the STOP button illuminates again. Note this position.
4. Position R73 mid-way between the two points noted above. The STOP button lamp should go out. The STOP button lamp should come on when the leader is inserted.

Capstan Belt Adjustment

Occasionally it may be necessary to adjust the belt tension or belt alignment on the capstan drive assembly. The following adjustments should also be followed when replacing the belt or any of the drive components, i.e., capstan, capstan motor, flywheel, etc.

Access to the belt drive assembly is accomplished through the bottom of the transport as shown in figure 12. To facilitate adjustments in this area, the transport can be pivoted up to approximately 45 degrees by grasping the front edge moulding on the transport and raising the transport to the canted position.

To expose the belt inside the dust cover, remove the two screws on the front, and the two screws at the rear of the cover, and slide the lower half of the cover down and away from the top section.

Five socket head cap screws located on the capstan motor bracket assembly permit the adjustment of the belt alignment and tension. Three screws located on the motor base, when loosened, allow the motor to be positioned in the vertical plane so that the belt will not skew on the flywheel. The remaining two screws fasten the motor bracket to the transport frame through two slotted holes in the bracket. Loosening these screws allows the motor to be moved back and forth, which adjusts the tension on the belt.

The following procedure should be used when adjustment of the belt is necessary.

1. Spin the flywheel by hand and observe that the belt, as it passes, over the crown of the flywheel remains centered. There should be no skewing of the belt (up or down motion across the crown of the flywheel).
2. If skewing of the belt is noticed, loosen the three screws on the capstan motor base, and cock the motor back and forth until a position is found which allows the belt to ride true on the flywheel without skewing. Tighten the three screws.
3. Position the SPEED switch for 15 ips operation. Press the POWER button, and insert the tape sensor mask. Press the PLAY button and allow the capstan to get up to speed; then press the STOP button. Observe that the flywheel stops at the same time the capstan motor pulley stops with no belt slippage over the motor pulley or flywheel. If slipping occurs, loosen the two screws through the slotted holes on the motor bracket and move the motor back to a point where the belt just stops slipping. Tighten the screws in the motor bracket at this point.

Capstan Idler Tracking

The alignment of the capstan idlers with the capstan is important in maintaining the proper tape tension

within the Isoloop. Shims are used under the idler to shift the idler up or down, depending on the alignment needed. Figure 14 shows the proper relationship of the idlers to the capstan and the position at which the shims are placed.

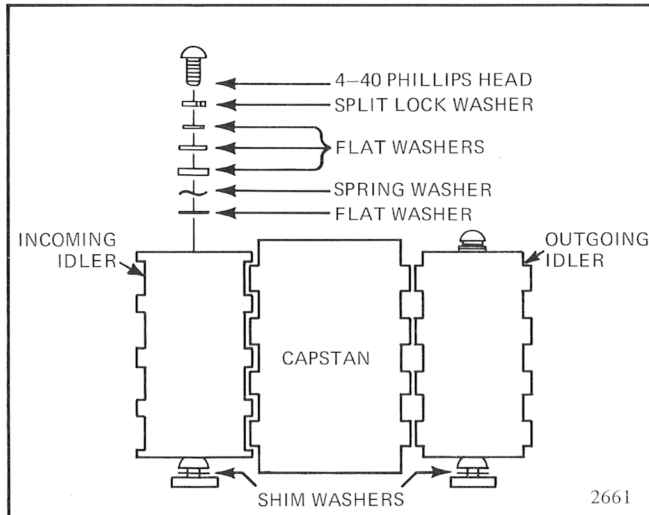


Figure 14. Capstan Idler Alignment

Capstan Idler Pressure Adjustment

Capstan idler pressure is adjusted by means of a spring-loaded screw in the solenoid linkage which varies the linkage arm length. See figures 13 and 15. Perform the capstan idler pressure adjustment as follows:

1. Press the plunger of the ingoing idler solenoid all the way in, and turn the adjustment screw clockwise until the idler does not contact the capstan.
2. Repeat step 1 for the outgoing idler.

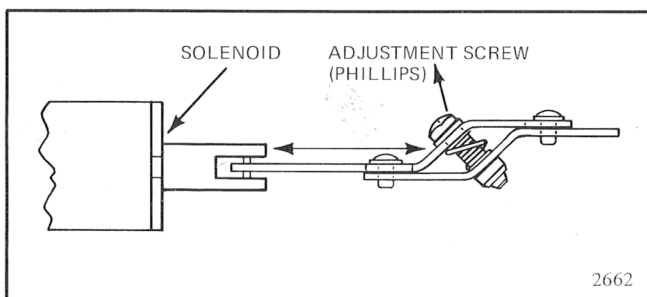


Figure 15. Capstan Idler Linkage Adjustment

3. Insert the tape sensor mask.
4. Press the POWER button, then the PLAY button. The capstan idlers should move toward the capstan.
5. Adjust the ingoing linkage arm screw counterclockwise until the idler is positively driven by the capstan, then turn the screw approximately 1-1/4 additional turns counterclockwise.
6. Repeat step 5 for the outgoing idler.
7. Remove the tape sensor mask, and thread a full reel of tape on the transport.
8. Press the PLAY button; both idlers should press the tape against the capstan, and tape movement should start smoothly without any loops forming in the tape path.
9. Observe the tape just before it enters between the ingoing idler and the capstan. If any wrinkling or deformation of the tape is observed at this point the idler pressure is too great. Turn the ingoing linkage arm screw clockwise until there is no distortion of the tape as it enters the idler.
10. With the finger, press in firmly on the capstan idler solenoid plungers to be certain the plungers are fully seated when the solenoids are energized. The solenoid mounting screws may be loosened, and the solenoid positioned to obtain proper seating of the plunger.

Reel Height Adjustment

Reel height adjustment is required only if tape drags on the reel flanges, or if a new motor or reel hub is installed. The following procedure should be used if reel height adjustment is necessary.

CAUTION

Before attempting adjustment of the reel height, inspect the reels to be sure that the reel flanges are not bent.

1. Check the distance between the reel hub flange and the top of the motor mounting plate. See figure 16.

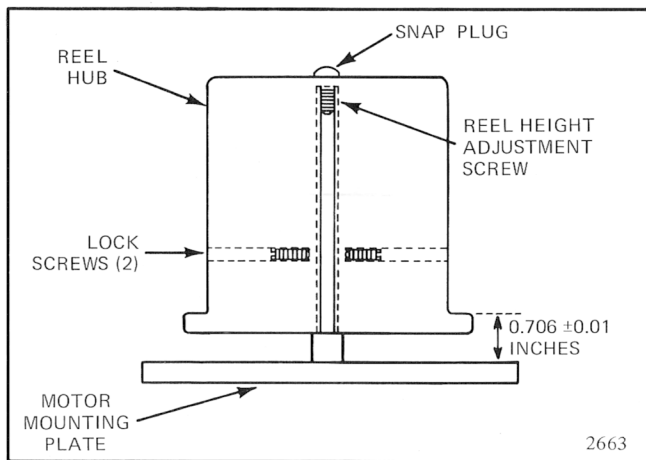


Figure 16. Reel Height Adjustment

2. Loosen the two locking screws (10-32 Allen head) accessible through the holes on the side of the reel hub. Remove the snap plug on the top of the reel hub; this allows access to the reel height adjustment screw. Insert a 10-32 Allen wrench, and adjust the reel hub height for 0.706 ± 0.01 inch between the top of the reel hub flange and the motor mounting plate.

NOTE

Snap plugs covering the reel height adjustment screws are not used on 1 inch tape transport reel hubs.

3. Tighten the two reel hub lock screws.
4. Load and thread a full reel of tape on the transport.
5. Press the POWER button, then the PLAY button. The tape should wind onto the take-up reel without touching the inside of either reel flange.
6. If the tape should drag on either reel flange, loosen the two lock screws, and adjust the reel hub up or down in the

direction away from the flange that the tape is dragging on. Repeat the adjustment until the tape winds on and off the reels without touching the reel flanges. The tape should not crease on the shoulders of the ingoing or outgoing tape guides when the reel height adjustment is correct.

Reel Torque Adjustment

The incoming and outgoing tape tension is controlled by the reel motor torque. The amount of torque developed by the take-up and rewind motor is controlled by the setting of R61 and R62. See figure 12. The required torque for each motor is developed when R61 and R62 is set at maximum resistance.

Incoming Tape Tension

The incoming tape tension is controlled by R8 on the transport logic board (see figure 19) in addition to R61 and R62. R8 should also be set for maximum resistance for proper holdback torque on the rewind motor when the transport is operating in the PLAY or RECORD mode.

Head Shield Cover Adjustment

Place the transport in the PLAY mode, observing the time required for the head shield cover to close after the PLAY button is pressed. The cover should close between 1/2 and 3/4 second. Adjust the head shield cover dash pot air port for the proper closing time. See figure 13. When the transport is placed in either the STOP, FORWARD or REWIND mode, the head shield cover should open immediately.

Tape Lifter Adjustment

The tape lifter assembly should seldom need adjustment. However, the following checks can be made to determine proper operation:

1. The tape lifter arms should operate when the transport is activated in the FORWARD or REWIND mode, lifting the tape away from the heads.
2. Moderate finger pressure on the tape lifter override lever (see figure 13) should allow

the tape to return to its normal path over the heads. If excessive pressure is required to override the tape lifter, adjustment of solenoid L5 may be necessary. See figure 12. For smooth operation and moderate pressure to operate the override lever, the solenoid plunger must not seat. Adjustment of the solenoid is accomplished by loosening the two phillip head screws that hold the solenoid to its bracket, and adjusting the position of the solenoid until the proper override operation is obtained. The solenoid must be positioned so that sufficient torque is applied to the lifter arm to hold the tape away from the heads yet not allow the solenoid plunger to seat.

3. When the tape lifter operates, the tape should be lifted away from the record head; the distance between the tape and record head should be 0.005 to 0.015 inch. Adjustment is accomplished by a setscrew located on the tape lifter arm. Access to the setscrew is obtained by removing the head mounting plate. The setscrew should be adjusted until the tape and record head are separated by 0.005 to 0.015 inch when the tape lifter solenoid is energized. This adjustment is made by trial and error. First, adjust the setscrew; replace the head mounting plate and measure the separation between the tape and record head. This process should be repeated until the proper separation is obtained.

Flutter Test

Flutter is checked by recording a 3 kHz signal and then playing it back into a flutter meter. Flutter checks are useful as a troubleshooting aid in determining which component, or group of components, is contributing to the flutter. Using a flutter meter in which three bandpasses are provided, components contributing to flutter can be determined, as shown in table 5. The following steps are to be followed in checking flutter.

NOTE

It is extremely important that all tape guides, heads, capstan surface,

puck idlers, capstan flywheel, and capstan motor spud be thoroughly cleaned, as described at the beginning of this section.

Table 5. Components Contributing to Flutter

Waveband	Component Area
0.5 to 30 cps	Flywheel and capstan
30 to 300 cps	Capstan motor and reversing idler
0.5 to 300 cps	Used to check overall flutter up to 300 cps

1. Connect an audio oscillator to the input of the recording electronics. Set the oscillator frequency to approximately 3kHz (some flutter meters contain their own internal oscillator). Connect the output of the playback electronics to the flutter meter input.
2. Position the SPEED switch for 15 ips operation. Position the tape so that it will start near the beginning of the reel.
3. Record the test signal at 0 VU for approximately 3 minutes. Rewind the tape to the start of the test signal recording.
4. Start the tape and calibrate the input level to the flutter meter. Check the frequency acceptability to the discriminator, then switch to the fullband flutter position (0.5 to 300 cps). Employ 0.5% full scale sensitivity. Flutter should not exceed 0.04% at 15 ips, or 0.07% at 7-1/2 ips.
5. Since it is possible for flutter components to cancel in playback because the phase of the recorded flutter may be opposite to the same component being generated during playback, it is necessary to stop and start the tape during playback at least 15 or 20 times and to accept the worst reading, where the recorded and reproducing phases are additive, as the true worst

flutter case. This must be done on each test. Do not check flutter with a playback head while recording the carrier with another head.

6. Make each flutter measurement at about 100 feet from the beginning of the reel, near the center, and again at about 100 feet from the end of the reel.
7. Identify any prominent frequency components in observed flutter, using an oscilloscope. Sources of such components must be determined and steps taken to minimize them if they cause overall flutter readings to exceed specifications. Several sources are:
 - a. Rotation rate of the capstan. A large component at this rate indicates improper belt tension.
 - b. Rotation rate of the reversing idler (same rate as capstan).
 - c. Rotation rate of the ingoing pressure roller.
 - d. Rotation rate of the outgoing pressure roller (rate close to that of c).
 - e. Rotation rate of the capstan motor.
 - f. Rotation rate of the take-up or supply reel.
 - g. Resonant component of the reversing idler mass coupled to elasticity of the tape; approximately 100 cycles on the idler for 1 inch tape, 70 cycles for 2 inch tape. Try running the tape at high speed over the reversing idler. If the latter produces considerable noise, whining, growling, or hissing, it may mean that the bearings have been damaged; in which case the idler should be replaced, since considerable flutter will otherwise be generated. Do not try to repair the idler. Replace it.

SIGNAL ELECTRONICS ALIGNMENT

The 3M Brand Series 500 Professional Audio Tape Recorder is factory aligned for peak performance. It is recommended that, whenever a circuit board, the heads, or other components are changed, the

following applicable alignment procedure be performed to insure optimum performance of the tape recorder. All controls are accessible from the front of the console by opening the two doors below the transport. A chart is located on the back of one of these doors that is an aid in locating the circuit boards for each channel, and their associated alignment controls and test points. This chart is reproduced in figure 17.

Power Supply Adjustment

Prior to performing any alignment on the signal electronics, the output voltage of the dc power supply should be checked. Press the POWER button on the transport, and measure the dc voltage at the power supply output terminals. The voltage should be 28 volts dc; if not, adjust the power supply output to the proper voltage.

NOTE

For maintenance and adjustment information on the signal electronics power supply, refer to the manual supplied with the unit.

Playback Alignment

The 7-1/2 and 15 ips playback alignment is accomplished by using industry standard calibration tapes which conform to the NAB format. These calibration tapes are listed in table 4.

NOTE

The following alignment procedures, in many cases, make reference to a single channel. In these instances, the procedure should be repeated for all channels requiring alignment.

15 ips Playback Alignment

1. Thoroughly degauss and clean all heads.
2. Remove the head cover plate to expose the head azimuth adjustment screws.
3. Place all output TERMINATION switches to the ON position (600 ohm termination).

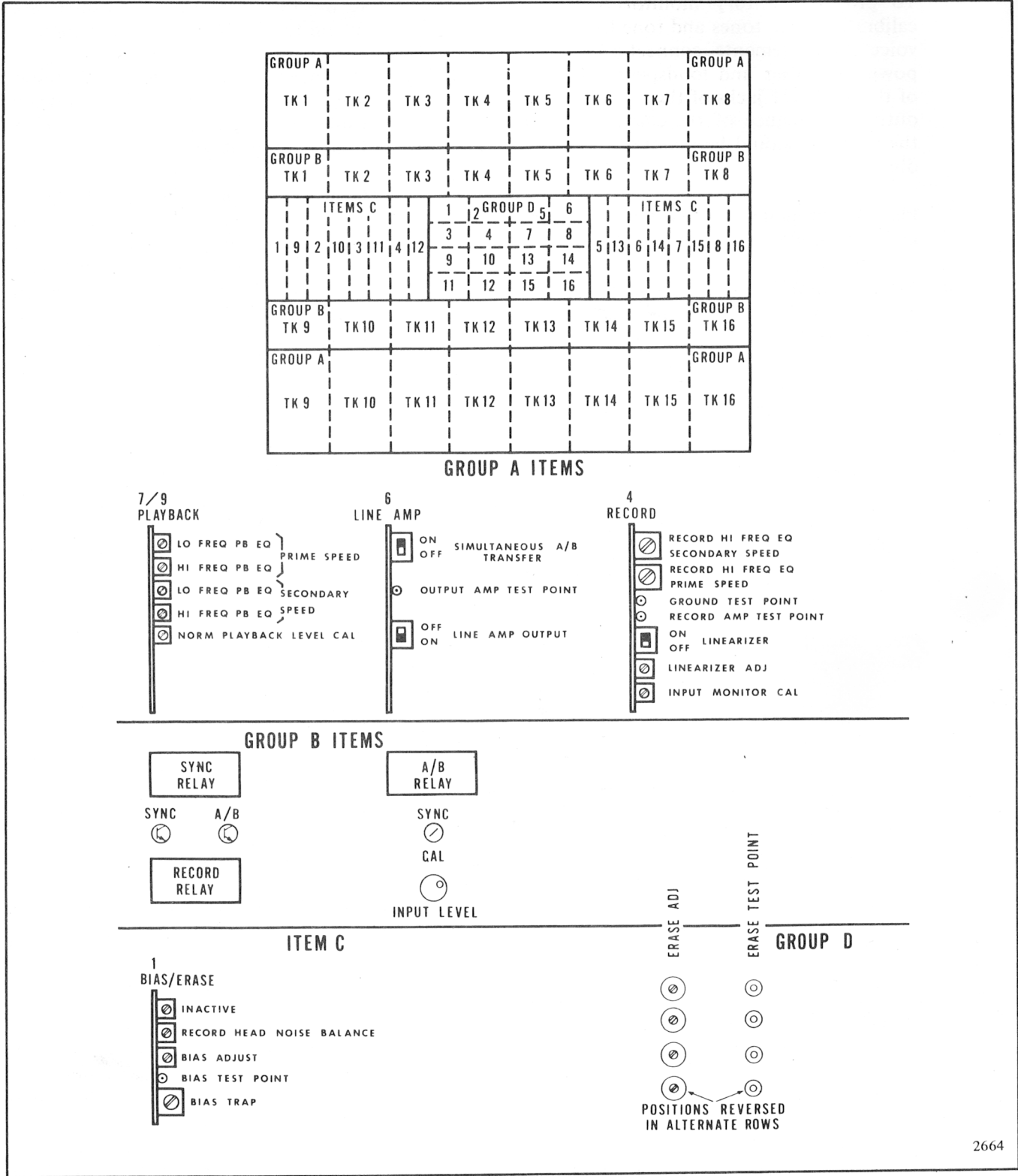


Figure 17. Signal Electronics Adjustment Locations

4. To provide auditory monitoring of the calibration tape tones and tone frequency voice announcements, connect a high gain power amplifier and loudspeaker to one of the OUTPUT jacks of the recorder. The output impedance of the channel driving the monitor should be maintained at 600 ohms.
5. Place the program select switch to NORM, and each mode select switch to SAFE.
6. Place all SIMULTANEOUS A/B TRANSFER switches on the number 6 boards to the ON position.
7. Place the SPEED select switch to the position providing 15 ips tape speed. This will be the HIGH position with recorders having a speed range of 7-1/2 – 15 ips or the LOW position with recorders equipped for 15–30 ips operation.
8. Apply power to the recorder by pressing the POWER button.
9. Press the B OUTPUT button on the transport or remote control unit.
10. Load and thread the 15 ips calibration tape on the transport.
11. Start the recorder in the reproduce mode by pressing the PLAY button. The first tone on the calibration tape is 700 Hz; this tone is used to establish a calibrated output reference level for each reproduce channel. Observe the VU meters; if the output level of each reproduce channel is not within $\pm 1/2$ VU of zero, VU adjust the NORM PLAYBACK LEVEL CAL potentiometer on the corresponding PLAYBACK amplifier board (7/9) to produce zero VU output.
12. The second tone from the calibration tape is 15 kHz. At this time, check for proper tape tension in the Isoloop by applying finger pressure to the tape as it moves against the incoming tape guide. If an increase of more than 1/2 VU is observed on the VU meters the incoming capstan idler pressure should be increased. Refer

to the Tape Transport Adjustment section herein for details on this adjustment.

13. If adjustment of the capstan idler pressure was necessary during step 12, rewind the calibration tape to the 700 Hz reference tone and repeat step 11.
14. Continue to play the 15 kHz test tone, and adjust the playback head azimuth adjustment screw (see figure 18) for a peak signal level on all VU meters. Care should be taken to ensure that the largest peak is found, as two lesser peaks may be noticed while performing this adjustment.

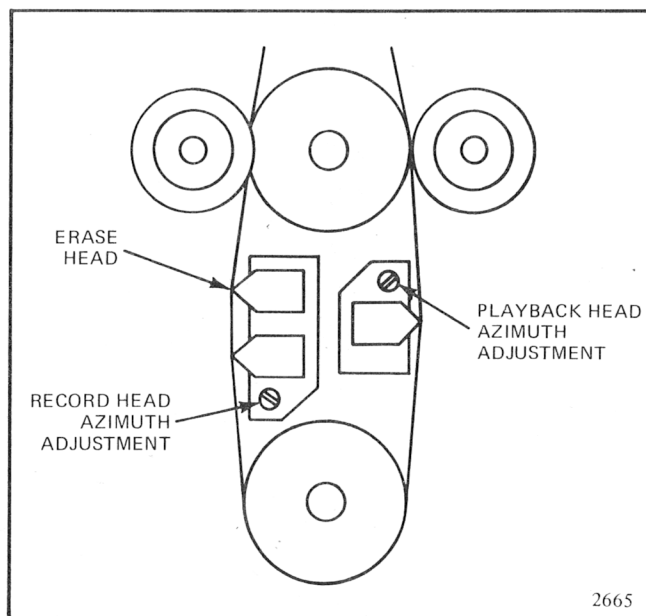


Figure 18. Record and Playback Head Azimuth Adjustments

15. Connect the OUTPUT of channel 1 to the vertical input of the oscilloscope, and the horizontal input of the scope to the recorder OUTPUT channel corresponding to the center track.
16. Shuttle the calibration tape to the commencement of the 2.5 kHz test tone.
17. Press the PLAY button and observe the lissajous pattern on the oscilloscope.

Adjust the playback head azimuth adjustment screw to obtain minimum phase error between the two output signals.

18. Play the calibration tape through all test tones (30 Hz to 15 kHz) and minimize the phase error.

NOTE

If the phase error should approach 180 degrees between 2.5 and 5 kHz, the wrong peak was selected during the adjustment in step 14. Repeat step 14, 17, and 18, if necessary.

19. Compare the phase relationship between channel 1 and all other channels while playing the 15 kHz tone, and readjust the playback head azimuth screw to obtain a phase error of not more than 90 degrees.
20. Shuttle the calibration tape to the commencement of the 10 kHz test tone.
21. Press the PLAY button and adjust the PRIME SPEED HI FREQ PB EQ potentiometer on the PLAYBACK boards (7/9) to obtain zero VU on the corresponding channel VU meter.
22. Check the 700 Hz playback reference level by repeating step 11.
23. Shuttle the calibration tape to the commencement of the 50 Hz tone.
24. Press the PLAY button and adjust the PRIME SPEED LO FREQ PB EQ potentiometer on the PLAYBACK boards (7/9) to obtain zero VU on the corresponding channel VU meter.
25. Play all test tones from 30 Hz to 15 kHz. The frequency response should be within ± 1 VU from 100 Hz to 12 kHz, increasing to +2, -1 VU at 15 kHz. The 30 and 50 Hz tones shall be within +1, -3 VU of the 700 Hz reference level.

NOTE

Readjustment of the PRIME SPEED LO FREQ PB EQ potentiometers may be necessary to bring the low frequency tones within the response limits stated in step 25.

7 1/2 ips Playback Alignment

The 7-1/2 ips playback alignment is performed in the same manner as the 15 ips alignment described earlier except for the following.

1. The 7-1/2 ips calibration tape shall be used.

NOTE

At the time of this publication, a 7-1/2 ips 16 track 2 inch calibration tape was not available from the customary supplier. Until such time this tape becomes available and the user requires a need for performing alignment at this secondary speed, the 1 inch calibration tape specified in table 4 may be used. When using the 1 inch calibration tape on a 2 inch transport, tracks 9 through 16 may be aligned by simply loading and threading the tape in the normal manner. To enable the 1 inch test tape to guide over tracks 1 through 8, a spacer should be placed on the reel tables before the 1 inch test tape reels are loaded and threaded on the transport.

2. A VTVM shall be used to monitor the reproduced output of the test tone signal levels rather than the VU meters.
3. The playback head azimuth adjustments and the NORM PLAYBACK LEVEL CAL adjustment made at 15 ips should not be disturbed unless 7-1/2 ips is to be used as the speed of primary usage.

With the above considerations the 7-1/2 ips alignment should be performed as follows:

1. Play the 700 Hz reference tone at the beginning of the calibration tape and note the output level from each channel on the VTVM. Use a meter scale that will give a middle to three quarter scale reading on the VTVM.

NOTE

The 700 Hz reference tone, and the frequency run on the 7-1/2 ips calibration tape is recorded at a level of 10 VU below zero VU to accommodate the heavier recording preemphasis used at the higher frequencies. For this reason, a more accurate measurement can be obtained when using a VTVM to monitor the output level of the test tones rather than the VU meters.

2. Shuttle the calibration tape to the commencement of the 10 kHz test tone. Play the 10 kHz tone and adjust the SECONDARY HI FREQ PB EQ potentiometer to produce the same level on the VTVM noted in step 1.
3. Shuttle the calibration tape to the commencement of the 50 Hz test tone. Play the 50 Hz tone and adjust the SECONDARY SPEED LO FREQ PB EQ potentiometer to produce the same level on the VTVM noted in step 1.
4. Play all test tones from 30 Hz to 10 kHz. The frequency response should be within ± 1 dB from 100 Hz to 10 kHz. The 30 and 50 Hz tones shall be within +1, -3 dB of the 700 Hz reference level.

NOTE

Readjustment of the SECONDARY SPEED LO FREQ PB EQ potentiometers may be necessary to bring the low frequency tones within the response limits stated in step 4.

Record Alignment

The following alignment procedure should be performed, using the same type of tape to be used for subsequent recording whenever possible. The recorder was factory aligned for use with 3M type 202 or 203 tape. It is essential that the preceding playback alignment be checked before performing the record alignment.

Bias Frequency Adjustment

1. Insert the tape sensor mask.
2. Place the transport in the record mode and allow the recorder 3 minutes to stabilize.
3. With a frequency counter, measure the bias frequency at one of the ERASE TEST POINTS. If necessary, adjust C11 on the transport logic board to obtain a frequency of $120 \text{ kHz} \pm 500 \text{ Hz}$ at the test point. Access to C11 is obtained by tilting the transport up, and adjusting C11 on the logic board through the hole provided at the rear of the transport.

Bias Level Adjustment

1. Load and thread a degaussed reel of tape on the transport. Set the SPEED switch to 15 ips.
2. Connect an audio oscillator to the INPUT of the channel under test. Set the oscillator to 1 kHz at a level of +4 dBm.
3. Connect a VTVM to the OUTPUT of the channel under test.
4. Press the B OUTPUT button. Place the mode select switch corresponding to the channel under test to the READY position.
5. Start the recorder in the record mode. Turn the BIAS ADJUST potentiometer on the BIAS/ERASE board of the channel under test to the maximum CCW position. Slowly turn the BIAS ADJUST potentiometer in the cw direction, watching for a peak signal indication on the VTVM.

When the peak is established, continue to turn the BIAS ADJUST potentiometer in the cw direction until the signal level on the VTVM drops 2 dB from the established peak reading. The record head bias is now set for 2 dB overbias, which is recommended when using 3M heads and type 202 or 203 tape.

6. Adjust the INPUT LEVEL control corresponding to the channel under test for zero VU, as measured on the VU meter panel.
7. Repeat the above for the remaining channels.

NOTE

A VTVM may be connected to the BIAS TEST POINT during the bias adjustment. As the bias is adjusted for each channel, the VTVM reading is recorded. This data can then be used during preventive or corrective maintenance checks.

Bias Trap Adjustment

1. Remove all input signals from the recorder. Connect a VTVM to the RECORD AMP TEST POINT on board No. 4.
2. Place the transport in the RECORD mode, and adjust the BIAS TRAP trimmer capacitor on board No. 1 for minimum signal on the VTVM. Repeat this adjustment on all channels.

Record Head Azimuth Alignment

1. Thread a degaussed reel of tape on the transport. Set the SPEED select switch for 15 ips operation. Apply a 2.5 kHz +4 dBm signal to the recorder input.
2. Connect the outputs from the reproduce electronics corresponding to the top and center tracks to the inputs (vertical and horizontal, respectively) of an oscilloscope to produce a lissajous pattern. Press the B OUTPUT button.

3. Start the recorder in the RECORD mode, and adjust the record head azimuth screw (see figure 17) for minimum phase error. Sweep the input oscillator frequency over the range of 30 Hz to 15 kHz while maintaining an input level of +4 dBm. Check each combination of any two tracks, and optimize the phase error for less than 90 degrees.

Record Equalizer Adjustment

1. Thread a degaussed reel of tape on the transport. Apply a 1 kHz +4 dBm signal to the input.
2. Press the B OUTPUT button, and start the recorder in the RECORD mode. Adjust the INPUT LEVEL control for 0 VU on the corresponding VU meter.
3. Press the A OUTPUT button and adjust the INPUT MONITOR CAL potentiometer on the No. 4 board for 0 VU on the corresponding VU meter.
4. Press the B OUTPUT button, and adjust equalizer trimmer capacitors on the RECORD amplifier No. 4 boards in accordance with the test conditions given in table 6.

Table 6. Record Equalizer Test Conditions

Speed (ips)	Input Signal	Adjust for VU Meter Reading of:
7-1/2 (secondary)	10 kHz @ -6 dBm	-10 VU
15 (primary)	10 kHz @ +4 dBm	Zero VU
30 (secondary)	15 kHz @ +4 dBm	Minimum signal

5. Set the SPEED select switch for 15 ips operation. Slowly sweep the input signal maintaining a level of +4 dBm from 30 Hz to 15 kHz. The response should be within

± 2 VU 100 Hz to 15 kHz, and +2, -4 VU at 50 and 30 Hz.

6. Set the SPEED switch to 30 ips if the recorder is provided with this speed, and repeat the frequency response check outlined in step 5.
7. Set the SPEED switch to 7-1/2 ips if the recorder is provided with this speed. Slowly sweep the input signal maintaining a level of +4 dBm from 30 Hz to 10 kHz. The response should be within ± 2 VU 100 Hz to 10 kHz, and +2, -4 VU at 50 and 30 Hz.

3. Adjust the 1 kHz oscillator input signal level for exactly 3 percent third harmonic distortion, as measured on the wave analyzer.
4. Place the LINEARIZER switch on the No. 4 board to the ON position. Adjust the LINEARIZER ADJ potentiometer to obtain minimum distortion on the wave analyzer. The third harmonic distortion level should be less than 0.8 percent with the LINEARIZER switch ON and 3 percent with the LINEARIZER switch OFF. Leave the LINEARIZER switch ON after this adjustment is completed.

Sync Level Adjustment

1. Apply a 700 Hz +4 dBm signal to the INPUT, and place the recorder in the record mode. Adjust the INPUT LEVEL control for zero VU on the corresponding VU meter, if necessary. Record this signal for approximately 1 minute at 15 ips.
2. Rewind the tape to the beginning of the recorded 700 Hz signal. Place the program select switch in the CUE position and the channel under test mode select switch in the SYNC position. Start the recorder in the PLAY mode and adjust the SYNC CAL control for zero VU on the corresponding VU meter.

Linearizer Adjustment

NOTE

As delivered, the recorder is adjusted for use with Scotch Brand low-noise tape types 202 or 203. If the recorder is to use a different type of tape, the LINEARIZER ADJ control may require adjustment, as outlined below.

1. Place the LINEARIZER switch on No. 4 board to the OFF position.
2. Apply 1 kHz at +10 dBm to the INPUT. Connect a Wave Analyzer and VTVM to the reproduce OUTPUT.

NOTE

The recorder may be operated with the linearizer distortion reduction circuit disabled if it is felt that this circuit is misaligned. This is accomplished by placing the LINEARIZER switch in the OFF position until proper alignment can be performed. Third harmonic distortion products will be more prevalent at the higher recording levels when operated under this condition.

Noise Balance Adjustment

Before making the noise balance adjustments, it is absolutely essential to degauss and clean all heads very carefully. Remove power from the recorder while degaussing the heads. Perform the noise balance adjustment as follows:

1. Load and thread a used reel of degaussed tape on the transport.
2. Connect a high gain power amplifier and loudspeaker to the reproduce OUTPUT jack of the channel under test. Short the INPUT of the channel.
3. Place the recorder in the RECORD mode, and advance the gain control on the external monitor amplifier until the tape noise is heard loudly.

4. Adjust the RECORD HEAD NOISE BALANCE potentiometer on the No. 1 board for minimum thumping and crackle.
5. Adjust the ERASE ADJ capacitor to further minimize thumping and crackle.

Erasure Test

1. Connect an audio oscillator to the INPUT of the channel under test. Set the oscillator for 1 kHz output at a level of +10 dBm.
2. Connect a VTVM to the ERASE TEST POINT of the channel under test.
3. Connect a wave analyzer to the OUTPUT of the channel under test.
4. Place the mode select switch corresponding to the channel under test to the READY position. All other mode select switches should be in the SAFE position.
5. Start the recorder in the RECORD mode and adjust the ERASE ADJ capacitor for peak on the VTVM. Then adjust the 1 kHz input signal level to obtain 3 percent third harmonic distortion as read on the wave analyzer.
6. Remove the input signal and rewind the tape to the start of the 1 kHz recorded signal.
7. Place the mode select switch in the SAFE position. Start the recorder in the RECORD mode.
8. When the 1 kHz signal appears, establish a reference level on the wave analyzer; then, initiate erasure of the track by placing the mode select switch to the READY position.
9. Return the mode select switch to the SAFE position, and rewind the tape once again.

10. Playback the erased segment of tape, noting the amount of signal erasure on the wave analyzer with respect to the reference level established in step 8 above. The signal should be at least 72 dB below the reference level; if not, turn the erase level potentiometer (R3) on the BIAS/ERASE board (No. 1) a few turns clockwise and repeat steps 4 through 10. The voltage measured at the ERASE TEST POINT should be less than 0.55 volt ac when 72 dB of erasure is accomplished.

Signal/Noise Test

1. Clean and degauss the heads. Load and thread a degaussed reel of tape on the transport.
2. Connect a VTVM to the OUTPUT of the channel under test.
3. Record a segment of tape with an input signal of 1 kHz at +10 dBm. Establish a reference level of the reproduced 1 kHz signal on the VTVM.
4. Record a segment of tape with the input signal removed, and note the noise level as measured on the VTVM.
5. The difference between the VTVM readings noted in steps 3 and 4 represent the signal-to-noise ratio of the channel under test.

NOTE

Noise figures stated in the system specifications are obtained by the use of bandpass filters. Such filters exclude all noise outside the stated passband.

TROUBLESHOOTING

The modular construction of the 3M Brand Series 500 Professional Audio Recorders provide not only

a fast and easy method of repair but also an excellent method of troubleshooting. The signal electronics assembly is so arranged in modular form allowing individual circuit boards of any channel to be replaced or exchanged with a similar board from a known good channel. When boards are interchanged, alignment of the channel(s) may be necessary to provide peak performance.

Failure of the recorder to operate properly may be caused by a malfunction in the recorder, or by external causes. Before troubleshooting the recorder, verify that the power and signal connections are correct, and that all of the operational controls are properly set.

Some of the troubles most likely to be encountered are presented in table 7. However, the best troubleshooting tool is a familiarity with the equipment and a thorough understanding of its theory of operation.

Figure 19 shows the major parts location on the transport logic board to help in troubleshooting.

The following paragraphs contain some general precautions which should be observed when performing maintenance on the recorder.

1. Do not strike the reversing idler. It is delicate and located in a vulnerable position at the front of the mechanism. If damaged, flutter will be excessively high.
2. Exercise great care in installing head mounting plates. They can be screwed into place with a head lead pinched between the mounting plate and the transport casting, thus breaking wire insulation or cutting a head lead. Be certain no leads will get in the way before installation.
3. Exercise great care in removing and replacing the mu metal cover over the playback head stack. The slot at the rear cover can slice head lead insulation, thereby grounding head leads or actually cutting through them. Be certain that this cover is fully seated so that the lower lip will not scrape on tape as it passes by. Otherwise tape edge may be cut and bad tracking over the heads may result.
4. Do not go from READY to SAFE when the recorder is operating in the RECORD mode. First stop the transport. This will

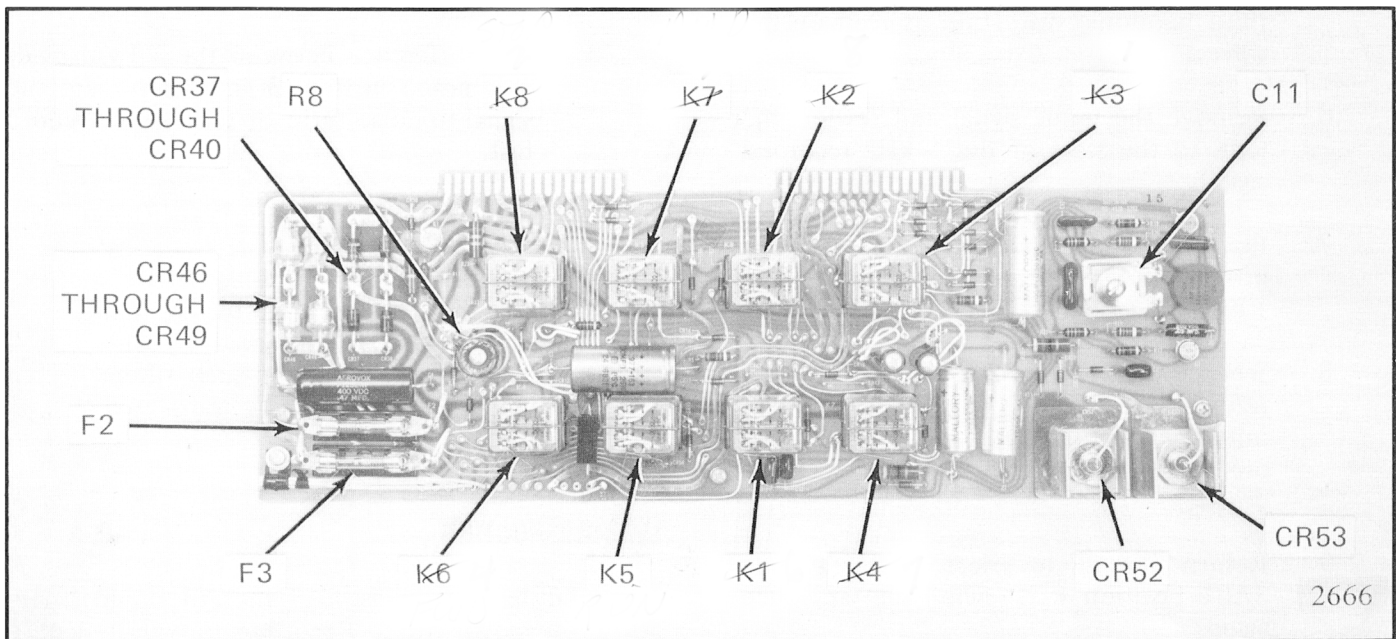


Figure 19. Transport Logic Board

prevent the possibility of a thump from being recorded on the tape and possible magnetization of the record head.

5. Do not remove any of the electronics cards when the power is on. It requires only a few seconds to turn off the power, remove a card, restore power and be ready to operate. Otherwise it is possible to magnetize a head or damage a meter.

FIELD SERVICE

Regular scheduled maintenance service is available from the Mincom Division service office on a contract basis. If immediate service is required, it may be obtained on an emergency basis. Every effort is made to furnish the needed repair as soon as possible. For a complete description of 3M's maintenance service plans and their costs, contact the Mincom Division service office.

FACTORY REPAIR SERVICE

If desired, the recorder or major assemblies, may be returned to the factory (transportation prepaid) for repair. When recorder or assembly is returned:

1. Indicate the symptom of defect. State as completely as possible, both on an instrument tag and on the order form, the nature of the problem encountered. Too much information is far better than too little. If the trouble is intermittent, please be specific in describing the instrument's performance history.

2. Give special instructions. If any changes in the instrument or assembly have been made, and it is desired to retain the modified form, please indicate this specifically.
3. To facilitate expeditious repair, your Contract or Purchase Order authorizing the work should be directed to Mincom Division – 3M Company – 300 South Lewis Road – Camarillo, California 93010 – Attn: Contracts Department.
4. Pack securely and label. Proper packaging saves money. The small amount of extra care and time it takes to cushion a part or instrument properly may prevent costly damage while in transit. Make certain that the address is both legible and complete; failure to do so often results in needless delay. Address all shipments and correspondence to:

Mincom Division
3M Company
300 South Lewis Road
Camarillo, California 93010

Attn: Receiving Inspection

5. Show return address on repair correspondence. Please clearly indicate the exact address the equipment should be returned to after repair is completed. Terms are net 30 days – f.o.b., Camarillo, California.

Table 7. Troubleshooting Guide

Symptom	Cause	Correction
TRANSPORT		
1. Transport stops when leader passes photo cell V60.	Tape sensor adjustment R73 out of adjustment.	Adjustment R73 in accordance with Tape Sensor Adjustment procedure.
2. STOP button lights when tape is not threaded.	Lamp DS8 burnt out.	Replace DS8.

Table 7. Troubleshooting Guide (Cont.)

Sympton	Cause	Correction
TRANSPORT (Cont.)		
3. STOP button does not light when tape is threaded.	Defective component on tape sensor board. V60 defective.	Troubleshoot sensor board (56013B075) Q1 or Q2 possibly defective. Replace V60.
4. Transport coasts to stop from PLAY mode when STOP button is pressed.	Relay K7 cannot be operated during stop sequence because the reed switch is not closed.	Adjust flag stops and clearance of magnets over reed switches on direction sensor board (56004A100).
5. Transport coasts to stop from FORWARD mode when the STOP button is pressed. Possibly causing tape breakage.	Same as 4, above.	Same as 4, above.
6. Transport coasts to stop from REWIND mode when STOP button is pressed.	Same as 4, above except K6.	Same as 4, above.
7. Tape continues in REWIND when STOP button is pressed. Does not clear after tape runs out or POWER switch is turned off and on.	K7 hung up. Contacts 5 and 9 sticking.	Replace K7.
8. Transport throws loop when starting in PLAY mode, generally worse near end of reel rather than beginning.	Ingoing solenoid capstan idler needs adjustment.	Adjust ingoing capstan idler linkage.
9. Capstan coasts to stop from PLAY or RECORD mode when STOP button is pressed.	Defective contacts on either K5 or K101. CR101, R101 or C101 defective on Capstan Start-Stop Assembly (56013A170)	Replace K5 or K101. Troubleshoot Capstan Start-Stop Assembly. Replace defective components.
10. Sluggish Solenoid operation: L1, L2.	Misalignment or in need of lubrication.	Try lubricating first with graphite or silicone. Loosening to improve alignment may change absolute position of linkages when plunger is seated necessitating their further adjustment.

Table 7. Troubleshooting Guide (Cont.)

Symptom	Cause	Correction
TRANSPORT (Cont.)		
11. Tape lifter hangs up.	Misalignment or in need of lubrication.	Plunger must not drag too forcefully against core of solenoid. Body should be so positioned to avoid such side drag, and to provide best compromise of depth of travel to satisfy easy override yet adequate lifting power.
12. Tape lifter difficult to override manually.	Plunger approaches full seated position too closely.	
13. Tape lifter fails to lift tape from heads.	Plunger operating too far from seated position.	Loosen two mounting screws, lubricate plunger and shift body (holes are oversize) to achieve above requirements.
14. Transport appears completely dead.	Blown fuse F1. Intermittent operation of power switch S6. C66 charged to greater than 30 volts but no 27 volt dc at collector of Q60 or at test point means Q60 is defective.	Replace with 5 amps slow blow. Press a few times to observe if lights come on. Replace Q60 after checking load resistance from collector to ground for short circuit defect. Clear defect before again applying power.
15. All lamps excessively bright and short lived.	Regulator Q60 and associate circuit, Q1, R14, R15, and CR50 not functioning.	Replace Q60. Catcher diode CR51 will also require replacement if condition persisted for more than a few seconds. Check resistance of 27 volt load to be certain Q60 will not be overloaded. Transport may be operated without CR51 until replaced.
16. Flutter and Wow excessive.	Numerous sources possible. Most likely are: a) Insufficient capstan idler pressure either ingoing or outgoing. b) Defective reversing idler. c) Capstan bell tension in need of adjustment. d) Dirty flywheel and motor pulley.	Localize cause of trouble using oscilloscope while referring to Transport Alignment Procedures in this section.
ELECTRONICS		
1. A-B monitor lamps are dim or do not come on when POWER button on transport is pressed.	Short circuit on 28 vdc bus in electronic module assembly. Defective 28 vdc power supply.	Remote one plug-in board at a time and re-insert to determine if fault is in cards or module wiring. Troubleshoot power supply using instruction manual supplied with the unit as a guide.

