JH-24 SERIES
MULTITRACK TAPE RECORDERS

SECOND EDITION: FEBRUARY, 1982

MCI®

1400 W. Commercial Blvd.• Ft. Lauderdale, FL 33309• Phone (305) 491-0825/Telex: 514362 MCI FTL

February, 1983

JH-24 SCHEMATIC CHANGES

1. Schematic SC2600-D-0001, Analog Torque Board Chart, pag 3-23
   change C1 to 22/25, all dash numbers

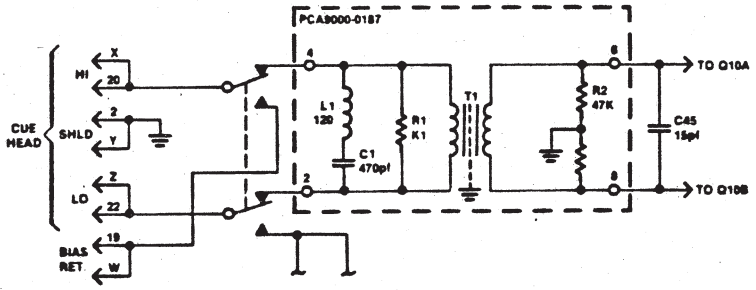
2. Schematic SC9000-D-0151, Audio Power Supply, page 6-11
   change polarity of C8
   delete C11

3. Schematic 9000-D-0147, Output Module, page 4-17
   change R200 and R300 from 47 ohms to 120 ohms

4. Schematic SC9000-D-0146, Reproduce Board, page 4-15
   change R35 from 1M to 2.2M
   change C27 from 15MF25V-CLYRL to 10MF16V-NPLCR

5. Schematic SC9000-C-0148, Bias Board, page 4-19
   change C12 from 470pf to 270pf
   change C21 from 150pf to 100pf
   change R25 from 100 to 47
   change C3 from 470pf to 330pf
   re-label R36 as R37 and R37 as R36
   change R48, R49, R51, and R52 from 5% to 1% resistors

6. Schematic SC9000-D-0149, Record/Cue Board, page 4-21
   change R11 and R58 from 2.6k to 1k ohms
   delete R104
   change R603 from 1k to 3.9k ohms
   update the schematic in your manual as shown below



7. Schematic SC9000-C-0182, Bus Board, page 4-11
   change R1 from 150 to 220

8. Schematic SC0600-D-0604, ±18V Regulator Board, page 6-9
   change R21 and R35 from .10, 20W to .08, 20W

9. Schematic PCA2500-0287-00, Capstan Tach Board, page 3-35
   change R2 from 3.3M to 1.3M
   add one 1.3M resistor from pins 1 & 2 of IC1 to ground

10. Schematic SC2500-E-1033, Phase Locked Loop Board, page 3-21
   change R17 from 1k to 2k ohms
   change R19 from 1.3M to 2.2M
   change R23 from 3.9k to 4.7k ohms
   change C15 from .1/100 to .01/100

11. Schematic SC2500-D-0630, JH-114PS Power Supply, page 6-5
   change R4 from 2.4k to 2.2k

12. Schematic SC9000-D-0145, Strip Board, page 4-13
   change C1 from 20/35 to 220/50

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MOTOR REMOVAL JH-114 SERIES TRANSPORT

Includes JH-16/114 and JH-24 Series

Tools Required

.Number 8 Allen Driver
.Medium flat-bladed screwdriver
.Small slip-joint pliers or 3/16" Nut driver
.AC Voltmeter (HP 400 FL or equivalent) Test Leads
.Bench Power supply capable of delivering 12 vDC at 1 amp maximum

.... Do one motor at a time ....

Step 1 Remove locking screw located on inside top of reel lock. Remove bushing.

Step 2 Remove reel lock nut. Lift reel lock and spring from motor shaft.

Step 3 Remove (3) (8-32-½") Allen head screws and lift reel lock base and turntable from motor shaft.

Step 4 Remove factory shims and retain for reinstallation. (Use piece of adhesive tape to hold together)

Step 5 Remove rear cover panel.

Step 6 Viewing deck from rear, disconnect the tachometer harness and the motor supply harness from the motor assembly.

Step 7 To remove motor, loosen (4) (6-32 x 1"). Do not remove screws.

Step 8 From rear of machine, support the motor in one hand and remove motor mounting screws completely.

CAUTION: Reel motor is heavy. Support carefully to prevent damage to hands or the tape machine. Assistance from another individual may aid in motor removal.

Step 9 Go to tachometer disassembly procedure.

Step 10 Reverse procedure to reinstall.

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TACHOMETER DISASSEMBLY

.... Do one motor at a time ....

Step 1 Place motor on bench to disassemble

Step 2 Remove screws holding harness to tachometer. Do not discard these screws. They will be needed on reassembly.

Step 3 Remove nuts from bottom of tach with pliers or nutdriver. Discard these nuts.

Step 4 Remove spring cap, spring, and brush. Discard these parts.

Step 5 Install new brush and spring as shown in illustration; then install spring cap. NOTE: Spring must fit over round post on brush for proper installation.

Step 6 Reinstall nuts supplied with kit and reinstall tachometer harness using screws from step 2.

Black - Pin 1
Red - Pin 2

Step 7 Using a tie wrap, tie brake solenoid assembly to energized position to assure brake is mechanically released.

Step 8 *Attach bench power supply to reel motor (set at 12 vDC)

NOTE: These motors must run the play direction of use to seat brushes properly.

Step 9 Connect AC volt meter to tachometer output. Loosen recessed screws on bottom of tachometer (do not remove) and rotate cap while monitoring AC output of tachometer. Turn cap to null AC component. Tighten screws on cap. Run motor for approximately 4 hours.

Step 10 For JH-110 Series, cut tie wrap on brake assembly (installed in step 7) before reinstallation of motor.

* If the bench power supply cannot be obtained, the transport may be used to substitute. Route motor supply harness through motor mounting hole in deck. Connect. Install opaque card in tape sensor slot. Put machine in play mode. Proceed with Step 9.

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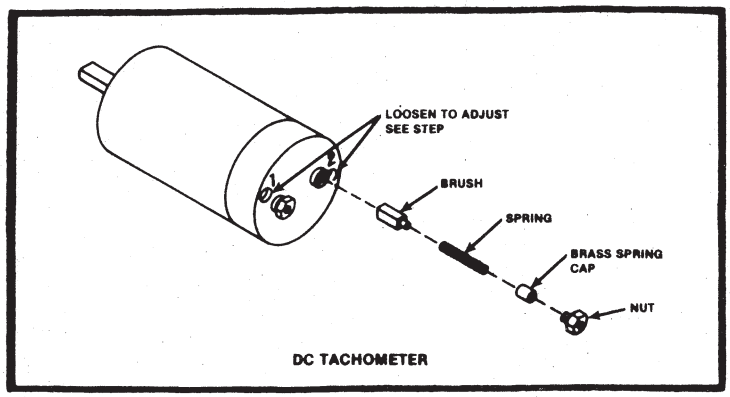

JH-114 TRANSPORT
AS VIEWED FROM REAR OF DECK

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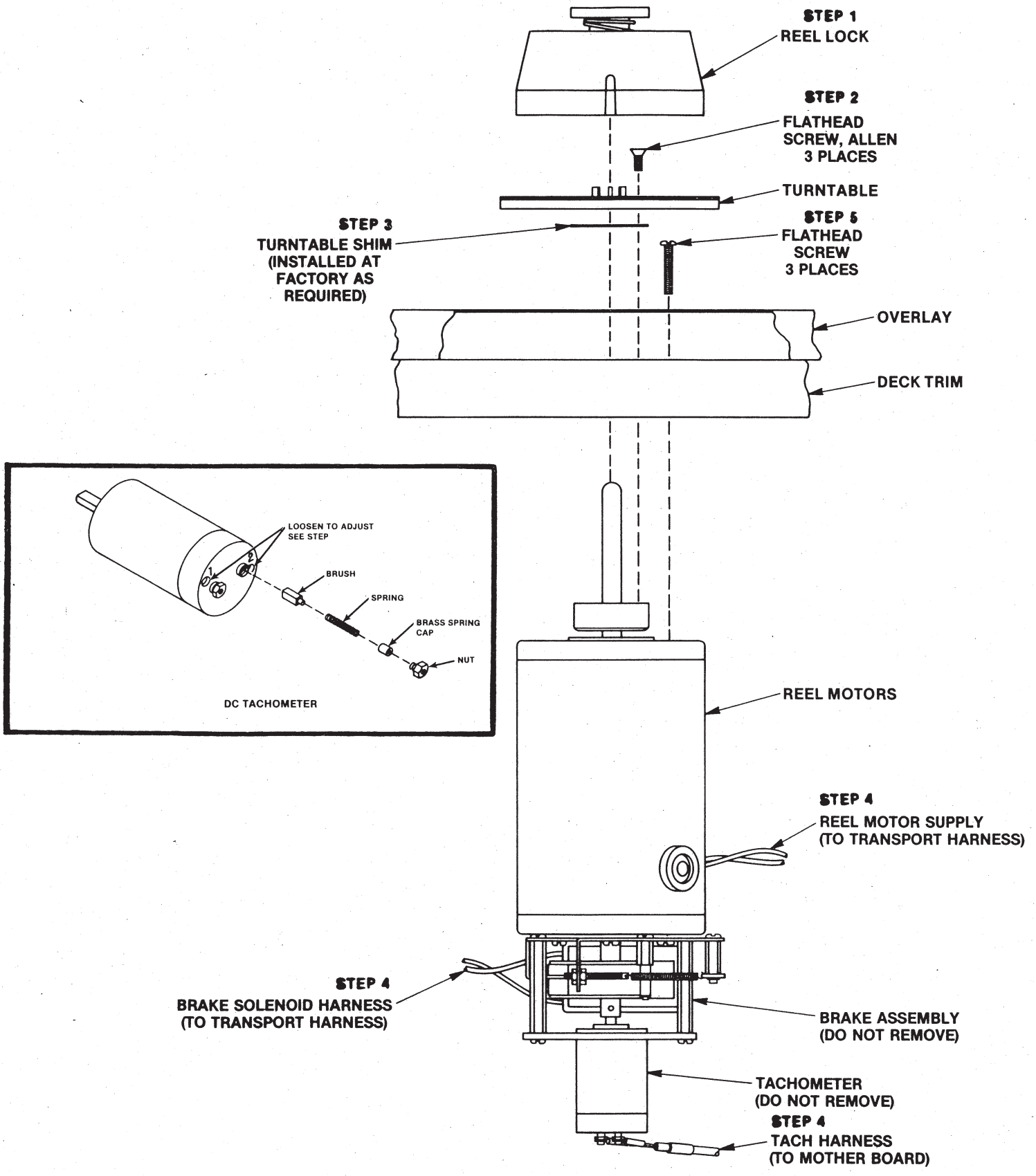
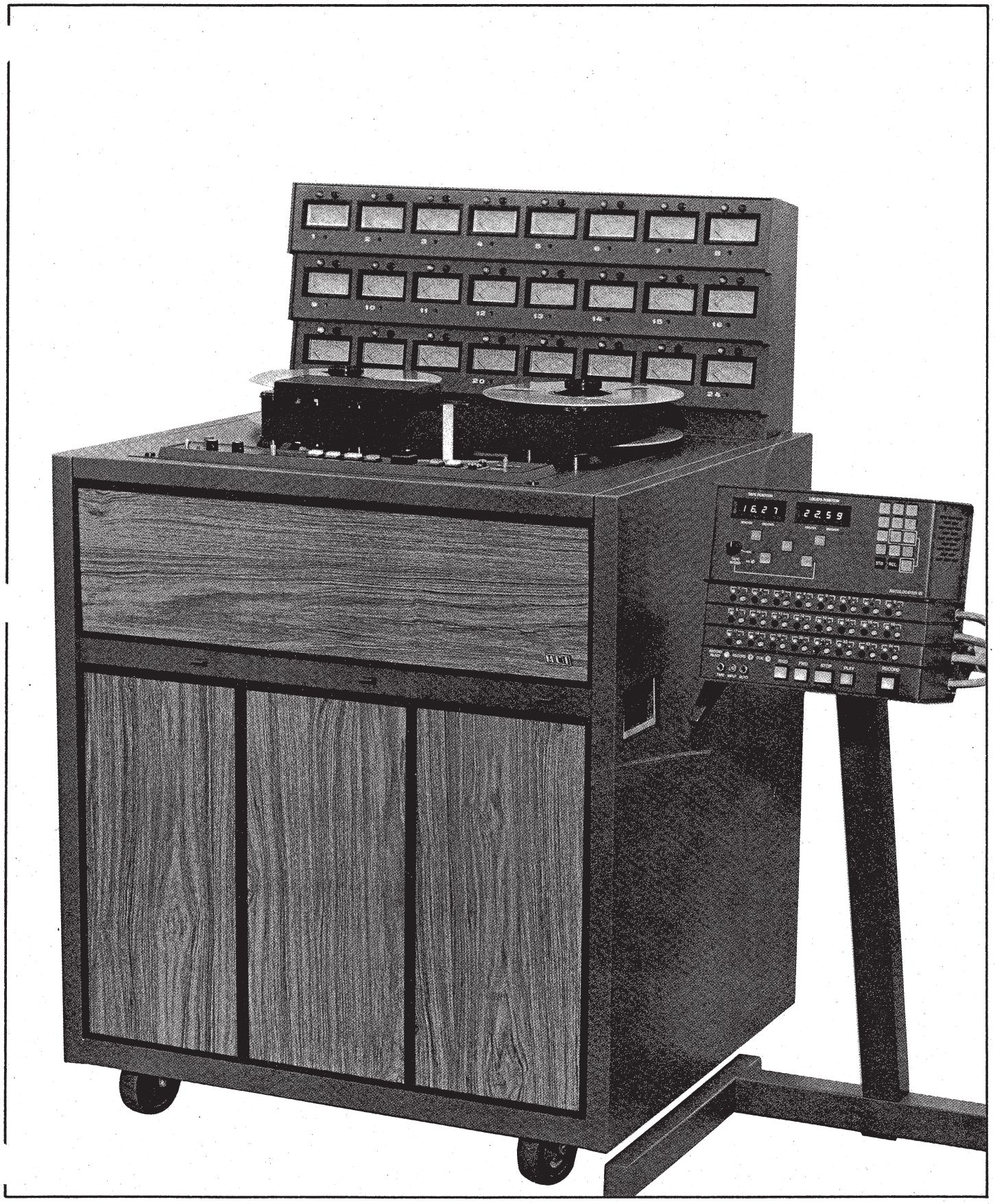


JH-110 TRANSPORT
AS VIEWED FROM REAR OF DECK



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INTRODUCTION

1.1 General Information

The JH-24 Series consists of three multitrack tape configurations: an eight track version using one inch tape, a sixteen track version, and a twenty-four track version both using two inch tape. Each JH-24 multitrack recorder includes a JH-114 tape transport, eight, sixteen, or twenty-four channels of record/reproduce electronics, and a remote control unit.

The modular packaging and design of the JH-24 Series multitrack recorders facilitate system upgrading and compatibility with a variety of tapes and tape formats. Conversion kits, containing heads and tape roller guides, adapt the two inch 16 or 24 track versions to a one inch 8 track format. Eight and 16 track versions expand to 16 and 24 track machines; cabinets can be ordered pre-wired for future expansion. Torque limit switches on the transport adjust the reel motor torque,allowing a wide range of sizes and tape thicknesses to be used.

The compatibility of the JH-24 is further enhanced by its equalization standard switching capability. Switches on the Record/Cue and Reproduce Modules allow alignment to either the NAB or IEC equalization.

1.1.1 JH-114 Tape Transport

Tape motion for the JH-24 multitrack is performed by the JH-114 Tape Transport. The JH-114 is a highly reliable two speed, one or two inch tape transport. The standard operating speeds are 15 and 30 inches per second, derived from a stable 96 kHz crystal oscillator. A variable speed control can vary the pitch by 20% above or below the standard speeds, using an internal voltage controlled oscillator. Tape speed can also be controlled by and external source, such as MCI's AutoLocator III or JH-45 SMPTE/EBU AutoLock.

The JH-24 uses servo controlled dc motors to precisely control the tape speed and tension. A phase lock loop servo locks the capstan motor's speed to the selected reference. A constant tension servo system regulates the torque applied to the reel motors, keeping the tension uniform throughout the entire length of the tape at all tape speeds.

MCI's manual velocity control (MVC) touch sensitive joystick allows the operator to shuttle the tape at any speed up to the fast forward/rewind speeds. The direction and speed of the tape is directly related to the position of the Joystick.

1.1.2 Audio Electronics

The JH-24's record/reproduce electronics are packaged in three rollout drawers located below the tape transport. Each drawer contains complete audio electronics for eight channels. Channels 1 through 8 are located in the left drawer, channels 9 through 16 are in the center drawer, and channels 17 through 24 are in the right drawer. These drawers slide out from the cabinet for easy access to the equalization and level adjustments.

The equalization networks not only provide the proper amplitude response in accordance with either the NAB or IEC specifications, but also

compensate for phase errors normally introduced by these networks. The phase integrity of the ɔcord/reproduce electronics gives the JH-24 and excellent square wave response which surpasses conventional equalization techniques. All the equalization and level adjustments on the record and reproduce modules are made via eighteen-turn potentiometers for accuracy and stability.

There are no transformers in the line input or line output amplifier circuits. Balanced amplifiers are used to provide greater noise immunity and lower distortion. Transformers have also been eliminated from the reproduce and record/cue head preamps.

MCI's QUIOR (QUiet Initiation Of Record) circuitry eliminates punch-in and punch-out noise. These delay and ramp circuits control the timing of the erase and bias signals to prevent clicks and pops from being recorded onto the tape when switching into or out of record mode.

1.1.3 Remote Control Unit

The remote control unit attaches to the JH-24 transport via a 35 foot cable harness. Longer cable lengths are available. Motion control switches on the remote duplicate the functions of the switches on the transport. The monitor input and record ready status for each channel are also controlled from the remote unit. The remote unit mounts on the JH-22 stand which also supports the optional AutoLocator III.

1.1.4 Power Supplies

Operating voltages for the JH-24 multitrack are provided by two power supplies mounted at the bottom of the cabinet. Each power supply is housed in its own chassis. The JH-24D supplies power to the audio electronics; the JH-114PS supplies power to the transport and to the AutoLocator III if used. Various input voltage ranges are easily selected by the fuse plug for worldwide operation.

1.2

TABLE 1-1 JH-24 SPECIFICATIONS

Reel Size	7, 10½, and 14 inches		
Tape Width	1 inch 8 track 2 inch 16 and 24 track		
Tape Speeds			
Fixed	15 and 30 ips (38 and 76 cm/s)		
Variable	±20% about fixed speeds		
Long Term Speed Stability	better than 0.02%		
Start Time	1200 msec @ 30 ips 600 msec @ 15 ips		
Stop Time	4 seconds with 10½ inch reels		
Rewind Time	85 seconds for 2500 ft. 140 seconds for 4800 ft.		
Wow and Flutter	0.04% DIN 45507 weighted @ 15 ips 0.03% DIN 45507 weighted @ 30 ips		
Frequency Response	30 ips AES:	36 to 26kHz	+1½, −3dB
Record and Repro	15 ips NAB:	30 to 26kHz	+1½, −2dB

Signal to Noise		**8 & 16 track**	**24 track**
Record and Repro	30 ips AES	−67dB	−64dB
Referenced to 510nWb/m	15 ips NAB	−63dB	−60dB
Unweighted, 20 Hz to 20kHz			
Weighted, dB(A)	30 ips AES	−72dB	−69dB
Referenced to 510nWb/m	15 ips NAB	−68dB	−65dB

Harmonic Distortion		
1 kHz fundamental at 510nWb/m		
3rd harmonic	30 ips AES	<0.35%
	15 ips NAB	<0.50%
2nd harmonic	30 ips AES	<0.10%
	15 ips NAB	<0.10%
3% 3rd harmonic fluxivity level	30 ips AES	1040nWb/m
	15 ips NAB	1020nWb/m
Depth of Erasure	better than 80dB at 1 kHz	
Erase Frequency	105 kHz	
Bias Frequency	210 kHz	

Input Impedance	10 kΩ
Output Source Impedance	120Ω, balanced
Maximum Output	+28dBm at clipping, balanced +22dBm at clipping, unbalanced
Weight	
8 track	410 lbs (186 kg)
16 track	474 lbs (215 kg)
24 track	538 lbs (244 kg)

Cabinet Dimensions:

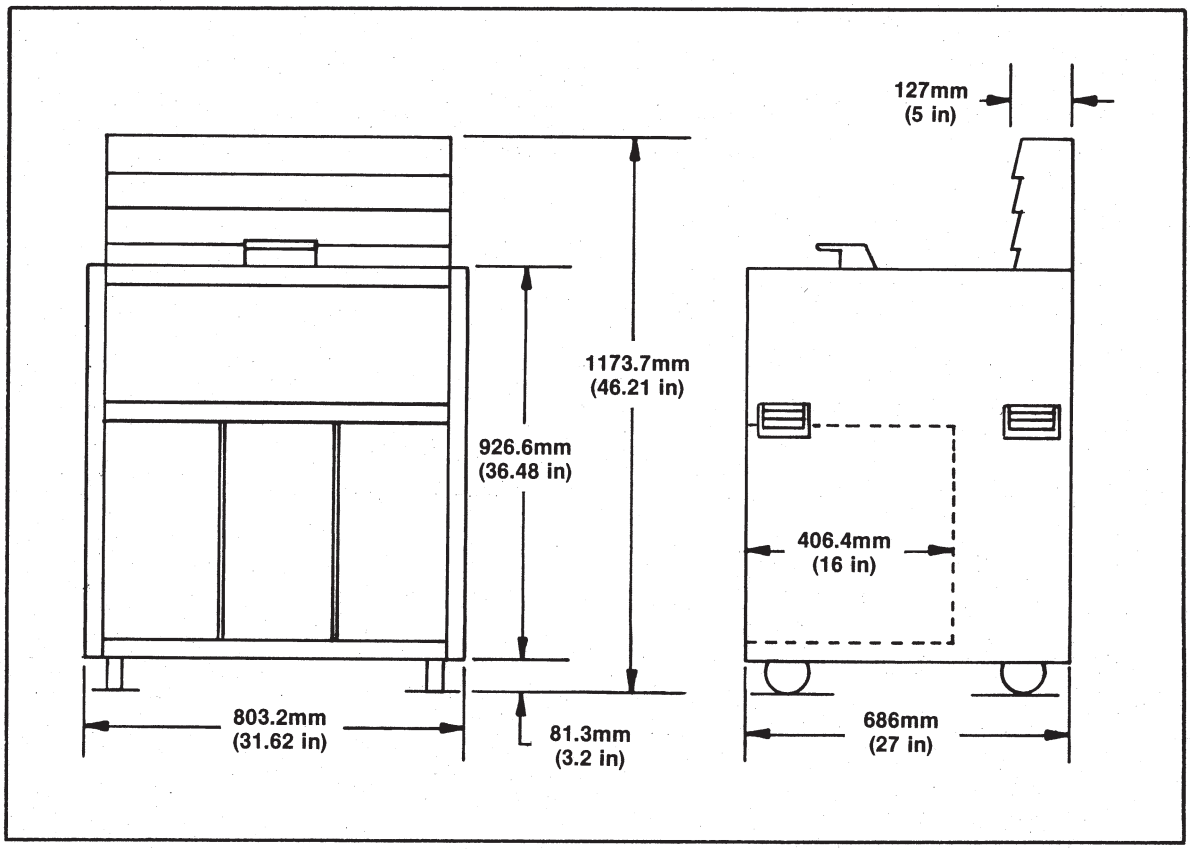


Figure 1-1 Cabinet Dimensions

* Typical values given. Specifications are largely dependent on tape formulation. Also, the performance of any particular type of tape varies from batch to batch.

TABLE 1-2 JH-24 ORDERING NUMBERS

JH-24-8	1 inch 8 track with 8 channels of electronics and remote controls
JH-24-16/8	1 inch 8 track with 8 channels of electronics and remote controls, cabinet is wired for 16 channels
JH-24-16	2 inch 16 track with 16 channels of electronics and remote controls
JH-24-24/16	2 inch 16 track with 16 channels of electronics and remote controls, cabinet wired for 24 channels
JH-24-24	2 inch 24 track with 24 channels of electronics and remote controls

UPGRADE KITS

U-KIT NO. 24-1	Upgrades JH-24-16/8 to JH-24-16
U-KIT NO. 24-2	Upgrades JH-24-24/16 to JH-24-24
U-KIT NO. 24-3	Upgrades JH-24-8 to JH-24-16
U-KIT NO. 24-4	Upgrades JH-24-16 to JH-24-24

ACCESSORIES

A/L III	AutoLocator III
JH-45	AutoLock
JH-20	Accessory stand, for A/L III or JH-45
JH-21	Dual accessory stand, for 2 A/L IIIs or JH-45s
AS6B79	Tape path alignment kit

HEAD ASSEMBLIES

HA-24-8	8 track head assembly
HA-24-16	16 track head assembly
HA-24-24	24 track head assembly

TAPE PATH CONVERSION KITS

LTG-1	2 inch to 1 inch conversion kit (heads not included)
LTG-2	1 inch to 2 inch conversion kit (heads not included)

SECTION 2
OPERATING PROCEDURES

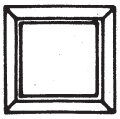
2.1 Introduction

All the control switches and indicators on the tape transport, remote control unit, and AutoLocator III are listed and defined in this section. You will probably be familiar with most of the controls, but, some of these are unique to this system. So, even if you are experienced with other types of tape recorders, scan through the list of functions.

Several examples of the use of the controls follow the lists. If you have never operated the JH-24 multitrack before, perform all the operating procedures in order. They will demonstrate all the features of this tape machine. The operating procedures can also be used as a post installation checkout, since they test all the functions of the transport, audio electronics, remote control unit, and the optional AutoLocator III.

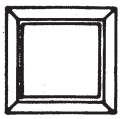
2.2 JH-114 Transport Controls and Indicators

2.2.1 Transport Controls



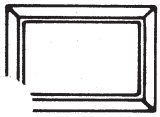
RWD

Rewinds tape onto supply reel at fast speed. Cancels previous motion command (i.e. FWD, PLAY, or RECORD).



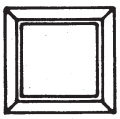
FWD

Winds tape onto take up reel at fast speed. Cancels previous motion command.



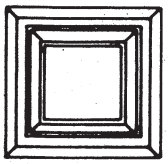
STOP

Cancels previous motion command, stops tape, and raises shield.



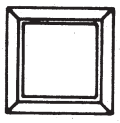
PLAY

Initiates playback at selected speed and cancels previous motion command or record command.



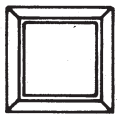
RECORD

When pressed with PLAY or while in play mode, starts recording on all channels in record ready status.



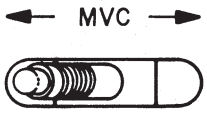
SHIELD

Lowers head shield in stop or play mode. Shield may be latched down by pressing EDIT. Latch is cancelled by pressing SHIELD again.



EDIT

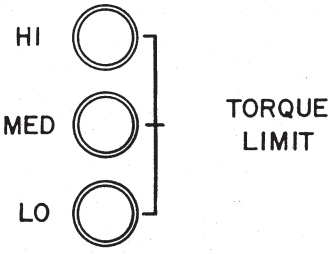
When pressed with tape removed from tape load sensor, unspools tape from supply reel without winding it onto take up reel. Tape spills off right side of deck for editing and stops when STOP is pressed.



MVC JOYSTICK

From stop mode, manually controls tape speed and direction while hand is in contact with joystick. When released, transport returns to stop mode.

From rewind or fast forward modes, manually controls tape speed and direction if touched and will continue to control tape motion when released. Cancelled by any motion control command.



TORQUE LIMIT SWITCHES

Adjusts maximum torque applied by the reel motors for various tapes and reel sizes.

HI — for 14 inch reels and 1½ mil tape
MED — for 10½ inch reels and 1½ mil tape
LO — for 7½ inch reels, 1 mil tape, and alignment tapes

Press remote PLAY button.
PLAY light is on. Blue lights on meter panel are on. Meters monitor Line Inputs. Yellow LEDs are on for channels in record-ready.

Press remote RECORD button.
In addition to conditions above, red lights come on, on the meter panel, for the channels in record-ready. On the Remote Control Units both yellow and red LEDs are on for channels in record-ready. A red light shows that the channel is recording.

Press remote STOP button.

Place machine in tape mode by pressing TAPE button on MASTER STATUS section of the remote unit.
Blue lights go out on the meter panel (meters are now monitoring the reproduce head). On channels which are in record-ready status, yellow LEDs will be on.

Press remote PLAY button.
All meters monitor reproduce head (whether the channel is in record-ready or not).

Press remote RECORD button.
Red lights come on, on the meter panel, for the channels in record-ready, showing that these channels are recording. Both yellow and red LEDs are on for the channels in record-ready at the individual channel controls. (These channels record the audio on the input line, and monitor the reproduce heads).

Press STOP button.

Put some channels (not ones already in record-ready mode) into cue mode by pressing CUE switch on individual channel control section.
Green LEDs come on for these channels.

Leave some channels in record-ready mode.
Yellow LEDs will be on for these channels.

Press remote PLAY button.
Channels which were in cue mode monitor the record head connected as a playback head.

Press remote RECORD button.
Channels which were in cue mode monitor record head. Green LEDs are on for these channels.

Channels which were in record-ready mode have both yellow and red LEDs on, and red lights on the meters. These channels are recording and they are monitoring the reproduce head.

Press STOP button.

Place the MASTER STATUS into AUTO.
Channels which are unassigned monitor the record head (cue mode).

Place some channels into record-ready status. Leave some channels unassigned.
Channels in record-ready monitor the line input. Yellow LEDs are on for these channels.

Press PLAY button.
Unassigned channels monitor record head. Record-ready channels monitor record head during play mode only.

Press RECORD button.
Channels which were in record-ready monitor input (blue light comes on, on meter panel). Yellow LEDs, red LEDs and red meter lights are on for these channels.

Unassigned channels remain in cue (monitor the record head).

NOTE: In auto mode, channels which are placed into record-ready automatically switch in this fashion:
STOP — channel monitors line input
PLAY — channel monitors record head (cue mode)
RECORD — channel monitors line input

Press remote STOP button.

Press both INPUT and AUTO MASTER STATUS buttons. Place some channels in record-ready.
Yellow LEDs are on for channels in record-ready. Record-ready channels monitor line input.

Press remote PLAY button.
Record-ready channels monitor line input. Other channels monitor record head (cue mode).

Press remote RECORD button.
Both yellow and red LEDs are on for record-

AUTO

Selects automatic overdub operation. Monitor source for all channels in record ready status switch as follows:

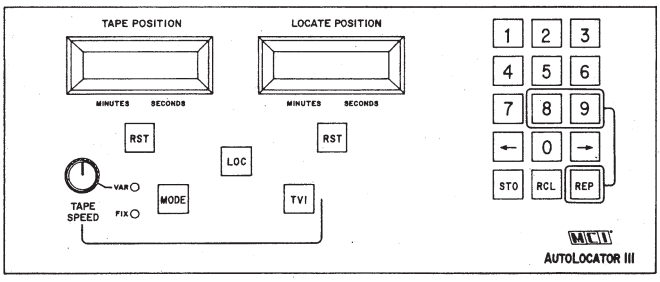
Stop mode — input
Play mode — cue
Record mode — input

Monitor source for all other channels is cue (record head).

INPUT/AUTO

Monitor source for all channels in record ready status is the input.

Monitor source for all other channels is cue (record head).



2.2.4 AutoLocator III

TAPE POSITION DISPLAY

Displays the present tape position in minutes and seconds or tape velocity in inches per second.

LOCATE POSITION DISPLAY

Displays the autolocate position in minutes and seconds or pitch change in ¼ semitones from standard speed.

NUMERIC KEYBOARD (0 through 9)

Each switch enters its corresponding digit into the Locate Position display and memory.

Shifts Locate Position to Tape Position.

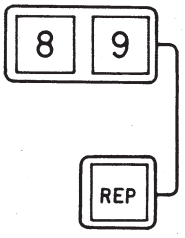
Shifts Tape Position to Locate Position.

STO

Stores the Locate Position into memory selected by numeric key.

RCL

Recalls position stored in memory selected by numeric key and displays it in the Locate Position display.



8/9/REP

Repeatedly returns tape to locate position 8 and plays to locate position 9. Cancelled by any function key.

RST

Clears position display and memory to zero.

LOC

Starts autolocation to position in Locate Position display.

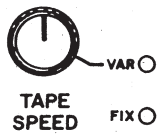
2.2.5 Tape Speed Control

TVI

Displays tape velocity in inches per second in the Tape Position display and pitch change in ¼ semitone increments in the Locate Position display.

MODE

Selects either fixed or variable capstan speed reference when transport reference switch is in EXT position.



TAPE SPEED

Varies the capstan speed when variable speed reference is selected by MODE switch.

VAR INDICATOR (Red LED)

Indicates variable capstan speed reference.

FIX INDICATOR (Green LED)

Indicates fixed crystal capstan speed reference.

2.3 Operating Procedures

2.3.1 Transport Controls

Turn the power switch on.

Head shields move down. All function lights are off.

Insert an opaque card into the tape sensor slot.

STOP button light goes on. The take-up reel starts turning counter-clockwise; supply reel clockwise. The speed of rotation for both reels is approximately one turn in three seconds. The speed need not be identical for both reels.

Remove card. Load spool of tape. Thread the machine.

Reels wind up loose tape and establish idle tension. STOP light is on.

Press the STOP button.

Head shields move up.

Press the SHIELD button.

Head shields move down.

Press the FWD button.

STOP light goes off, FWD light comes on. Tape lifter lifts the tape from the heads. The tape accelerates to fast speed in the forward direction.

Press the RWD button.

FWD light goes off, RWD light comes on. Tape decelerates, reverses direction, and accelerates to fast speed in the rewind direction.

Press the STOP button.

RWD light goes off, STOP light comes on. Tape decelerates and stops. Tape lifter moves back, head shields move up.

Slowly move the MVC (Manual Velocity Control) joystick to the right.

Head shields go down. Joystick LED comes on. Tape moves forward. (Speed movement is directly related to the angle of the joystick).

NOTE: Joystick may not work if good hand contack is not made with the surface of the tape transport. Contact may be made by either hand.

Slowly move the MVC joystick to the left.

Tape comes to a stop and moves in the reverse direction. Speed of the movement is directly related to the angle of the joystick.

Release the MVC joystick.

MVC LED turns off.

Press the FWD button.

STOP light goes off, FWD light comes on. Head shields go down. Tape lifter lifts tape. Tape accelerates to full speed forward.

Touch the MVC control.

MVC LED comes on. Tape slows to the speed established by the position of the MVC control.

Release MVC control.
Tape continues to move, MVC LED light stays on (latched MVC mode).

Move MVC control.
Tape speed changes according to the angle of the control.

Press any transport control button.
Machine drops out of latched MVC mode and enters the mode selected. MVC LED goes off.

Turn REFERENCE to FIX and SPEED to LO. Press PLAY button.
STOP light goes off. Head shields come up. Capstan pinch roller engages. PLAY light comes on. Tape moves forward at low play speed (usually 15 ips).

Turn REFERENCE to VAR. Turn red SPEED potentiometer.
Play speed varies as the speed potentiometer is rotated.

Turn SPEED switch to HI.
Machine goes into STOP mode.

Press PLAY button. Turn SPEED potentiometer.
Machine goes into high speed play mode (usually 30 ips). Speed varies as speed potentiometer is rotated.

Select FIX reference.
Machine goes into fixed high speed mode (internally crystal controlled).

NOTE: If EXT is selected with no external source, the VCO will control the machine at its center frequency (approximately 19.2 kHz). The external reference source can be either 19.2 kHz or −5 to +5 volts applied to the capstan servo programming plug on the rear of the machine.

With machine in PLAY mode, push Manual Tape Lifter control to the left.
Tape lifter comes out. Head shields go down.

Press RWD button, allow tape to rewind completely. Thread tape across heads and through the capstan assembly. Do not thread the tape sensor and do not start tape onto takeup reel.
As soon as tape comes away from the takeup reel, the tape sensor causes the machine to switch all function lights off and all the motors stop.

Press EDIT button.
EDIT light comes on. Capstan pinch roller engages. Tape moves at play mode speed. Tape spills off machine to the right. Tape sensor does not control the machine in this mode. Takeup reel does not turn.

Thread tape through the tape sensor and around the takeup reel.

Press EDIT button.
SHIELD light comes on. STOP light comes on. Head shields go down.

Press PLAY button.
Machine goes into play mode except that the head shields stay in their down position.

This is shield latched condition. No tape motion mode will cause the shields to come up.

Press SHIELD button.
SHIELD light goes off.

Press STOP button.
STOP light comes on. The shield latch condition is removed.

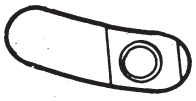
2.3.2 Remote Controls

NOTE: Transport motion controls are duplicated on the remote unit. These controls operate exactly like the controls on the transport.

Place machine in INPUT mode by pressing INPUT button on MASTER STATUS section of the remote unit.
On the meter panel, a blue light comes on above each meter. This means that the meter is monitoring the Line Input on that channel.

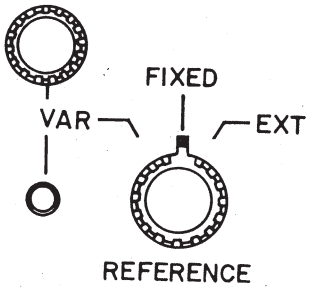
Supply audio signal to the input lines.
Meters monitor the audio on the input lines.

Put some channels into record-ready mode by pressing the individual channel RECORD-READY buttons.
Yellow LED comes on for these channels.



MANUAL SHIELD LEVER
Momentarily retracts tape lifter, placing tape against heads during fast modes, or momentarily extends tape lifter and lowers head shield during stop mode.

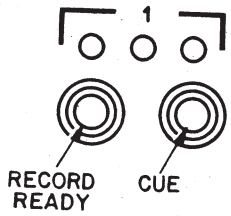
SPEED SELECT
Selects playback/record speed and equalization.
HI — selects 30 ips, AES
LO — selects 15 ips, NAB/IEC



REFERENCE SELECT
Selects the speed reference for the capstan phase locked loop.
EXT — selects an external reference (–5 to +5 volt level or 19.2 kHz clock) for slaving this transport to another device.
FIX — selects an internal crystal oscillator as a fixed reference for the capstan.
VAR — selects an internal variable reference set by the variable reference adjustment potentiometer.

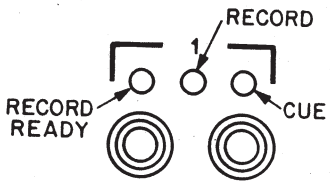
VARIABLE REFERENCE ADJUST
Varies the capstan speed by ±20% when the reference switch is in the VAR position.

2.2.2 Individual Channel Status



RECORD READY (Black Button)
Enables recording on that particular track.

CUE (Gray Button)
Selects the record head for playback.



READY INDICATOR (Yellow LED)
Indicates that channel is in record ready mode.

RECORD INDICATOR (Red LED)
Indicates that channel is recording.

CUE INDICATOR (Green LED)
Indicates that channel playback signal is coming from the record head (cue or sync mode).

2.2.3 Master Status

TAPE
Selects the repro or record head as source for line output and VU meters.

INPUT
Selects the line input signal as the source for the line output and VU meters.

ready channels. These channels monitor line input. Red and blue meter lights are on. Unassigned channels monitor record head (cue mode).

Press STOP.

2.3.3 AutoLocator Controls

Press both RESET buttons.
TAPE POSITION and LOCATE POSITION displays reset to zero minutes and zero seconds.

Press numeric 1, 2, and 3.
LOCATE POSITION displays 1 minute, 23 seconds.

Press LOC.
Transport autolocates to 1:23. TAPE POSITION increments to 1:23 and stops.

Press the RESET button directly under the LOCATE POSITION display.

Press LOC.
Transport returns to zero. Both displays indicate 0:00.

Press numeric 4, 5, and 6.
LOCATE POSITION displays 4:56.

Press STO and numeric key 7.
The time displayed in LOCATE POSITION is stored in locate memory number 7.

Press both RESET buttons to clear the displays. Press RCL and then press numeric key 7.
The time stored in memory 7, 4:56, is recalled from memory and displayed in the LOCATE POSITION.

Press the shift right button (→).
Time 0:00 now appears in both position displays.

Press STO and numeric key 8.
Time 0:00 from the LOCATE POSITION is stored into locate memory number 8.

Press numeric keys 4 and 5. Press the shift left button.
The time 0:45 appears in the LOCATE POSITION display and then in the TAPE POSITION display.

Press STO and numeric key 9.
The time 0:45 is now stored in locate memory number 9.

Press REP.
The transport rewinds to 0:00 and stops. Transport switches into play mode, PLAY light comes on, TAPE POSITION increments to 0:45. Transport rewinds to 0:00 and repeats process again. This will continue until any motion command button is pressed.

Press STOP.
The repeat function is cancelled, the transport stops.

Turn the transport REFERENCE switch to EXT. Press the MODE button.
The green FIX LED goes off; the red VAR LED comes on.

Press PLAY. Press and hold the TVI button.
The TAPE POSITION display indicates the tape velocity in inches and hundreths of inches per second.

Turn the SPEED potentiometer. Keep the TVI button pressed in.
The transport speed varies under control of the SPEED potentiometer. Tape speed is displayed in the TAPE POSITION. The LOCATE POSITION flashes the variance from the standard speed in terms of enharmonic semi-tones. Only multiples of ¼ semi-tones are displayed. If the speed is not a multiple of ¼ semi-tone the LOCATE POSITION will be blank.

Press the MODE button. Keep the TVI button pressed in.
The red VAR LED goes off; the red FIX LED comes on. The TAPE POSITION displays 30.00 ips or 15.00 ips depending on the tape speed selected.

Release the TVI button. Press STOP.

SECTION 3
TAPE TRANSPORT

3.1 General Description

Functionally, the tape transport consists of three major systems: the control logic system, the capstan servo system, and the tape tension servo system. Figure 3-1 illustrates the interconnection of the transport's three systems. The operation of the control logic, capstan servo, and tape tension servo systems are covered in this section; schematics and assembly drawings are located at the end of this section.

The control logic system generates commands which control the operation of tape transport. Inputs to the Control Logic Board come from the motion control switches and tape load sensor. Outputs from the Control Logic Board operate the indicator lights, reel motor brakes, pinch roller, head shields, and tape lifter. Motion and stop commands control the operating mode of the tape tension system.

The capstan servo system moves the tape past the heads at a constant velocity during play and record modes. Reference and speed switches select the reference frequency for the phase locked loop. The Phase Locked Loop Board, capstan motor, and capstan tachometer form the servo loop, which locks the capstan motor's speed to the selected reference.

The tape tension servo system keeps a constant tension on the tape during the stop, play, and record modes and reels the tape in the rewind and fast forward modes. Reel motor motion is servo controlled by the Analog Torque Board. Commands from the control logic select the servo reference which determines the speed and direction of the motors. The reel motors can also be controlled by signals from the MVC and the autolocator.

3.2 Control Logic

The control logic system consists of the Control Logic Board, the Interface/Lamp Driver Board, and four Solenoid Driver Boards. Drivers on the Interface/Lamp Driver Board operate the motion control lights and record relays. This board also buffers the Autolocate and MVC commands. The Solenoid Driver Boards contain amplifiers which operate the reel motor brake, play, shield, and tape lifter solenoids in response to TTL signals from the Control Logic Board.

The Control Logic Board contains combinational logic circuits whose outputs control all the functions of the transport. Portions of the schematics have been re-drawn to help you follow the signals through the logic. These drawings show the logic levels present for the mode indicated. If measuring these levels, remember, that outputs of the cross coupled latches remain constant until switched, and the outputs of the switches and pulse networks are momentary.

Figure 3-2 shows the logic involved in the stop mode. The number inside each gate is the chip's IC number in the schematic diagram. Logic levels in the figure indicate the stop mode with tape in the tape sensor slot.

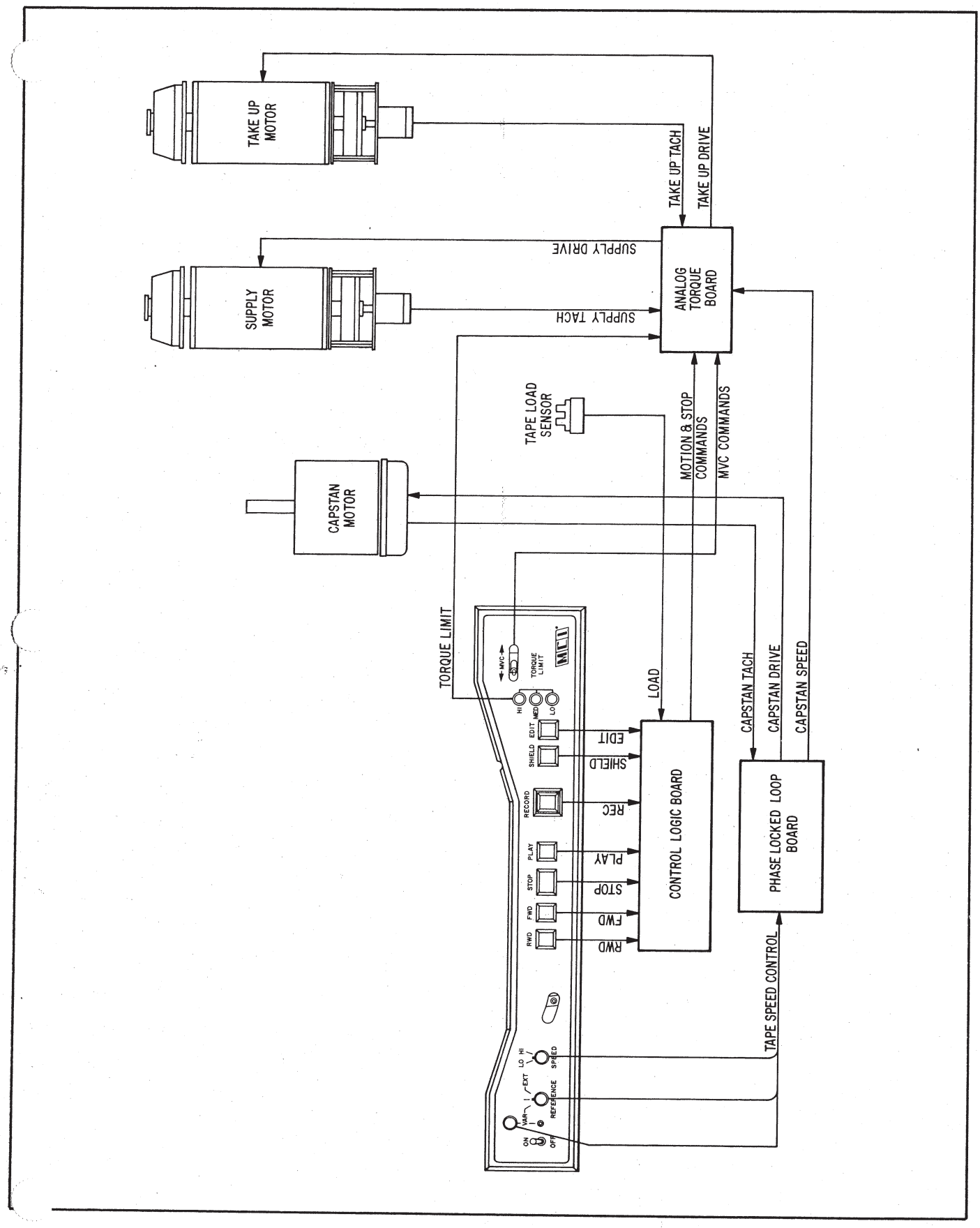


Figure 3-1 Transport Simplified Block Diagram

Figure 3-3 shows the logic involved in the play and the play/record modes.

Figures 3-4 and 3-5 have the logic for the fast forward and rewind modes.

Figure 3-6 shows the logic involved in the edit mode and the head shield operation.

Figure 3-7 shows the logic involved in the tape deck manual velocity control (DMVC) and remote manual velocity control (RMVC) modes and in the tape lifters.

3.3 Capstan Servo System

3.3.1 Phase Locked Loop

Figure 3-8 is a block diagram of the capstan servo system showing the phase locked loop, reference select logic, and the capstan dc motor. Whenever the play mode is initiated, the capstan motor accelerates to the selected speed. When the motor speed approaches the reference speed, the servo locks. Once lock is established the capstan turns at a constant speed.

The capstan's speed is measured by a slotted disk and photo sensors mounted to the bottom of the capstan motor. This tachometer produces 500 pulses per revolution. The arrangement of the photo sensors and logic on the Capstan Tach Board doubles the frequency of the pulses. The frequency of this pulse train is directly related to the motor speed. At 15 ips this frequency is 9.6kHz. On the Phase Locked Loop Board these capstan tachometer pulses clock a one shot; they can be measured at test point 1. The one shots fix the pulse widths of the tachometer and reference waveforms to 5us as required by the comparator.

The phase comparator produces an output waveform whose duty cycle is proportional to the phase difference between the reference pulses and the tachometer pulses. Specifically, the pulse width of the phase comparator output is equal to the time difference between the rising edge of the reference pulse and the falling edge of tachometer pulse. Prior to achieving lock, the output of the phase comparator is latched high. After obtaining lock, the output has approximately a 30% duty cycle. If the tachometer pusles begin to lag behind the reference pulses, the duty cycle increases, speeding up the motor. As the motor speeds up, the phase difference between the two pulse trains decreases, decreasing the duty cycle of the phase comparator output and slowing the motor.

The rectangular wave output from the phase comparator is averaged by an active filter. The resulting dc level is then amplified and used to drive the capstan motor.

3.3.2 Reference Frequency

The reference frequency for the phase locked loop comes from one of three sources: a crystal oscillator, a VCO, or some external source such as the AutoLocator III or the AutoLock. Figures 3-9, 10, 11, and 12 detail the reference selection circuit.

When the speed reference switch is in the FIX position, a 96 kHz crystal oscillator provides the reference. The crystal frequency is divided down to 19.2 kHz and applied to the speed select circuit. The speed select switch and a binary counter choose the frequency reference for high or low speed operation.

When the speed reference switch is in the VAR position, the VCO supplies the input frequency to the speed select circuit. The center frequency of the VCO is 19.2 kHz. The output frequency can be varied by ±20% with a ±5 volt input. Either the variable speed control potentiometer or an externally supplied dc level provide the reference input to the VCO.

When the speed reference switch is in the EXT position an exteral frequency input is selected as the speed reference for the phase locked loop. For standard speed operation this signal should be 19.2 kHz. If no external frequency is present and the reference switch is in the EXT position, the reference circuit chooses the VCO, operating at its center frequency, as the reference input.