Table 7. Troubleshooting Guide (Cont.)

Symptom	Cause	Correction
ELECTRONICS (Cont.)		
2. A-B transfer causes clicks in output.	Leaky capacitor C15 in output of record monitor amplifier on board 4 or at output of pre-amplifier C6 on board 7/9. Also can be leaky input capacitor on line amplifier board 6.	Exchange boards 4, 6, and 7/9 one at a time from known good channel to determine defective board. Troubleshoot defective board looking at capacitors mentioned as being most possible cause of trouble.
3. Loss of signal in record board 4.	Defective field effect transistor Q2. Easily damaged by static charge from soldering iron or tool held in hand.	Replace Q2. Be very careful to avoid static charges. Ground soldering iron to ground bus on board.
4. Noise or intermittent operation in any area of electronics module.	Dirty contacts at base of card plug.	Remove and reinsert board. Use ink eraser to clean contact surfaces.
5. High distortion.	Insufficient bias. Magnetized head, either record or reproduce head. Noise balance control mis-adjusted.	Adjust record bias as prescribed under Signal Electronics Alignment. Degauss heads. Adjust for minimum noise after degaussing all heads.
6. Poor noise figure.	Noisy Q1 or Q2 on preamplifier board 7/9. Head cables badly routed, near hum fields. Defective playback head requiring excessive gain. Lack of good system ground can produce hum or buzzing. Third wire in power cord not always effective as good ground.	Substitute another preamplifier board to compare noise and replace transistors. Reroute for minimum noise. Keep away from power cord. This can be very important. Try breakin tape if head appears to be smeared over by oxide material. Replace head if necessary. Connect casted frame of transport to good earth ground.
7. Wrong output level.	Improper choice of line impedance or termination.	Check TERMINATION switch position of the channel in question. Output transformer impedance may be changed from normal 600 ohm output to 150 ohms by moving lead from terminal 6 to terminal 4.

TECHNICAL DESCRIPTION

INTRODUCTION

The 3M Brand, Series 500 recorders consist basically of a tape transport and the required record and reproduce electronics with their associated control circuits. The signal to be recorded is amplified and applied to a magnetic record head which impresses a magnetic pattern in the oxide coating of the magnetic recording tape in accordance with the variations of the input signal. During reproduction, the variations in magnetic flux that were impressed on the tape during recording are sensed by a reproduce head, amplified, and applied to the recorder output and monitoring circuits.

In order to record and reproduce with a minimum of distortion, a high-frequency bias is mixed with the input signal at the record head so that recording takes place in the portion of the magnetization curve that is essentially linear. The signal recovered by the reproduce head must also be equalized by circuits that compensate for the response characteristics of the reproduce head at low and high frequencies.

The high-frequency signal that is used for bias is also used to erase signals that may have previously been recorded on the tape. The erase signal is applied to a separate erase head, which is similar to the record head but applies the high-frequency signal at a much higher level. The signal applied to the erase head drives the magnetic material of the tape to complete magnetic saturation to obliterate any signal or noise that may have been previously recorded on the tape. Then, as the tape moves out of the saturating field, alternate field oscillations result in completely degaussed tape.

The Isoloop tape drive maintains differential tension within the loop of tape passing over the heads and ensures that the tape remains in close contact with the heads during tape travel. This ensures that the magnetic flux impressed by the record head penetrates the oxide material uniformly and eliminates variations in amplitude that can result if the close head-to-tape contact is not maintained. Similar amplitude variations can take place if the tape is not maintained in close contact with the play head.

TAPE TRANSPORT MECHANICAL FUNCTIONS

Figure 20 illustrates the basic mechanical operation of the tape transport. When tape is placed in the Isoloop drive path as shown, the tape transport motion control logic circuits (to be covered later) are automatically activated by the photoelectric tape sensor, placing the transport in the standby condition. Operation of the transport is then accomplished by pressing the desired tape motion control switch either on the transport panel or at the remote control box. Each tape motion control switch operates through a system of safety interlock relays that allows any button to be pressed in any sequence at any time with complete safety to the tape and machine.

Components of the tape drive system (see figure 21) consist of a capstan drive motor, two reel drive motors, and control relays that determine the mode of operation. When in play and record modes, the tape is moved through the Isoloop by the capstan. The reel drive motors maintain constant tension on the tape as it enters and leaves the loop. When in fast-forward or rewind, the capstan motor is stopped, tension is released within the Isoloop, and the reel drive motors move the tape through the loop independently of the capstan. Before entering and after leaving the Isoloop, the tape passes over guides to ensure that the tape is properly aligned with the magnetic heads.

When the transport is placed in the play or record mode, the capstan motor starts, the solenoids press the capstan idlers against the tape, clamping it to the capstan to prevent it from slipping. The tape is moved past the incoming idler and capstan, past the erase and record heads, and around the reversing idler. From the reversing idler, it passes the play head, and the outgoing idler and capstan. During fast-forward and rewind, solenoid-actuated tape lifters hold the tape away from the heads so that signals on the tape will not be played back which would cause an annoying squeal. The tape lifters are inactive in the play, record, and stop modes. The tape lifter may be manually overridden by pressing the tape lifter override lever. This restores the tape against the head so that it may be heard.

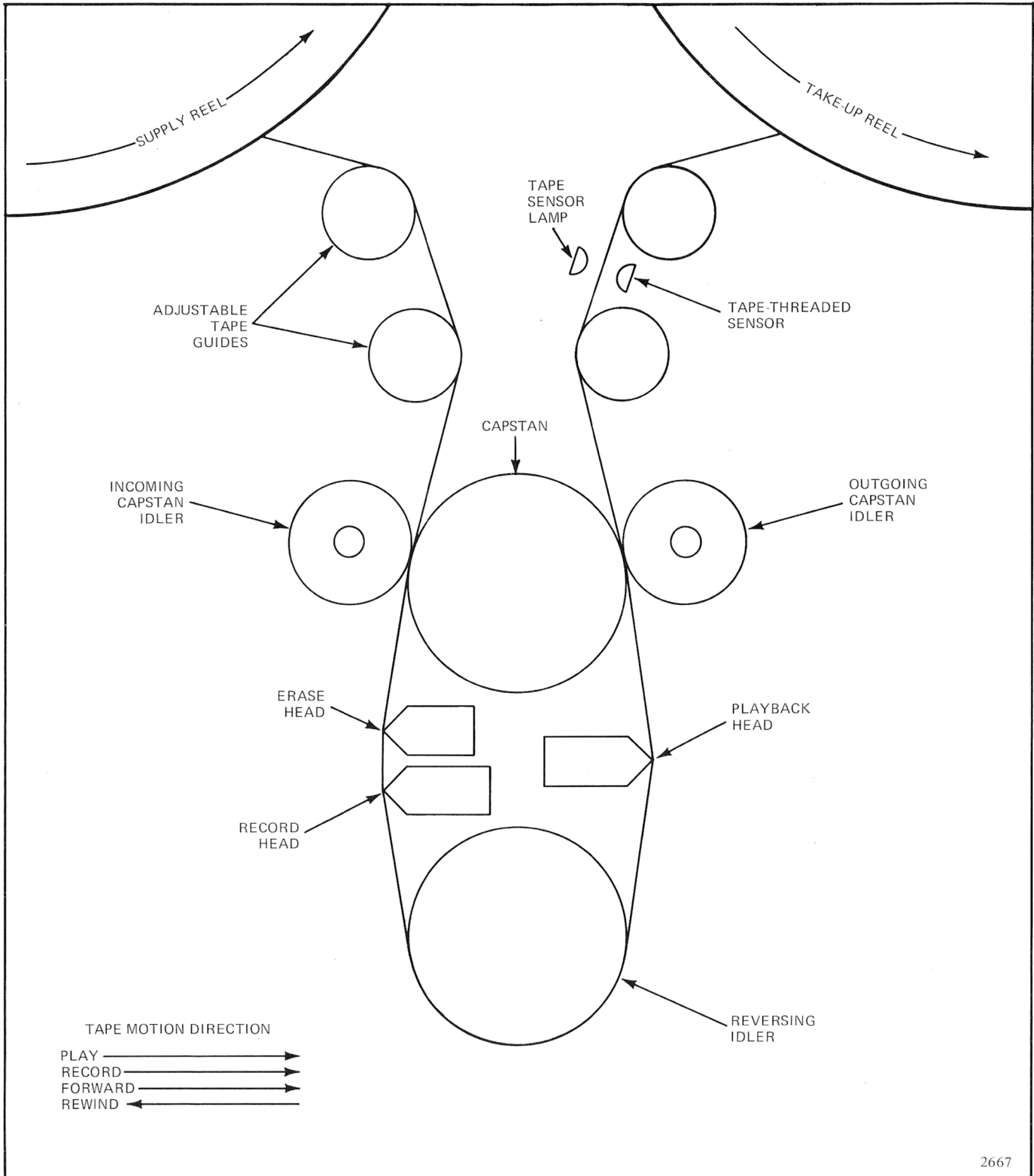


Figure 20. Tape Transport, Block Diagram

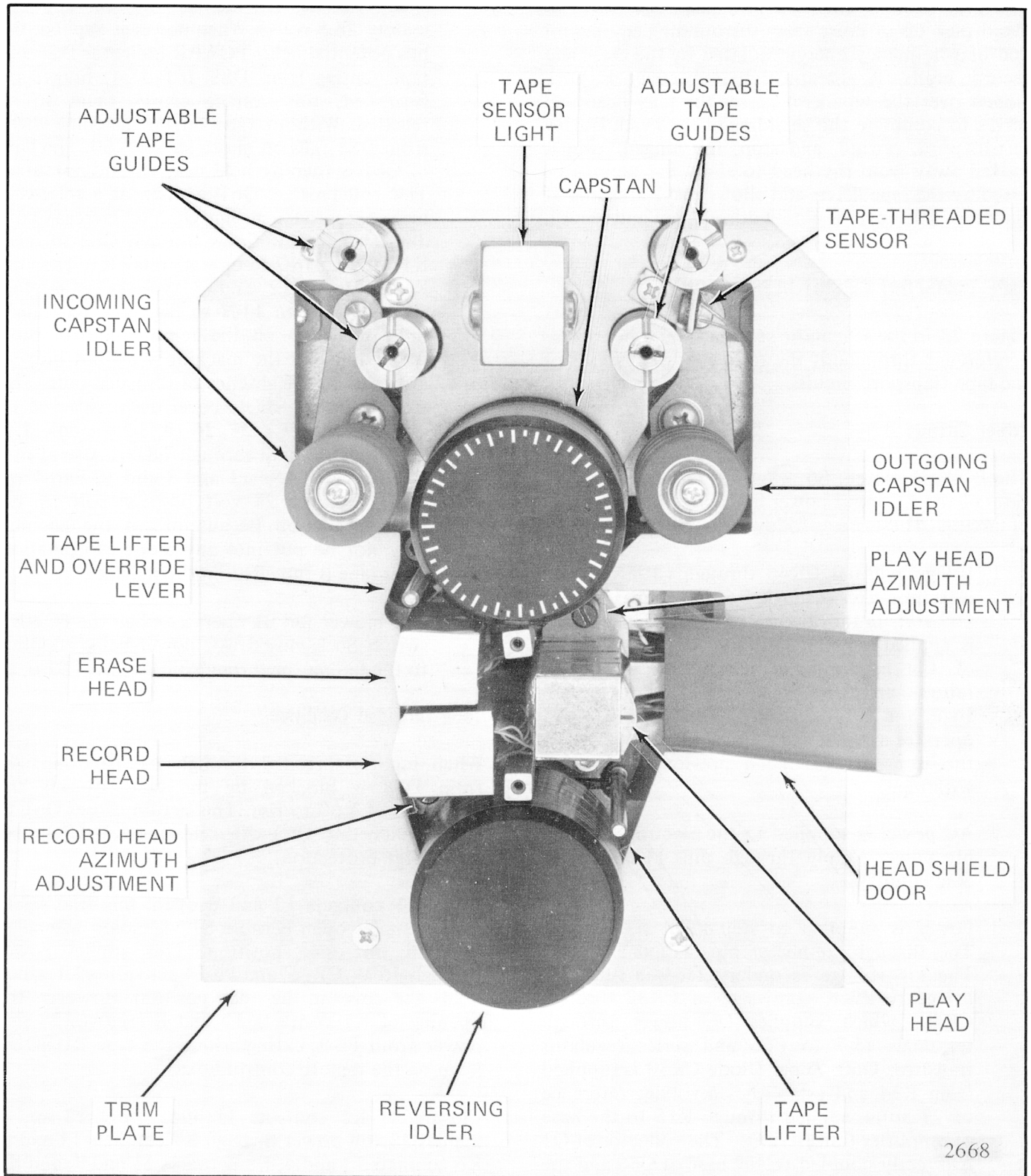


Figure 21. Tape Drive Components

The play head is enclosed in a magnetic shield to avoid pick up of noise from surrounding equipment and bias-frequency energy radiated by the erase and record heads. A solenoid-actuated cover is positioned over the tape as it passes the play head and serves to complete the shielding of the head. During fast-forward, rewind, and stop, the hinged cover is moved away from the head to allow the tape to be lifted by the tape lifters and allows easy threading of the tape. The cover is closed during play and record.

TAPE TRANSPORT CIRCUIT DESCRIPTION

Figure 23 in the schematic section should be used as a reference throughout the following discussions of the tape transport circuits.

Power Circuits

The POWER switch, S6, when operated, closes both sides of the AC input power line activating a number of circuits. These are as follows:

1. Bridge rectifier CR46 through CR49 charges capacitor C65 through R60 to approximately 165 volts in the absence of a load. This voltage is applied through J7-2 and J9-1 to the fields of the take-up and rewind motors. Field returns are through J7-1, and J9-2 through J6-4, and K1 contacts 6 and 10. Relay K1 operates as soon as power is turned on, unless the transport has been previously threaded with tape.
2. AC power is supplied to the electronic assembly power supply through pins 11 and 12 of connector J4.
3. Power is supplied to step-down transformer T60 through connector pins 1 and 2 of J13. The low-voltage secondary feeds a full-wave bridge rectifier, consisting of CR37 through CR40, which supplies DC power through terminals J5-5 to C66 and series regulator transistor Q60. Zener Diode CR50 is supplied from R14 and establishes a voltage reference of 27 volts, applied through R15 to the base of amplifier transistor Q1. The collector of Q1 is directly coupled to the base of Q60 and the output collector potential of Q60 establishes the emitter voltage of Q1. The two transistors

thus act to regulate the bus potential (approximately 26.5 volts). When power is applied, the bus potential lights POWER indicator DS6 and tape sensing lamp DS8. If fail-safe brakes are furnished, this voltage causes them to be released. Without tape on the machine, light from DS8 falls on photo sensor V60. The base of Q61 is thereby held near ground potential. The collector at Q61 is then at a relatively high potential, causing Q62 to increase conduction. Current flows through Q62 to relay K1 through J6-7 to operate relay K1. Through K1 contacts 12 and 8, voltage is applied through J6-9 to J3-N to light the RUNOUT indicator lamp on the remote control box, indicating that the machine is on but inoperative due to the absence of threaded tape. The playback head shield cover door is caused to open through CR-25, J6-14, to solenoid L4, with a return path through TB1-1. Also at this time, K1 contacts 11 and 3 and 12 and 4 are open, and the 27 volt bus can perform no further function. Because of this, the machine may not be put into any mode of operation until tape is threaded on the machine.

4. The blower fan B1 operates when the POWER switch S6 is closed, AC power being supplied to the fan motor through TB1-5 and TB1-6.

Tape Threaded Condition

When tape is threaded through the Isoloop, light from DS8 is blocked by the tape, causing the resistance of V60 to rise. This action causes Q61 to conduct, cutting Q62 off, releasing K1. CR1 provides surge protection.

When K1 contacts 12 and 8 open, the head shield cover remains open because S12 is closed whenever it is in the open position. This applies power through J6-M, CR26, and P6-14 activating L4 which holds the cover in the open position. However, the opening of K1 contacts 12 and 8 removes 28 volt power from P6-9, extinguishing the tape RUNOUT lamp on the remote control box.

Closure of K1 contacts 11 and 3 and 12 and 4 applies 28 volt power through K7 contacts 11 and 3, K6 contacts 12 and 4, K8 contacts 11 and 3, and K5 contacts 12 and 4 through J5-14 to light STOP lamp DS3; and a path through CR13 and R5 charges C3,

and operates K4. Opening of K1 contacts 10 and 6 inserts R9 in the return path of the reel motor fields. The voltage developed across this resistor is applied through K5 contacts 1 and 9, K6 contacts 1 and 9, K7 contacts 1 and 9 through J6-A to the armature of the rewind motor. A similar path applies the same voltage to the take-up motor through K5 contacts 2 and 10, K6 contacts 2 and 10, K7 contacts 2 and 10, and J6-2. The polarity of the voltage and the armature terminals used in connecting the reel motors cause them to turn in opposite directions. The torque generated is small but sufficient to remove any slack in the tape threaded through the Iso-loop. With the tape now threaded and the STOP lamp illuminated, the transport is ready to be put into motion from its standby condition.

From Standstill To Play

28 volt power is present at PLAY switch S5 through J6-D, J2-9, and J2-10. Pressing the PLAY push-button applies power through J6-18 and CR4 to operate relay K3 momentarily. Through K7 contacts 11 and 3, K6 contacts 12 and 4, K8 contacts 11 and 3, K101 contacts 1 and 9, and K3 contacts 8 and 12, K5 is activated. The power activating K5 is also applied through P6-17 to PLAY indicator lamp DS5, and capstan idler solenoids L1 and L2, which press the tape against the capstan. AC power is applied to the capstan motor through K5 contacts 7 and 11, K1 contacts 1 and 9, P5-D, J11-2, switch S8, and through plug P8 to the capstan motor.

Prior to the operation of K5, relay K4 is operated, and capacitor C3 is charged through R5, CR13, and K5 contacts 4 and 12. Upon operation of K5, power is transferred from contact 4 to contact 8 of K5. The transfer of power to contact 8 provides the necessary holding power to maintain K5 operative when the initial path through K3, and K101 is broken. The breaking of contacts 12 and 4 when K5 operates removes power from the STOP lamp DS3 and relay K4; however, K4 does not release immediately due to the charge on C3, but K4 remains operative for approximately 0.5 second.

When K5 operates, full dc power is applied through K4 contacts 6 and 10, K5 contacts 6 and 10, K6 contacts 2 and 10, and K7 contacts 2 and 10 to the take-up motor armature. Reasonably high hold-back torque to the supply motor is obtained through K4

contacts 6 and 10, R8, K5 contacts 5 and 9, K6 contacts 1 and 9, and K7 contacts 1 and 9. After the tape is up to speed and K4 releases, the break at K4 contacts 6 and 10 inserts resistors R61, R62, and R63 in the armature paths to establish proper winding and hold-back torque, since the acceleration period is now replaced by constant-velocity operation.

From Play To Stop

Directly beneath the take-up reel hub on the take-up motor shaft is mounted a ball bearing. The outer race of this bearing is not rigidly mounted but is centered in a light-weight vane. The vane would rotate with the take-up motor shaft but is prevented from doing so by two posts. The vane rests against one post when the motor turns in one direction and shifts through an angle of about 15 degrees to rest against the other post when the motor turns in the other direction. The vane carries a small magnet, which causes operation of reed switch S14 when the motor runs in the forward direction. Switch S14 is released and S13 is caused to close when the motor turns in the reverse direction.

With the machine in the play mode, if the STOP pushbutton is pressed the following takes place: Bus voltage is applied from K3 contacts 10 and 2 through J6-11, J2-12, J2-11, and the closed contacts of S3, through J6-8, to operate relay K8. Bus power from J6-D is applied through S14, which is closed in the forward direction, through J5-18, K8 contacts 6 and 10 to operate K7. Relay K7 closes a holding path for relay K8 through K7 contacts 12 and 8, K8 contacts 8 and 12, to K8 terminal 14, so that K7 and K8 both remain operated after pressure is removed from S3. The REWIND lamp is lit through K7 contacts 11 and 7. The break at K8 contacts 3 and 11 opens the holding circuit for K5, extinguishing the PLAY lamp and dropping out the capstan idler solenoids so as to release the tape from the capstan.

Relay K5, however, does not release immediately when its holding circuit is broken due to the charge on C13 and C14. This delay is necessary in order to allow sufficient time for the capstan idlers to release their tension on the tape before the braking action is initiated to stop the capstan motor.

When K5 releases, ac power is removed from the capstan motor due to the breaking of K5 contacts 7

and 11. Concurrently with the removal of the ac power, dc power is applied to the capstan motor, which causes a dynamic braking action on the motor, bringing it to a rapid stop.

The dc braking power applied to the capstan motor when the STOP button is pressed with the transport operating in the play or record mode (K5 energized) is provided by the capstan start-stop assembly 56013A170. The operation of this circuit assembly follows.

As described earlier, the capstan is started when K5 operates to close contacts 7 and 11, which applies ac power to the capstan motor. AC power is also applied at this time to J12-4 on the capstan start-stop control assembly. P12-4 routes the ac line power to the junction of R102 and R103. R103 is in parallel with R102 through closed contacts 10 and 2 of K101. Diode CR102 is connected in such a manner to R102 and R103 that it will conduct during the negative swing of the ac power cycle, charging C102. The return path for C102 is through K101 contacts 3 and 11. When power is applied to J12-4, C102 charges very rapidly through the low resistance of R102 and R103 in parallel, causing relay K101, which is connected across C102, to operate immediately. When K101 operates, contacts 10 and 2 are broken, removing R103 from the charging path. This increases the resistance 10 fold, limiting the voltage rise across the coil of K101 to the nominal operating value for the relay.

When K101 operates, capacitor C101 is charged through R101, CR101, closed contacts 8 and 12 of K101, and J12-1 which is connected to one side of the ac power line. When K5 releases, contacts 11 and 7 are broken, removing ac power from the capstan motor and J12-4 on the capstan start-stop control board. K101 releases approximately 0.5 second after the removal of ac power from J12-4. This delay is due to the charge on C102 across the coil of K101. During this time, brake power is supplied through J12-1, contacts 8 and 12 of K101, CR101, R101, J12-2, contacts 3 and 11 of K5 to the capstan motor. This rectified dc power applied to the motor causes its rotating inertia to be overcome very rapidly, bringing the capstan to a stop. When K101 releases after the delay period, contacts 8 and 12 open, removing power from the braking circuit. Capacitor C103 provides arc suppression between K101 contacts 8 and 12. Capacitor

C101 continues to discharge through the capstan motor until its charge is dissipated.

Capacitor C102 is connected in the charging circuit in such a manner that, if relay K101 should be removed from its socket, one side of the capacitor is opened through contacts 11 and 3 or 11 and 7. If C102 remained in the circuit and the relay was removed with the transport operating in the play or record mode, the voltage developed across C102 would exceed the dc breakdown voltage of the capacitor. Because of this, relay contacts 3, 7, and 11 on K101 are used to remove C102 from the circuit to prevent damage to the capacitor in the event K101 is removed.

When the STOP button S3 is pressed, relays K8 and K7 operate; the operation of K7 provides full torque power through K7 contacts 5 and 9 and through J6-A to the rewind motor, while the break at K7 contacts 2 and 10 removes all take-up motor torque. The tape comes to a standstill and attempts to start in the reverse direction. Motion of the tape in the opposite direction, however, causes the vane in the sense switch assembly to leave its former position against the forward stop and swing toward the reverse stop. When the magnet moves away from S14, this switch opens, dropping out K7. This applies a light holding torque to the tape. When K7 releases, it releases K8 by opening K7 contacts 8 and 12. Relay K4 is held closed through K7 contacts 11 and 3, K6 contacts 12 and 4, K8 contacts 11 and 3, K5 contacts 12 and 4, CR13 and R5. It previously operated through K7 contacts 12 and 8, CR14 and R5. With the exception of K4, all relays are deenergized and STOP lamp DS3 is lit.

From Stop To Rewind

With the machine in standby, pressing REWIND pushbutton S2 causes bus voltage to be applied through K3 contacts 10 and 2, J6-11, J2-12, J2-11, S3, S2, J5-R, and K8 contacts 2 and 10, which operate K7. This relay applies rewind torque through K7 contacts 5 and 9, as outlined above; and K7 locks up to the power bus through K7 contacts 11 and 7, and K8 contacts 2 and 10. The tape accelerates in the rewind direction with full power on the armature of the rewind motor. Since this is a dc shunt motor, it would reach a certain terminal velocity at which time tape would be loosely wound except for the following feature. As the tape comes

up to speed in rewind, the armature of the take-up motor is open circuited because of the break at K7 contacts 2 and 10. It operates as a dc generator without load until a definite terminal voltage is reached, the voltage rising as the speed increases. Zener diodes CR52 and CR53 will not pass current until the total potential across the diodes reaches 60 volts. Therefore, when the generated voltage reaches this level, current flows through J9-4, J6-S, CR53, CR52, J6-2 and J9-3 to act as a load and effective brake on the take-up motor, limiting the maximum speed at which it will supply tape and thereby providing a controlled tension in the reel being filled. Closure of K7 contacts 12 and 8 provides a path through CR24, and J6-14 to open the head shield door and through J6-15 to operate the tape lifters.

When either K5, K6, or K7 release, removing power from the armature of the take-up or rewind motor, an arc would normally develop between the breaking relay contacts due to the large inductive load of these motors. Two circuits are incorporated to reduce or suppress this arcing in order to increase the life of these relay contacts. CR30, R10, C5, and C6 constitute one of these arc suppression circuits. CR30 and R10 provide a common charging path for C5 and C6 which are connected to K7, 9 and 10, respectively. The opposite junction of CR30 and R10 is connected to the positive bus of the bridge rectifier power supply. Consider the transport to be running in the rewind mode, power being supplied to the armature of the rewind motor through closed contacts 5 and 9 on K7. Capacitor C5 is discharged at this time due to the closed contacts 5 and 9 on K7. When the transport mode of operation is changed, K7 will release, breaking contacts 5 and 9. Instantly, capacitor C5 will charge very rapidly to the power supply potential through CR30, thus absorbing, to a large measure, the current that would normally cause arcing as contacts 5 and 9 are drawn apart. C6, in the same manner, shunts the current away from contacts 6 and 10 on K5, and K6 when these relays release. The discharge path for C5 and C6 is provided through R10 and the closed contacts of their associated relays when they are energized.

To provide still further protection against relay contact damage, a second circuit is also used to suppress arcing between the relay contacts mentioned above. Two high voltage power transistors

Q1, and Q2 are used to effectively shunt the relay contacts whenever these relays are released, removing power from either the rewind or take-up motor. The collectors of Q1 and Q2 are at the positive bus potential supplied from the junction of CR47 and CR49 through P5-11 and J9-1. The motor armature circuit supplying power to the rewind motor is connected to the emitter of Q1 through connector J7-3. This arrangement places Q1 in parallel with contacts 5 and 9 on K7. During the period in which K7 is energized providing power through contacts 5 and 9 to the rewind motor, capacitor C1 will charge to the power supply bus potential. The charging path for C1 is provided from the junction of CR46 and CR48, through P5-L, R60 or S7 if in the WIDE position, J9-4 to C1, through R1, CR1, J7-3, J6-A, closed contacts 5 and 9 on K7, jumper E11/E15 to the positive return of the bridge rectifier at the junction of CR47 and CR49. When K7 releases, contacts 5 and 7 are broken, which removes the short circuit between the collector and emitter of Q1, the charging path for C1, and power to the rewind motor. Instantaneously, the charge on C1 causes Q1 to conduct, shunting the current that would be drawn in the form of an arc between the opening contacts of the relay. The current through Q1 to the rewind motor after K7 releases will decay exponentially due to the discharging of C1 through R1, R2, J7-3, and the armature of M2.

The operation of Q2 is identical to the operation of Q1, providing arc suppression between contacts 6 and 10 on K5 and K6.

From Rewind To Stop (Tape Moving in Rewind Direction)

Pressing STOP switch S3 operates relay K8 through K3 contacts 10 and 2, J6-11, J2-12, J2-11, S3, and J6-8. Since tape is moving in the rewind direction, the sense switch vane has caused S13 to be closed. Therefore, K6 is caused to operate through J6-D, J9-6, S13, and K8 contacts 5 and 9. Relay K8 is locked up through K6 contacts 11 and 7, K8 contacts 8 and 12, and K6 is held up by S13. Relay K7, however, is released by the break at K8 contacts 10 and 2 and the fact that S14 is open. The power that was supplied to the rewind motor through K7 contacts 5 and 9 is removed by its release and transferred through operation of K6 through K6 contacts 6 and 10 to the take-up motor, which now operates to bring the tape to standstill and attempts to reverse it to the forward direction.

As soon as the sense switch vane moves away from S13 toward S14, S13 opens, releasing K6 and placing all circuits in the standby condition. During the stopping interval, the REWIND lamp goes out and the FORWARD lamp is lit from release of K7 and operation of K6. In standby, the tape lifter solenoid is released and K8 is released by the break at K6 contact 7 and 11. The head cover door remains operated through S-12, J6-M and CR-26, unless manually overridden to break S-12. Relay K4 remains energized throughout the above action, either through K7 contacts 12 and 8, CR14; or through K6 contacts 11 and 7, CR14; or through K7 contacts 11 and 3, K6 contacts 12 and 4, K8 contacts 11 and 3 and K5 contacts 12 and 4 and CR13.

From Rewind To Stop (Tape Moving in Forward Direction)

It is possible while shuttling the tape at high speed to have the tape moving in the forward direction but to have the controls in the rewind mode. If the STOP pushbutton is pressed at this time, K8 is energized in the manner described above; however, K7 is not released in favor of K6 because the sense switch vane is in position to cause S14 to be closed and S13 open. Thus, K7 remains energized and the tape comes to standstill and attempts to reverse, at which time the sense switch opens S14, releasing K7 and putting the machine in standby. At this time the tape lifters are released and K8 is released by the break at K7 contacts 8 and 12. The door solenoid remains energized through S12, unless overridden manually to break S12.

From Stop To Forward

With the machine in standby, pressing the FORWARD pushbutton causes bus voltage to be applied through K3 contacts 10 and 2, J6-11, J2-12, J2-11, S3, S2, S4, J5-S, CR17 and K8 contacts 1 and 9 to operate K6. Relay K6 applies full torque to the take-up motor through K6 contacts 6 and 10, K7 contacts 2 and 10, J6-2, and J9-3, causing tape to accelerate in the forward direction. Relay K6 locks up to the power bus through K8 contacts 9 and 1, K6 contacts 8 and 12, and K7 contacts 3 and 11. Motor speed is limited by the action of Zener diodes CR52 and CR53 as described before.

Closure of K6 contacts 11 and 7 provides a path through CR24 to open the head shield door and through J6-15 to operate the tape lifters.

From Forward To Stop (Tape Moving in Forward Direction)

Pressing STOP switch S3 operates relay K8 through K3 contacts 10 and 2, J6-11, J2-12, J2-11, S3 and J6-8. Since tape is moving in the forward direction, the sense switch has caused S14 to be closed and S13 to be open. Thus, K7 is operated through J6-D, S14, J5-18, and K8 contacts 6 and 10. Relay K8 is locked up through K7 contacts 12 and 8, and K8 contacts 8 and 12. Relay K6, however, is released by the break at K8 contacts 9 and 1. The power that was supplied to the take-up motor is cut off by the break occurring at K6 contacts 6 and 10 and applied through closure of K7 contacts 5 and 9 to the rewind motor, which now operates to bring the tape to standstill and attempting to reverse it to the rewind direction. As soon as the sense switch vane moves by reversal of tape motion, it releases S14, thereby releasing K7 and placing all circuits in standby. During the stopping interval, the FORWARD lamp goes out and the REWIND lamp lights because of the release of K6 and operation of K7. In standby, the tape lifter solenoid is released. K8 is released by K7 contact 8 and 12. The door solenoid remains energized through S12 unless manually overridden to break S12.

From Forward To Stop (Tape Moving in Rewind Direction)

It is possible, while shuttling tape at high speed, to have the tape moving in the rewind direction but to have the controls in the forward mode. If the STOP button is pressed at this time, K8 pulls in the manner described above. However, K6 is not released in favor of K7 because S13 is held closed by the sense switch vane while S14 is open. Thus, K6 remains operated and the tape comes to standstill and attempts to reverse, at which time the sense switch opens S13, releasing K4 and putting the mechanism in standby. At this time, the lifter solenoid is released, and K8 is released by the break at K6 contact 7 and 11. The door solenoid remains operated through S12 unless manually overridden to break S12.

From Forward To Rewind

Considering the tape to be in the forward mode regardless of its actual direction, relay K6 is energized. Pressing the REWIND pushbutton closes a circuit to operate K7 through K3 contacts 10 and 2, J6-11, S3, S2, J5-R, K8 contacts 2 and 10 to K7-14 through K7-13, CR19 and R6 to ground. Relay K7 operates, opening the holding path for K6 at K7 contacts 3 and 11, which releases, further breaking its holding circuit at K6 contacts 8 and 12. Torque power to the reel motors is, therefore, reversed. Relay K7 locks up through K8 contacts 10 and 2, and K7 contacts 7 and 11.

From Rewind To Forward

Considering the tape to be in the rewind mode regardless of its actual direction, relay K7 is energized. Pressing the FORWARD pushbutton closes a circuit to operate K6 through K3 contacts 10 and 2, J6-11, J2-12, J2-11, S3, S2, S4, J5-S, CR17, and K8 contacts 1 and 9 to K6-14. Because J5-S applies bus potential to CR20 as well as to CR17, the coil of K7 is effectively shorted, since the total voltage appears across R6. This releases K7, K6 remains operated over the path K7 contacts 11 and 3, K6 contacts 12 and 8, and K8 contacts 1 and 9. Torque to the reel motors is, therefore, reversed.

From Rewind To Play

In the rewind mode, regardless of actual direction of tape motion, relays K7 and K4 are energized. Pressing PLAY pushbutton S5 causes bus power to flow through S5, J6-18, and CR4 to operate K3. A holding path is established through K7 contacts 12 and 8, K3 contacts 11 and 7, R1, CR8 and CR7 so that K3 will not release when S5 is released. Relay K3 contacts 10 and 2 open the paths to S3, S2 and S4 pushbuttons to render them inactive at this time. The potential from K7 contacts 12 and 8 through K3 contacts 11 and 7, and through R1 also feeds through CR9 to terminal 14 of K8, causing it to operate. Whether K7 continues to hold or to transfer to K6 is determined by the direction the tape is moving, as outlined above. In any event, operation of K8 functions to bring the tape to standby condition. When K6 or K7 is released by the sense switch as the tape reaches standstill and attempts to reverse, the break at K6 contacts 7 and 11 or K7 contacts 8 and 12 releases K8. Normally,

the machine would now remain in standby, but at this time K3 is still operated even though its supply path through K3 contacts 7 and 11 is open. This is because it is held by the charge in C1 for sufficient time to perform an additional function. When K8 releases, bus power is supplied through K7 contacts 11 and 3, K6 contacts 12 and 4, K8 contacts 11 and 3, K101 contacts 1 and 9 and K3 contacts 8 and 12 to operate K5. The functions from here on are as described in the paragraph, "From Standstill to Play."

From Forward To Play

In the fast-forward mode, regardless of actual direction of tape motion, relays K6 and K4 are energized. Pressing PLAY pushbutton S5 causes bus power to flow through J6-D, J2-9, J2-10, S5, J6-18, and CR4 to operate K3. A holding path is established for K3 through K6 contacts 11 and 7, K3 contacts 11 and 7, R1, CR8, and CR7 so that K3 will not release when S5 is released. Relay K3 opens the paths to S3, S2, and S4 pushbuttons to render them inactive at this time. The potential from K7 contacts 12 and 8 through K3 contacts 11 and 7 and R1 also feeds through CR9 to terminal 14 of K8, causing it to operate. Whether K6 continues to hold or to transfer to K7 is determined by the direction of tape movement. In any event, operation of K8 functions to bring the machine to a standby condition. When K6 or K7 is released by the sense switch as the tape reaches standstill and attempts to reverse direction, the break at K6 contacts 7 and 11, or K7 contacts 8 and 12, releases K8. Normally, the machine would now remain in standby; but at this time K3 is still energized, even though its supply path through K3 contacts 7 and 11 is open. This is because it is held by the charge in C1 for sufficient time to perform an additional function. When K8 releases, bus power is supplied through K7 contacts 11 and 3, K6 contacts 12 and 4, K8 contacts 11 and 3, and K3 contacts 8 and 12 to energize K5. The functions from here on are as described in paragraph, "From Standstill to Play."

Tape Runout

When the tape runs out from any mode of operation, the light from lamp DS8 falls upon photo diode V60, causing K1 to energize. This action opens the bus supply to all other relays. All power is, therefore, removed from the armatures of the

take-up and rewind motors. A short circuit is applied to the armature of each motor. One such circuit is through J9-4, J6-S, K1 contacts 10 and 6, J6-4, J2-1, J2-2, J5-P, K5 contacts 2 and 10, K6 contacts 2 and 10, K7 contacts 2 and 10, J6-2 and J9-3. The other circuit is through J7-4, J6-S, K1 contacts 10 and 6, J6-4, J2-1, J2-3, J5-V, K5 contacts 1 and 9, K6 contacts 1 and 9, K7 contacts 1 and 9, J6-A, and J7-3. As the fields are fully excited, this system acts to brake the motors to a standstill, since they operate as dc generators operating into a short circuit.

Record Mode Operation

To select the record mode the RECORD and PLAY buttons must be pressed simultaneously. This action reduces the possibility of accidental activation of the record mode while satisfying the switch logic requirements to activate the record circuits. Simultaneously pressing the RECORD and PLAY buttons will apply bus power to J6-18 through S5, and to J5-13 through S5 and S1. If the recorder was previously in the standby mode (STOP light illuminated), K3 will operate, placing the recorder in the play mode as described earlier. Positive bus power is applied to the collector of Q4 via J5-13, S1, and S5. The base of Q4 is connected through R24 to the holding circuit of K5, which is at the positive bus potential. With the collector and base connected to the positive bus in this manner, Q4 will conduct through the coil of K2, causing the relay to operate. A holding circuit is established through contacts 8 and 12 of K2 through CR55 to the collector of Q4 allowing Q4 to continue to conduct and holding K2 in when the RECORD button is released. The path established to hold K2 then lights DS1 through J6-3 and supplies positive bus voltage to the electronics power cable through connector J4-9, which is routed to the MASTER RECORD relay in the signal electronics assembly. Relay contacts 11 and 7 provide the ground return for the MASTER RECORD relay through J6-T. The positive bus potential at the collector of Q4 is also applied through R16 and CR29 to the bias oscillator. Capacitor C7 provides decoupling from the bus power supply and also causes the voltage applied to the oscillator to decay exponentially when power is removed. Transistors Q2 and Q3 operate as a low power push-pull oscillator to provide a high frequency signal to J6-U and J6-V. The bias signal is routed to the bias/erase amplifier boards in the

signal electronics assembly through connector pins J4-1 and J4-2 and its associated cable.

Speed Change Switch

Speed change switch S8 selects windings of the capstan motor to provide either of two speeds. These are related by the ratio 2:1 and, therefore, can be provided for tape speeds of 7½ and 15 ips, or 15 and 30 ips, etc. Dc bus potential is supplied to either J4-6 or J4-7 in the electronics power cable, depending on the motor speed, in order to control the equalizer-select relays on the circuit boards in the signal electronics assembly.

Monitor Switching

Two pushbuttons on the transport, S10 and S11, are arranged to transfer the output line amplifier and VU meter of each channel from the incoming signal source to the playback signal and vice versa. Pressing A switch S10 applies positive bus voltage from J6-D through J2-9, J2-10, and S10 to J4-5, which is in the electronics power connector, causing operation of the A/B transfer relays in each channel. Similarly, B switch S11 applies a ground to terminal J4-4 to cause reverse operation of the transfer relays. These switches are momentary contact types and are not backlighted.

Tape Width Switch

It is necessary to provide two torque ranges for the reel drive motors due to the difference in weight and tape handling characteristics between 1 and 2 inch tape. Compensation in the torque requirements between tape sizes is provided by S7 and R60. The amount of torque developed by the reel drive motors M2 and M3 is dependent, to a large extent, on the amount of current that can be drawn from the bridge rectifier power supply CR46 through CR49. To provide the proper torque to the drive motors when 1 inch tape is used, the current path from the power supply is from the junction of CR46 and CR48 through P5-L and R60 to J9-4 and J7-4, which completes the path to the armature of M2 and M3 from the negative side of the power supply. A path from the junction of CR46 and CR48 through R60 is also provided to the fields of M2 and M3. With a common current path to both motors established through R60, its resistance value will control the amount of torque developed by the

motors. The resistance value of R60 is such that the amount of torque delivered to the drive motors when 1 inch tape is used is sufficient to properly perform the take-up and rewind handling of the tape. When 2 inch tape is to be used on the transport, R60 is shorted through S7, removing it from the current path and allowing the drive motors to draw an additional amount of current from the power supply. This provides the necessary increase in torque required to drive the larger 2 inch tape reels and provide a greater tape wrap tension for proper transfer from one reel to the other.

SIGNAL ELECTRONICS FUNCTIONS

Processing of the output signal to be recorded and the signal extracted from the recorded tape (playback) is accomplished in the signal electronics assembly. Four plug-in circuit boards provide the necessary signal processing for each record/playback channel. In addition to the circuit boards, the signal electronics assembly contains the necessary signal switching circuits which control the various modes of operation of each channel.

The plug-in circuit boards associated with each channel are described in detail after the following description of their use in the overall operation of the recorder.

Record Mode (See figure 22.)

The signal to be recorded is applied through connector J-A to the primary of transformer T-A, which reflects an impedance of 20,000 ohms to the signal source. The secondary of T-A is connected across the RECORD LEVEL control R-A, which establishes the signal level applied to the record amplifier. This amplifier provides preemphasis, equalization, and linearization to the signal, and sufficient gain to drive the record head. A relay on the board selects the proper equalization for two tape speeds. This relay is controlled by the tape SPEED switch on the transport. Linearization is selectable by means of a switch on the circuit board and is adjustable. The degree of linearization required depends on the signal level, and corrects for distortion that occurs as the signal level approaches the saturation level of the tape.

In addition to the record amplifier, a monitor amplifier on the board provides sufficient signal

amplification of the input signal to drive the line amplifier. The line amplifier output is applied to the VU meter and output connector J-F for monitoring of the input signal. A RECORD MON. CAL. control on the record amplifier board enables the monitor amplifier gain to be adjusted so that, without the linearizer circuit in service, 3% total harmonic distortion on playback produces a reading of 6 dB above zero VU on the VU monitor meter.

The record signal from the record amplifier board is connected to contact 12 on the record relay K-B. This circuit is normally grounded until relay K-B is operated through the mode select switches on the remote control box and the RECORD function switch on the transport panel. When K-B operates, the signal is applied through contacts 12 and 8 to the bias/erase amplifier board at terminal 22 on connector J-B. Operation of the record relay K-B also applies 28 volts dc power to the bias/erase amplifier at terminal 12 on connector J-B. A 120 kHz bias oscillator is energized in the transport when the record mode is selected. This bias signal is applied to the bias/erase amplifiers in each channel at terminals 14 and 15 on board connector J-B. This signal is amplified by the bias amplifier to the proper magnitude to drive the record head. The audio signal at terminal 22 is coupled to the bias output through a bias trap circuit which has no effect on the audio signal but offers a high impedance to the 120 kHz bias signal, thus preventing the bias from being fed back into the record amplifier. A bias amplitude control provides adjustment of the bias output level to the record head, and a noise balance control allows an adjustable amount of dc signal component to be applied to the record head to correct for any external fixed magnetic fields in the vicinity of the record head gap.

Bias current through the record head can be monitored at the TP BIAS test point, which is connected to the record head return with a 27 ohm resistor to ground.

The record signal and bias is applied to the record head through contacts 3 and 9 on the normal-sync relay K-C which is deenergized, as shown, when the selected channel is operated in the record mode.