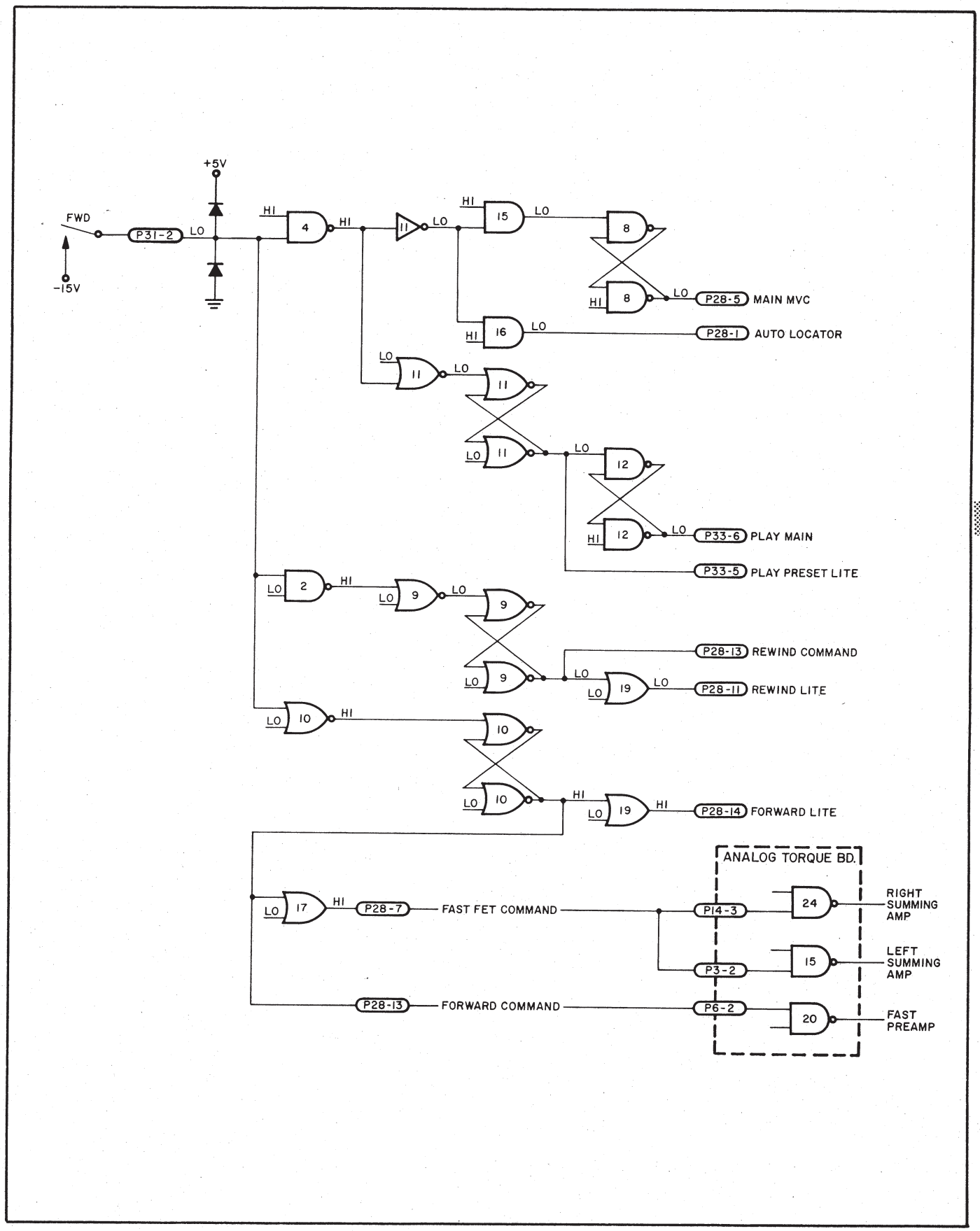


Figure 3-4 Fast Forward Mode Logic

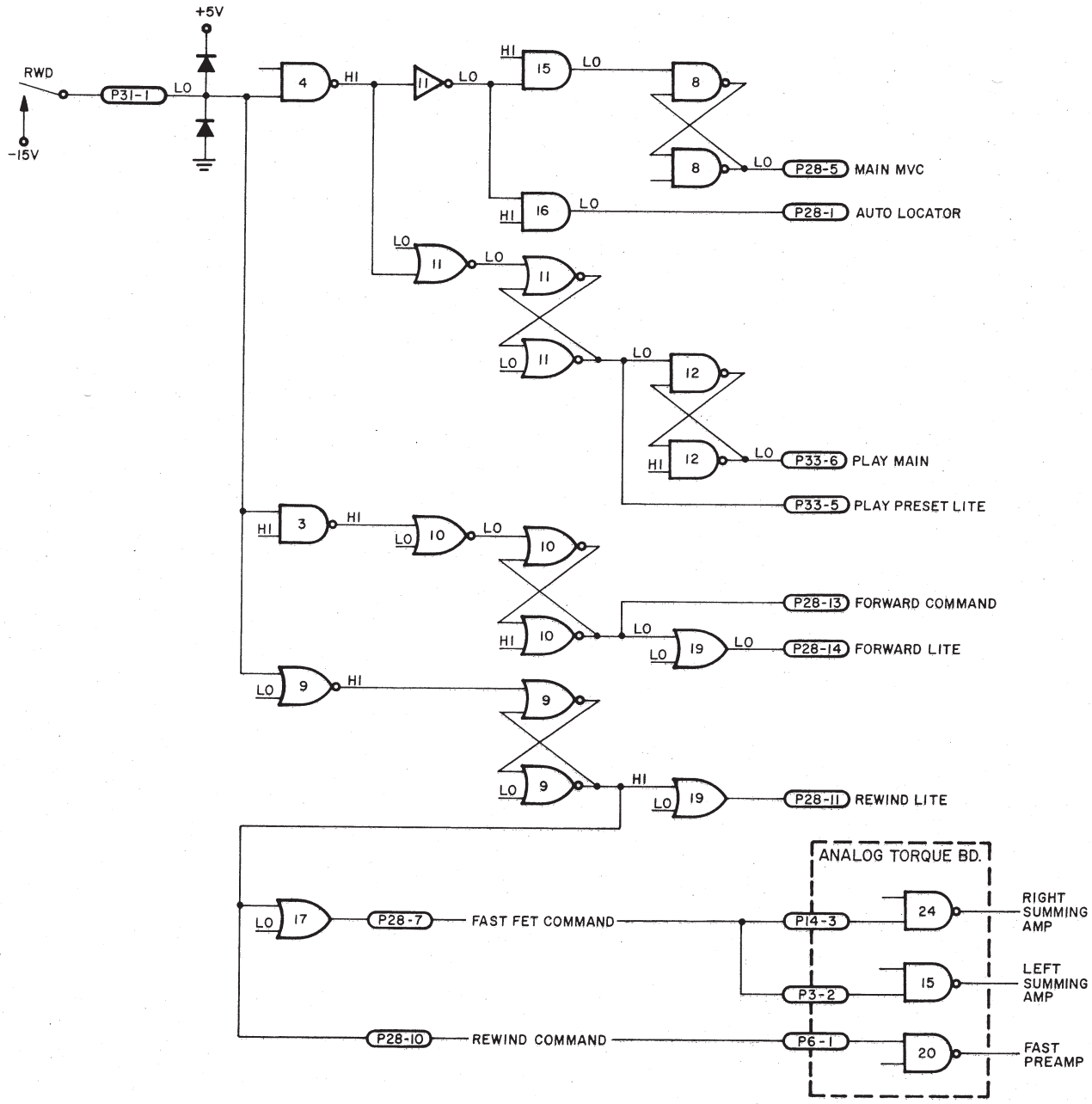


Figure 3-5 Rewind Mode Logic

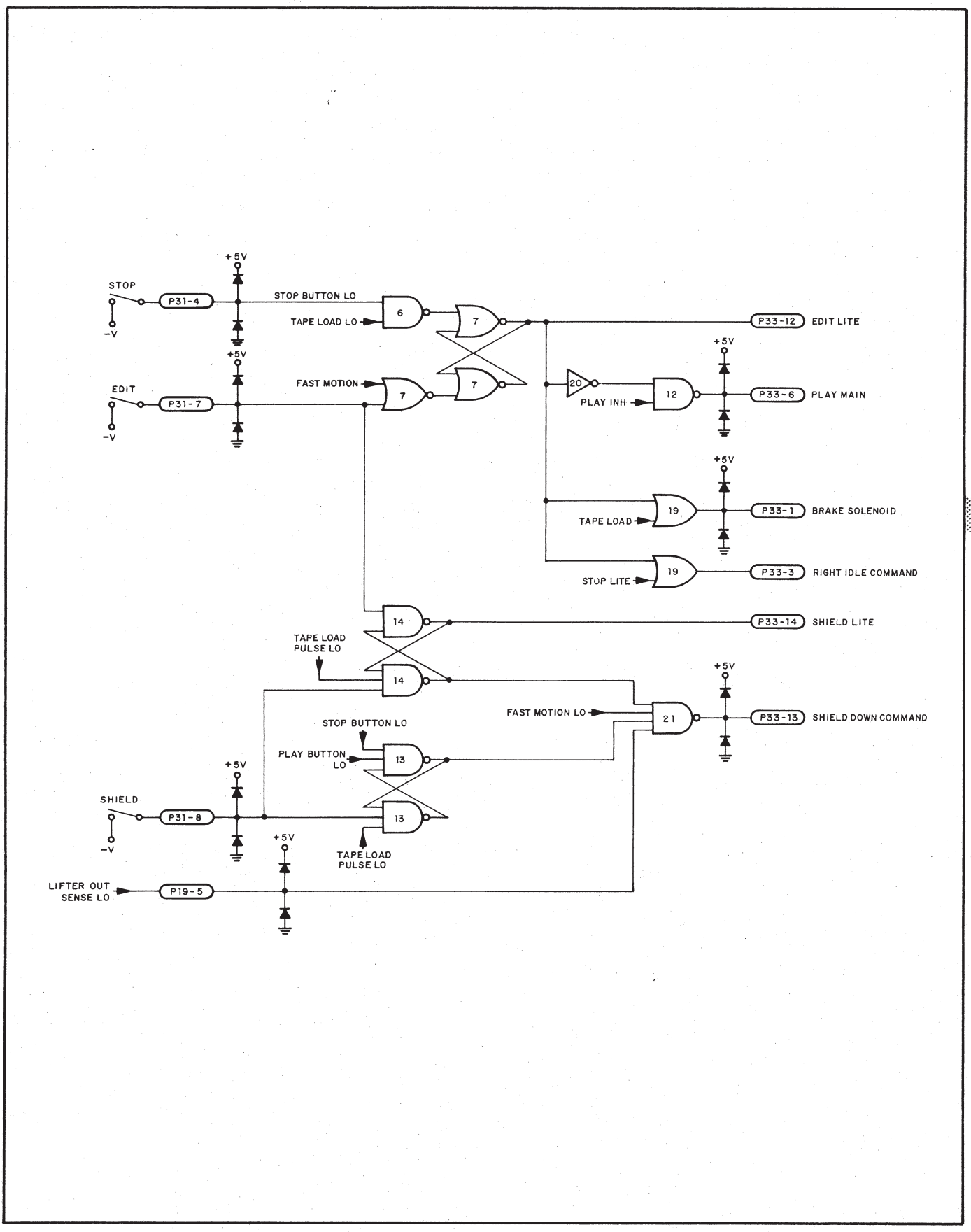


Figure 3-6 Edit Mode and Shield Logic

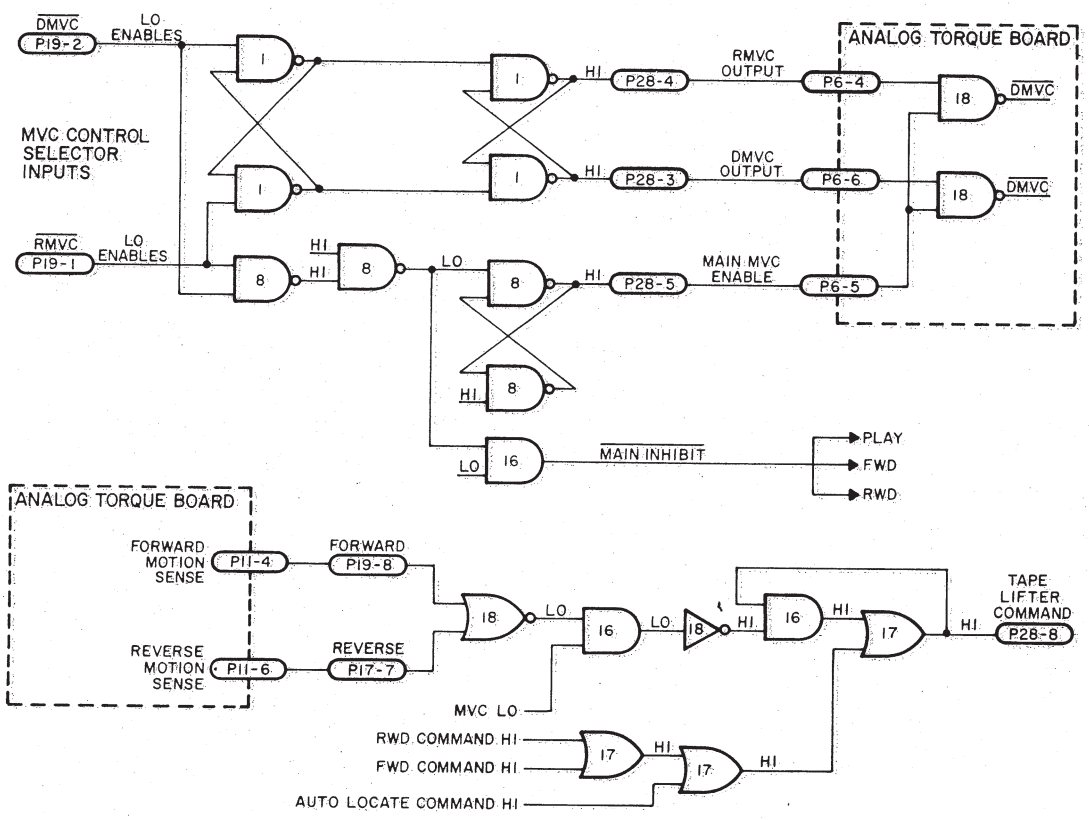


Figure 3-7 MVC Mode and Tape Lifter Logic

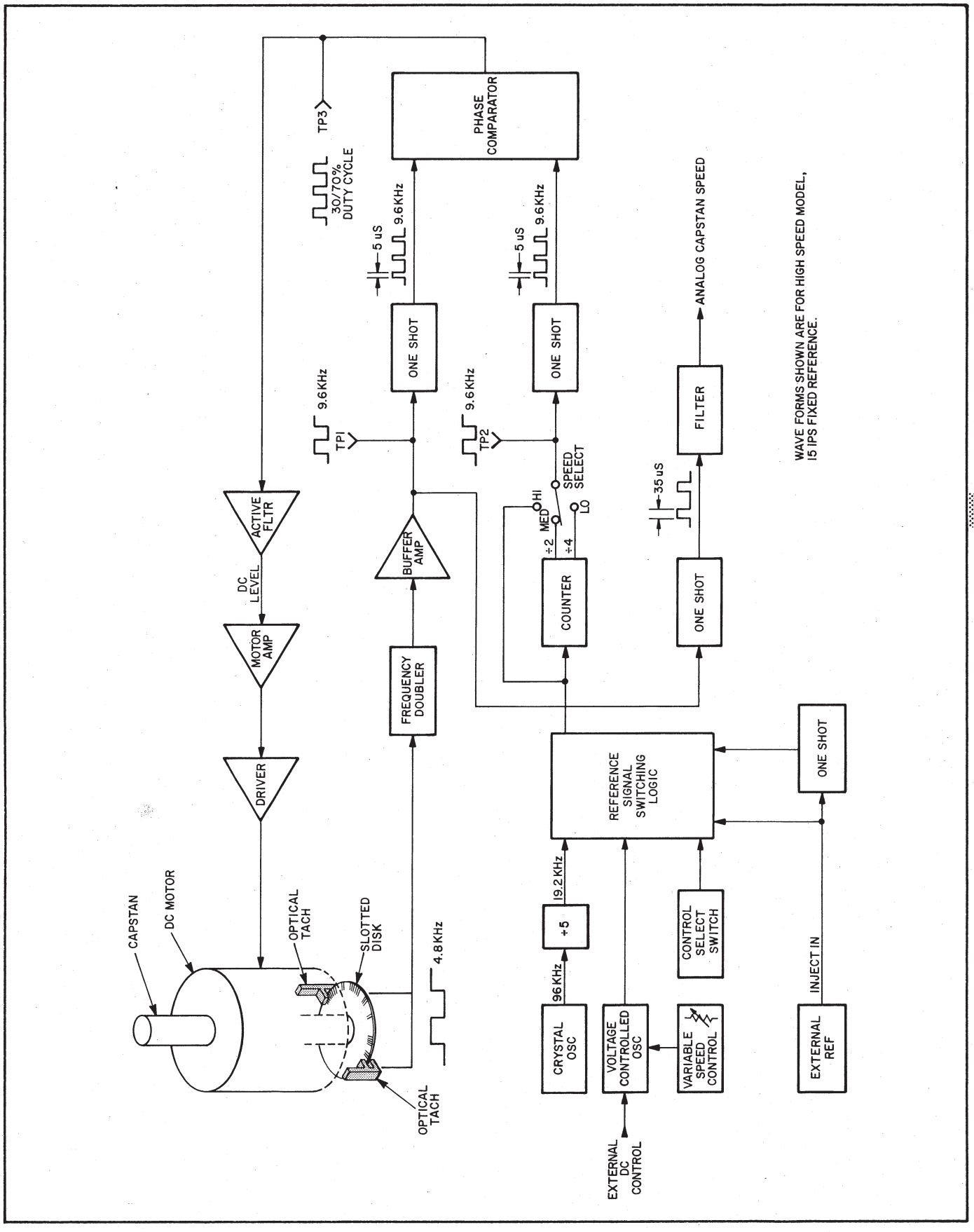


Figure 3-8 Phase Locked Loop Block Diagram

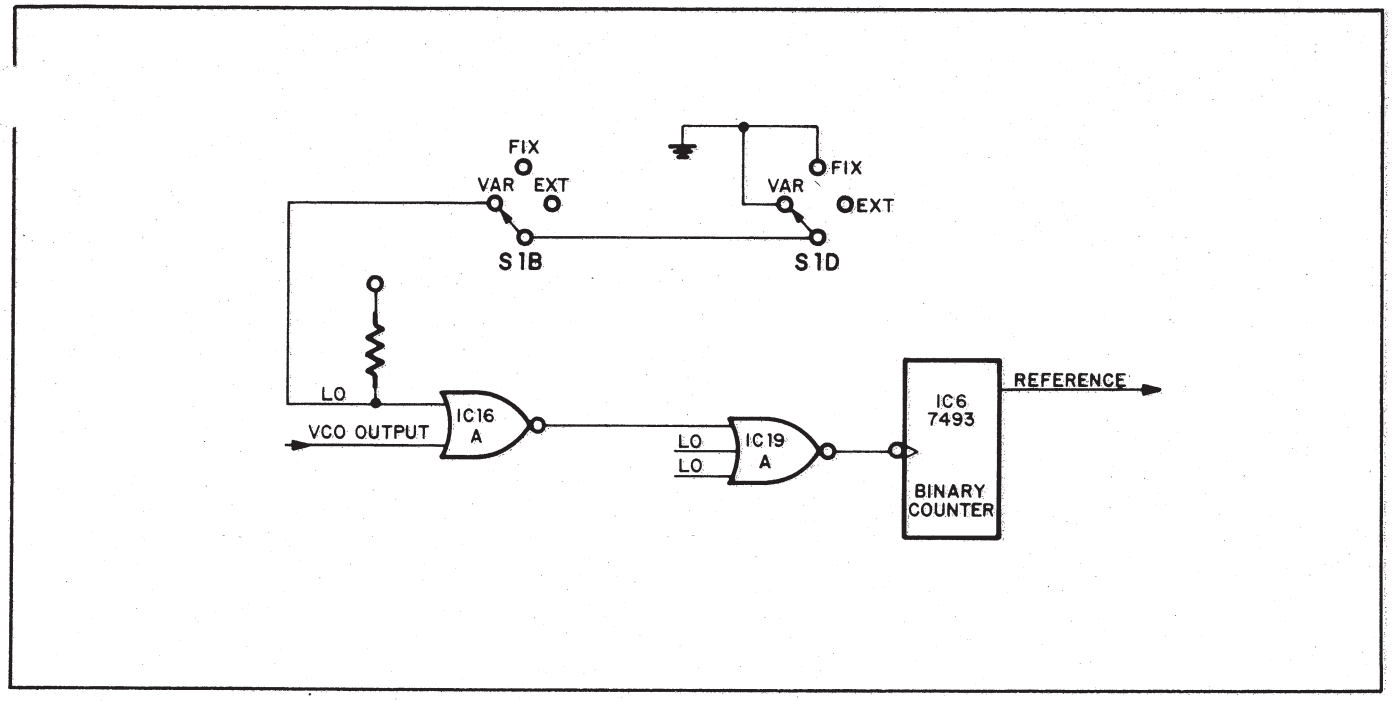


Figure 3-9 Variable Reference

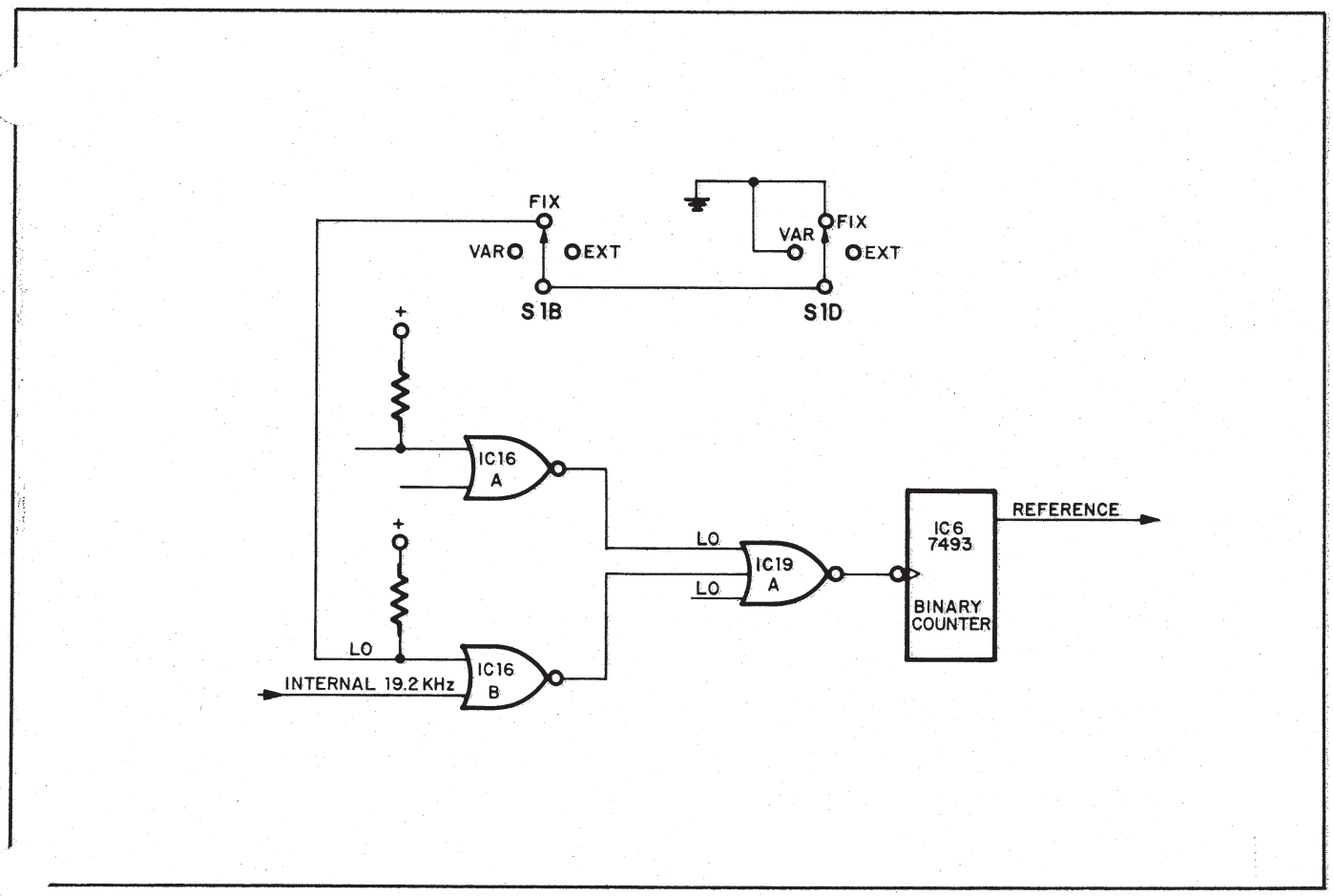


Figure 3-10 Fixed Reference

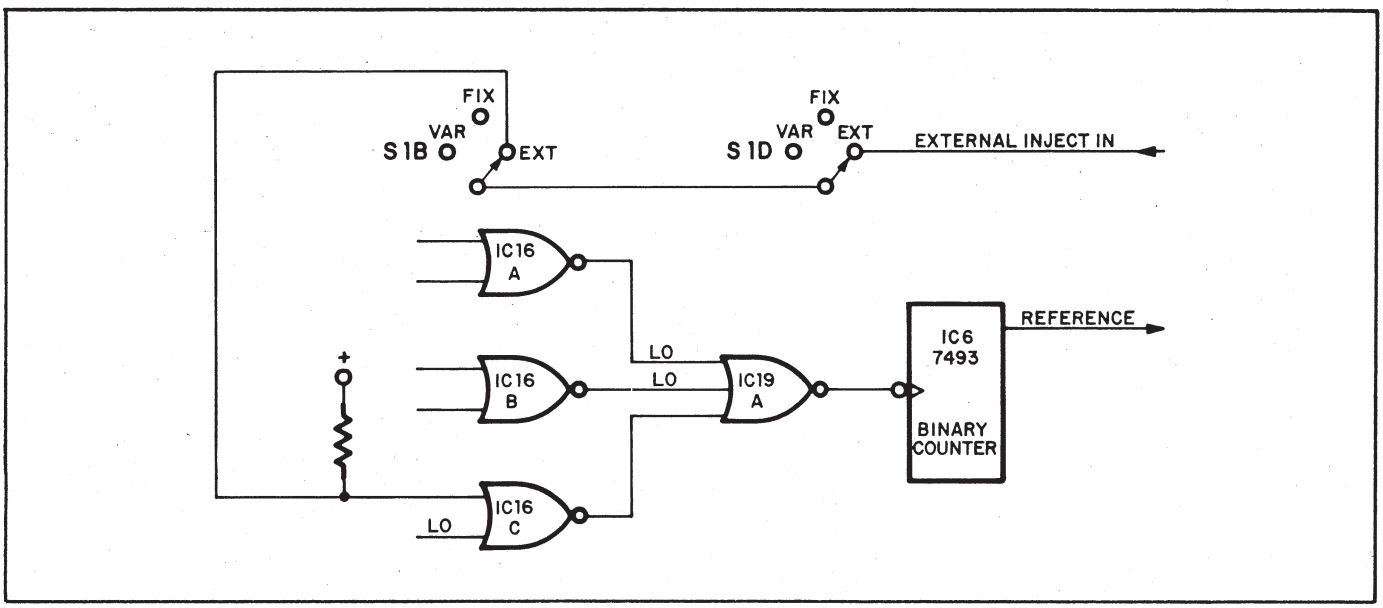


Figure 3-11 External Reference with Signal

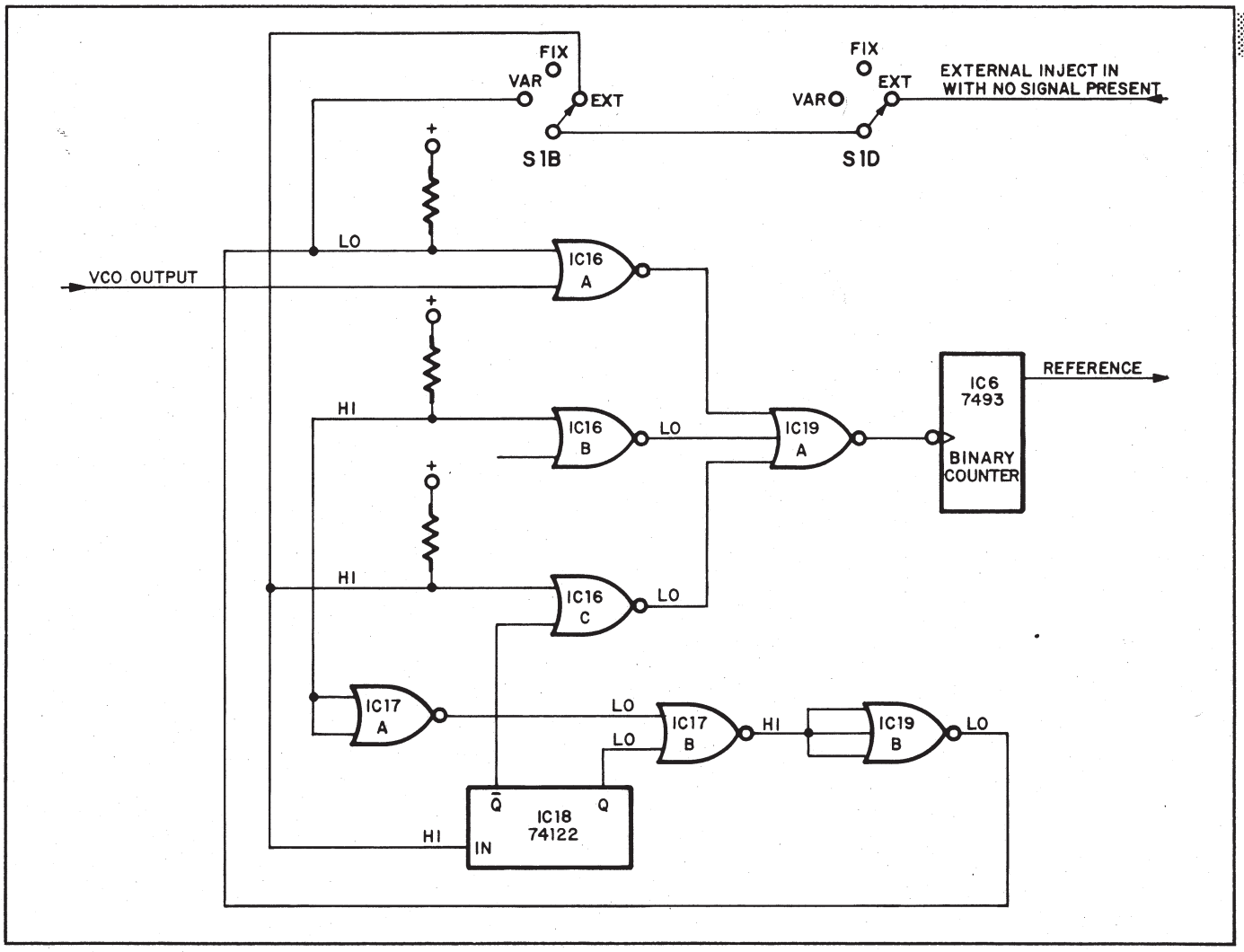


Figure 3-12 External Reference without Signal

3.4 Tape Tension Servo System

ure 3-13 is a block diagram of the tape tension servo system. All the circuits represented in the diagram are located on the analog torque board, except the phase locked loop and the motor drivers. The motor drivers for the reel motors are located on a heat sink in the power supply. The phase locked loop circuitry shown is located on the Phase Locked Loop Board.

A positive signal applied to the reel motor drivers allows current to flow through the motors. This current produces a torque which accelerates the motor. The torque is always applied in the direciton to pull the tape. That is, the supply reel is always driven in a clockwise direction and the take up reel is always driven in a counter-clockwise direction.

The tape tension servos are always active, whenever there is tape in the tape load sensor. Reel motor torque is continually adjusted to maintain a constant tension on the tape in all modes. Commands from the control logic, through FET switches, select the servo loop involved in each mode. There are three tension servo loops: the e servo loop for the stop mode, the play servo op for the play and record modes, and the fast servo loop for the fast forward, rewind, autolocator, and MVC modes.

3.4.1 Idle Servo Loops

There are two idle servo loops, one for each reel motor. In the stop mode, they drive both reel motors in opposite directions. Both motors pull on the tape to apply the required tension to the tape. With no tape reels mounted on the transport and a card in the tape sensor slot, you can see the reel motors turning in opposite directions, completing one revolution every three seconds.

The torque applied to the motors is set by the idle adjust potentiometers. The idle adjust level is summed with the dc output of the tachometers to resist any motion which tends to alter the tension on the tape. This provides a dynamic braking force which prevents tape motion during the stop mode. The reels will only move to take up slack in the tape path and to establish proper tape tension.

3.4.2 Play Servo Loops

ere are two separate play servo loops, one for each reel motor. During play mode and record mode the servos apply the torque required to keep the tape moving at a constant speed under constant tension.

The torque required to keep a constant tension on the tape depends on the amount of tape on each reel. Since the amount of tape on a reel changes continuously during play and record, the torque must be continuously adjusted. Divider circuits in the servo loops calculate the adjustments necessary to maintain the proper tension.

The tenison applied to the tape is equal to the motor's torque divided by the effective radius, which is the distance between the center of the hub and the point at which the tape leaves the reel. This means that for any given torque, the tension decreases as the tape radius increases. Therefore, in order to deep the tape tension constant, the torque must increase as the radius increases. More torque is required for a full reel (large radius) than for an empty one (small radius).

The radius of the roll of tape is proportional to the speed of the tape divided by the speed of the reel motor. A full reel, which requires more torque because of its larger radius, turns slower than an empty reel, which requires less torque because of its smaller radius. The reel motor tachometer supplies a dc level indication of the tape speed. Analog dividers in the play servo loops divide the tape speed by the reel motor speed producing a torque signal proportional to the radius of the roll of tape.

In play or record mode, as the take up reel fills with tape, the torque is proportionally increased to pull the tape with the proper tension. The opposite happens to the supply reel whose radius decreases. It requires less torque to decelerate the reel to apply the proper holdback tension.

3.4.3 Fast Servo Loop

There is one feedback loop involved in the fast modes. The control logic selects the fast servo loop FETs in the fast forward and rewind modes, and when the transport is under autolocator or MVC control. Torque, applied by the servo, drives the tape at a constant speed selected by the FWD or RWD switches or at a variable speed proportional to the autolocator or MVC analog velocity voltages.

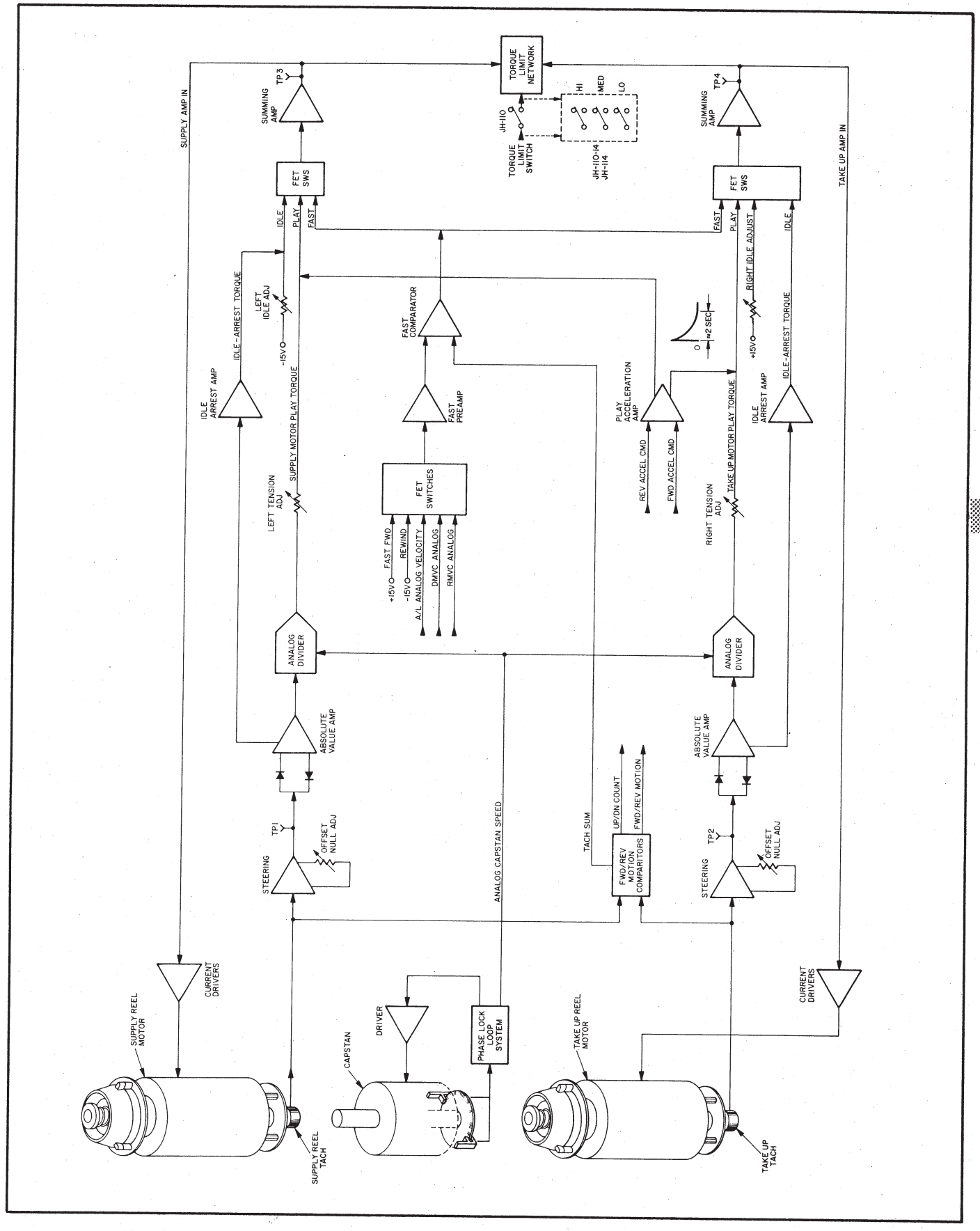


Figure 3-13 Tape Tension Servo Block Diagram

The fast feedback loop consists of a summation of the two reel motor tachometer signals. The fast loop servos when the combined speed of both reel motors reaches the control velocity at the fast comparator. In the fast forward and rewind modes this is approximately 300 inches per second. From that point, the reel motors are accelerated only to maintain the speed selected by the FET switches. The combined tachometer signals also produce direction information for the autolocator's position display.

Torque limiting circuitry clamps the output of the fast comparator to limit the maximum torque applied to the motor. The maximum torque is controlled by the torque limit switches mounted on the transport deck.

SECTION 4
AUDIO ELECTRONICS

4.1 General Description

The JH-24 contains 8, 16, or 24 channels of audio electronics. Each channel consists of a Reproduce Board, an Output Module, a Record/Cue Board, a Bias Board, and a Strip Board. Each group of eight channels contains one Bus Board. The Bus Board in the left drawer includes the master oscillator which provides the bias and erase signals for all the channels.

The Bus Board is located along the bottom of the drawer assembly. Eight Strip Boards located on the left side of the drawer assembly plug directly into the Bus Board. A cable harness connects each Bus Board to the audio power supply. These cable harnesses carry the regulated voltages and control signals to the drawer assemblies, and also bring the master oscillator signals to the center and right drawer assemblies.

Operating voltages and control signals are distributed to the eight channel electronics through the Bus Board. Two three amp fuses on each Bus Board protect the 24vdc lines which travel through the board to the meter assembly.

The Strip Board forms the backplane for the other four boards of the channel electronics. Edge connectors on the Reproduce, Output, Record/Cue, and Bias Boards connect these boards to the Strip Board. Signals from the Bus Board, the heads, the line input and line output, and from the other channels are all routed through the Strip Board. This board also contains the record relay which switches the bias and erase signals during recording.

Located in the bottom card slot is the Bias Board. It contains the oscillators, delay timing, and ramp circuits for the bias and erase signals. The oscillators produce a 210 kHz bias signal and a 105 kHz erase signal derived from the crystal master oscillator. The level controls for these two signals are mounted on this board.

The delay timing and ramp circuits on the Bias Board make up the QUIOR (QUiet Initiation Of Record) control. These circuits eliminate punch in and punch out noise associated with switching into and out of record mode. Equalization signals from the transport speed switch select the ramp timing and the output level of the bias and erase voltages. Switches on the board can defeat the function of the QUIOR timing circuits if desired.

The Record/Cue Board slides into the card slot directly above the Bias Board. This board contains the amplifiers and equalization networks for the signals going to and coming from the record/cue head. A relay connects the record/cue head to either the output of the line input amplifiers for recording, or to the input of the cue amplifiers for monitoring.

Level and equalization adjustments for both the record circuitry and the cue circuitry are located on the edge of the Record/Cue Board. A button switch selects the equalization networks so that the channel can be aligned to either the NAB or IEC standards without changing components. The speed switch on the transport automatically selects the corresponding equalization for the selected speed.

The card slot above the Record/Cue Board holds the Output Module. This board contains amplifiers which drive the channel's differential line output. FET switches select one of three possible inputs for the line output. They are: the line input from the Record/Cue Board; the cue signal, also from the Record/Cue Board; and the repro signal from the Reproduce Board. The FETs are controlled by the individual channel status (CUE, RECORD-READY) and master status (TAPE, INPUT, AUTO) buttons on the remote unit.

A bias defeat switch, mounted on this board, is used for spot erasures. This switch prevents recording on the channel when it is pressed in. The erase head, however, is unaffected. Any signals on the track will be erased in record mode, but no audio or bias will be recorded on the track.

The Reproduce Board is located in the top card slot. This board contains the amplifiers and equalization networks for the signals coming from the repro head. Level and equalization adjustments for the repro signal are also located on the board.

A button switch, at the edge of the card, selects the equalization networks involved in aligning the channel to either NAB or IEC standards. Signals from the transport's speed select switch alter the equalization networks to correspond with the selected tape speed.

4.2 Recording

Figure 4-1 is a block diagram of the circuitry involved in recording. It shows the audio signal flow from the line input to the record head for one channel. All channels are identical. The origin and flow of the bias and erase signals are also shown. For detailed information, see the schematic diagrams for each board at the end of this section. Use the block diagram to link the schematics together. Note that the Bus Board shown in the block diagram represents the Bus Board located in the right drawer assembly. The Bus Boards in the other two drawers do not have 210 kHz master oscillators.

Record mode is initiated by pressing the channel's individual status record-ready button and pressing the transport's record button. The transport's record button can be pressed while the transport is in play mode or concurrently with the play button from stop.

Record mode is exited by releasing the channel's record-ready button or by pressing the transport's play or stop button. Pressing the individual status record-ready button takes that channel only out of record. Pressing the play or stop button takes all channels out of record.

Two relays energize to allow recording on each channel. A record relay, K1 on the Strip Board, turns on in response to the record momentary, record hold and record completion signals. It, in turn, energizes a cue relay, K1, located on the Record/Cue Board.

The record relay allows current to flow through transformers T1 and T2 from the bias and erase drivers. It switches the erase signal to the erase head and the bias signal to the Record/Cue Board. It energizes the cue relay on the Record/Cue Board. It also enables the cross feed amplifier.

The cue relay, when energized, connects the output of the record amplifiers and the bias to the record/cue head. When de-energized, it connects the record/cue head to the input of the cue amplifiers.

The source of the bias signal is the 210 kHz sine wave from the master oscillator. The 210 kHz is applied differentially to the bias amplifiers. The gain at this stage is independently controlled for each speed. High or low speed bias adjustmennt potentiometers are selected with FETs by the $\overline{\text{HI EQ}}$ or $\overline{\text{LO EQ}}$ signals from the speed select switch.

These equalization signals also select the ramp timing and delay for the QUIOR (QUiet Initiation Of Record). QUIOR delays the bias with respect to the erase signal to compensate for the physical distance between the erase head and the record head. The amplitude of the bias and erase signals is ramped to reduce transient noise.

The source of the erase signal is one phase of the 210 kHz master oscillator frequency. A D flip-flop divides this signal down to 105 kHz. An erase amplifier applies the flip-flop output to transformer T2. The amplitude of the erase signal is adjusted by T2 and the erase peaking capacitor C20.

The audio signal arrives at the Strip Board via shielded cables to J5, which plugs directly into a connector on that board. The line input is fed differentially to the balanced input amplifiers on the Record/Cue Board. These amplifiers send the line input signal to two potentiometers. The input calibration potentiometer (IN CAL) sends part of the audio signal to the Output Module for monitoring the line input. The calibrate record potentiometer (LVL) sends part of the audio signal to the equalization networks. The cal record potentiometer sets the level of the signal recorded on the tape.

After the potentiometer, the audio signal splits into two paths. The low frequencies are applied to the input of a summing amplifier; the high frequencies are sent to a differentiator. The gain of the differentiator increases by 6 dB per octave while keeping a constant 90 degree phase shift at all frequencies. This produces the necessary rise in amplitude at higher frequencies to produce a flat response on the tape.

The amount of high frequency gain is determined by the high frequency equalization potentiometers (<). FET switches, controlled by the $\overline{\text{HI EQ}}$ and $\overline{\text{LO EQ}}$ signals select the level required for that speed.

The NAB/IEC switch on the Record/Cue Board (not shown) selects resistors and capacitors within these equalization networks. The values of these components allow the board to be aligned to either standard.

At the summing amplifier the high frequencies and low frequencies are summed together. The linearity adjustment, on some early models of this machine, (LIN) corrects for nonlinearities inherent in various types of recording tape.

The record head driver amplifiers produce a constant current output required by the inductive record head. Bias frequencies are kept from bleeding back into the amplifiers by the bias trap, a notch filter at the output of the record head drivers.

Audio and bias are added together just prior to the cue relay. The relay is shown in its energized position (recording), connecting the audio and bias signals to the record/cue head.

The cross feed amplifier sends the audio signal, out of phase, to the adjacent tracks. The out of phase signals are sent to the cue monitor circuits of the tracks directly above and below the track being recorded on. Since the signals are out of phase they tend to cancel the cross talk generated by the recording track.

A bias defeat switch on the Output Module disables the cue relay for spot erasures. With this switch on, the relay remains in the cue position; bias is not applied to the record head. When the transport is placed into record mode, the erase signal is applied to the erase head. The tape can then be moved by hand past the erase head to erase the signal without applying audio or bias to the record head.

4.3 Reproducing

The monitoring circuits can reproduce either the audio signal read by the repro head, the audio signal read by the record/cue head, or the line input signal. The master status and individual channel status buttons on the remote unit determine which input signal is present at the line output and the channel VU meter.

Figure 4-2, a block diagram, depicts the circuits involved in the monitoring portion of the audio electronics. Use the block diagram to follow the signal flow described in this section. For particular information, consult the schematic diagrams of these boards.

4.3.1 Repro

The repro head picks up the signal from the tape and sends it differentially to the Reproduce Board. A shielded cable from the repro head plugs directly into the Strip Board (P7/J7). From the Strip Board the repro signal is sent to the transformerless preamplifiers on the Repro Board.

On the Repro Board, the amplified signal splits into two paths. The paths taken by the repro signal are determined by the $\overline{\text{HI EQ}}$ and $\overline{\text{LO EQ}}$ lines from the transport's speed control switch and the NAB/IEC switch on the Reproduce Board. High speed and low speed FET switches select the equalization networks required by that selected speed. The NAB/IEC switch selects components which allow the networks to be aligned to either standard.

The high audio frequencies travel through the upper equalization networks shown in the block diagram. The < potentiometers set the high frequency rise in amplitude defined by either the NAB or IEC standards, depending on the position of the NAB/IEC switch.

The low audio frequencies travel through the lower equalization networks in the block diagram. These low frequencies are integrated. The gain of the integrator decreases by 6 dB per octave with a constant −90 degree phase shift at all frequencies. This compensates for the 6 dB per octave rise in amplitude due to the velocity characteristics of the head. The > adjustment potentiometers set the low frequency compensation to comply with either the NAB or IEC standards. After the integrator, the high and low frequencies are summed together at a summing amplifier.

The repro level potentiometer (LVL) adjusts the gain of the repro monitor. Normally, the gain is set to produce a 0VU line output from the level set tone of an alignment tape. From the potentiometer, the repro output is sent to the Output Module via the Strip Board.

4.3.2 Cue

When the cue relay on the Record/Cue Board is de-energized the output of the record/cue head is applied differentially to balanced amplifiers. The amplified cue signal, prior to equalization, is summed with the out-of-phase cross feed signals if either or both of the adjacent channels are in record mode. The cross feed signals will cancel out the cross talk bleeding into the cue signal from the record/cue head.

After the summing amplifier, the audio passes through the same type of split path equalization as on the Reproduce Board. The operation of this portion of the Record/Cue Board is identical to the operation of the Reproduce Board.

The amplitude of the cue output signal is adjusted with the cue level potentiometer (LVL). This level is normally set to produce a 0VU line output from the level set tone on a standard alignment tape.

4.3.3 Input

The line input signal is applied to the Record/Cue Board as described in the record section. The monitoring signal is taken from the input cal potentiometer (IN CAL). This potentiometer is normally adjusted to produce unity gain from the line input to the line output. A 0VU line input signal will appear as a 0VU line output and channel meter reading.

All three monitor signals are sent to the Output Module. Each signal is applied to an FET switch. These FETs are controlled by the cue command, input control, and the master tape command signals. These all come from the remote control unit. Only one of these FETs will be on at a time. The selected monitor signal is then amplified by balanced line output amplifiers. The balanced audio signal is sent through the Strip Board to the channel VU meter and to the line output connector.

The line input and line output signal connections to the console are made via multipin connectors at the back of the transport cabinet. There are two connectors for every eight channels of electronics. The connectors and the pin outs are shown in Figure 4-3.

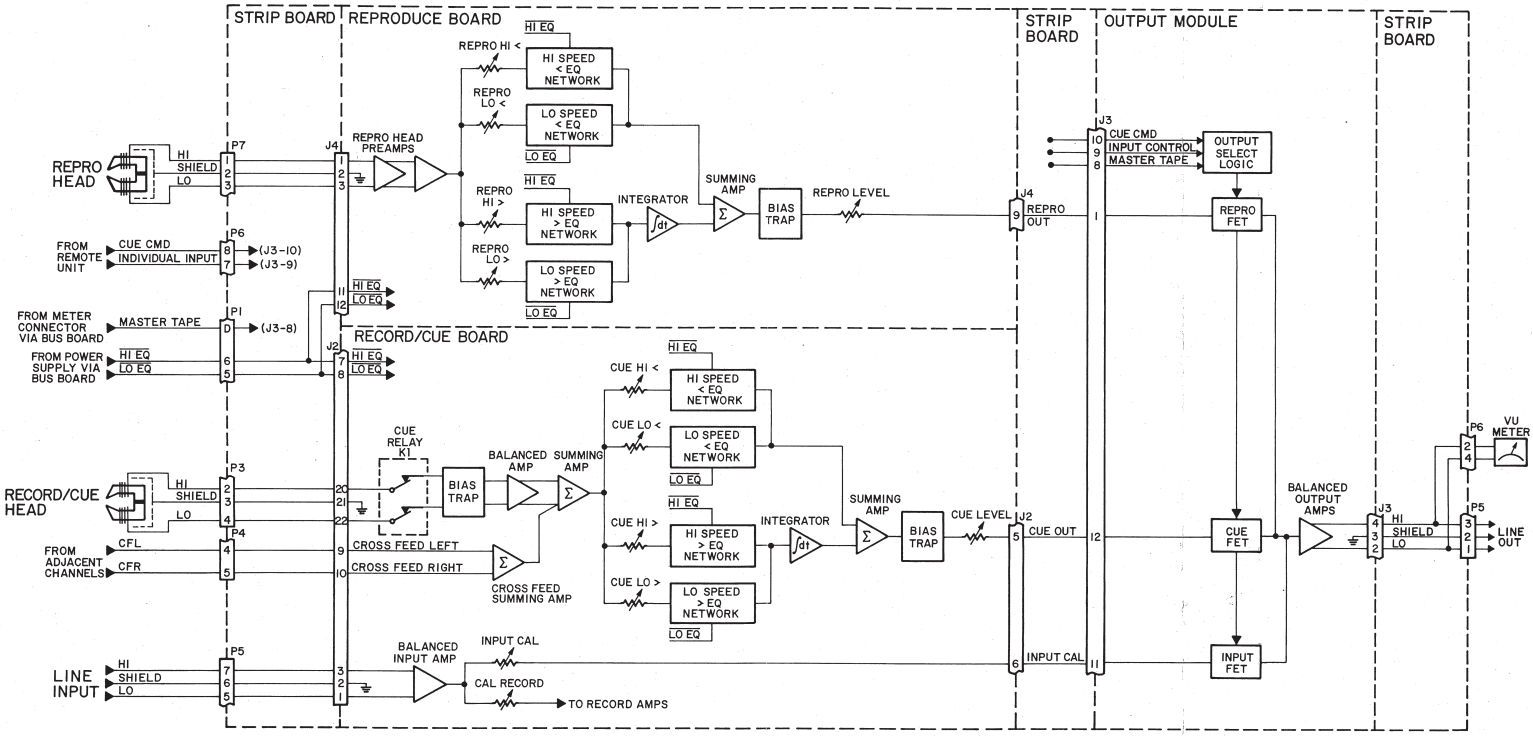
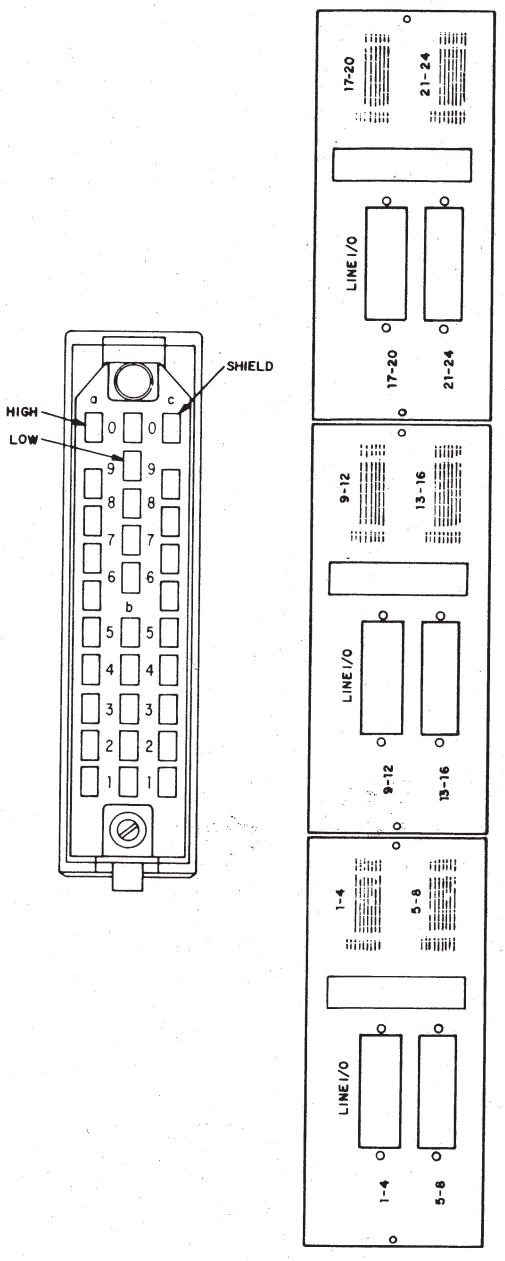


Figure 4-2 Reproduce Block Diagram



ROW ASSIGNMENTS

	Tracks 1-4	Tracks 5-8	Tracks 9-12	Tracks 13-16	Tracks 17-20	Tracks 21-24
Row 0	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.
Row 9	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.
Row 8	Line In 4	Line In 8	Line In 12	Line In 16	Line In 20	Line In 24
Row 7	Line In 3	Line In 7	Line In 11	Line In 15	Line In 19	Line In 23
Row 6	Line Out 4	Line Out 8	Line Out 12	Line Out 16	Line Out 20	Line Out 24
Row 5	Line Out 3	Line Out 7	Line Out 11	Line Out 15	Line Out 19	Line Out 23
Row 4	Line In 2	Line In 6	Line In 10	Line In 14	Line In 18	Line In 22
Row 3	Line In 1	Line In 5	Line In 9	Line In 13	Line In 17	Line In 21
Row 2	Line Out 2	Line Out 6	Line Out 10	Line Out 14	Line Out 18	Line Out 22
Row 1	Line Out 1	Line Out 5	Line Out 9	Line Out 13	Line Out 17	Line Out 21

Figure 4-3 Line Input and Output Connectors

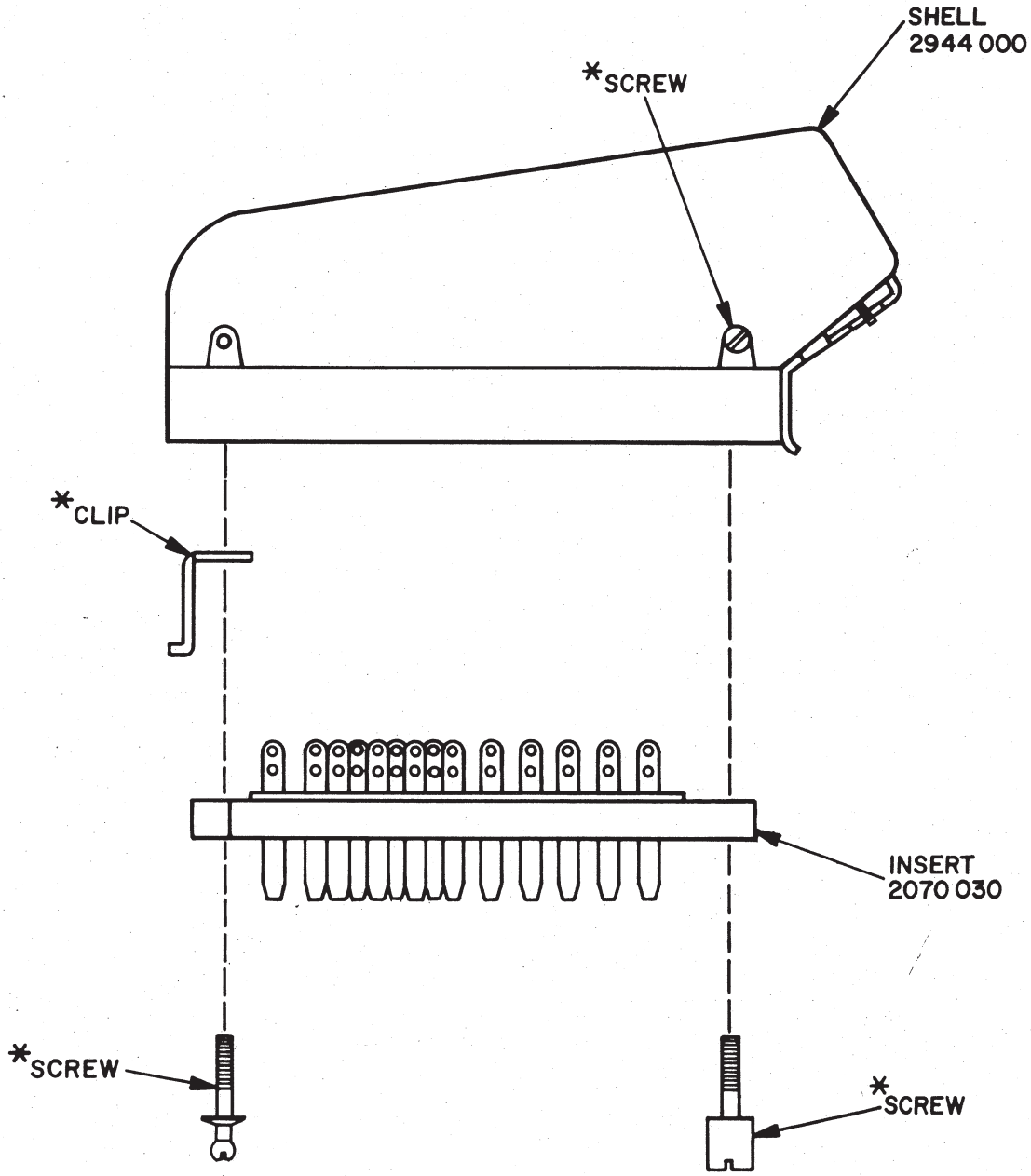
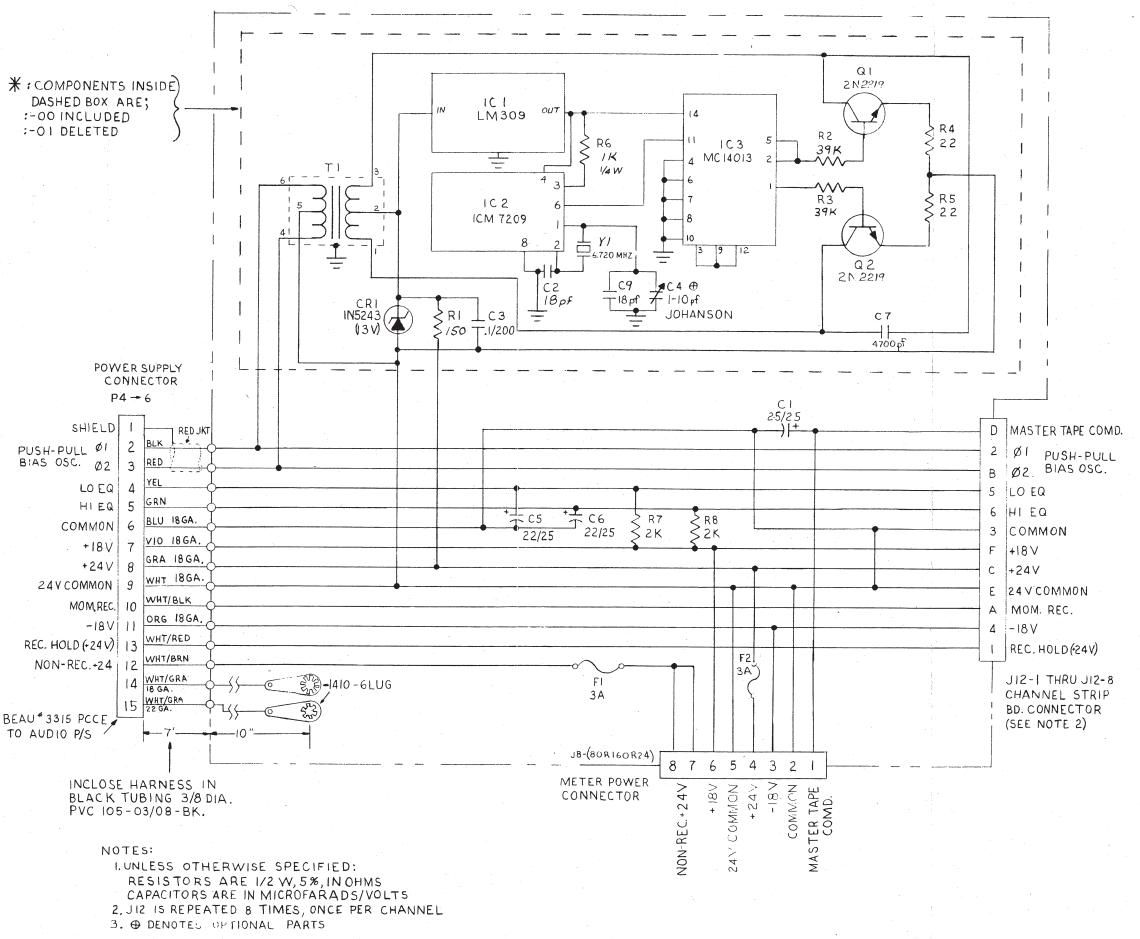


Figure 4-4 I/O Connector Assembly Drawing

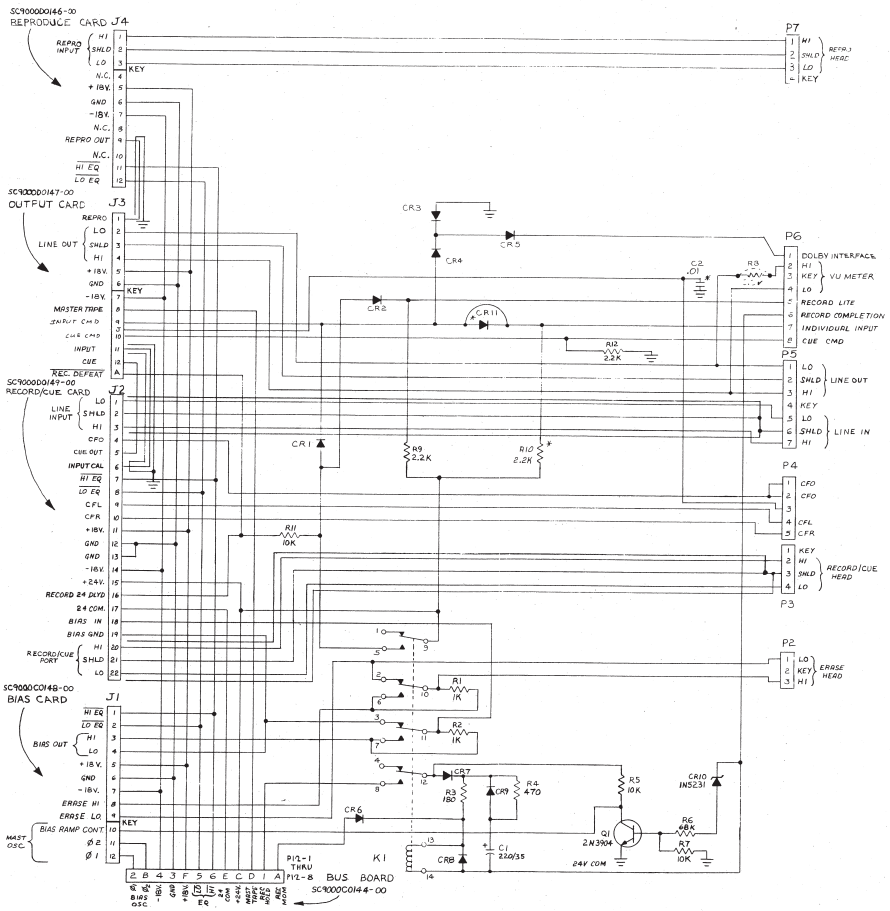


NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   RESISTORS ARE 1/2 W, 5%, IN OHMS
   CAPACITORS ARE IN MICROFARADS/VOLTS
2. J12 IS REPEATED 8 TIMES, ONCE PER CHANNEL
3. ⊕ DENOTES OPTIONAL PARTS

Bus Board
SC9000C0182 rev G

PARTS LIST — BUS BOARD

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
WDA9000-0182-00	BUS BOARD WITH OSCILLATOR	1	
02CD-22GA-RED	CABLE MULTI-CONDUCTOR	7ft	
09-65-1081	MOLEX 8PIN LOCK 3/4"	1	J8
P3315-CCE	CABLE CONNECTOR MALE	1	P4
PCA9000-0182-00	BUS BOARD WITH OSCILLATOR		
1.0KOHM5%-¼W	CARBON FILM RESISTOR	1	R6
102071A	FUSE CLIP	4	
150--OHM5%-½W	CARBON FILM RESISTOR	1	R1
18PF1KV-CCD20	CERAMIC DISC CAPACITOR 20%	2	C2, C9
1N5243-13V	DIODE, ZENER 13V-10%	1	CR1
2.0-KOHM5%-½W	CARBON FILM RESISTOR	2	R7, R8
22---OHM5%-½W	CARBON FILM RESISTOR	2	R4, R5
22MF25V-CLY	LYTIC CAPACITOR	3	C1, C5, C6
2N2219A	TRANSISTOR NPN	2	Q1, Q2
39--KOHM5%-½W	CARBON FILM RESISTOR	2	R2, R3
6.720MHZ	CRYSTAL SP-7000-0256-00	1	Y1
:0047MF250V-CMY	MYLAR CAPACITOR	1	C7
:1MF100V-CCD20	CERAMIC DISC CAPACITOR	1	C3
AR754-2	CAN, BIAS COIL	1	T1
D-1021-10	COIL, BIAS	1	T1
ICM7209IPA	CMOS CLOCK GENERATOR	1	IC2
LM309H	5 VOLT REGULATOR	1	IC1
[illegible]-9000-0173-00	CINCH CONNECTOR	8	J12-1 thru J12-8
[illegible]14013CP	IC, MOTOROLA	1	IC3
MDA-3AMP-SB	FUSE, 3AMP SLOW BLOW	2	F1, F2