A second power amplifier, also driven by the 120 kHz signal, applies its output through terminal 21 on the bias/erase amplifier board to variable

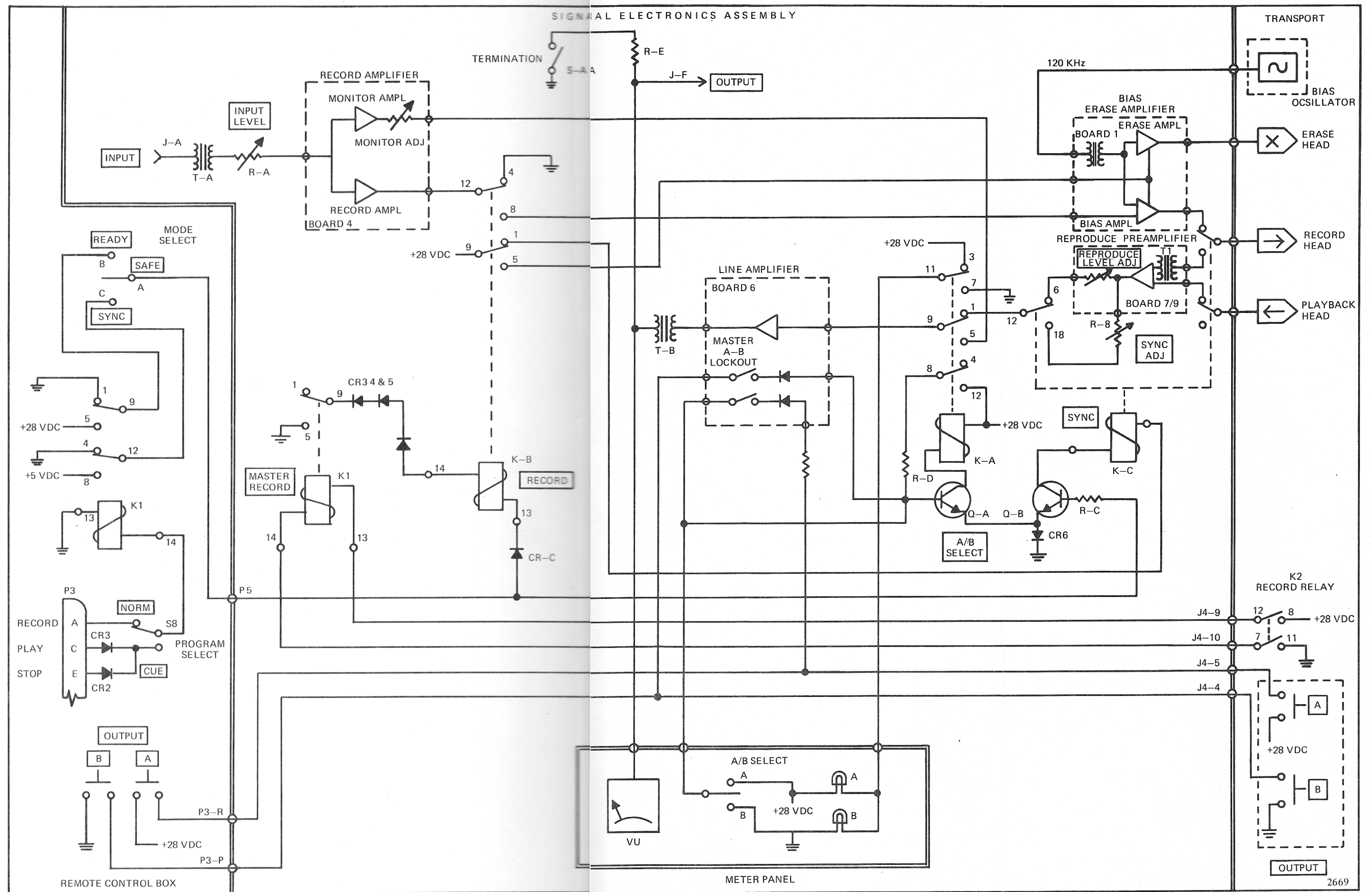


Figure 22. Signal Electronics, Simplified Block Diagram

capacitor C-A, which couples the signal to the erase head. Capacitor C-A adjusts the amount of erase current supplied to the erase head. The erase head current can be monitored at TP-A, which is connected through terminal 16 to a 10 ohm resistor in the return path from the erase head. Inductor L-A and capacitor C-B provides the proper reactance to tune the secondary of the erase amplifier output transformer and erase head to the 120 kHz signal.

Playback Function (See figure 22.)

Signals recorded by the circuits described in preceding paragraphs will be reproduced by the corresponding playback head and may be monitored on the VU meter or at the OUTPUT jack when the B OUTPUT select button is pressed. The playback output signal will be delayed from the corresponding record signal by an amount equal to the linear distance between the record head and the playback head times the tape speed. This delay is slight, however, and represents no difficulty when monitoring the input/playback quality of the recording.

The signal induced in the playback head is connected to terminal 4 on the reproduce amplifier board connector J-C through contacts 1 and 7 on the normal-sync relay K-C. The preamplifier board provides the required signal gain to drive the line amplifier, high and low frequency equalization, and phase correction for two tape speeds.

In the normal playback mode, the reproduce preamplifier output is taken from terminal 22 on board connector J-C. The signal level at this output terminal is controlled by R17, the REPRODUCE LEVEL potentiometer on the preamplifier board. This control is normally adjusted to produce an output of zero VU with a standard reference level tape providing a 700 Hz signal tone at the reproduce head.

The reproduce signal at the junction of R-F and R-H is routed through contacts 6 and 12 on the normal-sync relay K-C to the A/B select relay contact 1. When the B output is selected, the reproduce signal will be applied to the line amplifier input through contacts 1 and 9 on the A/B select relay, as shown. The reproduce signal output from the line amplifier will then be displayed on the VU meter and routed to the output connector J-F.

Sync Playback Function (See figure 22.)

When the sync mode of operation is selected the normal-sync relay K-C operates, disconnecting the playback head from the reproduce preamplifier input, and connects the record head through T1 to the reproduce preamplifier. Due to the operation of the normal-sync relay, the normal playback head has been completely disconnected and the record head connected to the primary of T1, which couples the sync input to the reproduce amplifier. The use of transformer T1 provides an improved impedance match between the record head (used as a playback head) and the reproduce amplifier input. When the record head is used as a playback head, it matches closely the frequency response and gain of the normal playback head. Due to its wider gap, however, the extreme high frequencies suffer some attenuation, depending upon the tape speed.

Mode Select Circuits (See figures 22 and 25.)

The operational mode of each channel in the signal electronics assembly is selected at the remote control box. Each channel is provided with a mode select switch, allowing three (3) modes of operation to be chosen, i.e., READY, SAFE, and SYNC. The RECORD and SYNC relays associated with each channel in the signal electronics assembly provide the required mode switching within the electronic circuits of the selected channel. These relays respond to the mode selected at the remote control box when the transport tape motion controls are activated. In conjunction with the mode select switches, an additional switch is provided on the remote control box panel, which is referred to as the program select switch. This switch, depending on its position, i.e., NORM or CUE, determines the transport mode of operation that will activate the electronic circuits of the channel or channels preprogrammed by the mode select switches. This feature is especially useful when overdub recordings are made, as will become apparent during the following discussion of the mode selection circuits.

Activation of the mode select circuits are initiated by +28 volts dc commands originating from the tape transport control circuits. These commands are routed to the remote control box via connector P3, pins A, C, and E. Operation of relay K1 depends on the position of the program select switch S8 and the transport mode of operation selected. When S8 is in

the NORM position, operation of K1 will only occur when the transport record mode is selected. Under these conditions, +28 volts dc is provided to terminal 14 on relay K1 through the closed contacts on S8, which is connected to P3-A. The +28 volts dc provided at P3-A when the record mode is activated is also applied to DS1, which illuminates the RECORD selector switch S1 on the remote control box. With S8 in the CUE position, operation of K1 will occur when the transport is operated in the record, play, or stop mode. +28 volts dc from the transport is provided to P3-C when either the record or play mode is selected. From P3-C, this potential is applied through CR3 and the contacts of S8 to terminal 14 on relay K1, causing it to operate. DS5 is also connected to P3-C, causing the PLAY selector switch S5 to illuminate when the play or record mode is active. When the transport is in the standby mode (STOP selector switch S3 illuminated), +28 volts dc is provided to P-3E, which also causes K1 to operate through CR2, S8 to terminal 14. CR2 and CR3 are connected back-to-back, thus preventing illumination of the PLAY indicator lamp when the transport is in the STOP mode and the STOP indicator lamp from illuminating when the transport is operated in the PLAY or RECORD mode.

Operation of relay K1 provides two discrete voltages to each mode select switch. +28 volts dc is supplied to the upper contact on each mode select switch from P5-U through closed contacts 5 and 9 on K1. The +28 volt potential on K1-9 is also applied through R1 to zener diode VR1 and produces a regulated voltage of approximately +5 volts dc at K1-8, which is tied to the junction of R1 and VR1. C1 provides a delayed build up of the +5 volts dc across VR1 when K1 operates. The +5 volts dc is applied to the lower contact on each mode select switch through closed contacts 8 and 12 on K1. The middle contact of each mode select switch can be positioned so as to provide either +28 volts dc (READY mode) or +5 volts dc (SYNC mode) and, when left in the center position (SAFE mode), an open circuit (zero volts) to the record and sync relay circuits of the respective channel in the signal electronics assembly.

The record and sync relay circuits are identical in each signal channel, each being programmed by the mode select switches at the remote control box. The control voltage at on the middle contact of each mode select switch is routed through P5 to its

respective signal channel. This control voltage is applied to terminal 13 of the RECORD relay (K-B), through diode (CR-C), and to the base of the SYNC relay drive transistor (Q-B) through resistor (R-C). As mentioned earlier, activation of the mode select circuits are initiated by the transport logic control circuits which operate K1 in the remote control box. Two distinct sequences of operation are provided by the program select switch. Let us first consider S8 in the NORM position. K1 in the remote control box will operate, applying +5 volts dc and +28 volts dc to contacts B and C, respectively, on each mode select switch only when the transport is activated in the RECORD mode. Assume that the READY and SYNC mode has been selected for several channels. On those channels selected for the READY mode, +28 volts dc will be applied from the upper contact of the mode select switch through the remote control cable and connector P5 to the junction of CR-C and R-C in the signal electronics assembly. Simultaneously with the application of the +28 volts dc control voltage, the MASTER RECORD relay (K1) will operate due to the closing of record relay (K2) on the transport logic board. This relay places +28 volts dc on terminal 13 and ground to terminal 14 on the MASTER RECORD relay, causing it to operate. Operation of the MASTER RECORD relay provides a ground return for the coil on each RECORD relay (K-B). This path is from terminal 14 on each relay (K-B) through CR3, CR4, CR5, and closed contacts 9 and 5 on MASTER RECORD relay (K1). Those channels that have been programmed to operate in the record mode (mode select switch in the READY position) will cause the RECORD relay in the channel selected to operate due to the presence of +28 volts dc, which is applied through CR-C to terminal 13 of the RECORD relay. The +28 volts dc control voltage is also applied to the base of the SYNC relay drive transistor through R-C. This would normally cause the transistor to conduct, causing the SYNC relay to operate, if it were not that to the breaking of contacts 9 and 1 on the RECORD relay removing +28 volts dc from the SYNC relay coil which has its return connected to the collector of the SYNC relay drive transistor. The slow rise of voltage across VR1 in the control box prevents any momentary operation of the SYNC relays prior to operation of the individual RECORD relays. Thus the +28 volts dc command from the mode select switches at the remote control box has caused the RECORD relays of the selected channel(s) to operate when the transport is activated in the record mode.

Those channels selected to function in the sync mode are supplied with +5 volts dc from the mode select switches. This potential, applied through CR-C to the RECORD relay (K-B), is not sufficient to cause the relay to operate. However, it is of sufficient level to forward bias the SYNC drive transistor on, causing the SYNC relay to operate. The +28 volts dc in this case is maintained through contacts 9 and 1 of the RECORD relay (K-B) to the coil of the SYNC relay and, in return, to the collector of the SYNC drive transistor.

Channels in which the mode select switches are placed in the SAFE position will present an open circuit or no command voltage to the RECORD and SYNC relays in the signal electronics assembly. Under this condition, the RECORD relay(s) K-B are unable to operate, preventing accidental erasure of any prerecorded material. The SYNC relay is also prevented from operating due to the absence of bias voltage on the base of the SYNC drive transistors, thus allowing any recorded material on these tracks to be reproduced under normal playback conditions.

After a selection has been recorded with the program select switch in the NORM position, as in the preceding description, the same tape can be replayed in the normal reproduce mode without resetting of any switches on the remote control box. If a second recording attempt is necessary, starting the transport in the record mode will again activate the previously selected sync and record channels.

When it is necessary to listen to a prerecorded track for cuing purposes before the record mode is activated, the CUE position of the program select switch is used. This will allow relay K1 in the remote control box to operate when the transport is placed in the PLAY mode, as described earlier. The control voltages supplied to the mode select switches through the closed contacts of K1 will then cause those channels selected to operate in the SYNC mode.

Two 28 volt indicator lamps associated with each mode select switch indicate the mode selected for each channel. A red lamp indicates the READY mode selection, a green lamp indicates the SYNC mode selection, and the absence of illumination of either lamp indicates a SAFE mode selection.

DETAILED CIRCUIT DESCRIPTIONS OF ELECTRONICS

The following paragraphs contain detailed descriptions of each of the circuit boards used in the signal electronics assembly.

Nab Record Amplifier (Board 4) (See figure 28.)

The input signal to be recorded is applied at terminal 14, after it has passed through the input transformer and level control. C1 couples it to Q1, which is biased to the proper operating point by R1 and R2. After amplification, the signal is coupled by C3 to an equalizer network which provides pre-emphasis, boosting the high and low frequencies in accordance with standard NAB practice. This is accomplished as follows.

Consider R6 and R7 as an attenuator network, with R8 short circuited, as it effectively is at high frequencies because of C4 and C5. This attenuator network reduces the voltage swing at the junction of R6 and R7 from what it was at collector of Q1. However, if a bypass capacitor C18 or C19 is connected across R6 it permits the high frequencies to suffer less attenuation. The result is an adjustable rise in response for high frequencies. The degree to which this is true depends on the setting of the variable capacitor. Practical values of C18 and C19 make it necessary for the junction of R6 and R7 to appear always as a very high impedance. Current cannot be drawn from this point without upsetting the equalization characteristic. Thus, the junction is used to drive a field effect transistor, Q2. At the low frequency end of the spectrum C4 and C5 show increasing impedance as the signal frequency is lowered; therefore, the voltage at the junction of R6 and R7 would continue to rise as the frequency drops except that R8 provides a shelving off to prevent unnecessary sensitivity to subaudible frequencies.

Relay K1 automatically changes the high frequency equalization when tape speed is changed. The output of Q2 is applied to terminals into which may be inserted values of C8, C20, R11, and R12 to adjust for any requirement arising for shelving equalization, in addition to the normal NAB equalizers just described. All four components may be

eliminated in many instances, a jumper being furnished across the R11 or C20 terminals.

After this network, the signal is fed to the base of Q3 whose bias is set by R13, R14, and R15. This operates with Q4 in a Darlington circuit to provide gain and low impedance output at C11 to drive the record head. R18 normally provides a degree of degeneration, determined by the setting of R20 and R19 in series with C12 and C21. But the degree of degeneration can also be reduced by conduction of Q5 and Q6 when S1 is closed. Q5 and Q6 act to change the degeneration with instantaneous signal amplitude; thus, they tend to deform the signal whenever its amplitude attains a value sufficient to overcome their contact potential. This results in a distortion inverse to that which overload of the tape normally introduces. By employing Q5 and Q6 in this manner and properly adjusting the overall degeneration by means of R20, the LIN ADJ. control, it is possible to introduce the proper corrective distortion into the recording process so that the normal 3% tape distortion point, without such correction, shows somewhat less than 1% when this linearizer is employed.

C11 feeds the record head connected at terminal 22. R22 is a resistor in series with the head to establish a constant current characteristic. R23 provides a high resistance path to ground so that the ground side of C11 will always be discharged, even when no head is connected to terminal 22. This is a means of preventing accidental record head magnetization.

C14 couples the input signal to Q7. The gain of Q7 is adjusted by the combination of emitter resistors R27 and R28, which is bypassed by C16, to provide the proper range of signal levels to R30. This control, RECORD MON CAL., can be conveniently adjusted to serve the input signal audio monitoring and input signal VU meter monitoring circuits. R29 and C17 are provided to give a slight rise in output at 15 kc to make up for losses in the input transformer, wiring, and meter sensitivity occurring at the extreme end of the spectrum.

Bias And Erase Amplifier (Board 1) (See figure 29.)

Whenever the transport is put into the recording mode, a 120 kHz signal is generated within the transport and applied to all bias and erase amplifier boards at terminals 14 and 15. T1 operates as a

bridging transformer. It has two secondaries. One of these feeds the base of Q2 through resistor R4. This resistor is employed to permit insertion of a feedback signal from R26. Q2 amplifies the 120 kHz signal and provides sufficient power to drive the push-pull amplifier Q5 and Q6. C13 and C14 tune the secondary of T4, and C16 and C17 tune the primary of T5 in order to minimize harmonic distortion. Even order harmonics are particularly objectionable, since they result in increased background noise recorded into the tape.

The output of Q5 and Q6 is fed through T5 and C18 to R19 and R24, the latter variable to control the amount of 120 kHz bias signal fed through terminal 1 to the record head. The audio signal comes from the record amplifier and is applied at terminal 22. It passes without loss through the tuned circuit L2, C19, and C21 which is tuned to present a high impedance to 120 kHz, thus preventing feedback of bias power to the record amplifier.

CR2 and CR3 each operate as half-wave rectifiers. If the arm of R23 is run to the end connected to CR2, then the upper end of R21 will have an average negative potential. Conversely, if the arm is run to the other end, then the upper end of R21 will have an average positive potential. R20 allows current set up by such potential to flow through R19 and R24 to the record head, thereby making it possible to inject a very small but adjustable dc current into the head, in addition to the audio and bias frequencies, to allow minimization of noise resulting from strong external magnetic fields or even order harmonic distortion from the bias supply.

These circuits are activated by application of potential at terminal 12. In order to prevent a recorded thump when the record button is depressed, R27 and C20 are provided to permit the dc bias on the base of Q1 to rise slowly, and C15 is provided across R17 for the same purpose on Q5 and Q6. The bias envelope, therefore, grows to operating level in a matter of about 10 milliseconds. When the recording mode is deactivated, another thump or click is avoided by allowing reservoir capacitor C2 to permit the bias waveform to decay to zero over a period of about 60 milliseconds. R1 allows C2 to charge at a reasonable rate when the circuits are activated without causing a surge on the power supply, but CR1 permits the capacitor to be connected directly to the load during discharge. L1 and C1 constitute a

filter to stop bias frequency ripple on the power bus connected to terminal 12.

The amount of drive applied to Q5 and Q6 is controlled by feedback resistor R26, which also improves the waveform at the output by cancelling out internally generated distortion products.

The second winding of T1 feeds the 120 kHz signal to an almost identical circuit, except that the output transistors Q3 and Q4 have a higher power rating in order to supply the erase head with sufficient drive to completely erase a saturated tape. The feedback signal input at terminal 19 is not connected in the Series 500 recorders, allowing a greater amount of drive current to be delivered to the erase head. Erase current is proportional to the voltage developed across R29 and is monitored by a test jack connected to terminal 16. Erase current test jacks for each channel are located on the signal electronics assembly front panel. The center tap secondary of T3, which is connected to terminal 20, is not used in the series 500 recorders. The record bias current can be monitored at TP1 because of the voltage developed across R22. R22 is in series with the ground return lead from the record head. R25, connected between terminals 2 and 3, is also inactive in this system.

Line Amplifier (Board 6) (See figure 30.)

This is a full-spectrum flat response amplifier which provides sufficient gain and output power to adequately drive an outgoing line at up to a peak level of +28 dBm (600 ohms).

Q1 is an emitter follower, accepting an input impedance of 10,000 ohms or lower and providing low impedance excitation for Q2. Q2 drives Q3 and Q4 (complementary symmetry types) to result in push-pull excitation of Q5 and Q6. A required static potential difference between the bases of Q3 and Q4 is established by the contact potential drop across CR1, CR2, and CR3.

CR4, R20, and C12; CR5, R19, and C11 are drift compensation networks that stabilize the operating points of Q5 and Q6. The dc operating point for these two transistors is set by R13, R14, and R15; and Q2, Q3, and Q4. A feedback path through C13, R21, and R22 assures minimum distortion for all signal frequencies. The output signal is coupled

through C14, S1, and R24 to terminal 21. The signal at terminal 21 is routed to the primary of a 600 ohm line matching transformer. The output from the transformer is connected to the output jack for the respective channel and to the appropriate VU meter on the meter panel.

S2, CR6, and CR7 are used in the A-B monitor select circuits. When S2 is opened, the respective channel will not respond to the A-B transfer command when either the A or B pushbuttons on the transport or remote control box is pressed. The output transfer can only be accomplished with S2 open by pressing the respective A-B select switch on the meter panel. With S2 closed, A-B transfer will take place in the respective channel and all other channels in which S2 is closed whenever the A-B buttons on the transport are operated. CR6 and CR7 are isolating diodes, permitting all channels to operate from the A-B OUTPUT switches on the transport or remote control box but preventing the transfer switches on the meter panel from activating any channel(s) other than its own.

R1, R2, R3, R4, and R25 are not used in the Series 500 recorders.

Nab Preamp (Board 7/9) (See figure 27.)

This plug-in circuit board provides the required signal amplification of the playback head signal or the record head signal, when the later is used in the SYNC mode (overdub). In addition, the circuit board performs the necessary frequency equalization and phase correction for two tape speeds.

Two input circuits are provided on this board. When the selected channel is operated in the normal playback mode, the input signal is supplied from the playback head to terminal 4. When the selected channel is operated in the sync mode, terminal 4 is connected to terminal 16, the output of transformer T1. The primary of T1 is then connected to the record head through terminals 14 and 17. The input circuit is selected through the contacts of the normal-sync relay, external to circuit board. T1 provides additional signal gain and impedance matching to the preamplifier when the record head is used as a playback head. This is required due to the reduced voltage output of the record head when it is used as a playback head.

From terminal 4, the signal is applied to the base of Q1 through C1 and R2. The collector of Q1 is direct coupled to the base of Q2, providing a signal path and dc bias to the second amplifier stage. The output of Q2 is direct coupled to the base of Q3. A feedback path is also provided from the collector of Q2, through one of two RC frequency equalization networks, to the emitter of Q1. Relay K1 in the normal or deenergized condition (as shown for the primary speed tape operation) places C7, R18, R19, and R20 in the feedback path. When K1 is energized, C8, R21, R22, and R23 are placed in the feedback path, providing the proper frequency equalization for the secondary speed tape operation. C7 (or C8) with R20 (R23) controls the point where the customary 6 dB per octave correction becomes no longer effective at higher frequencies. R19 (or R22) controls the point at very low frequencies where the relation again no longer holds true, and the amplifier shelves off. The proper dc operating point for Q1 and Q2 is maintained by the bias established at the junction of R8 and R9 in the emitter circuit of Q2. This dc bias is applied through R5 to the base of Q1, thus providing a controlled amount of negative feedback to Q1 in relation to the input signal level. C4 filters out any ac component present at the junction of R8 and R9.

Q3 operates as a phase distortion correction stage. Considerable rotation of phase normally occurs in the overall process of recording and playing back tape, the situation being increasingly pronounced at shorter wavelengths. In copying tapes, the effect is compounded. Q3 and its associated circuits provide an effective correction for such distortion.

A paraphase signal output condition exists between the emitter and collector of Q3; that is, equal amplitude with 180 degree phase difference. C5, which couples the collector signal to the base of Q4, presents a high impedance to the low frequencies contained in the recorded signal. R13 (or R13 in series with R14, depending upon the state of K2) feeds the emitter signal directly to the base of Q4.

As a result of this action, the low frequency phase components present at the emitter of Q3 predominate at the base of Q4 and are 180 degrees out of phase with the same signal at the collector of Q3. Conversely, capacitor C5 presents a very low impedance to the higher signal frequencies, allowing them to pass readily to the base of Q4.

At intermediate frequencies, the vector sum of R13 (R13 and R14) causes the signal to be applied to the base of Q4 at some intermediate phase angle between zero and 180 degrees, while the amplitude remains constant throughout the entire frequency range.

The result of this frequency/phase shift action cancels the inherent phase distortion of the signal caused by the magnetic transfer characteristics when the signal was recorded on the tape.

In fast tape speed operation, K1 is deenergized as shown. During slow tape speed operation, K1 is energized which removes R14 from the circuit.

Emitter follower Q4 provides the required signal isolation and impedance output requirements. From the emitter of Q4, the signal is coupled through C6 to the reproduce level control R17. The output signal from the arm of R17 is connected to terminal 22; this signal is applied to the line driver amplifier through the contacts of the normal-sync relay and the A-B select relay when the selected channel is operated in the normal playback mode. The signal is also routed through R16 to terminal 21; this output is utilized to drive the line amplifier when the selected channel is operated in the SYNC mode.

Q5 is a series voltage regulator which provides regulated power from the input bus terminal 12 to the four transistor stages in this assembly. R24 and R25 establishes the proper operating point for Q5, thus establishing a fixed voltage drop across Q5. C10 provides filtering of any power supply ripple on the regulated voltage. C9 filters any ripple at the base of Q5.

SCHEMATICS

This section contains schematics of the 3M Brand Series 500 Professional Audio Tape Recorder. The schematics included are listed in table 8 below.

Table 8. Schematics

Figure No.	Title	Drawing No.
23	Tape Transport Assembly	E56013B100
24	Signal Electronics Module Assembly	E56059B100
25	Remote Control Assembly	E56017A100
26	Meter Panel Assembly	E56038A100
27	Overdub Preamplifier Board	E23059B090
28	NAB Record Amplifier Board	E23059B040
29	Bias and Erase Amplifier Board	E23059B020
30	Line Driver Amplifier Board	E23059A060
31	Head Wiring Diagram (16 Track)	E56119A000
32	Head Wiring Diagram (8 Track)	E56119A100
33	Harness Assembly, Tape Transport	E56013A150

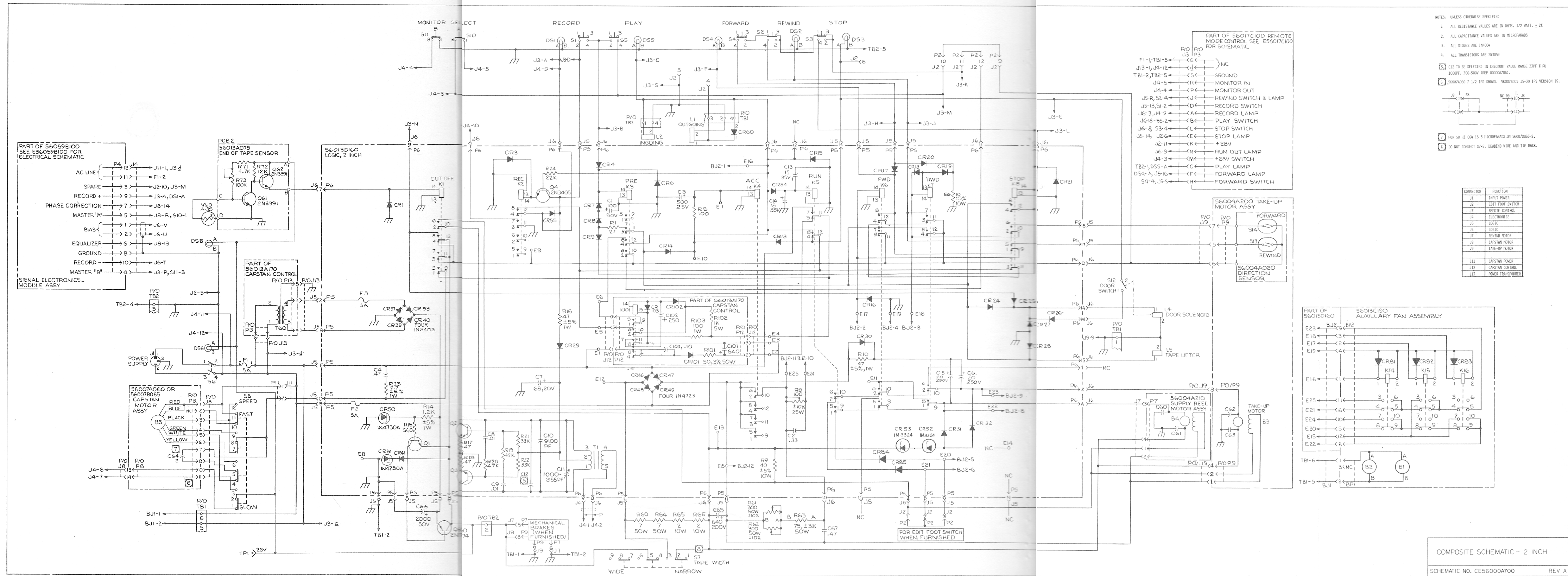
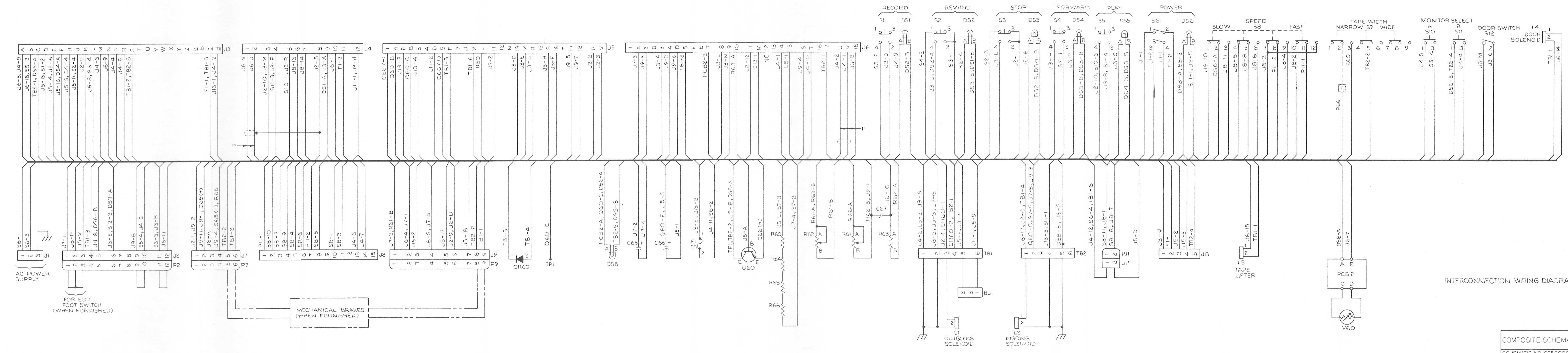


Figure 23. Composite Schematic (Sheet 1 of 2)



INTERCONNECTION WIRING DIAGRAM

COMPOSITE SCHEMATIC-2 IN.
SCHEMATIC NO. CE56000A700 REV A

Figure 23. Composite Schematic (Sheet 2 of 2)
(Interconnection)

NOTES: UNLESS OTHERWISE SPECIFIED
 1. ALL RESISTANCE VALUES ARE IN OHMS, 1/2 W, ± 5%
 2. ALL DIODES ARE IN 400V
 3. ALL TRANSISTORS ARE 2N843
 4. POSITIONING OF ALL RELAYS ARE UNLESS CONTACTS MAY BE USED AS BUSHING POINTS.

INDIVIDUAL TRACK TO CONNECTOR DESTINATIONS									
TRACK NO.	A	B	C	D	E	F	G	H	I
1	12-3	12-11	12-28	12-34	J5-7	J6-B	J7-B	J7-NN	J7-TT
2	7	14	31	37	B	D	D	J	RR
3	2	10	42	48	C	F	F	MM	SS
4	5	13	45	51	D	C	C	H	PP
5	1	8	41	47	E	F	L	R	J7-WW
6	4	17	44	50	F	J	N	T	J6-TT
7	17	24	40	46	H	E	K	P	RR
8	21	27	43	49	J	H	M	S	SS
9	16	23	54	60	K	L	V	Z	PP
10	20	26	57	64	L	N	X	BB	JJ
11	15	22	53	59	N	K	U	Y	FF
12	18	25	56	63	N	A	W	AA	HH
13	30	36	52	58	P	R	DD	JJ	EE
14	33	39	55	62	R	F	DD	LL	Z
15	29	35	47	55	S	S	CC	HH	X
16	J2-32	J2-38	J2-72	J2-78	J5-T	J6-41	J7-EE	J7-KK	J6-Y

COMPONENT DESIGNATION TABULATION									
TRACK NO.	R-A	R-B	R-C	R-D	R-E	R-F	R-G	R-H	R-I
1	R101	R201	R301	R401	R501	R601	R701	R801	R901
2	R102	R202	R302	R402	R502	R602	R702	R802	R902
3	R103	R203	R303	R403	R503	R603	R703	R803	R903
4	R104	R204	R304	R404	R504	R604	R704	R804	R904
5	R105	R205	R305	R405	R505	R605	R705	R805	R905
6	R106	R206	R306	R406	R506	R606	R706	R806	R906
7	R107	R207	R307	R407	R507	R607	R707	R807	R907
8	R108	R208	R308	R408	R508	R608	R708	R808	R908
9	R109	R209	R309	R409	R509	R609	R709	R809	R909
10	R110	R210	R310	R410	R510	R610	R710	R810	R910
11	R111	R211	R311	R411	R511	R611	R711	R811	R911
12	R112	R212	R312	R412	R512	R612	R712	R812	R912
13	R113	R213	R313	R413	R513	R613	R713	R813	R913
14	R114	R214	R314	R414	R514	R614	R714	R814	R914
15	R115	R215	R315	R415	R515	R615	R715	R815	R915
16	R116	R216	R316	R416	R516	R616	R716	R816	R916

COMPONENT DESIGNATION TABULATION									
TRACK NO.	J-A	J-B	J-C	J-D	J-E	K-A	K-B	K-C	J-F
1	J501	J101	J201	J301	J401	K101	K201	K301	J601
2	J502	J102	J202	J302	J402	K102	K202	K302	J602
3	J503	J103	J203	J303	J403	K103	K203	K303	J603
4	J504	J104	J204	J304	J404	K104	K204	K304	J604
5	J505	J105	J205	J305	J405	K105	K205	K305	J605
6	J506	J106	J206	J306	J406	K106	K206	K306	J606
7	J507	J107	J207	J307	J407	K107	K207	K307	J607
8	J508	J108	J208	J308	J408	K108	K208	K308	J608
9	J509	J109	J209	J309	J409	K109	K209	K309	J609
10	J510	J110	J210	J310	J410	K110	K210	K310	J610
11	J511	J111	J211	J311	J411	K111	K211	K311	J611
12	J512	J112	J212	J312	J412	K112	K212	K312	J612
13	J513	J113	J213	J313	J413	K113	K213	K313	J613
14	J514	J114	J214	J314	J414	K114	K214	K314	J614
15	J515	J115	J215	J315	J415	K115	K215	K315	J615
16	J516	J116	J216	J316	J416	K116	K216	K316	J616

COMPONENT DESIGNATION TABULATION (CONT'D)		
TRACK NO.	C-C	CR-E
1	CR101	CR501
2	CR102	CR502
3	CR103	CR503
4	CR104	CR504
5	CR105	CR505
6	CR106	CR506
7	CR107	CR507
8	CR108	CR508
9	CR109	CR509
10	CR110	CR510
11	CR111	CR511
12	CR112	CR512
13	CR113	CR513
14	CR114	CR514
15	CR115	CR515
16	CR116	CR516

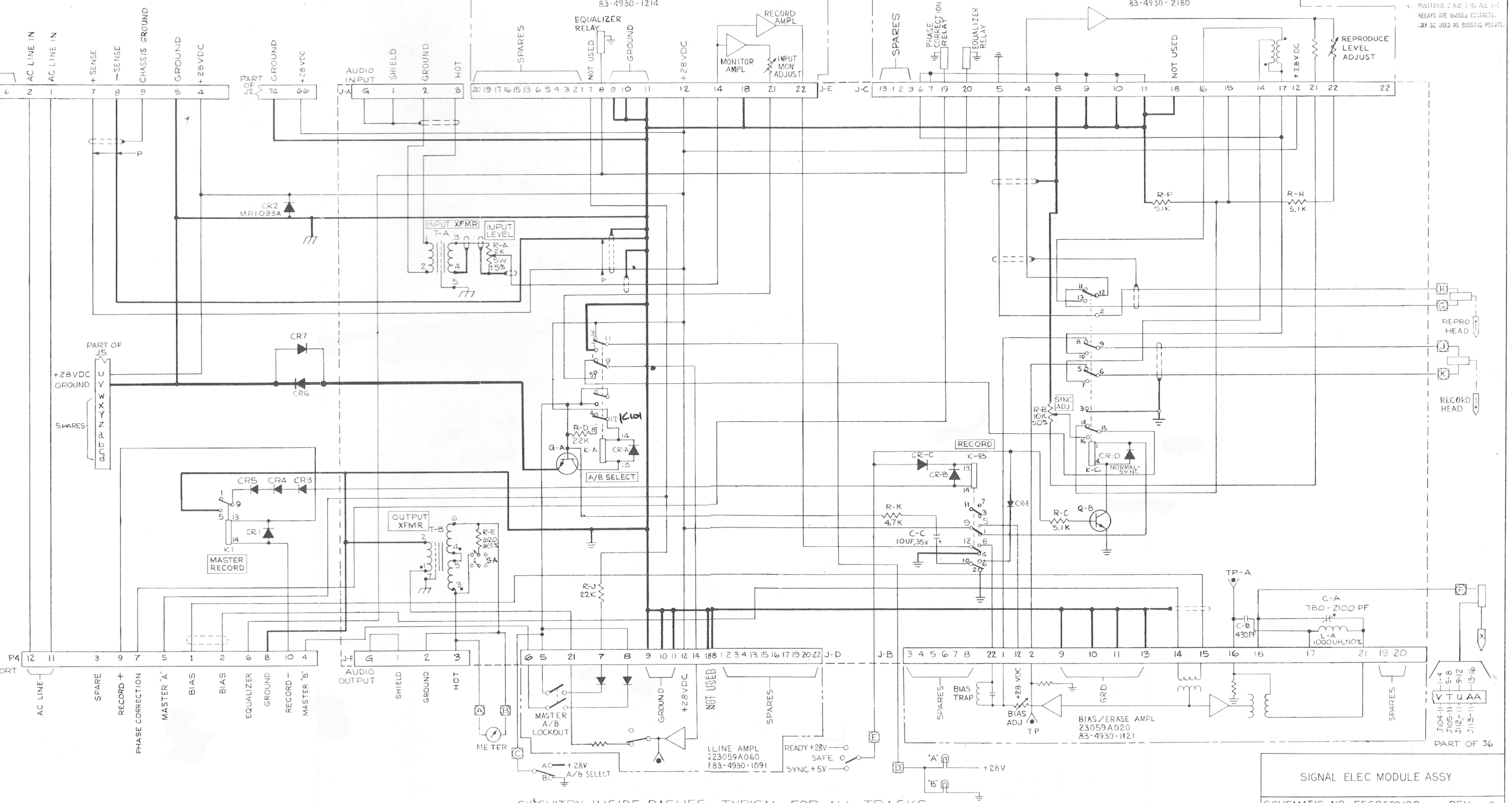


Figure 24. Signal Electronics Module Assembly
 M56 PAR 1-70
 69/70

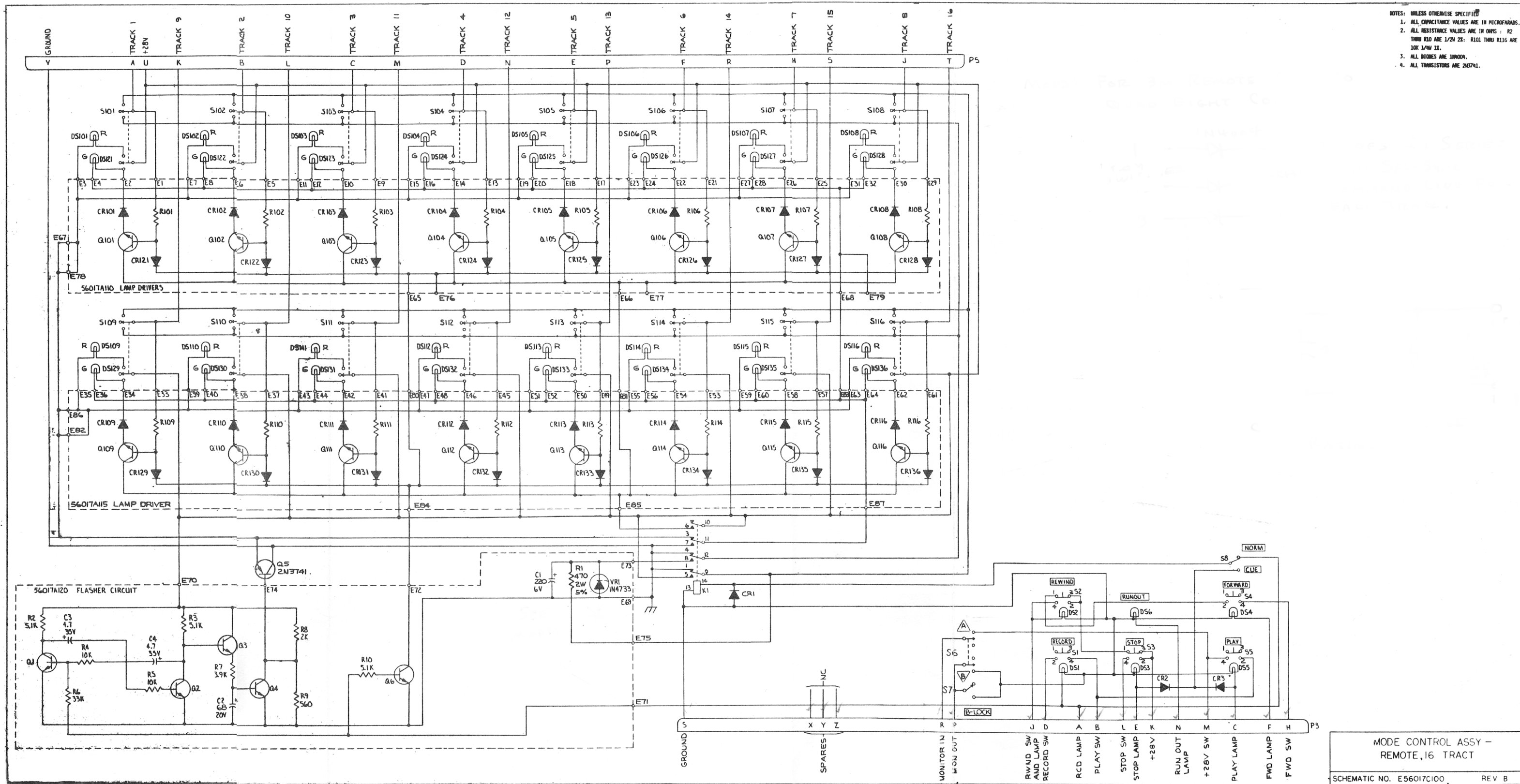


Figure 25. Remote Control Assembly

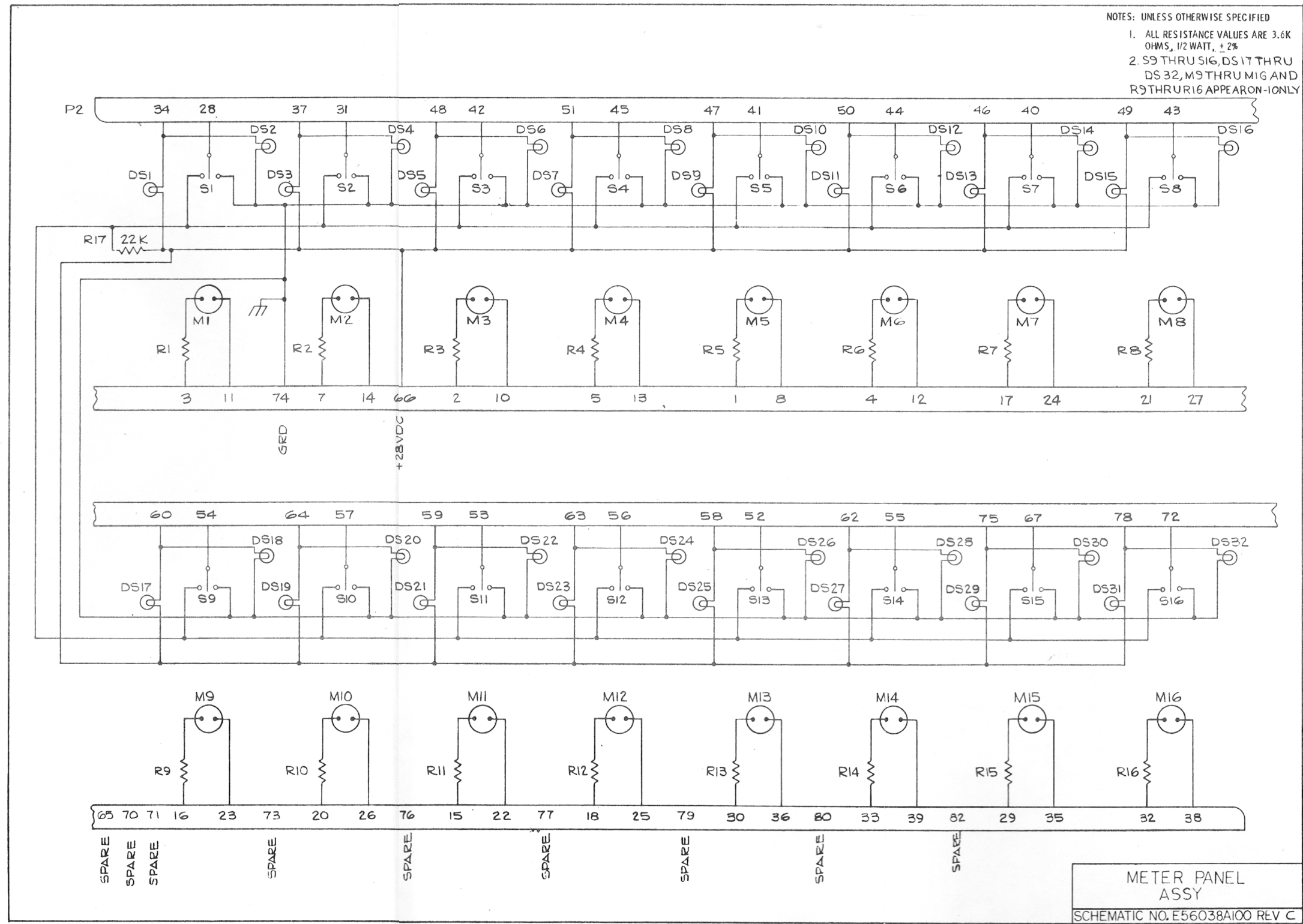


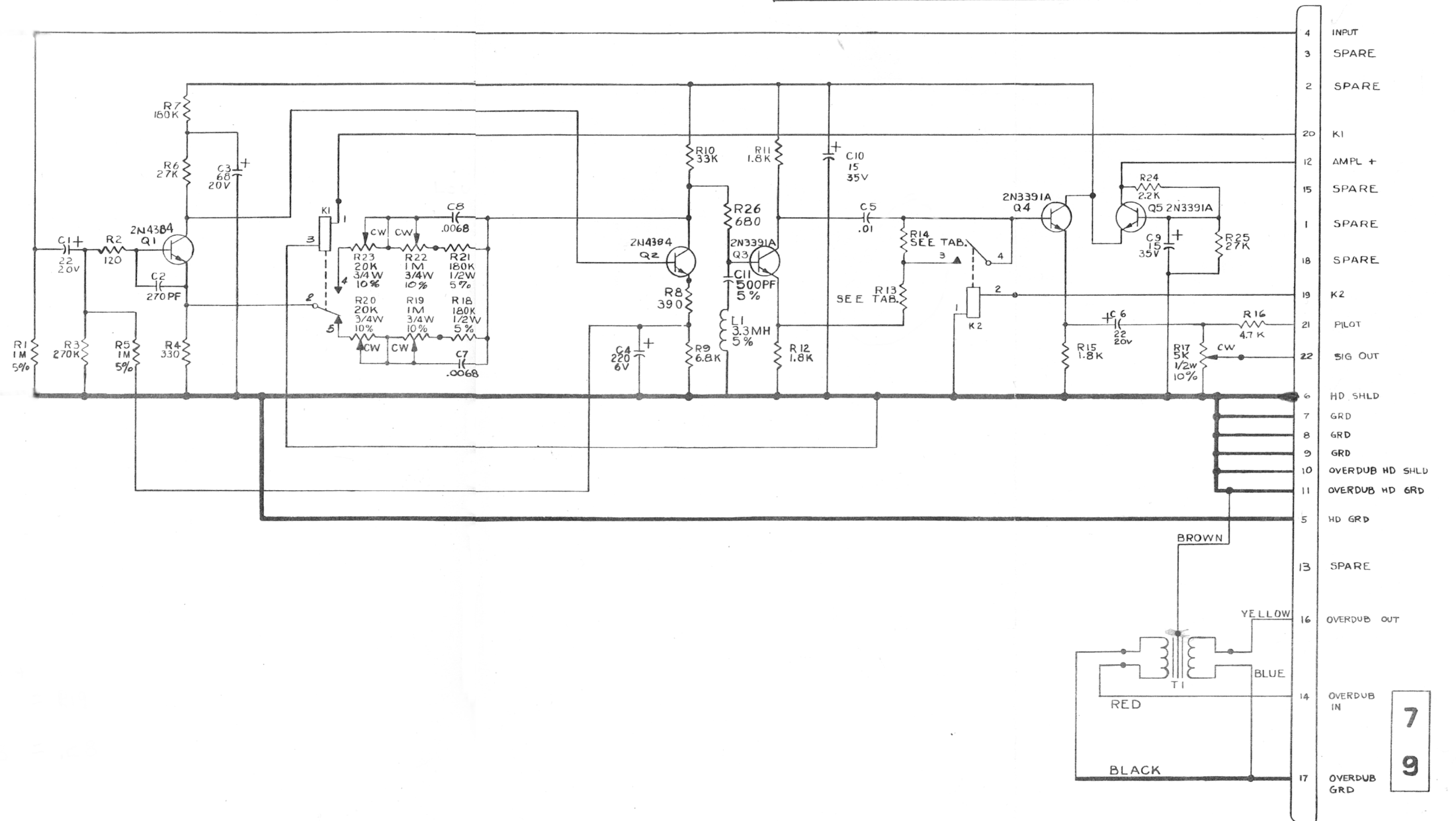
Figure 26. Meter Panel Assembly

150

COMPONENT VALUE
TABULATION

DASH NO.	CAT. NO.	CONFIG	VALUE
-1	83-4930-2180	7.5-151PS	1.8K 1.8K
-2	83-4930-2511	15-30 1PS	910Ω 910Ω

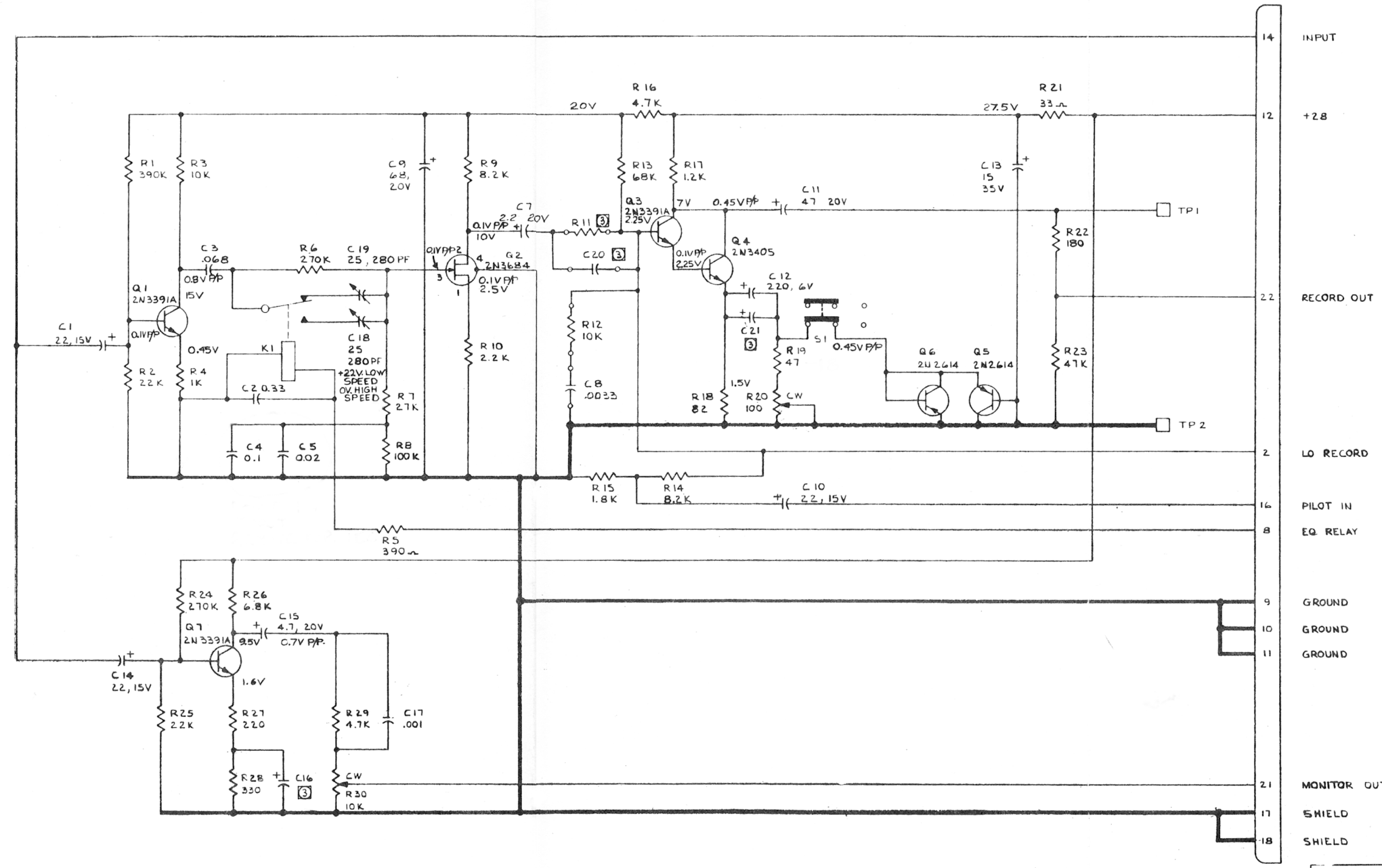
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, 2%
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS.



PREAMP, OVERDUB
SCHEMATIC NO. E23059B090 REV E

Figure 27. Overdub Preamplifier Board

- NOTES: UNLESS OTHERWISE SPECIFIED
 1. CAPACITANCE VALUES ARE IN MICROFARADS
 2. RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, ±5%
 3. C16, C20, C21 & R11 ARE NOT FURNISHED. R11 IS JUMPERED OUT.
 4. P/P VOLTS AT OVU 1KC



NAB RECORD AMPLIFIER
 SCHEMATIC NO E23059B040 REV F

Figure 28. NAB Record Amplifier Board

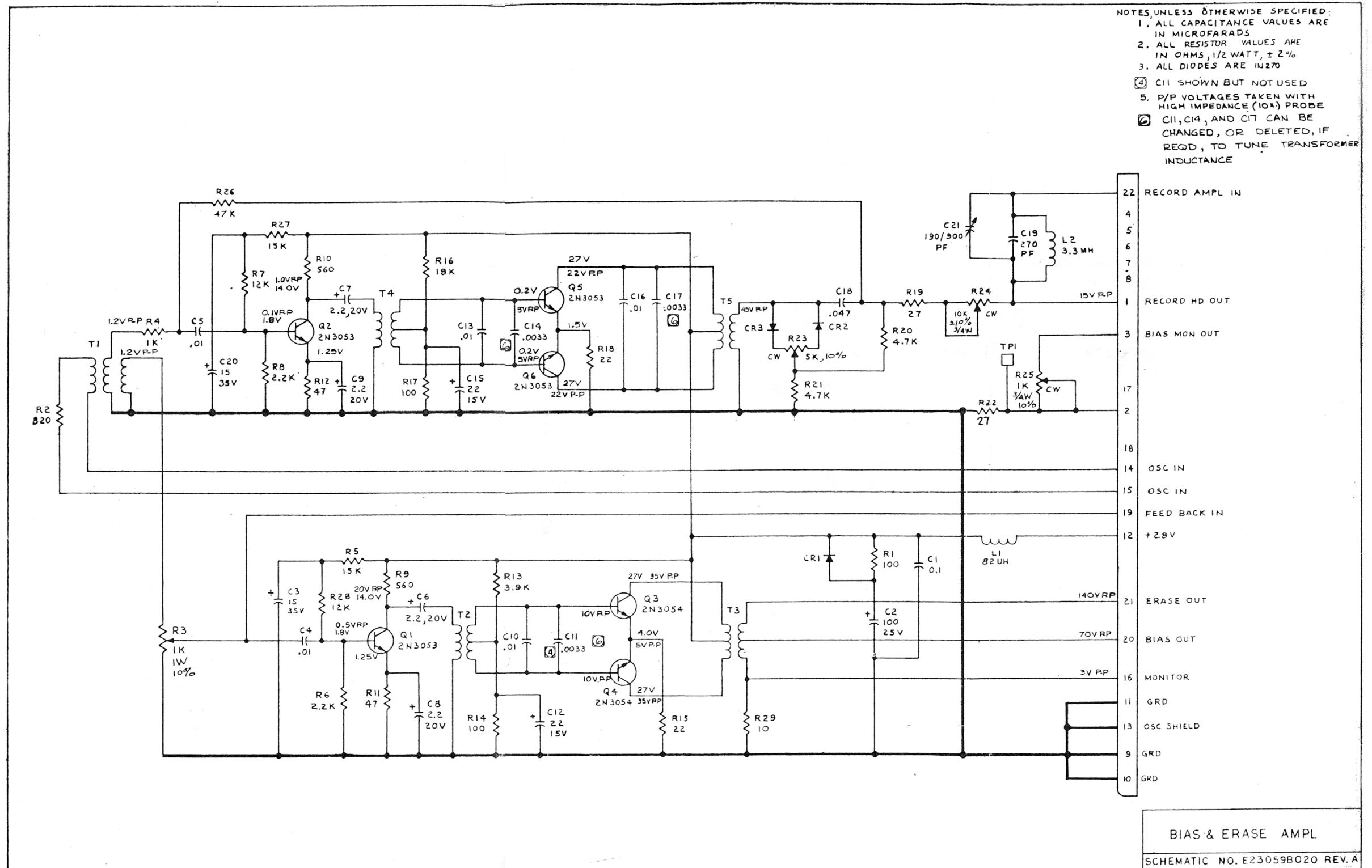
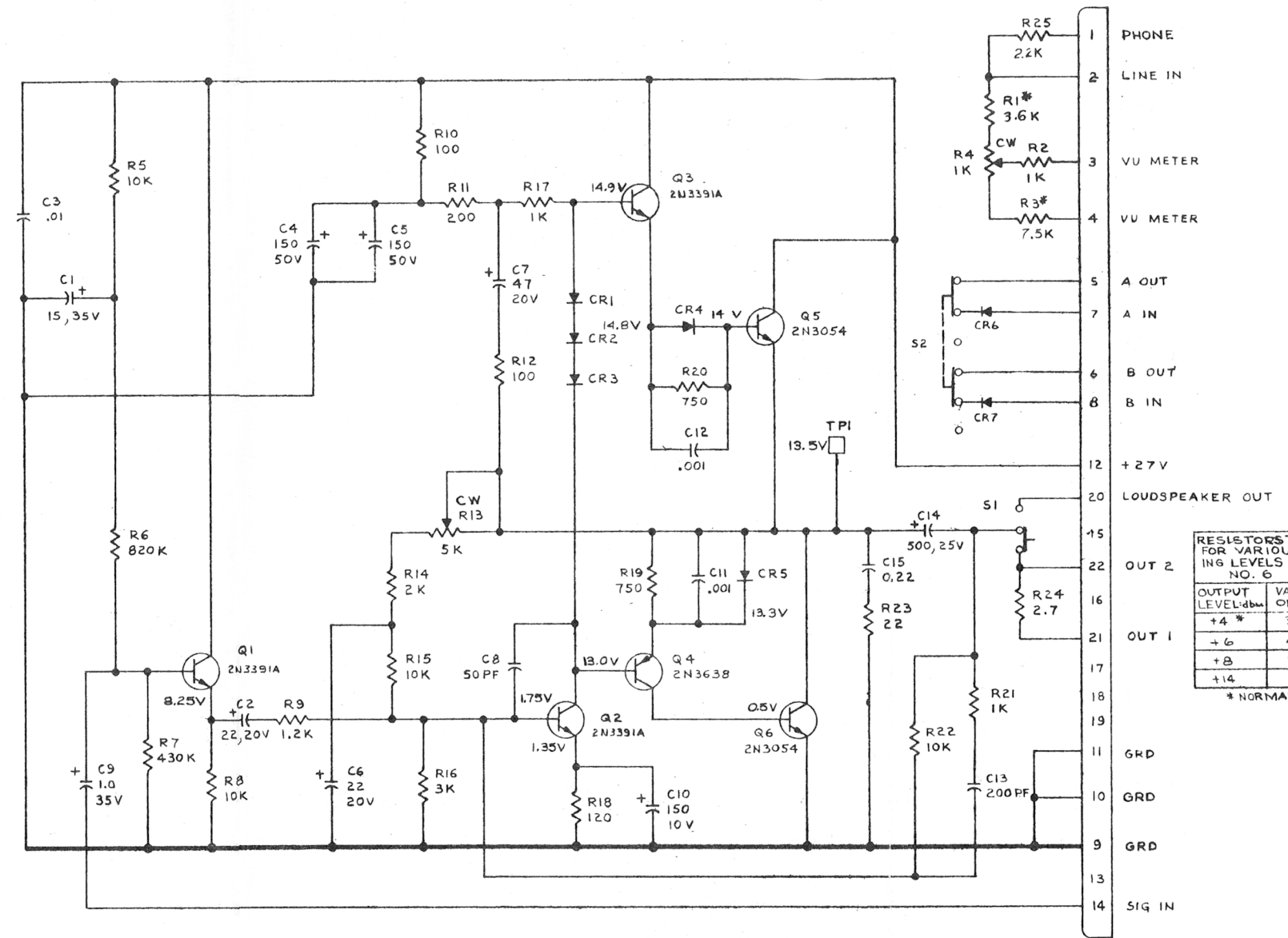


Figure 29. Bias and Erase Amplifier Board

NOTES: UNLESS OTHERWISE SPECIFIED
 1. CAPACITANCE VALUES ARE IN MICROFARADS
 2. RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, ± 5%
 3. ALL DIODES ARE IN 4002



RESISTORS TO BE SELECTED FOR VARIOUS LINE OPERATING LEVELS AT OUTPUT OF NO. 6 BOARD

OUTPUT LEVEL: dbm	VALUE OF R1	VALUE OF R3
+4 *	3.9K *	7.5K *
+6	4.7K	6.2K
+8	6.2K	4.3K
+14	7.5K	3.3K

* NORMAL VALUES

6

LINE DRIVER AMPLIFIER
 SCHEMATIC NO. E23059A060 REV G

Figure 30. Line Driver Amplifier Board

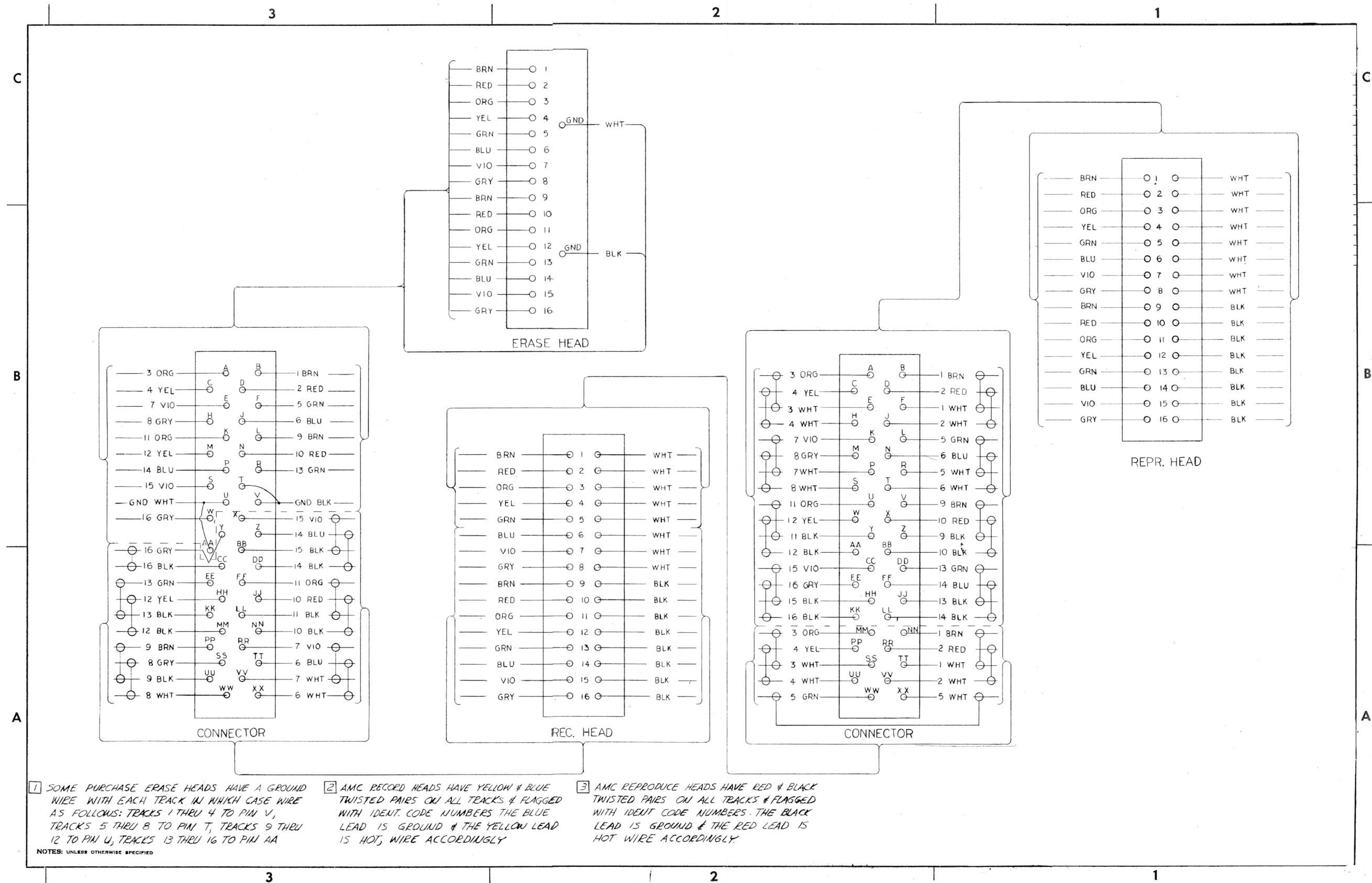
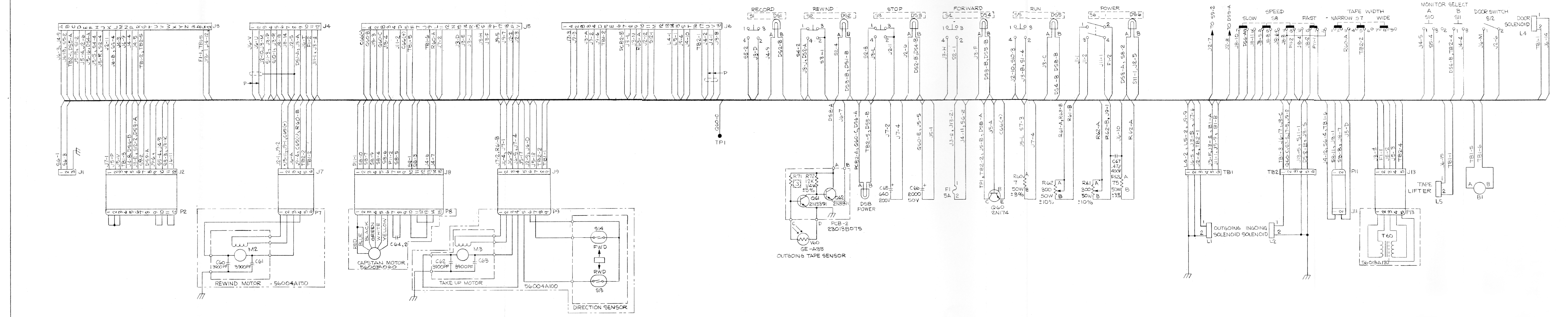


Figure 31. Head Wiring Diagram (16 Track)

NOTES: UNLESS OTHERWISE SPECIFIED
 1. ALL CAPACITANCE VALUES ARE IN MICROFARADS
 2. ALL RESISTANCE VALUES ARE IN OHMS
 3. SELECTED IN MACHINE CHECKOUT



HARNESS ASSY-2 IN.,
 TAPE TRANSPORT
 SCHEMATIC NO. E5603A150 REV B

Figure 33. Harness Assembly, Tape Transport

PARTS LIST

GENERAL

The parts lists in this section contain all the information required to order replacement parts for the 3M Brand Professional Audio Series 500 Recorders. Drawings for mechanical assemblies are included to aid in parts identification. Electrical parts are identified by reference designators on the assemblies of which they are a part.

The parts lists are arranged in numerical order according to their part number, which is in the upper right corner of the parts list. When an assembly drawing is included, it follows immediately after the parts list.

ORDERING REPLACEMENT PARTS

Parts for this equipment should be ordered through a 3M Sales and Service Office listed in the front of this manual. Price and delivery information on parts or complete instruments may be obtained from the Sales and Service Office. It is recommended that whenever possible and particularly when an

instrument is used in a critical application, the user maintain a minimum stock of spare parts.

When ordering parts the following information should be included.

1. Description of the part, obtained from the parts list.
2. The Mincom catalog number, also on the parts list.
3. The schematic reference designator, if applicable, given on the applicable schematic and on the parts list.
4. The part or type number of the major assembly, as shown on the nameplate, and the serial number of that assembly.

The following table lists each of the parts lists included in this manual. To locate a parts list, determine the part number or assembly name and locate it in the following table. The referenced page number may then be used to find the parts list.

Table 9. Parts List

Part Number	Description	Catalog Number	Page Number
23059B020	Bias Erase Circuit Board	83-4930-2952	91
23059B040	NAB Record Circuit Board	83-4930-1214	93
23059A060	Line Amplifier Circuit Board	83-4930-1091	95
23059B090-1	Overdub Preamplifier Board 7.5/15	83-4930-2180	97
23059B090-2	Overdub Preamplifier Board 15/30	83-4930-2511	99
23059A110	Extender Printed Circuit Board	83-4930-1746	101
56000A000	Professional Audio Recorder	83-5990-0812	102
56000A009	Assy - 1-8T, 50 Hz, NAB, M 7.5/15	83-5995-6014	103
56000A010	Assy - 1-8T, 50 Hz, NAB, M 15/30	83-5995-6015	104
56000A022	Assy - 1-8T, 60 Hz, NAB, M 7.5/15	83-5995-6012	105
56000A027	Assy - 1-8T, 60 Hz, NAB, M 15/30	83-5995-6013	106
56000A920	Kit - CVRSN, 8-16 Track, 7.5/15 ips	83-5990-1063	107
56000A930	Kit - CVRSN, 8-16 Track, 15/30 ips	83-5990-1064	108
56004A010	Hub Assy-Reel, NAB, 2 Inch	83-4240-0563	109

Table 9. Parts List (Cont.)

Part Number	Description	Catalog Number	Page Number
56004B020	PC Board Assy-Direction Sensor	83-4930-2830	110
56004B100	Motor Assy – Take Up Reel	83-4560-0238	111
56004A150	Motor Assy – Supply Reel	83-4560-0224	112
56009A100	Power Supply Assy – 2 Inch Transport	83-4930-2642	113
56013A075	PC Board Assy-Sensor, EOT, Outgoing	83-4930-2832	114
56013B100-1	Trans Assy – 2-1 Inch, 60 Hz, 7.5/15	83-5920-1779	115
56013B100-2	Trans Assy – 2-1 Inch, 50 Hz, 7.5/15	83-5920-1780	116
56013B100-3	Trans Assy – 2-1 Inch, 60 Hz, 15/30	83-5920-1781	117
56013B100-4	Trans Assy – 2-1 Inch, 50 Hz, 15/30	83-5920-1782	118
56013B100	Trans Assy – 2-1 Inch, (Mechanical)	Drawing	119/120
56013A130	Suppressor Assy-Arc, Torque Motor	83-4550-3727	121
56013A150	Harness Assy – 2 Inch, Tape Transport	83-4570-0722	122
56013B160	PC Board Assy – Logic 2 Inch	83-4930-2792	123
56013A170	Control Assy – Capstan, Start-Stop	83-4930-2641	125
56013B180	Chassis Assy – Wrap Around, 2 Inch	83-5920-1778	126
56013A190	Fan Assy – Auxiliary	83-4560-0244	127
56013A300-1	Trans Assy – 1 Inch, 60 Hz, 7.5/15	83-5920-1784	128
56013A300-2	Trans Assy – 1 Inch, 50 Hz, 7.5/15	83-5920-1785	129
56013A300-3	Trans Assy – 1 Inch, 60 Hz, 15/30	83-5920-1786	130
56013A300-4	Trans Assy – 1 Inch, 50 Hz, 15/30	83-5920-1787	131
56013A900	Kit – Capstan Area Parts, 2 Inch	83-5990-0857	132
56013A910-1	Kit – Speed, 60 Hz, 15/30	83-5990-0858	133
56013A910-2	Kit – Speed, 50 Hz, 7.5/15	83-5990-0859	134
56013A910-3	Kit – Speed, 50 Hz, 15/30	83-5990-0850	135
56013A910-4	Kit – Speed, 60 Hz, 7.5/15	83-5990-0935	136
56013A920	Kit – Capstan Area Parts, 1 Inch	83-5990-1027	137
56013B990	Kit – Common Parts, Tape Transport	83-5990-1019	138
56017A100	Mode Control Assy-RMT, 16 Track	83-5920-1749	141
56017A100	Mode Control Assy (Mechanical)	Drawing	143/144
56017A250	Mode Control Assy-RMT, 8 Track	83-5920-1805	145
56028A000	Console Assy – Large Module	83-5920-1644	147
56028A900	Kit Mounting	83-5990-0834	148
56028A910	Kit-Installation, Mtg Transport	83-5990-0836	149
56031A110	Cable Assy – 16 Track	83-4570-0723	150
56031A900	Kit – Pwr Sup, Sig Elect	83-5990-0866	151
56038A100-1	Meter Panel Assy, 16 Track	83-5920-1619	152
56038A100-2	Meter Panel Assy, 8 Track	83-5920-1643	154
56038A100	Meter Panel Assy, (Mechanical)	Drawing	155/156
56059B100-1	Signal Elect Module Assy, 16 Track	83-5920-1759	157
56059B100-2	Signal Elect Module Assy, 8 Track	83-5920-1760	163
56059B100	Signal Elect Module Assy, (Mechanical)	Drawing	169/170
56059A900	Kit – Sig Elect, NAB, 16 Track, 7.5/15	83-5990-0835	171
56059A905	Kit – Sig Elec BDS, NAB, 16 Track, 15/30	83-5990-0921	172
56059A910	Kit – Sig Elec BDS, 8 Track, 7.5/15	83-5990-0855	173
56059A915	Kit – Sig Elec BDS, NAB, 8 Track, 15/30	83-5990-0922	174
56119A000	Hd Assy – Snd Rec/Rep, Mag Eraser, 16 Track	83-5950-1366	175
56119A200	Hd Assy – Snd Rec/Rep, Mag Eraser, 8 Track	83-5950-1688	176

MATERIAL REQUIREMENTS

REF. DES. OR FIND NO.	DRAWING NUMBER - MFG PART NO.	MFGR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
C1	112A1A104M	HOPKINS	CAP-FXD,PAPER, .10UF, 50V, 20%	83-1510-4185	1.0
C2	107X002	SPRAGUE	CAP-FXD,TA, 100 UF, 25V, 20%	83-1510-6222	1.0
C3,C20	TSD5-35-156	COMP INC	CAP-FXD,TA, 15UF 35V 20%	83-1510-6209	2.0
C4,C5	210B1B103J	ELECTRO CUBE	CAP-FXD,PLSTC, .01UF,100V, 5%	83-1510-4192	2.0
C6,C7,C8,C9	TSD-1-20-225	CMP INC	CAP-FXD,TA, 2.2UF 20V 20%	83-1510-6240	4.0
C10,C13,C16	192P10392	SPRAGUE	CAP-FXD,PAPER, .01 UF,200V,10%	83-1510-4414	3.0
C12,C15	TSD3-15-226	COMP INC	CAP-FXD,TA, 22UF 15V 20%	83-1510-6257	2.0
C14,C17	192P33292	SPRAGUE	CAP-FXD,PAPER,.0033UF,200V,10%	83-1510-4405	2.0
C18	WMF1S47	CORNEL-DUBLR	CAP-FXD,PLSTC,.047UF 100V 10%	83-1510-4481	1.0
C19	831-X3R-271K	ERIE	CAP-FXD,CER, 270PF1000V 10%	83-1510-1103	1.0
C21	4610	ARCO	CAP-VAR,MICA,190-900 PF	83-1510-6252	1.0
CR1,CR2,CR3	1N270	HUGHES	DIODE-GE, GEN PUR,100PIV, 60 MA	83-1530-0263	3.0
L1	4631	J.W. MILLER	INDUCTOR-FXD,82UH,250MA	83-1540-0409	1.0
L2	70F333AI	J.W. MILLER	CHOKO-RF,3.3 MH 5%	83-1540-0410	1.0
Q1,Q2,Q5,Q6	2N3053	R.C.A.	TSTR-SI,NPN, PWR, 60 VCB	83-1530-2180	4.0
Q3,Q4	2N3054	R.C.A.	TSTR-SI,NPN, H PWR, 100 HFE	83-1530-2227	2.0
R1,R14,R17	0A781-7221	MINCOM SPEC	RES-FXD,FILM,100 OHM,1/2W,2% S	83-1520-7221	3.0
R2	0A781-7358	MINCOM SPEC	RES-FXD,FILM,820 OHM,1/2W,2% S	83-1520-7358	1.0
R3	3282W-1-1.02	BOURNS INC	RES-VAR,COMP, 1 K OHM 1W 10%	83-1520-1401	1.0
R4	0A781-7175	MINCOM SPEC	RES-FXD,FILM,1K OHM,1/2W,2% S	83-1520-7175	1.0
R5,R27	0A781-7144	MINCOM SPEC	RES-FXD,FILM,15K OHM,1/2W,2% S	83-1520-7144	2.0
R6,R8	0A781-7360	MINCOM SPEC	RES-FXD,FILM,2.2K OHM,1/2W,2% S	83-1520-7360	2.0
R7,R28	0A781-7145	MINCOM SPEC	RES-FXD,FILM,12K OHM,1/2W,2% S	83-1520-7145	2.0
R9,R10	0A781-7355	MINCOM SPEC	RES-FXD,FILM,560 OHM,1/2W,2% S	83-1520-7355	2.0
R11,R12	0A781-7337	MINCOM SPEC	RES-FXD,FILM,47 OHM,1/2W,2% S	83-1520-7337	2.0
R13	0A781-7363	MINCOM SPEC	RES-FXD,FILM,3.9K OHM,1/2W,2% S	83-1520-7363	1.0
R15,R18	0A781-7329	MINCOM SPEC	RES-FXD,FILM,22 OHM,1/2W,2% S	83-1520-7329	2.0
R16	0A781-7146	MINCOM SPEC	RES-FXD,FILM,18K OHM,1/2W,2% S	83-1520-7146	1.0
R19,R22	0A781-7331	MINCOM SPEC	RES-FXD,FILM,27 OHM,1/2W,2% S	83-1520-7331	2.0
R20,R21	0A781-7147	MINCOM SPEC	RES-FXD,FILM,4.7K OHM,1/2W,2% S	83-1520-7147	2.0
R23	3067P-1-502	BOURNS	RES-VAR, WW, 5K OHM 1/2W 10%	83-1520-1319	1.0
R24	77PRI0K	BECKMAN	RES-VAR,COMP,10K OHM,3/4 W,10%	83-1520-1213	1.0
R25	77PRIK	BECKMAN	RES-VAR,COMP,1K OHM,3/4 W, 10%	83-1520-1211	1.0
R26	0A781-7379	MINCOM SPEC	RES-FXD,FILM,47K OHM,1/2W,2% S	83-1520-7379	1.0
R29	0A781-7375	MINCOM SPEC	RES-FXD,FILM,33K OHM,1/2W,2% S	83-1520-7375	1.0
T1	00000A718	A MINCOM	XFMR-TORROIDAL,ARNOLD CORE	83-3540-1150	1.0
T2,T4,T5	00000A719	A MINCOM	XFMR-TORROIDAL,ARNOLD CORE	83-3540-1151	3.0
T3	00000A720	A MINCOM	XFMR-TORROIDAL,ARNOLD CORE	83-3540-1152	1.0

CATALOG NO. 83-4930-2952

TITLE PC BD ASSY-BIAS ERASE

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MATERIAL	REQUIREMENTS	DESCRIPTION	PH CATALOG NO.	QTY.
TPI	3-582118-9	AMP INC	JACK-TIP, .156 WD X .460 DP		83-1610-0752	1.0
1	23059B021	A MINCOM	PC BD-BIAS ERASE		83-3640-1877	1.0
2	00000A667	B MINCOM	HANDLE-EJECTOR, P.C. BD, 1.50 LG		83-3270-0371	1.0
3	79-022-094-0250	ESNA	PIN-SPRING, .094 DIA X .250 LG		83-7280-0270	1.0
4	00000A734-1	B MINCOM	LABEL-IDENT, P.C. BD, MARKED #1*		83-3550-1446	1.0
5	23 059A016	A MINCOM	BRACKET-COMPONENT MIG, SIG ELEC		83-3320-1132	1.0
6	#FXE-22-122	THERMAX	WIRE-TYPE C, 22GA WHI TEFLN JKT		83-7910-0476	AR

TITLE P.C. 8D ASSY-RECORD,NAB #14 CATALOG NO. 83-4930-1214

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
C1,C10,C14	TSD3-15-226	COMP INC	CAP-FXD,TA, 22UF 15V 20%	83-1510-6257	3.0
C2	W210B1V334J	ELECTRO CUBE	CAP-FXD,MYLAR,.33UF,150V, 5%	83-1510-4301	1.0
C3	112A1B683K	ELECTRO CUBE	CAP-FXD,PAPER,.068 UF,100V,10%	83-1510-4332	1.0
C4	112A1A104J	ELECTRO-CUBE	CAP-FXD,PAPER,.10UF 50V 5%	83-1510-4310	1.0
C5	17MB203J	JEDCO	CAP-FXD,PLSTC,.02UF,100V, 5%	83-1510-4191	1.0
C7	TSD-1-20-225	COMP INC	CAP-FXD,TA, 2.2UF 20V 20%	83-1510-6240	1.0
C8	E3FR-332-1C	MIDWEC	CAP-FXD,PLSTC,.0033UF 100V 5%	83-1510-4445	1.0
C9	TSD5-20-686	COMP INC	CAP-FXD,TA, 68UF 20V 20%	83-1510-6211	1.0
C11	TSD5-20-476	COMP INC	CAP-FXD,TA, 47UF 20V 20%	83-1510-6199	1.0
C12	TSD5-6-227	COMP INC	CAP-FXD,TA, 220UF 6V 20%	83-1510-6259	1.0
C13	TSD5-35-156	COMP INC	CAP-FXD,TA, 15UF 35V 20%	83-1510-6209	1.0
C15	TSD1-20-475	COMP INC	CAP-FXD,TA, 4.7UF 20V 20%	83-1510-6196	1.0
C17	210B1C102K	ELECTRO CUBE	CAP-FXD,PLSTC,.001 UF,200V,10%	83-1510-4296	1.0
C18,C19	464	ARCO	CAP-VAR,MICA,25 MMF-280 MMF	83-1510-6277	2.0
K1	701-3	ELEC-TROL	RELAY-SPDT, 2K OHM 24VDC	83-1550-3620	1.0
Q1,Q3,Q7	2N3391A	GENERAL ELEC	TSTR-SI,NPN, PWR, 25 VCB	83-1530-2230	3.0
Q2	2N3684		TSTR-SI,N-CHAN,FLD EFFECT 50MA	83-1530-2244	1.0
Q4	2N3405	G.E.	TSTR-SI,NPN,GEN PUR,50VCE	83-1530-2232	1.0
Q5,Q6	2N2614		TSTR-GE,PNP, SIGNAL, 40VCB	83-1530-2233	2.0
R1	0A781-7397	MINCOM SPEC	RES-FXD,FILM,390K OHM,1/2W,2% S	83-1520-7397	1.0
R2,R25	0A781-7372	MINCOM SPEC	RES-FXD,FILM,22K OHM,1/2W,2% S	83-1520-7372	2.0
R3	0A781-7148	MINCOM SPEC	RES-FXD,FILM,10K OHM,1/2W,2% S	83-1520-7148	1.0
R4	0A781-7175	MINCOM SPEC	RES-FXD,FILM,1K OHM,1/2W,2% S	83-1520-7175	1.0
R5	0A781-7174	MINCOM SPEC	RES-FXD,FILM,390 OHM,1/2W,2% S	83-1520-7174	1.0
R6,R24	0A781-7393	MINCOM SPEC	RES-FXD,FILM,270K OHM,1/2W,2% S	83-1520-7393	2.0
R7	0A781-7373	MINCOM SPEC	RES-FXD,FILM,27K OHM,1/2W,2% S	83-1520-7373	1.0
R8	0A781-7387	MINCOM SPEC	RES-FXD,FILM,100K OHM,1/2W,2% S	83-1520-7387	1.0
R9,R14	0A781-7369	MINCOM SPEC	RES-FXD,FILM,8.2K OHM,1/2W,2% S	83-1520-7369	2.0
R10	0A781-7360	MINCOM SPEC	RES-FXD,FILM,2.2K OHM,1/2W,2% S	83-1520-7360	1.0
R12	0A781-7148	MINCOM SPEC	RES-FXD,FILM,10K OHM,1/2W,2% S	83-1520-7148	1.0
R13	0A781-7383	MINCOM SPEC	RES-FXD,FILM,68K OHM,1/2W,2% S	83-1520-7383	1.0
R15	0A781-7201	MINCOM SPEC	RES-FXD,FILM,1.8K OHM,1/2W,2% S	83-1520-7201	1.0
R16,R29	0A781-7147	MINCOM SPEC	RES-FXD,FILM,4.7K OHM,1/2W,2% S	83-1520-7147	2.0
R17	0A781-7359	MINCOM SPEC	RES-FXD,FILM,1.2K OHM,1/2W,2% S	83-1520-7359	1.0
R18	0A781-7342	MINCOM SPEC	RES-FXD,FILM,82 OHM,1/2W,2% S	83-1520-7342	1.0
R19	0A781-7337	MINCOM SPEC	RES-FXD,FILM,47 OHM,1/2W,2% S	83-1520-7337	1.0
R20	77PR100	BECKMAN	RES-VAR,COMP,100 OHM,3/4 W,10%	83-1520-1153	1.0
R21	0A781-7333	MINCOM SPEC	RES-FXD,FILM,33 OHM,1/2W,2% S	83-1520-7333	1.0
R22	0A781-7345	MINCOM SPEC	RES-FXD,FILM,180 OHM,1/2W,2% S	83-1520-7345	1.0

CATALOG NO. 83-4930-1214

TITLE P.C. BD ASSY-RECORD,NAB

REF. DES. OR FIND NO. DRAWING NUMBER MFR NAME DESCRIPTION PH CATALOG NO. QTY.