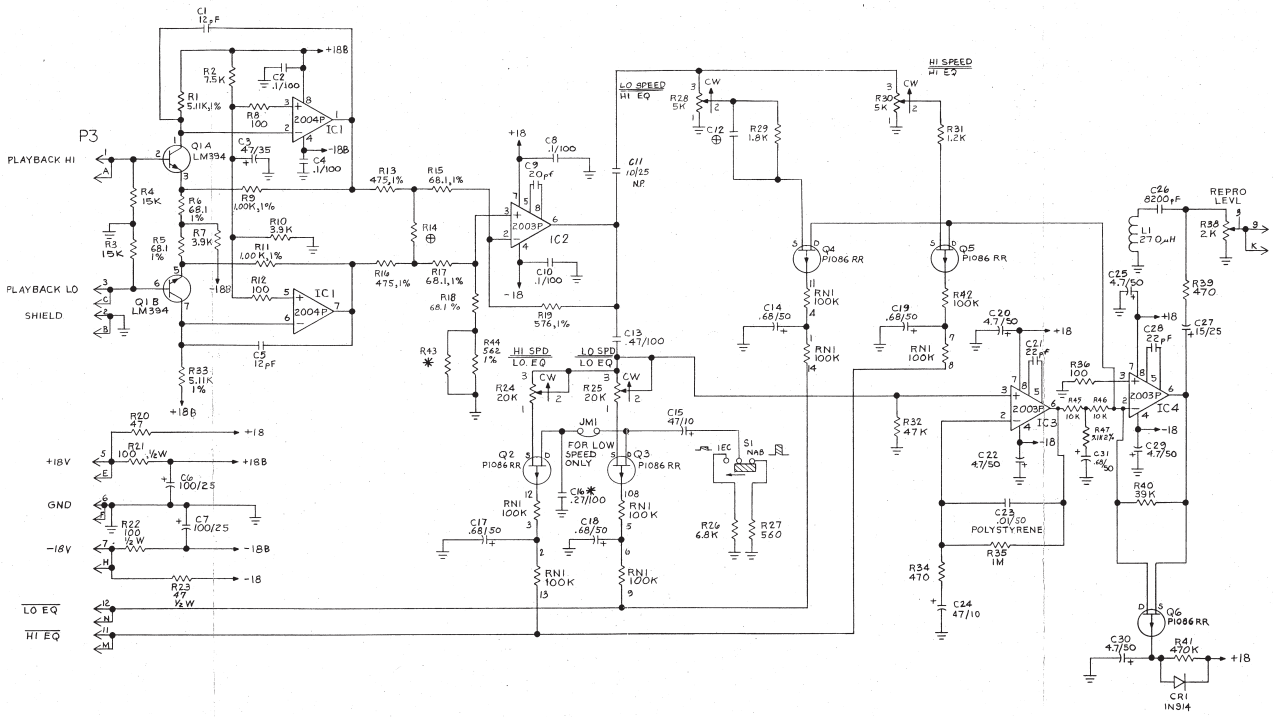


NOTES (UNLESS OTHERWISE SPECIFIED):
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4 W, 5%.
2. ALL CAPACITOR VALUES ARE IN µF, VOLTS.
3. ALL DIODES IN4004
4. * DENOTES OPTIONAL PART

Strip Board
SC9000D0145 rev G

PARTS LIST — STRIP BOARD

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA9000-0145-00	STRIP BD. ASSY JH24D	1	
09-65-1031	MOLEX 3PIN LOCK 3/4"	1	P2
09-65-1041	MOLEX 4PIN LOCK 3/4"	2	P3, P7
09-65-1051	MOLEX 5PIN LOCK 3/4"	1	P4
09-65-1071	MOLEX 7PIN LOCK 3/4"	1	P5
09-65-1081	MOLEX 8PIN LOCK 3/4"	1	P6
1.0-KOHM5%-¼W	CARBON FILM RESISTOR	2	R1, R2
10--KOHM5%-¼W	CARBON FILM RESISTOR	3	R5, R7, R11
180--OHM5%-¼W	CARBON FILM RESISTOR	1	R3
1N4004	DIODE, RECTIFIER - SILICON	9	CR1-CR9
1N5231B-5.1V	DIODE, ZENER-SILCN 5.1V-5	1	CR10
2.2-KOHM5%-¼W	CARBON FILM RESISTOR	3	R9, R10, R12
20C250	HOLD DOWN SPRING P&B	1	
220MF25V-CLY	LYTIC SIEM B41283 .41"X.	1	C1
27B007	RELAY SOCKET POTTER/BRUM	1	K1
2N3904	TRANSISTOR	1	Q1
470--OHM5%-¼W	CARBON FILM RESISTOR	1	R4
50-24B-10	P.C. CONN CINCH	3	J1, J3, J4
50-44B-10	P.C. CONN CINCH	1	J2
50-PK-2	CINCH POLARIZING KEY	3	
68--KOHM5%-¼W	CARBON FILM RESISTOR	1	R6
HC4E-24VDC	RELAY	1	K1



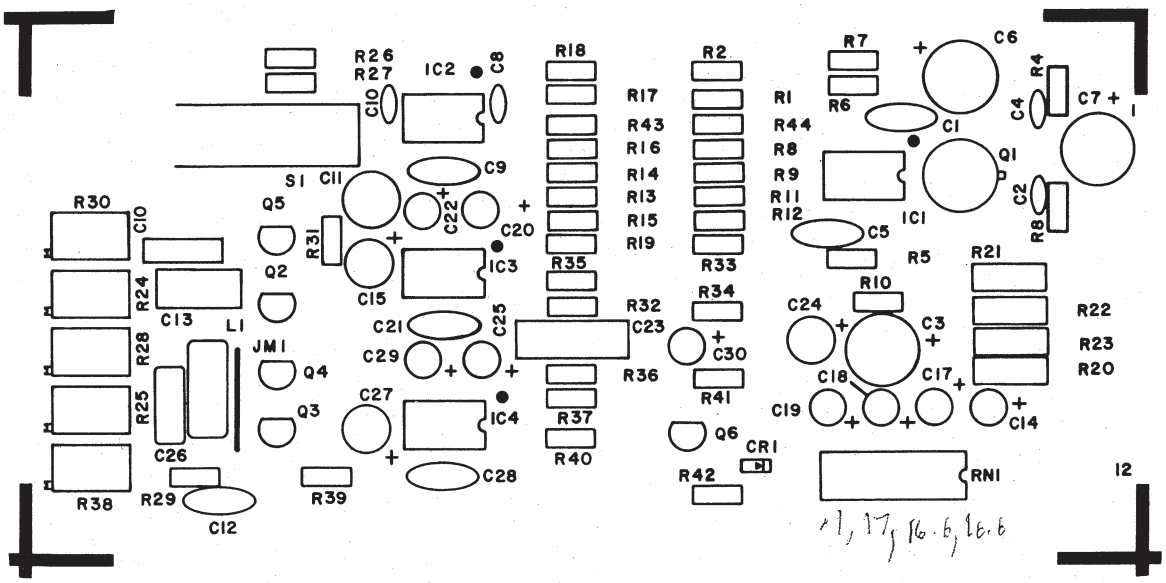
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTOR VALUES ARE IN OHMS, ¼W ±5% EXCEPT, 1% RESISTORS WHICH ARE ⅛W.
   ALL CAPACITOR VALUES ARE IN MICROFARADS/VOLTS.
2. ⊕DENOTES OPTIONAL COMPONENTS NOT NORMALLY REQUIRED
3. NUMBERS AND → CORRESPOND TO GOLD FINGERS ON COMPONENT SIDE OF P.C. BD.
   LETTERS AND → CORRESPOND TO GOLD FINGERS ON SOLDER SIDE OF P.C. BD.
4. ✱DENOTES VARIABLE COMPONENT (SEE CHART)

✱DASH Nº	DESCRIPTION	VARIABLE COMPONENTS		
		C16	JM1	R43
-00	HIGH SPEED	IN	—	CHOSEN BY TEST
-01	LOW SPEED	—	IN	CHOSEN BY TEST

DASH Nº CHART

Reproduce Board
SC9000D0146 rev F

JH-24



1, 17, 16.6, 16.6

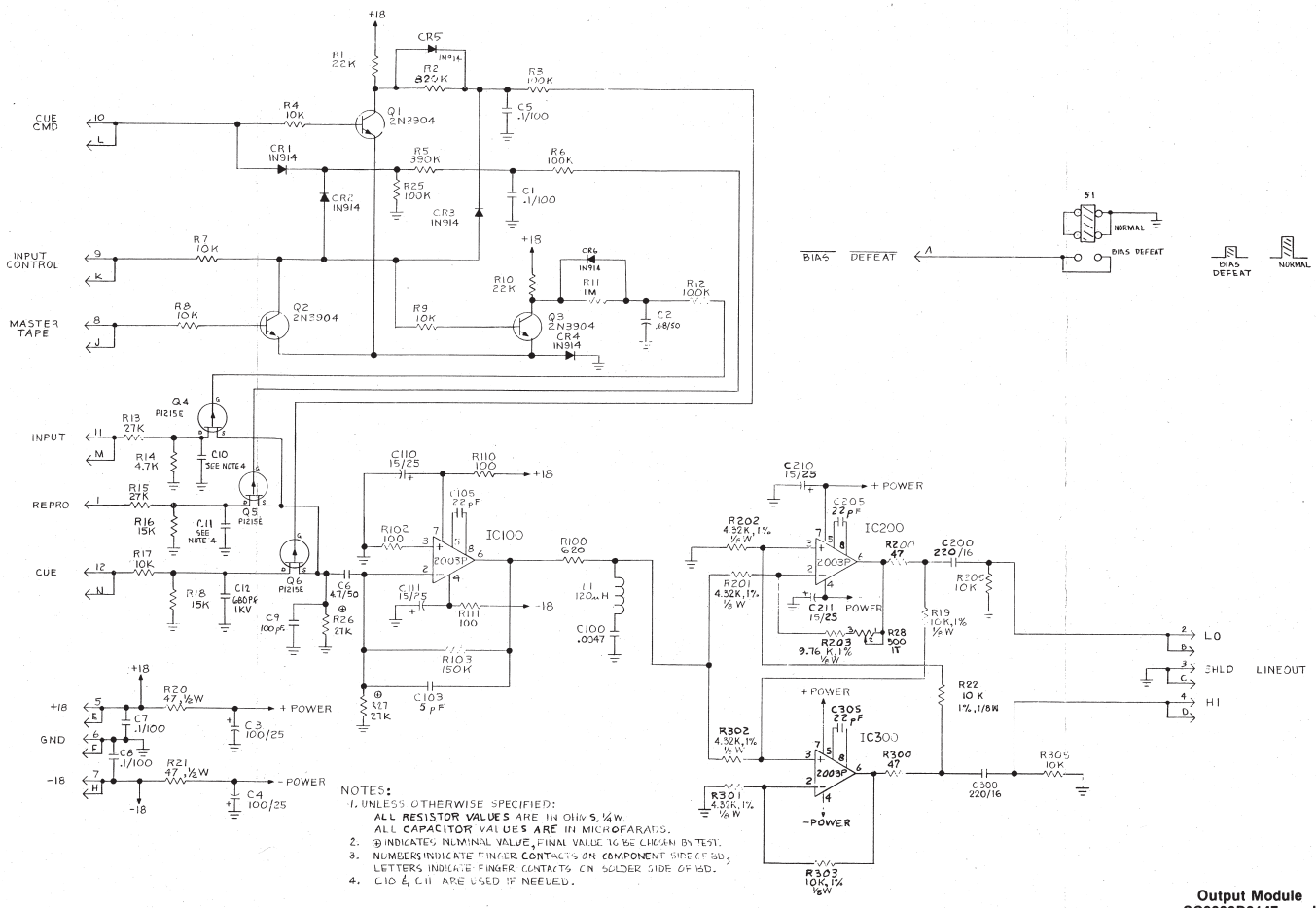
REPRODUCER JH-24
SS9000C0146-00B
SILKSCREEN

0, 16.8, 16.8, 16.8, 0, 0, 16.8
1, 17, 16.6, 16.6, 0, 0, 17

PARTS LIST — REPRODUCE BOARD

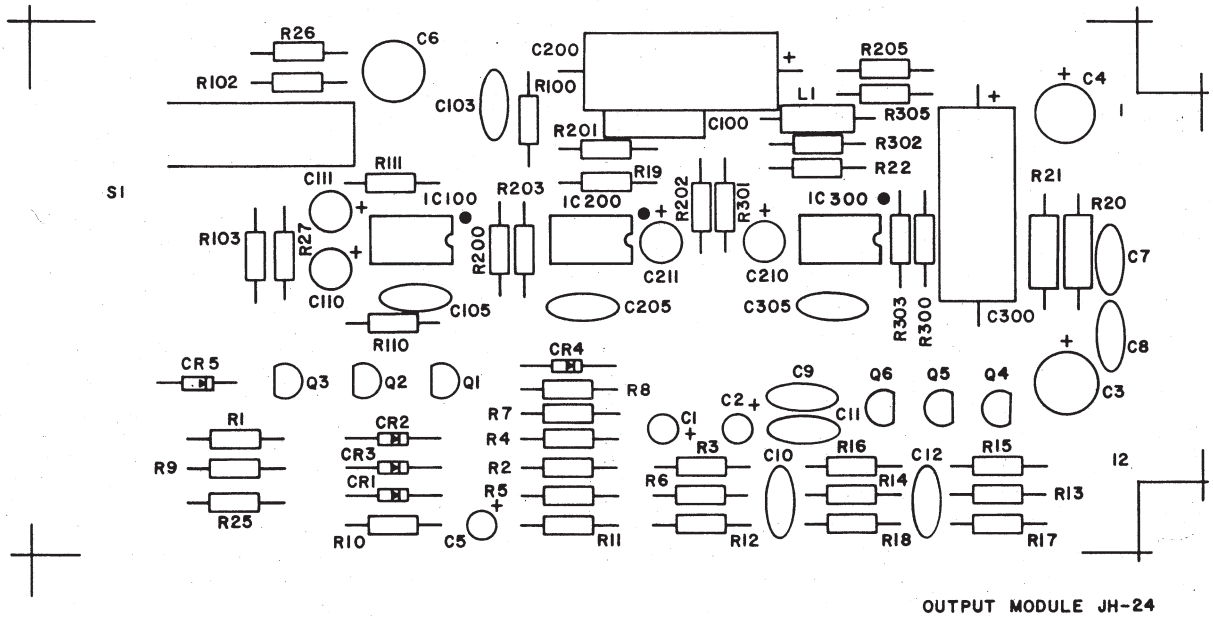
ART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA9000-0146-00	REPRODUCE CARD ASSY JH24	1	
08P-DIP-SKT	DIP SKT 8PIN ARIES 8-511	4	
1.0-KOHM1%-1/8W	METAL FILM RES RN55D1001	2	R9, R11
1.2-KOHM5%-¼W	CARBON FILM RESISTOR	1	R31
1.8-KOHM5%-¼W	CARBON FILM RESISTOR	1	R29
2.2-MOHM5%-¼W	CARBON FILM RESISTOR	1	R35
100--OHM5%-½W	CARBON FILM RESISTOR	2	R21, R22
100--OHM5%-¼W	CARBON FILM RESISTOR	3	R8, R12, R36
100-KOHM5%-¼W	CARBON FILM RESISTOR	1	R42
100MF25V-CLYRL	LYTIC RAD/LD SEALED (GP)	2	C6, C7
10MF25V-NPLC	NON-POLAR (RADIAL) LYTIC	1	C11
12PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	2	C1, C5
15-KOHM5%-¼W	CARBON FILM RESISTOR	2	R3, R4
15MF20V-CTA10	DIP TANT CAP 10% SEL 1/A	1	C27
15S271K	270MH INDUCTOR	1	L1
2003P	SIG#NE5534AN OP AMP	3	IC2, 3, 4
2004P	SIG#NE5532FE OP AMP PLAS	1	IC1
20PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	1	C9
22PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	2	C21, C28
3.9-KOHM5%-¼W	CARBON FILM RESISTOR	2	R7, R10
301-150	BIVAR PERM-O-PADS	12	
312-250	BIVAR PERM-O-PADS	12	
15-400	BIVAR PERM-O-PADS	1	
39--KOHM5%-¼W	CARBON FILM RESISTOR	1	R40
4114R-001-104	100K DIP 14PIN RES NET	1	RN1
47---OHM5%-½W	CARBON FILM RESISTOR	2	R20, R23

ART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
47--KOHM5%-¼W	CARBON FILM RESISTOR	1	R32
470--OHM5%-¼W	CARBON FILM RESISTOR	2	R34, R39
470-KOHM5%-¼W	CARBON FILM RESISTOR	1	R41
475--OHM1%-1/8W	METAL FILM RES RN55D4750	2	R13, R16
47MF10V-CLYRL	LYTIC RAD/LD SEALED (GP)	2	C15, C24
47MF25V-CLYRL	LYTIC RAD/LD SEALED (GP)	1	C3
4:7MF35V-CLYRL	LYTIC RAD/LD SEALED (LL)	5	C20, 22, 25, 29, 30
5.11KOHM1%-1/8W	METAL FILM RESISTOR	2	R1, R33
560--OHM5%-¼W	CARBON FILM RESISTOR	1	R27
576--OHM1%-1/8W	METAL FILM RES RN55D5760	2	R18, R19
6.8-KOHM5%-¼W	CARBON FILM RESISTOR	1	R26
68.1-OHM1%-1/8W	METAL FILM RES.	4	R5, R6, R15, R17
7.5-KOHM5%-¼W	CARBON FILM RESISTOR	1	R2
:0082MF250V-CMY	MYLAR CAPACITOR MEPCO SR	1	C26
:01MF50V-CPS	CAP ELPAC PD5R103 POLY	1	C23
:1MF100V-CCD20	CERAMIC DISC CAPACITOR	4	C2, C4, C8, C10
:27MF100V-CMPF	CAP METAL POLY-FILM	1	C16
:47MF100V-CMPF	MET POLY CAP 5% SIEMEN B	1	C13
:68MF50V-CLYRL	LYTIC RAD/LD SEALED (LL)	4	C14, C17, C18, C19
LM394H	TRANSISTOR, JH600	1	Q1
MC-9000-0159-01	CARD PULL EXTRUSION JH24D	1	
MC-9000-0159-02	REPRO PULL LAB JH24D	1	
?1086RR	XSTOR FIELD EFFECT P	5	Q2-Q6
APCPOT20K-18T	BU3299X-1-203/BK68XR20K	2	R24, R25
SAPCPOT2K-18T	BU3299X-1-202/BK68XR2K	1	R38
SAPCPOT5K-18T	BU3299X-1-502/BK68XR5K	2	R28, R30
SP-7100-2307-51	F2UEE FA201 BK/OR W/SPC	1	S1



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTOR VALUES ARE IN OHMS, 1/4W.
   ALL CAPACITOR VALUES ARE IN MICROFARADS.
2. ⊕ INDICATES NOMINAL VALUE, FINAL VALUE TO BE CHOSEN BY TEST.
3. NUMBERS INDICATE FINGER CONTACTS ON COMPONENT SIDE OF BD.; LETTERS INDICATE FINGER CONTACTS ON SOLDER SIDE OF BD.
4. C10 & C11 ARE USED IF NEEDED.

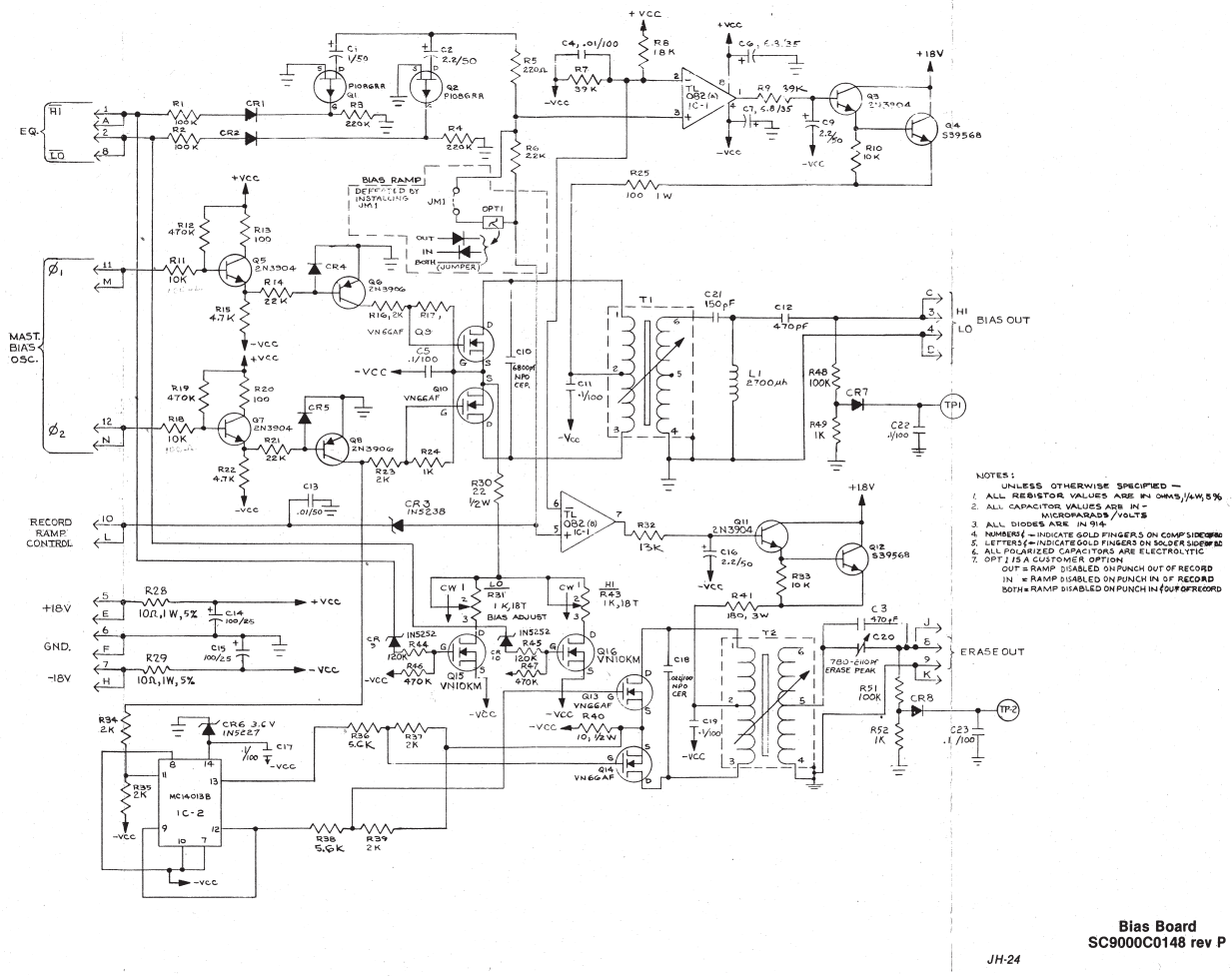
Output Module
SC9000D0147 rev J



OUTPUT MODULE JH-24
SS9000C0147-00B
SILKSCREEN

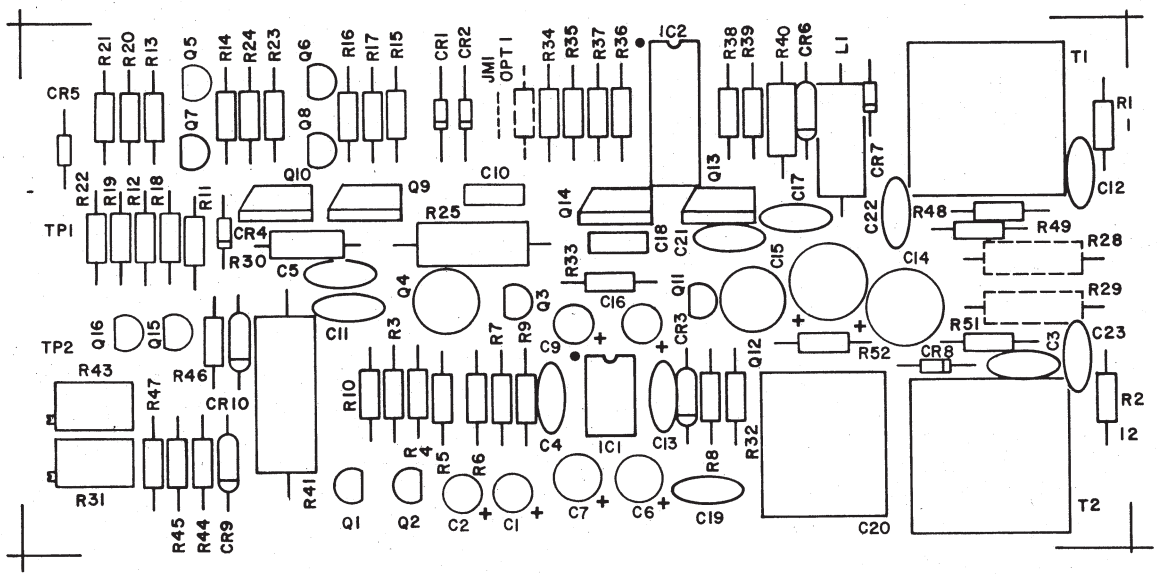
PARTS LIST — OUTPUT MODULE

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA9000-0147-00	OUTPUT CARD ASSY JH24D	1	
08P-DIP-SKT	DIP SKT 8PIN ARIES 8-511	3	
1--MOHM5%-¼W	RESISTOR	1	R11
10--KOHM1%-1/8W	METAL FILM RES RN55D1002	4	R19, R22, R203, R303
10--KOHM5%-¼W	CARBON FILM RESISTOR	7	R4, R7-R9, R17, R205, R305
100--OHM5%-¼W	CARBON FILM RESISTOR	3	R102, R110, R111
100-KOHM5%-¼W	CARBON FILM RESISTOR	4	R3, R6, R12, R25
100MF25V-CLYRL	LYTIC RAD/LD SEALED (GP)	2	C3, C4
100PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	1	C9
15--KOHM5%-¼W	CARBON FILM RESISTOR	2	R16, R18
150-KOHM5%-¼W	CARBON FILM RESISTOR	1	R103
15MF20V-CTA10	DIP TANT CAP 10% SEL 1/A	4	C110, C111, C210, C211
15S121K	120MH INDUCTOR	1	L1
1N914	DIODE, SIGNAL-SILCN GLASS	6	CR1, 2, 3, 4, 5, 6
2003P	SIG♀NE5534AN OP AMP	3	IC100, 200, 300
22--KOHM5%-¼W	CARBON FILM RESISTOR	2	R1, R10
220MF40V-CLY	LYTIC CAPACITOR SIEMEN-D	2	C200, C300
22PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	3	C105, C205, C305
27--KOHM5%-¼W	CARBON FILM RESISTOR	3	R13, R15, R26
2N3904	TRANSISTOR	3	Q1, 2, 3
301-150	BIVAR PERM-O-PADS	7	
312-250	BIVAR PERM-O-PADS	9	
390-KOHM5%-¼W	CARBON FILM RESISTOR	1	R5
32KOHM1%-1/8W	METAL FILM RESISTOR	4	R202, R201, R301, R302
4.7-KOHM5%-¼W	CARBON FILM RESISTOR	1	R14
4.7MF50V-NPLC	NON-POLAR (RADIAL) LYTIC	1	C6
47---OHM5%-½W	CARBON FILM RESISTOR	4	R20, R21, R200, R300
5PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	1	C103
68---OHM5%-¼W	CARBON FILM RESISTOR	2	
820-KOHM5%-¼W	CARBON FILM RESISTOR	1	R2
:0047MF400V-CMY	MYLAR CAP MEPCO C350AFA4	1	C100
:1MF100V-CCD20	CERAMIC DISC CAPACITOR	4	C1, C5, C7, C8
:68MF50V-NPLC	LYTIC CAPACITOR	1	C2
MC-9000-0159-01	CARD PULL EXTRUSION JH24D	1	
MC-9000-0159-04	OUTPUT CD PULL LAB JH24D	1	
P1215E	XSTOR FIELD EFFECT P	3	Q4, 5, 6
SP-7100-2307-51	F2UEE FA201 BK/OR W/SPC	1	S1
620--OHM5%-¼W	CARBON FILM RESISTOR	1	R100
680PF1KV-CCD20	CAPACITOR	1	C12
TAPCPOT500-1T	POTENTIOMETER	1	



Bias Board
SC9000C0148 rev P

JH-24

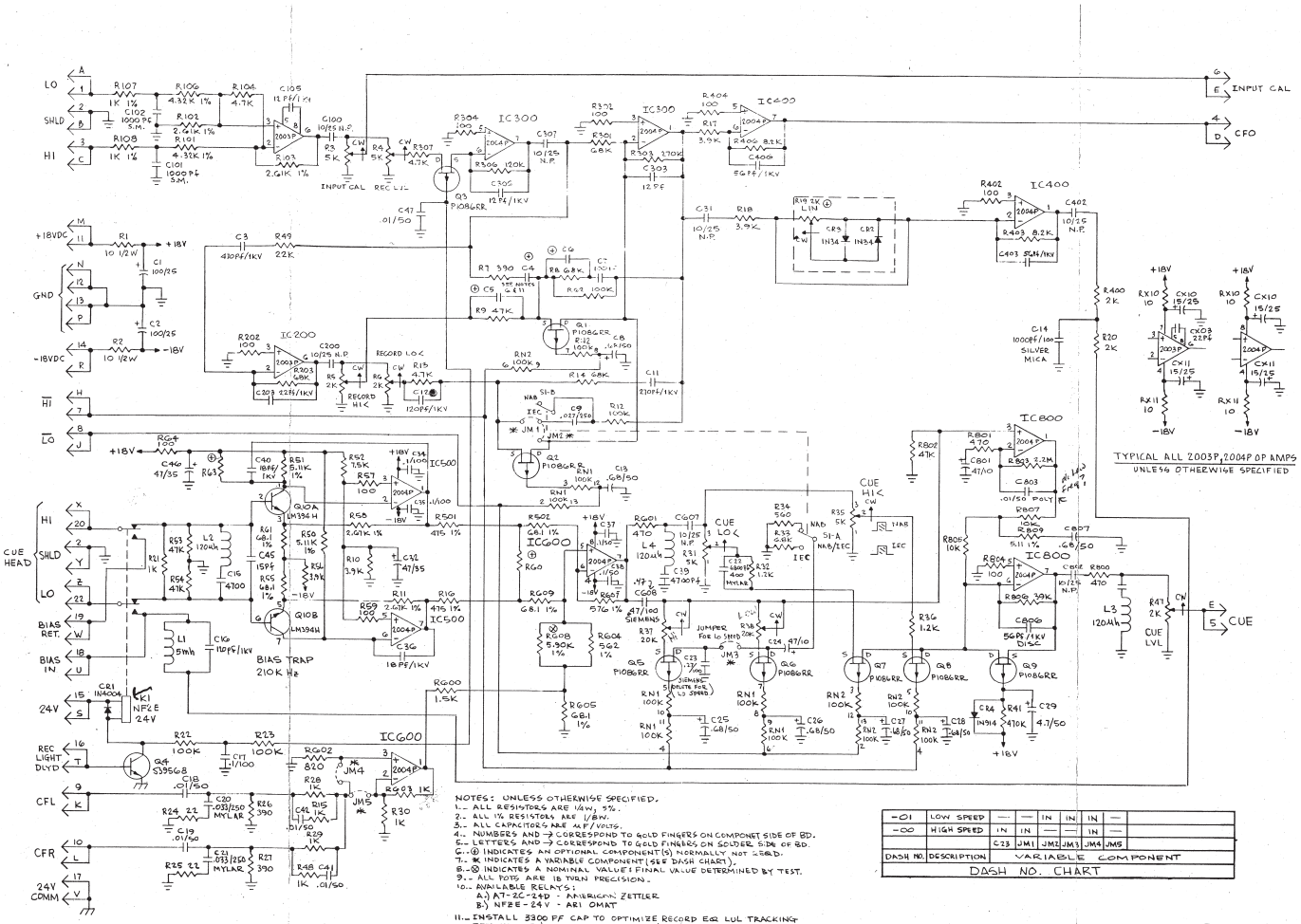


BIAS BD JH-24
SS9000C0148-00C
SILKSCREEN

ART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
2N3904	TRANSISTOR	4	Q3, Q5, Q7, Q11
2N3906	TRANSISTOR	2	Q6, Q8
2N5681-539568	XSTOR NPN AMPLIFIER	2	4, 12
301-150	BIVAR PERM-O-PADS	6	
312-250	BIVAR PERM-O-PADS	12	
315-400	BIVAR PERM-O-PADS	1	
39--KOHM5%-¼W	CARBON FILM RESISTOR	2	R7, R9
4.7-KOHM5%-¼W	CARBON FILM RESISTOR	2	R15, R22
47---OHM5%--1WM	METAL FILM AIRCO M01	1	R25
470-KOHM5%-¼W	CARBON FILM RESISTOR	4	R12, R19, R46, R47
270PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	1	C12
50865-5	AMP PC SOLDER JACK	2	
5.6-KOHM5%-¼W	CARBON FILM RESISTOR	2	R36, R38
:01MF160V-CPCF	POLY-CARB CAP S/T KC1849	1	C10, C18
:01MF50V-CCD20	CERAMIC DISC CAP 20% TOL	3	C4, C13
:1MF100V-CCD20	CERAMIC DISC CAPACITOR	6	C11, C17, C22, C19, C23, C24
AP5-7D	PAD, TRANSISTOR TO-5 TYPE	2	
AR754-2	CAN, BIAS COIL ARBO MFG	2	T1, T2
D-1021-10	COIS BIAS CENTRAL COIL	2	T1, T2
MC-9000-0159-01	CARD PULL EXTRUSION JH24D	1	
MC-9000-0159-03	BIAS CD PULL LAB JH24D	1	
MC14013CP	IC (MOTOROLA)	1	IC2
)86RR	XSTOR FIELD EFFECT P	2	Q1, Q2
-4615	ARCO VAR CAP	1	C20
SAPCPOT2K-18T	RU3299X-1-202/BK68XR2K	2	R31, R43
TL082CP	DUAL OP AMP	1	IC1
VN10KM	SILICONIX VMOS FET	2	Q15, Q16
VN86HF	V-MOS FET SILICONIX	4	Q9, 10, 13, 14
7.5-KOHM5%-¼W	CARBON FILM RESISTOR	1	R9

PARTS LIST — BIAS BOARD

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA9000-0148-00	BIAS CARD ASSY JH24D	1	
08P-DIP-SKT	DIP SKT 8PIN ARIES 8-511	1	
09-64-1021	MOLEX 2 PIN NON-LOCK 3/4''	1	
1.0-KOHM5%-¼W	CARBON FILM RESISTOR	4	R17, R24, R49, R52
10--OHM5%--1WM	METAL FILM AIRCO M01	2	R28, R29
10--OHM5%-½W	CARBON FILM RESISTOR	1	R40
10--KOHM5%-¼W	CARBON FILM RESISTOR	3	R10, R33, R35
100-OHM5%-¼W	CARBON FILM RESISTOR	4	R13, R20, R11, R18
100-KOHM5%-¼W	CARBON FILM RESISTOR	4	R1, 2, 48, 51
100MF25V-CLYRL	LYTIC RAD/LD SEALED (GP)	2	C14, C15
13--KOHM5%-¼W	CARBON FILM RESISTOR	1	R32
120-KOHM5%¼W	CARBON FILM RESISTOR	2	R44, R45
14P-DIP-SKT	DIP SKT ARIES 14-511-10	1	
100PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	1	C21
15MF20V-CTA10	DIP TANT CAP 10% SEL 1/A	2	C6, C7
18--KOHM5%-¼W	CARBON FILM RESISTOR	1	R8
180--OHM10%-3WW	WIRE WOUND RES-ROCKWOOD	1	R41
1MF50V-CLYRL	LYTIC RAD/LD SEALED (LL)	1	C1
1N5227-3.6V	DIODE, ZEN-SILIC 3.6V-10%	1	CR6
1N5238B-8.7V	DIODE, ZENER-SILC 8.7V-5%	1	CR3
1N5252B-24V	DIODE, ZENER-SILCN 24V-5%	2	CR9, CR10
1N914	DIODE, SIGNAL-SILCN GLASS	6	CR1, 2, 4, 5, 7, 8
2.0-KOHM5%-¼W	CARBON FILM RESISTOR	5	R16, 23, 34, 37, 39
--OHM5%-½W	CARBON FILM RESISTOR	1	R30
22--KOHM5%-¼W	CARBON FILM RESISTOR	3	R6, R14, R21
220--OHM5%-¼W	CARBON FILM RESISTOR	1	R5
220-KOHM5%-¼W	CARBON FILM RESISTOR	2	R3, R4
2700MH	DELE2500-48 AIR 1312-27J	1	L1
2:2MF50V-CTA10	DIP TANT CAPACITOR 10%	3	C2, C9, C16

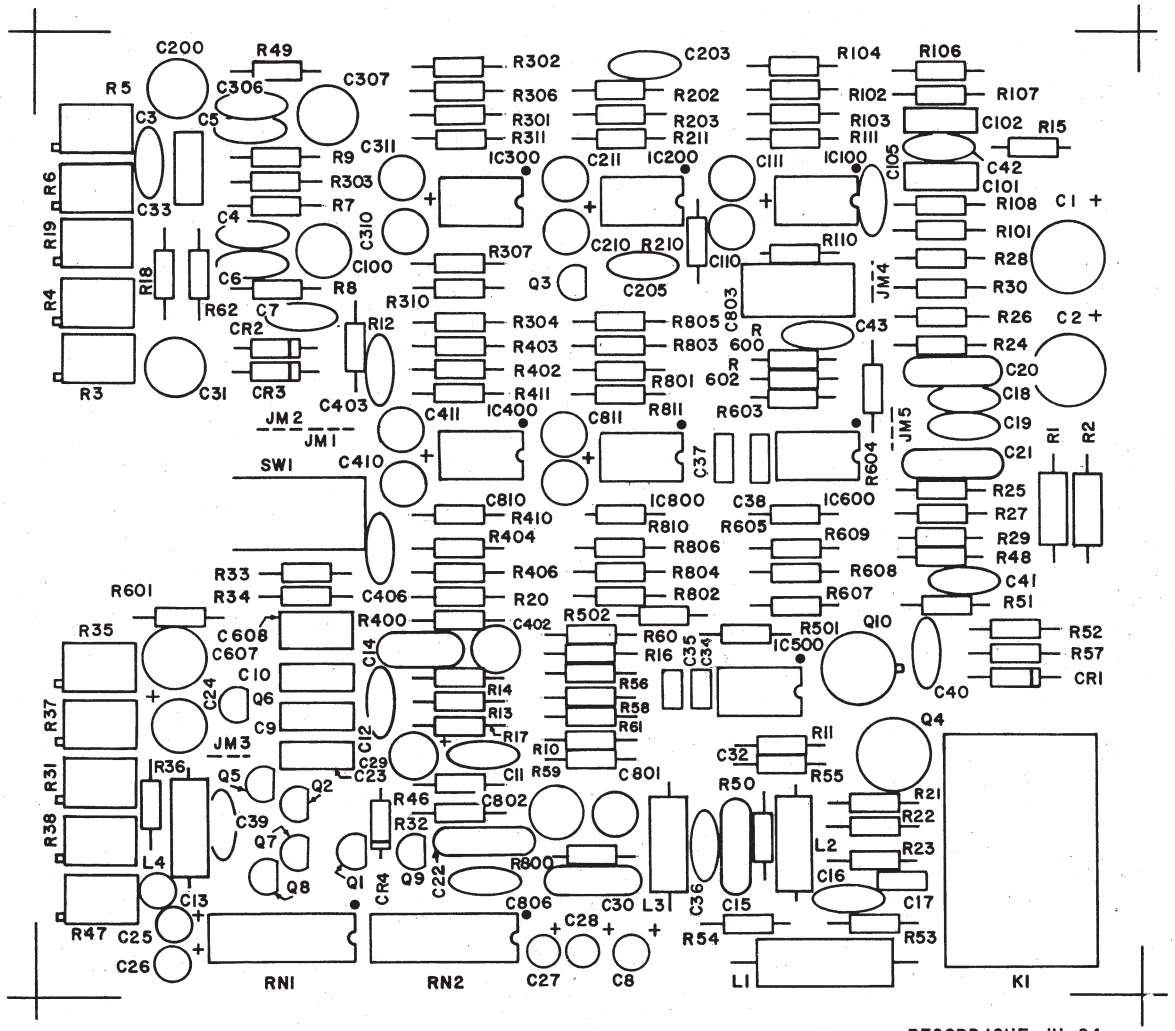


-01	LOW SPEED	—	—	IN	IN	IN	—	
-00	HIGH SPEED	IN	IN	—	—	IN	—	
		C23	JM1	JM2	JM3	JM4	JM5	
DASH NO.	DESCRIPTION	VARIABLE COMPONENT						

DASH NO. CHART

NOTES: UNLESS OTHERWISE SPECIFIED.
1.- ALL RESISTORS ARE 1/4W, 5%.
2.- ALL 1% RESISTORS ARE 1/8W.
3.- ALL CAPACITORS ARE MF/VOLTS.
4.- NUMBERS AND → CORRESPOND TO GOLD FINGERS ON COMPONENT SIDE OF BD.
5.- LETTERS AND → CORRESPOND TO GOLD FINGERS ON SOLDER SIDE OF BD.
6.- ⊕ INDICATES AN OPTIONAL COMPONENT(S) NORMALLY NOT USED.
7.- * INDICATES A VARIABLE COMPONENT (SEE DASH CHART).
8.- ⊗ INDICATES A NOMINAL VALUE; FINAL VALUE DETERMINED BY TEST.
9.- ALL POTS ARE 18 TURN PRECISION.
10.- AVAILABLE RELAYS:
A.) AT-2C-24D - AMERICAN ZETTLER
B.) NF2E-24V - ARI OMAT
11.- INSTALL 3300 PF CAP TO OPTIMIZE RECORD EQ LVL TRACKING BETWEEN 15 & 30 IPS WITH MAGNETIC & AGFA PEM TAPE. AS SHOWN IS OPTIMUM FOR 3M 226 & AMPEX 456 TAPE.

Record/Cue Board
SC9000D0149 rev U

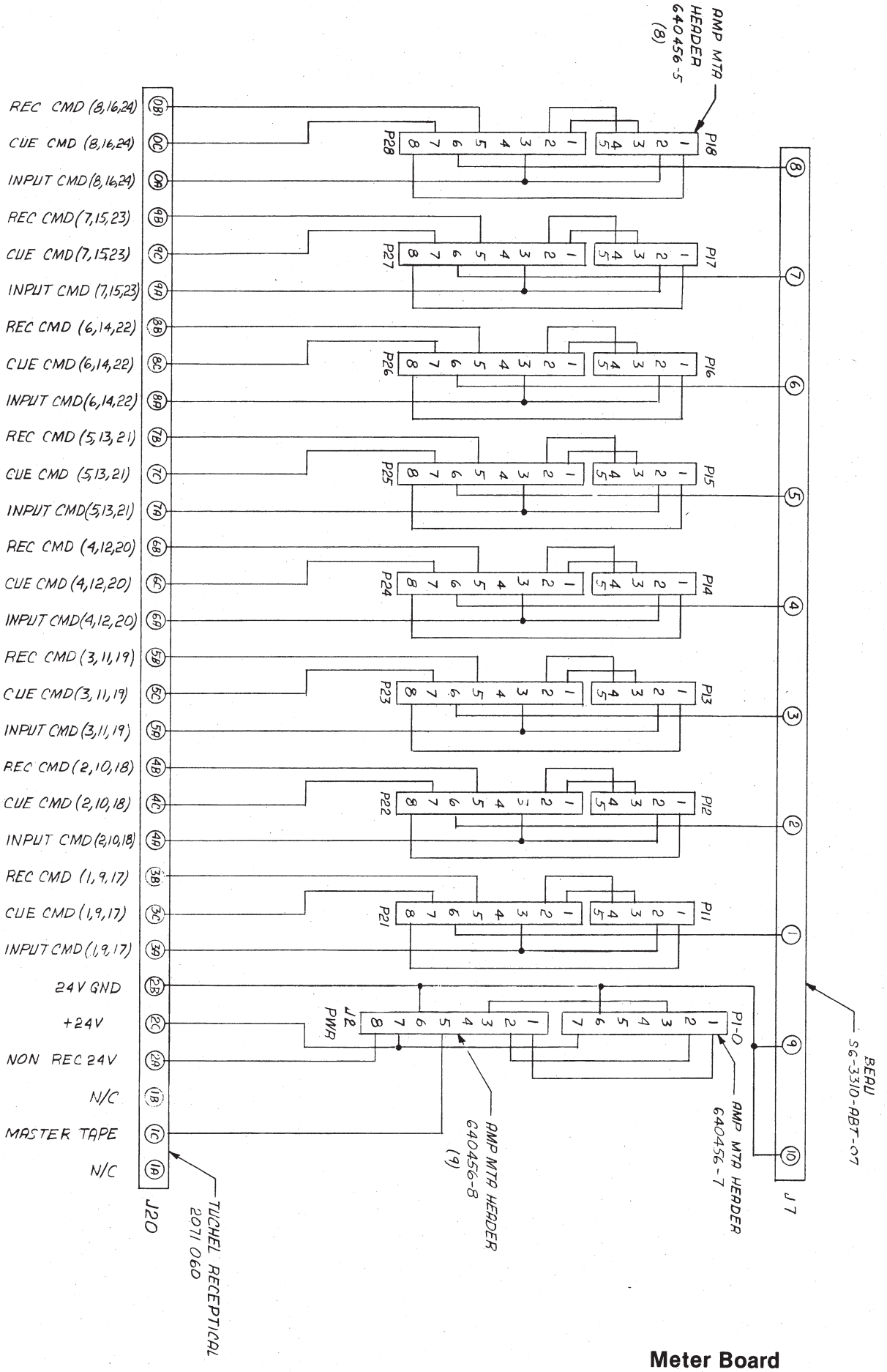


RECORD/CUE JH-24
SS9000D0149-00C
SILKSCREEN

PARTS LIST — RECORD/CUE BOARD

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA9000-0149-00	RECORD/CUE CARD ASSY JH-24	1	
08P-DIP-SKT	DIP SKT 8PIN ARIES 8-511	7	
1.0-KOHM1%-1/8W	METAL FILM RES RN55D1001	4	R11, 58, 107, 108
1.0-KOHM5%-¼W	CARBON FILM RESISTOR	5	R21, 28, 29, 30, 603
1.2-KOHM5%-¼W	CARBON FILM RESISTOR	1	R23, 36
1.5-KOHM5%-¼W	CARBON FILM RESISTOR	1	R600
10---OHM5%-½W	CARBON FILM RESISTOR	2	R1, R2
100-OHM5%-¼W	CARBON FILM RESISTOR	6	R57, 59, 202, 302, 404, 804
100-KOHM5%-¼W	CARBON FILM RESISTOR	5	R12, 22, 23, 62, 304
1000PF100V-CSM	SILVER MICA CAP ARCO DM1	3	C14, C101, C102
100MF25V-CLYRL	LYTIC RAD/LD SEALED (GP)	2	C1, C2
100PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	1	C7
10MF25V-NPLC	NON-POLAR (RADIOAL) LYTIC	6	C31,100, 200, 307, 607, 802
120PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	2	C12, C16
12PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	3	C105, C303, C306
15MF20V-CTA10	DIP TANT CAP 10% SEL 1/A	1	C402
15S121K	120MH INDUCTOR	3	L2, L3, L4
1N34	DIODE, SIGNAL-GERMANIUM	2	CR2, CR3
1N4004	DIODE, RECTIFIER - SILICON	1	CR1
2.0-KOHM5%-¼W	CARBON FILM RESISTOR	2	R20, R400
2.2-KOHM5%-¼W	CARBON FILM RESISTOR	1	R49
2.2-MOHM5%-¼W	CARBON FILM RESISTOR	1	R803
2.61KOHM1%-1/8W	METAL FILM RES RN55C2611	2	R102, R103
)3P	SIG♀Ne5534AN OP AMP	2	IC100, IC200
2004P	SIG♀NE5532FE OP AMP	6	IC300, 400, 500, 600
22---OHM5%-¼W	CARBON FILM RESISTOR	2	R24, R25, IC700, IC800
22PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	1	C203
270-KOHM5%-¼W	CARBON FILM RESISTOR	1	R303
270PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	1	C11
2N5681-S39568	XSTOR NPN AMPLIFIER	1	Q4
3.9-KOHM5%-¼W	CARBON FILM RESISTOR	4	R10, 17, 18, 56
301-150	BIVAR PERM-O-PADS	21	
312-250	BIVAR PERM-O-PADS	23	
315-400	BIVAR PERM-O-PADS	5	
320--OHM5%-¼W	CARBON FILM RESISTOR	1	R602
3300PF100V-CPF	POLY FILM CAP S/T KT1805	1	C4
39--KOHM5%-¼W	CARBON FILM RESISTOR	1	R806
390--OHM5%-¼W	CARBON FILM RESISTOR	2	R26, R27
390-KOHM5%-¼W	CARBON FILM RESISTOR	1	R7
4.32KOHM1%-1/8W	METAL FILM RES RN55D4321	2	R101, R106
4.7-KOHM5%-¼W	CARBON FILM RESISTOR	3	R9, 13, 307

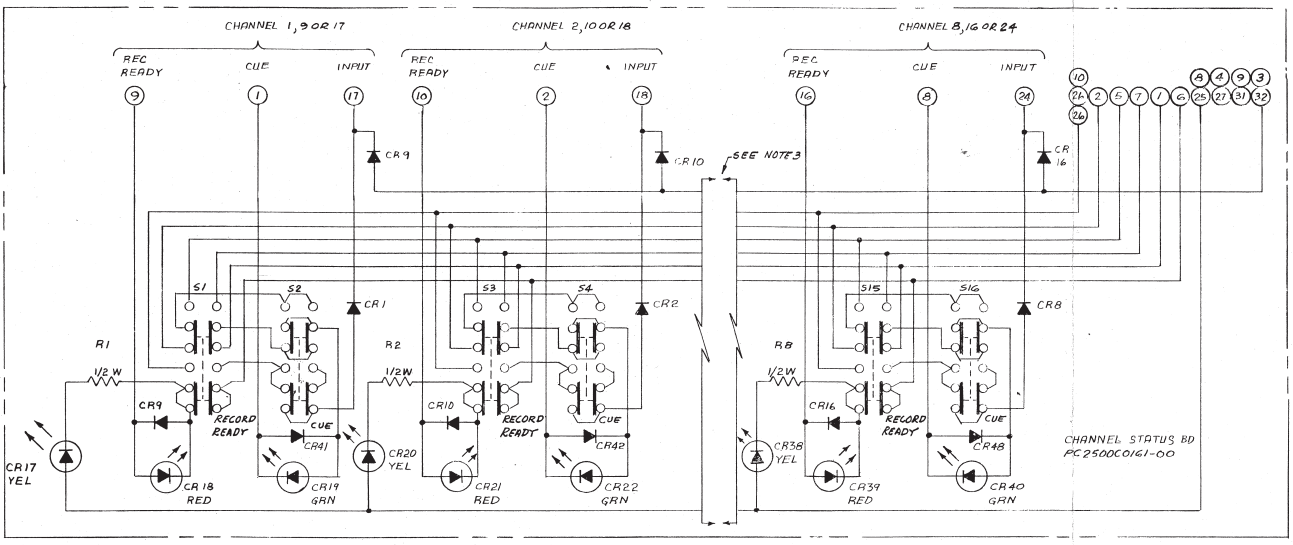
PART MBER	DESCRIPTION	QUAN.	DESIGNATOR
4114R-001-104	100K DIP 14PIN RES NET	2	RN1, RN2
47--KOHM5%-¼W	CARBON FILM RESISTOR	3	R53, R54, R802
470--OHM5%-¼W	CARBON FILM RESISTOR	3	R601, R800, R801
470-KOHM5%-¼W	CARBON FILM RESISTOR	1	R46
4700PF100V-CPF	POLY FILM CAP S/T KT1805	3	C15, C30, C39
470PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	1	C3
475--OHM1%-1/8W	METAL FILM RES RN55D4750	2	R16, R501
47MF10V-CLYRL	LYTIC RAD/LD SEALED (GP)	2	C24, C801
47MF25V-CLYRL	LYTIC RAD/LD SEALED (GP)	1	C32
4:7MF35V-CLYRL	LYTIC RAD/LD SEALED (LL)	1	C29
5.11KOHM1%-1/8W	METAL FILM RESISTOR	2	R50, R51
5000MH	DELE 2500-62 AIR10125-2J	1	L1
511--OHM1%-1/8W	METAL FILM RES RN55C5110	1	R604
560--OHM5%-¼W	CARBON FILM RESISTOR	1	R34
576--OHM1%-1/8W	METAL FILM RES RN55D5760	2	R304, R607
6.8-KOHM5%-¼W	CARBON FILM RESISTOR	1	R33
68--KOHM5%-¼W	CARBON FILM RESISTOR	4	R4, 8, 203, 301
68.1-OHM1%-1/8W	METAL FILM RES.	5	R55, R61, 502, 609, 605
7.5-KOHM5%-¼W	CARBON FILM RESISTOR	1	R52
8.2-KOHM5%-¼W	CARBON FILM RESISTOR	2	R403, R406
:01MF50V-CCD20	CERAMIC DISC CAP 20% TOL	2	C18, C19
:01MF50V-CPS	CAP ELPAC PD5R103 POLY	1	C803
:027MF250V-CMY	MYLAR CAPACITOR MEPCO SR	1	C9
:03MF250V-CMY	MYLAR CAPACITOR MEPCO SR	2	C20, C21
IF50V-CCD20	CENTRALAB CY20C104ZD CER	4	C34, C35, C37, C38
:27MF100V-CMPF	CAP METAL POLY-FILM SEM	1	C23
:47MF100V-CMPF	MET POLY CAP 5% SIEMEN B	1	C608
:68MF50V-CLYRL	LYTIC RAD/LD SEALED (LL)	7	C8, 13, 17, 25, 26, 27, 28
AP5-7D	PAD, TRANSISTOR TO-5 TYPE	1	
LM394H	TRANSISTOR, JH600	1	Q10
MC-9000-0160-01	CARD PULL EXTRUSION	1	
MC-9000-0160-02	RECORD/CUE CD PULL LABEL	1	
NF2E-24V	RELAY, DPDT ARROW M	1	K1
P1086RR	XSTOR FIELD EFFECT P	8	Q1, 2, 3, 5, 6, 7, 8, 9
SAPCPOT20K-18T	BU3299X-1-203/BK68XR20K	2	R37, R38
SAPCPOT2K-18T	BU3299X-1-202/BK68XR2K	4	R5, 6, 19, 47
SAPCPOT5K-18T	BU3299X-1-502/BK68XR5K	4	R3, 4, 31, 35
SP-7100-2307-51	F2UEE FA201 BK/OR W/SPC	1	S1
56PF1KV-CCD20	CAPACITOR DISC	3	C403, C406, C806



Meter Board
SC9000-C-0177

PARTS LIST — METER BOARD

PART NUMBER	DESCRIPTION	QUAN.
PCA9000-0017-00	PCA, METER, JH114	1
1N4004	DIODE, RECTIFIER - SILICON	24
2.2-KOHM5%-½W	CARBON FILM RESISTOR	24
7387-PS	LAMP 28V BI-PIN (PRECISION)	16

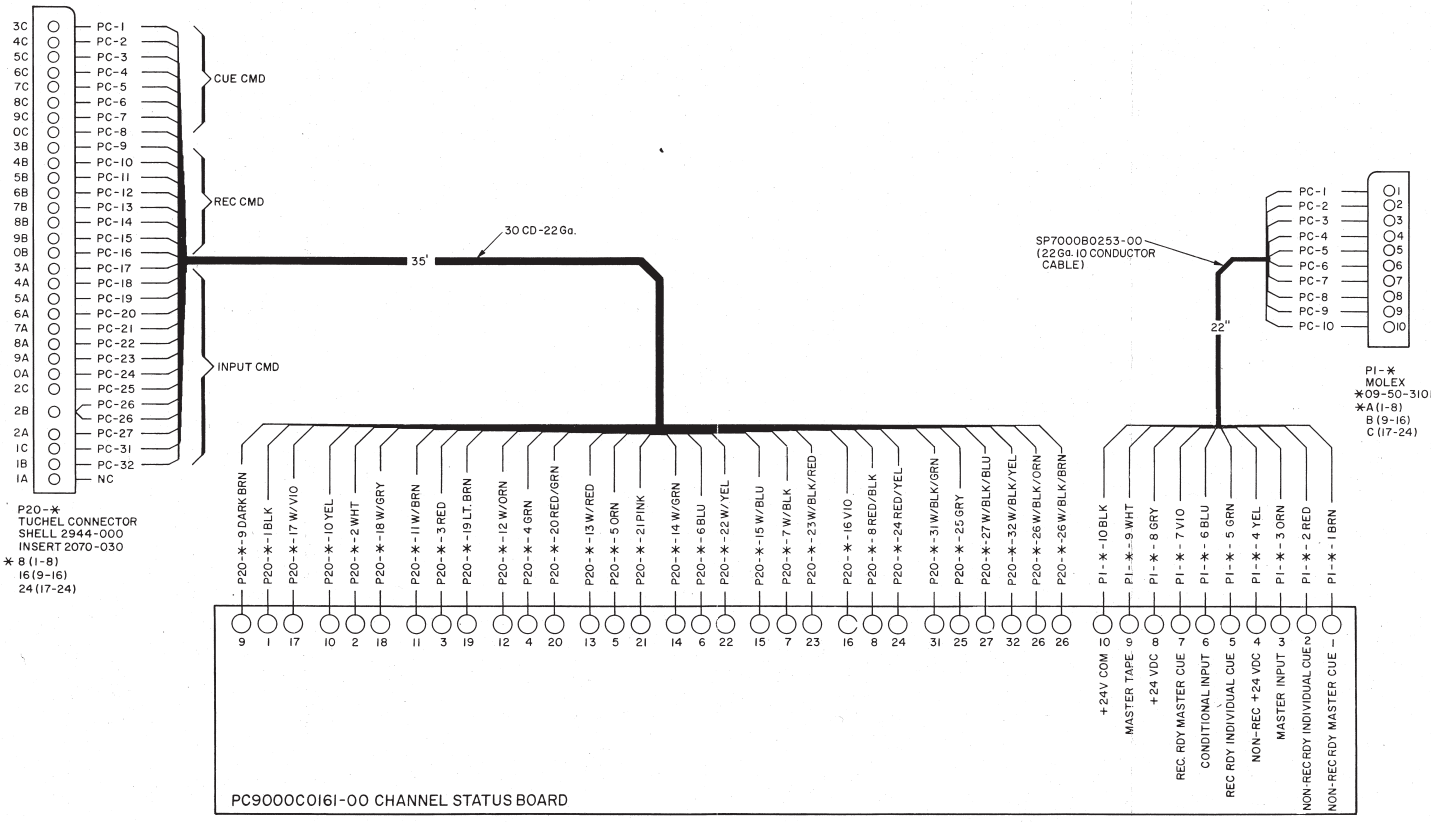


NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL DIODES ARE IN4004.
2. ALL SWITCHES ARE SHOWN IN THE NON-ENGAGED POSITION.
3. CHANNELS 3-7 ARE IDENTICAL TO CHANNELS 1, 2 & 8; COMPONENT NUMBERING CONTINUES IN SAME SEQUENCE AS IN CHANNELS 1 & 2
4. ○ = PADS ON CHANNEL STATUS BOARD (WHERE EXTERNAL CABLE IS SOLDERED).

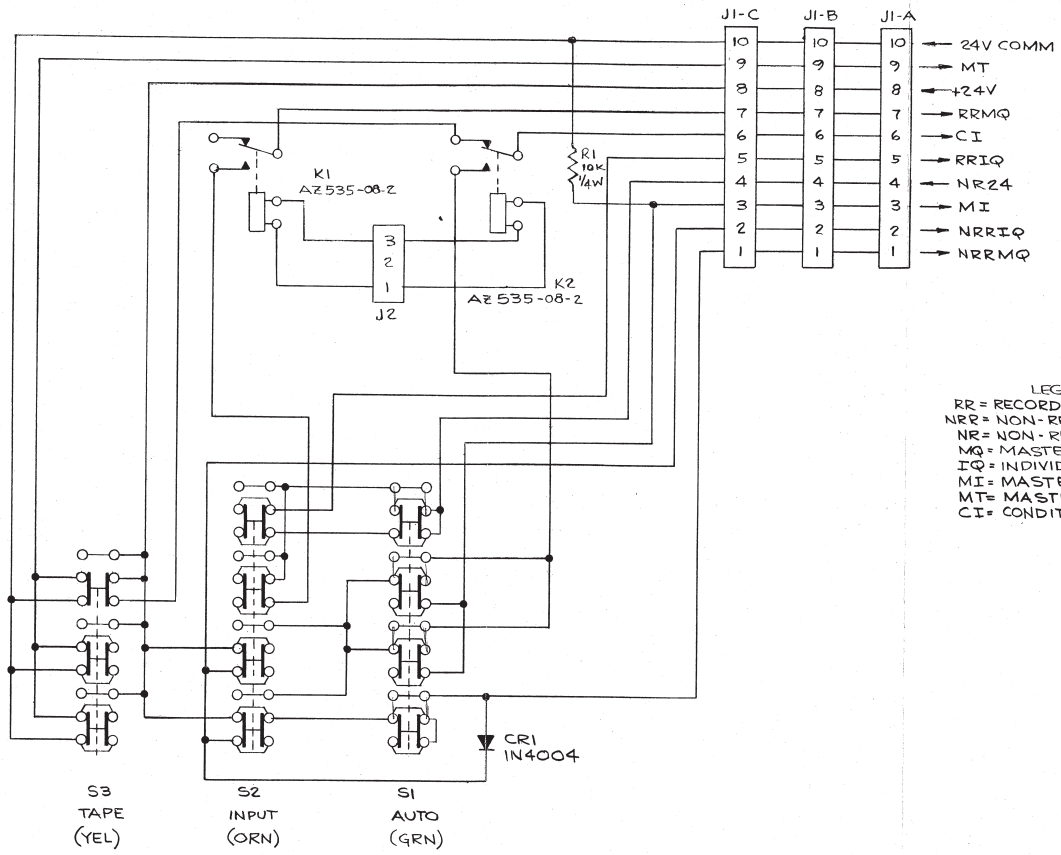
PARTS LIST — CHANNEL STATUS BOARD

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA9000-0161-00	CHANNEL STATUS ASSY	1	
1.5-KOHM5%-½W	CARBON FILM RESISTOR	8	
1N4004	DIODE, RECTIFIER - SILICON	39	
SP-7000-2305-14	SWITCH 4 POLE LOCKING	16	
MC-4300-0100-00	LED BOARD	1	
MV5075C	LED RED MONSANTO	8	
XC22G	LED GREEN	8	
XC22Y	LED YELLOW	8	
XC22R	LED RED	8	



NOTE: FOR USE WITH MTR HSG 2000D0801-34, 2000D0801-35 & 2000D0801-36 ONLY.

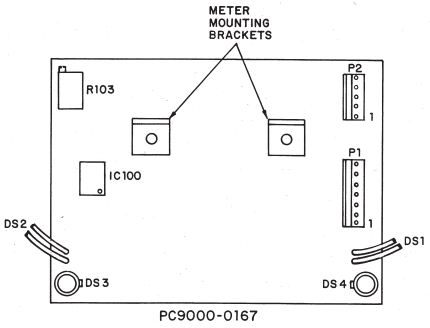
Channel Status Board (2 of 2)
SC9000C0161 rev B

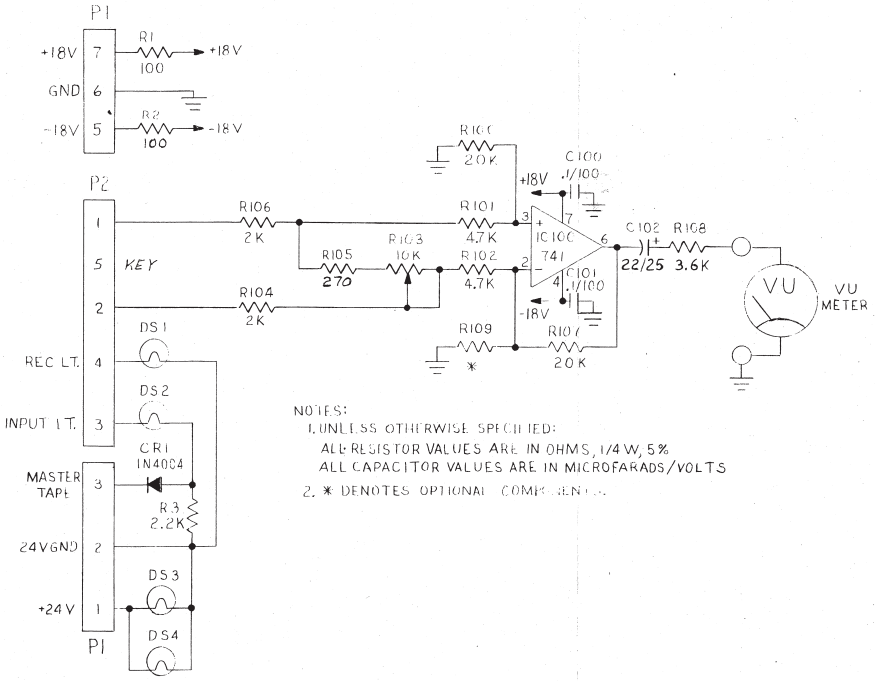


LEGEND
RR = RECORD READY
NRR = NON-RECORD READY
NR = NON-RECORD
MQ = MASTER CUE
IQ = INDIVIDUAL CUE
MI = MASTER INPUT
MT = MASTER TAPE
CI = CONDITIONAL INPUT

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL SWITCHES ARE SHOWN IN THE NON-ENGAGED POSITION.
2. ARROWS INDICATE DIRECTION OF CONTROL OR POWER FLOW.
3. INTERFACE CONNECTOR CODING IS DERIVED BY COMBINING LEGEND FUNCTIONS.

Master Switch Board
SC2500C0231 rev C





PARTS LIST — METER BUFFER BOARD

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA9000-0166-00	PCA, METER BUFFER BD JH24	1	
2--KOHM5%-¼W	RESISTOR, CARBON FILM	2	R1, R2
4.7-KOHM5%-¼W	RESISTOR, CARBON FILM	2	R3, R4
20-KOHM5%-¼W	RESISTOR, CARBON FILM	2	R6, R9
100 OHM5%-¼W	RESISTOR, CARBON FILM	2	R7, R10
3.6-KOHM5%-¼W	RESISTOR, CARBON FILM	1	R11
TAPCPOT10K-1T	POT 10K TOP ADJUST 1TURN	1	R5
08P-DIP-SKT	DIP SOCKET 8 PIN ARIES 8-511	1	
741CP	OP AMP	1	IC1
09-65-1041	CONN MOLEX 4PIN PC BD LOCK	1	P1
09-65-1031	CONN MOLEX 3PIN PC BD LOCK	1	P2
:1MF50V-CCD20	CENTRAL LAB CY20C104ZD BLUE	2	C1, C2
312-250	BIVAR PERM-O-PADS	2	

SECTION 5
AUTOLOCATOR III

5.1 General Description

The AutoLocator III is a microprocessor based position locator and velocity indicator. The microprocessor executes programs stored in its memory to perform the functions requested by the button switches on the front panel. The AutoLocator III is available as an optional accessory to the JH-24. It mounts directly above the remote unit and interfaces to the tape transport via a thirty foot long cable harness.

Operating voltages for the autolocator come from the JH-24 transport. The AutoLocator III does not contain its own power supply, but does contain voltage regulators which produce +5vdc from the transport's +8vdc output. The transport's power supply also supplies ±15vdc to the autolocator as required by the amplifiers on the AutoLocator III.

The AutoLocator III contains two four digit LED segment displays; one displays the current tape position, the other displays the desired locate position. Both displays indicate tape position in minutes and seconds of playback/record time normalized to the standard (fixed) speeds.

A numeric keyboard enters digits into the locate position display. With each key strike the digits in the display shift to the left, entering the new digit in the rightmost column. If, by mistake, a number greater than 59 is punched into the seconds columns, the display will automatically convert the time into minutes and seconds. For example, if 78 seconds is entered into the locate position display, it will be converted to 1 minute 18 seconds prior to the execution of any function.

Once a time (or position) is entered into the locate position display the transport can autolocate to that position simply by pressing the LOC button.

At any time while the transport is in stop, play, or record mode the current tape position can be loaded into a locate position memory. Pressing → (shift right), STO (store), and any of the numeric keys stores the time from the tape position display into the corresponding locate memory. These positions can later be recalled and displayed in the locate position display by pressing RCL and the respective numeric key. The LOC button will then locate the transport to the position retrieved from memory.

The locate memories can be pre-loaded with any position by entering the time into the locate position display via the numeric keyboard. From the located position display the time is entered into the memory with the STO and numeric key sequence.

The position memory can be pre-loaded with any position by first entering the time into the locate position display via the numeric keyboard. Then, the ← (shift left) button, is used to shift the locate position into the tape position display, redefining the current tape position.

The → (shift right) button, can be used to temporarily store tape positions into the locate position display for future locates or to mark the position for convenience.

The repeat function yo-yos the transport between the positions stored in memories 8 and 9. The

transport, after pressing REP, autolocates to position 8, drops into play mode, plays back up to position 9, rewinds to position 8, and drops into play mode again. This process will continue indefinately. It is cancelled by pressing the transport STOP, RWD or FWD button or the autolocator's LOC button.

For the repeat function to work, the tape position stored in memory 9 must be greater than the tape position stored in memory 8. If this is not the case, and the REP button is pressed, the transport will autolocate to the position stored in memory 8 and stop.

The AutoLocator III also performs velocity control and velocity display functions. Pressing and holding the TVI (Tape Velocity Indicator) button displays the tape speed in the tape position display. Releasing the TVI button returns the autolocator to the position display mode.

If the tape transport's reference select switch is in the external (EXT) position, the MODE switch toggles between the fixed crystal speed reference and the variable dc reference level to the VCO. LEDs on the front panel indicate whether the fixed reference or the variable reference is selected.

, the variable mode the SPEED potentiometer on the autolocator controls the pitch in the same manner as the SPEED potentiometer on the transport deck when the transport is in VAR reference.

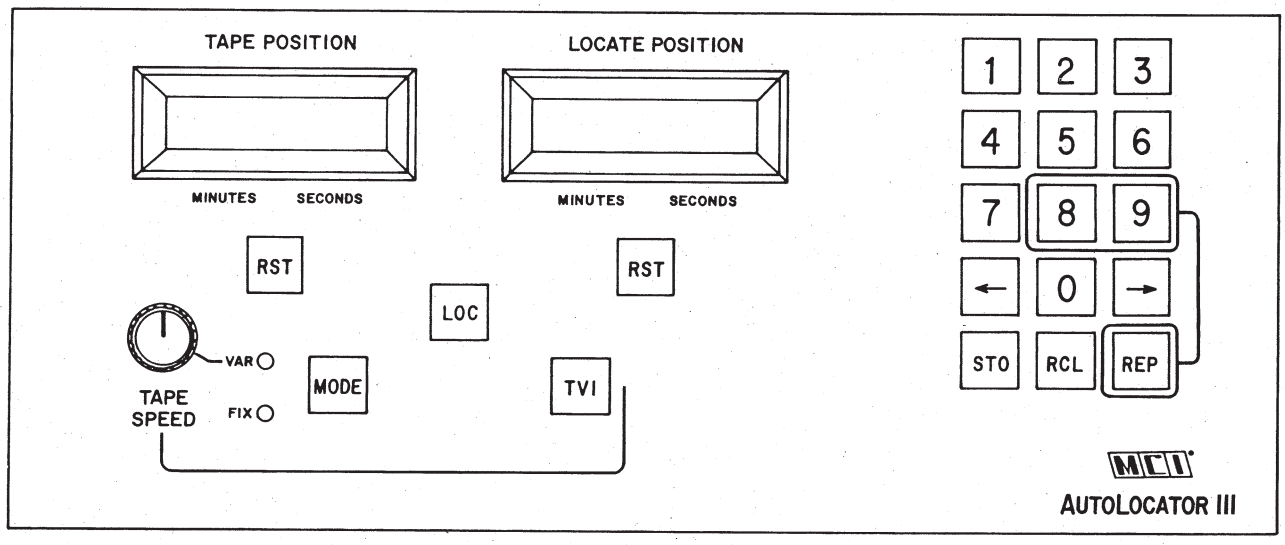
In variable reference mode, the TVI switch displays both the tape velocity in the tape position display and the pitch change in the locate position display. Pitch change is indicated in terms of semitones of the enharmonic scale. Only multiples of ¼ semitones are displayed. The locate position display is blank unless the tape velocity is within ±0.03ips of a multiple of ¼ semitone pitch change from the standard speed.

5.2 Hardware Functional Description

Refer to the block diagram of the AutoLocator III, Figure 5-1. The microprocessor, its memory and I/O ports are located on the Processor Board. The display and display encoders are located on the Display Board. Schematics for these boards are found at the end of this section.

The microprocessor communicates with its memory and I/O ports via the address and data bus. This bus is multiplexed, that is, it is used for both address and data. Addresses arrive on the bus first, followed by data. An address latch stores the bus address low order bits (A0-A7) while the data is asserted on the bus. The high order bus address bits (A8-A12) are not latched; these lines are not multiplexed.

Control signals from the microprocessor allow the memory or I/O ports to assert information onto, or receive information from the address and data bus. To fetch an address or an instruction from memory, the microprocessor asserts an address onto the bus and latches the address in the ad dress latch. The memory then places the contents of that location on the bus for the processor to



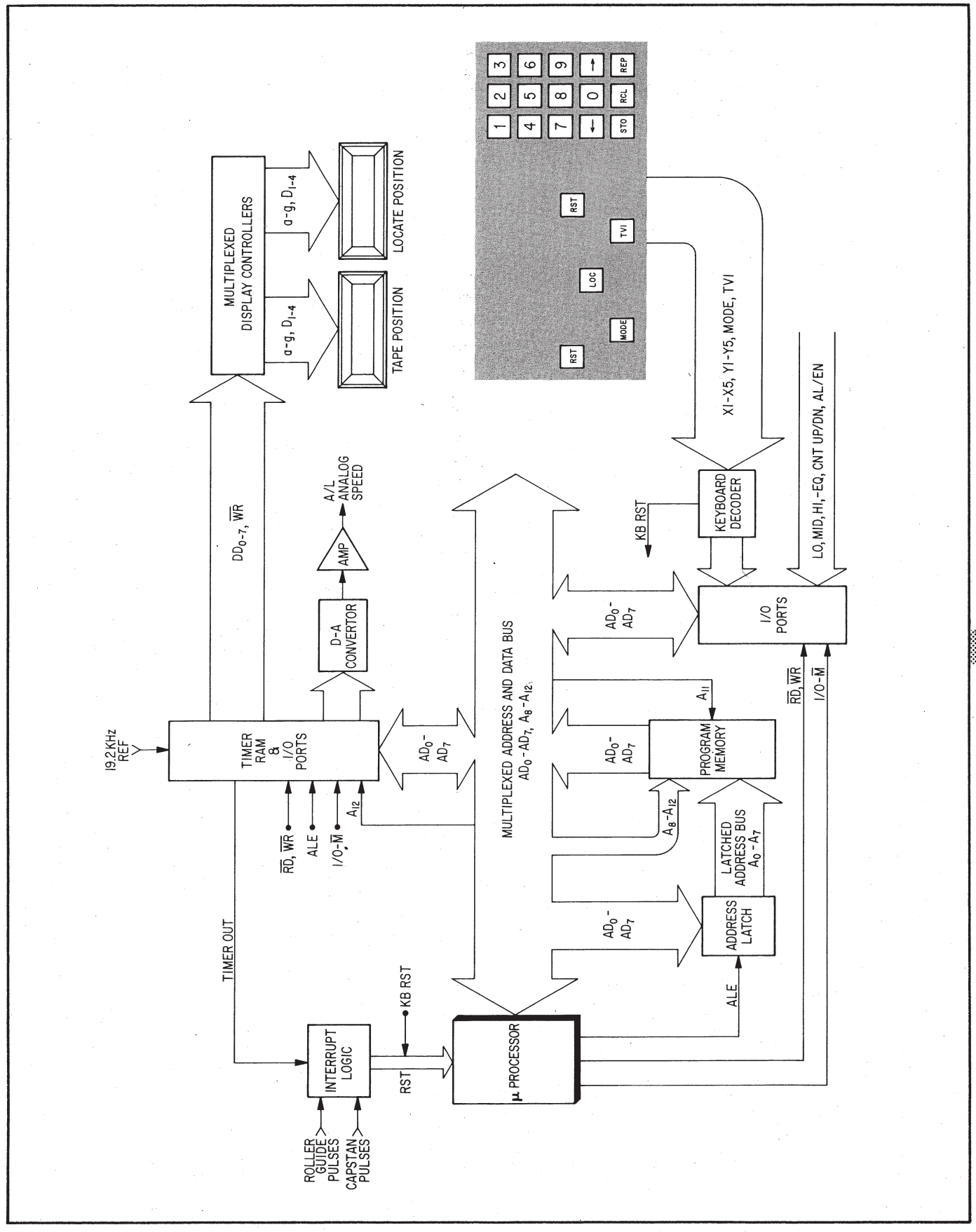


Figure 5-1 AutoLocator III Block Diagram

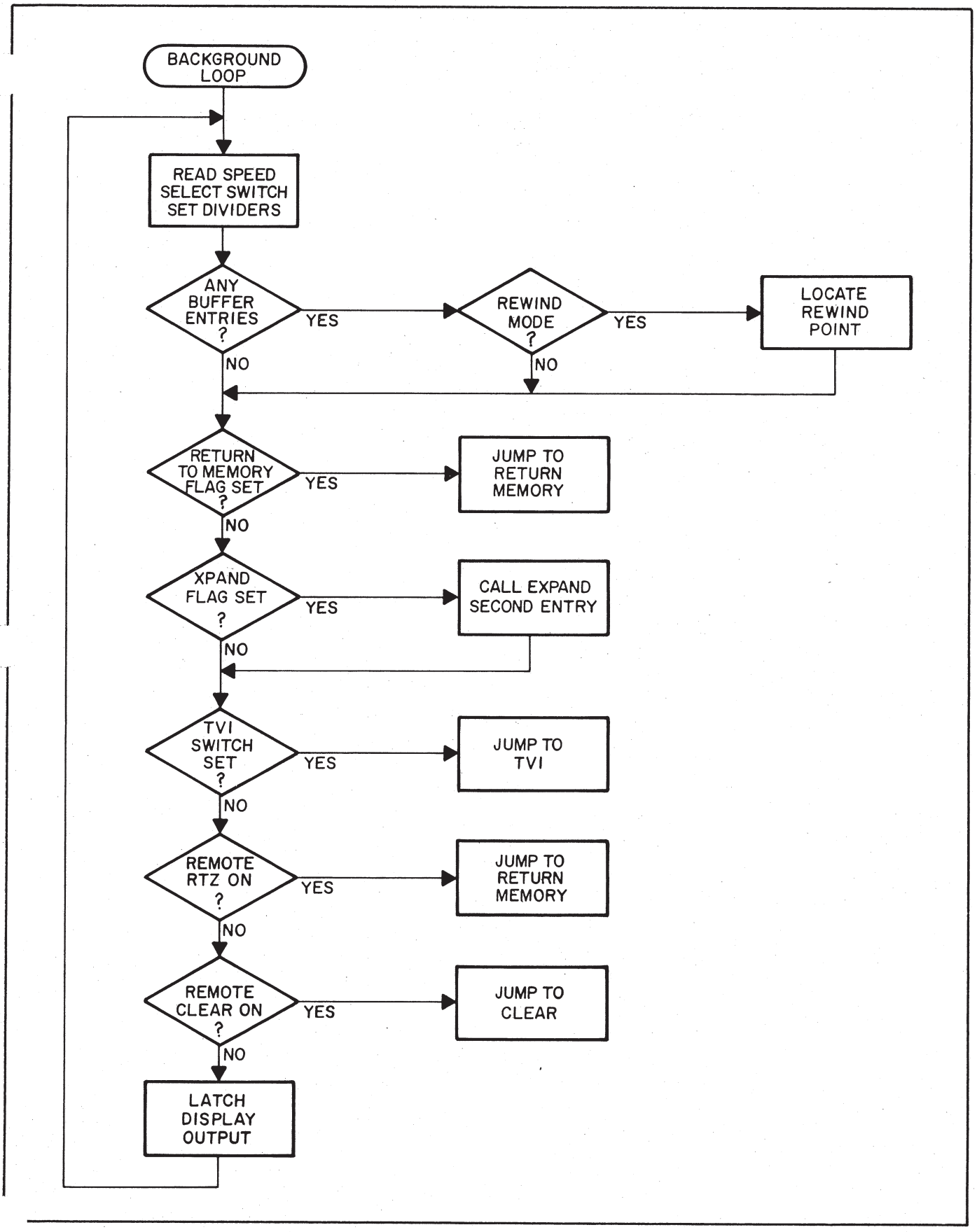


Figure 5-2 Background Loop Flow Chart

read. The microprocessor reads and writes data from and to the I/O ports using the command signals $\overline{RD}$, $\overline{WR}$, and I/$\overline{OM}$.

Data from the I/O ports is sent to the display controllers to operate both LED displays and to the D to A converter to operate the reel motors. The I/O ports receive speed and direction information from the transport and commands from the keyboard and function switches.

5.3 Program Description

The program which determines the operation of the microprocessor is stored in the program memory. The stored program is organized into a background loop, subroutines which perform certain tasks, and interrupt service routines which handle the interrupts. A flowchart of the background program is included in this section to give a basic idea of the program structure.

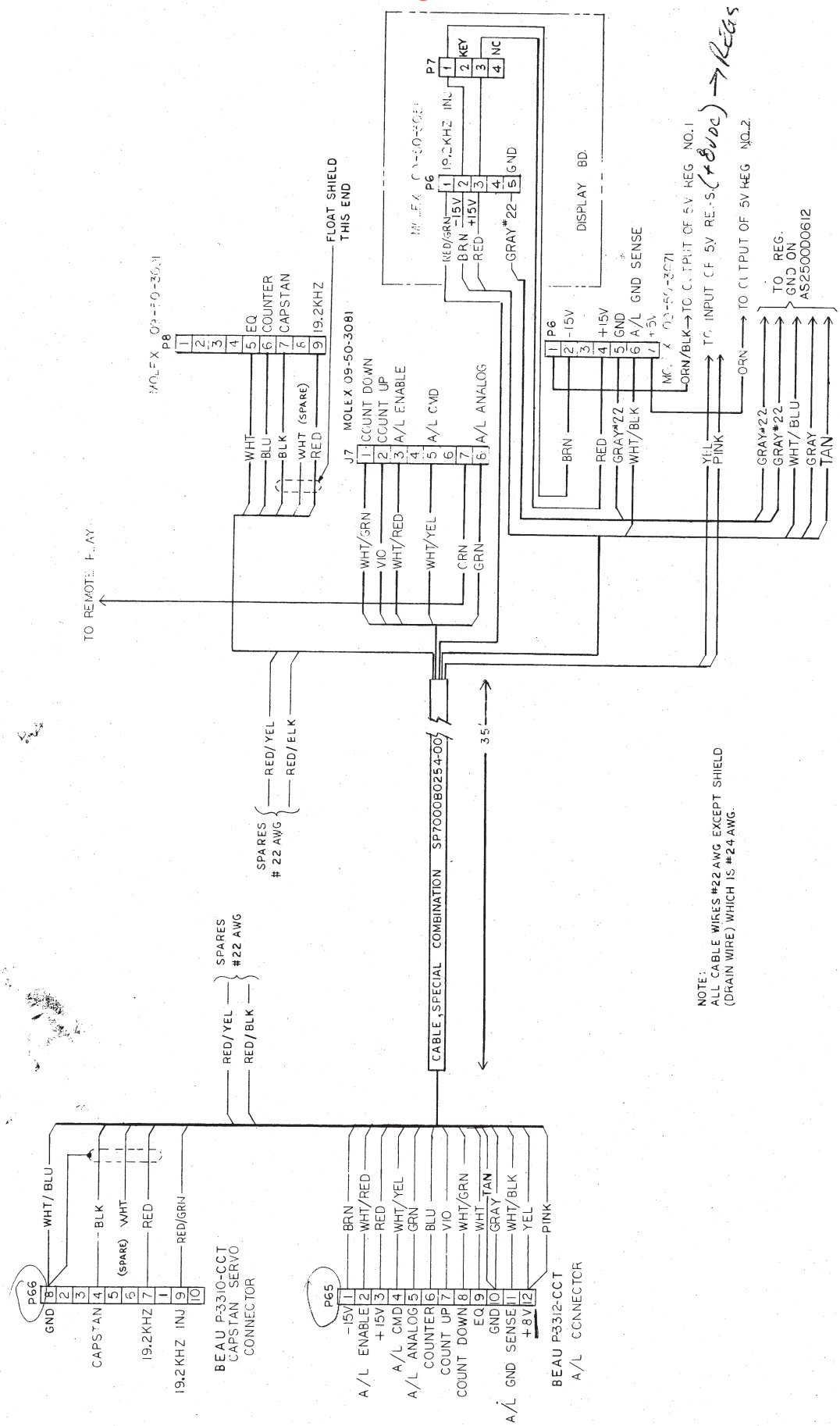
From power up, the processor executes instructions in the background loop program, Figure 5-2. In this loop, the processor reads speed information, poles various flags, and updates the display. Note that the displays are multiplexed; the processor sends data to the tape position display and the locate position display alternately. The speed switch information from the transport is used to normalize the displays so that they show the correct time for the speed selected.

If any flags are set when they are tested, the program jumps to the appropriate subroutine. When the subroutine function is completed, the program returns to the background loop. At any time an interrupt will cause the program to vector to the interrupt service routine. After servicing the interrupt, the program will return to the place in the background loop or subroutine where the interrupt occurred.

As an example, assume that the TVI switch is pressed, setting the TVI flag. When the program tests the TVI switch flag, it jumps to the TVI subroutine. This subroutine sets a timer and the capstan tachometer pulses are allowed to interrupt the processor through the interrupt logic. Every other capstan pulse causes a jump from the TVI routine to the capstan interrupt routine which counts the pulses. When the timer times out, the velocity is calculated, displayed, and the program returns to the background loop.

Interrupts are also generated by the display button switches and the roller guide tachometer pulses. Each time the microprocessor receives a roller guide pulse, its vectors to the roller guide interrupt service routine. This routine updates (increments or decrements) the display count and returns to the background loop or to the subroutine where the interrupt occurred.

Pressing a keyboard switch generates an interrupt which causes the program to jump to the switch interrupt routine. Here, the switch's numeric value is read and decoded. The switch value determines which subroutine is jumped to next. If, for example, the LOC switch is pressed, the return to memory flag gets set. The program jumps to the return to memory subroutine from the background to autolocate the tape to the position stored in the locate position display memory. Once the memory position is reached, the program returns to the background loop.



Remote Cable
WD2500D0631 rev E

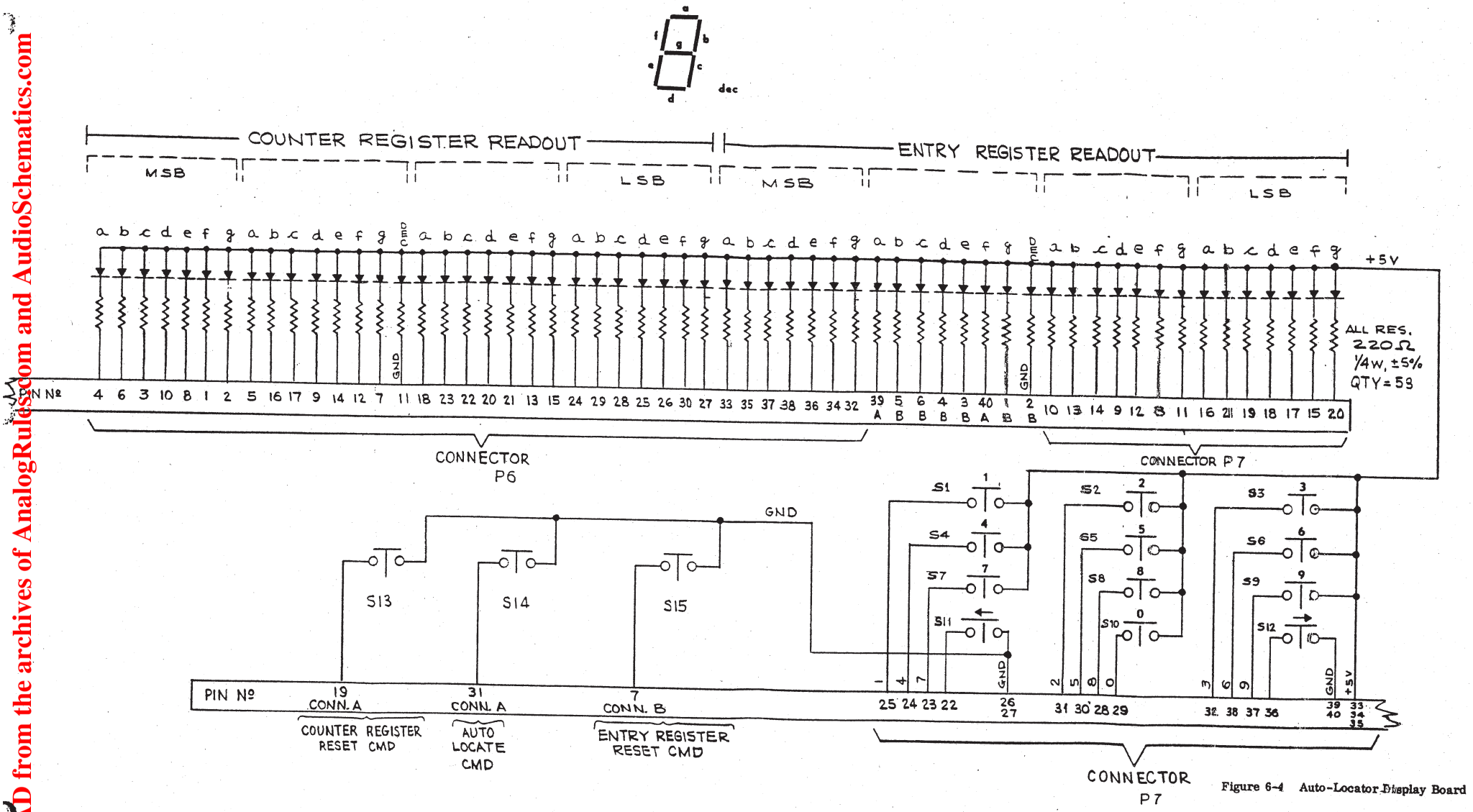
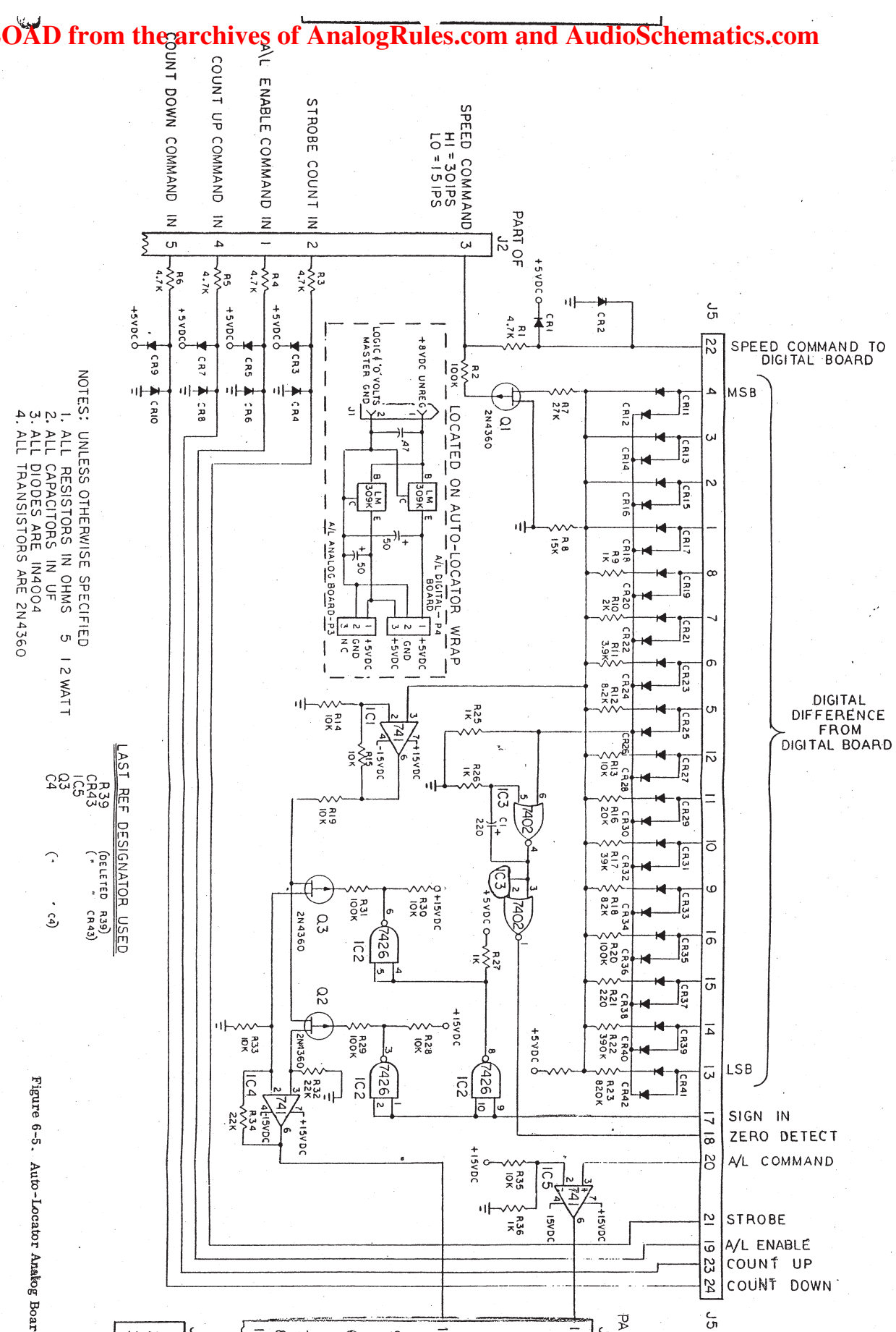


Figure 6-4 Auto-Locator Display Board



NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS IN OHMS 5 1 2 WATT
2. ALL CAPACITORS IN UF
3. ALL DIODES ARE IN4004
4. ALL TRANSISTORS ARE 2N4360

LAST REF DESIGNATOR USED

R39	(DELETED R39)	
CR43	(" " CR43)	
IC5		
Q3		
C4	(' C4)	

Figure 6-5. Auto-Locator Analog Board and Power Distribution.

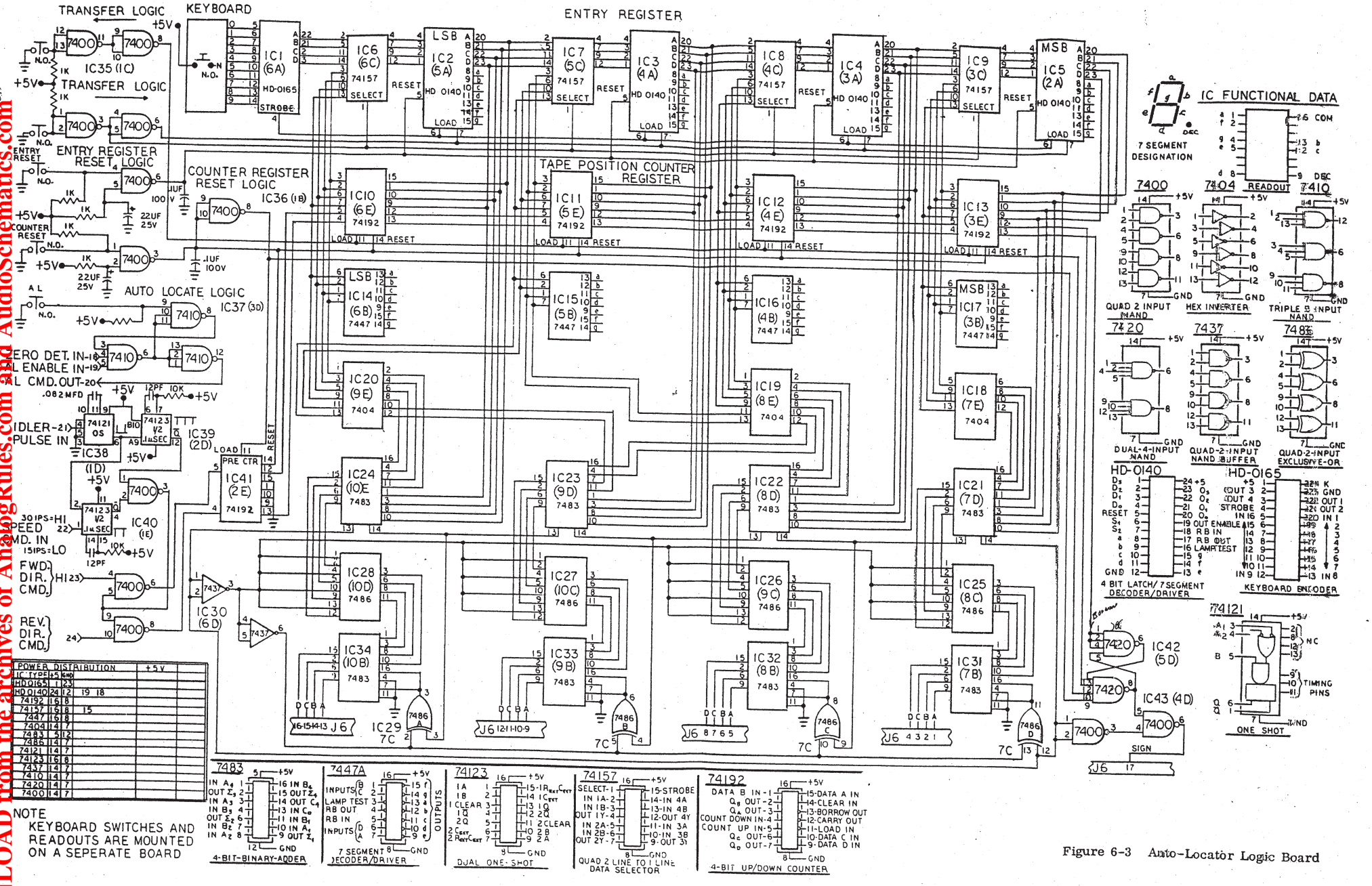
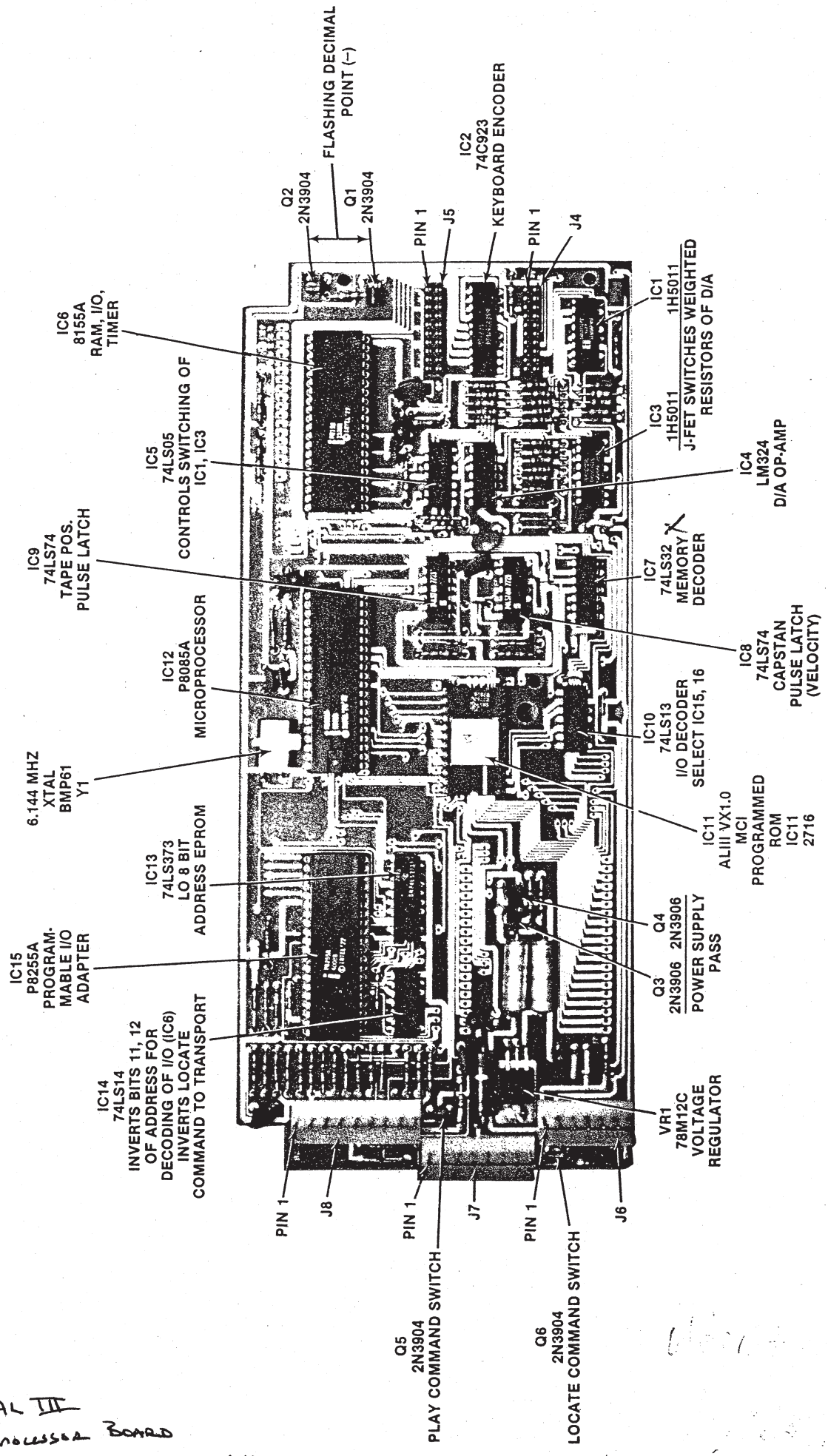


Figure 6-3 Auto-Locator Logic Board



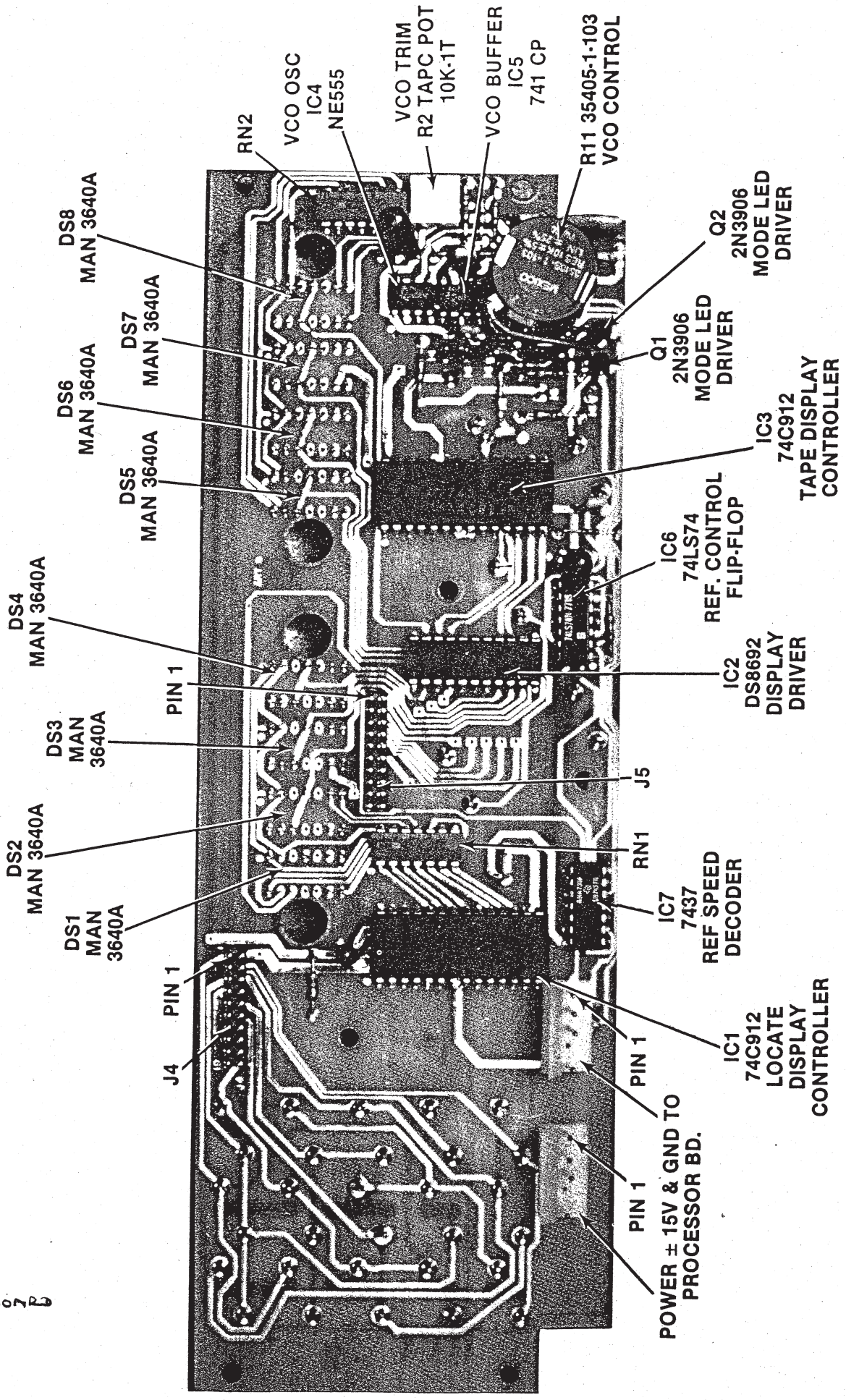
AL III
PROCESSOR BOARD

PARTS LIST — PROCESSOR BOARD

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA2500-0611-01	PCA, PROCESSOR BD, A/L III	1	
09-65-1071	MOLEX 7PIN LOCK 3/4"	1	
09-65-1081	MOLEX 8PIN LOCK 3/4"	1	
09-65-1091	MOLEX 9PIN LOCK 3/4"	1	
1-87227-0	20PIN DOUBLE POST DIP	2	
1.0-KOHM5%-¼W	CARBON FILM RESISTOR	1	R35
1.0-MOHM5%-¼W	CARBON FILM RESISTOR	5	R10, 11, 12, 13, 14
10--KOHM5%-¼W	CARBON FILM RESISTOR	11	R8, 21, 23, 40, 41, 42, 28, 34, 37, 38, 47
10--MOHM5%-¼W	CARBON FILM RESISTOR	2	R22, R24
100-KOHM5%-¼W	CARBON FILM RESISTOR	6	R15, 16, 17, 18, 19, 27
10MF25V-CLY	LYTIC CAPACITOR SIEMEN-D	2	C16, C17
180--OHM5%--2WM	METAL OXIDE RES.	1	R46
1N5231B-5.1V	DIODE, ZENER-SILCN 5.1V-5	1	CR20
1N5248-18V	DIODE, ZENER-SILCN 18V-10%	1	CR24
1N914	DIODE, SIGNAL-SILCN GLASS	18	CR1-CR11, CR13-16, CR18, 19, 22
2.2-KOHM5%-¼W	CARBON FILM RESISTOR	1	R2
20P-DIP-SKT	DIP SKT AUGAT 520-AG-11D	1	
22--KOHM5%-¼W	CARBON FILM RESISTOR	2	R25, R26
22-03-2191	19P MALE WAFER MOLEX CON	1	
22-03-2201	MOLEX	1	
22PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	2	C13, C14
4P-DIP-SKT	DIP SKT AUGAT 524-AG-11D	1	
27--KOHM5%-¼W	CARBON FILM RESISTOR	1	R9
2:2MF50V-CLYRL	LYTIC RAD/LD SEALED (LL)	3	C12, C18, C21
2N3904	TRANSISTOR	4	Q1, Q2, Q5, Q6
2N3906	TRANSISTOR	2	Q3, Q4
33--KOHM5%-¼W	CARBON FILM RESISTOR	1	R33
39--KOHM5%-¼W	CARBON FILM RESISTOR	1	R6
4.7-KOHM5%-¼W	CARBON FILM RESISTOR	12	R3, 4, 30, 31, 32, 43, 44, 45, 49, 50, 51
40P-DIP-SKT	DIP SKT AUGAT 540-AG-11D	3	
470--OHM5%-¼W	CARBON FILM RESISTOR	1	R48
470PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	2	C2, C6

ART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
5.1-KOHM2%-¼W	CARBON FILM RESISTOR	2	R20, R29
68--KOHM5%-¼W	CARBON FILM RESISTOR	1	R52
74C923	IC KEYBOARD ENCODER	1	IC2
74LS05	IC HEX INVERTER	1	IC5
74LS13	IC DUAL 4 INPUT NAND	1	IC10
74LS14	IC HEX SCHMITT TRIGGER	1	IC14
74LS32	IC QUAD OR GATES	1	IC7
74LS373	IC 8BIT LATCH	1	IC13
74LS74	IC DUAL D FLIP FLOP	2	IC8, IC9
78M12CP	+ 12V REG NAT'L (PLAST)	1	VR1
80.6KOHM1%-1/8W	METAL FILM RESISTOR	1	R5
:001MF1KV-CCD20	CERAMIC DISC CAP 20% TOL	4	C9, C10, C22, C25
:01MF50V-CCD20	CERAMIC DISC CAP 20% TOL	3	C3, C7, C23
:47MF100V-CMPF	MET POLY CAP 5% SIEMEN B	1	C1
BMP61	BUCKMAN CRYSTAL 6.144 MHZ	1	Y1
IH5011	QUAD ANALOG SW H-LEV 15V	2	IC1, IC3
LM324	QUAD OP AMP 1ST/NAT	1	IC4
P8085-A	IC MICROPROCESSOR INTEL	1	IC12
P8155	IC PIA RAM INTEL ONLY	1	IC6
P8255-A	IC PPI INTEL ONLY	1	IC15
TY-23M	CABLE TIE-SMALL	1	
N AL V.X.1.0	MCI PROGRAMMED ROM This ROM is programmed by MCI. Replacement ROMs must have the same "X" digit to work with the hardware. The last two digits of the part number indicate the revision level. The revision level of the replacement ROM must be equal to or greater than the revision level of the original ROM.	1	IC11

JH 24 Processor Board AL III SC2500-E-0611



AL III Display Board

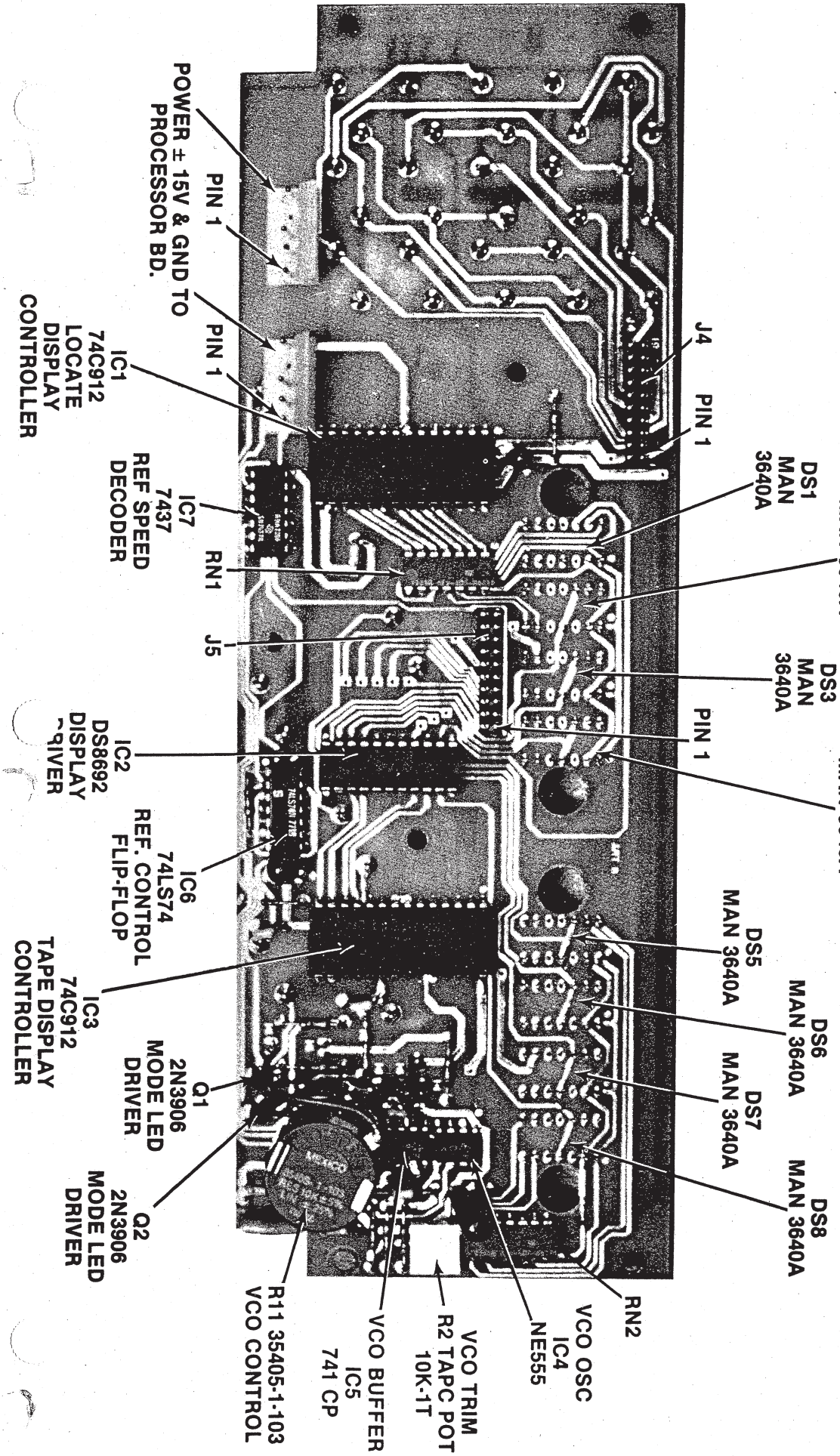
PARTS LIST — DISPLAY BOARD

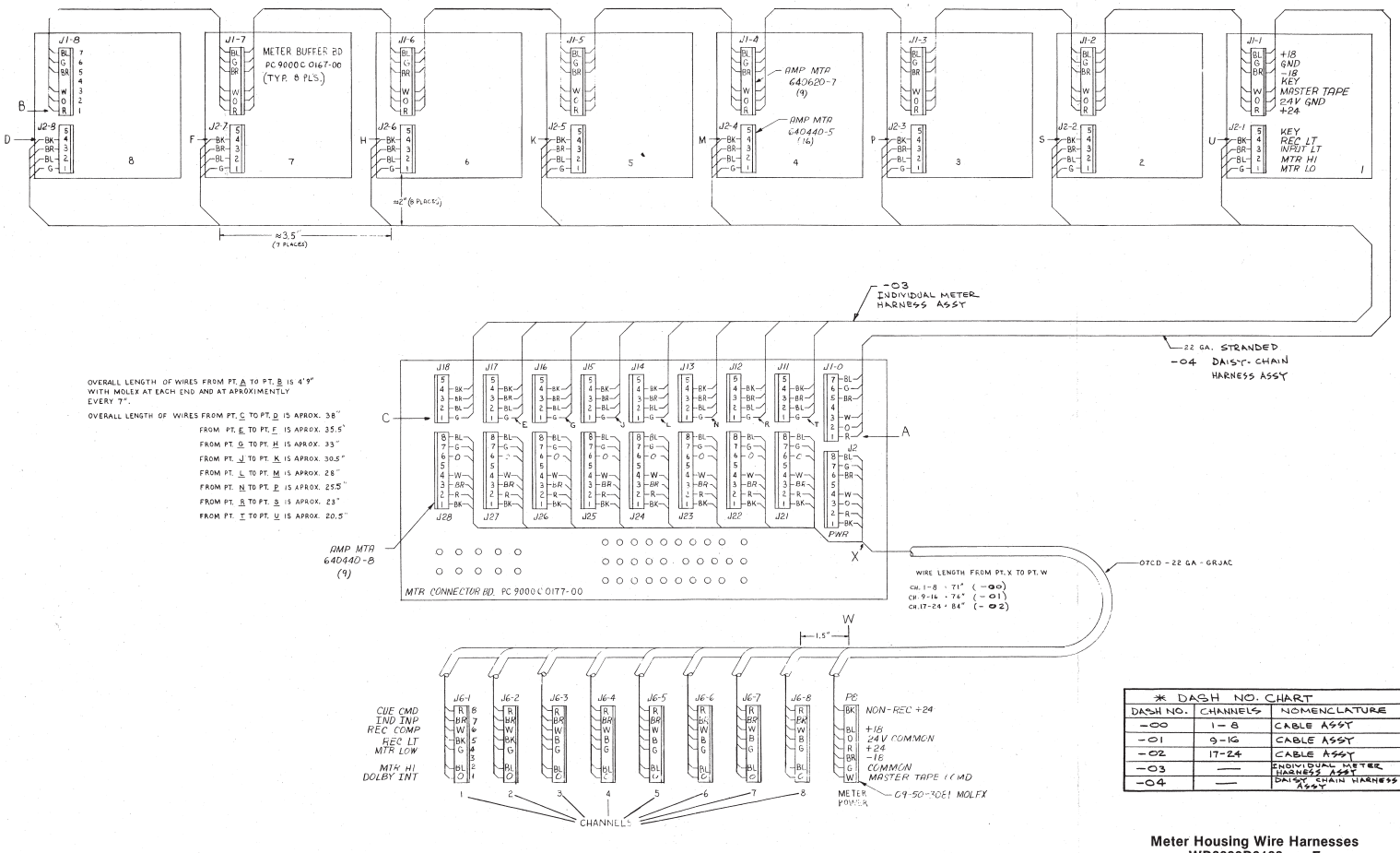
PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA2500-0610-00	PCA, DISPLAY BD A/L III	1	
09-65-1021	MOLEX 2PIN LOCK 3/4"	1	
09-65-1051	MOLEX 5PIN LOCK 3/4"	1	
1-87227-0	20PIN DOUBLE POST DIP	2	
1.0-KOHM5%-¼W	CARBON FILM RESISTOR	2	R3, R10
10--KOHM5%-¼W	CARBON FILM RESISTOR	2	R4, R5
150--OHM5%-¼W	CARBON FILM RESISTOR	2	R7, R8
180--OHM5%-¼W	CARBON FILM RESISTOR	1	R6
1N5231B-5.1V	DIODE, ZENER-SILCN 5.1V-5	1	CR7
1N914	DIODE, SIGNAL-SILCN GLASS	2	CR1, CR7
22--KOHM5%-¼W	CARBON FILM RESISTOR	1	R9
220--OHM5%-½W	CARBON FILM RESISTOR	1	R13
22P-DIP-SKT	DIP SKT AUGAT 522-AG-11D	1	
28P-DIP-SKT	DIP SKT AUGAT 528-AG-11D	2	
2:2MF50V-CLYRL	LYTIC RAD/LD SEALED (LL)	1	C11
2N3906	TRANSISTOR	2	Q1, Q2
3.3-KOHM5%-¼W	CARBON FILM RESISTOR	1	R1
3540S-1-103	10K 10TURN LIN PANEL MOUNT	1	R11
4114R-001-470	47 OHM 14P-DIP BOURN DIP	2	RN1, RN2
47---OHM5%-¼W	CARBON FILM RESISTOR	1	R12
47MF35V-CLYRL	LYTIC RAD/LD SEALED (GP)	2	C6, C8
741CP	OP AMP	1	IC5
7437	QUAD 2-IN NAND BUFFER	1	IC7
74C912	IC DISPLAY CONTROL NATL	2	IC1, IC3
74LS74	IC DUAL D FLIP FLOP	1	IC6
:0068MF400V-CMY	MYLAR CAPACITOR MEPCO	1	C1