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
R23	0A781-7379	MINCOM SPEC	RES-FXD,FILM,47K OHM,1/2W,2% S	83-1520-7379	1.0
R26	0A781-7367	MINCOM SPEC	RES-FXD,FILM,6.8K OHM,1/2W,2% S	83-1520-7367	1.0
R27	0A781-7220	MINCOM SPEC	RES-FXD,FILM,220 OHM,1/2W,2% S	83-1520-7220	1.0
R28	0A781-7350	MINCOM SPEC	RES-FXD,FILM,330 OHM,1/2W,2% S	83-1520-7350	1.0
R30	77PR10K	BECKMAN	RES-VAR,COMP,10K OHM,3/4 W,10%	83-1520-1213	1.0
S1	TYPE G350-PC	CONTL WIRT	SWITCH-SLIDE, DPDT,125V 3AMP	83-1550-5212	1.0
TP1	3-582118-9	AMP INC	JACK-TIP,.156 WD X .460 DP	83-1610-0752	1.0
TP2	3-582118-0	AMP INC	JACK-TEST,.156WD X .230 HT,BLK	83-1610-0765	1.0
1	00000A667	B MINCOM	HANDLE-EJECTOR,P.C. BD,1.50 LG	83-3270-0371	1.0
2	23059A016	A MINCOM	BRACKET-COMPONENT MTG,SIG ELEC	83-3320-1132	2.0
3	00000A734-3	B MINCOM	LABEL-IDENT,P.C-BD,*4*	83-3550-1448	1.0
4	23059B041	F MINCOM	P.C. BD-RECORD,NAB	83-3640-0729	1.0
5	79-022-094-0250	ESNA	PIN-SPRING,.094 DIA X .250 LG	83-7280-0270	1.0
6	7717-2	THERMALLOY	PAD-TSTR, INLINE, 3 LEADS	83-9690-0191	3.0
7	MS35206-215	MIL STD	SCREW-MACH,PAN HD,4-40 X 3/8	83-9260-4515	1.0
8	MS35649-42	MIL STD	NUT-HEX,PLAIN,4-40 X .250 WD	83-9260-2003	1.0
9			WASHER-FLAT,GENERAL PURPOSE #4	83-9261-4002	1.0
10	MS35338-40	MIL STD	WASHER-LOCK,SPLIT,HELICAL,#4	83-9261-4303	1.0
12	1434	BIRNBACH	WIRE-BUS,22GA ROUND	83-7910-0105	AR

TITLE P.C. BD ASSY-LNE AMP,SIG ELECT (6) CATALOG NO. 83-4930-1091

----- M A T E R I A L R E Q U I R E M E N T S -----

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	D E S C R I P T I O N	PH CATALOG NO.	QTY.
C1	TSD5-35-156	COMP INC	CAP-FXD, TA, 15UF 35V 20%	83-1510-6209	1.0
C2,C6	TSD4-20-226	COMP INC	CAP-FXD, TA, 22UF 20V 20%	83-1510-6203	2.0
C3	625B1B103J	ELECTRO CUBE	CAP-FXD,MYLAR,-.01 UF,100 V	83-1510-4227	1.0
C4,C5	977-123	GEN INSTR	CAP-FXD,ELECT, 150UF 50V	83-1510-2212	2.0
C7	TSD5-20-476	COMP INC	CAP-FXD,TA, 47UF 20V 20%	83-1510-6199	1.0
C8	OA836-5148	MINCOM SPEC	CAP-FXD,MICA, 50PF 500V 5%	83-1510-5148	1.0
C9	TSD1-35-105	COMP INC	CAP-FXD,TA, 1UF 35V 20%	83-1510-6208	1.0
C10	TSD5-10-157	COMP INC	CAP-FXD,TA, 150UF 10V 20%	83-1510-6245	1.0
C11,C12	DD102	AEROVOX	CAP-FXD,CER, 1000PF 1000V GMV	83-1510-1024	2.0
C13	OA836-5214	MINCOM SPEC	CAP-FXD,MICA, 200PF 500V 5%	83-1510-5214	1.0
C14	977-163	GEN INSTR	CAP-FXD,ELECT, 500UF 25V	83-1510-2044	1.0
C15	P222MC	HOPKINS	CAP-FXD,PLSTC, .22UF 200V 5%	83-1510-4167	1.0
CR1,CR2,CR3,CR4,CR5,CR6, CR7	IN4004	MOTOROLA	RECT -SI, DIF JCT,400PIV 1 AMP	83-1530-0151	7.0
Q1,Q2,Q3	2N3391A	GENERAL ELEC	TSTR-SI,NPN, PWR, 25 VCB	83-1530-2230	3.0
Q4	2N3638	FAIRCHILD	TSTR-SI,PNP, SW, 25 VCB	83-1530-2155	1.0
Q5,Q6	2N3054	R.C.A.	TSTR-SI,NPN, H PWR, 100 HFE	83-1530-2227	2.0
R1	OA781-7362	MINCOM SPEC	RES-FXD,FILM,3.6K OHM,1/2W,2% S	83-1520-7362	1.0
R2,R17,R21	OA781-7175	MINCOM SPEC	RES-FXD,FILM,1K OHM,1/2W,2% S	83-1520-7175	3.0
R3	OA781-7368	MINCOM SPEC	RES-FXD,FILM,7.5K OHM,1/2W,2% S	83-1520-7368	1.0
R4	77PR1K	BECKMAN	RES-VAR,COMP,1K OHM,3/4 W, 10%	83-1520-1211	1.0
R5,R8,R15,R22	OA781-7148	MINCOM SPEC	RES-FXD,FILM,10K OHM,1/2W,2% S	83-1520-7148	4.0
R6	LITTLE DEVIL	OHMITE	RES-FXD, COMP, 820KOHM 1/2W 5	83-9520-3218	1.0
R7	OA781-7398	MINCOM SPEC	RES-FXD,FILM,430K OHM,1/2W,2% S	83-1520-7398	1.0
R9	OA781-7359	MINCOM SPEC	RES-FXD,FILM,1.2K OHM,1/2W,2% S	83-1520-7359	1.0
R10,R12	OA781-7221	MINCOM SPEC	RES-FXD,FILM,100 OHM,1/2W,2% S	83-1520-7221	2.0
R11	OA781-7346	MINCOM SPEC	RES-FXD,FILM,200 OHM,1/2W,2% S	83-1520-7346	1.0
R13	3067P-1-502	BOURNS	RES-VAR, WW, 5K OHM 1/2W 10%	83-1520-1319	1.0
R14	OA781-7263	MINCOM SPEC	RES-FXD,FILM,2K OHM,1/2W,2% S	83-1520-7263	1.0
R16	OA781-7219	MINCOM SPEC	RES-FXD,FILM,3K OHM,1/2W,2% S	83-1520-7219	1.0
R18	OA781-7344	MINCOM SPEC	RES-FXD,FILM,120 OHM,1/2W,2% S	83-1520-7344	1.0
R19,R20	OA781-7357	MINCOM SPEC	RES-FXD,FILM,750 OHM,1/2W,2% S	83-1520-7357	2.0
R23	OA781-7329	MINCOM SPEC	RES-FXD,FILM,22 OHM,1/2W,2% S	83-1520-7329	1.0
R24	LITTLE DEVIL	OHMITE	RES-FXD,COMP,2.7 OHM 1/2W 5%	83-9520-3258	1.0
R25	OA781-7360	MINCOM SPEC	RES-FXD,FILM,2.2K OHM,1/2W,2% S	83-1520-7360	1.0
S1,S2	TYPE G350-PC	CONTL WIRT	SWITCH-SLIDE, DPDT, 125V 3AMP	83-1550-5212	2.0
TPI	3-582118-9	AMP INC	JACK-TIP,.156 WD X .460 DP	83-1610-0752	1.0

CATALOG NO. 83-4930-1091

TITLE P.C. BD ASSY-LINE AMP, SIG ELECT

----- MATERIAL REQUIREMENTS -----

REF. DES. OR FIND NO. DRAWING NUMBER MFGR NAME DESCRIPTION PH CATALOG NO. QTY.

REF. DES. OR FIND NO.	DRAWING NUMBER	MFGR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
1	23059A061	F MINCOM	P.C. BD-LINE AMP, SIGNAL ELECT	83-3640-0668	1.0
2	00000A667	B MINCOM	HANDLE-EJECTOR, P.C. BD, 1.50 LG	83-3270-0371	1.0
3	79-022-094-0250	ESNA	PIN-SPRING, .094 DIA X .250 LG	83-7280-0270	1.0
4	00000A734-4	B MINCOM	LABEL-IDENT, P.C. BD, #6*	83-3550-1449	1.0
6	MS35206-215	MIL STD	SCREW-MACH, PAN HD, 4-40 X 3/8	83-9260-4515	4.0
7			NUT-HEX, SM PATT, 4-40 X .188 WD	83-9260-2201	4.0
8			WASHER-FLAT, .219 OD X .125 ID	83-9261-4012	4.0
9	MS35338-4C	MIL STD	WASHER-LOCK, SPLIT, HELICAL, #4	83-9261-4303	4.0
10	7717-2	THERMALLOY	PAD-ISTR, INLINE, 3 LEADS	83-9690-0191	3.0

TITLE PC BD ASSY-PREAMP,OVDUB 7.5-15 CATALOG NO. 83-4930-2180

M A T E R I A L R E Q U I R E M E N T S

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	D E S C R I P T I O N	PH CATALOG NO.	QTY.
C1,C6	TSD4-20-226	COMP INC	CAP-FXD,TA, 22UF 20V 20%	83-1510-6203	2.0
C2	0A836-5096	MINCOM SPEC	CAP-FXD,MICA, 270PF 500V 5%	83-1510-5096	1.0
C3	TSD5-20-686	COMP INC	CAP-FXD,TA, 68UF 20V 20%	83-1510-6211	1.0
C4	TSD5-6-227	COMP INC	CAP-FXD,TA, 220UF 6V 20%	83-1510-6259	1.0
C5	E3XFR-103-1C	MIDWEC	CAP-FXD,PLSTC,.010UF 100V 5%	83-1510-4449	1.0
C7,C8	E3FR-682-1C	MIDWEC	CAP-FXD, PLS .0068UF 100V 5%	83-1510-4447	2.0
C9,C10	TSD5-35-156	COMP INC	CAP-FXD, TA, 15UF 35V 20%	83-1510-6209	2.0
C11	0A836-5120	MINCOM SPEC	CAP-FXD,MICA, 500PF 500V 5%	83-1510-5120	1.0
K1	701-3	ELEC-TROL	RELAY-SPDT, 2K OHM 24VDC	83-1550-3620	1.0
K2	201-3	ELECTROL	RELAY-SPST, 2K OHM 24 V DC	83-1550-3621	1.0
L1	70F333AI	J.W. MILLER	CHDKE-RF,3.3 MH 5 %	83-1540-0410	1.0
Q1,Q2	2N4384	SPRAGUE	TSTR-SI,NPN, SW, 40 VCB	83-1530-2156	2.0
Q3,Q4,Q5	2N3391A	GENERAL ELEC	TSTR-SI,NPN, PWR, 25 VCB	83-1530-2230	3.0
R1,R5	LITTLE DEVIL	OHMITE	RES-FXD,COMP, 1M OHM 1/2W 5%	83-9520-3220	2.0
R2	0A781-7344	MINCOM SPEC	RES-FXD,FILM,120 OHM,1/2W,2% S	83-1520-7344	1.0
R3	0A781-7393	MINCOM SPEC	RES-FXD,FILM,270K OHM,1/2W,2% S	83-1520-7393	1.0
R4	0A781-7350	MINCOM SPEC	RES-FXD,FILM,330 OHM,1/2W,2% S	83-1520-7350	1.0
R6,R25	0A781-7373	MINCOM SPEC	RES-FXD,FILM,27K OHM,1/2W,2% S	83-1520-7373	2.0
R7,R18,R21	0A781-7389	MINCOM SPEC	RES-FXD,FILM,180K OHM,1/2W,2% S	83-1520-7389	3.0
R8	0A781-7174	MINCOM SPEC	RES-FXD,FILM,390 OHM,1/2W,2% S	83-1520-7174	1.0
R9	0A781-7367	MINCOM SPEC	RES-FXD,FILM,6.8K OHM,1/2W,2% S	83-1520-7367	1.0
R10	0A781-7375	MINCOM SPEC	RES-FXD,FILM,33K OHM,1/2W,2% S	83-1520-7375	1.0
R11,R12,R13,R14,R15	0A781-7201	MINCOM SPEC	RES-FXD,FILM,1.8K OHM,1/2W,2% S	83-1520-7201	5.0
R16	0A781-7147	MINCOM SPEC	RES-FXD,FILM,4.7K OHM,1/2W,2% S	83-1520-7147	1.0
R17	0A818-1535	MINCOM SPEC	RES-VAR,CERMET,5K OHM, 1/2W S	83-1520-1535	1.0
R19,R22	79P R1MEG	BECKMAN	RES-VAR, FILM, 1 MEG OHM	83-1520-1421	2.0
R20,R23	79P R20K	BECKMAN	RES-VAR,FILM, 20 K. OHM	83-1520-1422	2.0
R24	0A781-7360	MINCOM SPEC	RES-FXD,FILM,2.2K OHM,1/2W,2% S	83-1520-7360	1.0
R26	0A781-7218	MINCOM SPEC	RES-FXD,FILM,680 OHM,1/2W,2% S	83-1520-7218	1.0
T1	TR-145 BV-35845	BEYER XMFR	XFMR-AUDIO FREQ,15 K HZ,80 OHM	83-1540-1284	1.0
1	23 059B091	D MINCOM	PC BD-PREAMP, OVERDUB	83-3640-1507	1.0
2	00000A667	B MINCOM	HANDLE-EJECTOR,P.C. BD,1.50 LG	83-3270-0371	1.0
3	79-022-094-0250	ESNA	PIN-SPRING, .094 DIA X .250 LG	83-7280-0270	1.0
4	7717-2	THERMALLOY	PAD-TSTR, INLINE, 3 LEADS	83-9690-0191	5.0
5	00000A734-7	B MINCOM	LABEL-IDENT,P.C. BD,#7 9#	83-3550-1452	1.0
6	23 059A092	MINCOM	BRKT-COMP,P.C. BD, PREAMP	83-3320-1974	1.0

PARTS LIST

PL 23059B090-1

REV E

TITLE PC 8D ASSY-PREAMP,OVDUB 7.5-15 CATALOG NO. 83-4930-2180

----- MATERIAL REQUIREMENTS -----

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFGR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
7	MS20470A2-3	MIL STD	RIVET-SOLID,UNIV. HD, 1/16 DIA	83-9260-3048	2.0

TITLE PC BD ASSY-PREAMP, OVERDUB 15/30 *79* CATALOG NO. 83-4930-2511

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
C1, C6	TSD4-20-226	COMP INC	CAP-FXD, TA, 22UF 20V 20%	83-1510-6203	2.0
C2	0A836-5096	MINCOM SPEC	CAP-FXD, MICA, 270PF 500V 5%	83-1510-5096	1.0
C3	TSD5-20-686	COMP INC	CAP-FXD, TA, 68UF 20V 20%	83-1510-6211	1.0
C4	TSD5-6-227	COMP INC	CAP-FXD, TA, 220UF 6V 20%	83-1510-6259	1.0
C5	E3XFR-103-1C	MIDWEC	CAP-FXD, PLSTIC, .010UF 100V 5%	83-1510-4449	1.0
C7, C8	E3FR-682-1C	MIDWEC	CAP-FXD, PLS .0068UF 100V 5%	83-1510-4447	2.0
C9, C10	TSD5-35-156	COMP INC	CAP-FXD, TA, 15UF 35V 20%	83-1510-6209	2.0
C11	0A836-5120	MINCOM SPEC	CAP-FXD, MICA, 500PF 500V 5%	83-1510-5120	1.0
K1	701-3	ELEC-TROL	RELAY-SPDT, 2K OHM 24VDC	83-1550-3620	1.0
K2	201-3	ELECTROL	RELAY-SPST, 2K OHM 24 V DC	83-1550-3621	1.0
L1	70F333AI	J.W. MILLER	CHOKE-RF, 3.3 MH 5 %	83-1540-0410	1.0
Q1, Q2	2N4384	SPRAGUE	TSTR-SI, NPN, SW, 40 VCB	83-1530-2156	2.0
Q3, Q4, Q5	2N3391A	GENERAL ELEC	TSTR-SI, NPN, PWR, 25 VCB	83-1530-2230	3.0
R1, R5	LITTLE DEVIL	OHMITE	RES-FXD, COMP, 1M OHM 1/2W 5%	83-9520-3220	2.0
R2	0A781-7344	MINCOM SPEC	RES-FXD, FILM, 120 OHM, 1/2W, 2% S	83-1520-7344	1.0
R3	0A781-7393	MINCOM	RES-FXD, FILM, 270K OHM, 1/2W, 2% S	83-1520-7393	1.0
R4	0A781-7350	MINCOM SPEC	RES-FXD, FILM, 330 OHM, 1/2W, 2% S	83-1520-7350	1.0
R6, R25	0A781-7373	MINCOM SPEC	RES-FXD, FILM, 27K OHM, 1/2W, 2% S	83-1520-7373	2.0
R7, R18, R21	0A781-7389	MINCOM SPEC	RES-FXD, FILM, 180K OHM, 1/2W, 2% S	83-1520-7389	3.0
R8	0A781-7174	MINCOM SPEC	RES-FXD, FILM, 390 OHM, 1/2W, 2% S	83-1520-7174	1.0
R9	0A781-7367	MINCOM SPEC	RES-FXD, FILM, 6.8K OHM, 1/2W, 2% S	83-1520-7367	1.0
R10	0A781-7375	MINCOM SPEC	RES-FXD, FILM, 33K OHM, 1/2W, 2% S	83-1520-7375	1.0
R11, R12, R15	0A781-7201	MINCOM SPEC	RES-FXD, FILM, 1.8K OHM, 1/2W, 2% S	83-1520-7201	3.0
R13, R14	0A781-7264	MINCOM SPEC	RES-FXD, FILM, 910 OHM, 1/2W, 2% S	83-1520-7264	2.0
R16	0A781-7147	MINCOM SPEC	RES-FXD, FILM, 4.7K OHM, 1/2W, 2% S	83-1520-7147	1.0
R17	0A818-1535	MINCOM SPEC	RES-VAR, CERMET, 5K OHM, 1/2W S	83-1520-1535	1.0
R19, R22	79P R1MEG	BECKMAN	RES-VAR, FILM, 1 MEG OHM	83-1520-1421	2.0
R20, R23	79P R20K	BECKMAN	RES-VAR, FILM, 20 K OHM	83-1520-1422	2.0
R24	0A781-7360	MINCOM SPEC	RES-FXD, FILM, 2.2K OHM, 1/2W, 2% S	83-1520-7360	1.0
R26	0A781-7218	MINCOM SPEC	RES-FXD, FILM, 680 OHM, 1/2W, 2% S	83-1520-7218	1.0
T1	TR-145 BV-35845	BEYER XMFR	XFMR-AUDIO FREQ, 15 K HZ, 80 OHM	83-1540-1284	1.0
1	230598091	D MINCOM	PC BD-PREAMP, OVERDUB	83-3640-1507	1.0
2	00000A667	B MINCOM	HANDLE-EJECTOR, P.C. BD, 1.50 LG	83-3270-0371	1.0
3	79-022-094-0250	ESNA	PIN-SPRING, .094 DIA X .250 LG	83-7280-0270	1.0
4	7717-2	THERMALLOY	PAD-TSTR, INLINE, 3 LEADS	83-9690-0191	5.0
5	00000A734-7	B MINCOM	LABEL-IDENT, P.C. BD, #7 9#	83-3550-1452	1.0

TITLE PC BD ASSY-PREAMP,OVERDUB15/30 CATALOG NO. 83-4930-2511

----- MATERIAL REQUIREMENTS -----

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
6	23.059A092	MINCOM	BRKT-COMP,P.C.BD,PREAMP	83-3320-1974	1.0
7	MS20470A2-3	MIL STD	RIVET-SOLID,UNIV. HD, 1/16 DIA	83-9260-3048	2.0

REV A

PL 23059A110

P A R T S L I S T

CATALOG NO. 83-4930-1746

TITLE P.C. RD ASSY-EXTENDER

--- MATERIAL REQUIREMENTS ---

REF. DES. OR FIND NO. DRAWING NUMBER MFGR NAME DESCRIPTION PH CATALOG NO. QTY.

REF. DES. OR FIND NO.	DRAWING NUMBER	MFGR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
1	23059A111	B MINCOM	P.C. BD-EXTENDER	83-3640-1139	1.0
2	2VK22S/1-2	VIKING	CONN-P.C., ELEC, PIERCD, 22 CON	83-1610-0845	1.0
3	MS35206-217	MIL STD	SCREW-MACH, PAN HD, 4-40 X 1/2	83-9260-4517	2.0
4			WASHER-FLAT, .219 OD X .125 ID	83-9261-4012	2.0
5	MS35338-40	MIL STD	WASHER-LOCK, SPLIT, HELICAL, #4	83-9261-4303	2.0
6	1434	BIRNBRACH	WIRE-BUS, 22GA ROUND	83-7910-0105	AR
7	TFT-200/22	ALPHA WIRE	TUBING-TEFLON, #22, .027 ID, NAT	83-7910-0388	AR

CATALOG NO. 83-5990-0812

TITLE REC-PROFESSIONAL AUDIO, UNIV

REF. DES. OR FIND NO. DRAWING NUMBER MFGR NAME DESCRIPTION PH CATALOG NO. QTY.

REF. DES. OR FIND NO.	DRAWING NUMBER	MFGR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
1	56000A020	C MINCOM	ASSY-2-16T, 7.5-15, 60HZ, NAB, M	83-5995-6008	AR
2	56000A025	C MINCOM	ASSY-2-16T, 15-30, 60HZ, NAB, M	83-5995-6010	AR
3	56000A001	C MINCOM	ASSY-2-16T, 7.5-15, 50HZ, NAB, M	83-5995-6000	AR
4	56000A003	C MINCOM	ASSY-2-16T, 15-30, 50HZ, NAB, M	83-5995-6002	AR

REV A

PL 56000A009

PARTS LIST

CATALOG NO. 83-5995-6014

ASSY-1-8T, 7.5-15, 50HZ, NAB, M

MATERIAL REQUIREMENTS

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
1	56013A300-2	A MINCOM	TRANS ASSY-1, 7.5-15, 50HZ	83-5920-1785	1.0
2	56017A250	A MINCOM	MODE CONTROL ASSY-REMOTE, 8 TRK	83-5920-1805	1.0
3	56028A000	B MINCOM	CONSOLE ASSY-LARGE MODULE	83-5920-1644	1.0
4	56028A900	C MINCOM	KIT-MOUNTING	83-5990-0834	1.0
5	56031A900	D MINCOM	KIT-PWR SUP, SIG ELECT	83-5990-0866	1.0
6	56038A100-2	C MINCOM	METER PANEL ASSY-8 TRACK	83-5920-1643	1.0
7	56059B100-2	C MINCOM	SIGNAL ELECT MODULE ASSY-8 TCK	83-5920-1760	1.0
8	56059A910	B MINCOM	KIT-SIG ELECT BDS, 7.5-15, 8 TCK	83-5990-0855	1.0
9	56119A200	B MINCOM	HD ASSY-SND, REC/REP, MAG ERASER	83-5950-1688	1.0

PARTS LIST

CATALOG NO. 83-5995-6015

TITLE ASSY-1-8T, 15,30,50HZ,NAB,M

REF. DES. OR FIND NO. DRAWING NUMBER MFGR NAME DESCRIPTION PH CATALOG NO. QTY.

REF. DES. OR FIND NO.	DRAWING NUMBER - MFGR PART NO.	MFGR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
1	56013A300-4	A MINCOM	TRANS ASSY-1, 15-30, 50HZ	83-5920-1787	1.0
2	56017A250	A MINCOM	MODE CONTROL ASSY-REMOTE, 8 TRK	83-5920-1805	1.0
3	56028A000	B MINCOM	CONSOLE ASSY-LARGE MODULE	83-5920-1644	1.0
4	56028A900	C MINCOM	KIT-MOUNTING	83-5990-0834	1.0
5	56031A900	D MINCOM	KIT-PWR SUP, SIG ELECT	83-5990-0866	1.0
6	56038A100-2	C MINCOM	METER PANEL ASSY-8 TRACK	83-5920-1643	1.0
7	56059B100-2	C MINCOM	SIGNAL ELECT MODULE ASSY-8 TCK	83-5920-1760	1.0
8	56059A915	A MINCOM	KIT-SIG ELEC BDS, 8T, 15-30,NAB	83-5990-0922	1.0
9	56119A200	B MINCOM	HD ASSY-SND, REC/REP, MAG ERASER	83-5950-1688	1.0

REV A

PL 56000A022

P A R T S L I S T

CATALOG NO. 83-5995-6012

ASSY-1-8T,7.5-15,60HZ,NAB,M

--- MATERIAL REQUIREMENTS ---

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH	CATALOG NO.	QTY.
1	56013A300-1	A MINCOM	TRANS ASSY-1, 7.5-15, 60HZ		83-5920-1784	1.0
2	56017A250	A MINCOM	MODE CONTROL ASSY-REMOTE, 8 TRK		83-5920-1805	1.0
3	56028A000	B MINCOM	CONSOLE ASSY-LARGE MODULE		83-5920-1644	1.0
4	56028A900	C MINCOM	KIT-MOUNTING		83-5990-0834	1.0
5	56031A900	D MINCOM	KIT-PWR SUP, SIG ELECT		83-5990-0866	1.0
6	56038A100-2	C MINCOM	METER PANEL ASSY-8 TRACK		83-5920-1643	1.0
7	56059B100-2	C MINCOM	SIGNAL ELECT MODULE ASSY-8 TCK		83-5920-1760	1.0
8	56059A910	B MINCOM	KIT-SIG ELECT BDS, 7.5-15, 8 TCK		83-5990-0855	1.0
9	56119A200	B MINCOM	HD ASSY-SND, REC/REP, MAG ERASER		83-5950-1688	1.0

PARTS LIST

CATALOG NO. 83-5995-6013

TITLE ASSY-1-8T,15-30,60HZ,NAB,M

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MATERIAL	REQUIREMENTS	DESCRIPTION	PH CATALOG NO.	QTY.
1	56013A300-3	A	MINCOM	TRANS ASSY-1, 15-30, 60HZ	83-5920-1786	1.0
2	56017A250	A	MINCOM	MODE CONTROL ASSY-REMOTE, 8 TRK	83-5920-1805	1.0
3	56028A000	B	MINCOM	CONSOLE ASSY-LARGE MODULE	83-5920-1644	1.0
4	56028A900	C	MINCOM	KIT-MOUNTING	83-5990-0834	1.0
5	56031A900	D	MINCOM	KIT-PWR SUP, SIG ELECT	83-5990-0866	1.0
6	56038A100-2	C	MINCOM	METER PANEL ASSY-8 TRACK	83-5920-1643	1.0
7	56059B100-2	C	MINCOM	SIGNAL ELECT MODULE ASSY-8 TCK	83-5920-1760	1.0
8	56059A915	A	MINCOM	KIT-SIG ELEC BDS, 8T, 15-30, NAB	83-5990-0922	1.0
9	56119A200	B	MINCOM	HD ASSY-SND, REC/REP, MAG ERASER	83-5950-1688	1.0

REV A

PL 56000A920

PARTS LIST

TITLE KIT-CVRSN,8-16 TRK,7.5-15 IPS CATALOG NO. 83-5990-1063

----- MATERIAL REQUIREMENTS -----

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
1	56119A000	C MINCOM	HD ASSY-SND REC/REP, MAG ERASER	83-5950-1366	1.0
2	56059A910	B MINCOM	KIT-SIG ELECT BDS, 7.5-15, 8 TCK	83-5990-0855	1.0

CATALOG NO. 83-5990-1064

TITLE KIT-CVRSN,8-16 TRK,15.30 IPS

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MATERIAL	REQUIREMENTS	DESCRIPTION	PH CATALOG NO.	QTY.
1	56119A000	C MINCOM		HD ASSY-SND REC/REP, MAG ERASER	83-5950-1366	1.0
2	56059A915	A MINCOM		KIT-SIG ELEC BDS,8T,15-30,NAB	83-5990-0922	1.0

REV B

PL 56004A010

PARTS LIST

CATALOG NO. 83-4240-0563

TITLE HUB ASSY-REEL,N.A.B., 2 INCH

----- MATERIAL REQUIREMENTS -----

REF. DES. OR FIND NO. DRAWING NUMBER MFGR NAME DESCRIPTION PH CATALOG NO. QTY.

1	56004A011	A	MINCOM	HUB-REEL, 2 INCH	83-3240-0564	1.0
2	31-S-062-050	A	STD PRSD STL	PIN-SPRING, .062 DIAx.500LG	83-7280-0159	1.0
3	56004A012	A	MINCOM	PIN-GUIDE REEL HUB, 2 INCH	83-3280-0768	1.0

CATALOG NO. 83-4930-2830

TITLE PC BD ASSY-DIRECTION SENSOR

----- MATERIAL REQUIREMENTS -----

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFGR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
P9	1-480277-0	AMP INC	SHELL-CONN,RECT, .850 WD X.905	83-1610-0930	1.0
S13,S14	MRR-2	HAMLIN	SWITCH-REED,MAGNETIC,28V 47OMA	83-1550-5259	2.0
1	23004B011	B MINCOM	P.C. 8D-DIRECTION SENSOR	83-3640-1035	1.0
2	60618-4	AMP INC	CONTACT-ELEC,PIN, .084 DIA	83-1610-0925	3.0
3	56004A022	A MINCOM	LABEL-I.D., ADHESIVE BACK	83-3550-1869	1.0
4		AUTOLITE	WIRE-TYPE B,22GA WHT NYLON JKT	83-7910-0180	AR

TITLE MOTOR ASSY-TAKE UP REEL CATALOG NO. 83-4560-0238

----- MATERIAL REQUIREMENTS -----

REF. DES. OR FIND NO. DRAWING NUMBER MFGR NAME DESCRIPTION PH CATALOG NO. QTY.

REF. DES. OR FIND NO.	DRAWING NUMBER	MFGR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
P9	1-480277-0	AMP INC	SHELL-CONN,RECT, .850 WD X.905	83-1610-0930	1.0
1	LFSS-10-1/3	MIN PREC BRG	BRG-BALL,ANL,R,PLAIN, .625 BORE	83-1230-0331	1.0
2	60618-4	AMP INC	CONTACT-ELEC,PIN, .084 DIA	83-1610-0925	4.0
3	56004A010	B MINCOM	HUB ASSY-REEL,N.A.B., 2 INCH	83-4240-0563	1.0
4	56004A102	A MINCOM	BRACKET-MOTOR MTG	83-3320-2150	1.0
5	56004A106	B MINCOM	TERM-LUG, MOD	83-3630-0600	2.0
6	56004A105	A MINCOM	INDICATOR-FLAG, DIR SENSOR	83-3550-1825	1.0
7	56004A101	A MINCOM	MOTOR-SPECIFICATION CONTROL	83-3560-0216	1.0
8	56004A020	B MINCOM	PC BD ASSY-DIRECTION SENSOR	83-4930-2825	1.0
9	MS35338-43	MIL STD	WASHER-LOCK,SPLIT,HELICAL,#10	83-9261-4307	4.0
10	MS16998-26	MIL STD	SCREW-CAP,SOC HD,10-32 X 3/8	83-9261-2100	2.0
11	MS51017-35	MIL STD	SETScrew-CUP PT,8-32 X 1/4	83-9261-0069	1.0
12	MS35338-40	MIL STD	WASHER-LOCK,SPLIT,HELICAL,#4	83-9261-4303	3.0
13	2342	H.H. SMITH	SPACER-SLV, RD, PLAIN, .500 LG	83-9350-0221	3.0
14	H-31	HAMLIN	MAGNET-PERMANENT, BAR,600-800	83-1190-0061	1.0
15	56004A104	B MINCOM	BRKT-PC BD MTG,DIR SENSOR	83-3320-2168	1.0
16	N4	RICHCO	CLAMP-LOOP,.250 DIA,NYLON	83-7650-0084	1.0
18	MS51964-80	MIL STD	SETScrew-HEX SOC,5/16-24 X 1/2	83-9261-4403	1.0
19	1711	GC ELECT	BUTTON-PLUG,SPR TENS .250 DIA	83-7270-0103	1.0
20	56004A103	MINCOM	ADAPTER-BRG, DIRECTION SENSOR Y	83-3210-0359	1.0

CATALOG NO. 83-4560-0224

TITLE MOTOR ASSY-SUPPLY REEL

REF. DES. OR FIND NO. --- MATERIAL REQUIREMENTS --- PH CATALOG NO. QTY.

DRAWING NUMBER MFGR NAME DESCRIPTION MFGR PART NO.

REF. DES. OR FIND NO.	DRAWING NUMBER	MFGR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
P7	1-480276-C	AMP INC	SHELL-CONN, RECT, .665 WD X.850	83-1610-0929	1.0
1	60618-4	AMP INC	CONTACT-ELEC, PIN, .084 DIA	83-1610-0925	4.0
2	1711	GC ELECT	BUTTON-PLUG, SPR TENS .250 DIA	83-7270-0103	1.0
3	56004A010	B MINCOM	HUB ASSY-REEL, N.A.B., 2 INCH	83-4240-0563	1.0
4	56004A102	A MINCOM	BRACKET-MOTOR MFG	83-3320-2150	1.0
5	56004A101	A MINCOM	MOTOR-SPECIFICATION CONTROL	83-3560-0216	1.0
6	MS51964-80	MIL STD	SETScrew-HEX SOC, 5/16-24 X 1/2	83-9261-4403	1.0
7	MS16998-26	MIL STD	SCREW-CAP, SOC HD, 10-32 X 3/8	83-9261-2100	2.0
8	MS35338-43	MIL STD	WASHER-LOCK, SPLIT, HELICAL, #10	83-9261-4307	4.0

TITLE PWR SUPPLY ASSY-2 IN TRANSPORT CATALOG NO. 83-4930-2642 3050

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
C65	CG23U50C1	MALLORY	CAP-FXD, ELECT, 2000UF 50V	83-1510-2206	1.0
C66	36D641F200AC2A	SPRAGUE	CAP-FXD, ELECT AL, 640 UF, 200VDC	83-1510-2268	1.0
F1	313005.	LITTELFUSE	FUSE-SLO-BLO, 125V 5 AMP	83-7550-8006	1.0
Q60	2N174	MOTOROLA	TSTR-GE, PNP, PWR, 80 VCB	83-1530-2001	1.0
TP1	4451-C-9	USECO	TERMINAL-FEEDTHRU, .094 LG	83-9630-0559	1.0
1	200512-3	AMP INC	SHELL-CONN, RECT, 26 POSITIONS	83-1610-0663	1.0
2	160-3	AMPHENOL	CONN-PLUG, ELEC, POWER, 2 PIN	83-1610-1107	1.0
3	342004	LITTELFUSE	FUSEHOLDER-POST, AG 3 FUSE	83-1620-0083	1.0
4	201924-1	AMP INC	CLIP-SPG TENS, POSITION LOCKING	83-1620-0127	1.0
5	212-42-01838	PLASTIGLIDE	BUSHING-ELEC COND, INSUL, NYLON	83-9630-0300	1.0
6	VR3	MALLORY	CLAMP-COMP MTG, 1.375 DIA	83-1650-0371	2.0
7	200389-4	AMP INC	PIN-GUIDE, CENTER, AMP SERIES M	83-7280-0196	1.0
8	23009A001	MINCOM	CHASSIS-TRANSPORT ELECT, MDL 23	83-3310-0830	1.0
9	RA853	THOMS & BETS	TERM-LUG, INSUL, R IG, .26WD	83-9630-0203	2.0
10	200390-4	AMP INC	RECP-GUIDE PIN, CENTER, SERIES M	83-7270-0302	1.0
12			NUT-HEX, SM PATT, 6-32 X .250 WD	83-9260-2202	9.0
13	MS35206-228	MIL STD	SCREW-MACH, PAN HD, 6-32 X 3/8	83-9260-4531	7.0
14	MS35206-230	MIL STD	SCREW-MACH, PAN HD, 6-32 X 1/2	83-9260-4533	2.0
15			WASHER-FLAT, SM PATT, #6	83-9261-4013	9.0
16	MS35338-41	MIL STD	WASHER-LOCK, SPLIT, #6	83-9261-4305	9.0
17	7274633	DELCO	KIT-TSTR MTG	83-1530-2016	1.0

TITLE PC BD ASSY-SENSOR,EOT,OUTGOING CATALOG NO. 83-4930-2832

REF. DES. OR FIND NO.	DRAWING NUMBER - MFGR PART NO.	MATERIAL	REQUIREMENTS	DESCRIPTION	PH CATALOG NO.	QTY.
Q61, Q62	2N3391	GENERAL ELEC	TSTR-SI, NPN, PWR, 25 VCB		83-1530-2226	2.0
R71	LITTLE DEVIL	OHMITE	RES-FXD, COMP, 4.7K OHM 1/4W 5%		83-9520-2111	1.0
R72	LITTLE DEVIL	OHMITE	RES-FXD, COMP, 12K OHM 1/4W 5%		83-9520-2159	1.0
R73	3329H-1-104	BOURNS	RES-VAR, 1 TURN, 100K OHM, 1/2W		83-1520-1553	1.0
1	56013A076	MINCOM	PC BD-SENSOR, EOT, OUTGOING		83-3640-1773	1.0

TITLE TRANS ASSY-2-1 IN,60HZ,7.5-15 CATALOG NO. 83-5920-1779

----- MATERIAL REQUIREMENTS -----

REF.	DES.	OK	FIND	NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
1					56004A100	B MINCOM	MOTOR ASSY-TAKE UP REEL	83-4560-0215	1.0
2					56004A150	B MINCOM	MOTOR ASSY-SUPPLY REEL	83-4560-0224	1.0
3					56013B160	B MINCOM	PC BD ASSY-LOGIC 2 INCH	83-4930-2792	1.0
4					56013A170	D MINCOM	CONT ASSY-CAPSTAN, START-STOP	83-4930-2641	1.0
5					56013B180	C MINCOM	CHASSIS ASSY-WRAP AROUND, 2 IN	83-5920-1778	1.0
6					56013A900	D MINCOM	KIT-CAPSTAN AREA PARTS, 2 INCH	83-5990-0857	1.0
7					56C13B990	A MINCOM	KIT-COMMON PARTS, TAPE TRANSPT	83-5990-1019	1.0
8					56013A910-4	A MINCOM	KIT-SPEED, 7 1/2-15, 60 HZ	83-5990-0935	1.0
9					56013A130	A MINCOM	SUPPR ASSY-ARC, TORQUE MOTOR	83-4550-3727	1.0

CATALOG NO. 83-5920-1780

TRANS ASSY-2-1 IN, 50 HZ, 7.5-15

TITLE

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
1	56004A100	B MINCOM	MOTOR ASSY-TAKE UP REEL	83-4560-0215	1.0
2	56004A150	B MINCOM	MOTOR ASSY-SUPPLY REEL	83-4560-0224	1.0
3	56013B160	B MINCOM	PC BD ASSY-LOGIC 2 INCH	83-4930-2792	1.0
4	56013A170	D MINCOM	CONT ASSY-CAPSTAN, START-STOP	83-4930-2641	1.0
5	56013B180	C MINCOM	CHASSIS ASSY-WRAP ARJUND, 2 IN	83-5920-1778	1.0
6	56013A900	D MINCOM	KIT-CAPSTAN AREA PARTS, 2 INCH	83-5990-0857	1.0
7	56C13B590	A MINCOM	KIT-COMMON PARTS, TAPE TRANSPT	83-5990-1019	1.0
8	56013A910-2	A MINCOM	KIT-SPEED, 7 1/2-15, 50 HZ	83-5990-0859	1.0
9	56013A130	A MINCOM	SUPPR ASSY-ARC, TORQUE MOTOR	83-4550-3727	1.0

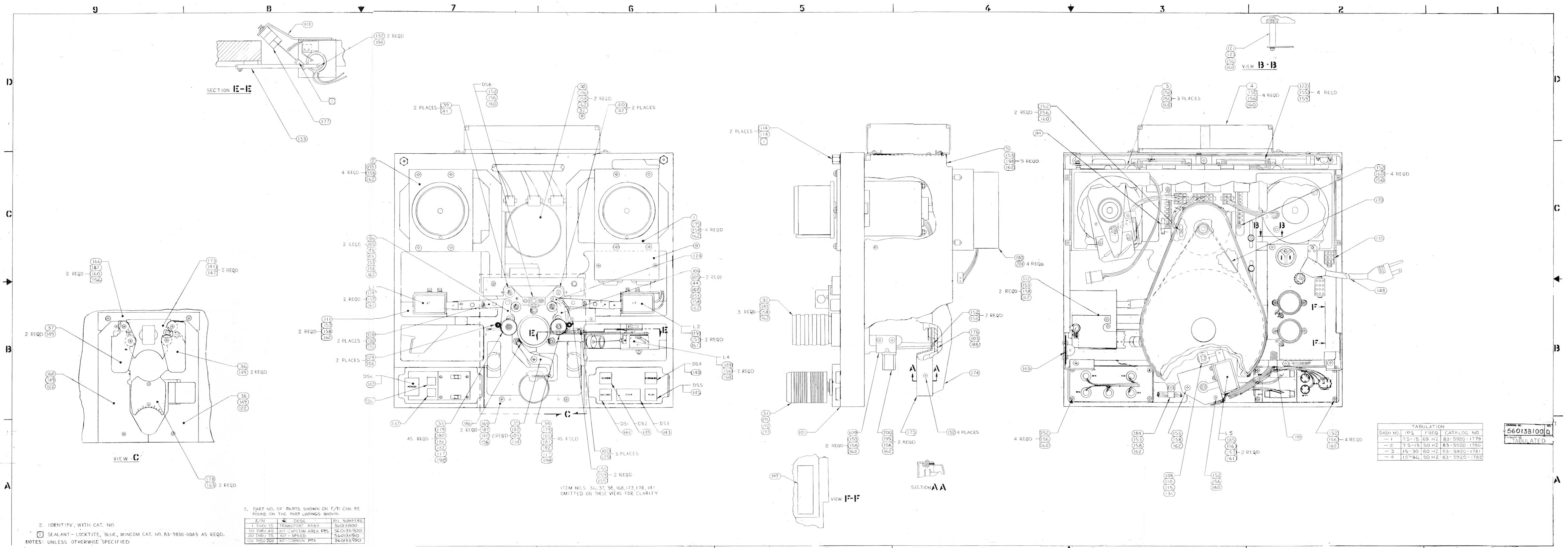
TITLE TRANS ASSY-2-1 IN,60 HZ,15-30 CATALOG NO. 83-5920-1781

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR. PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
1	56004A100	B MINCOM	MOTOR ASSY-TAKE UP REEL	83-4560-0215	1.0
2	56004A150	B MINCOM	MOTOR ASSY-SUPPLY REEL	83-4560-0224	1.0
3	56013B160	B MINCOM	PC BD ASSY-LOGIC 2 INCH	83-4930-2792	1.0
4	56013A170	D MINCOM	CONT ASSY-CAPSTAN, START-STOP	83-4930-2641	1.0
5	56013B180	C MINCOM	CHASSIS ASSY-WRAP AROUND, 2 IN	83-5920-1778	1.0
6	56013A900	D MINCOM	KIT-CAPSTAN AREA PARTS, 2 INCH	83-5990-0857	1.0
7	56013B990	A MINCOM	KIT-COMMON PARTS, TAPE TRANSPT	83-5990-1019	1.0
8	56013A910	A MINCOM	KIT-SPEED, 15-30, 60 HZ	83-5990-0858	1.0
9	56013A130	A MINCOM	SUPPR ASSY-ARC, TORQUE MOTOR	83-4550-3727	1.0

CATALOG NO. 83-5920-1782

TITLE TRANS ASSY-2-1 IN,50 HZ,15-30

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
1	56004A100	B MINCOM	MOTOR ASSY-TAKE UP REEL	83-4560-0215	1.0
2	56004A150	B MINCOM	MOTOR ASSY-SUPPLY REEL	83-4560-0224	1.0
3	56013B160	B MINCOM	PC BD ASSY-LOGIC 2 INCH	83-4930-2792	1.0
4	56013A170	D MINCOM	CONT ASSY-CAPSTAN, START-STOP	83-4930-2641	1.0
5	56013B180	C MINCOM	CHASSIS ASSY-WRAP ARJUND, 2 IN	83-5920-1778	1.0
6	56013A900	D MINCOM	KIT-CAPSTAN AREA PARTS, 2 INCH	83-5990-0857	1.0
7	56013B990	A MINCOM	KIT-COMMON PARTS, TAPE TRANSPT	83-5990-1019	1.0
8	56013A910-3	A MINCOM	KIT-SPEED, 15-30, 50 HZ	83-5990-0860	1.0
9	56013A130	A MINCOM	SUPPR ASSY-ARC, TORQUE MOTOR	83-4550-3727	1.0



TABULATION

DASH NO.	IPS	FREQ	CATALOG NO.
- 1	7.5-15	60 HZ	83-5920-1779
- 2	7.5-15	50 HZ	83-5920-1780
- 3	15-30	60 HZ	83-5920-1781
- 4	15-30	50 HZ	83-5920-1782

560138100D
 UNCONTROLLED

3. PART NO. OF PARTS SHOWN ON F/D CAN BE FOUND ON THE PART LISTINGS SHOWN.

P/N	DESC.	P/L NUMBERS
1 THRU 15	TRANSPORT ASSY	560138100
30 THRU 45	KIT - CAPSTAN AREA P.TS.	560138100
50 THRU 75	KIT - SPEED	560138100
100 THRU 201	KIT - COMMON P.TS.	560138100

2. IDENTIFY, WITH CAT. NO.
 SEALANT - LOCKTITE, BLUE, MINCOM CAT. NO. 83-9830-0043 AS REQD.
 NOTES: UNLESS OTHERWISE SPECIFIED

ITEM NO. 5 36, 37, 38, 168, 173, 178, 141
 OMITTED ON THESE VIEWS FOR CLARITY

Tape Transport Assembly

REV A

PL 56013A130

PARTS LIST

CATALOG NO. 83-4550-3727

SUPPR ASSY-ARC, TORQUE MOTOR

TITLE

REF.	DES. OR FIND NO.	DRAWING NUMBER - MEGR PART NO.	MFGR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
AJ7		1-480273-C	AMP INC	SHELL-CONN, RECT, .565 WDX.65	83-1610-0923	1.0
AJ9		1-480274-0	AMP INC	SHELL-CONN, RECT, .65 WD X.805	83-1610-0924	1.0
AP7		1-480276-0	AMP INC	SHELL-CONN, RECT, .665 WD X.850	83-1610-0929	1.0
AP9		1-480277-C	AMP INC	SHELL-CONN, RECT, .850 WD X.905	83-1610-0930	1.0
CI,C2		TYPE P123ZNP	AEROVOX	CAP-FXD,PAPER .47UF 400V 20%	83-1510-4072	2.0
CR1,CR2		IN4004	MOTROLA	RECT -SI, DIF JCT, 400PIV 1 AMP	83-1530-0151	2.0
Q1,Q2		DTS-411	DELCO RADIO	TSTR-SI,NPN,PWR, 300 V	83-1530-2402	2.0
R1,R2		0A781-7348	MINCOM SPEC	RES-FXD,FILM,270 OHM,1/2W,2% S	83-1520-7348	2.0
R3,R4		0A781-7327	MINCOM SPEC	RES-FXD,FILM,18 OHM,1/2W,2% S	83-1520-7327	2.0
1		56013A994	A MINCOM	BRACKET-ARC SUPPRESSOR	83-3320-2312	1.0
2		725	H.H. SMITH	CLAMP-LOOP,.125 CABLE,NYLON	83-7650-0100	1.0
3		60618-4	AMP INC	CONTACT-ELEC, PIN, .084 DIA	83-1610-0925	11.0
4		60510-4	AMP INC	CONTACT-ELEC, SOC, 18-22GA SIZE	83-1610-0927	11.0
5		2010	CINCH-JONES	TERM STRIP-10 TERM POSITIONS	83-1640-1611	1.0
6		124-5	ZIERICK	TERM STRIP-ENDING,.156 WD	83-9630-0212	2.0
7			NATL WIRE	WIRE-TYPE B,22GA WHT NYLON JKT	83-7910-0043	AR

TITLE HARNESS ASSY-2 IN, TAPE TRANSPORT CATALOG NO. 83-4570-0722

REF. DES. OR FIND NO. DRAWING NUMBER MFRGR NAME DESCRIPTION PH CATALOG NO. QTY.