JH 24 AL III Display Board

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
:1MF100V-CCD20	CERAMIC DISC CAPACITOR	7	C2, 3, 4, 5, 7, 9, 10
DS8692	IC DISPLAY DRIVER NAT'L	1	IC2
MAN-3640A	DISPLAY MONSANTO	8	DS1 - DS8
MC-6000-0404-01	SW D-6 "1"	1	S3
MC-6000-0404-02	SW D-6 "2"	1	S2
MC-6000-0404-03	SW D-6 "3"	1	S1
MC-6000-0404-04	SW D-6 "4"	1	S8
MC-6000-0404-05	SW D-6 "5"	1	S7
MC-6000-0404-06	SW D-6 "6"	1	S6
MC-6000-0404-07	SW D-6 "7"	1	S5
MC-6000-0404-08	SW D-6 "8"	1	S12
MC-6000-0404-09	SW D-6 "9"	1	S11
MC-6000-0404-10	SW D-6 "0"	1	S4
MC-6000-0404-13	SW D-6 "STO"	1	S13
MC-6000-0404-14	SW D-6 "RCL"	1	S9
MC-6000-0404-15	SW D-6 "REP"	1	S16
MC-6000-0404-16	SW D-6 "RST"	2	S10, S15
MC-6000-0404-17	SW D-6 "LOC"	1	S14
MC-6000-0404-18	SW D-6 "TVI"	1	S19
MC-6000-0404-19	SW D-6 "MODE"	1	S20
MC-6000-0404-20	SW D-6 "→"	1	S17
MC-6000-0404-21	SW D-6 "←"	1	S18
MV5075C	LED RED MONSANTO	1	CR2, 3, 4, 5
NE555	PRECISION TIMER	1	IC4
TAPCPOT10K-1T	BU3386F-1-103/BK72MR10K	1	R2
XC209G	LED GREEN	1	CR6

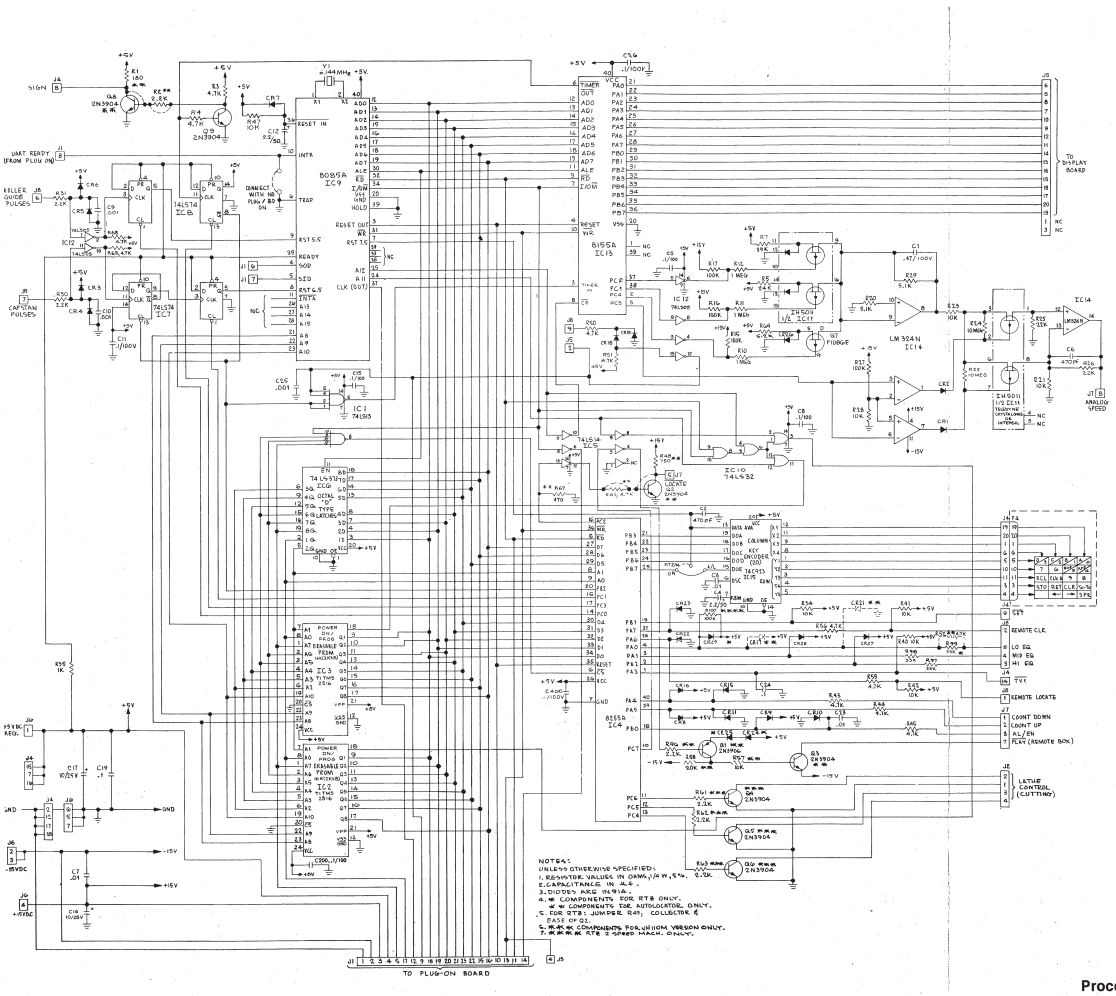
JH 24 ALIII Display Board



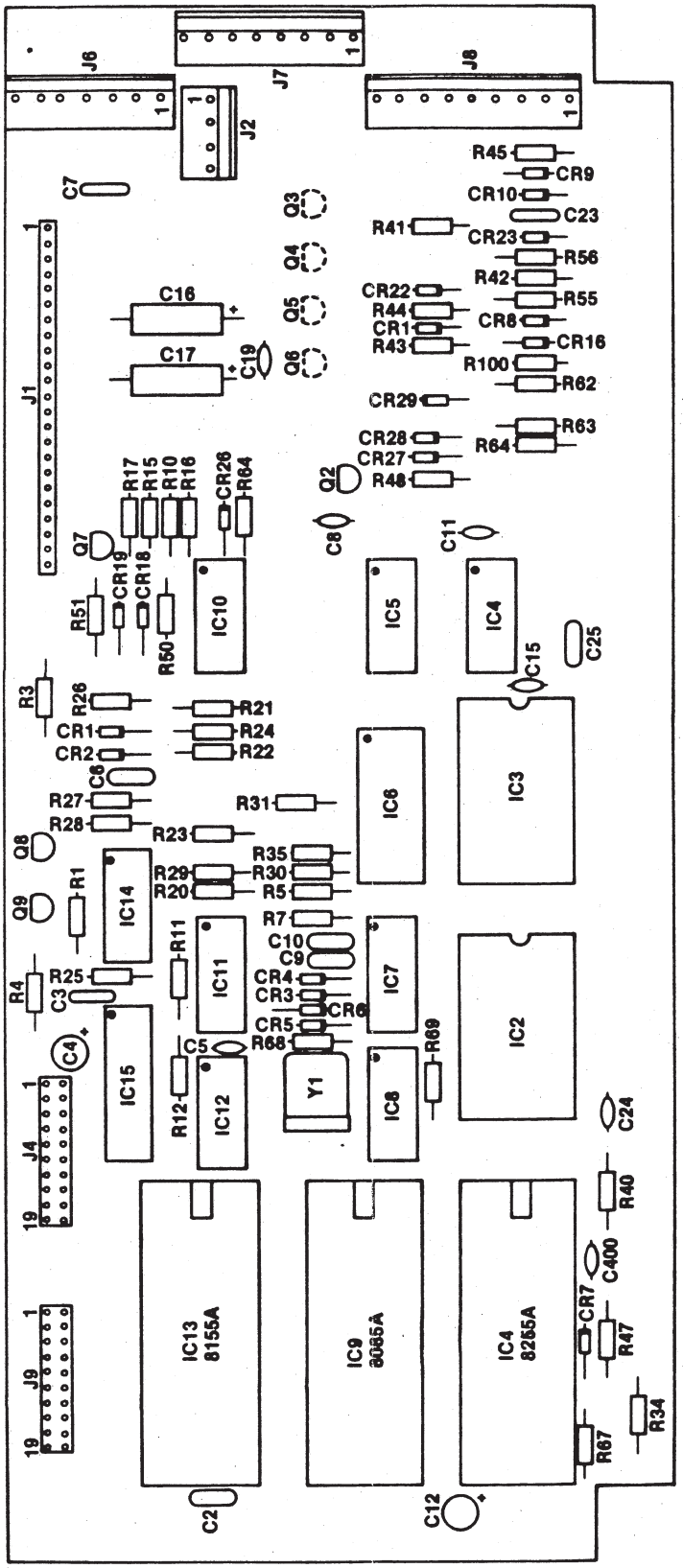


* DASH NO. CHART		
DASH NO.	CHANNELS	NOMENCLATURE
-00	1-8	CABLE ASSY
-01	9-16	CABLE ASSY
-02	17-24	CABLE ASSY
-03	—	INDIVIDUAL METER HARNESS ASSY
-04	—	DAISY CHAIN HARNESS ASSY

Meter Housing Wire Harnesses
WD9000D0183 rev E

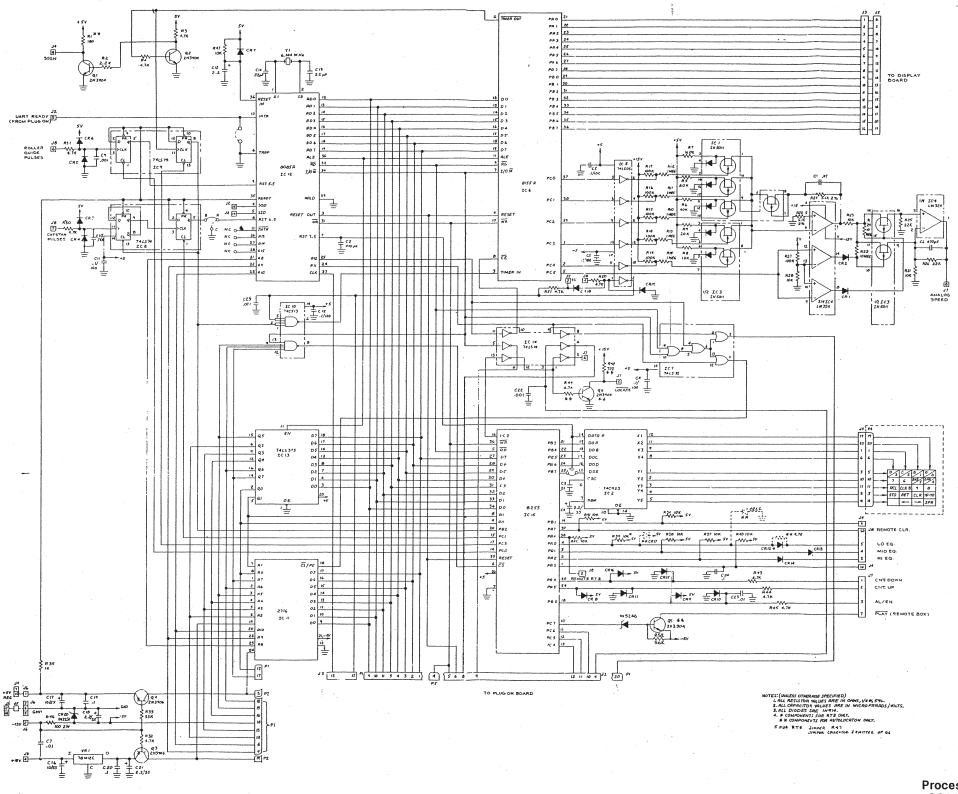


Processor Board
SC2500E0639-00 rev C



PARTS LIST — A/L III PROCESSOR BOARD
PCA2500-0639-00

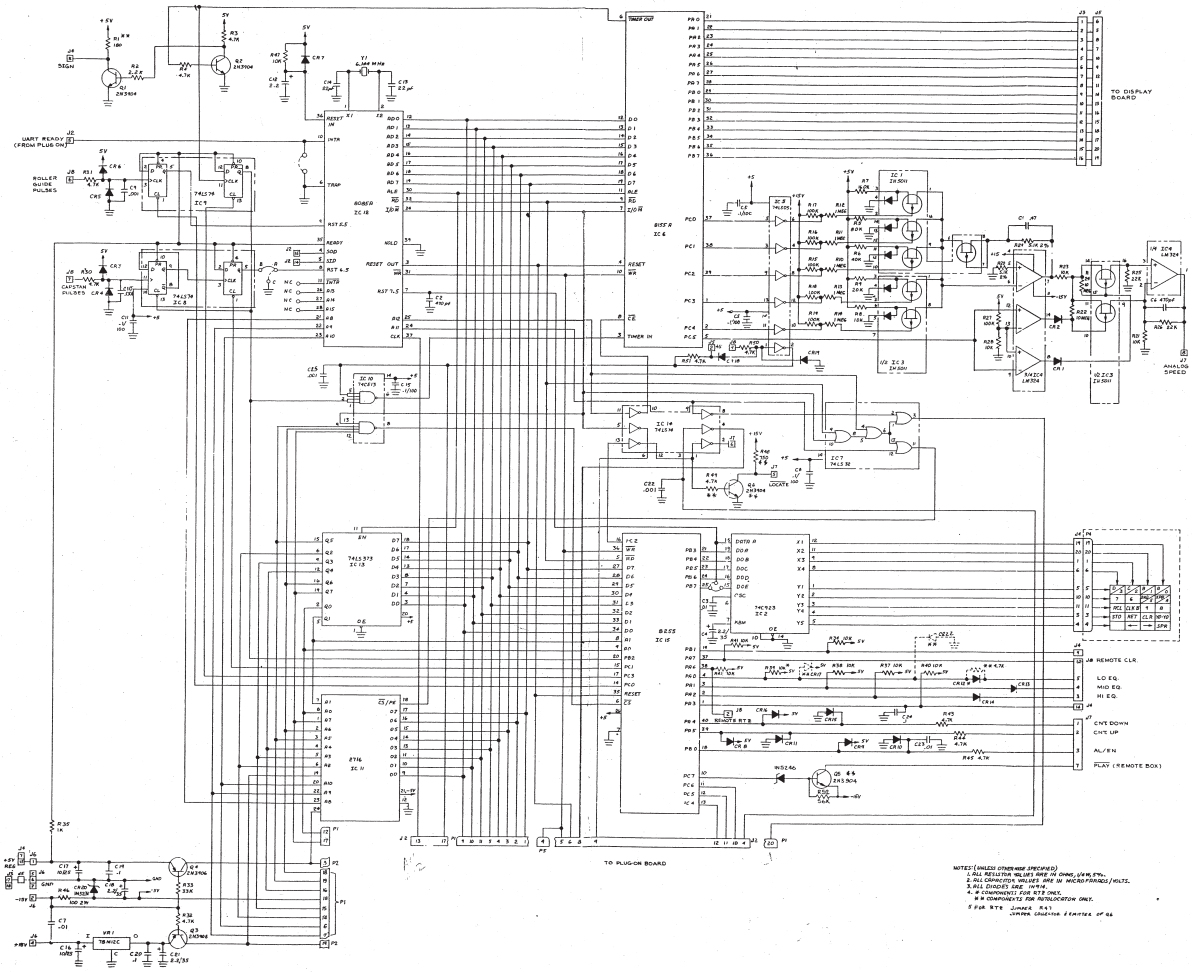
PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
09-65-1041	MOLEX 4PIN LOCK 3/4"	1	
09-65-1071	MOLEX 7PIN LOCK 3/4"	1	
09-65-1081	MOLEX 8PIN LOCK 3/4"	1	
09-65-1091	MOLEX 9PIN LOCK 3/4"	1	
1-87227-0	20PIN DIP SOCKET	2	
1.0-KOHM5%-¼W	CARBON FILM RESISTOR	1	R35
1.0-MOHM5%-¼W	CARBON FILM RESISTOR	3	R10,R11,R12
10--KOHM5%-¼W	CARBON FILM RESISTOR	8	R21,23,28,34,40,41,42,47
10--MOHM5%-¼W	CARBON FILM RESISTOR	2	R22,R24
100-KOHM5%-¼W	CARBON FILM RESISTOR	4	R15,16,17,27
10MF25V-CLY	LYTIC CAPACITOR	2	C16,C17
180--OHM5%-¼W	CARBON FILM RESISTOR	1	R1
1N914	DIODE	20	
2.2-KOHM5%-¼W	CARBON FILM RESISTOR	4	R2, 30, 31,96
20P-DIP-SKT	DIP SOCKET	1	
22--KOHM5%-¼W	CARBON FILM RESISTOR	2	R25,R26
22-03-2251	MOLEX, WAFER ASSY.	1	
24--KOHM55%-¼W	CARBON FILM RESISTOR	1	R5
24P-DIP-SKT	DIP SOCKET	2	
2:?MF50V-CLYRL	CAPACITOR LYTIC RADIAL	2	C4,C12
[illegible]04	TRANSISTOR	1	Q8
33--KOHM5%-¼W	CARBON FILM RESISTOR	3	R97,R98,R99
39--KOHM5%-¼W	CARBON FILM RESISTOR	1	R7
4.7-KOHM5%-¼W	CARBON FILM RESISTOR	11	R3,4,43,44,45,49,50,51,55,68,69
40P-DIP-SKT	DIP SOCKET	3	
470PF1KV-CCD20	CERAMIC DISC CAPACITOR	2	C2,C6
5.1-KOHM2%-¼W	CARBON FILM RESISTOR	2	R20,R29
6.2-KOHM5%-¼W	CARBON FILM RESISTOR	1	R64
74C923	IC KEYBOARD ENCODER	1	IC15
74LS05	IC HEX INVERTER	1	IC12
74LS13	IC DUAL 4-IN NAND	1	IC1
74LS14	IC HEX SCHMITT TRIGGER	1	IC5
74LS32	IC QUAD OR	1	IC10
74LS373	IC 8BIT LATCH	1	IC6
74LS74	IC DUAL D FLIP FLOP	2	IC7,IC8
:001MF1KV-CCD20	CERAMIC DISC CAPACITOR	3	C9,C10,C25
:01MF100V-CCD20	CERAMIC DISC CAPACITOR	3	C3,C7,C23
:1MF100V-CCD20	CERAMIC DISC CAPACITOR	8	C5,8,11,15,19,24,200,400
8MP61	CRYSTAL 6.411 MHz	1	Y1
IH5011	QUAD FET	1	IC11
LM324	QUAD OP AMP	1	IC14
P1086RR	P CHANNEL FET	1	Q7
P8085-A	MICROPROCESSOR INTEL	1	IC9
P8155	IC PIA RAM-INTEL	1	IC13
P8255-A	IC PPI INTEL	1	IC4
[illegible]2516	EPROM	2	IC2,IC3



±15v comes in on J6 on Display Board then via P7 on Display Bd to J6 on Processor Bd

Processor Board
SC2500-E-0611

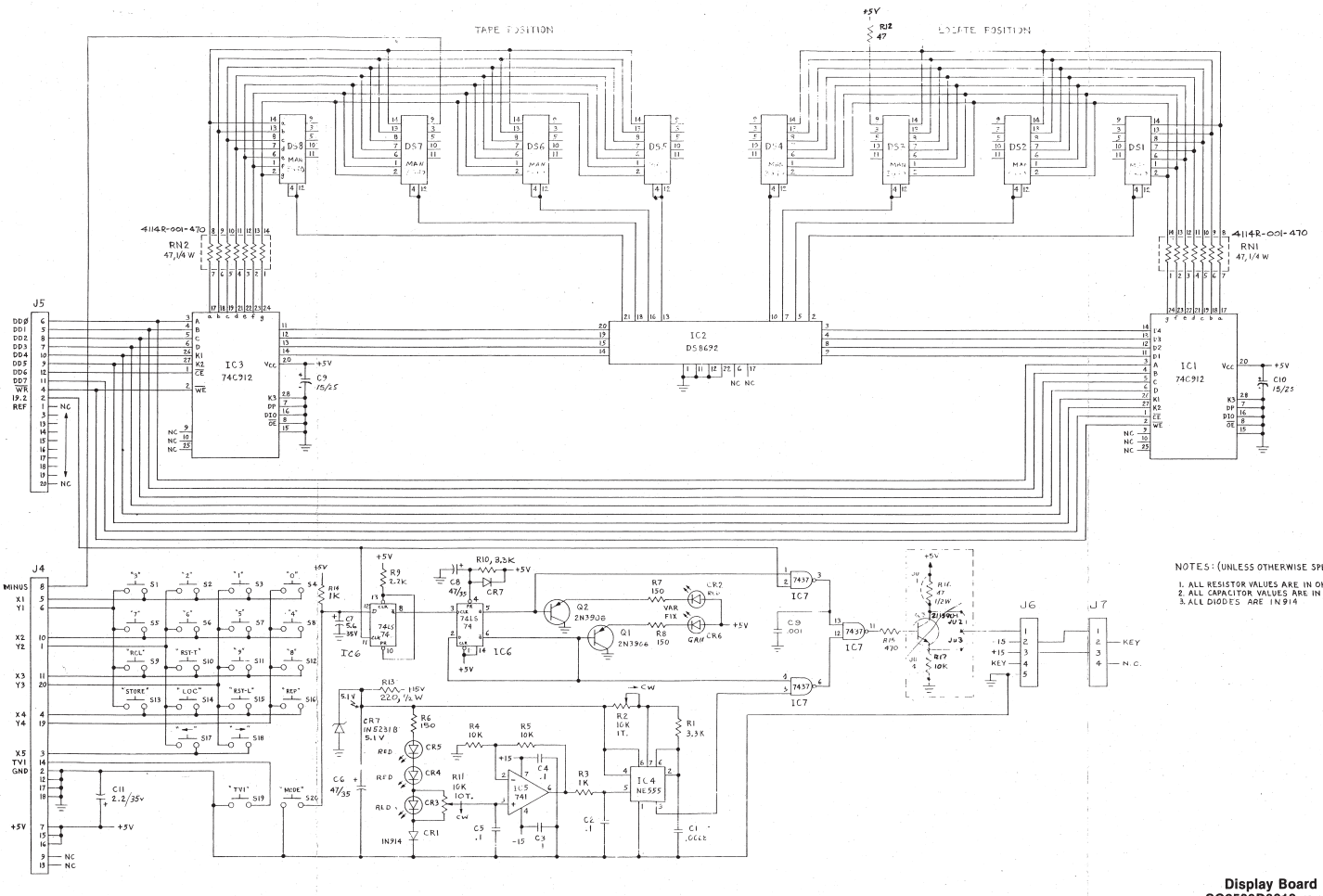
JH-24



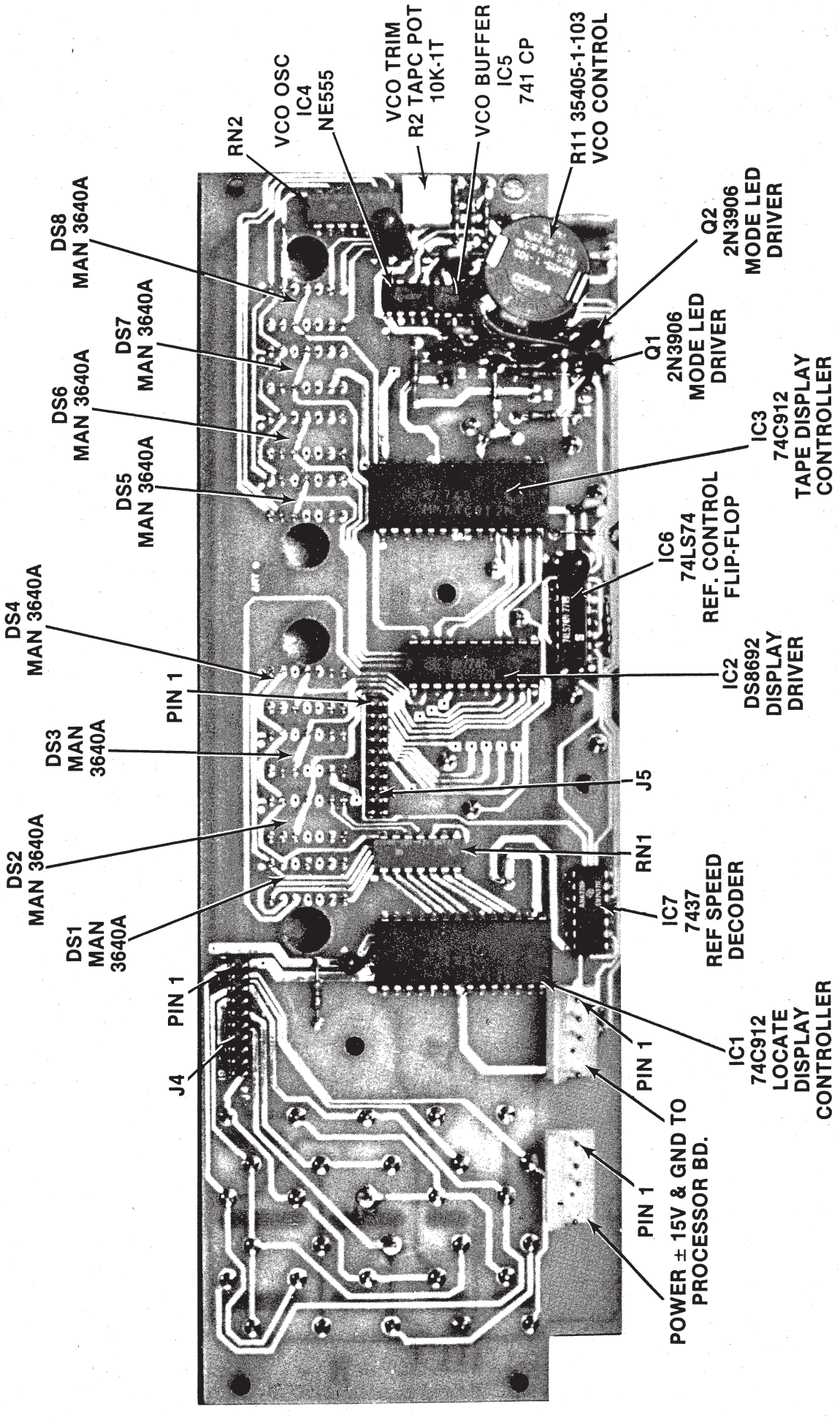
+5 provided by A.L. REGS

+8 DIRECT to Reg's direct from AL cable and Fused with IN-Line slow blow - center REAR of Machine

Processor Board
SC2500-E-0611



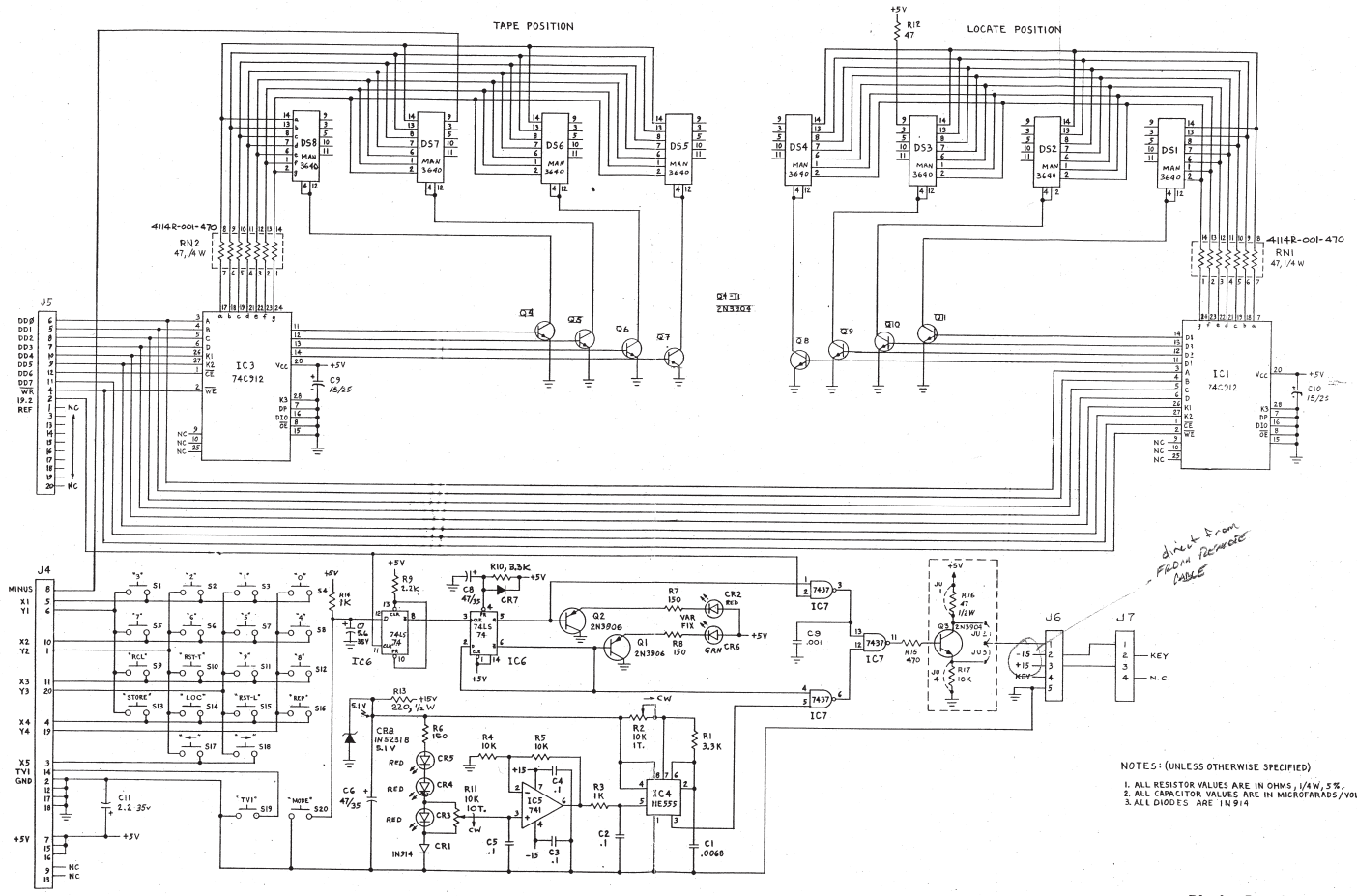
Display Board
SC2500D0610 rev G



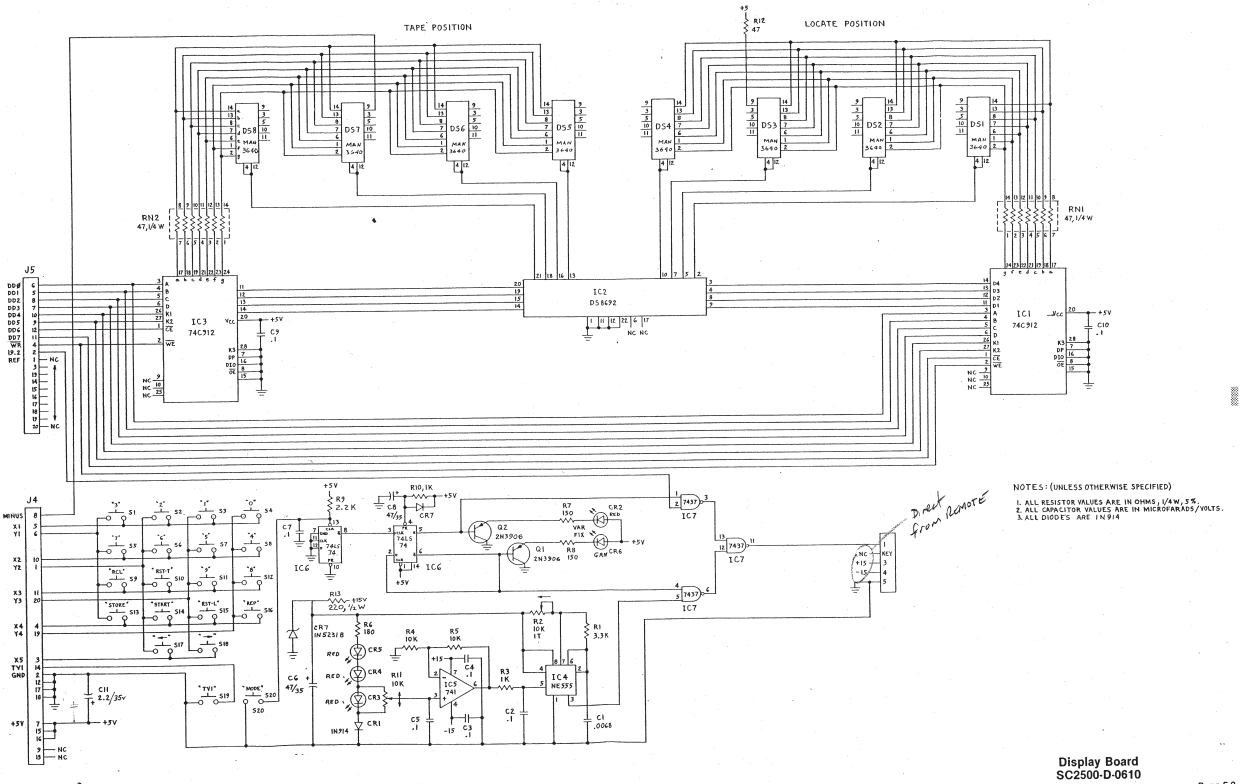
PARTS LIST — DISPLAY BOARD

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA2500-0610-00	PCA, DISPLAY BD A/L III	1	
09-65-1021	MOLEX 2PIN LOCK 3/4''	1	
09-65-1051	MOLEX 5PIN LOCK 3/4''	2	
1-87227-0	20PIN DOUBLE POST DIP	2	
1.0-KOHM5%-¼W	CARBON FILM RESISTOR	3	R3, R10, R14
10--KOHM5%-¼W	CARBON FILM RESISTOR	2	R4, R5
150--OHM5%-¼W	CARBON FILM RESISTOR	2	R7, R8
180--OHM5%-¼W	CARBON FILM RESISTOR	1	R6
1N5231B-5.1V	DIODE, ZENER-SILCN 5.1V-5	1	CR7
1N914	DIODE, SIGNAL-SILCN GLASS	2	CR1, CR7
22--KOHM5%-¼W	CARBON FILM RESISTOR	1	R9
220--OHM5%-½W	CARBON FILM RESISTOR	1	R13
22P-DIP-SKT	DIP SKT AUGAT 522-AG-11D	1	
28P-DIP-SKT	DIP SKT AUGAT 528-AG-11D	2	
2:2MF50V-CLYRL	LYTIC RAD/LD SEALED (LL)	1	C11
2N3904	TRANSISTOR	1	Q3
2N3906	TRANSISTOR	2	Q1, Q2
3.3-KOHM5%-¼W	CARBON FILM RESISTOR	1	R1
3540S-1-103	10K 10TURN LIN PANEL MOUNT	1	R11
4114R-001-470	47 OHM 14P-DIP BOURN DIP	2	RN1, RN2
47---OHM5%-¼W	CARBON FILM RESISTOR	2	R12, R16
47MF35V-CLYRL	LYTIC RAD/LD SEALED (GP)	2	C6, C8
470-OHM5%-¼W	RESISTOR	1	R15
741CP	OP AMP	1	IC5
7437	QUAD 2-IN NAND BUFFER	1	IC7
74C912	IC DISPLAY CONTROL NATL	2	IC1, IC3
74LS74	IC DUAL D FLIP FLOP	1	IC6
:0068MF400V-CMY	MYLAR CAPACITOR MEPCO	1	C1

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
:1MF100V-CCD20	CERAMIC DISC CAPACITOR	7	C2, 3, 4, 5, 7, 9, 10
DS8692	IC DISPLAY DRIVER NAT'L	1	IC2
MAN-3640A	DISPLAY MONSANTO	8	DS1 - DS8
MC-6000-0404-01	SW D-6 "1"	1	S3
MC-6000-0404-02	SW D-6 "2"	1	S2
MC-6000-0404-03	SW D-6 "3"	1	S1
MC-6000-0404-04	SW D-6 "4"	1	S8
MC-6000-0404-05	SW D-6 "5"	1	S7
MC-6000-0404-06	SW D-6 "6"	1	S6
MC-6000-0404-07	SW D-6 "7"	1	S5
MC-6000-0404-08	SW D-6 "8"	1	S12
MC-6000-0404-09	SW D-6 "9"	1	S11
MC-6000-0404-10	SW D-6 "0"	1	S4
MC-6000-0404-13	SW D-6 "STO"	1	S13
MC-6000-0404-14	SW D-6 "RCL"	1	S9
MC-6000-0404-15	SW D-6 "REP"	1	S16
MC-6000-0404-16	SW D-6 "RST"	2	S10, S15
MC-6000-0404-17	SW D-6 "LOC"	1	S14
MC-6000-0404-18	SW D-6 "TVI"	1	S19
MC-6000-0404-19	SW D-6 "MODE"	1	S20
MC-6000-0404-20	SW D-6 "→"	1	S17
MC-6000-0404-21	SW D-6 "←"	1	S18
MV5075C	LED RED MONSANTO	1	CR2, 3, 4, 5
NE555	PRECISION TIMER	1	IC4
TAPCPOT10K-1T	BU3386F-1-103/BK72MR10K	1	R2
XC209G	LED GREEN	1	CR6

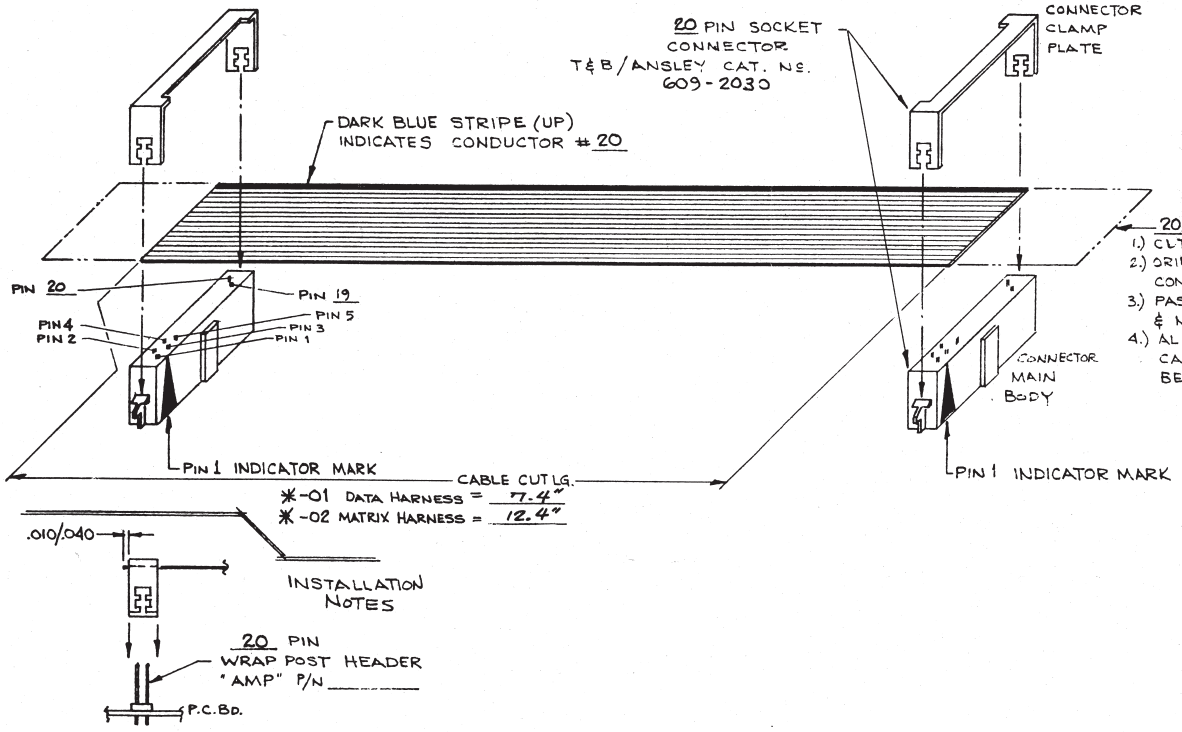


Display Board
SC2500D0610-01 rev I



Display Board
SC2500-D-0610

JH-24



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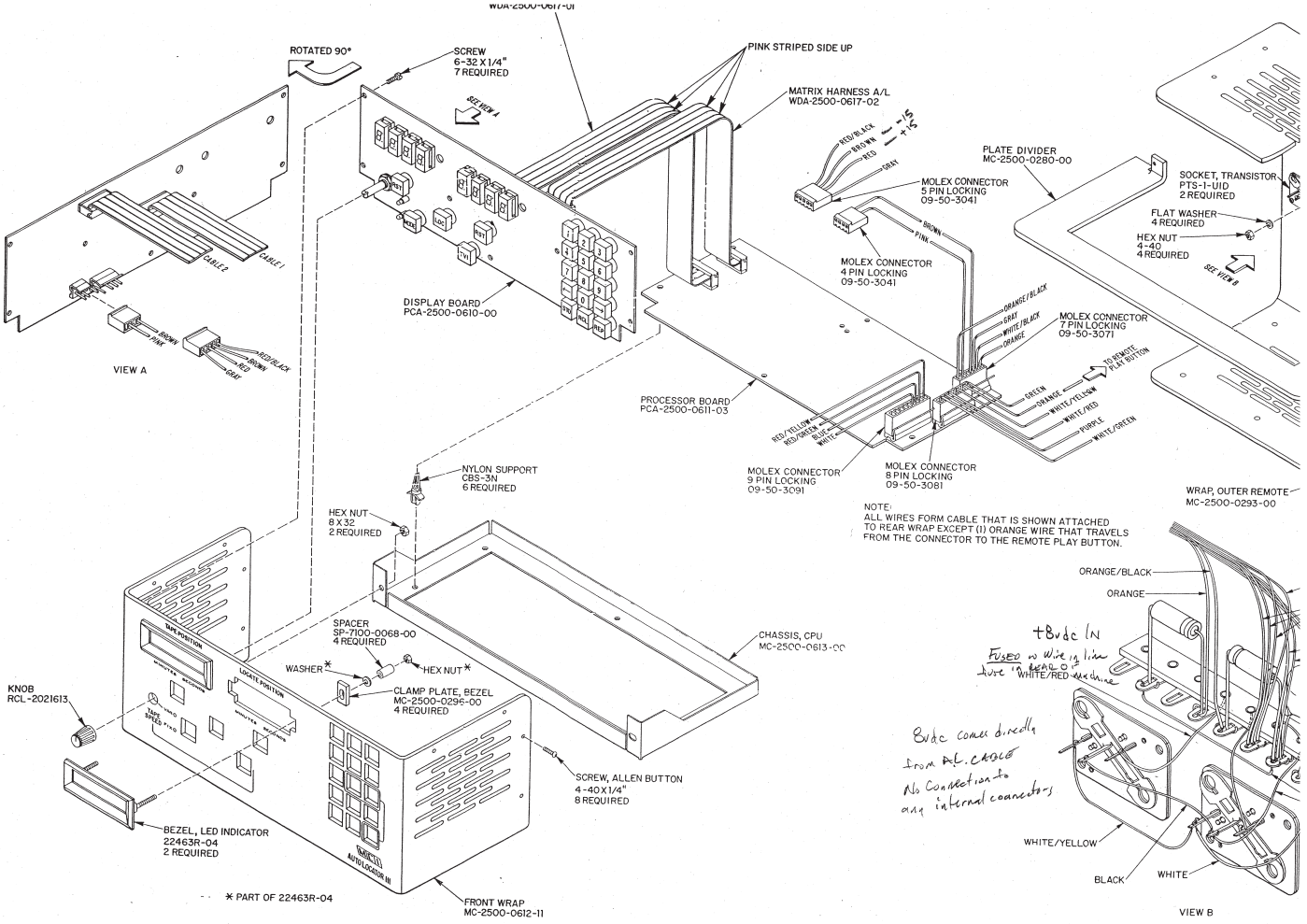
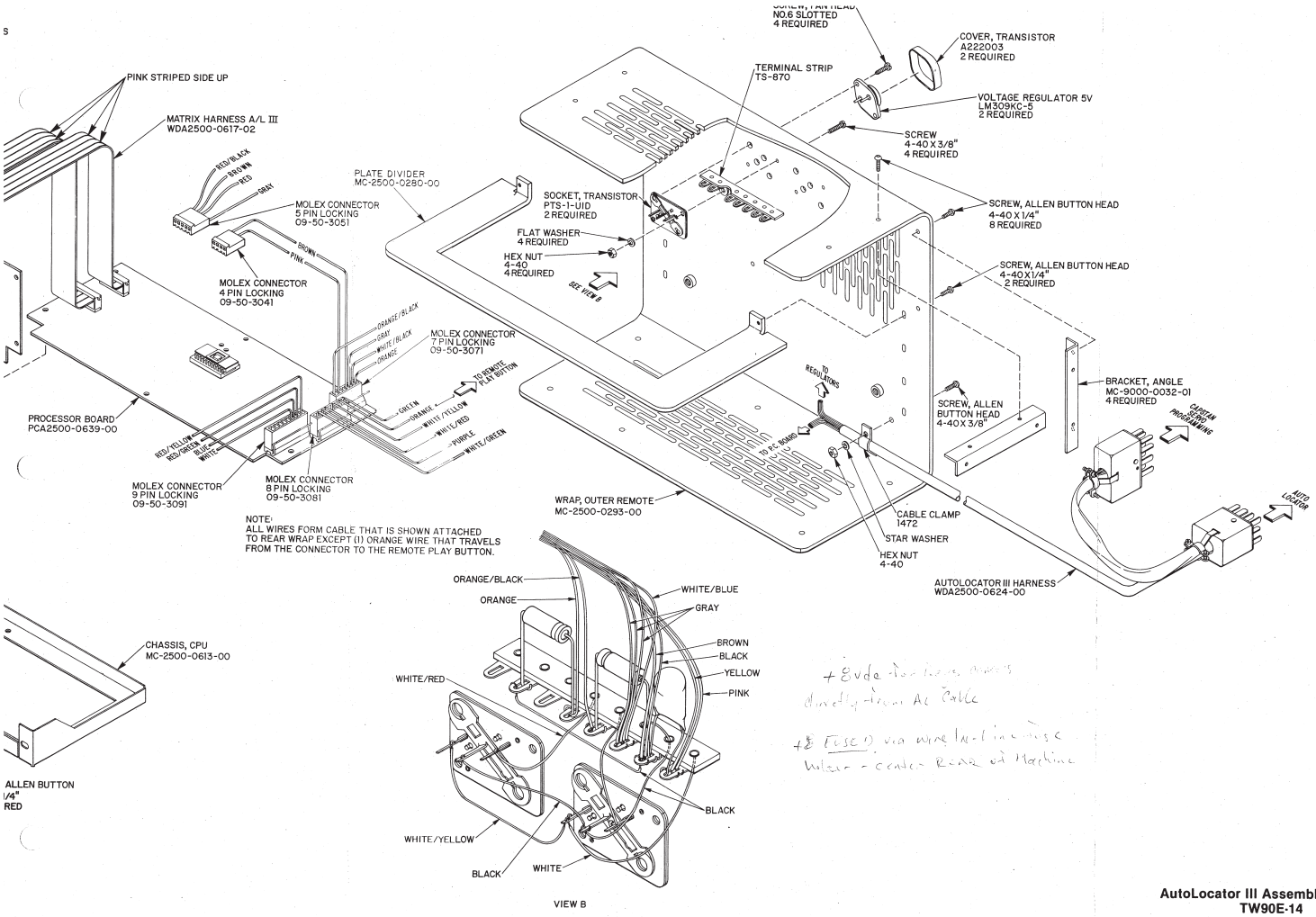


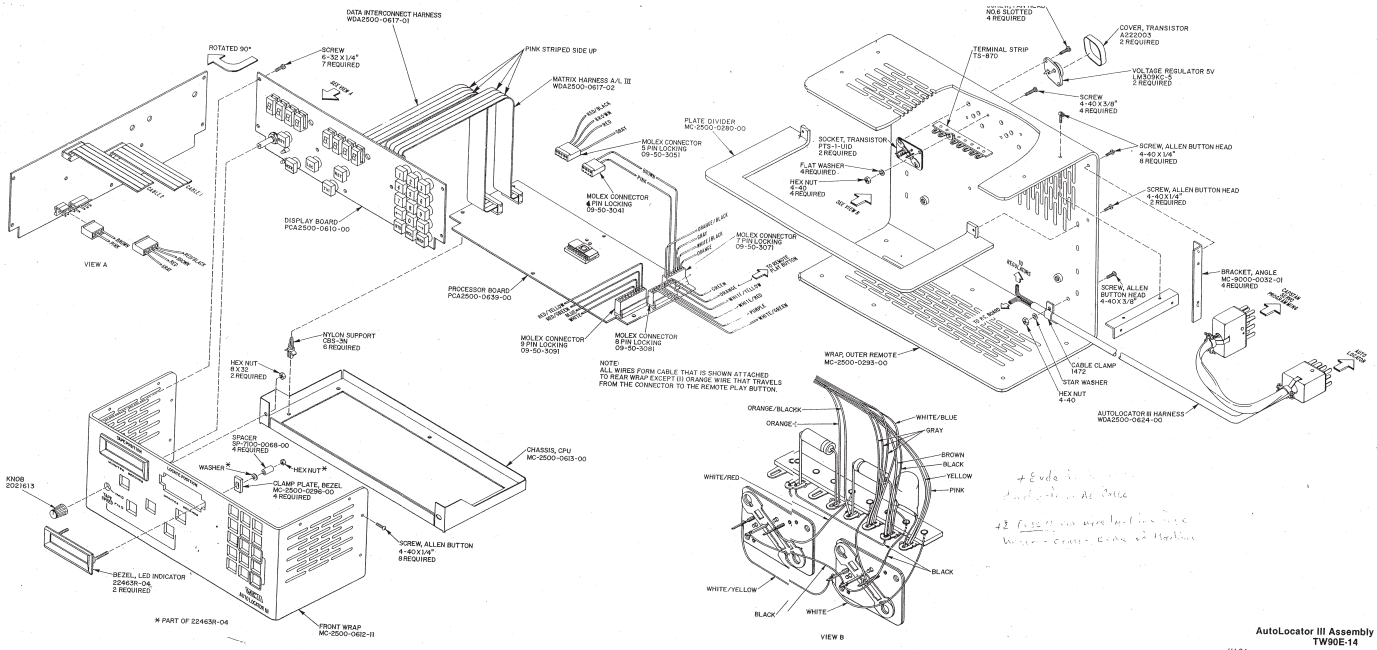


+ Evde-Jon have Power directly from AC Cable

+& FUSED via wire Inline with Violet - center REAR of Machine

AutoLocator III Assembly Drawing
TW90E-14

JH-24



AutoLocator III Assembly Drawing
TW90E-14

JH-24

SECTION 6
POWER SUPPLIES

6.1 General Description

The JH-24 contains two power supplies, the JH-114PS tape transport power supply and the JH-24D audio electronics power supply. Each power supply is housed in its own chassis. All connections to the power supplies are made via multipin connectors.

Input power for both supplies comes from the transport chassis. A single power cord plugs into the transport chassis at the rear of the cabinet. From the power cord, the input voltage is wired to two fuses in parallel; one is labeled DECK, the other is labeled AUDIO. Both fuses connect to the transport's power switch. Turning the power switch to ON applies the line voltage to both power supplies.

Input power to the JH-114PS is applied at the POWER connector on the transport chassis. The regulated and unregulated outputs from the power supply also enter the transport via this connector. Input power to the JH-24D is applied at the ELECTRONICS connector. The output voltages and control signals to the audio electronics arrive at the channel electronics via cables which are part of the Bus Boards. There is one cable harness for each set of eight channels.

Figure 6-1, the power distribution diagram, shows the interconnections between the transport and both power supplies. The internal harnessing of the power supplies is also shown. For detailed information of the circuitry of the power supplies, refer to the schematics at the end of this section.

6.2 JH-114PS Power Supply

The JH-114 PS is located toward the right side of the transport cabinet as viewed from the back of the machine. The fuse holder plug on the power supply chassis plugs in to select the available line voltage. For 115 and 100vac operation, the holder must contain a 5 amp fuse; for the 230vac operation the holder must contain a 3 amp fuse.

Power for the fan is obtained from the transformer's primary. The 115vac for the fan is also brought back to the two fan outlets on the transport chassis. The cabinet fan plugs into one of these outlets.

The power supply fan is part of the chimney assembly. The entire chimney assembly can be removed from the power supply by turning the four quick release fasteners. Sufficient cable slack is provided so that the power supply can be operated with the chimney removed. The inside of the chimney assembly contains the reel motor driver printed circuit board and four heat sink mounted transistors. These are not shown in the power distribution diagram since they are part of the reel motor servo circuitry. These components are however, shown on the power supply's schematic.

The transformer's secondary windings feed four full wave rectifier circuits and supply the 24vac signal for the MVC touch sense. The 8 volt rectified output is not regulated. It is sent to the 5 volt regulator on the mother board frame. The 8 volt output also goes to the AutoLocator III via connectors J65 and J66.

The +15 and −15 volt rectifier outputs are regulated by LM 340 and LM 320 devices respectively. These regulators are mounted on the back of the power supply chassis. The 30 volt rectifier output is sent directly to the supply and take-up reel motors (+30vdc unreg) and to the 22 volt regulator board. This printed circuit board is mounted inside the back cover of the power supply chassis. The pass transistor for the 22 volt regulator is mounted on the heat sink just below the circuit board. Over current protection is provided by this regulator. The 30 volt input to the regulator is shunted to ground if the current exceeds approximately 5 amps.

6.3 JH-24D Power Supply

The JH-24D power supply is located in the left side of the transport cabinet. It, like the JH-114PS, has a fuse holder plug which selects the available line voltage. For 100 and 115vac operation the fuse holder must contain a 6.25 amp fuse; for 220vac operation the fuse holder must contain a 4 amp fuse. Three more fuse holders are also mounted on the power supply front panel. For all voltage ranges these must be 10 amp fuses.

The audio power supply contains three printed circuit boards, the ±18 volt regulator PC board, the +24 volt regulator board, and the relay and power distribution board. The ±18 volt PC board is mounted on the chimney assembly. The chimney assembly, just as the one in the JH-114PS, removes from the power supply by turning the four quick release fasteners. Located inside the chimney are four series pass transistors mounted on heat sinks. The 24 volt regulator PC board mounts on the inside of the rear panel directly behind the chimney assembly. The pass transistors for this regulator are mounted on the rear panel. The relay board is fastened to the power supply's top cover. In order to access the relays on this board you must remove the top cover. The ±18 volt regulator receives its input from two full wave rectifiers. Each output from the rectifier is fused, these fuses are located on the front panel. Both are 10 amp fuses.

The reference voltage for the 18 volt regulators is provided by a zener diode and resistor network. Potentiometer R6, located near the center of the board, sets the reference voltage used by the comparators in both the +18 volt regulator and the −18 volt regulator. R6 adjusts both the positive and negative output voltage levels.

Both 18 volt regulators are over current limited. A current limiting transistor prevents the output current from exceeding 8 amps. Over voltage protection is provided by crowbar SCRs at both outputs. The SCRs fire if the regulated output voltage exceeds 24 volts. Once the SCR fires, the transport must be powered down to reset it.

An internal harness carries the +18 volt and −18 volt outputs to the relay and distribution board. The+18 volt output goes to the transport's speed select switch. This is the source of the high speed and low speed equalization signals. The regulated output voltages reach the audio bus boards via cable harnesses that are part of the bus board assemblies. These harnesses plug into connectors on the top cover of the power supply. The connections to all three connectors are identical.

The 24 volt regulator receives approximately 39 volts from a rectifier through a ten amp fuse located on the front panel. Its regulated output goes to the relays on the relay and distribution board. The relays, record hold and momentary record, switch the regulated 24 volts to the audio bus boards in response to signals from the Interface/Lamp Driver Board.

A zener diode and a resistor divider network provide the reference for the comparator in the regulator. Potentiometer R2, located near the bottom of the circuit board, adjusts the regulated output voltage. The ±18 volt chimney assembly must be removed to reach the voltage adjustment.