REF. DES. OR FIND NO.	DRAWING NUMBER - MFRGR PART NO.	MFRGR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
J2, J4	1-480275-0	AMP INC	SHELL-COMM, RECT, .650 WDX1.045	83-1610-0932	2.0
J5, J6	2VK180/1-2	VIKING	CONN-P.C., ELEC, PIERCD, 36 CON	83-1610-0782	2.0
J7, J13	1-480273-0	AMP INC	SHELL-COMM, RECT, .565 WDX.65	83-1610-0923	2.0
J8	1-480323-0	AMP INC	SHELL-COMM, RECT, .650WDX1.280	83-1610-0934	1.0
J9	1-480274-0	AMP INC	SHELL-COMM, RECT, .65 WD X.805	83-1610-0924	1.0
J11	1-480305-0	AMP INC	SHELL-COMM, RECT, 3 POS	83-1610-1142	1.0
P11	1-480304-0	AMP INC	SHELL-COMM, RECT, 3 POSITION	83-1610-1137	1.0
S1, S2, S3, S4, S5	1093	PENDAR	SW-PUSH, SPDT, 30V, 2 AMP	83-1550-5467	5.0
S6		LIKON	SWITCH-ALTERNATE ACT, ILLUM	83-1550-5231	1.0
S7	SS-34	STACKPOLE	SW-SLIDE, TPDT, 6 VAC	83-1550-5507	1.0
S8	TYPE SS12	STACKPOLE	SWITCH-SLIDE, 4PDT	83-1550-5230	1.0
S10, S11	513-0101-604	DIALCO	SWITCH-MOMENTARY, MAKE	83-1550-5233	2.0
TB1, TB2	3006	H.H. SMITH	TERM BD-2.250 BETWEEN MTG HOLE	83-1640-0588	2.0
1	42991-1	4 AMP INC	SOCKET-CONTACT, CONN, SIZE 16	83-1610-0689	8.0
2	G58134C	THOM & BETTS	FERRULE-RF CABLE GND .134ID	83-9690-0020	2.0
3	G5C194C	THOMAS&BETTS	FERRULE-RF CABLE GROUNDING	83-9690-0118	2.0
4	60510-4	AMP INC	CONTACT-ELEC, SOC, 18-22GA SIZE	83-1610-0927	53.0
10	23013A017	B MINCOM	CHASSIS-SWITCH MTG, TRANSPORT	83-3310-0708	1.0
11	23013A016	C MINCOM	PLATE-SWITCH MTG, TRANSPORT	83-3320-1115	1.0
12	SE-44 BRASS	UNITED SHOE	EYELET-BRASS, FLANGED, .112X.121	83-7290-0091	4.0
13		NATL WIRE	WIRE-TYPE B, 20GA WHT NYLON JKT	83-7910-0035	AR
14		NATL WIRE	WIRE-TYPE B, 20GA BLK NYLON JKT	83-7910-0039	AR
15		NATL WIRE	WIRE-TYPE B, 22GA WHT NYLON JKT	83-7910-0043	AR
16		NATL WIRE	WIRE-TYPE B, 22GA WHT NYLON JKT	83-7910-0052	AR
17		THERMAX	WIRE-TYPE C, 22GA WHT TEFLN JKT	83-7910-0476	AR
18	#EXE-22-122	THERMAX	WIRE-TYPE C, 20GA WHT TEFLN JKT	83-7910-0496	AR
19	#EXE-20-120	AMP INC	CONTACT-ELEC, SOC, 16 SIZE	83-1610-0678	13.0
20	42993-1	THOM & BETTS	SPLICE-CONDUCTOR, BUTT TYPE	83-9630-0382	4.0
21	RAA-217	THOM & BETTS	TERM-LUG, INSULR IG, .26WD	83-9630-0203	2.0
22	RA853	THOM & BETTS	LUG-TERMINAL SOLDERLS, RING, #10	83-9630-0205	4.0
23	RA873	THOM & BETTS	TERM-LUG, INSULR IG, .31WD	83-9630-0206	2.0
24	MS35206-227	MIL STD	SCREW-MACH, PAN HD, 6-32 X 5/16	83-9260-4530	4.0
25	MS35338-41	MIL STD	WASHER-LOCK, SPLIT, #6	83-9261-4305	4.0
26			WASHER-FLAT, SM PATT, #6	83-9261-4013	2.0
28			NUT-PLAIN, HEX, 5/8-24, 3/32 THK	83-9260-0064	1.0
29			WASHER-FLT, GP, .625 ID X.810 OD	83-9261-4378	1.0

--- MATERIAL REQUIREMENTS ---

REF. DES. OR FIND NO. DRAWING NUMBER MFR NAME DESCRIPTION PH CATALOG NO. QTY.

C1	TC3501	MALLORY	CAP-FXD,ELECT, 100UF 50V	83-1510-2045	1.0
C2	E3F-334-1C	MIDWEC	CAP-FXD, PLSTC, .33 UF 100V 5%	83-1510-4437	1.0
C3	977-163	GEN INSTR	CAP-FXD,ELECT, 500UF 25V	83-1510-2044	1.0
C4	TYPE P123ZNP	AEROVOX	CAP-FXD,PAPER .47UF 400V 20%	83-1510-4072	1.0
C5,C6	TC-55A	MALLORY	CAP-FXD,ELECT, 20 UF, 250 WVDC	83-1510-2292	2.0
C7	TSD5-20-686	COMP INC	CAP-FXD,TA, 68UF 20V 20%	83-1510-6211	1.0
C8,C9	TYPE P123ZNP	AEROVOX	CAP-FXD,PAPER, .01UF 200V 25%	83-1510-4046	2.0
C10	DM20F-912J	ARCO	CAP-FXD,MICA,9100 PF,100 V,5%	83-1510-5219	1.0
C11	313-M	ARCO	CAP-VAR,MICA,1000-2155PF 500V	83-1510-5001	1.0
C12	00000A706	A MINCOM	CAP-SELECTED VALUES,FM BD #2	83-3510-5360	1.0
C13,C14	TSD5-35-156	CGMP INC	CAP-FXD, TA, 15UF 35V 20%	83-1510-6209	2.0
CR1,CR3,CR4,CR6,CR7,CR8,CR9,CR13,CR14,CR15,CR16,CR17,CR18,CR19,CR20,CR21,CR24,CR25,CR26,CR27,CR28,CR29,CR30,CR31,CR32,CR41,CR54,CR55	IN4004	MOTOROLA	RECT -SI,DIF JCT,400PIV 1 AMP	83-1530-0151	28.0

CR37,CR38,CR39,CR40	IN5403	WESTINGHOUSE	RECT-SI, 3 AMPS, 300 V	83-1530-0460	4.0
CR46,CR47,CR48,CR49	IN4723	MOTOROLA	RECT-SI, 3 AMPS, 600 V	83-1530-0464	4.0
CR50,CR51	IN4750A	MOTOROLA	DIODE-SI,ZENER, 27 V, 1 W, 5%	83-1530-0439	2.0
CR52,CR53	IN3324	MOTOROLA	DIODE-SI,ZENER,30V,50W,20%	83-1530-0463	2.0

F2	313005.	LITTELFUSE	FUSE-SLO-BLO,125V 5 AMP	83-7550-8006	1.0
F3	313003.	LITTELFUSE	FUSE-3 AMP, SLO-BLO, 3AG	83-7550-8000	1.0

J12	1-480323-0	AMP INC	SHELL-CONN,RECT, .650WDXL.280	83-1610-0934	1.0
K1,K2,K3,K4,K5,K6,K7,K8	KHP17D12-24	POT & BRUMFD	RELAY-4PDT, 24 VDC 650 OHM	83-1550-3678	8.0

Q1,Q2,Q3	2N3053	R.C.A.	I STR-SI,NPN, PWR, 60 VCB	83-1530-2180	3.0
Q4	2N3405	G.E.	I STR-SI,NPN,GEN PUR,50VCE	83-1530-2232	1.0

R1	0A781-7331	MINCOM SPEC	RES-FXD,FILM,27 OHM,1/2W,2% S	83-1520-7331	1.0
R5	0A781-7221	MINCOM SPEC	RES-FXD,FILM,100 OHM,1/2W,2% S	83-1520-7221	1.0
R6	I720	OHMITE	RES-FXD, WW,100 OHM 10W 5%	83-1520-8253	1.0
R8	0368	OHMITE	RES-ADJ,WW,100 OHM 25 W 10%	83-1520-8635	1.0
R9	I717	OHMITE	RES-FXD,WW, 40 OHM 10W 5%	83-1520-8292	1.0
R10	LITTLE DEVIL	OHMITE	RES-FXD,COMP, 47 OHM 1W 5%	83-9520-4124	1.0
R14	LITTLE DEVIL	OHMITE	RES-FXD,COMP,1.2K OHM 1W 5%	83-9520-4153	1.0
R15	0A781-7355	MINCOM SPEC	RES-FXD,FILM,560 OHM,1/2W,2% S	83-1520-7355	1.0
R16	LITTLE DEVIL	OHMITE	RES-FXD,COMP, 47 OHM 1W 5%	83-9520-4124	1.0
R17,R18	0A781-7337	MINCOM SPEC	RES-FXD,FILM,47 OHM,1/2W,2% S	83-1520-7337	2.0

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MATERIAL	REQUIREMENTS	DESCRIPTION	PH CATALOG NO.	QTY.
R19, R20	0A781-7147	MINCOM SPEC	RES-FXD, FILM, 4.7K OHM, 1/2W, 2%		83-1520-7147	2.0
R21, R22	0A781-7375	MINCOM SPEC	RES-FXD, FILM, 33K OHM, 1/2W, 2% S		83-1520-7375	2.0
R23	LITTLE DEVIL	OHMITE	RES-FXD, COMP, 2.7 OHM 1W 5%		83-9520-4000	1.0
R24	0A781-7372	MINCOM SPEC	RES-FXD, FILM, 22K OHM, 1/2W, 2% S		83-1520-7372	1.0
T1	00000A721	B MINCOM	XFMR-TORROIDAL, ARNOLD CORE		83-3540-1153	1.0
1	9KH-2	POTTR & BRUM	SOCKET-RELAY, 14 PIN		83-1620-0184	8.0
2	56013B162	A MINCOM	PC BD-TRANS LOGIC		83-3640-1759	1.0
3			NUT-HEX, SM PATT, 6-32 X .250 WD		83-9260-2202	4.0
4			SCREW-MACH, PAN HD, 6-32 X 2 1/4		83-9260-4594	2.0
5			WASHER-FLAT, SM PATT, #6		83-9261-4013	8.0
6	MS35338-41	MIL STD	WASHER-LOCK, SPLIT, #6		83-9261-4305	7.0
7			SCREW-MACH, PAN HD, 6-32 X 2 1/2		83-9260-4600	1.0
8	#EXE-22-122	THERMAX	WIRE-TYPE C, 22GA WHT TEFLN JKT		83-7910-0476	AR
9	KHP	POTTER/BRUMF	SPG-HOLD DOWN, RELAY		83-1280-0571	8.0
10	MS35206-227	MIL STD	SCREW-MACH, PAN HD, 6-32 X 5/16		83-9260-4530	3.0
11	8070-E	LERCO	SPACER-SLV, HEX, TAP, .500 LG		83-9350-0063	3.0
12	4405	BUSSMANN MFG	FUSEHOLDER-BLOCK, AG 3 FUSE		83-1620-0001	2.0
13	MS35206-215	MIL STD	SCREW-MACH, PAN HD, 4-40 X 3/8		83-9260-4515	2.0
14			WASHER-FLAT, .219 OD X .125 ID		83-9261-4012	4.0
15	MS35338-4C	MIL STD	WASHER-LOCK, SPLIT, HELICAL, #4		83-9261-4303	2.0
16	56013A163	A MINCOM	HEAT SINK-0014 CONFIG MTG		83-3690-0379	2.0
17			NUT-HEX, SM PATT, 4-40 X .188 WD		83-9260-2201	2.0
18	10160-DAP	MILTON ROSS	PAD-TRANSISTOR, FOR T0-5 CASES		83-9690-0145	1.0
20	60510-4	AMP INC	CONTACT-ELEC, SOC, 18-22GA SIZE		83-1610-0927	6.0
21	#772	HH SMITH	CLAMP-STRAIN, .188 ID		83-7650-0101	1.0
22	7856	WALSCO	INSULATOR-WASHER, .140 ID		83-9630-0036	4.0
23	2150	H.H. SMITH	WASHER-FIBER, EXTRUDED, #6 SCRW		83-9630-0254	2.0

REV D

PL 56013A170

PARTS LIST

CATALOG NO. 83-4930-2641

CONT ASSY-CAPSTAN, START-STOP

TITLE

----- MATERIALS -----

REF. DES. OR FIND NO. DRAWING NUMBER MFR NAME DESCRIPTION PH CATALOG NO. QTY.

C101 36D641F200AC2A SPRAGUE CAP-FXD, ELECT AL, 640 UF, 200VDC 83-1510-2268 1.0
C102 BR250-50 CORNELL DUBL CAP-FXD, ELECT, 250UF 50V 83-1510-2031 1.0
C103 P123ZNP AEROVOX CAP-FXD, PAPER, .10UF, 400V, 20% 83-1510-4056 1.0
CR101 MR1033A MOTOROLA RECT-SI, 300 PRV, 3.0 AMP 83-1530-0364 1.0
CR102, CR103 IN4004 MOTOROLA RECT -SI, DIF JCT, 400PIV 1 AMP 83-1530-0151 2.0

K101 KHP17D12-24 POT & BRUMFD RELAY-4PDT, 24 VDC 650 OHM 83-1550-3678 1.0
P12 1-480324-C AMP INC SHELL-CONN, RECT, 15POSITION 83-1610-0933 1.0
P13 1-480276-C AMP INC SHELL-CONN, RECT, .665 WD X.850 83-1610-0929 1.0

R101 RH-50 DALE PROD RES-FXD, WW, 50 OHM, 50 W, 3% 83-1520-7531 1.0
R102 4623 OHMITE RES-FXD, WW, 1 K OHM 5W 5% 83-1520-8201 1.0
R103 LITTLE DEVIL OHMITE RESISTOR-CAR, 100 OHM 1 W 5% 83-9520-4090 1.0

T60 23009A004 A MINCOM XFMR-POWER, TRANSPORT ELECT 83-3540-1141 1.0

1 9KH1 POT-BRUM SOCKET-RELAY, 14-CONT 83-1620-0108 1.0
2 23013B781 A MINCOM CHASSIS-TORQUE CONTROL 83-3310-1440 1.0
3 VR3 MALLORY CLAMP-COMP MTG, 1.375 DIA 83-1650-0371 1.0
4 60618-4 AMP INC CONTACT-ELEC, PIN, .084 DIA 83-1610-0925 13.0
5 3006 H.H. SMITH TERM BD-2.250 BETWEEN MTG HOLE 83-1640-0588 2.0
6 SR-6P-1 HEYMAN MFG BUSHING-STR REL, CABLE, STR PNL 83-1690-0158 1.0
7 #EXE-20-120 THERMAX WIRE-TYPE C, 20GA WHT TEFLN JKT 83-7910-0496 AR
8 #EXE-22-122 THERMAX WIRE-TYPE C, 22GA WHT TEFLN JKT 83-7910-0476 AR
9 NATL WIRE WIRE-TYPE B, 22GA WHT NYLON JKT 83-7910-0043 AR

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH	CATALOG NO.	QTY.
C67	TYPE P123ZNP	AEROVOX	CAP-FXD,PAPER .47UF 400V 20%		83-1510-4072	1.0
R60	RH.50	DALE PROD	RES-FXD, WW, PWR, 7 OHM 50W 3%		83-1520-7775	1.0
R61,R62	0568B	OHMITE	RES-ADJ, WW, 300 OHM 50W 10%		83-1520-8311	2.0
R63	RH-50	DALE PRODUCT	RES-FXD, WW, 75 OHM 50W 3%		83-1520-7597	1.0
S12	MS24547-1	MIL STD	SWITCH-BASIC, SPDT, 28VDC, 7 AMP		83-1550-5067	1.0
1	JX-40	MICRO SWITCH	ACTUATOR-SWITCH, SPG LEAF TYPE		83-1550-5068	1.0
3	3-11	LEECRAFT	LAMPHOLDER-NE-51, NEON, .593 DIA		83-1620-0180	1.0
4	23007A007	B MINCOM	BRACKET-SWITCH MTG, DOOR		83-3320-1158	1.0
5	23013A034-2	A MINCOM	SUPPORT-TAPE DECK, TRANSPORT		83-3340-0692	1.0
6	56013B150	B MINCOM	HARN ASSY-2 IN TAPE TRANSPORT		83-4570-0794	1.0
7	#772	HH SMITH	CLAMP-STRAIN, .188 ID		83-7650-0101	1.0
8	56013A075	A MINCOM	PC BD ASSY-SENSOR, EOT, OUTGOING		83-4930-2832	1.0
9	56009A100	C MINCOM	PWR SUPPLY ASSY-2 IN TRANSPORT		83-4930-2642	1.0
10	MS35338-40	MIL STD	WASHER-FLAT, SM PATT, #6		83-9261-4013	6.0
11	MS35338-41	MIL STD	WASHER-LOCK, SPLIT, HELICAL, #4		83-9261-4303	4.0
12		MIL STD	WASHER-LOCK, SPLIT, #6		83-9261-4305	6.0

REV A

PL 56013A190

PARTS LIST

CATALOG NO. 83-4560-0244

TITLE FAN ASSY-AUXILIARY

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MATERIAL	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
B1, B2 BP1	REL48 1-480305-0		ROTRON AMP INC	FAN-TUREAXIAL, 115 V, 100 CFM SHELL-CONN, RECT, 3 POS	83-1560-0104 83-1610-1142	2.0 1.0
1	56013A992	A	MINCOM	BRKT-FAN, TRANSPORT VENTILATION	83-3320-2310	1.0
2	60618-4	A	AMP INC	CONTACT-ELEC, PIN, .084 DIA	83-1610-0925	2.0
3	725		H.H. SMITH	CLAMP-LOOP, .125 CABLE, NYLON	83-7650-0100	1.0
4	23013A081	A	MINCOM	SHIELD-MOTOR, FAN	83-3650-0562	2.0
5			NATL WIRE	WIRE-TYPE B, 22GA WHT NYLON JKT	83-7910-0043	AR
6	00000A662-1	C	MINCOM	LABEL-IDENT, ASSY	83-3550-1276	1.0

CATALOG NO. 83-5920-1784

TITLE TRANS ASSY-1, 7.5-15, 60HZ

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	REQUIREMENTS	DESCRIPTION	PH CATALOG NO.	QTY.
	56013A910-4	A MINCOM		KIT-SPEED, 7 1/2-15, 60 HZ	83-5990-0935	1.0
	56013B990	A MINCOM		KIT-COMMON PARTS, TAPE TRANSP	83-5990-1019	1.0
4	56013A920	A MINCOM		KIT-CAPSTAN AREA PARTS, 1 INCH	83-5990-1027	1.0
5	56004A110	B MINCOM		MOTOR ASSY-TAKE UP REEL, 1 INCH	83-4560-0256	1.0
6	56004A120	B MINCOM		MOTOR ASSY-SUPPLY REEL, 1 INCH	83-4560-0255	1.0
7	56013B160	B MINCOM		PC BD ASSY-LOGIC 2 INCH	83-4930-2792	1.0
8	56013A170	D MINCOM		CONT ASSY-CAPSTAN, START-STOP	83-4930-2641	1.0
9	56013B180	C MINCOM		CHASSIS ASSY-WRAP AROUND, 2 IN	83-5920-1778	1.0
10	56013A130	A MINCOM		SUPPR ASSY-ARC, TORQUE MOTOR	83-4550-3727	1.0
11	56004A030	A MINCOM		HUB ASSY-REEL, 1 IN TAPE, NAB	83-4240-0647	2.0
11	MS51964-78	MIL STD		SETScrew-HEX, CUP, 5/16-24X1/4LG	83-9261-4415	2.0
12	MS16998-26	MIL STD		SCREW-CAP, SOC HD, 10-32 X 3/8	83-9261-2100	4.0

PARTS LIST

CATALOG NO. 83-5920-1785

TITLE TRANS ASSY-1, 7.5-15, 50HZ

----- MATERIAL REQUIREMENTS -----

REF. DES. OR FIND NO. DRAWING NUMBER MFR NAME DESCRIPTION PH CATALOG NO. QTY.

REF. DES. OR FIND NO.	DRAWING NUMBER	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
	- MFR PART NO.				
	56013A910-2	A MINCOM	KIT-SPEED, 7 1/2-15, 50 HZ	83-5990-0859	1.0
	56C13B990	A MINCOM	KIT-COMMON PARTS, TAPE TRANSP	83-5990-1019	1.0
	56013A920	A MINCOM	KIT-CAPSTAN AREA PARTS, 1 INCH	83-5990-1027	1.0
4	56004A110	B MINCOM	MOTOR ASSY-TAKE UP REEL, 1 INCH	83-4560-0256	1.0
5	56004A120	B MINCOM	MOTOR ASSY-SUPPLY REEL, 1 INCH	83-4560-0255	1.0
6	56013B160	B MINCOM	PC BD ASSY-LOGIC 2 INCH	83-4930-2792	1.0
7	56013A170	D MINCOM	CONT ASSY-CAPSTAN, START-STOP	83-4930-2641	1.0
8	56013B180	C MINCOM	CHASSIS ASSY-WRAP AROUND, 2 IN	83-5920-1778	1.0
9	56013A130	A MINCOM	SUPPR ASSY-ARC, TORQUE MOTOR	83-4550-3727	1.0
10	56004A030	A MINCOM	HUB ASSY-REEL, 1 IN TAPE, NAB	83-4240-0647	2.0
11	MS51964-78	MIL STD	SETScrew-HEX, CUP, 5/16-24X1/4LG	83-9261-4415	2.0
12	MS16998-26	MIL STD	SCREW-CAP, SOC HD, 10-32 X 3/8	83-9261-2100	4.0

CATALOG NO. 83-5920-1786

TRANS ASSY-1, 15-30, 60HZ

REF.	DES. OR FIND NO.	DRAWING NUMBER - MEGR PART NO.	MFGR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
		56013A910-1	A MINCOM	KIT-SPEED, 15-30, 60 HZ	83-5990-0858	1.0
		56013B990	A MINCOM	KIT-COMMON PARTS, TAPE TRANSP	83-5990-1019	1.0
4		56013A920	A MINCOM	KIT-CAPSTAN AREA PARTS, 1 INCH	83-5990-1027	1.0
5		56004A110	B MINCOM	MOTOR ASSY-TAKE UP REEL, 1 INCH	83-4560-0256	1.0
6		56004A120	B MINCOM	MOTOR ASSY-SUPPLY REEL, 1 INCH	83-4560-0255	1.0
7		56013B160	D MINCOM	PC BD ASSY-LOGIC 2 INCH	83-4930-2792	1.0
8		56013A170	D MINCOM	CONT ASSY-CAPSTAN, START-STOP	83-4930-2641	1.0
9		56013B180	C MINCOM	CHASSIS ASSY-WRAP AROUND, 2 IN	83-5920-1778	1.0
10		56013A130	A MINCOM	SUPPR ASSY-ARC, TORQUE MOTOR	83-4550-3727	1.0
11		56004A030	A MINCOM	HUB ASSY-REEL, 1 IN TAPE, NAB	83-4240-0647	2.0
11		MS51964-78	MIL STD	SETScrew-HEX, CUP, 5/16-24X1/4LG	83-9261-4415	2.0
12		MS16998-26	MIL STD	SCREW-CAP, SOC HD, 10-32 X 3/8	83-9261-2100	4.0

TITLE TRANS ASSY-1, 15-30, 50HZ CATALOG NO. 83-5920-1787

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
	56013A910-3	A MINCOM	KIT-SPEED, 15-30, 50 HZ	83-5990-0860	1.0
	56013B990	A MINCOM	KIT-COMMON PARTS, TAPE TRANSP	83-5990-1019	1.0
	56013A920	A MINCOM	KIT-CAPSTAN AREA PARTS, 1 INCH	83-5990-1027	1.0
4	56004A110	B MINCOM	MOTOR ASSY-TAKE UP REEL, 1 INCH	83-4560-0256	1.0
5	56004A120	B MINCOM	MOTOR ASSY-SUPPLY REEL, 1 INCH	83-4560-0255	1.0
6	56013B160	B MINCOM	PC BD ASSY-LOGIC 2 INCH	83-4930-2792	1.0
7	56013A170	D MINCOM	CONT ASSY-CAPSTAN, START-STOP	83-4930-2641	1.0
8	56013B180	C MINCOM	CHASSIS ASSY-WRAP AROUND, 2 IN	83-5920-1778	1.0
9	56013A130	A MINCOM	SUPPR ASSY-ARC, TORQUE MOTOR	83-4550-3727	1.0
10	56004A030	A MINCOM	HUB ASSY-REEL, 1 IN TAPE, NAB	83-4240-0647	2.0
11	MS1964-78	MIL STD	SETScrew-HEX, CUP, 5/16-24X1/4LG	83-9261-4415	2.0
12	MS16998-26	MIL STD	SCREW-CAP, SOC HD, 10-32 X 3/8	83-9261-2100	4.0

TITLE KIT-CAPSTAN AREA PARTS, 2 INCH

CATALOG NO. 83-5990-0857

REF. DES. OR FIND NO.	DRAWING NUMBER - MFG PART NO.	MATERIAL	MFGR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
31	56007A010	D	MINCOM	IDLER ASSY-REVERSING, 2IN TAPE	83-4240-0555	1.0
32	56007A020	B	MINCOM	CAPSTAN ASSY-2 INCH TAPE	83-4240-0561	1.0
33	56007A030-1	C	MINCOM	ROLLER ASSY-2 IN INCOMING	83-4240-0557	1.0
34	56007A030-2	C	MINCOM	ROLLER ASSY-2 IN, OUTGOING	83-4240-0558	1.0
35	23013A040-3	C	MINCOM	ARM ASSY-TAPE LIFTER, 2 INCH	83-4210-0352	1.0
36	56013B115-2	A	MINCOM	COVER-IDLER, MACHINING	83-3310-1579	1.0
37	56013B115-1	A	MINCOM	COVER-IDLER, MACHINING	83-3310-1578	1.0
38	56013B122	A	MINCOM	COVER-TRIM, CAPSTAN AREA, RH	83-3310-1580	1.0
39	56008A103-1	A	MINCOM	SHAFT-TAPE GUIDE, 2-1 IN, INGO	83-3280-0787	2.0
40	56008A103-2	A	MINCOM	SHAFT-TAPE GUIDE, 2-1 IN, OUTGO	83-3280-0788	2.0
41	56008A104-1	A	MINCOM	SLEEVE-TAPE GUIDE, 2-1 IN, INGO	83-3230-0498	2.0
42	56008A104-2	A	MINCOM	SLEEVE-TAPE GUIDE, 2-1 IN, OUTGO	83-3230-0499	2.0
43	56013A110-1	B	MINCOM	ARM ASSY-ROLLER	83-4210-0350	1.0
44	56013A110-2	B	MINCOM	ARM ASSY-ROLLER	83-4210-0351	1.0

REV A

PL 56013A910-1

PARTS LIST

CATALOG NO. 83-5990-0858

TITLE KIT-SPEED, 15-30, 60 HZ

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MATERIAL	REQUIREMENTS	DESCRIPTION	PH CATALOG NO.	QTY.
1	56007A065-1	B	MINCOM	MOTOR ASSY-15-30, 60 HZ	83-4560-0226	1.0
2	23007A023-2	C	MINCOM	CAP-IDLER, REVERSING, PLAIN	83-3250-0108	1.0

PARTS LIST

CATALOG NO. 83-5990-0859

TITLE KIT-SPEED, 7 1/2-15, 50 HZ

----- MATERIAL REQUIREMENTS -----

REF. DES. OR FIND NO. DRAWING NUMBER MFGR NAME DESCRIPTION PH CATALOG NO. QTY.

1	56007A060-2	D MINCOM	MOTOR ASSY-7 1/2-15, 50 HZ	83-4560-0227	1.0
2	23007B023	A MINCOM	CAP-CAPSTAN STROBE, 50 HZ	83-3250-0183	1.0

PARTS LIST PL 56013A910-3 REV A

TITLE KIT-SPEED,15-30, 50 HZ CATALOG NO. 83-5990-0860

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MATERIAL	REQUIREMENTS	DESCRIPTION	PH CATALOG NO.	QTY.
1	56007A065-2	B	MINCOM	MOTOR ASSY-15-30, 50 HZ	83-4560-0228	1.0
2	23007B023	A	MINCOM	CAP-CAPSTAN STROBE, 50 HZ	83-3250-0183	1.0

PARTS LIST

CATALOG NO. 83-5990-0935

TITLE KIT-SPEED, 7 1/2-15, 60 HZ

----- MATERIAL REQUIREMENTS -----

REF. DES. OR FIND NO. DRAWING NUMBER MFGR NAME DESCRIPTION PH CATALOG NO. QTY.

50	56007A060-1	D	MINCOM	MOTOR ASSY-7 1/2-15, 60 HZ	83-4560-0225	1.0
51	23007A023-2	C	MINCOM	CAP-IDLER, REVERSING, PLAIN	83-3250-0108	1.0

REV A

PL 56013A920

PARTS LIST

CATALOG NO. 83-5990-1027

TITLE KIT-CAPSTAN AREA PARTS, 1 INCH

REF. DES. OR FIND NO. MATERIAL REQUIREMENTS PH CATALOG NO. QTY.

REF. DES. OR FIND NO.	DRAWING NUMBER - MEGR PART NO.	MEGR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
31	23007A020-6	G MINCOM	IDLER ASSY-REV, TAPE TRANS, 1 IN	83-4240-0644	1.0
32	23007A060-2	G MINCOM	CAPSTAN ASSY-TAPE TRANSPORT	83-5920-0833	1.0
33	56007A030-3	C MINCOM	ROLLER ASSY-IDLER, INCM, 1 INCH	83-4240-0645	1.0
34	56007A030-4	C MINCOM	ROLLER ASSY-IDLER, OUT, 1 INCH	83-4240-0646	1.0
35	23013A040-2	C MINCOM	ARM ASSY-TAPE LIFTER, 1 IN TAPE	83-4210-0242	1.0
36	56013B115-6	B MINCOM	COVER-IDLER, MACHINING	83-3310-1593	1.0
37	56013B115-5	B MINCOM	COVER-IDLER, MACHINING	83-3310-1592	1.0
38	56013B122	A MINCOM	COVER-TRIM, CAPSTAN AREA, RH	83-3310-1590	1.0
39	56013A064	A MINCOM	SCREW-MIG, TAPE GUIDE, MOD	83-3260-0226	4.0
40	56013A110-2	B MINCOM	ARM ASSY-ROLLER	83-4210-0351	1.0
41	23013B013-4	A MINCOM	TAPE GUIDE-INCOMING, 1 IN	83-3240-0629	2.0
42	23013B014-4	A MINCOM	TAPE GUIDE-OUTGOING, 1 IN	83-3240-0635	2.0
43	56013A110-1	B MINCOM	ARM ASSY-ROLLER	83-4210-0350	1.0

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
DS1, DS2, DS3, DS4, DS5, DS6	327	GENERAL ELEC	LAMP-INCANDESCENT, .04 AMP	83-1550-2506	6.0
DS8	1820	GE	LAMP-INCANDESCENT, 28 V., .10 A	83-1550-2602	1.0
L1, L2	42C24DC-AX	PHILLIPS CON	SOLENOID-ELECTRICAL, PUSH/PULL	83-1550-4516	2.0
L4	128264-001	LEDEX	SOLENOID-ROTARY	83-1550-4514	1.0
L5	42C24DC-AU	PHILLIPS CON	SOLENOID-ELECTRICAL, PUSH/PULL	83-1550-4513	1.0
101	23013A002	P MINCOM	PLATE-TAPE DECK, TRANSPORT	83-3320-1027	1.0
102	GP67-125X500-12	GROOV-PIN	PIN-GRVD, HDLS, .125 DIA X .500 LG	83-7280-0202	3.0
103			SCR-CAP, FH, 1/4 X 20 X 5/8, NYLOC	83-9262-0569	1.0
104	GP4-125X0500-12	GROOV-PIN	PIN-GRND, HDLS, .125 DIA X .500 LG	83-7280-0484	2.0
105	AMF50D-FS160	FAFNIR	BRG-BALL, ANLR, FLNGD, .3125 BORE	83-1230-0178	6.0
106	23013A035	B MINCOM	SHAFT-ARM, IDLER, TAPE TRANSPORT	83-3280-0407	2.0
107	23013B036	A MINCOM	SHAFT-MTG, TAPE LIFTER	83-3280-0536	1.0
108	FI2NTEC-524	KAYNAR	NUT-SELF LKG, HEX, 5/16-24	83-9260-0186	3.0
109	56013A991	A MINCOM	BRACKET-CABLE RETAINER	83-3320-2309	1.0
110	23013A067	B MINCOM	ARM-ACTUATOR, TAPE LIFTER	83-3210-0253	1.0
111	23013A028	D MINCOM	BRACKET-MTG, SOLENOID, TPE TRANS	83-3320-1107	1.0
112	23013A011	E MINCOM	BRACKET-MTG, SOLENOID, RH	83-3320-1108	1.0
113	56013A993	A MINCOM	BRKT-AIR, DASHPOT, HEAD DOOR	83-3320-2311	1.0
114	23013A055	A MINCOM	SPACER-COVER PLATE, TRANSPORT	83-3350-0414	2.0
115	TRUARC	MIL STD	RING-RETAINING, EXT, .225 I.D.	83-7270-0118	1.0
116	MS35206-241	MIL STD	SCREW-MACH, PAN HD, 8-32 X 1/4	83-9260-4547	2.0
117	LP22D82P6	LONG LOK	SCREW-SELF LKG, PAN HD, 8-32 X 3/8	83-9262-0623	2.0
118	MS51017-26	MIL STD	SETSCREW-CUP PT, 6-32 X 1/2	83-9261-0051	2.0
119			SCREW-SHC, 8-32 X 1/4	83-9261-2057	4.0
121	23013A045	A MINCOM	SPACER-PWR SUP MTG, 1.430 LG	83-3350-0412	1.0
122	MS35206-217	MIL STD	SCREW-MACH, PAN HD, 4-40 X 1/2	83-9260-4517	6.0
123	MS35206-237	MIL STD	SCREW-MACH, PAN HD, 6-32 X 1.750	83-9260-4544	1.0
124	23013A172	B MINCOM	BRACKET ASSY-PHOTOCELL	83-4320-1679	1.0
125	23013A044	A MINCOM	SPRING-RETURN, IDLER ARM, CAPSTN	83-3280-0422	3.0
128	23007A050-1	K MINCOM	ARM ASSY-IDLER, ACTUATING, RH	83-4210-0232	2.0
129		RUBBERCRAFT	BUMPER-RUB, SLV, .125 ID X .313	83-7230-0337	2.0
130		MIL STD	RING-RETAINING, TYPE E, 1/4 ID	83-7270-0413	2.0
131	21-S-094-0437	STD PRSD STL	PIN-SPRING, .094 DIA X .437 LG	83-7280-0223	3.0
132	6593	BIRNBACH	INSULATOR-WASH, NYLON, .016 TK	83-9630-0272	2.0
133	23013A095	B MINCOM	ARM ASSY-ACTUATOR, DOOR HD CVR	83-4210-0237	1.0
134		NYLOCK	SCREW-MACH, FH, 100% 10-32 X 5/8	83-9260-0029	1.0
135	23013A085	A MINCOM	CONN-PLUG, SHORTING, TAPE TRANS	83-4610-1136	1.0
136	185-1873	DIALCO	LENS-CAP ASSY, 1/2 IN SQ AMBER	83-1550-5243	1.0
137	185-1875	DIALCO	LENS-IND LT, .500 SQ, WHITE	83-1550-1778	1.0
139	16049A015-3	M MINCOM	LENS-INDICATOR LIGHT, *REMI*ND*	83-3550-1207	1.0

TITLE KIT-COMMON PARTS, TAPE TRANSPIT CATALOG NO. 83-5990-1019

----- MATERIAL REQUIREMENTS -----

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
140	16049A015-4	M MINCOM	LENS-INDICATOR LIGHT, *FORWARD*	83-3550-1208	1.0
141	23013A005	C MINCOM	LENS-LAMP, TAPE SENSOR	83-3550-1406	2.0
142	23013A027	C MINCOM	LENS-LIGHTED SWITCH, PUSHBUTTON	83-3550-1408	1.0
143	23013A038-1	E MINCOM	LENS-IND LT, ENGRAVED STOP	83-3550-1417	1.0
144	16C49A015-35	M MINCOM	LENS-INDICATOR LIGHT, *RECORD*	83-3550-1436	1.0
145	16049A015-36	M MINCOM	LENS-INDICATOR LIGHT, *PLAY*	83-3550-1437	1.0
146	DK-153	GASKET MFG	STRIP-GASKET MATL, 3/8 X 1/32	83-1190-0073	AR
147		M MIL STD	SCREW-MACH, FH, 6-32UNC-2A X 78	83-9260-6523	2.0
148	17460S	BELDON	CABLE ASSY-PWR, ELEC, 10 FT LG	83-1570-0303	1.0
149			SCR-MACH, OVAL HD, 6-32 X 1/2 L	83-9261-4404	6.0
151	MS35206-215	MIL STD	SCREW-MACH, PAN HD, 4-40 X 3/8	83-9260-4515	AR
152	MS35206-228	MIL STD	SCREW-MACH, PAN HD, 6-32 X 3/8	83-9260-4531	AR
153	MS35207-261	MIL STD	SCREW-MACH, PAN HD, 10-32 X 3/8	83-9260-4570	AR
155			WASHER-FLAT, .219 OD X .125 ID	83-9261-4012	AR
156			WASHER-FLAT, SM PAT, #6	83-9261-4013	AR
157			WASH-FLAT, SM PAT, .174 ID	83-9261-4064	AR
158			WASHER-FLAT, SM PAT, #10	83-9261-4046	AR
159	MS35338-40	MIL STD	WASHER-LOCK, SPLIT, HELICAL, #4	83-9261-4303	AR
160	MS35338-41	MIL STD	WASHER-LOCK, SPLIT, #6	83-9261-4305	AR
161			WASHER-LOCK, SPLIT, HELICAL, #8	83-9261-4306	AR
162	MS35338-43	MIL STD	WASHER-LOCK, SPLIT, HELICAL, #10	83-9261-4307	AR
163	MS35190-223	MIL STD	SCREW-MACH, FH, 4-40 X 3/8	83-9260-6504	2.0
165	00000A769	C MINCOM	LABEL-IDENTIFICATION, MODULE	83-3550-1621	1.0
166	56013A121	A MINCOM	SPACER-CAPSTAN AREA, TRIM SPT	83-3350-0647	1.0
168	56013B123	A MINCOM	COVER-TRIM, CAPSTAN AREA, LH	83-3310-1581	1.0
169	56013B124	A MINCOM	SPACER-TRIM, CPSN AREA, FRONT	83-3350-0708	1.0
170	56007A050	A MINCOM	BELT-DRIVE	83-3390-0047	1.0
173	56013B001	A MINCOM	COVER-LAMP, DECORATIVE	83-3310-1583	1.0
174	56007A055	B MINCOM	COVER-DUST, BELT DRIVE, TOP	83-3310-1437	1.0
175	56007A056	A MINCOM	COVER-DUST, BELT DRIVE, BOTTOM	83-3310-1438	1.0
176	56007A001	A MINCOM	FLYWHEEL-CAPSTAN DRIVE	83-3220-0293	1.0
177	303-85-15-1000	ELEC REGULTR	DASHPOT-AIR DAMPING CYLINDER	83-1270-0490	1.0
178	56007B005	A MINCOM	COVER-HEAD, TRIM	83-3310-1582	1.0
179	56007A035-1	A MINCOM	SHIM-IDLER, TAPE GUIDE	83-3230-0500	AR
180	56007A035-2	A MINCOM	SHIM-IDLER, TAPE GUIDE	83-3230-0501	AR
181	56007A035-3	A MINCOM	SHIM-IDLER, TAPE GUIDE	83-3230-0502	AR
182	56007A035-4	A MINCOM	SHIM-IDLER, TAPE GUIDE	83-3230-0503	AR
183	MS16998-31	MIL STD	SCREW-SHC, 10-32X1	83-9261-2105	3.0
184	N4	RICHCO	CLAMP-LOOP, .250 DIA, NYLON	83-7650-0084	2.0
185	56013A125	MINCOM	BRACKET-SOLENOID, TAPE LIFTER	83-3320-2156	1.0
187	MS35206-231	MIL STD	SCREW-MACH, PAN HD, 6-32 X 5/8	83-9260-4535	4.0
188	19007A022	D MINCOM	CAP-FLYWHEEL, PRECISION PLATE	83-3250-0082	1.0

REF. DES. OR FIND NO. DRAWING NUMBER MFGR NAME DESCRIPTION PH CATALOG NO. QTY.

189 MS35649-262 MIL STD NUT-HEX,PLAIN,6-32 X .313 WD 83-9260-2005 2.0

190 56013A190 A MINCOM FAN ASSY-AUXILIARY 83-4560-0244 1.0

191 56007A012 A MINCOM SCREW-REV IDLER,1/4-20 X 1.875 83-3260-0196 1.0

192 MS35338-44 MIL STD WASHER-LOCK,SPLIT,HELICAL,#1/4 83-9261-4309 1.0

193 AN960-4161 A & N STD WASHER-FLAT,LIGHT SERIES,#1/4 83-9262-0046 1.0

194 5555-12 TRUARC RING-REING,EXT,-120 ID 83-7270-0503 1.0

195 MS35207-263 MIL STD SCREW-MACH,PAN HD,10-32 X 1/2 83-9260-4572 AR

196 MS16998-29 MIL STD SCREW-CAP,SOC HD,10-32 X 3/4 83-9261-2103 2.0

197 00000A741-3 E MINCOM LABEL-IDENT,PATENT,MOD 23 83-3550-1500 1.0

198 SEE DESC A&N STD WASHER-#8,ASA B27.2-1958 .164R 83-9261-4005 AR

199 777 H H SMITH CLAMP-CABLE NYLON .542 DIA 83-7650-0007 1.0

200 MS21919DG-14 CANNON CLAMP-LOOP,.875 CABLE,AL ALY 83-7650-0105 2.0

201 SCREW-MACH,PAN HD,6-32 X 9/16 83-9260-4534 4.0

TITLE MODE CONTROL ASSY-RMT,16 TRK CATALOG NO. 83-5920-1749

REF. DES. OR FIND NO. DRAWING NUMBER MFR NAME DESCRIPTION PH CATALOG NO. QTY.

C1 CR1, CR2, CR3 TSD5-6-227 COMP INC CAP-FXD,TA, 220UF 6V 20% 83-1510-6259 1.0
IN4004 MOTOROLA RECT -SI, DIF JCT, 400PIV 1 AMP 83-1530-0151 3.0
DS1, DS2, DS3, DS4, DS5 327 GENERAL ELEC LAMP-INCANDESCENT, .04 AMP 83-1550-2506 5.0
DS6 417-604 DRAKE LAMP-IND, 28V, 40MA, AMBER, B1-PIN 83-1550-2617 1.0
L-28/40 MURA LAMP-PANEL ASSY, 28 V 40 MA 83-1550-2603 32.0

K1 KHP17D11 POTTR & BRUM RELAY-4PDT, 650 OHM 24VDC 3 AMP 83-1550-3550 1.0
P3 201359-3 AMP INC SHELL-COHN, RECT, 26 POSITIONS 83-1610-0674 1.0
P5 200512-3 AMP INC SHELL-COHN, RECT, 26 POSITIONS 83-1610-0663 1.0
R1 LITTLE DEVIL OHMITE RES-FXD, COMP, 470 OHM 2W 5% 83-9520-5528 1.0
S1, S2, S3, S4, S5 1093 PENDAR SW-PUSH, SPDT, 30V, 2 AMP 83-1550-5467 5.0
S6, S7 H-201 SWITCHCRAFT SWITCH-PUSHBUTTON, SPST 83-1550-5426 2.0
S8 7101 C & K COMP SWITCH-TOGGLE, SPDT 83-1550-5237 1.0
S101, S102, S103, S104, S105, S106, S107, S108, S109, S110, S111, S112, S113, S114, S115, S116 1454 CENTRALAB SWITCH-LEVER, WAFER TYPE, 2P3POS 83-1550-0031 16.0

V1 IN4733 MOTOROLA DIODE-SI, ZENER, 5.1 V, 10%, 49MA 83-1530-0353 1.0
XDS6 4422-003 DRAKE SOCKET-LAMP, B1-PIN, .397 MTG 83-1610-1501 1.0
XK1 9KH1 POT. BRUM SOCKET-RELAY, 14CONT 83-1620-0108 1.0

1 56017A101 A MINCOM PANEL-FRONT, MODE CONT, 16 TRK 83-3360-1507 1.0
2 56017A102 A MINCOM HOUSING-REMOTE MODE, 16 TRACK 83-3310-1547 1.0
3 56017A103 A MINCOM CHASSIS-SW, MODE CONTROL, 16 TRK 83-3310-1548 1.0
4 16049A015-3 M MINCOM LENS-INDICATOR LIGHT, *REWIND* 83-3550-1207 1.0
5 16049A015-4 M MINCOM LENS-INDICATOR LIGHT, *FORWARD* 83-3550-1208 1.0
6 16049A015-35 M MINCOM LENS-INDICATOR LIGHT, *RECORD* 83-3550-1436 1.0
7 16049A015-36 M MINCOM LENS-INDICATOR LIGHT, *PLAY* 83-3550-1437 1.0
8 23013A038-1 E MINCOM LENS-IND LT, ENGRAVED STOP 83-3550-1417 1.0

TITLE MODE CONTROL ASSY-RMT,16 TRK CATALOG NO. 83-5920-1749

REF. DES. OR FIND NO.	DRAWING NUMBER - MFCR PART NO.	MFCR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
9	42080-1-LP	4 AMP INC	PIN-CONTACT,CONN,20-24 GA WIRE	83-1610-0688	15.0
10	201923-1	AMP INC	CLIP-SPRING TENSION, MALE	83-1620-0126	4.0
11	201229-1	AMP INC	CLAMP-ELEC, STRAIN REL, .779 MCE	83-1650-0244	2.0
12	00000A662-1	C MINCOM	LABEL-IDENT, ASSY	83-3550-1276	1.0
13	200389-4	AMP INC	PIN-GUIDE,CENTER,AMP SERIES M	83-7280-0196	2.0
14	8748	BELDEN	WIRE-TYPE 8748, 22 GA,18CONDUC	83-7910-0534	AR
15	200390-4	AMP INC	RECP-GUIDE PIN,CENTER,SERIES M	83-7270-0302	2.0
16		MURA	LENS-CAP, INDICATOR, GREEN	83-1550-1618	16.0
17		MURA	LENS-INDICATOR LIGHT, CAP, RED	83-1550-1616	16.0
18	5025	3M	BUMPER-RUP,ADHESIVE MTG,.56 SQ	83-1230-0449	4.0
19	42991-1	4 AMP INC	SOCKET-CONTACT,CONN, SIZE 16	83-1610-0689	18.0
20	56017A104	A MINCOM	PAD-CUSHIONING	83-3350-0698	1.0
21	#24	RUBBERCRAFT	GROMMET-RUB,.750WD X1.375 OD	83-9630-0109	1.0
22	515-0051	DIALCO	RETAINER-LAMP, CARTRIDGE	83-1620-0243	32.0
23	3302	T I & B	CLAMP-STR RELIEF,CONN,3/8 IN	83-1650-0580	1.0
24	123-6	ZIERICK	TERM-LUG, UNINS,DBL LG,#6	83-9630-0039	1.0

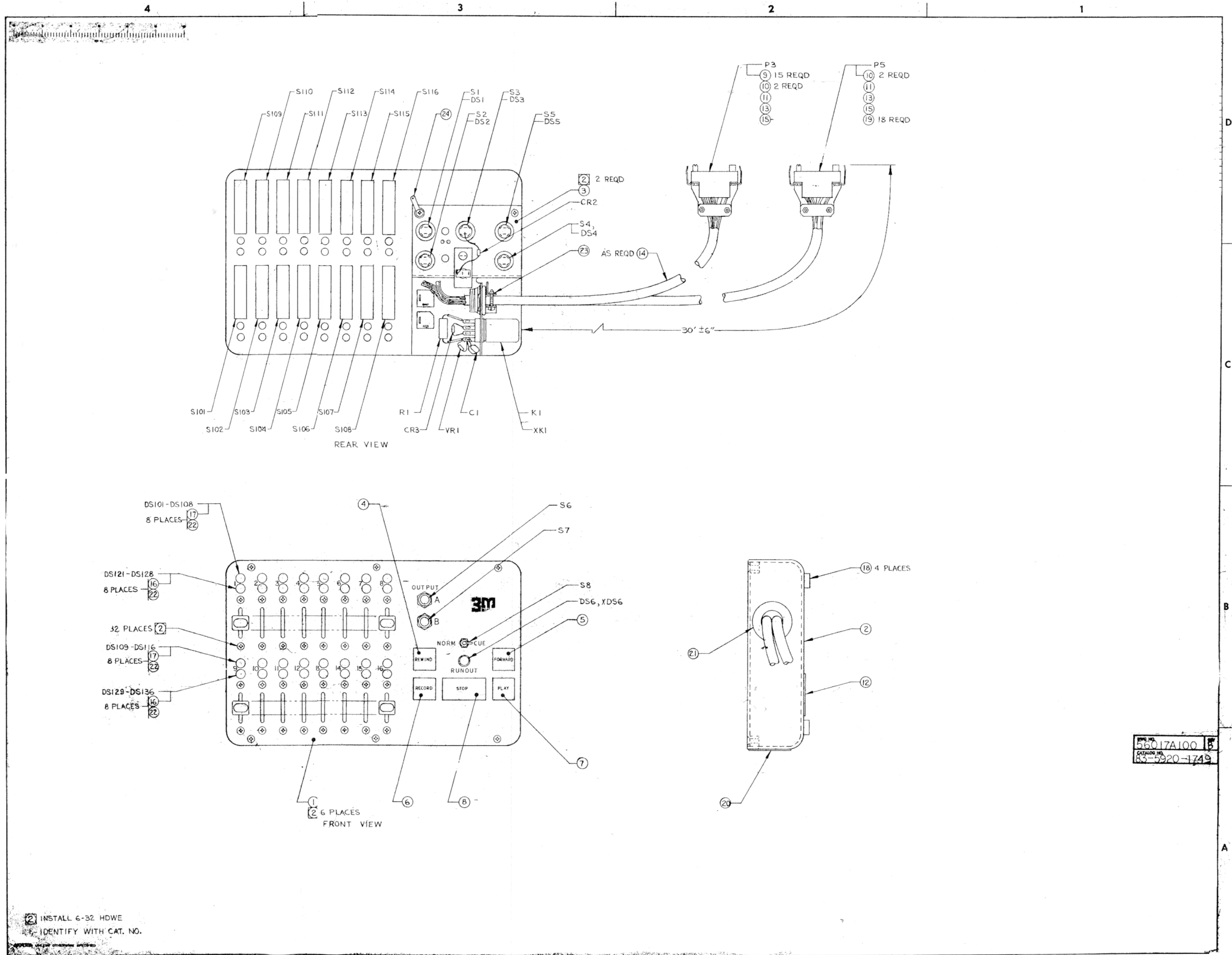


FIG. 17A 100 5
 83-220-1749

Mode Control Assembly

TITLE KIT-MOUNTING

CATALOG NO. 83-5990-0834

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MATERIAL	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
1	56028A007-1	A MINCOM		SUPPORT-UPPER, LEFT	83-3340-0693	1.0
2	56028A007-2	A MINCOM		SUPPORT-UPPER, RIGHT	83-3340-0694	1.0
3	56028A003	C MINCOM		HOUSING-METER	83-3310-1420	1.0
4	56028A004	A MINCOM		BRACKET-MODULE MOUNT, REAR	83-3320-2110	2.0
5	56028A005	A MINCOM		BRACKET-MODULE MOUNT, FRONT	83-3320-2111	2.0
6	56028A038	A MINCOM		PANEL-FILLER, HOUSING	83-3360-1423	1.0
7				SCR-MACH, F HD, 8-32 X 1/2	83-9260-6532	8.0
8	MS35206-230	MIL STD		SCREW-MACH, PAN HD, 6-32 X 1/2	83-9260-4533	3.0
9	MS24693-S28	MIL STD		SCREW-MACH, FH, 6-32 X .500	83-9260-6579	4.0
10				SCREW-WOOD, RD HD, #10 X 1.00LG	83-9262-0559	10.0
11				WASH-FLAT, SM PAT, .174 ID	83-9261-4064	4.0
12				WASHER-LOCK, SPLIT, HELICAL, #8	83-9261-4306	4.0
13				WASHER-FLAT, RD, .149 I.D.	83-9261-4063	3.0
14	MS35338-41	MIL STD		WASHER-LOCK, SPLIT, #6	83-9261-4305	2.0
15				WASH-FLAT, RD, SM PAT, .218 ID	83-9261-4066	8.0
16	MS35338-43	MIL STD		WASHER-LOCK, SPLIT, HELICAL, #10	83-9261-4307	8.0
17				NUT-HEX, SM PATT, 8-32 X .313 WD	83-9260-2203	4.0
18				NUT-HEX, SM PATT, 6-32 X .250 WD	83-9260-2202	2.0
19	MS35207-264	MIL STD		SCREW-MACH, PAN HD, 10-32 X 5/8	83-9260-4574	8.0
20				SCREW-WOOD, FH, SLOT, #12 X 1.25LG	83-9262-0617	8.0
21	MS35207-269	MIL STD		SCREW-MACH, PAN HD, 10-32 X 1 1/2	83-9260-4580	4.0
22	MS24693-S280	MIL STD		SCREW-MACH, FH, 10-32 X 1 1/2	83-9260-0185	6.0
23	MS24693-S272	MIL STD		SCREW-MACH, FH, 10-32 X 1 1/2	83-9260-6294	8.0
24	56059A110-1	B MINCOM		DOOR ASSY-LEFT HAND	83-4330-0398	1.0
25	56059A110-2	B MINCOM		DOOR ASSY-RIGHT HAND	83-4330-0399	1.0
26	34-10-101-10	SOUTHCO		LATCH ASSY-PUSHBUTTON	83-1270-0753	2.0
27	56059A119	A MINCOM		LABEL-IDENT, CONT LOCATIONS, M56	83-3550-1819	1.0

----- MATERIAL REQUIREMENTS -----
 REF. DES. OR FIND NO. DRAWING NUMBER MFR NAME DESCRIPTION PH CATALOG NO. QTY.

1	23000A001	C	MINCOM	BRKT-MTG, TRANSPORT	83-3320-1421	4.0
2	23000A002	C	MINCOM	TRIM-ANGULAR, TRANSPORT	83-3330-0315	1.0
3	23000A003	A	MINCOM	BAR-HINGE MTG, TRANSPORT	83-3290-0164	1.0
4	23000A004-1	A	MINCOM	PLATE-MTG, SIDE, LH, TRANSPORT	83-3320-1422	1.0
5	23000A004-2	A	MINCOM	PLATE-MTG, SIDE, RH, TRANSPORT	83-3320-1423	1.0
6	56028A911		MINCOM	COVER-TAPE DECK	83-3310-1447	1.0
7	56013A126-2	A	MINCOM	PLATE-MASKING, SWITCH	83-3320-2160	1.0
8	23013A022-2	D	MINCOM	PLATE-MASKING, SWITCH, CONTROL	83-3320-1425	1.0
9	23013A018-3	D	MINCOM	TRIM-SWITCH PANEL	83-3330-0316	1.0
10	23013A018-4	D	MINCOM	TRIM-SWITCH PANEL, RH	83-3330-0317	1.0
11	NAS1352-04-8	NAS	STD	SCREW-CAP, SOC HD, 4-40 X 1/2	83-9261-2003	2.0
12	MS24693-S24	MIL	STD	SCREW-MACH, FH, 6-32 X .250 1.00	83-9260-6571	2.0
13	MS24693-S27	MIL	STD	SCREW-MACH, FH, 6-32 X 7/16	83-9260-6576	8.0
14	MS35207-263	MIL	STD	SCREW-MACH, PAN HD, 10-32 X 1/2	83-9260-4572	5.0
15	MS35207-267	MIL	STD	SCREW-MACH, PAN HD, 10-32 X 1.00	83-9260-4577	3.0
16	AN960-4L	A&N	STD	WASHER-FLAT, LIGHT SERIES, #4	83-9261-4024	2.0
17				WASHER-FLAT, GENERAL PURPOSE, #10	83-9261-4006	8.0
18	MS35338-40	MIL	STD	WASHER-LOCK, SPLIT, HELICAL, #4	83-9261-4303	2.0
19	MS35338-43	MIL	STD	WASHER-LOCK, SPLIT, HELICAL, #10	83-9261-4307	8.0
20	MS35650-102	MIL	STD	NUT-HEX, PLAIN, 10-32 X .375 WD	83-9260-2107	2.0
21	MS24693-S28	MIL	STD	SCREW-MACH, FH, 6-32 X .500	83-9260-6579	8.0
22	MS35206-245	MIL	STD	SCREW-MACH, PAN HD, 8-32 X 1/2	83-9260-4551	4.0
23				WASHER-LOCK, SPLIT, HELICAL, #8	83-9261-4306	4.0
24	SEE DESC	A&N	STD	WASHER-#8, ASA B27.2-1958 .164R	83-9261-4005	4.0
25	23028A042	A	MINCOM	SUPPORT-CHANNEL, TRANSPORT	83-3340-0506	1.0
26	18059A014	C	MINCOM	SPACER-PANEL, SIGNAL ELECT	83-3350-0314	2.0
27	21FK-1032	STD	PRSD STL	NUT-SELF-LOCKING, 10-32 X 3/8	83-9260-2408	1.0
28	MS24693-S274	MIL	STD	SCREW-MACH, FH, 10-32X.75	83-9260-6585	1.0

CATALOG NO. 83-4570-0723

TRACK,PWR SUP

TITLE

REF. DES. OR FIND NO.	DRAWING NUMBER - MFGR PART NO.	MFGR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
C1	977-163	GEN INSTR	CAP-FXD,ELECT, 500UF 25V	83-1510-2044	1.0
P1	1-480324-0	AMP INC	SHELL-CONN,RECT, 15POSITION	83-1610-0933	1.0
1	60618-4	AMP INC	CONTACT-ELEC,PIN, .084 DIA	83-1610-0925	7.0
2	RA1103	THOMAS&BETTS	TERM-LUG, INSUL, FK TG .28WD	83-9630-0026	7.0
3	NB1930N-2	NATIONAL	WIRE-ELEC,STRAND,18 AWG,RED	83-7910-0592	AR
4	NB1930N-0	NATL WIRE	WIRE-ELEC,STRAND,18 AWG, BLACK	83-7910-0562	AR
5	NB1934N2SJ	NATL WIRE	WIRE-TYPE B,22GA RED/BLU 2 CON	83-7910-0362	AR
6	GSB124	THOM & BETTS	FERRULE-RF CABLE GND, .124 ID	83-9690-0093	2.0
7	GSC199	THOMAS&BETTS	FERRULE-RF CABLE GND, .199 ID	83-9690-0098	2.0
8	NATL WIRE&CABLE	WIRE-PVC TYPE B NYLON 20GA BRN		83-7910-0037	AR
9		NATL WIRE	WIRE-TYPE B,20 AWG,RED,N JKT	83-7910-0091	AR
10		NATL WIRE	WIRE-TYPE B,22GA BLK NYLON JKT	83-7910-0045	AR
11	RB1103	THOM & BETTS	TERM-LUG,FOR 16-14 AWG,#6 STUD	83-9630-0027	1.0

REV D

PL 56031A900

P A R T S L I S T

CATALOG NO. 83-5990-0866

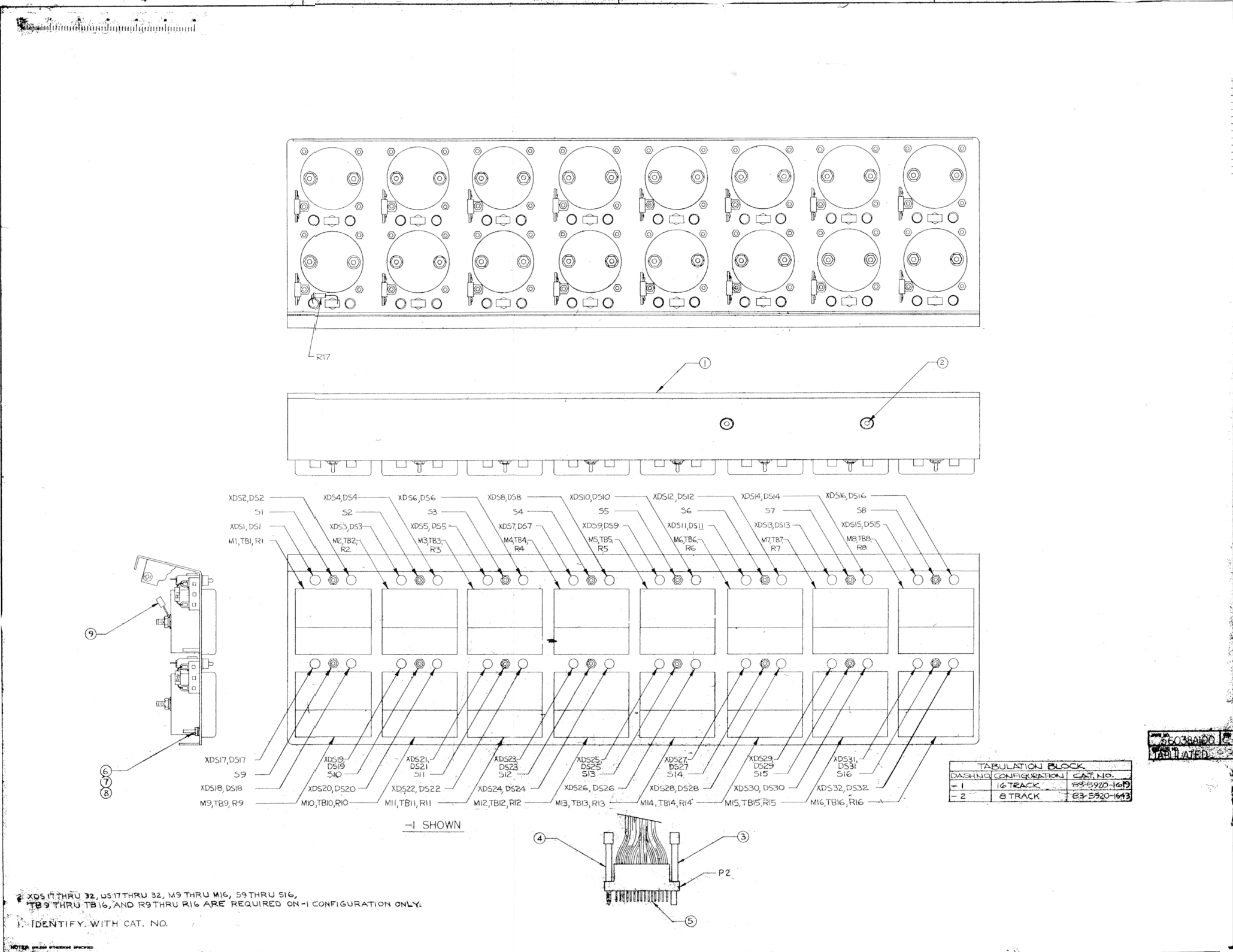
TITLE KIT-PWR SUP, SIG ELECT

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MATERIAL	REQUIREMENTS	DESCRIPTION	PH CATALOG NO.	QTY.
1	56031A101	MINCOM		PWR SUPPLY-SPEC CONTROL	83-4930-2639	1.0
2	56031A110	C MINCOM		CABLE ASSY-16 TRACK,PWR SUP	83-4570-0723	1.0
3	56031B103	A MINCOM		SPACER-MTG,PWR SUP, 2 HOLE	83-3350-0712	2.0
4	56028A008	A MINCOM		SHIELD-EM,POWER SUPPLY	83-3650-0632	1.0
5	SEE DESC			SCREW-WOOD, RND HD #8 X 7/8	83-9262-0556	4.0
6		A&N STD		WASHER-#8,ASA B27.2-1958 .164R	83-9261-4005	4.0

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
		NATL WIRE	WIRE-PVC, TYPE B, 22GA YELLOW	83-7910-0040	AR
		NATL WIRE	WIRE-TYPE B, 22GA VIO NYLON JKT	83-7910-0041	AR
		NATL WIRE	WIRE-PVC, TYPE B, 22GA GRAY	83-7910-0042	AR
		NATL WIRE	WIRE-TYPE B, 22GA BLU NYLON JKT	83-7910-0044	AR
		NATL WIRE	WIRE-TYPE B, 22GA BLK NYLON JKT	83-7910-0045	AR
		SURPRENANT	WIRE-TYPE B, 22 GA, VIOLET-WHITE	83-7910-0067	AR
		SURPRENANT	WIRE-PVC, B NYLON, 22GA, GRN-BLK	83-7910-0069	AR
		SURPRENANT	WIRE-PVC, B NYLON, 22GA, BLU-BLK	83-7910-0070	AR
	1434	BIRNBACH	WIRE-BUS, 22GA ROUND	83-7910-0105	AR
		NATL WIRE	WIRE-TYPE B, 22GA, GRN NYLN JKT	83-7910-0248	AR
		NATL WIRE	WIRE-TYPE B, 22GA RED NYLON JKT	83-7910-0249	AR
		NATL WIRE	WIRE-TYPE B, 22 GA ORNG NYL JKT	83-7910-0250	AR
		NATL WIRE	WIRE-TYPE B, 22GA, BRN NYLN JKT	83-7910-0251	AR
		NATL WIRE	WIRE-TYPE B, 22 GA YELLOW NYLN	83-7910-0259	AR
		NATL WIRE	WIRE-PVC TYPE B, 22 GA, GRN-WHT	83-7910-0260	AR
		NATL WIRE	WIRE TYPE B, 22 GA GRAY NYLN	83-7910-0261	AR
		NATL WIRE	WIRE-TYPE B, 22 GA RED NYLN JKT	83-7910-0264	AR
		NATL WIRE	WIRE-TYPE B, 22 GA BLU NYLN JKT	83-7910-0288	AR
		NATL WIRE	WIRE-TYPE B, 22GA ORN/BLK NYLN	83-7910-0297	AR
		NATL WIRE	WIRE-TYPE B, 22GA GRY/BLK NYLN	83-7910-0298	AR
		NATL WIRE	WIRE-TYPE B, 22GA PR/BLK NYLN	83-7910-0299	AR
		NATL WIRE	WIRE-PVC, B NYLON, 22GA, BRN-BLK	83-7910-0300	AR
		NATL WIRE	WIRE-TYPE B, 22GA BRN NYLN JKT	83-7910-0301	AR
		NATL WIRE	WIRE-TYPE B, 22 GA ORN NYLN JKT	83-7910-0303	AR
	TFT200/20	ALPHA WIRE	TUBING-TEFLON-20-NAT	83-7910-0321	AR
	#EXE-22-122	THERMAX	WIRE-TYPE C, 22GA WHT TEFLN JKT	83-7910-0476	AR
	42980-1-LP	4 AMP INC	PIN-CONTACT, CONN, 20-24 GA WIRE	83-1610-0688	66.0
	415-604	DRAKE	LAMP-IND, 28V, 40 MA, WHITE	83-1550-2618	16.0
	417-604	DRAKE	LAMP-IND, 28V, 40MA, AMBER, B1-PIN	83-1550-2617	16.0
	56038A101	A MINCOM	METER-VU, 2 1/2 IN WD, BLK, BEZEL	83-3550-3133	16.0
	201310-3	AMP INC	SHELL-CONN, RECT, 1.110 WDX2.593	83-1610-0668	1.0

TITLE METER PANEL ASSY-16 TRACK CATALOG NO. 83-5920-1619

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
R1,R2,R3,R4,R5,R6,R7,R8,R9, R10,R11,R12,R13,R14,R15, R16 R17	0A781-7362	MINCOM SPEC	RES-FXD, FILM, 3.6K OHM, 1/2W, 2% S	83-1520-7362	16.0
S1,S2,S3,S4,S5,S6,S7,S8,S9, S10,S11,S12,S13,S14,S15, S16	0A781-7372	MINCOM SPEC	RES-FXD, FILM, 22K OHM, 1/2W, 2% S	83-1520-7372	1.0
52	7105	C&K	SWITCH-TOGGLE, SPDT, 5 AMPS	83-1550-5487	16.0
TB1,TB2,TB3,TB4,TB5,TB6, TB7,TB8,TB9,TB10,TB11,TB12, TB13,TB14,TB15,TB16		CINCH-JONES	TERMINAL STRIP, LUG TYPE, 2 LUG	83-1640-1112	16.0
XDS1,XDS2,XDS3,XDS4,XDS5, XDS6,XDS7,XDS8,XDS9,XDS10, XDS11,XDS12,XDS13,XDS14, XDS15,XDS16,XDS17,XDS18, XDS19,XDS20,XDS21,XDS22, XDS23,XDS24,XDS25,XDS26, XDS27,XDS28,XDS29,XDS30, XDS31,XDS32	4422-003	DRAKE	SOCKET-LAMP, B1-PIN, .397 MTG	83-1610-1501	32.0
1	56038A102	B MINCOM	PANEL-METER MOUNT, 16 TRACK	83-3360-1402	1.0
2	6109-B-1032	AMATOM	FASTENER-TURNLOCK, 10-32X15/16	83-9262-0616	2.0
3	200867-2	AMP INC	FST-JACK SCR, CONN, .111 X 2.141	83-9262-0526	1.0
4	200871-2	AMP INC	FST-JACK SCR, CONN, .111 X 2.168	83-9262-0525	1.0
6			WASHER-FLAT, .219 OD X .125 ID	83-9261-4012	64.0
7	MS35338-4C	MIL STD	WASHER-LOCK, SPL II, HELICAL, #4	83-9261-4303	64.0
8			NUT-HEX, SM PATT, 4-40 X .188 WD	83-9260-2201	64.0
9	RA873	THOM & BETTS	LUG-TERMINAL SOLDERLS, RING, #10	83-9630-0205	32.0



2 XDS 17 THRU 32, DS 17 THRU 32, M9 THRU M16, S9 THRU S16,
 TB9 THRU TB16, AND R9 THRU R16 ARE REQUIRED ON -I CONFIGURATION ONLY.
 1 IDENTIFY WITH CAT. NO.

Meter Panel Assembly

--- MATERIAL REQUIREMENTS ---

REF. DES. OR FIND NO. DRAWING NUMBER MFR NAME DESCRIPTION PH CATALOG NO. QTY.

- MFR PART NO.

NATL WIRE	WIRE-PVC, TYPE B, 22GA YELLOW	83-7910-0040	AR
NATL WIRE	WIRE-TYPE B, 22GA VIO NYLON JKT	83-7910-0041	AR
NATL WIRE	WIRE-PVC, TYPE B, 22GA GRAY	83-7910-0042	AR
NATL WIRE	WIRE-TYPE B, 22GA WHT NYLON JKT	83-7910-0043	AR
NATL WIRE	WIRE-TYPE B, 22GA BLU NYLON JKT	83-7910-0044	AR
NATL WIRE	WIRE-TYPE B, 22GA BLK NYLON JKT	83-7910-0045	AR
SURPRENANT	WIRE-PVC TYPE B, 22 GA, RED-BLK	83-7910-0066	AR
SURPRENANT	WIRE-TYPE B, 22 GA, VIOLET-WHITE	83-7910-0067	AR
SURPRENANT	WIRE-PVC, B NYLON, 22GA, GRN-BLK	83-7910-0068	AR
SURPRENANT	WIRE-PVC, B NYLON, 22GA, BLU-BLK	83-7910-0069	AR
SURPRENANT	WIRE-PVC, B NYLON, 22GA, BLK-WHT	83-7910-0070	AR
BIRNBACH	WIRE-BUS, 22GA ROUND	83-7910-0071	AR
NATL WIRE	WIRE-TYPE B, 22GA, GRN NYLN JKT	83-7910-0105	AR
NATL WIRE	WIRE-TYPE B, 22GA RED NYLON JKT	83-7910-0248	AR
NATL WIRE	WIRE-TYPE B, 22 GA ORNG NYL JKT	83-7910-0249	AR
NATL WIRE	WIRE-TYPE B, 22GA, BRN NYLN JKT	83-7910-0250	AR
BIRNBACH	WIRE-BUS, 18GA ROUND	83-7910-0251	AR
NATL WIRE	WIRE-PVC TYPE B, 22 GA, GRN-WHT	83-7910-0257	AR
NATL WIRE	WIRE-TYPE B, 22 GA GRAY NYLN	83-7910-0259	AR
NATL WIRE	WIRE-TYPE B, 22GA WHT/BLK NYLN	83-7910-0260	AR
NATL WIRE	WIRE-TYPE B, 22 GA RED NYLN JKT	83-7910-0261	AR
NATL WIRE	WIRE-TYPE B, 22 GA BLU NYLN JKT	83-7910-0262	AR
NATL WIRE	WIRE-TYPE B, 22GA ORN/BLK NYLN	83-7910-0264	AR
NATL WIRE	WIRE-TYPE B, 22GA GRY/BLK NYLN	83-7910-0288	AR
NATL WIRE	WIRE-PVC, B NYLON, 22GA, BRN-BLK	83-7910-0297	AR
NATL WIRE	WIRE-TYPE B, 22GA, BRN NYLN JKT	83-7910-0298	AR
NATL WIRE	WIRE-TYPE B, 22 GA ORN NYLN JKT	83-7910-0300	AR
ALPHA WIRE	TUBING-TEFLON, #22, 027 ID, NAT	83-7910-0301	AR
ALPHA WIRE	WIRE-TYPE MW, 22GA BRV NYLN JKT	83-7910-0303	AR
ALPHA WIRE	WIRE-TYPE MW, 22GA BLK NYLN JKT	83-7910-0388	AR
ALPHA WIRE	WIRE-TYPE MW, 22GA RED NYLN JKT	83-7910-0459	AR
ALPHA WIRE	WIRE-TYPE MW, 22GA ORNG NYL JKT	83-7910-0460	AR
ALPHA WIRE	WIRE-TYPE MW, 22GA YEL NYLN JKT	83-7910-0461	AR
ALPHA WIRE	WIRE-TYPE MW, 22GA BLU NYLN JKT	83-7910-0462	AR
ALPHA WIRE	WIRE-TYPE MW, 22GA GRN NYLN JKT	83-7910-0463	AR
ALPHA WIRE	WIRE-TYPE MW, 22GA VIO NYLN JKT	83-7910-0464	AR
ALPHA WIRE	WIRE-TYPE MW, 22GA WHT NYLN JKT	83-7910-0465	AR
THERMAX	WIRE-TYPE C, 22GA WHT TEFLN JKT	83-7910-0466	AR
ALPHA	WIRE-TYPE MW, 22GA, RED/WHITE	83-7910-0467	AR
		83-7910-0476	AR
		83-7910-0538	AR

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TFT-200/22
1561-7
1561-2
1561-3
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1561-4
1561-10
1561-1
#EXE-22-122

TITLE SIGNAL ELECT MODULE ASSY-16TCK CATALOG NO. 83-5920-1759

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
C101, C102, C103, C104, C105, C106, C107, C108, C109, C110, C111, C112, C113, C114, C115, C116	TYPE 311	ALPHA	WIRE-TYPE MW, 22GA, ORNG/WHITE	83-7910-0539	AR
C201, C202, C203, C204, C205, C206, C207, C208, C209, C210, C211, C212, C213, C214, C215, C216	0A836-5119	ALPHA	WIRE-TYPE MW, 22GA, GREEN/WHT	83-7910-0541	AR
C301, C302, C303, C304, C305, C306, C307, C308, C309, C310, C311, C312, C313, C314, C315, C316	TSD-5-35-106	ALPHA	WIRE-TYPE MW, 22 GA, BLUE/WHT	83-7910-0542	AR
CR1, CR3, CR4, CR5, CR6, CR7, CR101, CR102, CR103, CR104, CR105, CR106, CR107, CR108, CR109, CR110, CR111, CR112, CR113, CR114, CR115, CR116, CR201, CR202, CR203, CR204, CR205, CR206, CR207, CR208, CR209, CR210, CR211, CR212, CR213, CR214, CR215, CR216, CR301, CR302, CR303, CR304, CR305, CR306, CR307, CR308, CR309, CR310, CR311, CR312, CR313, CR314, CR315, CR316, CR401, CR402, CR403, CR404, CR405, CR406, CR407, CR408, CR409, CR410, CR411, CR412, CR413, CR414, CR415, CR416, CR501, CR502, CR503, CR504, CR505, CR506, CR507, CR508, CR509, CR510, CR511, CR512, CR513, CR514, CR515, CR516	IN4-004	ALPHA	WIRE-TYPE MW, 22 GA, VIOLET/WHT	83-7910-0543	AR
		ALPHA	WIRE-TYPE MW, 22 GA, GREY/WHITE	83-7910-0544	AR
		ALPHA	WIRE-TYPE MW, 22 GA, GREY/BLK	83-7910-0552	AR
		ARCO	CAP-VAR, MICA, 780-2110PF 250V	83-1510-6274	16.0
		MINCOM SPEC	CAP-FXD, MICA, 430 PF, 500V, 5%	83-1510-5119	16.0
		COMP INC	CAP-FXD, TA, 10UF 35V 20%	83-1510-6214	16.0
		MOTOROLA	RECT -SI, DIF JCT, 400PIV 1 AMP	83-1530-0151	86.0
		MOTOROLA	RECT-SI, 300 PRV, 3.0 AMP	83-1530-0364	1.0

TITLE SIGNAL ELECT MODULE ASSY-16TCK CATALOG NO. 83-5920-1759

MATERIAL REQUISITION

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
J1	1-480323-0	AMP INC	SHELL-CONN, RECT, .650WDX1.280	83-1610-0934	1.0
J2	201311-3	AMP INC	SHELL-CONN, RECT, 1.11WD X2.59LG	83-1610-0669	1.0
J5	201359-3	AMP INC	SHELL-CONN, RECT, 26 POSITIONS	83-1610-0674	1.0
J6, J7	MRAC42S-67	WINCHESTER	CONN-RECP, RECTANGLR, 42 CON	83-1610-0817	2.0
J101, J102, J103, J104, J105, J106, J107, J108, J109, J110, J111, J112, J113, J114, J115, J116, J201, J202, J203, J204, J205, J206, J207, J208, J209, J210, J211, J212, J213, J214, J215, J216, J301, J302, J303, J304, J305, J306, J307, J308, J309, J310, J311, J312, J313, J314, J315, J316, J401, J402, J403, J404, J405, J406, J407, J408, J409, J410, J411, J412, J413, J414, J415, J416	2VK22S/1-2	VIKING	CONN-P.C., ELEC, PIERCD, 22 CON	83-1610-0845	64.0
D3F		SWITCHCRAFT	CONN-RECP, ELEC, PNL MTG, 3 SOC	83-1610-1105	16.0
D3M		SWITCHCRAFT	CONN-RECP, ELEC, PNL MTG, 3 PIN	83-1610-1106	16.0
KHPI7D11		POTTR & BRUM	RELAY-4PDT, 650 OHM 24VDC 3 AMP	83-1550-3550	33.0
K1, K101, K102, K103, K104, K105, K106, K107, K108, K109, K110, K111, K112, K113, K114, K115, K116, K201, K202, K203, K204, K205, K206, K207, K208, K209, K210, K211, K212, K213, K214, K215, K216		PARELCO	RELAY-ARMATURE, 4PDT, 700 OHM, 24	83-1550-0048	16.0
K301, K302, K303, K304, K305, K306, K307, K308, K309, K310, K311, K312, K313, K314, K315, K316		NYTRONICS	CHOKO-RF, 1000 UH, 10%	83-1540-0229	16.0
L101, L102, L103, L104, L105, L106, L107, L108, L109, L110, L111, L112, L113, L114, L115, L116		NYTRONICS	CHOKO-RF, 1000 UH, 10%	83-1540-0229	16.0

----- M A T E R I A L R E Q U I R E M E N T S -----

REF. DES. OR FIND NO. DRAWING NUMBER MFR NAME D E S C R I P T I O N P H C A T A L O G N O. QTY.

P4 1-480278-0 AMP INC SHELL-CONN, RECT, 12 POSITIONS 83-1610-0931 1.0
2N3643 FAIRCHILD TSTR-SI, NPN, SWITCHING, 300 HFE 83-1530-2234 32.0
Q101, Q102, Q103, Q104, Q105, Q106, Q107, Q108, Q109, Q110, Q111, Q112, Q113, Q114, Q115, Q116, Q201, Q202, Q203, Q204, Q205, Q506, Q207, Q208, Q209, Q210, Q211, Q212, Q213, Q214, Q215, Q216

R101, R102, R103, R104, R105, R106, R107, R108, R109, R110, R111, R112, R113, R114, R115, R116
302163 CTS OF BERNE RES-VAR, WW, 2K OHM 5W 5% 83-1520-1299 16.0

R201, R202, R203, R204, R205, R206, R207, R208, R209, R210, R211, R212, R213, R214, R215, R216
GA2G024S103UA ALLEN BRAD RES-VAR, COMP, 10K, 1/2 W, 10% 83-1520-1279 16.0

0A781-7142 MINCOM SPEC RES-FXD, FILM, 5.1K OHM, 1/2W, 2% S 83-1520-7142 48.0

0A781-7372 MINCOM SPEC RES-FXD, FILM, 22K OHM, 1/2W, 2% S 83-1520-7372 32.0

LITTLE DEVIL OHMITE RESISTOR-CAR, 620 OHM, 1W, 5% 83-9520-4146 16.0

0A781-7147 MINCOM SPEC RES-FXD, FILM, 4.7K OHM, 1/2W, 2% 83-1520-7147 16.0

TITLE SIGNAL ELECT MODULE ASSY-16TCK CATALOG NO. 83-5920-1759

MATERIAL REQUIREMENTS

REF. DES. OR FIND NO. DRAWING NUMBER MFR NAME DESCRIPTION PH CATALOG NO. QTY.

CONTINUED FROM PREVIOUS PAGE

R916

S101, S102, S103, S104, S105, S106, S107, S108, S109, S110, S111, S112, S113, S114, S115, S116

T101, T102, T103, T104, T105, T106, T107, T108, T109, T110, T111, T112, T113, T114, T115, T116

T201, T202, T203, T204, T205, T206, T207, T208, T209, T210, T211, T212, T213, T214, T215, T216

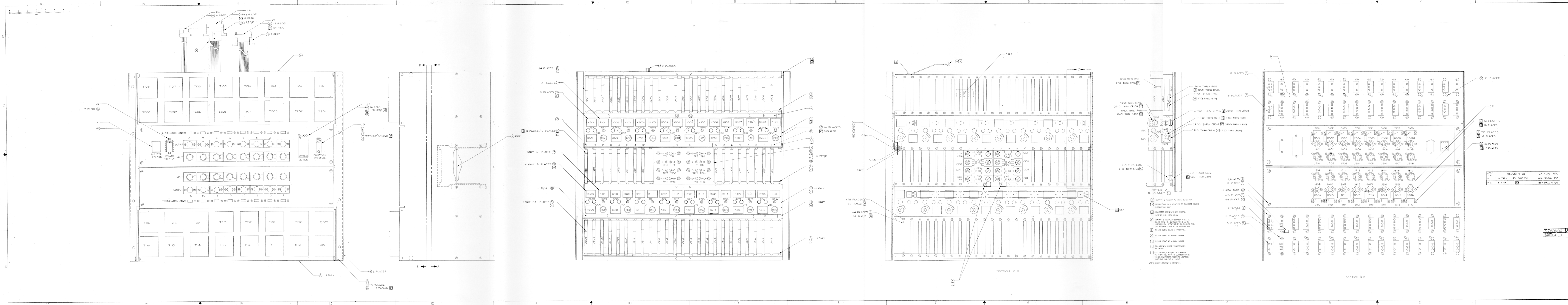
SS50 23 05 9A025 B MINCOM XFRM-AUDIO INPUT 83-1550-5229 16.0

23059A517 A MINCOM XFRM-AUDIO, OUTPUT, 5 OHM 83-3540-1122 16.0

56059B102-1 B MINCOM PANEL-RELAY, MODULE, UPPER 1.0
56059A103-2 A MINCOM SUPPORT CARD GUIDE, 18 GUIDES 2.0
56059A103-1 A MINCOM SUPPORT-CARD GUIDE, 25 GUIDES 4.0
56059A104 A MINCOM PANEL-SIDE, SIGNAL ELECTRONICS 2.0
56059A105-1 A MINCOM PANEL-REAR, SIG ELEC, UPPER 1.0
56059A105-2 A MINCOM PANEL-REAR, SIG ELEC, LOWER 1.0
56059A106 C MINCOM BRACKET-CAPACITOR MTG 1.0
23000A011 B MINCOM BRKT MTG-HEAD CONNECTOR 4.0
200389-4 AMP INC PIN-GUIDE, CENTER, AMP SERIES M 1.0
200390-4 AMP INC RECP-GUIDE PIN, CENTER, SERIES M 1.0
42991-1 4 AMP INC SOCKET-CONTACT, CONN, SIZE 16 66.0
42980-1-LP 4 AMP INC PIN-CONTACT, CONN, 20-24 GA WIRE 18.0
60510-4 AMP INC CONTACT-ELEC, SOC, 18-22GA SIZE 5.0
9KH1 SOCKET-RELAY, 14CONT 33.0
70-1W0-2 KNOB-CONTROL, RD, .250 SHAFT 16.0
200874-2 AMP INC FASTENER-JACK SCREW, FIXED, MALE 1.0
200875-2 AMP INC FASTENER-JACK SCREW, FIXED, FMAL 1.0
091-0024-000 VIKING INSERT-POLARIZING, CONN, .300 LG 64.0
100-2020S WINCHESTER SOCKET-CON, CONN, .766 LG, 20 GA 84.0
201924-1 AMP INC CLIP-SPG TENS, POSITION LOCKING 1.0
56059A107 A MINCOM SCREW-PIVOT, PANEL MTG 4.0
21FK-420 STD PRSD STL NUT-HEX, SELF LK, 1/4-20 X.439WD 4.0
AN960-416 A&N STD WASHER-FLAT, GENERAL PURP, #1/4 4.0
A10-2 PARELCO SOCKET-RELAY, 14 CONT 16.0
N4 RICHCO CLAMP-LOOP, .250 DIA, NYLON 1.0
777 H H SMITH CLAMP-CABLE NYLON .542 DIA 3.0

TITLE SIGNAL ELECT MODULE ASSY-16TCK CATALOG NO. 83-5920-1759

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART. NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
32	7166	WALSCO	TERM-LUG, UNINS, FLAT, #6	83-9630-0028	16.0
33	560598102-2	B MINCOM	PANEL-RELAY, MODULE, LOWER	83-3360-1512	1.0
34	60618-4	AMP INC	CONTACT-ELEC, PIN, .084 DIA	83-1610-0925	11.0
35	MS35206-203	MIL STD	SCREW-MACH, PAN HD, 2-56 X 1/4	83-9260-4502	5.0
36			WASHER-FLAT, SM PATT, #2	83-9261-4011	5.0
37	MS35338-35	MIL STD	WASHER-LOCK, SPLIT, HELICAL, #2	83-9261-4301	5.0
38	MS35369-22	MIL STD	NUT-HEX, PLAIN, 2-56 X .188 WD	83-9260-2001	5.0
39	4-01769	ALCON	TERM BD-5 POS, .325 WD X 1.312LG	83-1640-0625	1.0
40	56059A115	A MINCOM	LABEL-IDENT, TCKS 1-8, M56	83-3550-1815	1.0
41	56059A116	A MINCOM	LABEL-IDENT, TCKS 9-16, M56	83-3550-1816	1.0
42	56059A117	A MINCOM	LABEL-IDENT, BIAS/ERASE, L, M56	83-3550-1817	1.0
43	56059A118	A MINCOM	LABEL-IDENT, BIAS/ERASE, R, M56	83-3550-1818	1.0
45	YEC 120	BURNDY	FERRULE-RF CABLE GND, .300 OD	83-9690-0240	70.0
46	YEC-100	BRUNDY	FERRULE-RF CABLE YEL, .270 OD	83-9690-0212	76.0
47	GS8071C	THOMAS&BETTS	FERRULE-RF CABLE, .071 ID	83-9690-0091	19.0
48	GSC199	THOMAS&BETTS	FERRULE-RF CABLE GND, .199 ID	83-9690-0098	19.0
49	725	H.H. SMITH	CLAMP-LOOP, .125 CABLE, NYLON	83-7650-0100	16.0
50	60527-4	AMP	SOCKET-CONTACT, CONN, STR, 18-14	83-1610-1247	2.0
51	M-2786	ALLEN BRADLY	NUT-HEX, PLAIN, 3/8-32 X .500 OD	83-9260-2112	16.0
52	#774	H.H. SMITH	CLAMP-STRAIN, .313 ID	83-7650-0005	2.0
53	MS21919DG-16	CANNON	CLAMP-CABLE, CUSH, LOOP, 1.0 ID	83-7650-0054	2.0
54	00000A765-11	F MINCOM	STRAP-GROUNDING, 12.000 LG	83-3650-0625	1.0
55	56059A109	A MINCOM	SHIELD-EM, CABLE LEAD	83-3650-0631	1.0



Signal Electronics Module Assembly

REV C

PL 56059A900

PARTS LIST

TITLE KIT-SIG ELECT,NAB,7.5-15,16TCK CATALOG NO. 83-5990-0835

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MATERIAL	REQUIREMENTS	DESCRIPTION	PH CATALOG NO.	QTY.
1	23059B020	A	MINCOM	PC BD ASSY-BIAS ERASE	83-4930-2952	16.0
2	23059B040	F	MINCOM	P.C. BD ASSY-RECORD,NAB	83-4930-1214	16.0
3	23059A060	G	MINCOM	P.C. BD ASSY-LNE AMP,SIG ELECT	83-4930-1091	16.0
4	23059B090-1	E	MINCOM	PC BD ASSY-PREAMP,OVDUB 7.5-15	83-4930-2180	16.0
5	23059A110	A	MINCOM	P.C. BD ASSY-EXTENDER	83-4930-1746	1.0

PARTS LIST

CATALOG NO. 83-5990-0921

TITLE KIT-SIG ELEC BDS,16T,15-30,NAB

----- MATERIAL REQUIREMENTS -----

REF. DES. OR FIND NO. DRAWING NUMBER MFR NAME DESCRIPTION PH CATALOG NO. QTY.