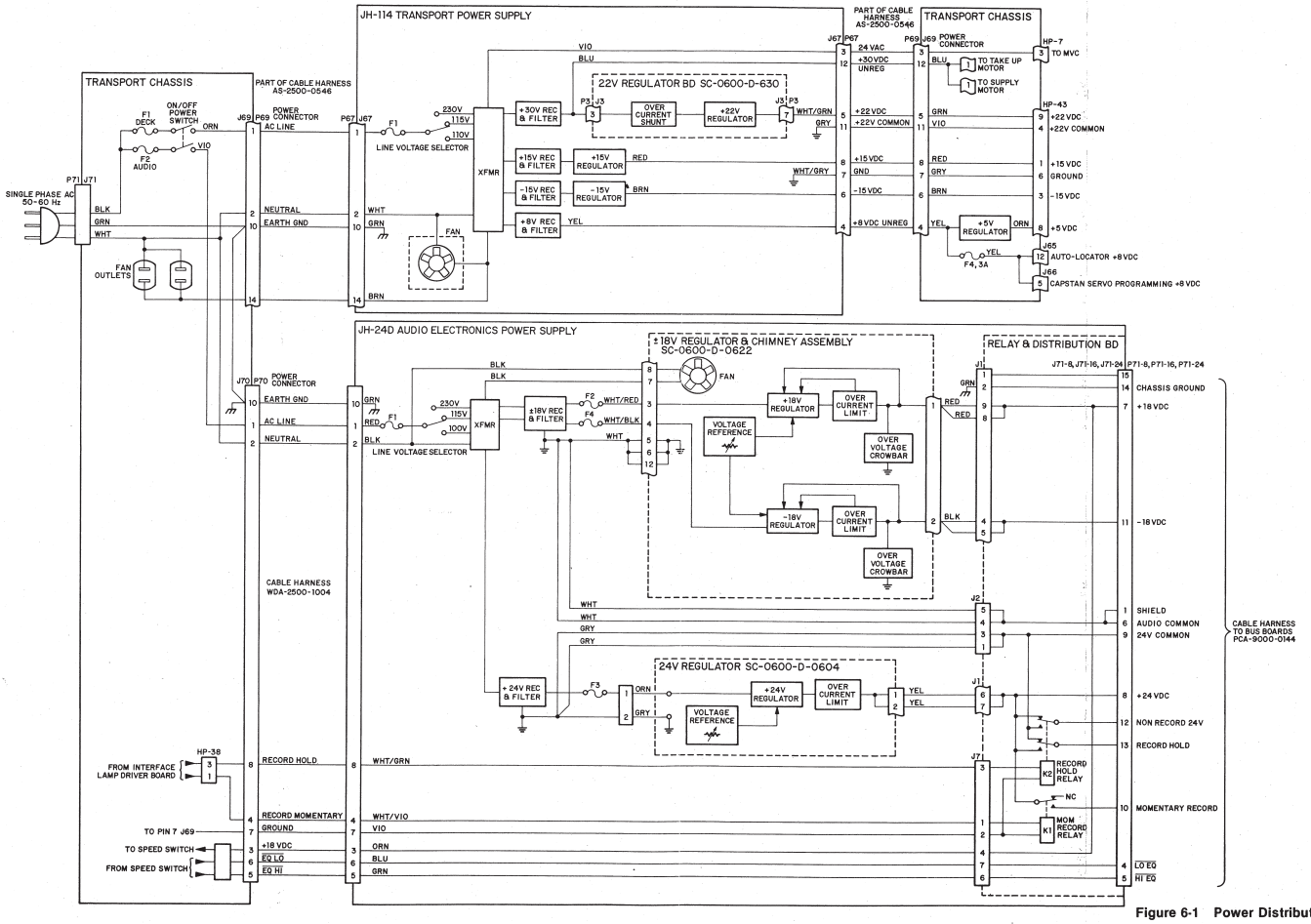
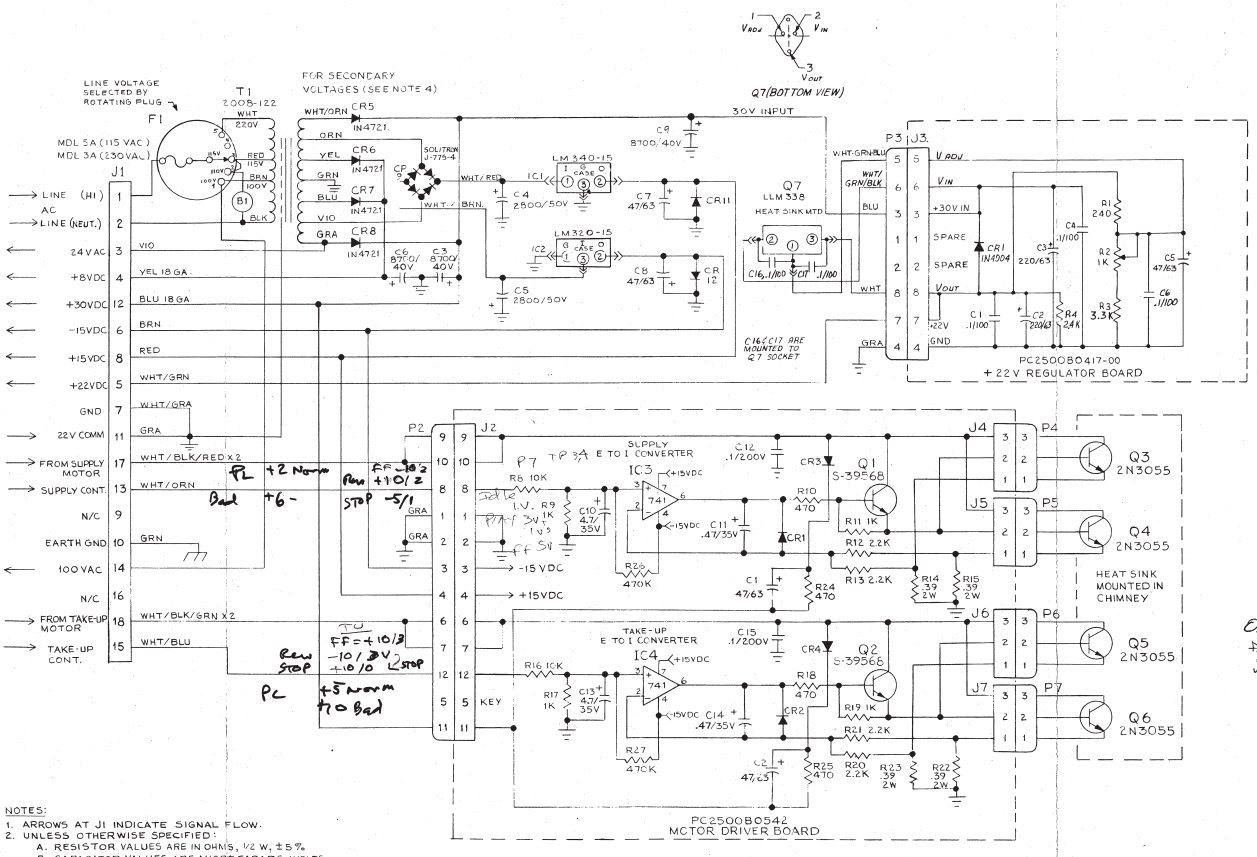
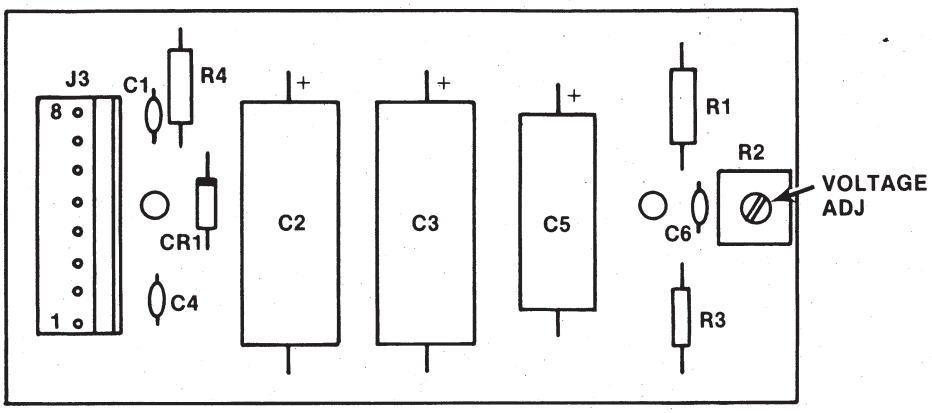


Figure 6-1 Power Distribution Block Diagram

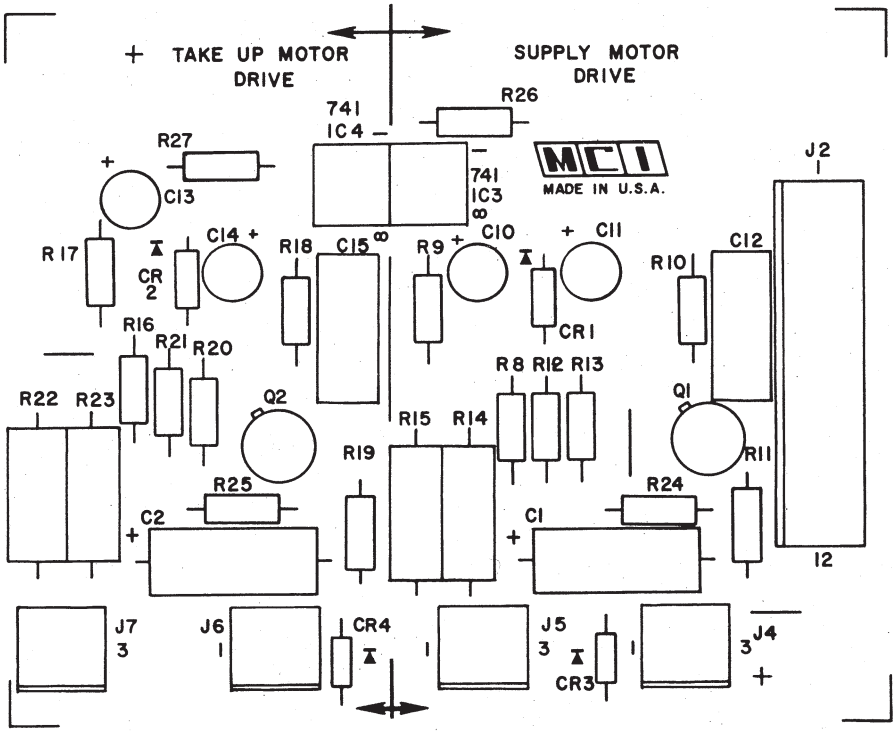


NOTES:
1. ARROWS AT J1 INDICATE SIGNAL FLOW.
2. UNLESS OTHERWISE SPECIFIED:
   A. RESISTOR VALUES ARE IN OHMS, 1/2 W, ±5%
   B. CAPACITOR VALUES ARE MICROFARADS/VOLTS
   C. DIODES ARE IN4004.
   D. WIRE GAUGE IS 22 GA.
3. ALL ⏚ SYMBOLS ARE CARRIED AS INDIVIDUAL WIRES TO A COMMON TIE POINT.
4. 48 VAC = WHT/ORN & GRA LEADS.
   32 VAC = ORN & VIO. LEADS.
   18 VAC = YEL & BLU LEADS.

Oscillations at Bridge diodes for ± 15v, 22v - replace Voltage regulators



PCA2500-0417-00

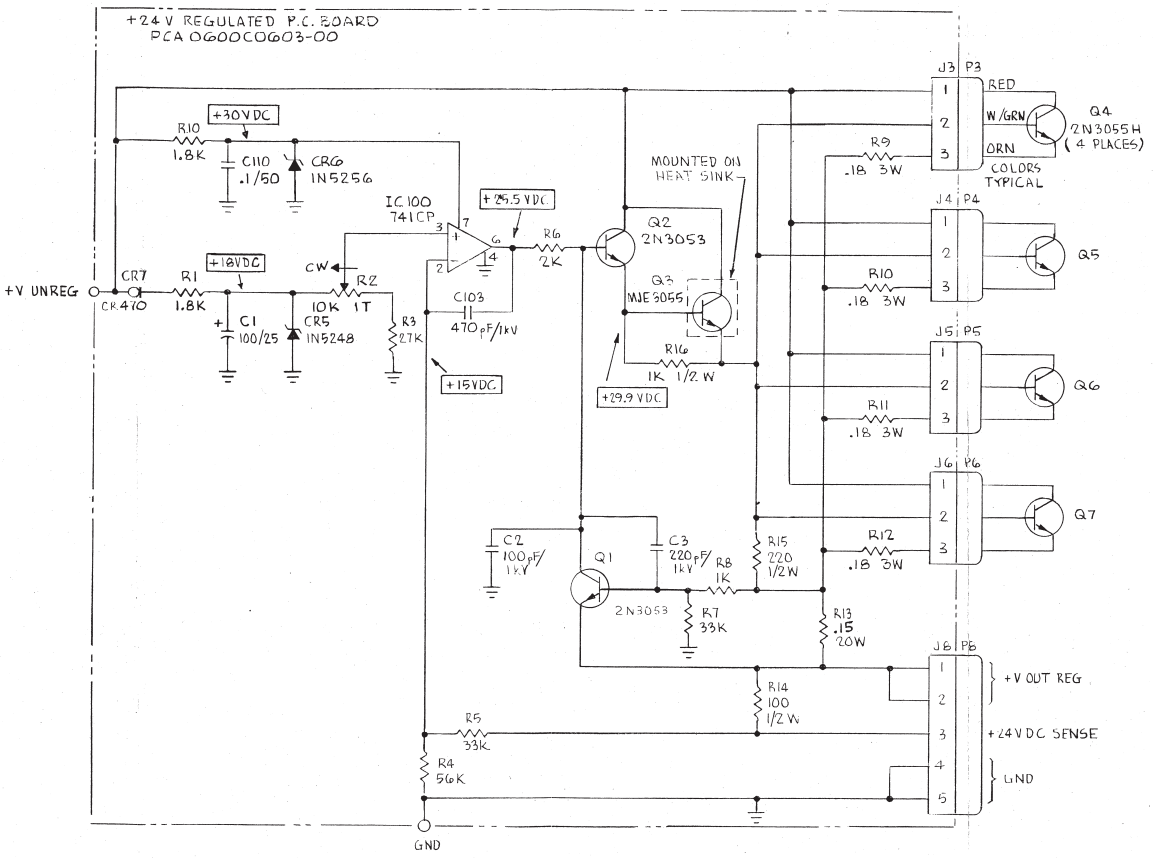


PARTS LIST — JH-114PS DECK POWER SUPPLY
22 VOLT REGULATOR BOARD

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA2500-0190-00	PCA, 22V REGULATOR, JH11	1	
09-65-1041	MOLEX 4PIN LOCK 3/4"	2	J3
0:15-OHM10%-3WW	WIRE WOUND RES-ROCKWOOD	1	R3
1.0-KOHM5%-½W	CARBON FILM RESISTOR	1	R6
10--KOHM5%-½W	CARBON FILM RESISTOR	2	R5, R7
100--OHM5%-½W	CARBON FILM RESISTOR	1	R4
1N5252B-24V	DIODE, ZENER-SILCN 24V-5%	1	CR10
298SB	HEATSINK-WAKEFIELD	1	
2N2270	XSTOR NPN AMPLIFIER	1	Q10
2N3053	XSTOR NPN HI-SPD SW	1	Q11
2N4249	XSTOR PNP AMPL SILCN	1	Q9
47MF63V-CLY	LYTIC CAPACITOR SIEMEN	1	C2
:68MF50V-CLYRL	LYTIC RAD/LD SEALED (LL)	1	C1
AP5-7D	PAD, TRANSISTOR TO-5 TYPE	2	

PARTS LIST — JH-114PS DECK POWER SUPPLY
MOTOR DRIVER BOARD

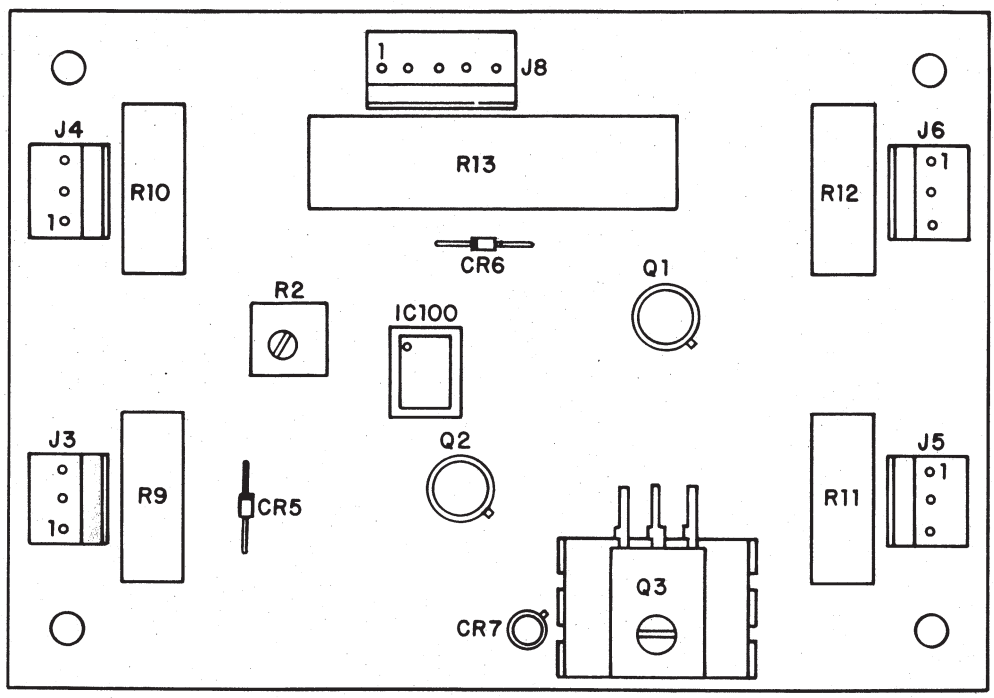
PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA2500-0542-00	PCA, MOTOR DRIVER, JH114	1	
09-65-1031	MOLEX 3PIN LOCK 3/4"	4	J4, 5, 6, 7
09-65-1121	MOLEX 12PIN LOCK 3/4"	1	J2
0:39-OHM10%-2WW	WIRE WOUND RES-ROCKWOOD	4	R14,15, 22,23
1.0-KOHM5%-½W	CARBON FILM RESISTOR	4	R9, 11, 17, 19
10--KOHM5%½W	CARBON FILM RESISTOR	2	R8, R16
16P-DIP-SKT	DIP SKT ARIES 16-511-10	1	
1N4004	DIODE, RECTIFIER - SILICON	4	CR1, CR2, CR3, CR4
2.2-KOHM5%-½W	CARBON FILM RESISTOR	4	R12, 13, 20, 21
2N5681-S39568	XSTOR NPN AMPLIFIER	2	Q1, Q2
470--OHM5%-½W	CARBON FILM RESISTOR	4	R10, 18, 24, 25
470-KOHM5%-½W	CARBON FILM RESISTOR	2	R26, R27
47MF63V-CLY	LYTIC CAPACITOR SIEMEN	2	C1, C2
4:7MF35V-CLYRL	LYTIC RAD/LD SEALED (LL)	2	C10, C13
741CP	OP AMP	2	IC3, IC4
:1MF200V-CMY	MYLAR CAPACITOR BLACK	2	C12, C15
:47MF50V-CLYRL	LYTIC RAD/LD SEALED (LL)	2	C11, C14
AP5-7D	PAD, TRANSISTOR TO-5 TYPE	2	



NOTES: UNLESS OTHERWISE SPECIFIED.
1.-ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 5%.
2.-ALL CAPACITOR VALUES ARE IN MICROFARADS/VOLTS

24V Regulator
SC0600-C-0622

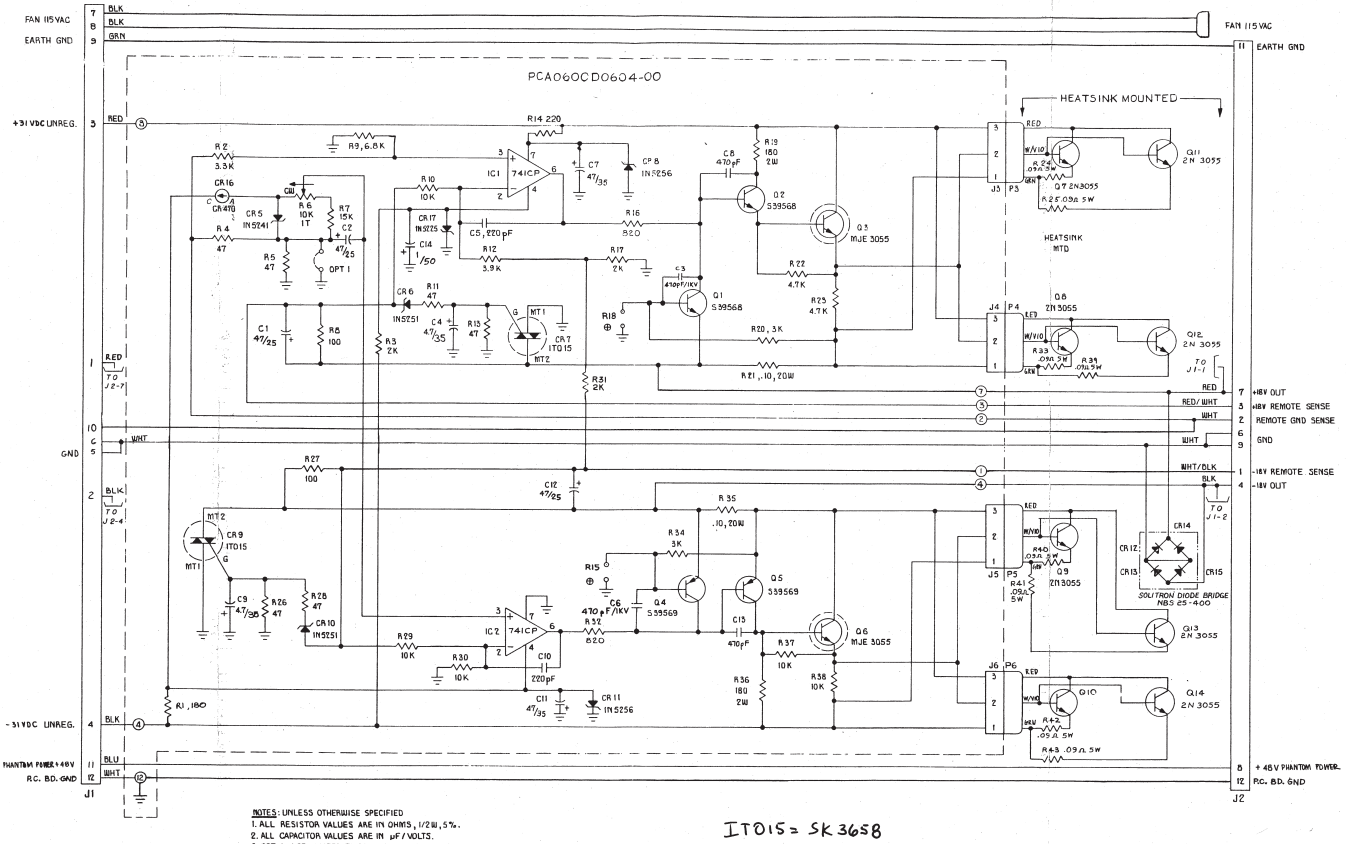
JH-24



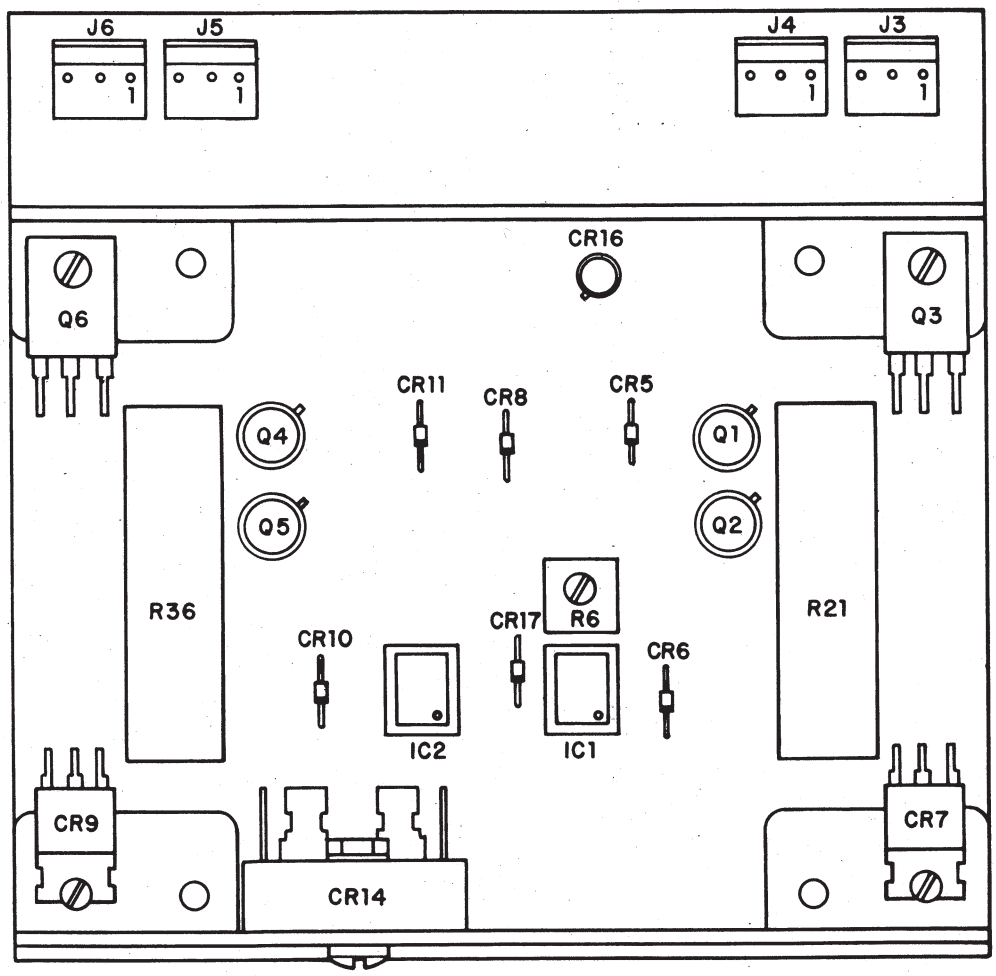
24 VOLT REGULATOR BOARD PCA0600-0603

PARTS LIST — JH-24D AUDIO POWER SUPPLY
24 VOLT REGULATOR BOARD

ART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA0600-0603-00	24V REGULATOR BD	1	
02-09-1118	MOLEX FEMALE TERM 1381TL	2	
03-09-1021	MOLEX 2CIR RECP LGE 154	1	
08P-DIP-SKT	DIP SKT 8PIN ARIES 8-511	1	
09-65-1031	MOLEX 3PIN LOCK 3/4"	4	J3, J4, J5, J6
09-65-1051	MOLEX 5PIN LOCK 3/4"	1	J8
0:18-OHM10%-3WW	WIRE WOUND RES-ROCKWOOD	4	R9, R10, R11, R12
0:18-OHM10%20WW	WIRE WOUND RES-ROCKWOOD	1	R13
1.0-KOHM5%-½W	CARBON FILM RESISTOR	1	R16
1.0-KOHM5%-¼W	CARBON FILM RESISTOR	2	R8
1.8-KOHM5%-¼W	CARBON FILM RESISTOR	2	R1, R10
100--OHM5%-½W	CARBON FILM RESISTOR	1	R14
100MF25V-CLY	LYTIC CAPACITOR SIEMEN-D	1	C1
100PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	1	C2
1548-2	TEST POINT TERM	10	
1N5248-18V	DIODE, ZENE-SILCN 18V-10%	1	CR5
1N5256-30V	DIODE, ZENE-SILCN 30V-10%	1	CR6
2.0-KOHM5%-¼W	CARBON FILM RESISTOR	1	R6
220--OHM5%-½W	CARBON FILM RESISTOR	1	R15
220PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	1	C3
27--KOHM5%-¼W	CARBON FILM RESISTOR	1	R3
?N3053	XSTOR NPN HI-SPD SWITCH	2	Q1, Q2
-KOHM5%-¼W	CARBON FILM RESITOR	2	R5, R7
470PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	1	C103
56--KOHM5%-¼W	CARBON FILM RESISTOR	1	R4
6107B-14	HEAT SENK THERMOLLOY	1	
741CP	OP AMP	1	IC100
:01MF50V-CCD20	CERAMIC DISC CAP 20% TOL	1	
:1MF100V-CCD20	CERAMIC DISC CAPACITOR	1	C110
MJE-3055	XSTOR NPN HI PWR AMP	5	Q3, Q4, Q5, Q6, Q7
TAPCPOT10K-1T	BU3386F-1-103/BK72MP10K	1	R2
CR470	DIODE ZENER SILICONIX	1	CR7



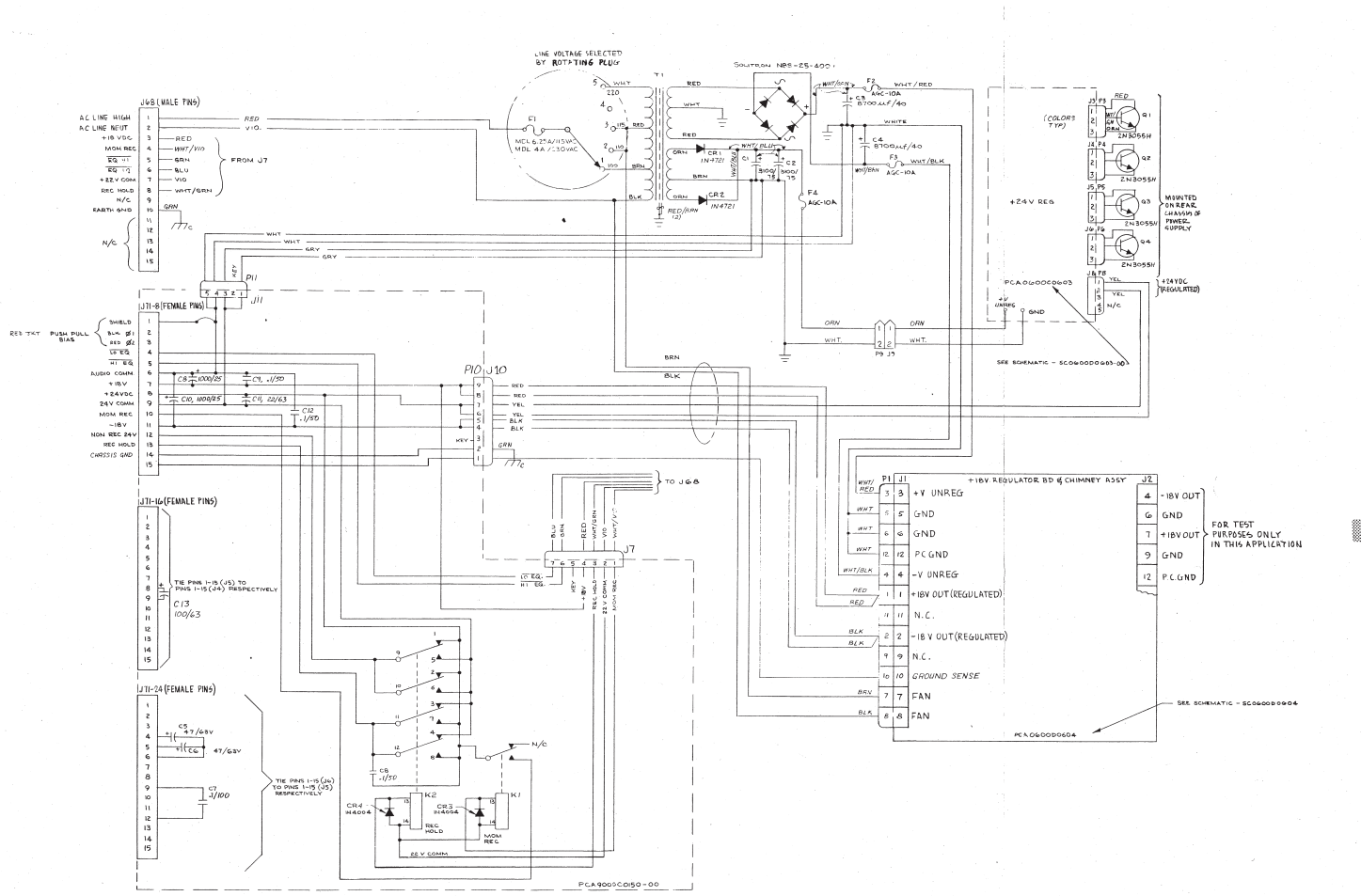
±18V Regulator Board
SC0600D0604 rev L



± 18 VOLT REGULATOR BOARD PCA0600-0604

PARTS LIST — JH-24 AUDIO POWER SUPPLY ± 18 VOLT REGULATOR BOARD

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA0600-0604-00	+ – 18V REGULATOR BD	1	
08P-DIP-SKT	DIP SKT 8PIN ARIES 8-511	2	
09-65-1031	MOLEX 3PIN LOCK 3/4"	4	J3, J4, J5, J6
0:10-OHM10%20WW	WIRE WOUND RES-ROCKWOOD	2	R21, R35
10--KOHM5%-½W	CARBON FILM RESISTOR	5	R10, 29, 30, 37, 38
100--OHM5%-½W	CARBON FILM RESISTOR	1	R8, R27
15--KOHM5%-½W	CARBON FILM RESISTOR	1	R7
1548-2	TEST POINT TERM	4	
180--OHM5%--2WM	METAL OXIDE RES.	2	R19, R36
180--OHM5%-½W	CARBON FILM RESISTOR	1	R1
1MF50V-CLYRL	LYTIC RAD/LD SEALED (LL)	1	C14
1N5225-3V	3.0VOLT ZENER DIODE	1	CR17
1N5241-11V	DIODE, ZENE-SILIC 11V-10%	1	CR5
1N5251	ZENER DIODE MOTO (GLASS)	2	CR6, CR10
1N5256-30V	DIODE, ZENE-SILIC 30V-10%	2	CR8, CR11
2.0-KOHM5%-½W	CARBON FILM RESISTOR	5	R3, 16, 17, 31, 32
220--OHM5%-½W	CARBON FILM RESISTOR	1	R14
220PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	2	C5, C10
2N5679-S39569	XSTOR PNP AMP SILCN TO-5	2	Q4, Q5
2N5681-S39568	XSTOR NPN AMPLIFIER	2	Q1, Q2
[illegible]-KOHM5%-½W	CARBON FILM RESISTOR	2	R20, R34
[illegible]-KOHM5%-½W	CARBON FILM RESISTOR	1	R2
3.9-KOHM5%-½W	CARBON FILM RESISTOR	1	R12
4.7-KOHM5%-½W	CARBON FILM RESISTOR	2	R22, R23
47---OHM5%-½W	CARBON FILM RESISTOR	6	R4, 5, 11, 13, 26, 28
470PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	2	C8, C13
47MF25V-CLYRL	LYTIC RAD/LD SEALED (GP)	5	C1, 2, 7, 11, 12
4:7MF50V-NPLC	NON-POLAR (RADIAL) LYTIC	2	C4, C9
6.8-KOHM5%-½W	CARBON FILM RESISTOR	1	R9
741CP	OP AMP	2	IC1, IC2
CR470	DIODE ZENER SILICONIX	1	CR16
IT015	TRIAC, DIODE	2	CR7, CR9
MJE-3055	XSTOR NPN HI PWR AMP SI	8	Q7 thru Q14
TAPCPOT10K-1T	BU3386F-1-103/BK72MR10K	1	R6



JH-24D Audio Power Supply
SC9000D0151 rev G

PARTS LIST — JH-24D AUDIO POWER SUPPLY RELAY AND DISTRIBUTION BOARD

ART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA9000-0150-00	P/S DISTRIBUTION & RELAY PCA	1	
09-65-1051	MOLEX 5PIN LOCK 3/4''	1	J2
09-65-1071	MOLEX 7PIN LOCK 3/4''	1	J7
09-65-1091	MOLEX 9PIN LOCK 3/4''	1	J1
1N4004	DIODE, RECTIFIER - SILICON	2	CR3, CR4
20C250	HOLD DOWN SPRINT P&B	2	
27E007	RELAY SOCKET POTTER/BRUM	2	
47MF63V-CLY	LYTIC CAPACITOR SIEMEN	2	C5, C6
4:7MF63V-CLY	LYTIC CAPACITOR SIEMEN	1	C7
:1MF100V-CCD20	CERAMIC DISC CAPACITOR	1	C8
HC4E-24VDC	ARROW —M RELAY	2	K1, K2
S63315-AB-08	CONN PC MTG 15 CIR	3	J71-8, -16, -24

SECTION 7

ALIGNMENT TESTS AND ADJUSTMENTS

7.1 Equipment Needed

MCI uses the following equipment to test and align its tape recorders. Your recording equipment must be periodically aligned to insure optimum performance. Carefully adhere to the following procedures, using the specified test equipment or test equipment of equal accuracy. Remember that the quality of the recording depends on the accuracy of the alignments. Verify the tape transport and audio alignments at least once a week to insure peak performance. Clean and demagnetize the heads before every recording session.

AC Voltmeter capable of reading at bias frequencies of 2100 kHz
Hewlett-Packard Model 400 FL

DC Voltmeter, electronic type, 0.3 volt, full scale
Triplett Model 603

Audio Signal Generator
Krohn-Hite Model 5800

Frequency Counter
Hewlett-Packard Model 5381A

Flutter Meter
EMT Model 424

Intermodulation Analyzer
Crown Model IMA

Wave Analyzer
Hewlett-Packard 3581A

Phase Meter
MCI Model JH-22

Spring Scales
Ametex 0-36 ounces (1.02 kgm) and 0-10 pounds (4.54 kgm)

Oscilloscope
Phillips Model 3232 (2 mv/cm vertical sensitivity, 10 mHz bandwidth, 0.2 microseconds/cm horizontal sweep).

NOTE: Never use any type of shielded leads for scope or meter when working with the 210 kHz Bias Oscillator; detuning and/or wrong readings will always occur. Use only open leads not more than 3 feet long.

The following service aids are available from MCI Customer Service Department:

Alignment Kit (surface blocks and height gauges)	AS6B79
Extender Boards	
Record/Cue Extender Card	PCA9000-0165
Repro, Output & Bias Extender Card	PCA9000-0164
Logic Annunciator Board	PCA2500-0177

CAUTION: Improperly slit tape can make a properly aligned tape path appear to be out of alignment. Carefully select the roll of tape used in the following procedures.

7.2 Transport Tests and Adjustments

1. Turntable Height

Test

Observe the spooling of the tape on the take up and supply reels. Tape should not rub against either reel flange; it should be as close to the bottom flange as possible without touching it.

Load a roll of tape. Use metal reels, insure that they are neither bent nor deformed.

Using the MVC Joystick, shuttle tape in both directions. Observe tape build up on each reel. Tape should not touch reel flanges. Release MVC Joystick.

Press FWD and observe tape, then, press RWD and observe tape. Tape should not touch reel flanges. Press STOP.

If Adjustments Are Necessary

If the tape is not 0.004 ± .002 inches above the bottom take up reel and supply reel flange, raise or lower the turntable. Turntable height is adjusted by adding or removing shims between the turntable and the reel motor. Refer to Pictorial 3-7 for details.

Remove Tape reel.
Remove the screw securing the reel hub.
Remove reel hub.
Remove the three screws securing turntable.
Remove the turntable.
Install or remove shims to add or subtract required height.
Replace turntable, screws, and hub.
Load a reel of tape and repeat above test.

The following die-cut paper shims are available from Customer Service:

MC-2500-0160-05	.005 Blue
MC-2500-0160-07	.0075 Clear
MC-2500-0160-10	.010 Brown
MC-2500-0160-20	.020 Yellow

2. Head Height

Test

Check the head height; heads must be centered in the tape path.

Press SHIELD and EDIT to latch the head shields.

Press PLAY.

Observe the tape movement across the heads. Tape should be centered between the top and bottom track shields of each head.

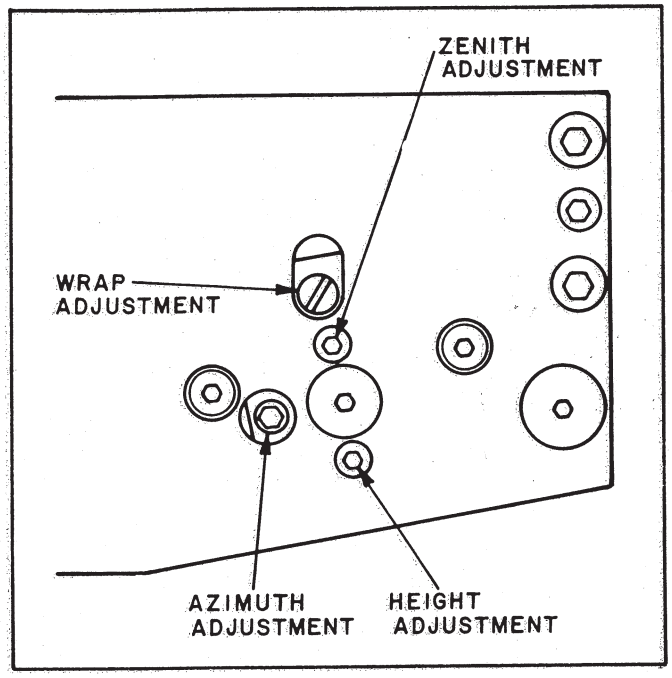


Figure 7-1 Head Adjustments

If Adjustments Are Necessary

If the tape does not split the track shields, turn the height and zenith adjustment screws to raise or lower the head. The erase head has no height adjustment. Adjust the head height until the visible part of the top track shield is the same width as the visible part of the bottom track shield. Turning the height adjustments clockwise raises the head. Always turn the height and zenith screws the same number of turns.

NOTE: Turning the height and zenith screws corrupts the azimuth alignment. The azimuth adjustment must be turned in the opposite direction as the height adjustments to correct the azimuth. Always follow this adjustment with the head zenith and azimuth tests; then go back and recheck the height alignment.

3. Head Zenith

Test

Check the head zenith alignments, head surfaces must be parallel to the fixed tape guides.

CAUTION: The head surfaces will be damaged if the alignment block is allowed to slide across the heads.

Gently lay the alignment block against the left fixed tape guide and the erase head. Both surfaces should be paralled, that is, the block should lie flat against both surfaces and should not move if you try to rock it back and forth at the corners.

Gently lay the alignment block against the erase head and the record head. Both surfaces should be parallel.

Gently lay the alignment block against the record head and the reproduce head. Both surfaces should be parallel.

Gently lay the alignment block against the reproduce head and the right fixed tape guide. Both surfaces should be parallel.

If Adjustments Are Necessary

If any head is not parallel to the fixed tape guide, turn the zenith adjustment screw, tilting the head until the surfaces are parallel.

4. Tape Lifter

Test

a. Check the parallelism of the tape lifter arm.

Load a roll of tape.

Press SHIELD and EDIT to latch the head shields.

Press PLAY.

Move the manual tape lifter control towards the left and lift the tape away from the heads. The tape should not skew up or down. If the tape skews in either direction, the lifter is not parallel to the tape path.

b. Check the travel of the tape lifter arm.

Press SHIELD.

Press STOP.

In the relaxed position the tape lifter arm should be approximately 1/8 inch behind the tape. Slowly move the manual tape lifter control to the left. Listen for the click of the microswitch. The microswitch should click and the head shields should drop just as the tape lifter arm begins to move forward.

At the extreme left travel of the manual lifter control, the tape should be raised clear of the record and reproduce heads. The tape need not clear the erase head.

c. Check the motion of the tape lifter.

Release the manual tape lifter control. Press RWD or FWD. The tape lifter should quickly move the tape away from the heads, but not slap the tape hard enough to bounce the tape away from the tape lifter arm.

If Adjustments Are Necessary

a. If the tape lifter arm is not parallel to the tape path, adjust the tape lifter solenoid mounting bracket. The solenoid is mounted on three studs. The angle of the lifter arm is changed by turning the hex nuts on these studs. Make small adjustments only. Re-check for tape skewing.

b. The limits of travel for the tape lifter are controlled by cams mounted on the bottom of the deck. The cam on the right sets the clearance behind the tape. The cam on the left sets the outward travel of the lifter arm. Rotate these cams to adjust the lifter arm travel.

The microswitch position is adjusted by loosening its mounting bracket and sliding the microswitch.

c. The speed of motion of the tape lifter is controlled by an air dashpot. Adjust the valve at the base of the air piston to obtain smooth motion in both directions.

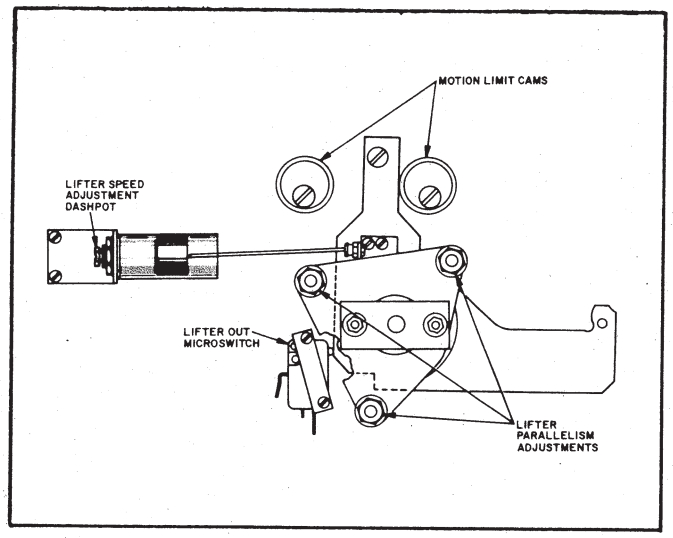


Figure 7-2 Tape Lifter Adjustments

5. Head Shields

Test

Check the movement of the head shields; they should move up and down smoothly without bouncing at the end of their travel.

Press SHIELD. The shields should move down and stop without bouncing.

Press STOP. The shields should move up and stop without bouncing.

If Adjustments Are Necessary

If the shields bounce at the bottom of their travel the brake is too loose. If the shields do not move all the way down the brake is too tight. Adjust the solenoid brake by loosening the locking nut and turning the BRASS adjustment screw. Do not loosen the other two screws which secure the shield lifter arm to the solenoid.

If the shields bounce at the top of their travel, adjust the air dashpot linked to the lever assembly. Dampen the bouncing by turning the valve nut at the base of the dashpot.

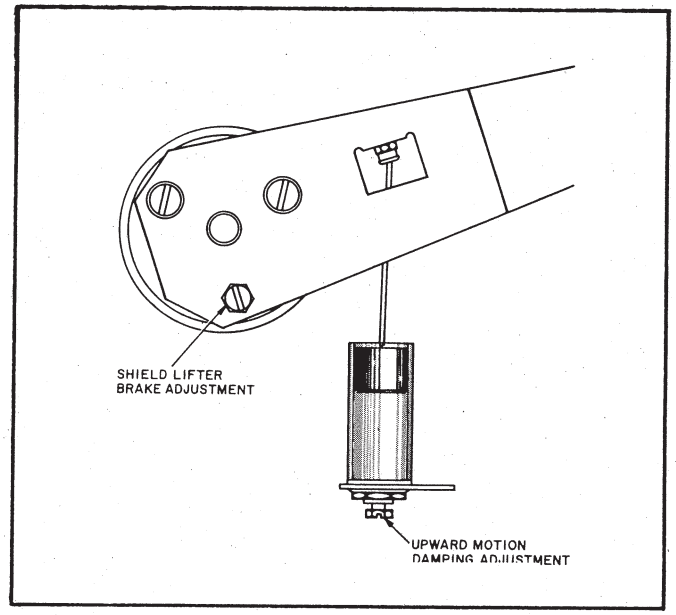


Figure 7-3 Shield Lifter Adjustments

6. Capstan Pinch Roller

Test

Check the Capstan Pinch Roller tension using a spring scale.

The pinch roller should exert a 5 to 6 pound force against the Capstan.

Attach the spring scale to the pinch roller shaft under the roller wheel. (The roller may have to be removed and replaced to attach the spring scale.)

Press PLAY.

Press your finger lightly against the pinch roller so that you can feel it turning.

Pull the spring scale toward the rear of the tape deck keeping the scale perpendicular to the arm. Note the scale reading just as the pinch roller begins to slip. Scale should read between 5 and 6 pounds (approximately 2½ kgm).

If Adjustments Are Necessary

If the tension is not between 5 and 6 pounds, adjust the lock nut at the end of the solenoid pull rod. Unlatch and open the transport deck plate. Turn the lock nut only a fraction of a turn and recheck the tension. Repeat until tension is within tolerance.

7. Dancer Arm

Check the damping action of the dancer arm. The dancer arm should be critically damped and the tape should not leave the surface of the arm.

Shuttle half of the tape onto the take up reel to balance the load between both reels. Toggle the transport between PLAY and STOP several times and observe the action of the dancer arm. The arm should move smoothly without being sluggish or oscillating.

If Adjustments Are Necessary

If the motion of the dancer arm is sluggish or if the tape leaves the surface of the dancer arm, it is overdamped. If the dancer arm flutters or oscillates, it is underdamped. Turn the valve adjustment at the base of the air dashpot to obtain critical damping. Never turn this adjustment more than ¼ turn before re-checking the damping as described above.

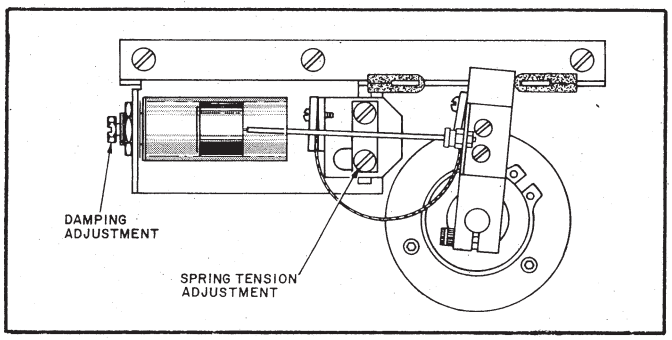


Figure 7-4 Dancer Arm Adjustments

8. Reel Motor Brakes

Test

a. Test the braking tension of both turntables in both directions.

Turn power off.

Remove the reels from both turntables.

Move the turntables by hand. The supply motor should brake hard in the counter-clockwise direction and only half as hard in the clockwise direction. The take up reel should brake hard in the clockwise direction and only half as hard in the counter-clockwise direction.

b. Check the action of the brake release solenoid.

Unplug both reel motors.

Turn power on.

Insert a card in the tape load sensor slot.

Move the turntables by hand. Both turntables should turn freely, with no drag in either direction.

If Adjustments Are Necessary

a. If the brakes are not engaged when the power is off, shorten the length of the brake bands by moving the tension spring to a different hole. If this is not sufficient, shorten the length of the brake bands by loosening the screws which connect the brake band to the brake band pivot. Slide the brake band toward the tension spring and tighten the screws.

b. If the brakes do not release completely when the brake solenoid is engaged, reposition the solenoid. Loosen the two hex nuts, slide the solenoid toward the front of the deck, and tighten the hex nuts.

These adjustments interact; re-check both conditions if either adjustment is made.

9. Tape Tension

Test

a. Test the idle tension adjustments.

Load a roll of tape.

Press STOP. The tape should not creep.

Press FWD; let the tape run for a few seconds; press STOP. Do the same in the reverse direction; press RWD and then STOP. The transport should decelerate from the fast speed and stop while keeping uniform tension on the tape.

b. Test the supply motor tension setting.

Shuttle the tape forward until there is approximately the same amount of tape on both reels.

Turn the SPEED switch to LO (15 ips).

Press PLAY. The dancer arm should be positioned mid way between its motion limit stops.

c. Test the take up motor tension setting.

Using a signal generator, record a few minutes of a 10 kHz tone onto the tape at 15 ips.

Rewind to the beginning of the tone.

Press TAPE on the remote unit.

Press PLAY and watch the channel VU meters.

Press the PUCK OFF switch to disengage the pinch roller. The VU meters should not change level, any speed change will change the output level from the tape. Press the PUCK OFF switch a second time to release it.

If Adjustments Are Necessary

If the transport fails any of the above tension tests, perform all the adjustments listed below.

a. Null the dc offset.

Tilt the transport deck to gain access to the PC boards.

Press STOP; the tape must not be moving. If the tape is creeping, turn down the idle adjustments to stop the tape.

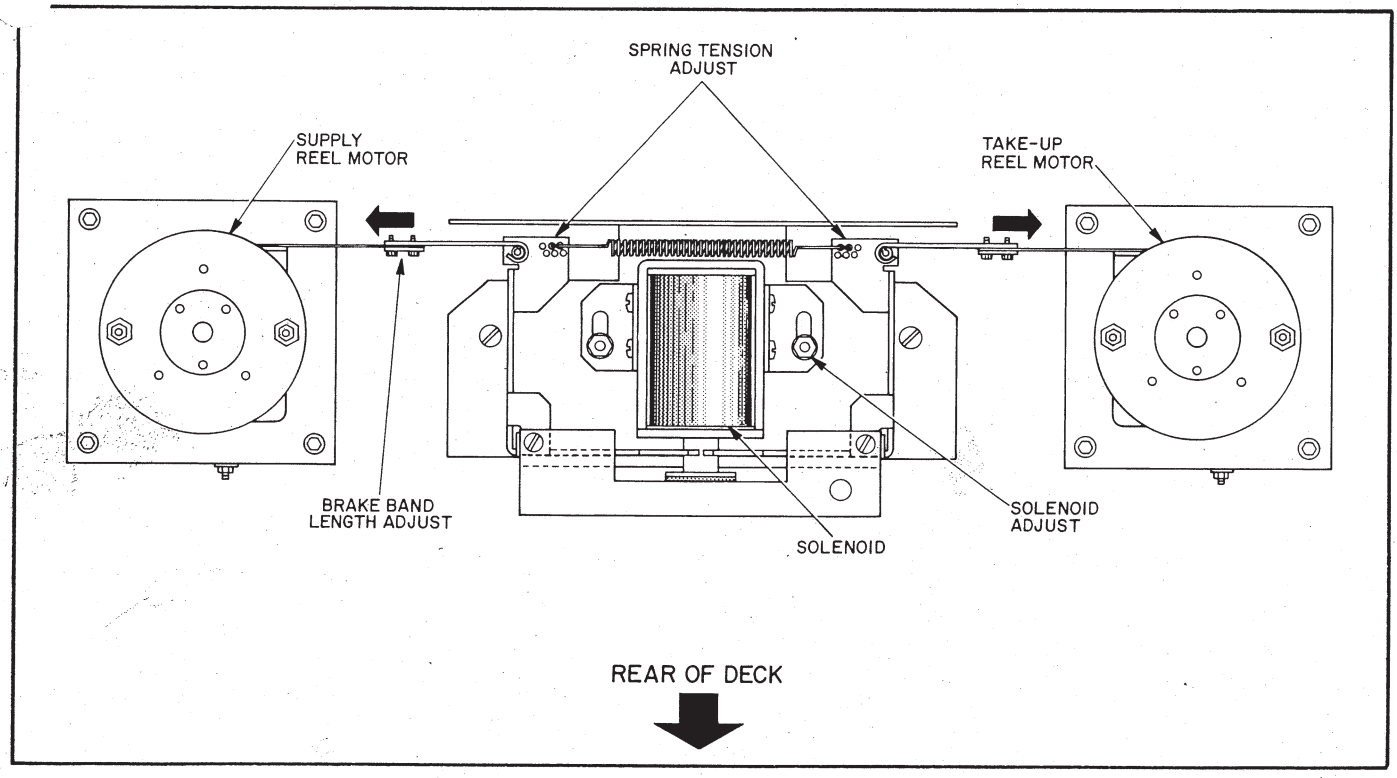


Figure 7-5 Reel Motor Brake Adjustments

Shuttle tape so both reels are even.

Press PLAY.

Adjust the LEFT TENSION potentiometer to center the position of the dancer arm.

Switch the transport from play to any other mode and back to the play mode. Re-check the position of the dancer arm. Re-adjust if necessary.

d. Adjust the take-up motor tension.

Locate the 10 kHz tone previously recorded on the tape.

Press PLAY.

Adjust the RIGHT TENSION potentiometer so that you can disengage the pinch roller with the PUCK OFF switch and not notice any change in tape speed. The level of the VU meters will increase if the tape speed increases and decrease if the tape speed decreases. There should be no change in the level when you push the PUCK OFF switch. Repeat adjustments c and d.

10. Capstan Speed

Test

Check the phase locked loop circuitry to find if it maintains lock throughout its speed range.

Turn the REFERENCE switch to VAR.

Turn the SPEED switch to LO.

Press PLAY.

Gradually turn the red speed adjustment knob from its lowest to its highest setting.

Turn the SPEED switch to HI.

Press PLAY.

Gradually turn the red speed adjustment knob from its lowest to its highest setting. The capstan's speed should change smoothly, with no sudden shifts or jerks.

If Adjustments Are Necessary

a. Adjust the capstan tachometer output.

Remove the bell cover from the bottom of the capstan motor.

Connect the oscilloscope probe to TP 1 on the Capstan Tach Board.

Turn the REFERENCE switch to VAR.

Turn the SPEED switch to HI.

Turn the red speed adjustment knob fully clockwise.

Press PLAY.

Adjust the cam on the Capstan Tach Board to obtain minimum amplitude jitter on the tachometer signal. This signal should be 800 mv peak-to-peak.

b. Adjust the VCO center frequency.

Connect a frequency counter or oscilloscope to TP 2 REF on the Phase Locked Loop Board.

Turn the REFERENCE switch to EXT.

Turn the SPEED switch to HI.

Adjust the VCO potentiometer (R18) to obtain a frequency of 19.2 kHz at TP 2 REF.

c. Set the phase locked loop circuit gain.

Connect the oscilloscope probe to TP 3 ø.

Turn the REFERENCE switch to FIX.

Adjust the GAIN potentiometer (R42) so that the average duty cycle of the waveform is 30%.

11. Manual Velocity Control

Test

a. Check for proper sensitivity adjustment.

Touch the MVC joystick. The red LED on the end of the joystick should illuminate and the tape should move in the direction indicated by the position of the joystick.

Release the joystick. The LED should turn off and the tape should stop.

Quickly toggle between FWD and RWD. This action should not falsely trigger the MVC; the LED should not flash.

b. Check the centering of the joystick.

Move the joystick to either side.

Slowly move the joystick to the vertical position. The tape should stop when the joystick is in the vertical position.

If Adjustments Are Necessary

a. Adjust the MVC sensitivity to prevent false triggering and to suit the user's preference.

Tilt the transport.

Turn potentiometer R3 on the Interface/ Lamp Driver Board clockwise to increase the sensitivity; counter-clockwise to decrease the sensitivity.

b. Set the center position of the joystick.

Move the joystick until the motion null position is reached.

Loosen the two set screws that secure the base of the joystick potentiometer.

Do not allow the potentiometer to move; using long nose pliers on the potentiometer shaft will help.

Move the joystick to the vertical position and tighten the set screws.

7.3 Audio Alignment

NOTE: Prior to aligning the audio electronics, check the position of the NAB/IEC switches on the Repro and Record/Cue Boards. If you intend to align the transport to NAB equalization standards, these buttons must be in their out position. If you intend to align the transport to IEC equalization standards, these buttons must be pressed in.

CAUTION: Remember that +4dBm, zero on the VU meters, equals −8 on a peak reading meter. If you are using the audio signal generator from a console equipped with peak reading light meters, set the output level to −8pk.

Light meters on MCI consoles have an intensified scale marker identifying the −8 peak level.

1. Input and VU Meter Calibration

a. Input Calibration

Set the signal generator controls for a 1 kHz sine wave output at +4 dBm.

Apply the 1 kHz signal to the line input of every channel.

Press INPUT on the remote unit.

Connect the ac voltmeter to the channel line output.

Adjust the IN CAL potentiometer on the Record/Cue Board to obtain a +4 dBm reading on the ac voltmeter.

b. VU Meter Calibration

Adjust the potentiometer on the Meter Buffer Board, R5, for a 0 VU level on the channel VU meter.

2. Record Head Wrap and Azimuth

WARNING: Improper record head wrap will greatly increase the wear and substantially shorten the lifetime of the head.

a. Record Head Wrap

Load a 15 ips reproduce alignment tape.

Turn the REFERENCE switch to FIX.

Turn the SPEED switch to LO (15 ips).

Press the AUTO button on the remote unit.

Playback the 10 kHz tone from the alignment tape.

Adjust the wrap cam directly above the record head to obtain a maximum reading on the VU meters.

Turn the wrap cam clockwise and carefully note the point where the VU meter levels begin to drop.

Apply the 1 kHz signal to the line input of every channel.

Press INPUT on the remote unit.

Connect the ac voltmeter to the channel line output.

Adjust the IN CAL potentiometer on the Record/Cue Board to obtain a +4 dBm reading on the ac voltmeter.

b. VU Meter Calibration

Adjust the potentiometer on the Meter Buffer Board, R5, for a 0 VU level on the channel VU meter.

2. Record Head Wrap and Azimuth

WARNING: Improper record head wrap will greatly increase the wear and substantially shorten the lifetime of the head.

a. Record Head Wrap

Load a 15 ips reproduce alignment tape.

Turn the REFERENCE switch to FIX.

Turn the SPEED switch to LO (15 ips).

Press the AUTO button on the remote unit.

Playback the 10 kHz tone from the alignment tape.

Adjust the wrap cam directly above the record head to obtain a maximum reading on the VU meters.

Turn the wrap cam clockwise and carefully note the point where the VU meter levels begin to drop.

Turn the wrap cam counter-clockwise and carefully note the point where the VU meter levels begin to drop.

Turn the wrap cam clockwise again until it is exactly half way between the two drop off points found above.

Press STOP.

NOTE: It is good practice to recheck the head wrap to insure proper alignment. With a grease pencil, make several marks across the face of the head. Place the transport in play. The tape will erase part of the marks from the head and indicate the area of contact. This erased area must be exactly the same on both sides of the gap. If not, repeat the alignment.

b. Record Head Azimuth

Connect the channel A and B oscilloscope probes to monitor the cue output of the outside tracks.

Playback the 10 kHz tone from the alignment tape.

Adjust the azimuth screw until both sine waves on the oscilloscope are in phase.

OR

Feed the outputs of all the tracks to the mixing console and combine all channels to obtain a mono output on the monitor.

Adjust the azimuth screw for a maximum mono output.

Press STOP.

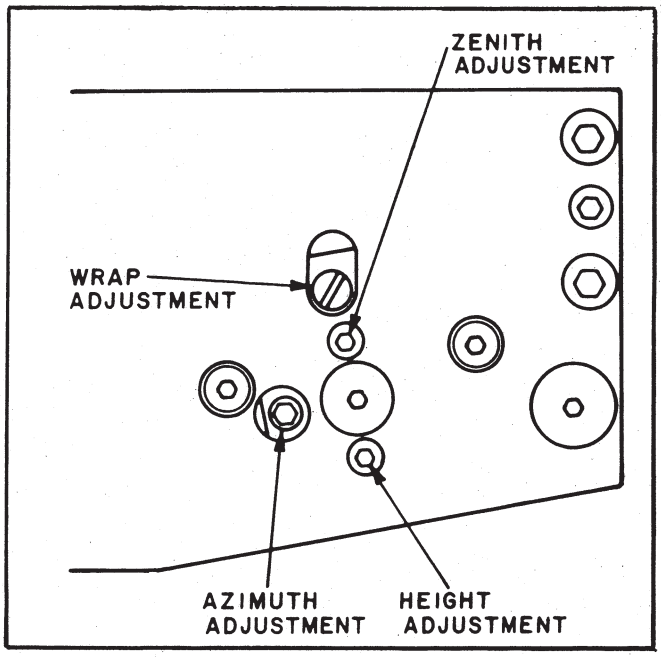


Figure 7-1 Head Adjustments

3. Reproduce Head Wrap, Height, and Azimuth

a. Repro Head Wrap

Remove the alignment tape and load a roll of bulk erased tape.

Set the signal generator controls for a 10 kHz output at +4 dBm.

Apply the 10 kHz signal to the line input of every channel.

Press all the individual channel RECORD-READY buttons on the remote unit.

Press the TAPE button on the remote unit.

Press PLAY and RECORD, record several minutes of the 10 kHz tone on the tape.

Press STOP.

Rewind to the beginning of the recording and playback the 10 kHz tone.

Adjust the repro head wrap cam to obtain a maximum reading on the VU meters.

Turn the wrap cam clockwise and carefully note the point where the VU meter levels begin to drop.

Turn the wrap cam counter-clockwise and carefully note the point where the VU meter levels begin to drop.

Turn the wrap cam clockwise again until it is exactly half way between the two drop off points found above.

b. Repro Head Height

Adjust the repro head height screw to obtain maximum output on the VU meters. Turn the zenith screw exactly the same amount and in the same direction as the height screw.

c. Repro Head Azimuth

Adjust the azimuth screw until the two sine waves on the oscilloscope are in phase. (Or, use the console as in 1.b.)