REF. DES. OR FIND NO.	DRAWING NUMBER	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
	- MFR PART NO.				
1	230598020	A MINCOM	PC BD ASSY-BIAS ERASE	83-4930-2952	16.0
2	230598040	F MINCOM	P.C. BD ASSY-RECORD,NAB	83-4930-1214	16.0
3	23059A060	G MINCOM	P.C. BD ASSY-LNE AMP, SIG ELECT	83-4930-1091	16.0
4	230598090-2	E MINCOM	PC BD ASSY-PREAMP,OVERDUB15/30	83-4930-2511	16.0
5	23059A110	A MINCOM	P.C. BD ASSY-EXTENDER	83-4930-1746	1.0

TITLE HD ASSY-SND REC/REP,MAG ERASER CATALOG NO. 83-5950-1366

MATERIAL REQUIREMENTS

REF. DES. OR FIND NO.	DRAWING NUMBER - MFR PART NO.	MFR NAME	DESCRIPTION	PH CATALOG NO.	QTY.
1	56119A010	C MINCOM	PLATE-HEAD MTG	83-3950-1412	1.0
2	56001A000	A MINCOM	HD ASSY-RECORD, 2 IN, 16 TRACK	83-5950-1367	1.0
3	56002A000	A MINCOM	HD ASSY-REPRODUCE, 2 IN, 16 TK	83-5950-1368	1.0
4	56101A000	A MINCOM	HD ASSY-ERASE, 2 IN, 16 TRACK	83-5950-1369	1.0
5	16002 0080-4	I MINCOM	SCREW-DIFFERENTIAL AZIMUTH	83-3950-0939	2.0
6	09002 002	O MINCOM	NUT-AZIMUTH, MOD G&CM, 8-32	83-3950-0148	2.0
7	56119A050	C MINCOM	SHIELD DOOR ASSY-2 INCH	83-4950-1415	1.0
8	56119A055	A MINCOM	SUPPORT-DOOR, FRONT	83-3340-0705	1.0
9	56119A056	A MINCOM	SUPPORT-DOOR, REAR	83-3340-0706	1.0
10	56119A057	B MINCOM	CRANK-ACTUATOR	83-3210-0356	1.0
11	56119A001	A MINCOM	SUPPORT-TRIM, HD COVER, 2 INCH	83-3340-0704	2.0
12	NAS1352-04-4	NAS STD	SCREW-SHC, 4-40X1/4	83-9261-2001	6.0
13	NAS1352-04-6P	NAS STD	SCREW-CAP, SOC HD, 4-40 X 3/8	83-9261-2002	4.0
14	MS51022-10		SETScrew, CUP POINT, 4-40 X.188	83-9261-0270	3.0
15	MS24693-54	MIL STD	SCREW-MACH, FH, 4-40 X 3/8	83-9260-6573	2.0
16	MS35338-40	MIL STD	WASHER-LOCK, SPLIT, HELICAL, #4	83-9261-4303	6.0
17			WASHER-FLAT, RD, .125 I.D.	83-9261-4062	6.0
18	MRAC 42P-G7	WINCHESTER	CONN-PLUG, RECTANGULAR, 42 CDN	83-1610-0917	2.0
19	7381-M	WALSCO	CLIP-RET, WIRE, .063 WD X-.375 HT	83-7270-0771	1.0



1.3.2 REGULATION

The power supply shall regulate its output voltage to within $\pm .05\%$ as a result of the simultaneous allowed specified changes of input voltage and output load when the direction of such changes are such to make their effects additive.

1.3.3 RIPPLE

The output ripple voltage of the power supply shall be less than 1.0 millivolts RMS.

1.3.4 AMBIENT OPERATING TEMPERATURE

The power supply shall operate at full load current and voltage ratings within an ambient temperature range of -20°C to $+40^{\circ}\text{C}$. The power supply shall derate in full load current to maximum operating temperature of 70°C ambient.

1.3.5 OUTPUT CURRENT

The maximum output current shall be 9 amperes from an ambient temperature of -20°C TO $+40^{\circ}\text{C}$. From $+40^{\circ}\text{C}$ to $+70^{\circ}\text{C}$ the current maximum shall derate linearly to 5 amperes.

1.3.6 OUTPUT VOLTAGE

The output shall be adjustable from 27 to 29 VDC. The point of measurement shall be the connection point of the remote sense terminals to the load. The maximum allowable voltage drop in the interconnecting wiring is 29 - V out i.e. 29-28 VDC (nominal setpoint) allows 1 volt line drop.

1.3.7 SHORT CIRCUIT AND OVERLOAD PROTECTION

The power supply shall not be damaged by a short circuit or overload between the output terminals

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1.3.7 (Cont..)

regardless of duration applied. Current limiting shall not allow the output current to exceed 12 amperes at +40°C. Short circuit current shall not exceed 5 amperes.

1.3.8 POLARITY

The power supply shall be capable of operating as a positive or negative supply.

1.3.9 TEMPERATURE COEFFICIENT

The output shall change less than .01% per degree centigrade.

1.3.10 ISOLATION VOLTAGE

A maximum of 500 VDC can be connected between chassis and input or output terminals.

CAUTION The input terminals shall be shorted together and the output terminals, including the sense terminals, shall be shorted together prior to performing this test.

1.3.11 INSULATION RESISTANCE

With 500 VDC connected between chassis and input or output terminals, the insulation resistance shall be at least 100 megohms at 25°C.

CAUTION The input terminals shall be shorted together and the output terminals including the sense terminals, shall be shorted together prior to performing this test.



1.3.12 MAGNETIC RADIATION

Magnetic radiation from the outside surfaces of the power supply shall not exceed 2 gauss on the end opposite the terminals and the bottom and 1 gauss on all other surfaces at full load.

2.0 OPERATION AND TEST

The procedure covered in the following section must be followed to test or operate the power supply.

2.1 OUTPUT VOLTAGE

Measure the output voltage at the remote sense points at the load. Set the voltage to 28.00 VDC.

2.2 REGULATION

The power supply shall be tested at full load and no load with the input voltage varied from 105 to 125 VAC at each condition. The output voltage measured at the sense points shall remain within \pm 140 millivolts.

2.3 RIPPLE

The output voltage ripple, measured with a True RMS meter at the sense points, shall not exceed 1.0 millivolt RMS from full load to no load and 105 to 125 VAC input.

2.4 ISOLATION VOLTAGE

The following terminals must be shorted together before applying voltage:

1. Positive Output, Positive Sense, Negative Output, Negative Sense.

(Cont..)

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2.4 (Cont..)

2. The two input terminals.

After the terminals have been shorted, slowly apply 500 VDC between chassis and each set of terminals. The insulation resistance shall be 100 megohms minimum.

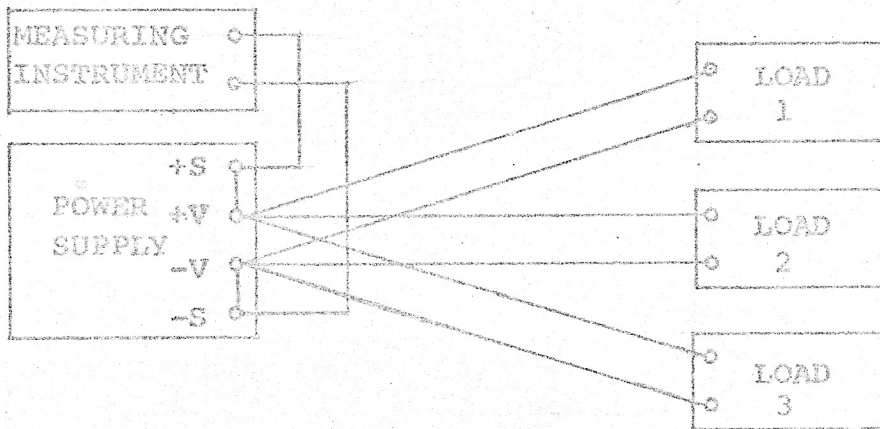
2.5 SHORT CIRCUIT PROTECTION

With an input voltage of 115 VAC, increase load beyond 9 ampere rating. Output current shall not exceed 12 amperes and with a complete short across the output the output current shall not exceed 5 amperes. This test applies up to +40°C. At +70°C rated output current is 5 amperes.



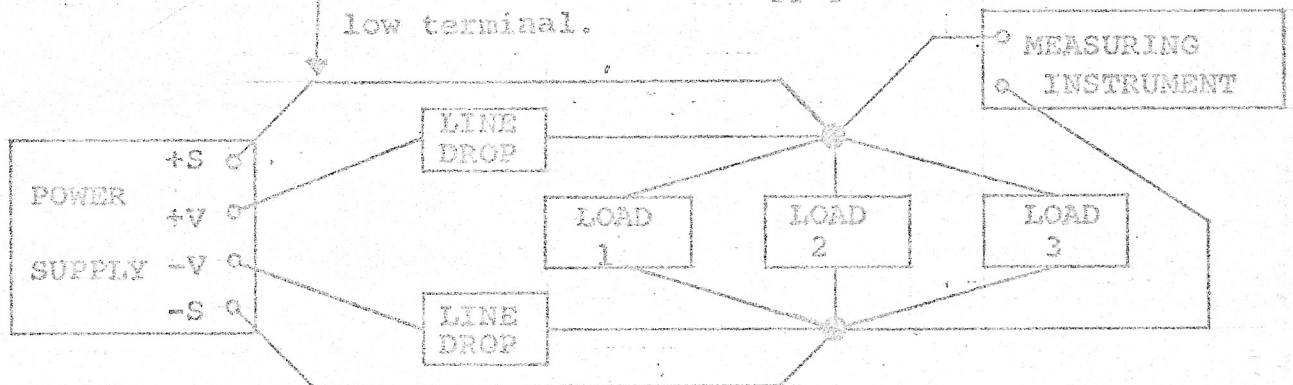
CONNECTION PROCEDURES

FIGURE 1



A) Correct DC Power Distribution Using Local Sensing

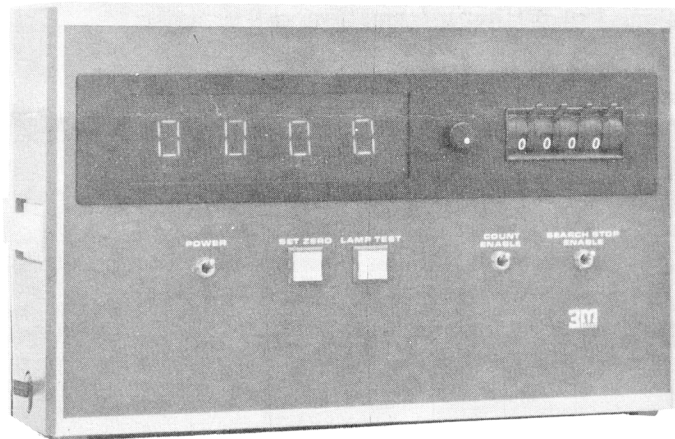
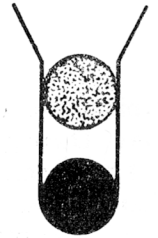
Remote sense wires usually twisted pair possibly shielded with shield connected at supply low terminal.



B) Correct DC power Distribution using Remote Sensing.

3M
BRAND

SELECTAKE[®]



The 3M Brand Selectake unit is an accessory for 3M Brand Professional Mastering Recorders. Four place readout tubes indicate recorder tape position. The unit will search and automatically locate a

preselected tape position. This small compact unit, measuring 12-3/8 inches by 5-3/4 inches by 3-5/16 inches, will adapt to all of the 3M Professional Audio Recorders.

OPERATING CONTROLS

POWER

Controls the input power, 105 - 120 volts ac, single phase, 50 - 60 Hz.

SET ZERO

Resets the readout tubes to indicate 0000.

LAMP TEST

Tests all segments of the readout tubes - indications are 8888.

Readout Tubes

Four digital display tubes indicate recorder tape location.

COUNT ENABLE

Allows the operator to maintain a registered count during such modes as editing when one reel may have tape added or subtracted while the other may contain the information to be located, i.e. downbeat vs leader.

SEARCH STOP ENABLE

Inhibits the automatic search operation.

Preselector

Sets the location of a predetermined tape position on the recorder.

Brightness

Regulates brightness of readout tubes.

A typical use of the Selectake unit would be as follows. During a recording session, the operator would note and log take starts as indicated on the readout tubes. When replays of certain takes are required, the previously recorded take starts would be set on the preselector.

The appropriate mode (forward or rewind) would be initiated on the recorder. The Selectake will then command the recorder to stop at the pre-selected location within ± 2.0 counts of the readout counter. The Selectake is inhibited by the SEARCH STOP switch and normal recording can proceed without interference.

For further information, call or write:

3M Company
Mincom Division
300 South Lewis Road,
Camarillo, California 93010
(805) 482-1911

SELECTAKE[®]

PROFESSIONAL AUDIO PRODUCTS
Mincom Division **3M**
COMPANY
300 SOUTH LEWIS ROAD • CAMARILLO, CALIFORNIA 93010



300 SOUTH LEWIS ROAD • CAMARILLO, CALIFORNIA 93010 • TEL. 482-1911

Mincom Division

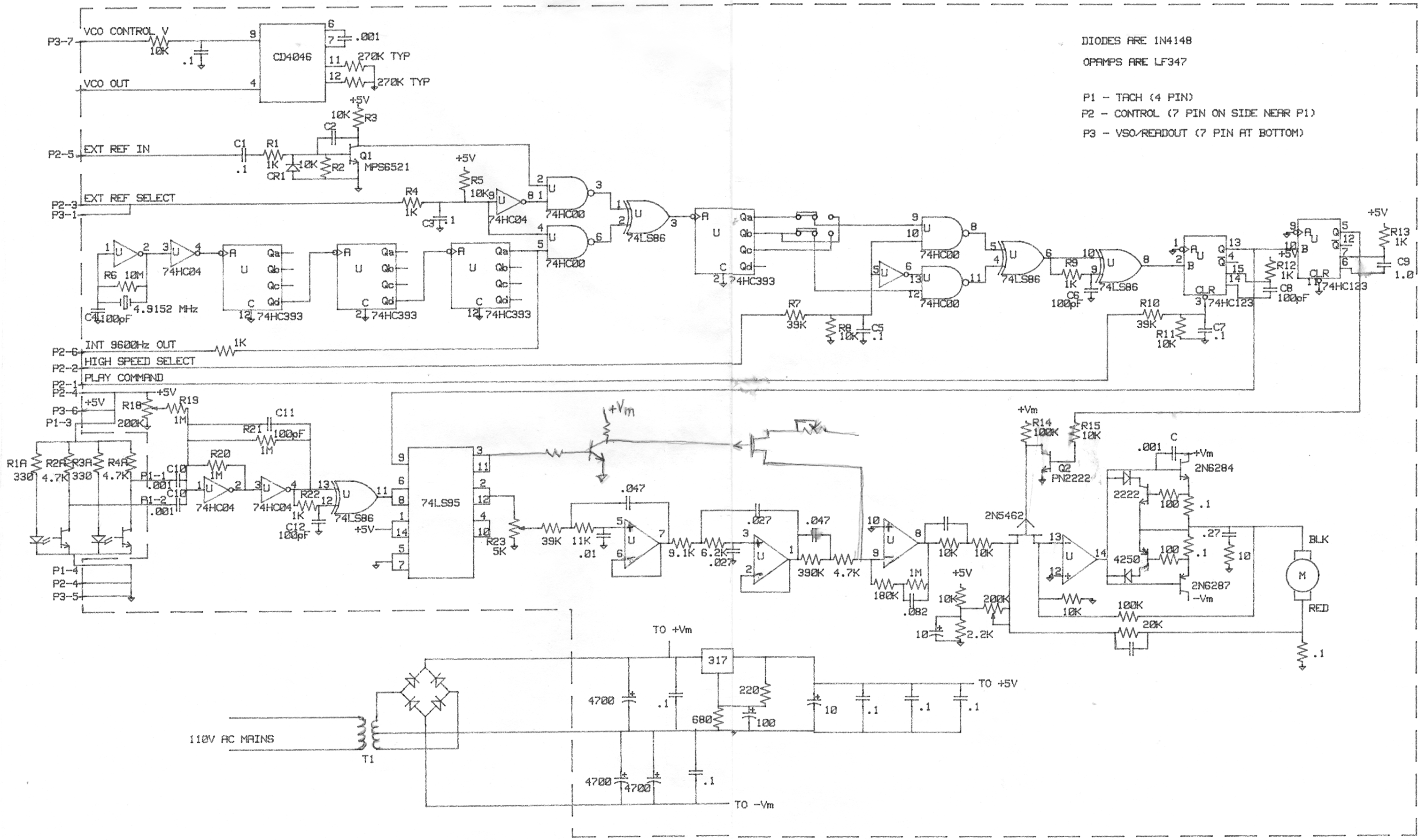
S E L E C T A K E

A counter locator for 3M Model 56 eight and sixteen track Recorder/Reproducers.

<u>Catalog Number</u>	<u>Price</u>
83-5920-1858 Factory installed model. (Price when ordered with recorder)	\$ 895.
83-5990-1156 Field Selectake kit. (Price includes Selectake and machine retrofit assembly)	\$1,020.

NOTE: Special price quotations will be given upon request for Selectake units to be used with Model 23 one, two, four and eight track systems as well as Model 64 one, two and four track Recorder/Reproducers.

Released 4-13-71
Professional Audio Products



DIODES ARE 1N4148
OPAMPS ARE LF347

P1 - TACH (4 PIN)
P2 - CONTROL (7 PIN ON SIDE NEAR P1)
P3 - VSO/READOUT (7 PIN AT BOTTOM)

110V AC MAINS

TO +Vm

TO +5V

TO -Vm

BLK
RED

Field Service Bulletin



TECHNICAL NO. 120

Subject: Modification to 16 Track PAR (M-56) to Prevent Arcing of K-5 Run Relay on Logic PC Board.

Applicable to: All M-56 PAR 16 Tracks.

Procedure:

I. The Parts Necessary to Perform this Modification are listed in Table I.

T A B L E I

<u>Item</u>	<u>Mincom Catalog No.</u>	<u>Description</u>	<u>Quantity</u>
1	83-1510-4056	Capacitor .1uf, 400v	1
2	83-1510-2141	Capacitor 1000uf, 50v	1
3	83-1520-8267	Resistor 20 Ω , 50w	1
4	83-9630-0021	Terminal Stud	2
5	83-9350-0783	5/8" Threaded Spacer	2
6	83-9261-4035	6-32 Flat Washer	2
7	83-9261-4305	6-32 Lock Washer	2
8	83-9260-2005	6-32 Nut	2
9	83-9260-4515	4-40 x 3/8" Screw	2
10	83-9261-4002	4-40 Flat Washer	2
11	83-9261-4303	4-40 Lock Washer	2

II. Remove All Power from machine

III. Disconnect J-12 leading to Capstan Start-Stop Assembly on rear of Transport casting and physically remove assembly, placing same in suitable work area.

IV. Install .1uf, 400v Capacitor (Item 1, Table I) in parallel with existing 100 Ω and 1K Ω resistors. Refer to Figure 1 for location.

V. Install Terminal Studs (Item 4, Table I) in pre-drilled holes as indicated in Figure 2.

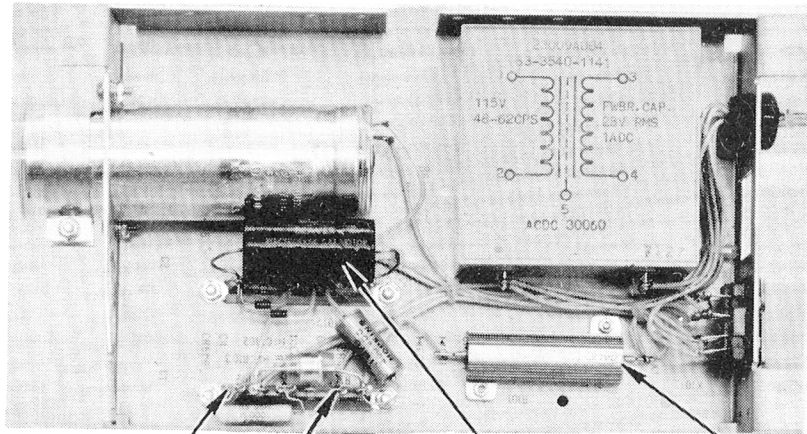
VI. Mount 1000uf, 50v capacitor (Item 2, Table I) to studs installed in Step V.

VII. Remove capacitor C-102 250uf, 50v from terminal board as indicated in Figure 1.

April 1972

- VIII. Using 22 gauge wire connected capacitor mounted in step VI to points on terminal board where capacitor removed in Step VII was connected.
- IX. Remove nut, flat washer & lock washer that secure R-101 to chassis and install 5/8" threaded spacer (Item 5, Table I). Mount 20 Ω , 50w resistor (Item 3, Table I) on threaded spacer & secure with hardware called out in Table I, Items 9, 10 and 11.
- X. Disconnect wire from P-12-2 that connects to K-101 side of R-101 and connect it to K-101 end of resistor added in Step IX.
- XI. Run 22 gauge jumper from left end of 20 Ω , 50w added resistor to K-101 end of 50 Ω , 50w resistor.
- XII. Change Capstan Start-Stop Assembly schematic diagram on logic board diagram in Instruction per Figure 3.
- XIII. Reinstall Capstan Start-Stop Assembly, Apply Power and check transport for correct operation.

FIGURE 1

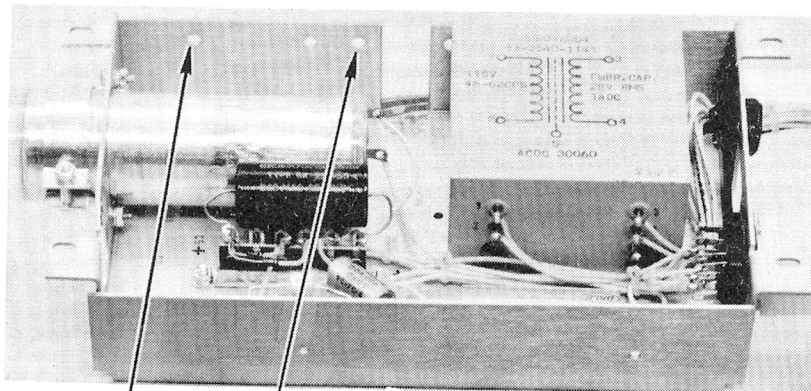


.1uf 400 Capacitor
Connection Points
on Terminal Board

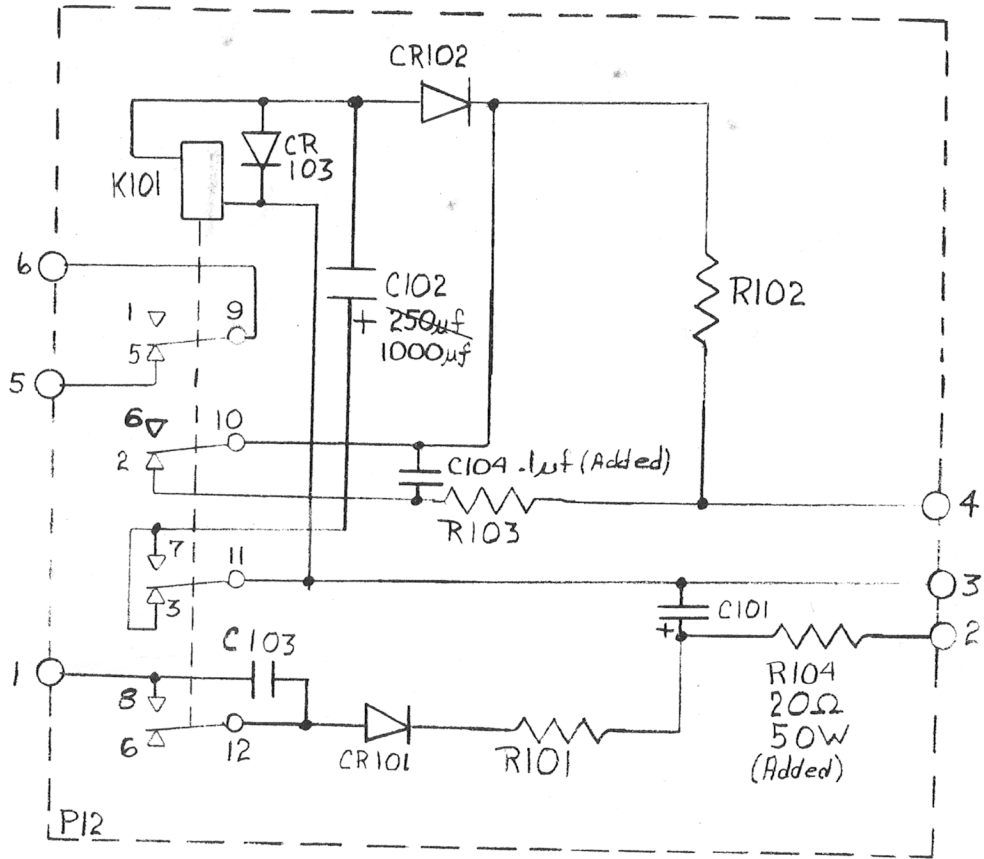
To be Removed

R101 50Ω, 50W

FIGURE 2



Install Terminal
Studs in these holes.



M-56 MODIFICATION TO PROVIDE "A" "B" LOCK SWITCH

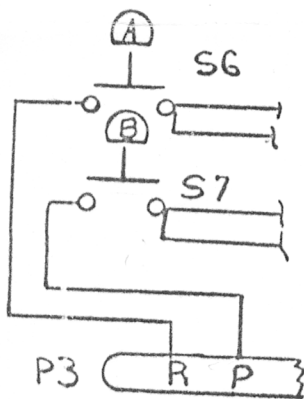
In recent months the M-56 Professional Recorder has had incorporated in it, circuitry to provide an automatic A-B command. This function transfers the recorder's output to the "A" or input monitor whenever a track is recording. At the termination of the recording the output is transferred to "B" or recorder output.

This modification eliminates the A-B push-button on the remote boxes. Added are two toggle type switches. One switch is a three (3) position switch similar to the switches found on the meter panel. This replaces the push-buttons, and in normal use becomes the A-B master command from the remote box. The other is a two (2) position switch which becomes A "B-Lock". In the "OFF" position all functions remain as prior to modification.

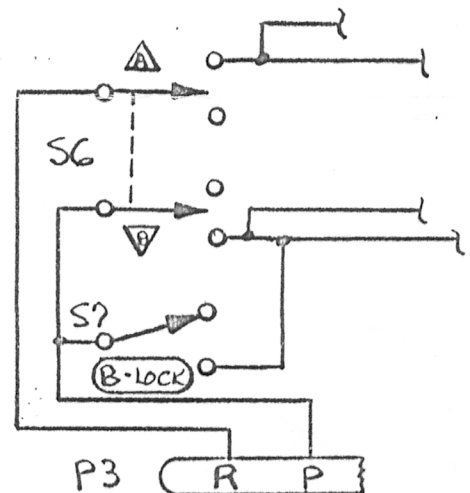
If the user desires to record and monitor the recorder output, he positions the "B-Lock" switch to ON or B-Lock. The recorder's A-B relays are now locked in the "B" position. Auto transfer to "A" upon record activation will not occur. The master A-B or individual A-B commands will not be accepted. If it is desirable to have some tracks accept their individual A-B commands or auto A-B commands, the A-B switch on their respective #6 boards (line amp) may be positioned to off.

The following are the modifications to accomplish this:

1. Remove the two push-button switches from the panel. Do not remove their wires until the new switches are installed and ready to have the wires transferred to the new switches.
2. Install the two toggle switches and new decal plate if available. The 3 position switch goes above the two position switch.
3. Wire the switches as shown.



WAS



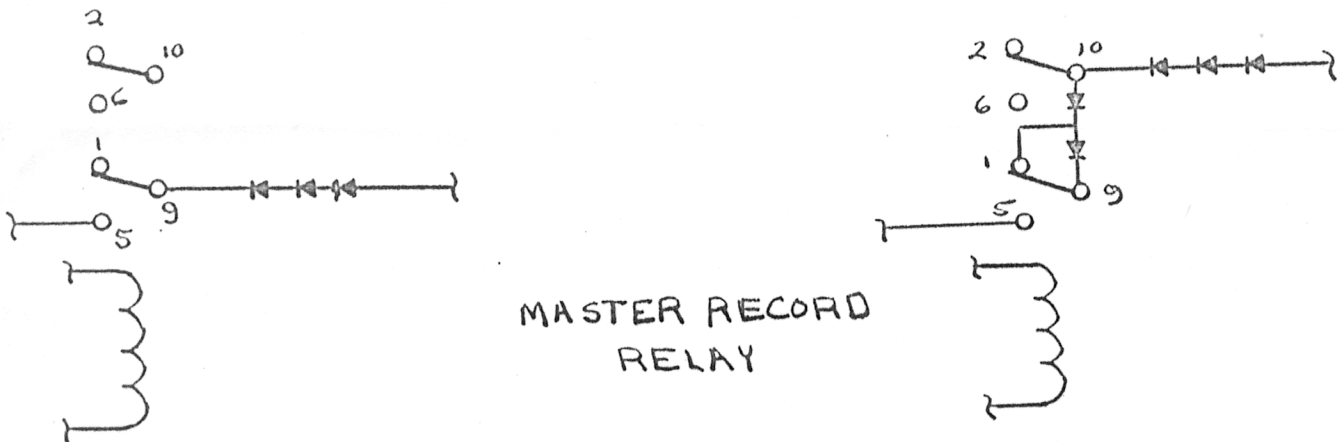
IS

56017BI00 Remote Control

S6 - 3 position DPDT C & K #7205 83-1550-5573
S7 - SPDT C & #7101 83-1550-5237

MODIFICATION TO ASSURE RECORD RELAY DROPOUT

When using the M-56 Remote Box, rapid movement of the ready-safe sync switch from record to sync may not allow the record relay to dropout before the 5v-sync command is applied. This modification will cause ample reduction of voltage to the record relay thus assuring dropout of all relays when the +5V sync command is present.



WAS

IS

56059B100 - Electronic Module

Diode In4004 83-1530-0151

HOW TO CONVERT A M-56 FROM +4 DBM OUTPUT

TO +8 DBM OUTPUT

1. Change the meter calibrate resistors located on the meter panel assembly from 3.6K to 8.2K (83-1520-7369).
2. In the signal electronics module, locate the reproduce preamp connectors (7/9 Bds.). The 5.1K resistors that are connected to pins 11 and 15 must be removed (ref. 56059A100 resistors R-F).
3. Using an alignment tape readjust the gain pot on the reproduce preamp to read "zero VU" when the reference tone is played. Be certain that the output is properly terminated with 600 OHMS. The output as measured with an external VTVM should now be +8 DBM.
4. Apply +8 DBM at 1 KC to the recorder input. Enter the record mode and adjust the Record Gain Control for "zero VU" output on the "VU Meter". Note: Be certain that the "B" output lights are on.
5. Maintaining the +8 DBM into the recorder readjust the record monitor pots (bottom pot on #4 Bds.) for zero VU. Note: Be certain the "A Monitor" lamps are on.

M-56 SYNC RESPONSE

The M-56 does not provide separate adjustable equalization in the overdub playback mode. Consequently, 15 Kc could be below an acceptable minimum level (usually -3db).

A modification may be made to the reproduce preamp (23059B090) to provide a fixed boost at 15 Kc of approximately 3db.

The modification consists of adding a .0082 UFD capacitor (83-1510-6017) in parallel with R16 (4.7K).

MODIFICATION TO REDUCE POPS, CLICKS & THUMPS

(When entering or leaving the record mode using the lever switches on the M-56 Remote Box)

The normal operation of the M-56 Professional Recorder is as follows:

1. Pre-select the tracks to be recorded on by positioning their respective lever switches to the ready position.
2. To start the recording, depress the record and play push-buttons simultaneously.
3. To terminate the recording the stop button is depressed.

Recently, some users of the M-56 have tried to initiate and terminate the recording by:

1. Depressing the record-play buttons simultaneously. This pre-sets the machine into the "record" mode.
2. Actual recording is then activated by moving the desired lever switches into the ready position.
3. Termination of the recording is then accomplished by moving the lever switch back to the "safe" position.

It is possible that when using this method pops, clicks or thumps may be put onto the tape at the beginning or end of the recording.

To reduce these problems to a minimum the following modifications are presented:

1. Modify the bias and erase boards as shown on the attached schematic.
 - a. Add five idodes - IN270, 83-1530-0263.
 - b. Change C2's total value to 200 to 250 UFD.
Note: This is generally accomplished by adding another 100 UFD (83-1510-6161) in parallel with the existing C2. However, if a 200 or 250 UFD capacitor of appropriate size is available C2 may be replaced with it.
2. Add a 2.7K $\frac{1}{2}$ watt resistor (83-1520-7361) to each record relay as shown in figure 1.

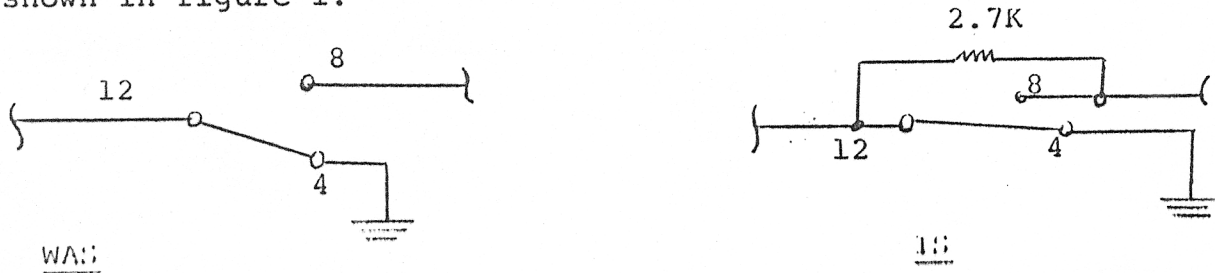
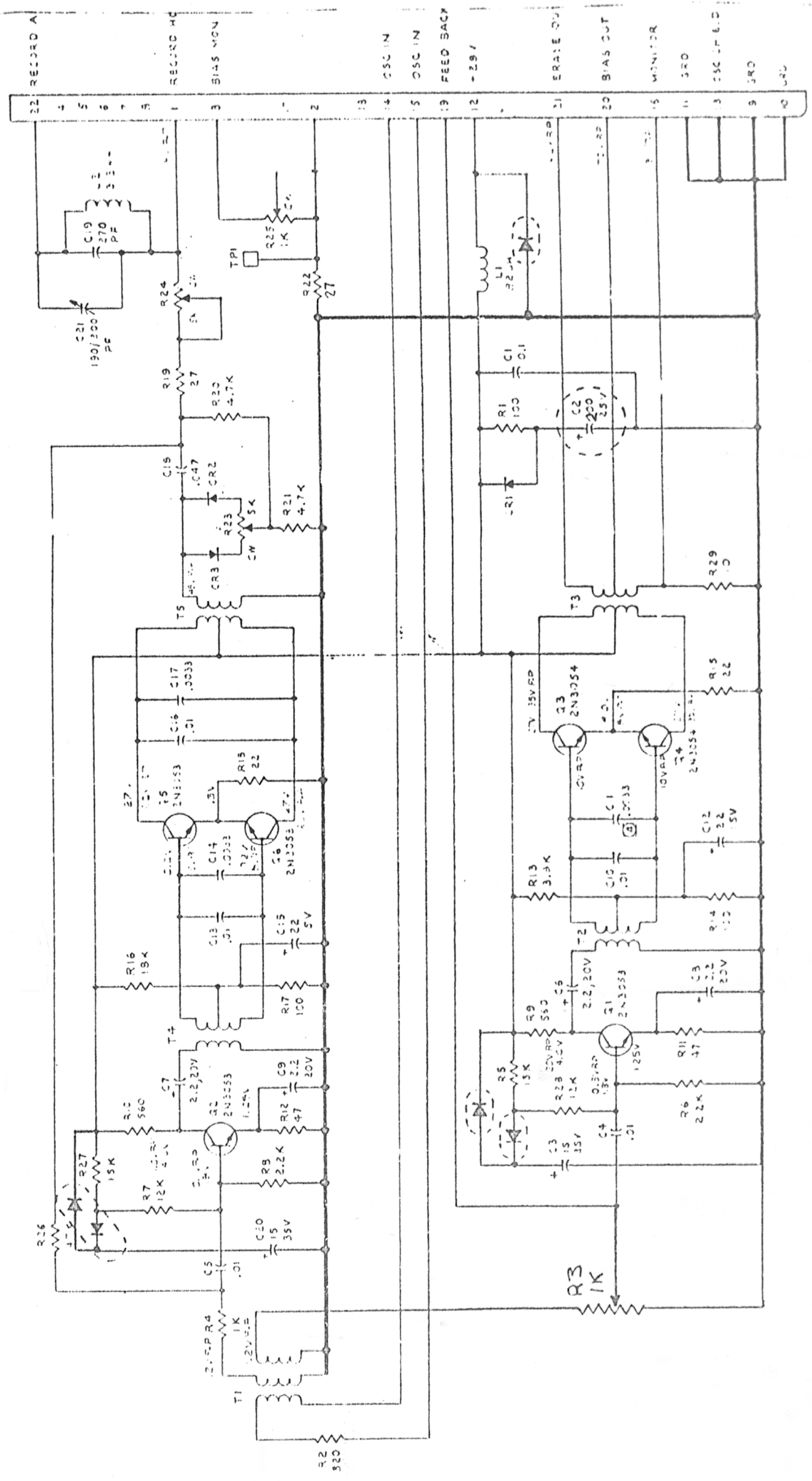


Figure 1 56059B100 Electronic Module

3. Perform the following alignments to assure optimum performance.
 - a. Connect a scope and vtvm to the erase test point of track one.
 - b. Adjust the coupling capacitor (adjacent to the test point) for maximum output as observed on the scope or vtvm.
 - c. Adjust R3 on the bias and erase amp for .5vrms (50 ma).
Note: machine must have a 3M type erase head.
 - d. Fine tune the coupling capacitor for the most symmetrical wave form as observed on the scope.
 - e. Repeat A-D for all tracks.
 - f. Check to assure that the machine erases properly by recording a 1KC tone at 3% on all tracks. Rewind the tape, remove the input and record again over the same length of tape while monitoring the tape output. If the tone is not completely erased, R3 on the bias and erase board may have to be advanced slightly.
 - g. Degauss the heads and adjust the noise balance pot on the #1 boards for minimum grotzel.
 - h. Using a non-metallic adjustment tool, adjust the bias traps on the #1 boards for minimum bias as seen with a scope at TP1 on the #4 board.
Note: fine tuning of this trap may reduce small snicks produced when leaving the record mode from the lever switch; therefore, it is recommended that a high gain monitor system is employed while making this adjustment.

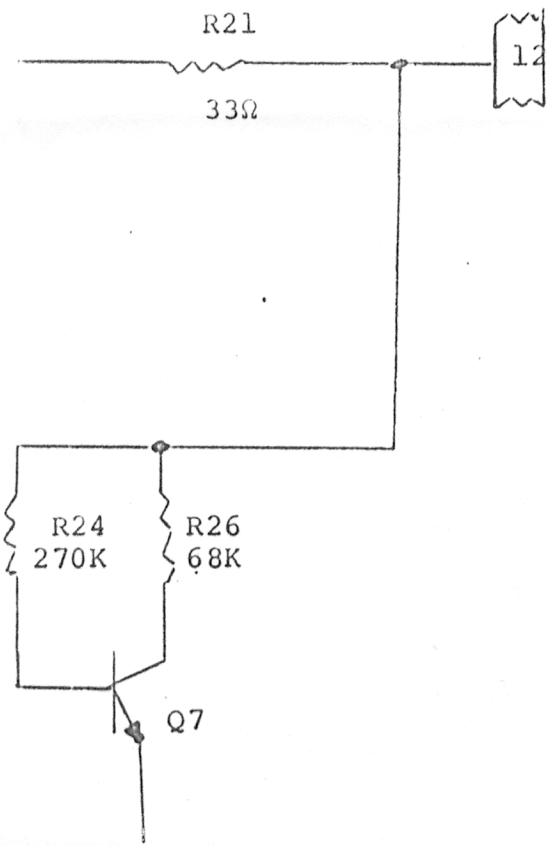
- 1. A.C. CAP
- 2. A.C. RES
- 3. A.C. RES
- 4. A.C. RES
- 5. P/R YOU HIGH IM



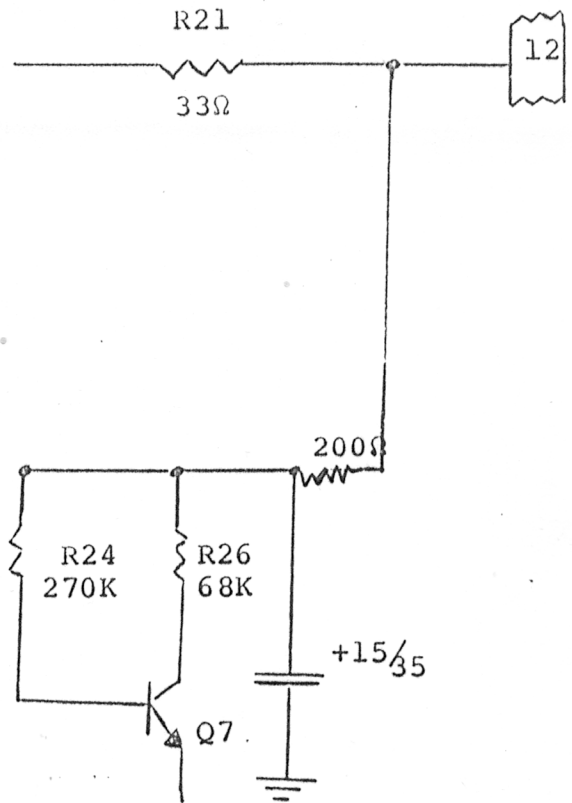
BIAS

MODIFICATION TO REDUCE THE POWER SUPPLY BUZZ IN
THE "A" MONITOR MODE

The M-56 Professional Recorder may exhibit a slight buzz in the "A" mode when used with a high gain monitoring system. Although not affecting the recorder's performance it may be an annoyance to some users. This modification will reduce this buzz to an inaudible level.



WAS



IS

23059B040 RECORD AMP BOARD

Resistor 200Ω ½ watt
Capacitor 15UFD/35V

83-1520-7346
83-1510-6209