Press STOP.

Press all the individual channel RECORD-READY buttons to take the transport out of record-ready mode.

4. Reproduce and Cue Level

a. Repro Level

Remove the bulk erased tape and load the 15 ips reproduce alignment tape.

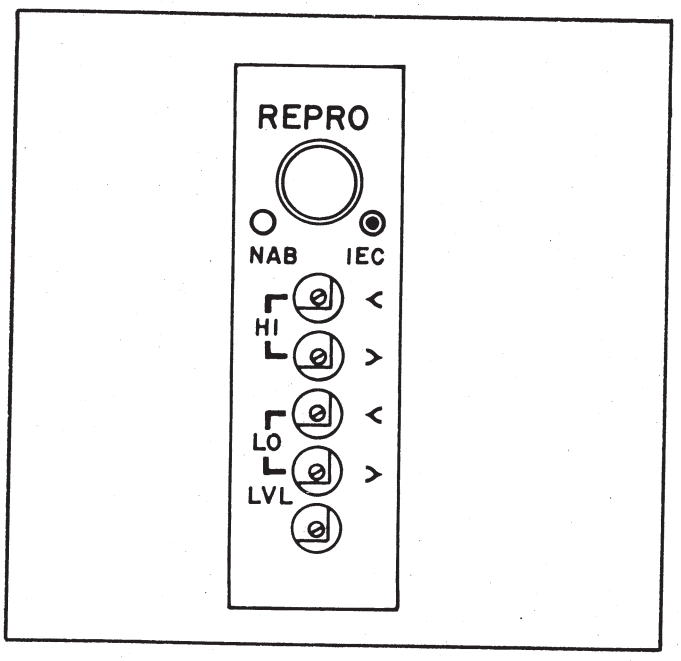


Figure 7-7 Repro Adjustments

Playback the level set tone from the alignment tape.

Adjust the REPRO LVL potentiometer on the Reproduce Board for a 0 VU level on the channel meter.

b. Cue Level

Press the AUTO button on the remote unit.

Adjust the CUE LVL potentiometer on the Record/Cue Board for a 0 VU level on the channel meter.

5. Reproduce and Cue High Frequency < Equalization

a. 15 ips Repro and Cue <

Press the TAPE button on the remote unit.

Playback the 10 kHz tone from the alignment tape.

Adjust the REPRO LO < potentiometer on the Reproduce Card for a 0 VU level on the channel meter.

Press the AUTO button on the remote unit.

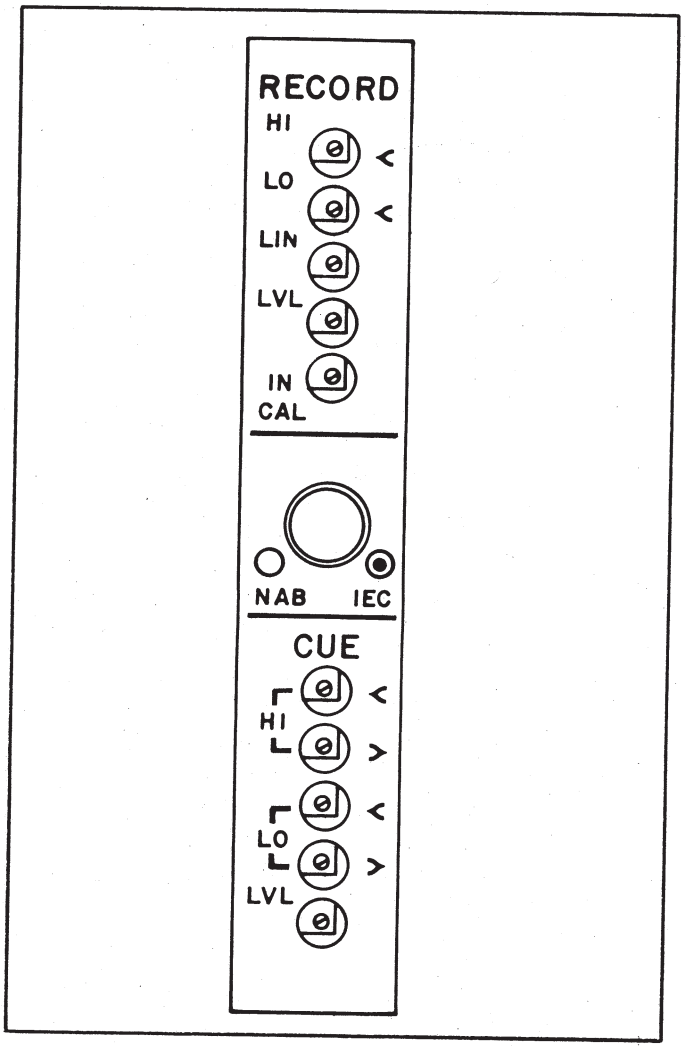


Figure 7-6 Record/Cue Adjustments

Adjust the CUE LO < potentiometer on the Record/Cue Board for a 0 VU level on the channel meter.

b. 30 ips Repro and Cue <

Remove the 15 ips reproduce alignment tape and load a 30 ips reproduce alignment tape.

Turn the SPEED switch to HI.

Press the TAPE button on the remote unit.

Playback the 10 kHz tone from the alignment tape.

Adjust the REPRO HI < potentiometer on the Reproduce Board for a 0 VU level on the channel meter.

Press the AUTO button on the remote unit.

Adjust the CUE HI < potentiometer on the Record/Cue Board for a 0 VU level on the channel meter.

Press STOP.

6. Bias and Erase Oscillators

a. Erase Voltage

Turn power off.

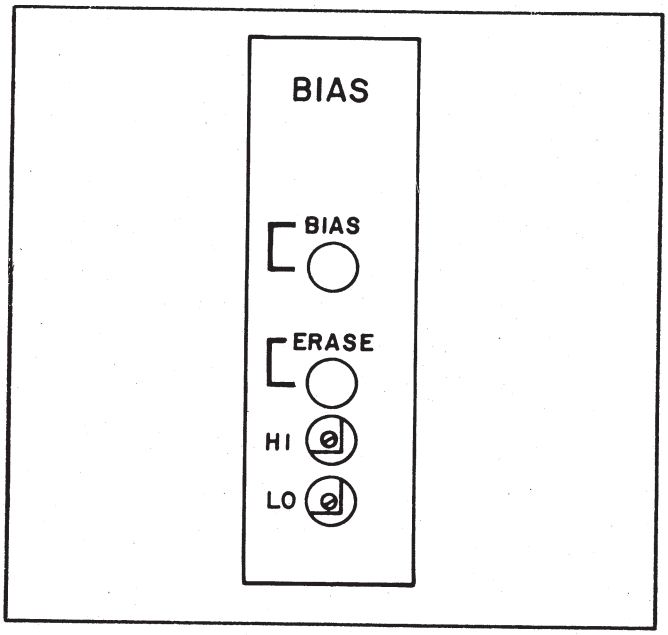


Figure 7-8 Bias Adjustments

Remove the Bias Board. Plug in the Extender Board (PCA9000-0164-00). Connect the Bias Board to the Extender Board.

Turn power back on.

Connect the dc volt meter to test point TP2 on the Bias Board.

Press PLAY and RECORD.

Adjust transformer T2 on the Bias Board for a maximum voltage at TP2.

Adjust the erase peak capacitor, C20, for the following voltage at TP2:

8 track . . . . 0.65 volts dc
16 track . . . . 0.65 volts dc
24 track . . . . 0.65 volts dc

b. Bias Voltage

Connect the dc voltmeter to test point TP1 on the Bias Board.

Adjust the transformer T1 for a maximum output voltage at TP1.

Press STOP.

Turn power off.

Remove the Extender Card and replace the Bias Board.

Turn power back on.

7. Over-Bias Level

NOTE: The amount of over-bias required for optimum performance depends upon the type of recording tape used and the recording speed. MCI has carefully analyzed several types of recording tape and recommends the over-biasing levels listed below. These over-biasing levels have been selected to give the minimum distortion and minimum high frequency loss over the widest range of recording fluxivity levels. Reset the over bias levels whenever the type of recording tape or the tape speed is changed.

Tape	15ips Over-Bias Level	30ips Over-Bias Level
Ampex 456	4½ dB	1¾ dB
Scotch 250	3 dB	2½ dB
Scotch 226	4½ dB	1½ dB
Agfa 468	4 dB	3 dB

a. 15ips Over-Bias

Turn the SPEED switch to LO.

Set the signal generator controls for a 10kHz output at +4dBm.

Press the TAPE button on the remote unit.

Press PLAY and RECORD.

Adjust the LO potentiometer on the Bias Board to obtain a maximum reading on the channel VU meter; note this reading.

Turn the LO potentiometer on the Bias Board clockwise to decrease the reading on the channel VU meter from the maximum reading noted above. Decrease the channel meter reading by the amount indicated in the above list for the type of tape used. For other types of recording tape not listed, follow the manufacturer's recommendations.

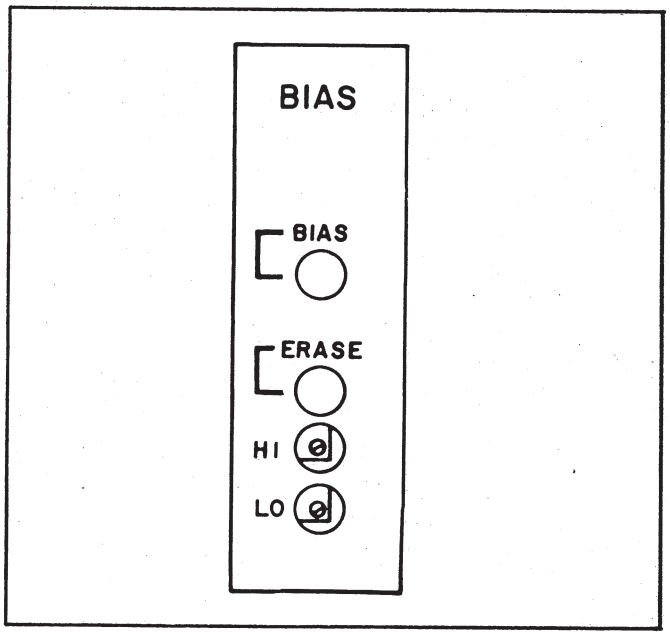


Figure 7-8 Bias Adjustments

b. 30ips Over-Bias

Turn the SPEED switch to HI.

Press PLAY and RECORD.

Adjust the HI potentiometer on the Bias Board to obtain a maximum reading on the channel VU meter; note this reading.

Turn the HI potentiometer on the Bias Board clockwise to decrease the reading on the channel VU meter from the maximum reading found above. Decrease the channel meter level by the amount indicated in the list for the type of tape used. For other types of recording tape not listed, follow the manufacturer's recommendations.

Press STOP.

8. Record Level

Adjust the output of the signal generator to 700 Hz at +4dBm.

Press the TAPE button on the remote unit.

Press PLAY and RECORD.

Adjust the RECORD LVL potentiometer on the Record/Cue Board for a 0 VU level on the channel meter.

9. Record High Frequency <

a. 15ips Record <

Set the controls on the signal generator for a 12 kHz output at +4dBm.

Turn the SPEED switch to LO.

Press all the individual channel RECORD-READY buttons on the remote unit.

Press the TAPE button on the remote unit.

Press PLAY and RECORD.

Adjust the RECORD LO < potentiometer on the Record/Cue Board for a 0 VU level on the channel meter.

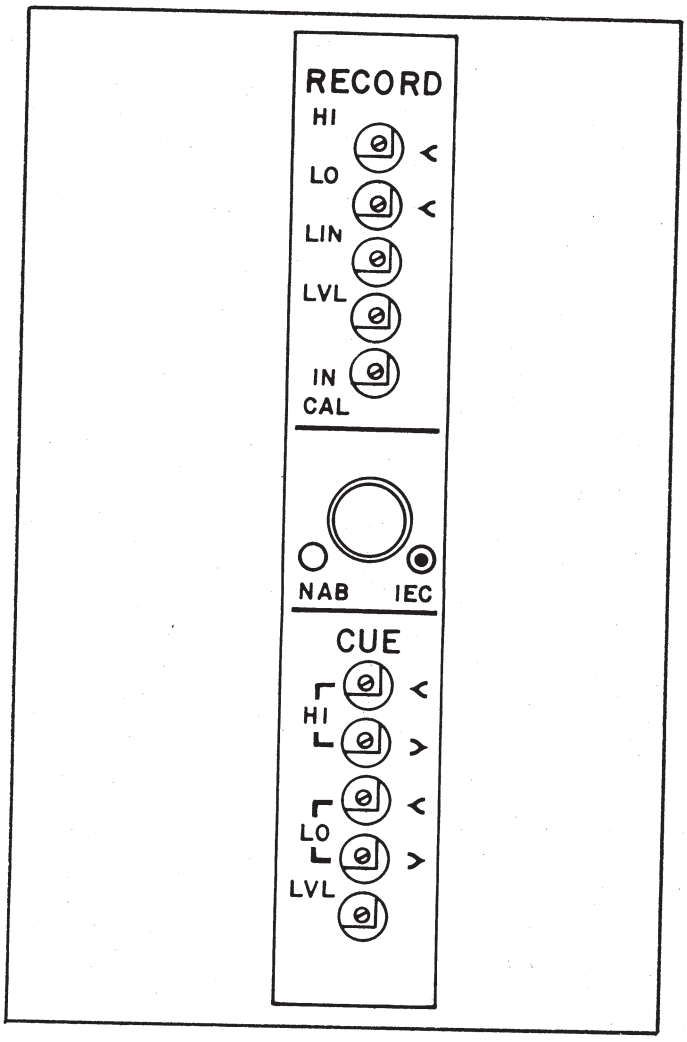


Figure 7-6 Record/Cue Adjustments

b. 30ips Record <

Turn the SPEED switch to HI.

Press PLAY and RECORD.

Adjust the RECORD HI < potentiometer on the Record/Cue Board for a 0 VU level on the channel meter.

10. Reproduce and Cue Low Frequency >

a. 15ips Repro and Cue >

Turn the SPEED switch to LO.

Set the controls of the signal generator for a 30 Hz output at +4dBm.

Press PLAY and RECORD.

Slowly vary the frequency between 30 Hz and 100 Hz.

Adjust the REPRO LO > potentiometer on the Reproduce Board so that the movement of the channel meter is centered around 0 VU.

Rewind the tape to the beginning of the 30 Hz to 100 Hz signal just recorded.

Press AUTO button on the remote unit.

Press PLAY.

Adjust the CUE LO > potentiometer on the Record/Cue Board to center the movement of the channel meter around 0 VU.

b. 30ips Repro and Cue >

Turn the SPEED switch to HI.

Press the TAPE button on the remote unit.

Press PLAY and RECORD.

Slowly vary the frequency of the signal generator between 30 Hz and 100 Hz.

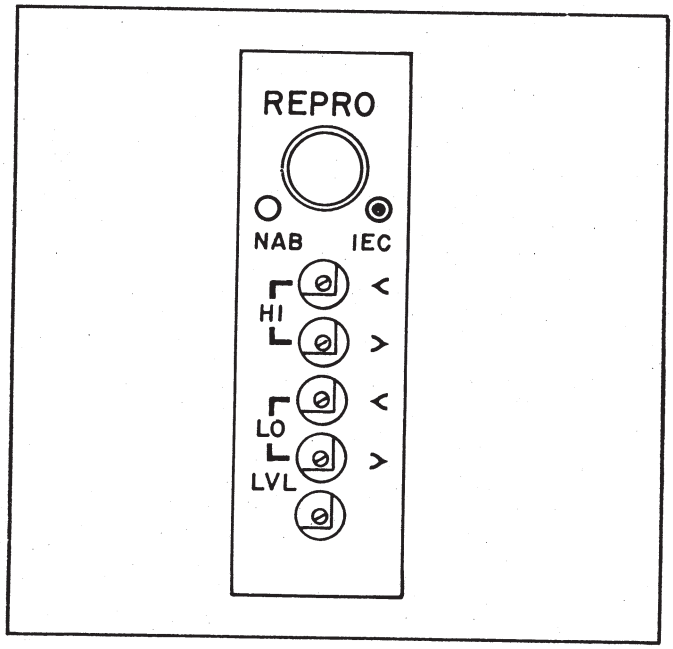


Figure 7-7 Repro Adjustments

Adjust the REPRO HI > potentiometer on the Reproduce Board to center the movement of the channel meter around 0 VU.

Rewind the tape to the beginning of the 30 Hz to 100 Hz signal just recorded.

Press the AUTO button on the remote unit.

Press PLAY.

Adjust the CUE HI > potentiometer on the Record/Cue Board to center the movement of the channel meter around 0 VU.

Press STOP.

11. Erase Head Wrap

Set the controls on the signal generator for a 1kHz output at +4dBm.

Press PLAY and RECORD. Record several minutes of the 1kHz tone.

While recording, connect the wave analyzer to the line output. Adjust the wave analyzer for a zero reading.

Rewind the tape to the beginning of the 1kHz tone just recorded.

Disconnect the signal generator from the channel line inputs.

Press PLAY and RECORD. The wave analyzer should read −80dB.

Adjust the erase head wrap cam to obtain a minimum reading on the wave analyzer.

Press STOP.

12. Noise Test

a. Reproduce Signal-to-noise Ratio Measurement.

Remove the roll of tape. Place a card in the tape load sensor.

Connect the input of the weighting network, shown in the figure, to the channel line output.

Connect an ac volt meter to the output of the weighting network.

Press SHIELD to unlatch the head shields.

Press STOP.

Press TAPE button on the remote unit.

The noise reading should be less than −62dBm.

b. Cue Signal-to-noise Ratio Measurement

Press the AUTO button on the remote unit.

The noise measurement should be less than −54dBm.

c. Record Signal-to-noise Ratio

Remove the card from the tape load sensor.

Load a roll of bulk erased tape.

Press the TAPE button on the remote unit.

Press PLAY and RECORD.

The noise measurement should be less than −58dBm.

Press STOP.

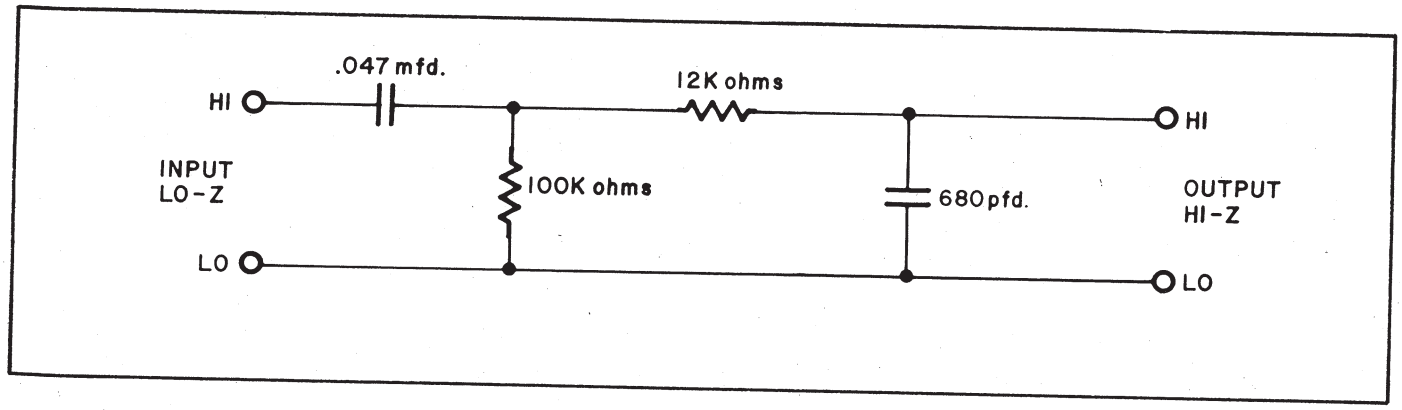


Figure 7-9 Weighting Network

SECTION 8
TROUBLESHOOTING

8.1 Introduction

Do not attempt to troubleshoot or repair this tape machine unless you have a thorough understanding of its operation and circuitry. To familiarize yourself with the tape transport's operation, read this manual and use the block diagrams to follow the signal flow through the schematics.

MCI conducts training seminars at its production facilities covering the theory of operation, alignment, and troubleshooting procedures for all current MCI products. We suggest that technicians involved in the maintenance and repair of MCI equipment attend our training seminar. Contact the Customer Service Department for information on class schedules and enrollment.

It is essential that you have the proper tools and test equipment in order to properly maintain your tape transport. These are listed in Section 3. But remember, the most important troubleshooting tool available is your knowledge of the equipment.

8.2 Control Logic Board

The Control Logic Board comes equipped with its own troubleshooting aid, the Logic Annunciator Board, PC-2500-0177-00. LEDs on this board indicate the logic level of the output commands from the control logic. Each LED is labeled; the following list gives the command signal name corresponding to the abbreviation printed on the PC board.

Table 8-1

Logic Annunciator Board LEDs

Al Enab	Autolocator enable command
DMVC	Deck manual velocity control
RMVC	Remote manual velocity control (always off)
MVC	Main manual velocity control command
F Fet	Fast FET command
Lifter	Tape Lifter out command
Rw Cmd	Rewind command
Rw Lt	Rewind light command
FF Cmd	Fast forward command
FF Lt	Fast forward light command
Bks	Brake release command
Stop	Stop command
R Idle	Right reel motor idle command
PP Lt	Play preset light command
P Lft	Play left reel motor command
P Rt	Play right reel motor command
Rec	Record command
Rec Mom	Record momentary command
Edit	Edit command
Sh	Shield down command
Sh Lt	Shield light command

A truth table, Table 8-2, summarizes the operation of the Logic Annunciator Board. Each column corresponds to one of the LEDs. To use the board, press the transport control, or remote control, to place the machine in each of the modes listed. In each mode check the condition of the LEDs with the truth table. Any mismatch between the truth table and the LEDs indicates a problem. Table 8-3

can direct you to the IC on the Control Logic Board which is probably malfunctioning.

The logic diagrams in Section 3, Figures 3-2 through 3-7, detail the logic flow for every control mode. Also, the schematic of the Control Logic Board, SC2500-D-027, indicates the function of each IC chip. Using the logic diagrams and the schematic you can easily trace back from the missing command signal to the faulty IC.

Table 8-2

Logic Annunciator Truth Table

LED / COMMAND	All Enab	DMVC	RMVC	MVC	FFet	Lifter	RwCmd	RwLt	FFCmd	FFLt	Bks	Stop	Idle	PPLt	PLft	PRt	Rec	Rec Mom	Edit	Sh[1]	Sh Lt[1]
RWD	on	on			on	on	on	on			on	√	√							on	
FWD	on	on			on	on			on	on	on	√	√							on	
STOP	on[2]	on									on	on	on							on	√
PLAY	on	on									on			on	on	on				√	√
RECORD	on	on									on			on	on	on	on	[3]			
EDIT		on									on		on		on				on	on	on
MVC		on		on	on						on										
LATCHED MVC	on	on		on	on	on					on									on	
AUTOLOCATE	on	on			on	on		on		on	on	√	√							on	
NO TAPE		on																			
MANUAL TAPE LIFTER OUT	on	on									on									on	

[1] Always on if shield is latched.
[2] Off while STOP is pressed down.
[3] On while RECORD is pressed down.

Table 8-3

Control Logic Troubleshooting

LED:	POSSIBLE CAUSE:
Al Enab	IC16, 8, 11, 4, 5, 18, 12, 7, 6, 20, 17, 9, 2, 10, or 3
DMVC	IC1
RMVC	Not used
MVC	IC8, 16, 15, 5, 18, 12, 20, 7, 17, 11, 4, 10, 3, 9, or 2
F Fet	IC17, 8, 9, 2, 5, 11, 4, 10, 3, 16, 15, 12, 20, 7, 6, or 18
Lifter	IC17, 16, 9, 2, 10, 3, 18, 8, 15, 5, 12, 7, 6, or 20
Rw Cmd	IC9, 2, 5, 11, 4, 10, or 3
Rw Lt	IC19, 9, 2, 5, 11, 4, 10, or 3
FF Cmd	IC10, 3, 5, 11, 4, 9, or 2
FF Lt	IC19, 10, 3, 5, 11, 4, 9, or 2
Bks	IC19, 5, 7, 6, 17, 16, 10, 3, 9, 2, 18, 8, 15, 12, 11, 4, or 20
Stop	IC5
R Idle	IC19, 20, 21, 18, 12, 17, 8, 15, 5, 7, 10, 3, 9, 2, 6, 16, 11, or 4
PP Lt	IC11, 4, 5, 16, 8, 15, 10, 3, 9, or 2
P Lft	IC12, 20, 7, 6, 11, 4, 16, 8, 15, 9, 2, 10, or 3
P Rt	IC18, 12, 20, 7, 6, 11, 4, 16, 8, 15, 5, 17, 9, 2, 10, or 3
Rec	IC6, 5, 18, 12, 7, 11, 4, 16, 17, 8, 15, 9, 2, 10, or 3
Rec Mom	IC7, 6, 5, 18, 12, 20, 11, 4, 16, 8, 17, 15, 9, 2, 10, or 3
Edit	IC7, 6, 17, 16, 9, 2, 18, 8, 15, 5, 12, 10, 3, 11, or 4
Sh	IC21, 13, 14, 20, 17, 16, 8, 15, 18, 10, 3, 9, 2, 11, or 4
Sh Lt	IC14, 20, or 5

8.3 Analog Torque Board

The Analog Torque Board contains servo loops which are always active whenever power is applied and tape is in the tape load sensor. Pinpointing a faulty component in a closed loop servo can be tricky, since the input to every component depends on its output. However, a tachometer signal can be generated by turning the reel motor by hand. This is a convenient way of generating a test signal if the loop is dead.

To aid troubleshooting efforts, the following list contains some problems and the corresponding possible cause.

No tape motion, any mode
Check IC13 or IC14

No take-up tension in idle or high idle speed
Check IC4 or IC5

No supply tension or tape spill in play
Check IC3 or IC7

No, or slow, rewind speed
Check IC18 or IC19

No, or slow, fast forward speed
Check IC18 or IC19

Follow the tape tension adjustments in Section 7. A misaligned torque board will appear to be malfunctioning.

The Analog Torque Board requires the proper inputs from the Control Logic Board to operate. Use the Logic Annunciator to check these inputs. In play mode, the Analog Torque Board requires the tape velocity signal from the Phase Locked Loop Board.

The driver circuitry for the reel motors are located inside the power supply. See the power supply schematic in Section 6 for these drivers.

8.4 Phase Locked Loop Board

The Phase Locked Loop Board operates the capstan motor during the play and record modes. The Photo Sensor Board provides the tachometer feedback signal from the capstan motor. If the Phase Locked Loop Board is receiving its command signals from the control logic, suspect the Phase Locked Loop Board, the Photo Sensor Board, or the capstan motor as the source of the capstan problem.

Note that the Phase Locked Loop Board provides the tape velocity signal to the Analog Torque Board. Loss of this signal will affect the reel motor servo operation. All other problems will affect the capstan operation.

Table 8-4 lists typical waveforms found on the Phase Locked Loop Board operating at medium speed with a fixed reference. The duty cycle of the waveform at TP3 is adjustable; refer to Section 7 for the proper set up of the duty cycle. All the other waveforms are fixed; if the measured waveform does not agree with the table, a fault exists on the board.

If the capstan motor is not working, only the reference (crystal) frequencies will be present. In these cases, tachometer signals can be generated by turning the capstan by hand.

Table 8-5 lists some common capstan failures. The table can help direct you to the faulty component.

Table 8-4
Phase Locked Loop Board Waveforms

Test Point	Pulse Width	Period	Peak Voltage
IC1 pin 6	(triangular)	10usec	4v
IC2 pin 6	5usec	10usec	11.5v
TP2	50usec	100usec	4v
IC3 pin 12	50usec	100usec	4v
IC6 pin 1	10usec	50usec	4v
IC6 pin 6	50usec	100usec	4v
IC6 pin 7	100usec	200usec	4v
IC15 pin 3	20usec	100usec	4v
TP1	20usec	100usec	6v
IC8 pin 8	0.2usec	100usec	4v
IC8 pin 9	0.2usec	100usec	4v
TP3	30usec	100usec	4v

Table 8-5
Capstan Troubleshooting

Capstan motor runs in stop mode
Check IC13

Capstan motor runs away in play mode
Check for broken wires on the Capstan Tach Board
Check IC1 on the Capstan Tach Board
Check tachometer connection on Phase Locked Loop Board

Sluggish start up time in play mode
Check IC15, it may be oscillating

Capstan does not run in fixed reference, but runs normally in variable reference
Check IC1, IC2, and IC3

Capstan does not run in variable reference, but runs normally in fixed reference
Check IC4 and IC5

Capstan operates normally in high speed, but not in low speed
Check IC6

Capstan will not run
Check ICs 7, 8, 11, 12, 13, and 14, Q3 and Q4

Capstan runs with uneven or jerky motion
Adjust R42, the PLL gain control

No variable speed control
Check IC16, 5, and 4

No external reference speed control
Check IC16 and IC18

8.5 Audio Electronics

Refer to the audio flow charts, Figures 4-2 and 4-3. These diagrams show the interconnections among the various audio PC boards. Pin and plug numbers are included on these diagrams so that the signal flow can be followed from board to board. Using these interconnections, the audio problem can be isolated to the printed circuit board level. Once the problem is isolated to a particular board, use standard troubleshooting techniques to locate the faulty components. Some common problems are listed in Table 8-6.

Most noise and distortion problems are the result of improper alignment. The erase, and particularly the bias voltages, are crucial. Improper bias levels will seriously degrade the performance of the audio electronics and the quality of the recording. Insure that the electronics are properly aligned. If it is impossible to align or to make an adjustment, then suspect a faulty component.

Table 8-6

Audio Troubleshooting

No output, any mode
Check IC100, IC200, IC300 on Output Module

No repro mode output
Check Q5 on the Output Module
Check IC4 on the Repro Board

No repro response below 2kHz
Check IC3 on Repro Board

Asymetrical clipping or high offset in repro
Check differential circuitry on Repro Board

No repro low frequency adjust or interactive adjustments
Check Q2 and Q3 on Repro Board

No repro high frequency adjust or interactive adjustments
Check Q4 and Q5 on the Repro Board

No input mode output
Check Q4 on the Output Module

No cue mode output
Check Q6 on the Output Module
Check relay K1, Q10, IC500, and IC800 on the Record/Cue Board

No cue response below 2kHz
Check IC800 on the Record/Cue Board

Asymetrical clipping or high offset in cue
Check Q10 and IC500 on the Record/Cue Board

No cue low frequency adjust or interactive djustments
Check Q5 and Q6 on the Record/Cue Board

No cue high frequency adjust or interactive adjustments
Check Q7 and Q8 on the Record/Cue Board

No record
Check cue relay K1 on Record/Cue Board
Check IC400, IC300, IC100, and Q3 on Record/Cue Board
Check record LED on remote unit

No high frequency recording
Check IC200, Q1 and Q2 on Record/Cue Board

Response not flat in one speed only
Check Q1, Q2 and summing resistors and capacitors on Record/Cue Board.

Response not flat in both speeds
Align Record/Cue and Bias Boards.

Repro or cue noisy
Check bias and erase circuitry
Align bias and erase

Erase but no record
Check position of bias defeat switch

VU meter not operating
Check IC1 on Meter Buffer Board

VU meter pins momentarialy on power up in repro mode
Check Q6 on Repro Board

VU meter pins momentarialy on power up in cue mode
Check Q9 and CR4 on Record/Cue Board

8.6 AutoLocator III

The AutoLocator III contains a microprocessor which is, due to the speeds at which it operates, rather difficult to troubleshoot. The most practical way to maintain the microprocessor is to keep on hand a set of replacement IC chips. These ICs are relatively inexpensive, and therefore, the most cost effective way to troubleshoot. Swap the suspected IC chips with known good chips.

As a general rule, suspect external circuitry and connections to the microprocessor rather than the microprocessor itself. Verify the regulated voltages before assuming the failure of any chip. Use Table 8-7, it lists some common failures and possible cures.

Table 8-7

AutoLocator III Troubleshooting

No operation
Check power
Check the oscillator crystal

No tape position or velocity display
Check CR3, 4, 5, and 6, and IC6 on the Processor Board

No or malfunctioning TVI
Check IC6 and IC8 on the Processor Board

No display except for the decimal point
Check IC11 on the Processor Board
Check IC1 and IC3 on the Display Board

Tape position display malfunctioning
Check for roller guide pulses to IC9, CR5 and CR6 on the Processor Board

Tape position operates in one direction only
Check IC15 on the Processor Board

No response to keyboard commands
Check keyboard switches
Check IC2 on the Processor Board

No velocity display
Check for capstan pulses
Check IC8, CR3, CR4, and IC6 on the Processor Board

No variable speed control
Check the ±15 volts on the Display Board
Check IC4, 5, and 7 on the Display Board

No mode change control
Check IC6, Q1 and Q2 on the Display Board
Check Q1 and Q2 on the Processor Board
Check the mode LEDs on the front panel

SECTION 9
SPARE PARTS

MCI offers five spare parts kits for the JH-24 to support your particular level of maintenance. This section lists the contents of each kit. These kits are available through your dealer or through MCI's Customer Service Department.

These kits are organized to support your particular level of maintenance activity. Purchase the kit or collection of kits for your requirements.

Spares kit number one (ordering number JH-24-S-KIT-1) is a collection of components which are most often used in printed circuit board level repair. Most of these components are difficult to obtain locally. Common components necessary for printed circuit board repair, such as resistors which are easily obtainable, are not included in this kit.

Spares kit number two (ordering number JH-24-S-KIT-2) contains transport switches, indicators, and controls; all are high use items.

Spares kit number three (ordering number JH-24-S-KIT-3) consists of replacement printed circuit boards and power supply assemblies. This kit is necessary for facilities performing board swapping maintenance or for responding to emergency repair situations.

Spares kit number four (ordering number JH-24-S-KIT-4) contains printed circuit boards and assemblies as does kit number three.

Spares kit number five (ordering number JH-24-S-KIT-5) contains AutoLocator III printed circuit boards and transport assemblies intended for those facilities performing extensive maintenance on their equipment.

Spares Kit # 1

JH-24-S-KIT-1

QUANTITY	DESCRIPTION	PART NUMBER
2	Capacitor, Lytic	100MF25V-CLYRF
2	Diode	1N34
2	Diode	1N4004J4
2	Diode, Zener 3.6V	1N5227-3.6V
4	Op Amp	2003P
4	Dual Op Amp	2004P
2	Transistor	2N2270
2	Transistor	2N3053
4	Transistor	2N3055-H
4	Transistor	2N3904
4	Transistor	2N3906
4	Capacitor, Lytic	47MF35V-CLYRL
2	IC, Quad 2-in NAND	7400
2	IC, Quad 2-in NOR	7402
2	IC, Hex Inverter	7404
2	IC, One Shot	74121
2	IC, Retrig One Shot	74122
2	IC, Dual Retrig One Shot	74123
2	Op Amp	741CP
2	IC, Dual 4-in NAND	7420
2	IC, Quad 2-in NOR Interface	7426
2	IC, Quad 2-in OR	7432
2	IC, Phase Comparator	7495
4	IC, Dual NOR Driver	75454
2	3A Fuse-Strip, Bias	AGC-3AMP-FB
2	Fuse-Deck, Audio Frame	AGC-5AMP-FB
2	Record/Cue Relay	AZ7-2C-24DE
1	Bias Coil	D-1021-10
2	Record Relay	HC4E-24VDC
1	Quad FET	IH5011
2	Triac, Diode	IT015
2	Dual BiFET Op Amp	LF353N
1	Voltage Regulator, 5V	LM309KC-5
4	Transistor	LM394H
1	IC, Dual Flip Flop	MC14013CP
2	4A Fuse-Deck, Power Supply	MDA-4AMP-SB
4	Transistor	MJE-3055
1	IC, VCO	NE566
4	FET, P Channel	P1086RR
3	Transistor	SP-7000-0127-01
2	Op Amp	TL081CP
2	Voltage Regulator, 18V	UA7818-UC
4	VMOS, FET	VN10KM
4	VMOS, FET	VN66AF

Spares Kit # 2

JH-24-S-KIT-2

QUANTITY	DESCRIPTION	PART NUMBER
1	Stop Switch	01-121
1	Motion Switch	01-151
4	Lamp - 24V 50MA	01-903
1	Wire Wound Resistor, 180Ω	180--OHM10%-3WW
1	100K DIP Resistor Network	4114R-001-104
6	28V Lamp 8'' lead	L28/40K
1	Red LED	MV5075C
1	Green LED	MV5274C
1	Yellow LED	MV5353
1	Tape Break Photo Cell	OPB-806
4	Potentiometer, 20K	SAPCPOT20K-18T
2	Potentiometer, 2K	SAPCPOT2K-18T
4	Potentiometer, 5K	SAPCPOT5K-18T
10	Light Bulb, VU Meter	SP-7000-0550-00
1	Light Bulb, Rec/Input	SP-7000-0550-01
2	Switch, Remote	SP-7000-2305-14

Spares Kit # 3

JH-24-S-KIT-3

QUANTITY	DESCRIPTION	PART NUMBER
1	JH-114 Transport Chimney Assy.	AS-2500-0194-36
1	JH-24 Audio Chimney Assy.	MCA0600-0604-00
1	Control Logic Board	PCA2500-0027-00
1	Solenoid Driver Board	PCA2500-0042-00
1	Interface/Lamp Driver Board	PCA2500-0416-00
1	Phase Locked Loop Board	PCA2500-0600-00
1	Analog Torque Board	PCA2600-0001-01
1	Reproduce Board	PCA9000-0146-00
1	Output Module	PCA9000-0147-00
1	Bias Board	PCA9000-0148-00
1	Record/Cue Board	PCA9000-0149-00

Spares Kit # 4

JH-24-S-KIT-4

QUANTITY	DESCRIPTION	PART NUMBER
1	VU Meter	52-5488
1	Pinch Roller	AS-6000-0237-23
1	Fan, Boxer	IMC-WS2107-FL9
1	22V Regulator Board	PCA2500-0190-00
1	Strip Board	PCA9000-0145-00
1	DC Tachometer	SP-7000-0196-01
1	Bus Board with Oscillator	WDA9000-0182-00

Spares Kit # 5

JH-24-S-KIT-5

QUANTITY	DESCRIPTION	PART NUMBER
2	EAO Switch	01-151
1	Vari-Speed Potentiometer	3540S-1-103
1	Brake Solenoid	40DC150-AX
1	Shield Dashpot	48592-1
1	Switch, Reference	73-4451
1	Switch, Speed	73-4468
1	Lifter Solenoid	810-360-528
1	Capstan Motor and Tach Assy.	ASA2500-0129-01
1	MVC Potentiometer	CM380C3
1	Dancer Arm Dashpot	B45121-1
1	Shield Down Microswitch	E2200A
1	Shield Solenoid	H15067-026
1	On/Off Toggle Switch	JBT-2223L
1	A/L III Display Board	PCA2500-0610-00
1	A/L III Processor Board	PCA2500-0611-01
1	A/L III Processor Plug On Board	PCA2500-0625-02
1	Reel Motor Assembly	SP-7000-0143-01
3	Switch	SP-7000-2305-12
2	Switch	SP-7000-2305-14
1	Molex Assortment consisting of:	
2	Molex 3cir. Recp. Lg.	03-09-1031
2	Molex 2cir. Plug Lg.	03-09-2022
2	Molex 3Hole Lock Cable	09-50-3031
1	Molex 8Hole Lock Cable	09-50-3081
2	Molex 12Hole Lock Cable	09-50-3121
2	Molex 24Hole Lock Cable	09-50-3241
1	Molex 3cir Para PC conn.	09-52-3030
1	Molex 5Pin Lock 1-3/16"	09-55-1052
1	Molex 12Pin Non-Lock 3/4"	09-64-1121
1	Molex 9Pin Non-Lock 15/16"	09-64-1092
1	Molex 12Pin Non-Lock 1-3/16"	09-64-1123
1	Molex 10Pin Chas Mtg	09-57-1105
1	Molex 4Pin Lock 3/4"	09-65-1041
1	Molex 8Pin Lock 3/4"	09-65-1081
1	Molex 12Pin Lock 3/4"	09-65-1121
1	Molex 10Pin Right Angle	09-66-1101

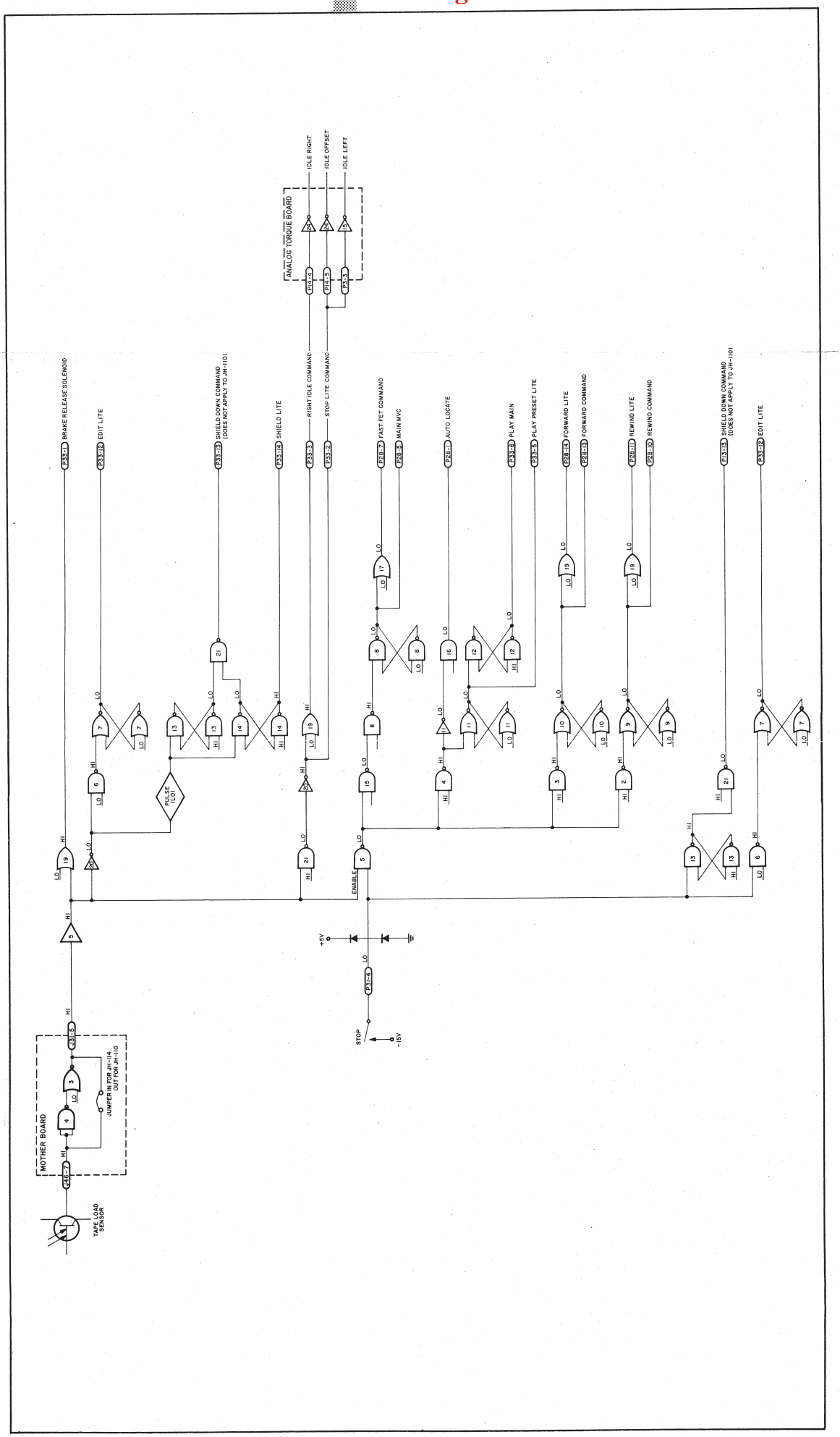


Figure 3-2 Stop Mode Logic

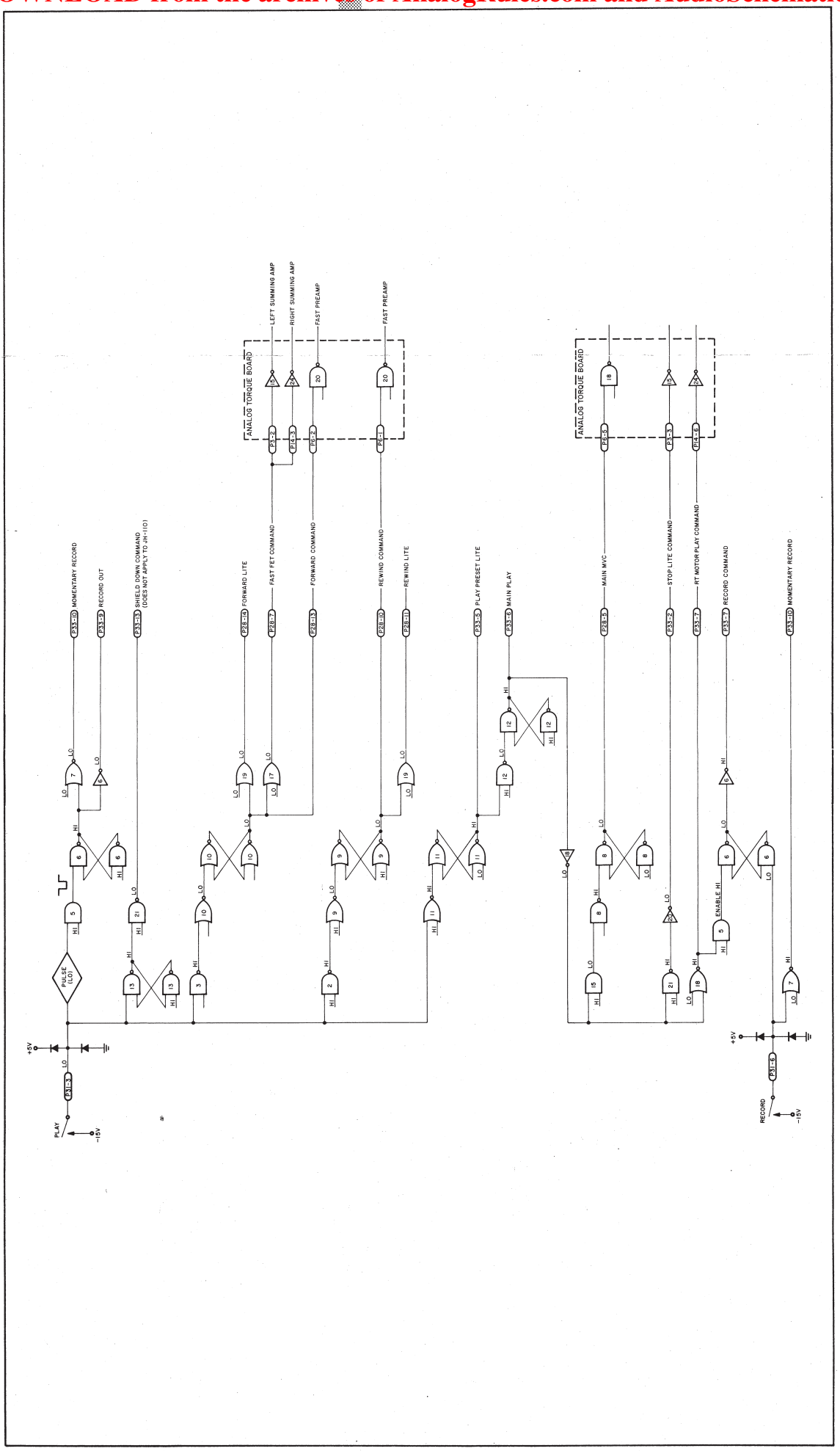


Figure 3-3 Play and Record Mode Logic

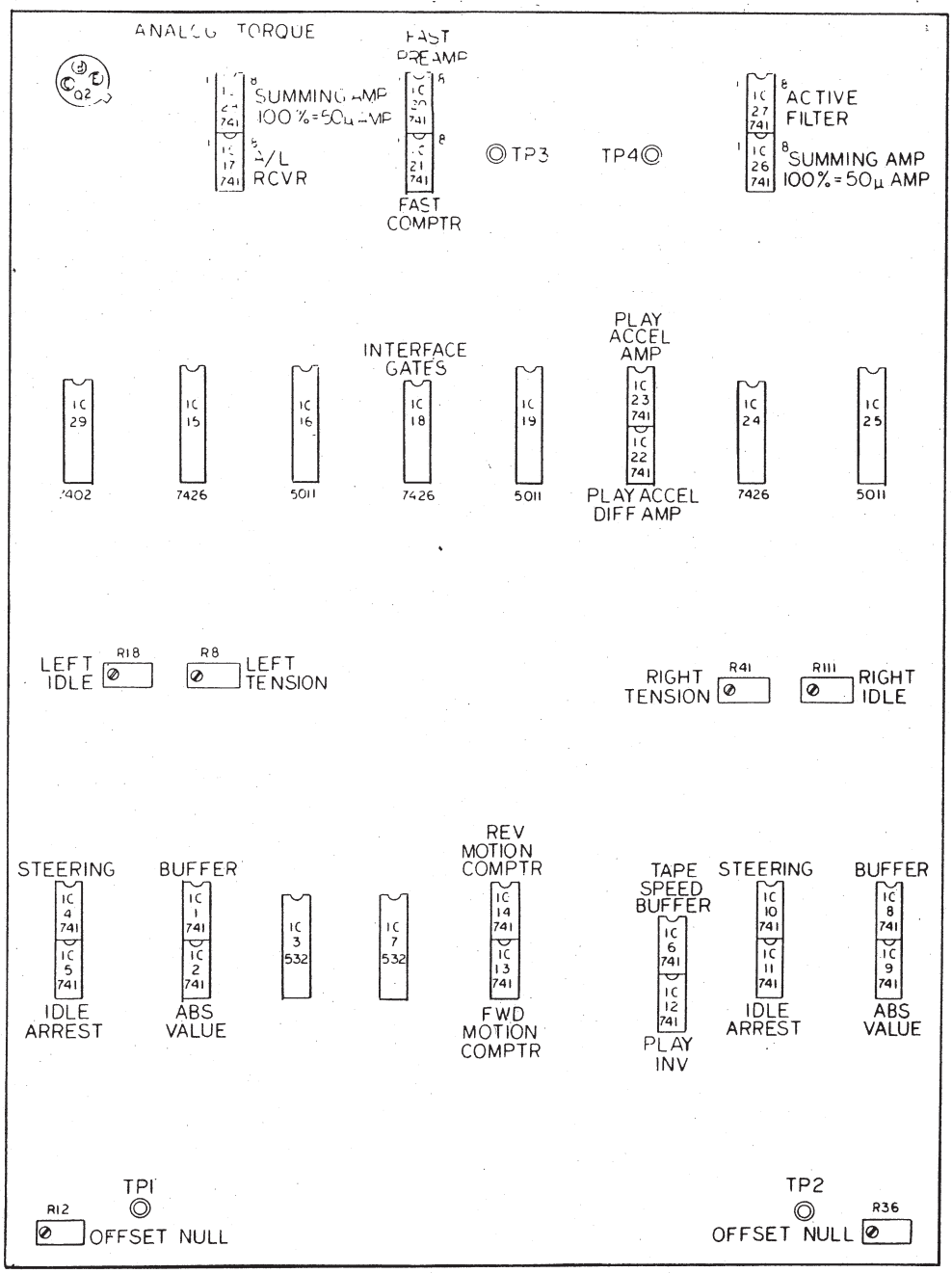
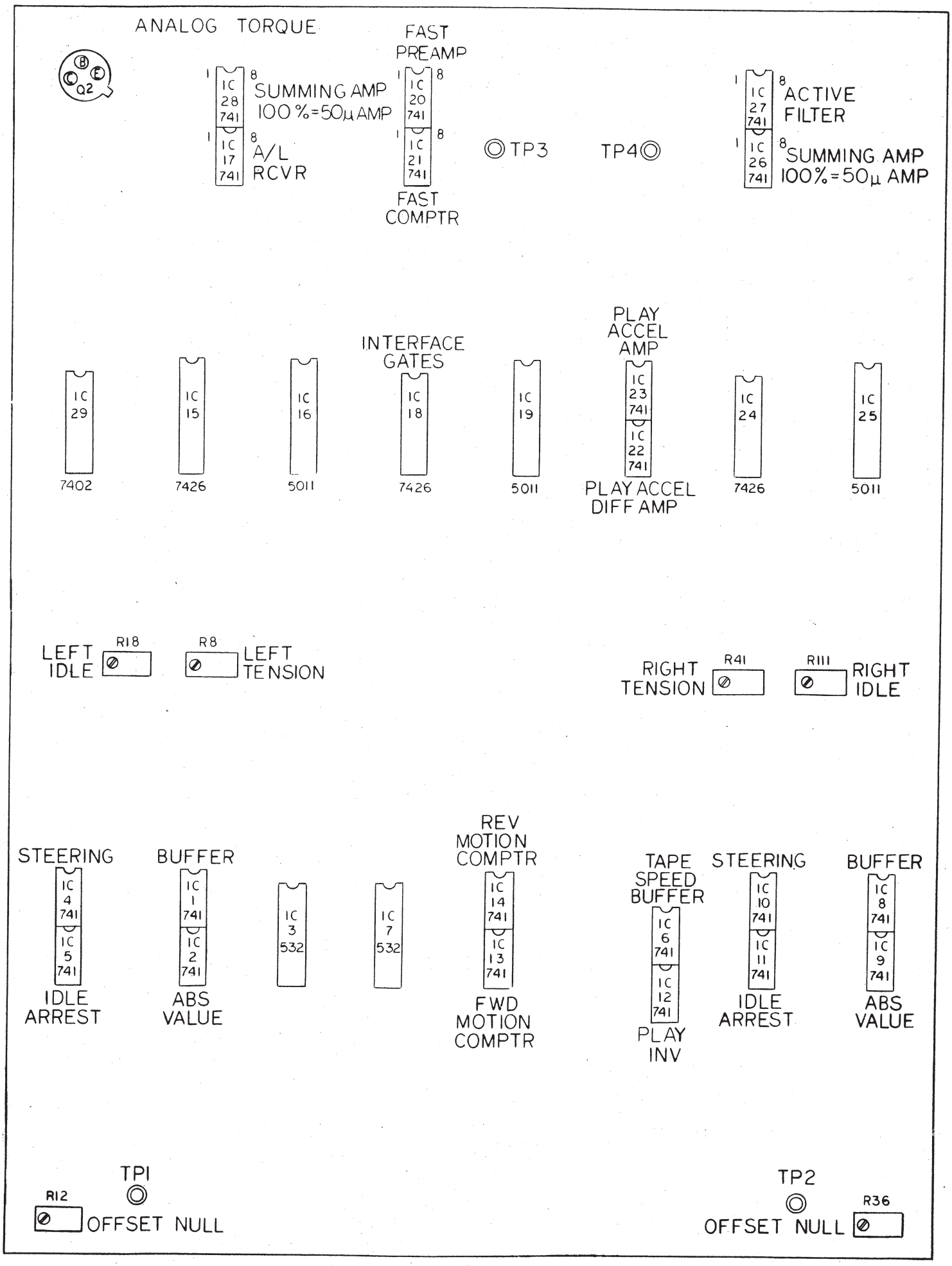
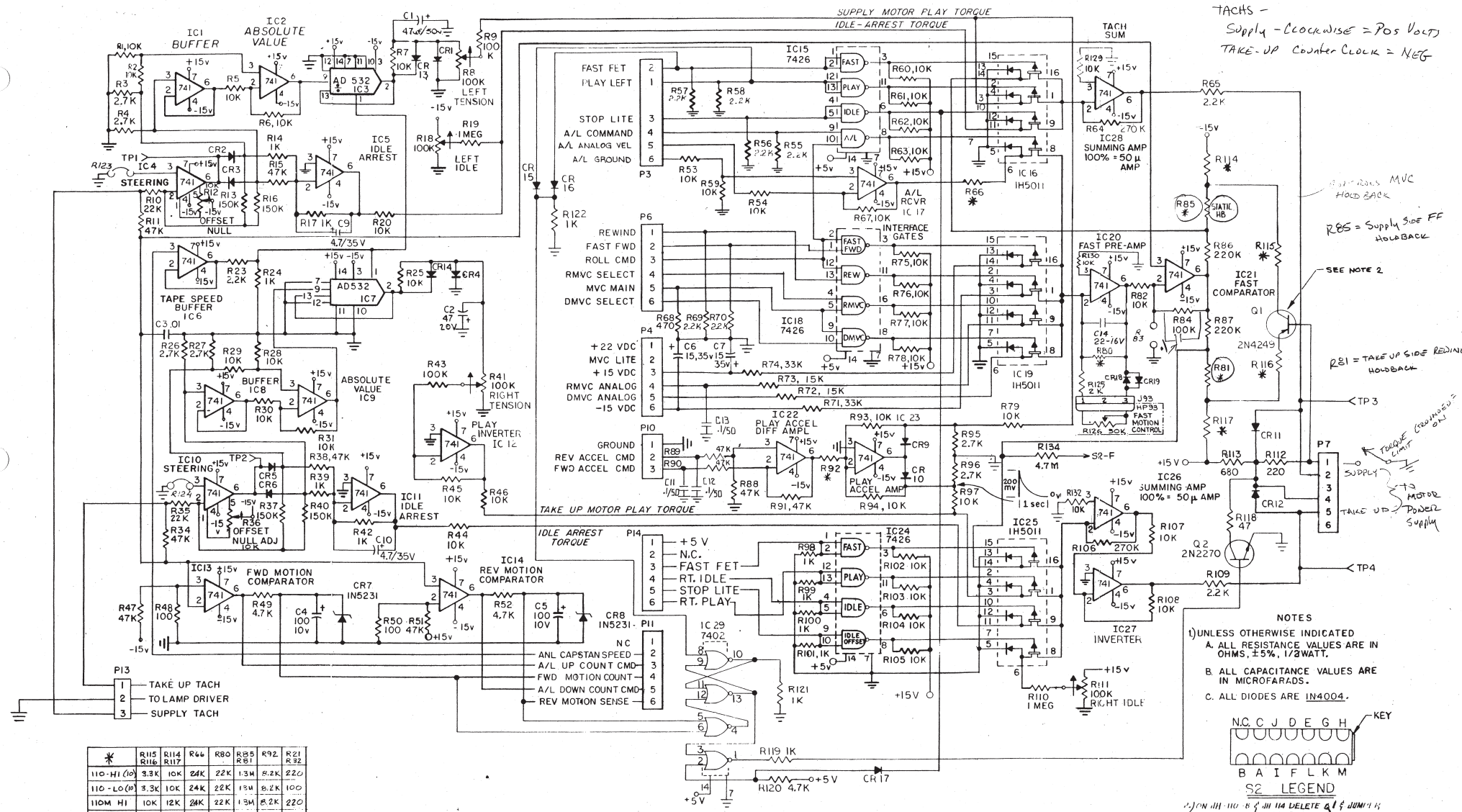


TABLE OF OPTIONAL/VARIABLE COMPONENTS

DASH #	*	R115 R116	R114 R117	R66	R80	R85 R81	R92	R71 R74	R112	Q1	JU1	JU2	CR18 CR17	J93	C1	C2	C8	CR1 CR13	CR4 CR14	R32	J1	R88 R89	CR20 CR21	R126 R127	
△01	114/24 HI	10K	12K	27K	22K	820K	3.6K	33K	JUMPER	OUT	IN	IN	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	
02	114/24 LO	10K	12K	27K	22K	820K	3.6K	33K	JUMPER	OUT	IN	IN	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	REPLACED BY-01
03	110-10.5"HI	7.5K	10K	24K	22K	1.3M	8.2K	39K	150	IN	OUT	OUT	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	
04	110-10.5"LO	7.5K	10K	24K	22K	1.3M	8.2K	39K	150	IN	OUT	OUT	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	REPLACED BY-03
05	110-14"HI	7.5K	10K	24K	22K	1.3M	8.2K	39K	OUT	IN	OUT	OUT	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	
06	110-14"LO	7.5K	10K	24K	22K	1.3M	8.2K	39K	OUT	IN	OUT	OUT	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	REPLACED BY-05
07	110M HI	10K	12K	24K	56K	1.3M	8.2K	33K	JUMPER	OUT	IN	IN	2K	IN	IN	22/25	22/25	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	
08	110M LO	10K	12K	24K	56K	1.3M	8.2K	33K	JUMPER	OUT	IN	IN	2K	IN	IN	22/25	22/25	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	REPLACED BY-07
09	10-8TK HI	10K	12K	27K	27K	680K	3.6K	33K	220	OUT	IN	IN	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	
10	10-8TK LO	10K	12K	24K	27K	680K	3.6K	33K	220	OUT	IN	IN	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	
21	19/24 W/ABS EFD	10K	12K	27K	22K	820K	3.6K	33K	JUMPER	OUT	IN	IN	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	JUMPER	IN	OUT	OUT	OUT	NOT RELEASED
△23	10-10.5" W/ABS EFD	7.5K	10K	24K	22K	1.3M	8.2K	39K	150	IN	OUT	OUT	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	JUMPER	IN	OUT	OUT	OUT	
△25	10-14" W/ABS EFD	7.5K	10K	24K	22K	1.3M	8.2K	39K	OUT	IN	OUT	OUT	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	JUMPER	IN	OUT	OUT	OUT	
△27	110M W/LO EFD	10K	12K	24K	56K	1.3M	3.6K	33K	OUT	IN	OUT	OUT	2.7K	IN	IN	22/25	22/25	OUT	IN	IN	JUMPER	IN	OUT	OUT	OUT	
△29	10-8TK W/ EFD	10K	12K	27K	27K	680K	3.6K	33K	220	OUT	IN	IN	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	JUMPER	IN	OUT	OUT	OUT	
30	10-8TK LO W/ EFD	10K	12K	24K	27K	680K	3.6K	33K	220	OUT	IN	IN	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	JUMPER	IN	OUT	OUT	OUT	
△31	110-LB. W/ EFD	10K	12K	27K	27K	680K	3.6K	33K	JUMPER	OUT	IN	IN	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	JUMPER	IN	OUT	OUT	OUT	REPLACED BY -32
△32	110-LB. W/ EFD	10K	12K	27K	27K	1M	3.6K	33K	JUMPER	OUT	OUT	OUT	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	100K	OUT	IN	IN	IN	

△ = CURRENT PRODUCTION
EFD = ELECTRONIC FLUTTER DAMPER





*	R115 R116	R114 R117	R46	R80	R85 R81	R92	R21 R32
110-HI (10)	3.3K	10K	24K	22K	1.3M	8.2K	220
110-LO (10)	3.3K	10K	24K	22K	1.3M	8.2K	100
110M HI	10K	12K	24K	22K	1.3M	8.2K	220
110M LO	10K	12K	24K	22K	1.3M	8.2K	100
110-8	10K	12K	27K	27K	680K	8.6K	220
110-14 HI	3.3K	10K	24K	22K	1.3M	8.2K	220
110-14 LO	3.3K	10K	24K	22K	1.3M	8.2K	100
114 HI	10K	12K	27K	22K	820K	3.6K	220
114 LO	10K	12K	27K	22K	820K	3.6K	100

Analog Torque Board
SC26D001

Section 3 *JH-110 SERIES* *Schematic 3*

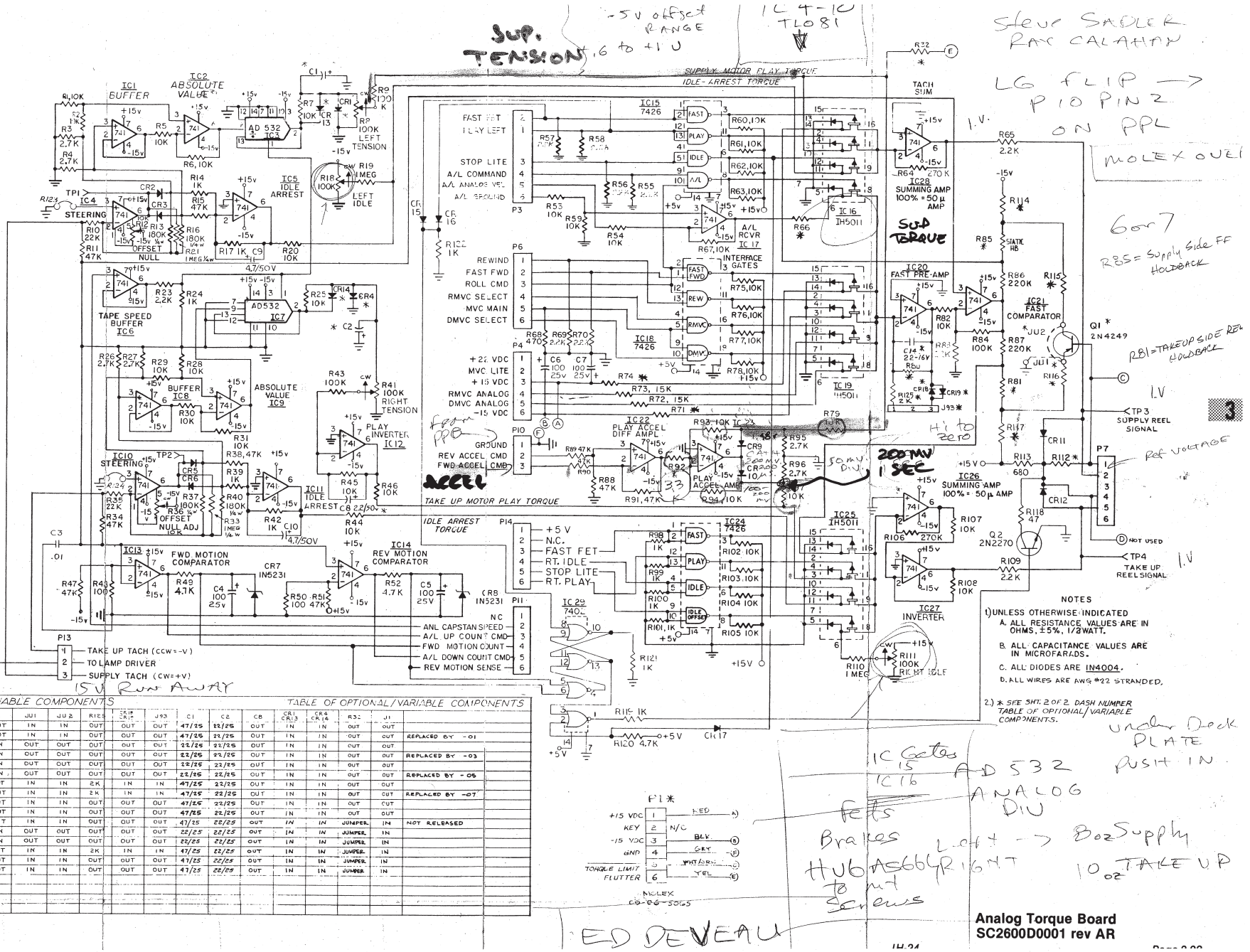
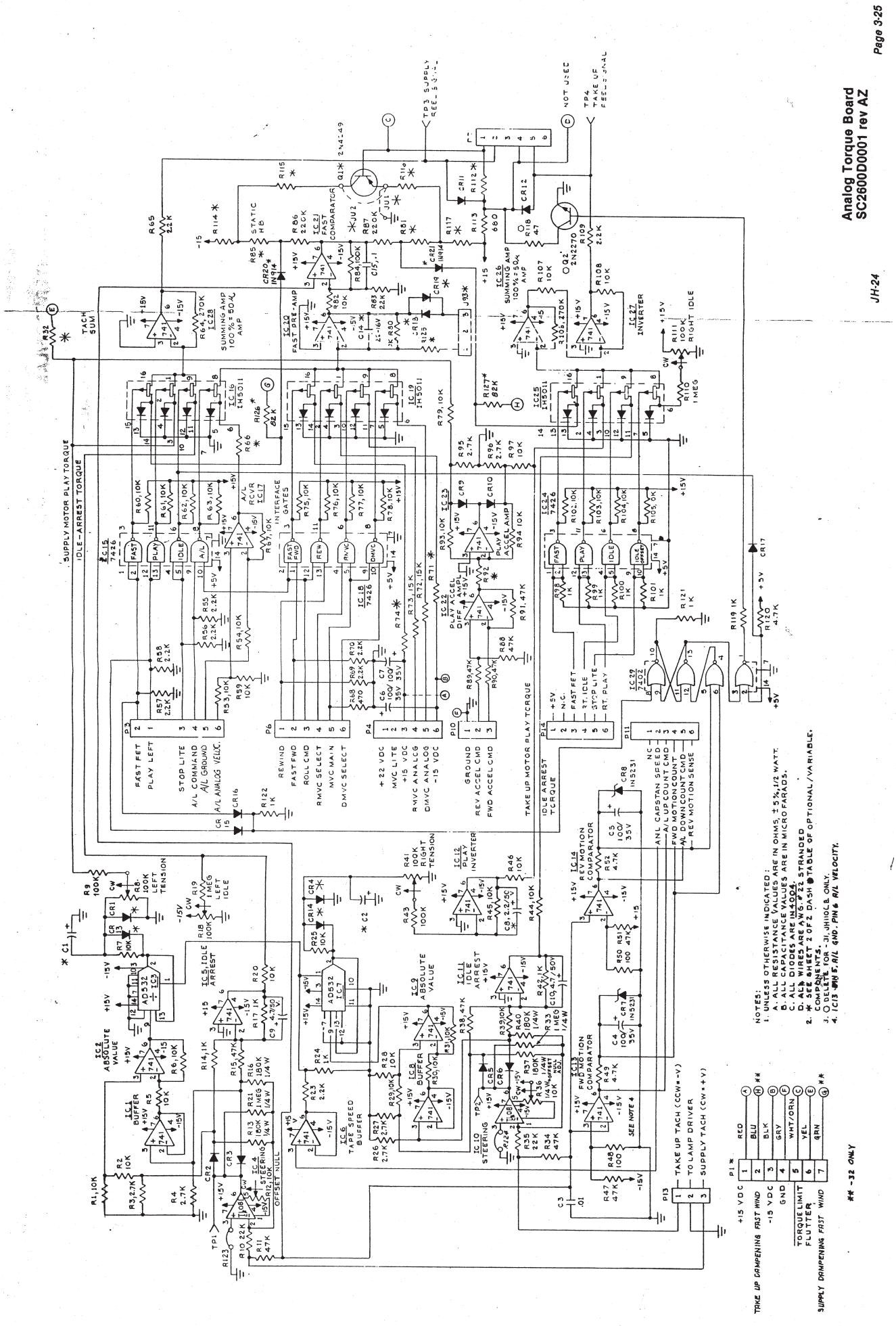


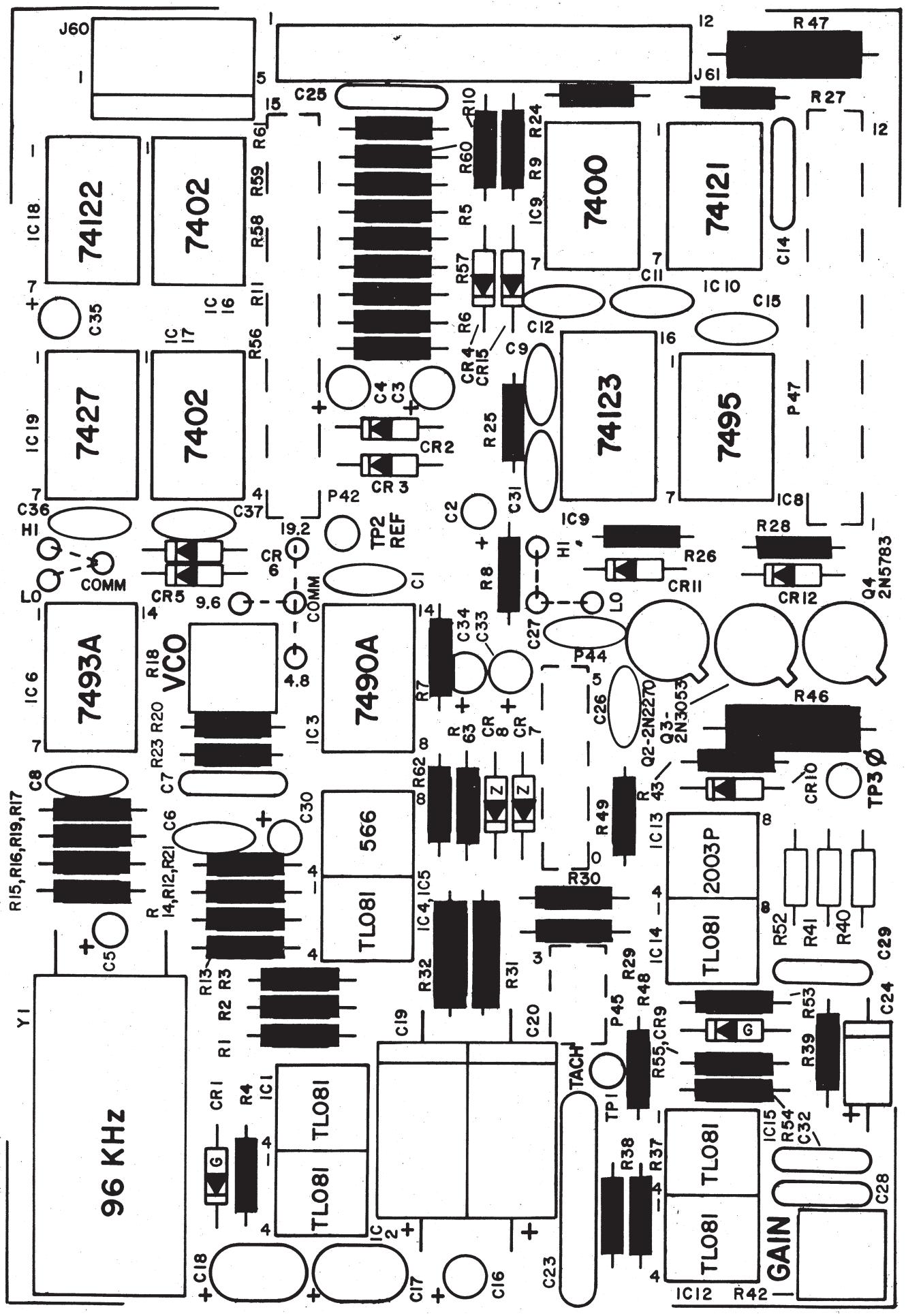
TABLE OF OPTIONAL/VARIABLE COMPONENTS

DASH #	*	R115 R116 R117	R66	R80	R85 R81	R92	R71 R74	R112	Q1	JU1	JU2	R123	SK1 SK2	J93	C1	C2	C8	CR1 CR13	CR4 CR14	R32	J1	
△ 01	116/24 HI	10K	12K	27K	22K	820K	3.6K	33K	JUMPER	OUT	IN	IN	OUT	OUT	OUT	47/25	22/25	OUT	IN	IN	OUT	OUT	
02	116/24 LO	10K	12K	27K	22K	820K	3.6K	33K	JUMPER	OUT	IN	IN	OUT	OUT	OUT	47/25	22/25	OUT	IN	IN	OUT	OUT	REPLACED BY -01
03	110-10.5" HI	7.5K	10K	24K	22K	1.3M	82K	39K	150	IN	OUT	OUT	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	OUT	OUT	
04	110-10.5" LO	7.5K	10K	24K	22K	1.3M	82K	39K	150	IN	OUT	OUT	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	OUT	OUT	REPLACED BY -03
05	110-14" HI	7.5K	10K	24K	22K	1.3M	82K	39K	OUT	IN	OUT	OUT	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	OUT	OUT	
06	110-14" LO	7.5K	10K	24K	22K	1.3M	82K	39K	OUT	IN	OUT	OUT	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	OUT	OUT	REPLACED BY -05
07	110 M HI	10K	12K	24K	56K	1.3M	82K	33K	JUMPER	OUT	IN	IN	2K	IN	IN	47/25	22/25	OUT	IN	IN	OUT	OUT	
08	110M LO	10K	12K	24K	56K	1.3M	82K	33K	JUMPER	OUT	IN	IN	2K	IN	IN	47/25	22/25	OUT	IN	IN	OUT	OUT	REPLACED BY -07
09	110-8TK HI	10K	12K	27K	27K	680K	3.6K	33K	220	OUT	IN	IN	OUT	OUT	OUT	47/25	22/25	OUT	IN	IN	OUT	OUT	
10	110-8TK LO	10K	12K	24K	27K	680K	3.6K	33K	220	OUT	IN	IN	OUT	OUT	OUT	47/25	22/25	OUT	IN	IN	OUT	OUT	
21	116/24 W/FLD EFD	10K	12K	27K	22K	820K	3.6K	33K	JUMPER	OUT	IN	IN	OUT	OUT	OUT	47/25	22/25	OUT	IN	IN	JUMPER	IN	NOT RELEASED
△ 23	110-10.5" W/FLD EFD	7.5K	10K	24K	22K	1.3M	82K	39K	150	IN	OUT	OUT	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	JUMPER	IN	
△ 25	110-14" W/FLD EFD	7.5K	10K	24K	22K	1.3M	82K	39K	OUT	IN	OUT	OUT	OUT	OUT	OUT	22/25	22/25	OUT	IN	IN	JUMPER	IN	
30	80M W/FLD EFD	10K	12K	24K	56K	1.1M	82K	33K	JUMPER	OUT	IN	IN	2K	IN	IN	47/25	22/25	OUT	IN	IN	JUMPER	IN	
50	110-8TK EFD	10K	12K	27K	27K	680K	3.6K	33K	220	OUT	IN	IN	OUT	OUT	OUT	47/25	22/25	OUT	IN	IN	JUMPER	IN	
	110-8TK EFD	10K	12K	24K	27K	680K	3.6K	33K	220	OUT	IN	IN	OUT	OUT	OUT	47/25	22/25	OUT	IN	IN	JUMPER	IN	

△ = CURRENT PRODUCTION
EFD = ELECTRONIC FLUTTER DAMPER

TABLE OF OPTIONAL/VARIABLE COMPONENTS

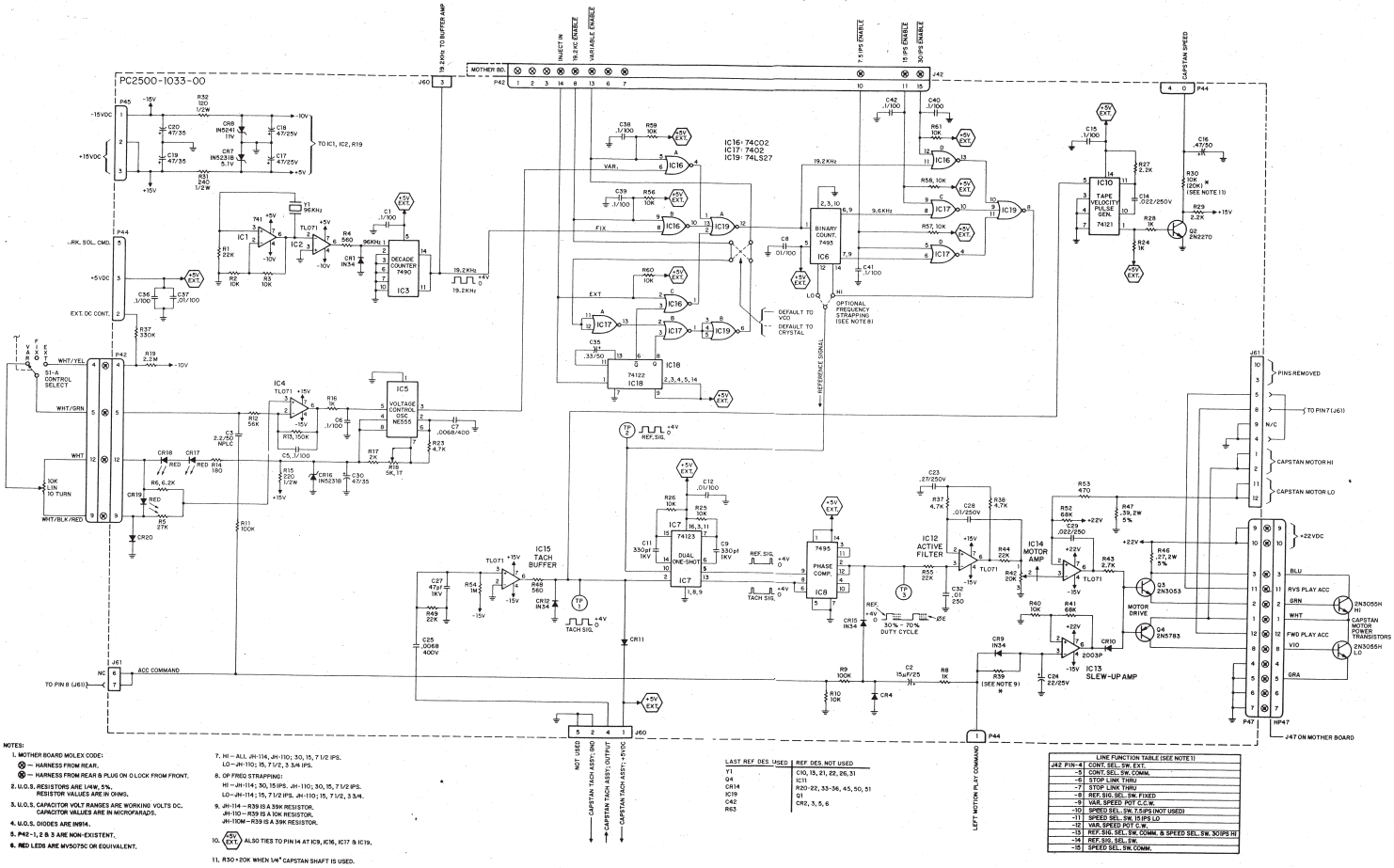




PARTS LIST — PHASE LOCKED LOOP BOARD

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA 2500-0600-00	PCA, PHASE LOCK LOOP BD	1	
09-52-3030	MOLEX 3CIR PARA PC CONN	11	P42,P44, P45, P47
09-64-1121	MOLEX 12PIN NON-LOCK 3/4	1	J61
09-65-1052	MOLEX 5PIN LOCK 15/16"	1	J60
0:27-OHM10%-2WW	WIRE WOUND RES-ROCKWOOD	1	R46
0:39-OHM10%-2WW	WIRE WOUND RES-ROCKWOOD	1	R47
1.0-KOHM5%-¼W	CARBON FILM RESISTOR	4	R7, R8, R24, R28
10--KOHM5%-¼W	CARBON FILM RESISTOR	16	R2, 3, 10, 15, 16, 19, 25, 26, 30, 40, 56-61
100-KOHM5%-¼W	CARBON FILM RESISTOR	5	R9, 11, 12, 13, 14
120--OHM5%-¼W	RESISTOR	1	R32
15--KOHM5%-¼W	CARBON FILM RESISTOR	1	R5
1548-2	TEST POINT TERM	3	TP1, TP2, TP3
15MF20V-CTA10	DIP TANT CAP 10% SEL 1/A	1	C2
16P-DIP-SKT	DIP SKT ARIES 16-511-10	4	
1N34	DIODE, SIGNAL-GERMANIUM	3	CR1, CR9, CR15
1N4004	DIODE, RECTIFIER - SILICON	2	CR11, CR12
1N5231B-5.1V	DIODE, ZENER-SILCN 5.1V-5	1	CR7
1N5241-11V	DIODE, ZENE-SILIC 11V-10%	1	CR8
1N914	DIODE, SIGNAL-SILCN GLASS	6	CR2, 3, 4, 5, 6, 10
2.2-KOHM5%-¼W	CARBON FILM RESISTOR	3	R27, R29, R48
2.7-KOHM5%-¼W	CARBON FILM RESISTOR	1	R43
2003P	SIG#NE5534AN OP-AMP	1	IC13
22--KOHM5%-¼W	CARBON FILM RESISTOR	3	R1, R49, R55
22--MOHM5%-¼W	CARBON FILM RESISTOR	1	R54
22MF25V-CLY	LYTIC CAP SIEMEN-STETTNE	1	C24
240--OHM5%-½W	CARBON FILM RESISTOR	1	R31
2:2MF35V-CTA10	DIP TANT CAPACITOR 10%	2	C33, C34
2N2270	XSTOR NPN AMPLIFIER SILICON	1	Q2
2N3053	XSTOR NPN HI-SPD SW SILICON	1	Q3
2N5783	XSTOR PNP SWTCH SILICON	1	Q4
3.3-KOHM5%-¼W	CARBON FILM RESISTOR	2	R17, R21
33--KOHM5%-¼W	CARBON FILM RESISTOR	1	R20
330PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	1	C26
36--KOHM2%-¼W	CARBON FILM RESISTOR	1	R6
360-0017-02-03	CAMBION PC SHORTING PLUG	3	
4.7-KOHM5%-¼W	CARBON FILM RESISTOR	3	R23, R37, R38
47---OHM5%-¼W	CARBON FILM RESISTOR	2	R62, R63
470--OHM5%-¼W	CARBON FILM RESISTOR	1	R53
47MF25V-CLYRL	LTYIC RAD/LD SEALED (GP)	2	C17, C18
47MF63V-CLY	LYTIC CAPACITOR SIEMEN	2	C19, C20
47PF1KV-CCD20	CERAMIC DISC CAP 20% TOL	3	C27, C11, C9
4:7MF35V-CLYRL	LYTIC RAD/LD SEALED (LL)	3	C3, C4, C5
50865-5	AMP PC SOLDER JACK	6	
68--KOHM5%-¼W	CARBON FILM RESISTOR	2	R41, R52
680--OHM5%-½W	CARBON FILM RESISTOR	1	R4
7402	QUAD 2-IN NOR	2	IC16, IC17
741CP	OP AMP	1	IC1
74121	MONOSTABLE MULTIVIBRATOR	1	IC10
74122	RETRIG MONO MULTI	1	IC18

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
74123	DUAL RETRIG MONOSTBLE MV	1	IC7
7427	TRIPLE 3-IN NOR	1	IC19
7490	DECADE COUNTER	1	IC3
7493	4-BIT BINARY COUNTER NAT	1	IC6
7495	4-BIT PARALLEL ACCESS	1	IC8
:001MF1KV-CCD20	CERAMIC DISC CAP 20% TOL	2	C6, C31
:0027MF630V-CMP	PLESSEY 106-.0027 10% 63	1	C7
:0068MF400V-CMY	MYLAR CAPACITOR MEPCO SR	1	C25
:01MF250V-CMY	MYLAR CAPACITOR MEPCO SR	2	C28, C32
:01MF50V-CCD20	CERAMIC DISC CAP 20% TOL	5	C1, C12, C15, C37, C8
:022MF250V-CMY	MYLAR CAPACITOR MEPCO SR	2	C14, C29
:1MF100V-CCD20	CERAMIC DISC CAPACITOR	6	C38, C39, C36, C42, C40, C41
:27MF250V-CMY	MYLAR CAPACITOR MEPCO SR	1	C23
:33MF50V-CLYRL	LYTIC RAD/LD SEALED (LL)	1	C35
:47MF50V-CLYRL	LYTIC RAD/LD SEALED (LL)	1	C16
:68MF50V-CLYRL	LYTIC RAD/LD SEALED (LL)	1	C30
AP5-7D	PAD, TRANSISTOR TO-5 TYPE	3	
J-0300X0.125T22	PREFORMED JUMPER SQUIRES	1	
NE566	FUNCTION GENERATOR	1	IC5
SP-7000-2300-00	MONITOR CRYSTAL 96KHZ	1	Y1
TAPCPOT20K-1T	BU3386F-1-203/BK72PMR20K	2	R18, R42
TL081CP	OP AMP	5	IC2, 4, 12, 14, 15
TY-23M	CABLE TIE-SMALL ALLSTATE	1	



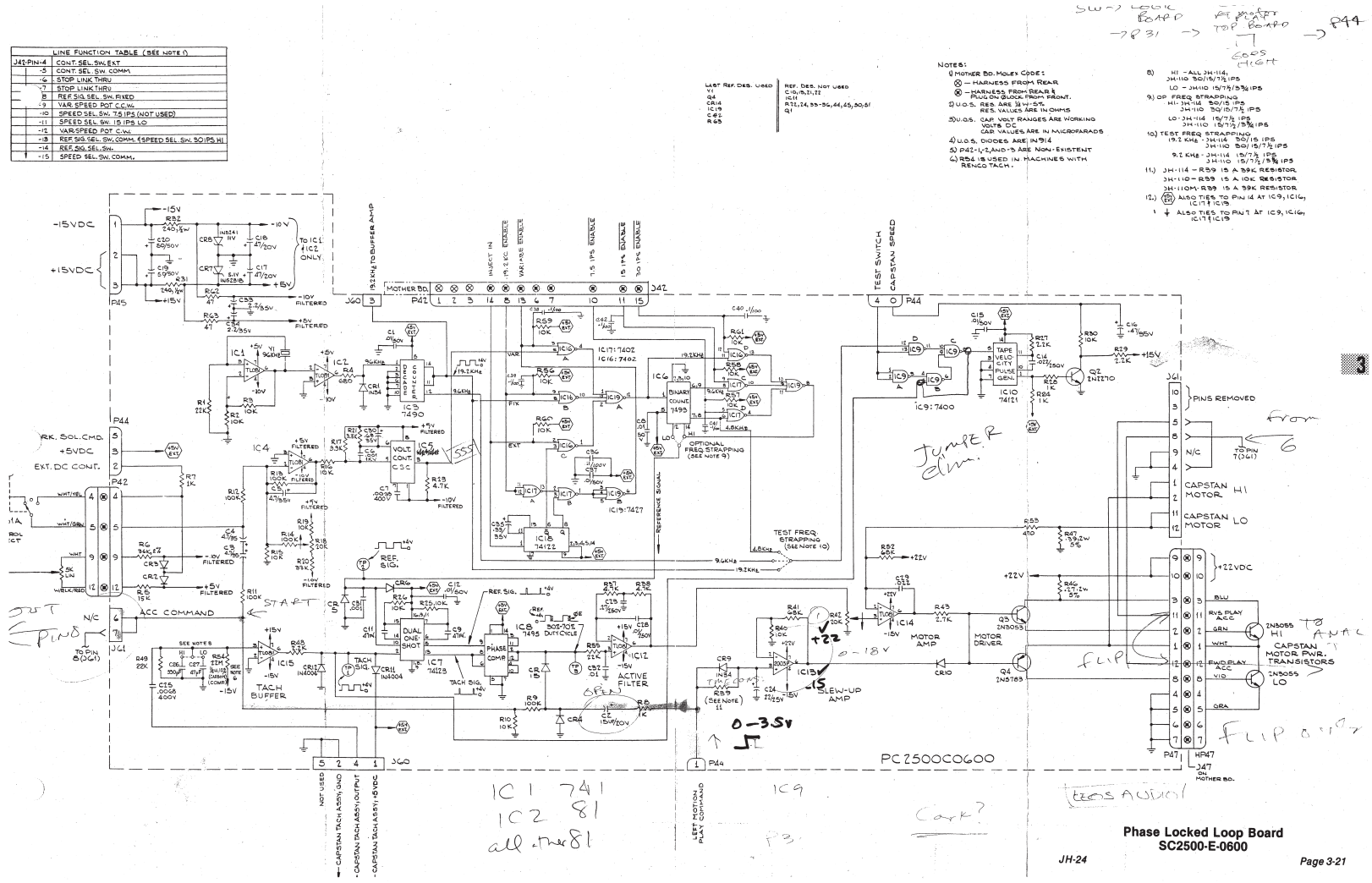
NOTES:

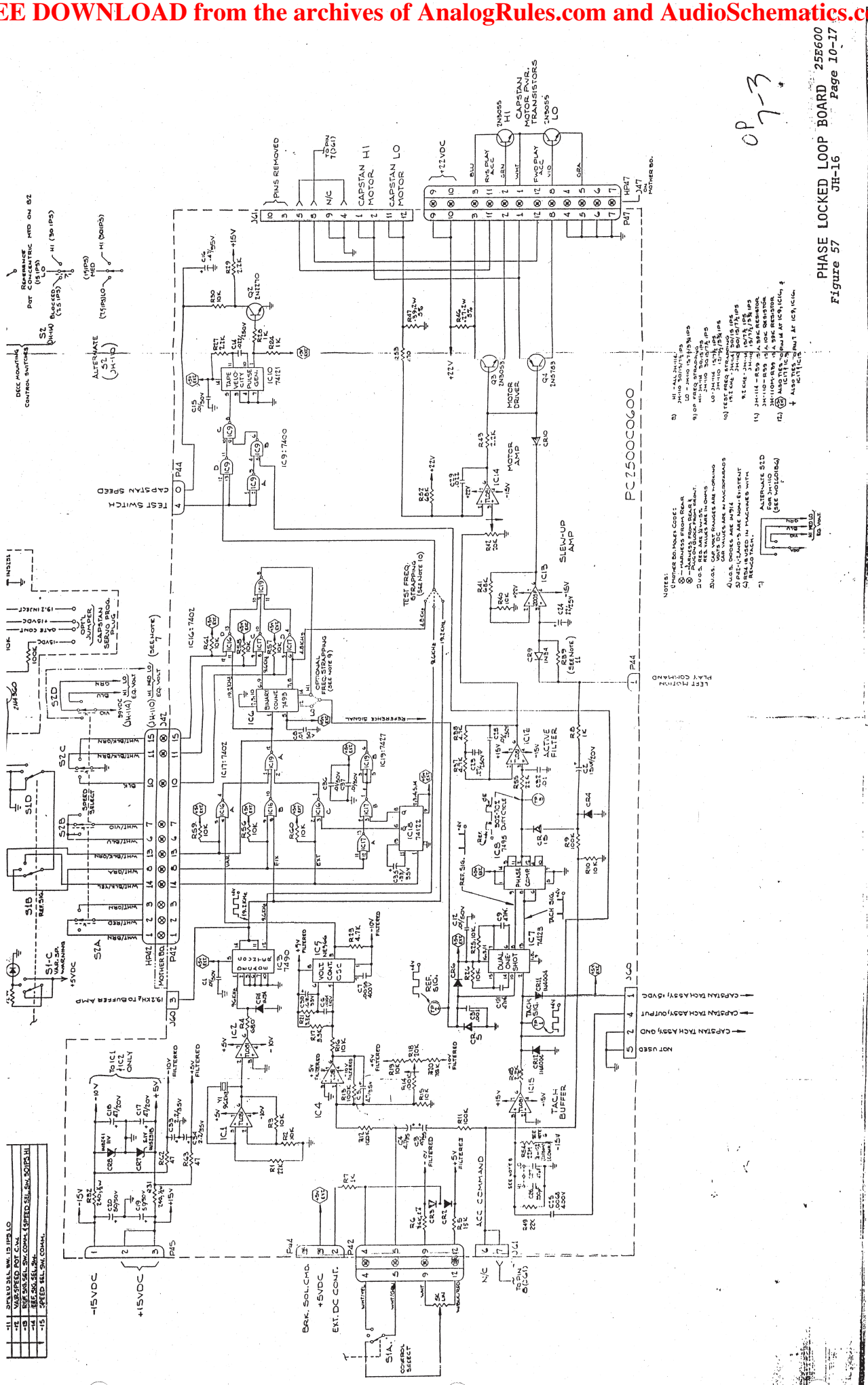
1. MOTHER BOARD MOLEX CODE:
   ⊗ — HARNESS FROM REAR.
   ⊗ — HARNESS FROM REAR & PLUG ON 0 LOCK FROM FRONT.
2. U.O.S. RESISTORS ARE 1/4W, 5%.
   RESISTOR VALUES ARE IN OHMS.
3. U.O.S. CAPACITOR VOLT RANGES ARE WORKING VOLTS DC.
   CAPACITOR VALUES ARE IN MICROFARADS.
4. U.O.S. DIODES ARE IN914.
5. P42-1, 2 & 3 ARE NON-EXISTENT.
6. RED LEDS ARE MV5075C OR EQUIVALENT.
7. HI – ALL JH-114, JH-110; 30, 15, 7 1/2 IPS.
   LO – JH-110; 15, 7 1/2, 3 3/4 IPS.
8. OP FREQ STRAPPING:
   HI – JH-114; 30, 15 IPS. JH-110; 30, 15, 7 1/2 IPS.
   LO – JH-114; 15, 7 1/2 IPS. JH-110; 15, 7 1/2, 3 3/4.
9. JH-114 – R39 IS A 39K RESISTOR.
   JH-110 – R39 IS A 10K RESISTOR.
   JH-110M – R39 IS A 39K RESISTOR.
10. (+5V EXT) ALSO TIES TO PIN 14 AT IC9, IC16, IC17 & IC19.
11. R30 = 20K WHEN 1/4" CAPSTAN SHAFT IS USED.

LAST REF. DES. USED	REF. DES. NOT USED
Y1	C10, 15, 21, 22, 26, 31
Q4	IC11
CR14	R20-22, 33-36, 45, 50, 51
IC19	Q1
C42	CR2, 3, 5, 6
R63	

LINE FUNCTION TABLE (SEE NOTE 1)	
J42 PIN-4	CONT. SEL. SW. EXT.
-5	CONT. SEL. SW. COMM.
-6	STOP LINK THRU
-7	STOP LINK THRU
-8	REF. SIG. SEL. SW. FIXED
-9	VAR. SPEED POT C.C.W.
-10	SPEED SEL. SW. 7.5IPS (NOT USED)
-11	SPEED SEL. SW. 15 IPS LO
-12	VAR. SPEED POT C.W.
-13	REF. SIG. SEL. SW. COMM. & SPEED SEL. SW. 30IPS HI
-14	REF. SIG. SEL. SW.
-15	SPEED SEL. SW. COMM.

Phase Locked Loop Board
SC2500E1033 rev B





PHASE LOCKED LOOP BOARD 25B600
Figure 57 JH-16 Page 10-17

OP 7-3

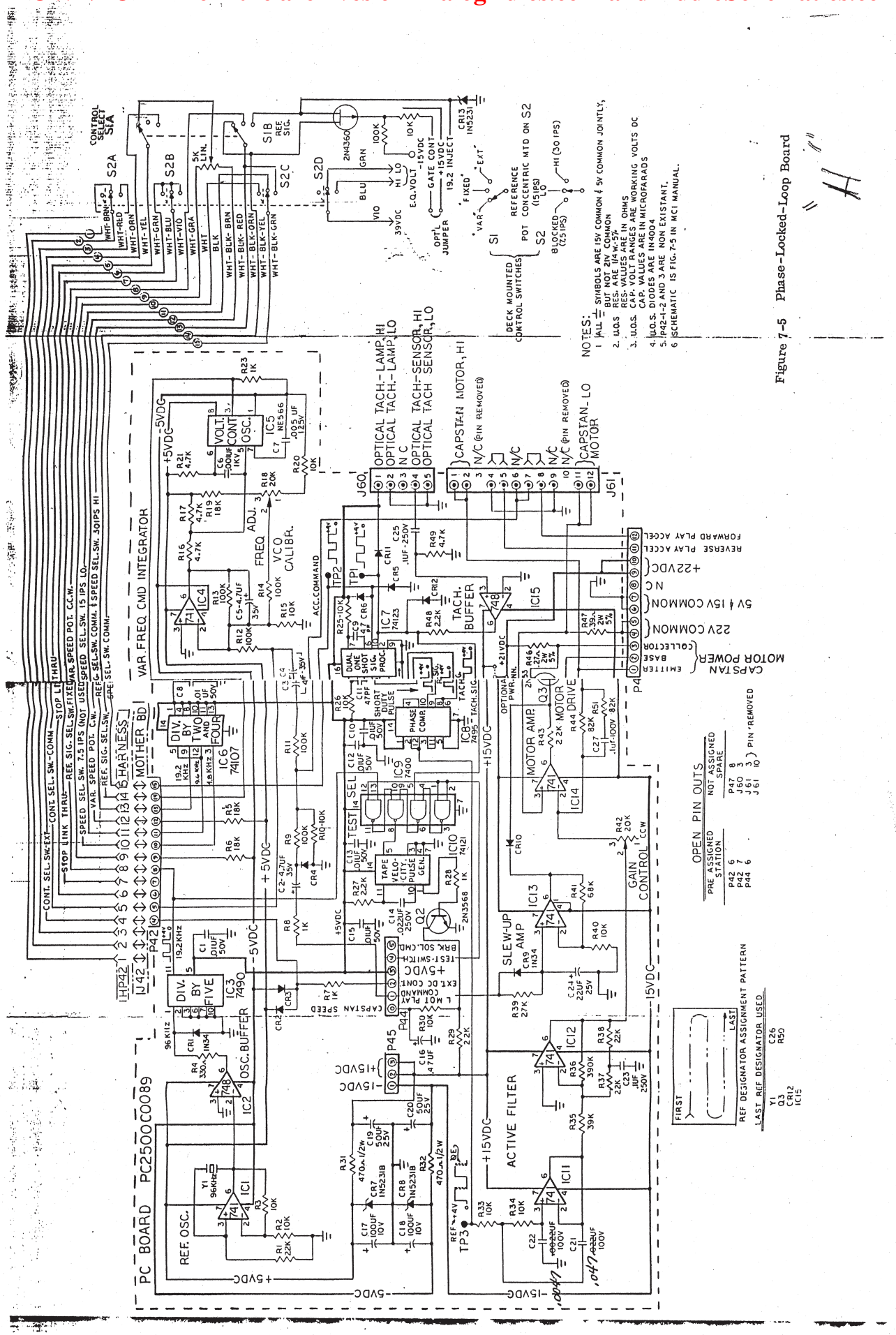
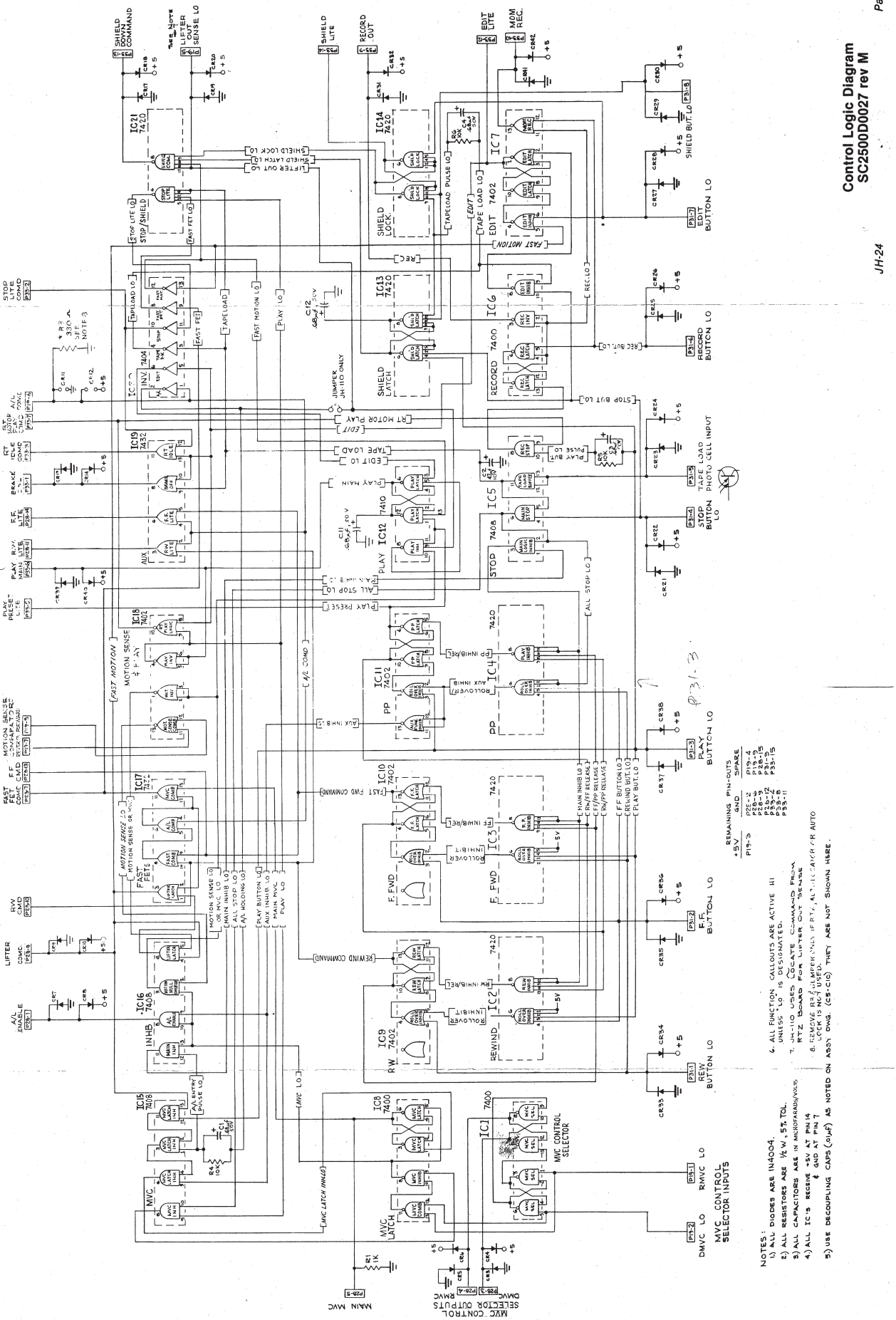


Figure 7-5 Phase-Locked-Loop Board

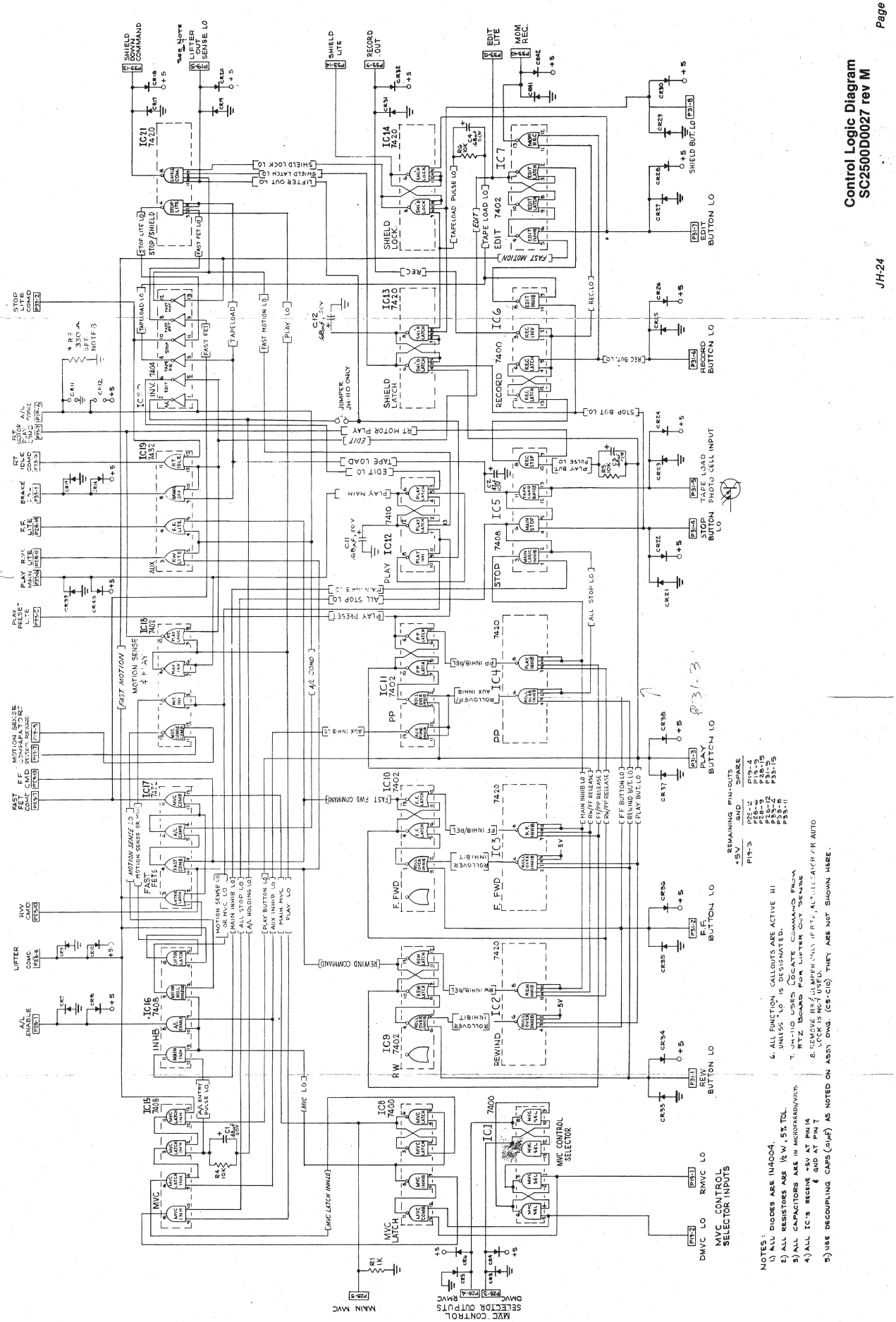
Control Logic Diagram SC2500D0027 rev M

JH-24



Control Logic Diagram SC2500D0027 rev M

JH-24



SECTION 5
AUTOLOCATOR III

5.1 General Description

The AutoLocator III is a microprocessor based position locator and velocity indicator. The microprocessor executes programs stored in its memory to perform the functions requested by the button switches on the front panel. The AutoLocator III is available as an optional accessory to the JH-24. It mounts directly above the remote unit and interfaces to the tape transport via a thirty foot long cable harness.

Operating voltages for the autolocator come from the JH-24 transport. The AutoLocator III does not contain its own power supply, but does contain voltage regulators which produce +5vdc from the transport's +8vdc output. The transport's power supply also supplies ±15vdc to the autolocator as required by the amplifiers on the AutoLocator III.

The AutoLocator III contains two four digit LED segment displays; one displays the current tape position, the other displays the desired locate position. Both displays indicate tape position in minutes and seconds of playback/record time normalized to the standard (fixed) speeds.

A numeric keyboard enters digits into the locate position display. With each key strike the digits in the display shift to the left, entering the new digit in the rightmost column. If, by mistake, a number greater than 59 is punched into the seconds columns, the display will automatically convert the time into minutes and seconds. For example, if 78 seconds is entered into the locate position display, it will be converted to 1 minute 18 seconds prior to the execution of any function.

Once a time (or position) is entered into the locate position display the transport can autolocate to that position simply by pressing the LOC button.

At any time while the transport is in stop, play, or record mode the current tape position can be loaded into a locate position memory. Pressing → (shift right), STO (store), and any of the numeric keys stores the time from the tape position display into the corresponding locate memory. These positions can later be recalled and displayed in the locate position display by pressing RCL and the respective numeric key. The LOC button will then locate the transport to the position retrieved from memory.

The locate memories can be pre-loaded with any position by entering the time into the locate position display via the numeric keyboard. From the located position display the time is entered into the memory with the STO and numeric key sequence.

The position memory can be pre-loaded with any position by first entering the time into the locate position display via the numeric keyboard. Then, the ← (shift left) button is used to shift the locate position into the tape position display redefining the current tape position.

The → (shift right) button, can be used to temporarily store tape positions into the locate position display for future locates or to mark the position for convenience.

The repeat function yo-yos the transport between the positions stored in memories 8 and 9. The transport, after pressing REP, autolocates to position 8,

drops into play mode, plays back up to position 9, rewinds to position 8, and drops into play mode again. This process will continue indefinitely. It is cancelled by pressing the transport STOP, RWD or FWD button or the autolocator's LOC button.

For the repeat function to work, the tape position stored in memory 9 must be greater than the tape position stored in memory 8. If this is not the case, and the REP button is pressed, the transport will autolocate to the position stored in memory 8 and stop.

The AutoLocator III also performs velocity control and velocity display functions. Pressing and holding the TVI (Tape Velocity Indicator) button displays the tape speed in the tape position display. Releasing the TVI button returns the autolocator to the position display mode.

If the tape transport's reference select switch is in the external (EXT) position, the MODE switch toggles between the fixed crystal speed reference and the variable dc reference level to the VCO. LEDs on the front panel indicate whether the fixed reference or the variable reference is selected.

In the variable mode the SPEED potentiometer on the autolocator controls the pitch in the same manner as the SPEED potentiometer on the transport deck when the transport is in VAR reference.

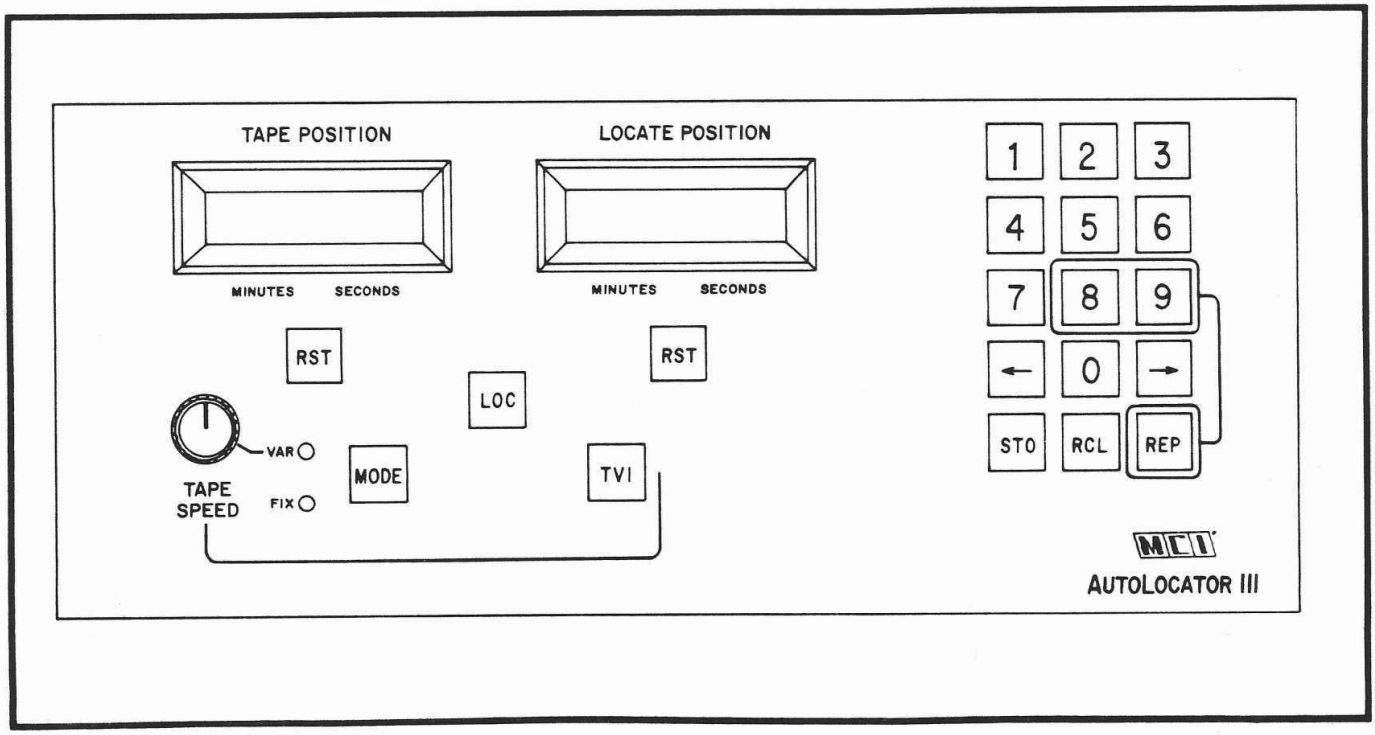
In variable reference mode, the TVI switch displays both the tape velocity in the tape position display and the pitch change in the locate position display. Pitch change is indicated in terms of semitones of the enharmonic scale. Only multiples of ¼ semitones are displayed. The locate position display is blank unless the tape velocity is within ±0.03ips of a multiple of ¼ semitone pitch change from the standard speed.

5.2 Hardware Functional Description

Refer to the block diagram of the AutoLocator III, Figure 5-1. The microprocessor, its memory and I/O ports are located on the Processor Board. The display and display encoders are located on the Display Board. Schematics for these boards are found at the end of this section.

The microprocessor communicates with its memory and I/O ports via the address and data bus. This bus is multiplexed, that is, it is used for both address and data. Addresses arrive on the bus first, followed by data. An address latch stores the bus address low order bits (A0-A7) while the data is asserted on the bus. The high order bus address bits (A8-A12) are not latched; these lines are not multiplexed.

Control signals from the microprocessor allow the memory or I/O ports to assert information onto, or receive information from the address and data bus. To fetch an address or an instruction from memory, the microprocessor asserts an address



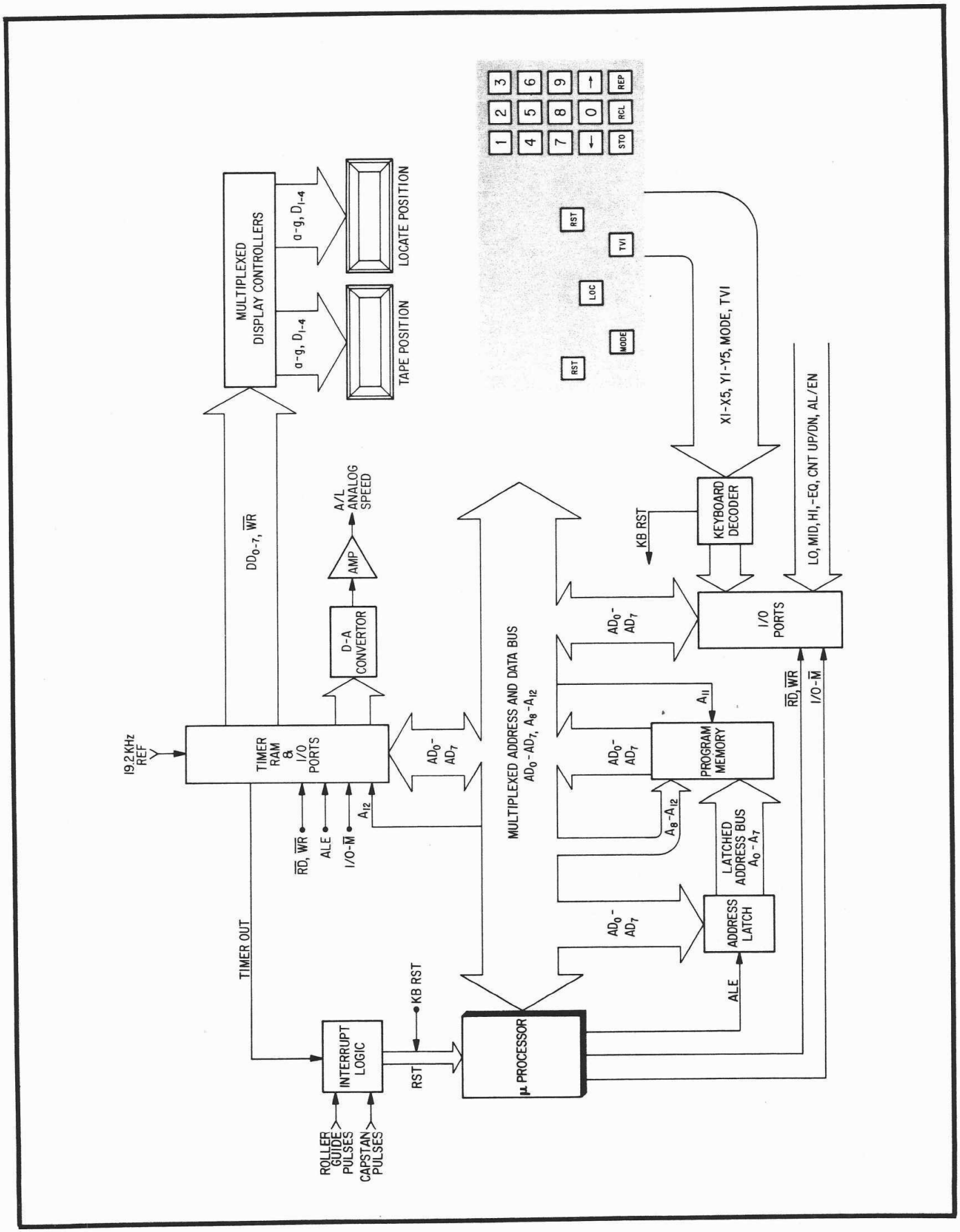


Figure 5-1 AutoLocator III Block Diagram

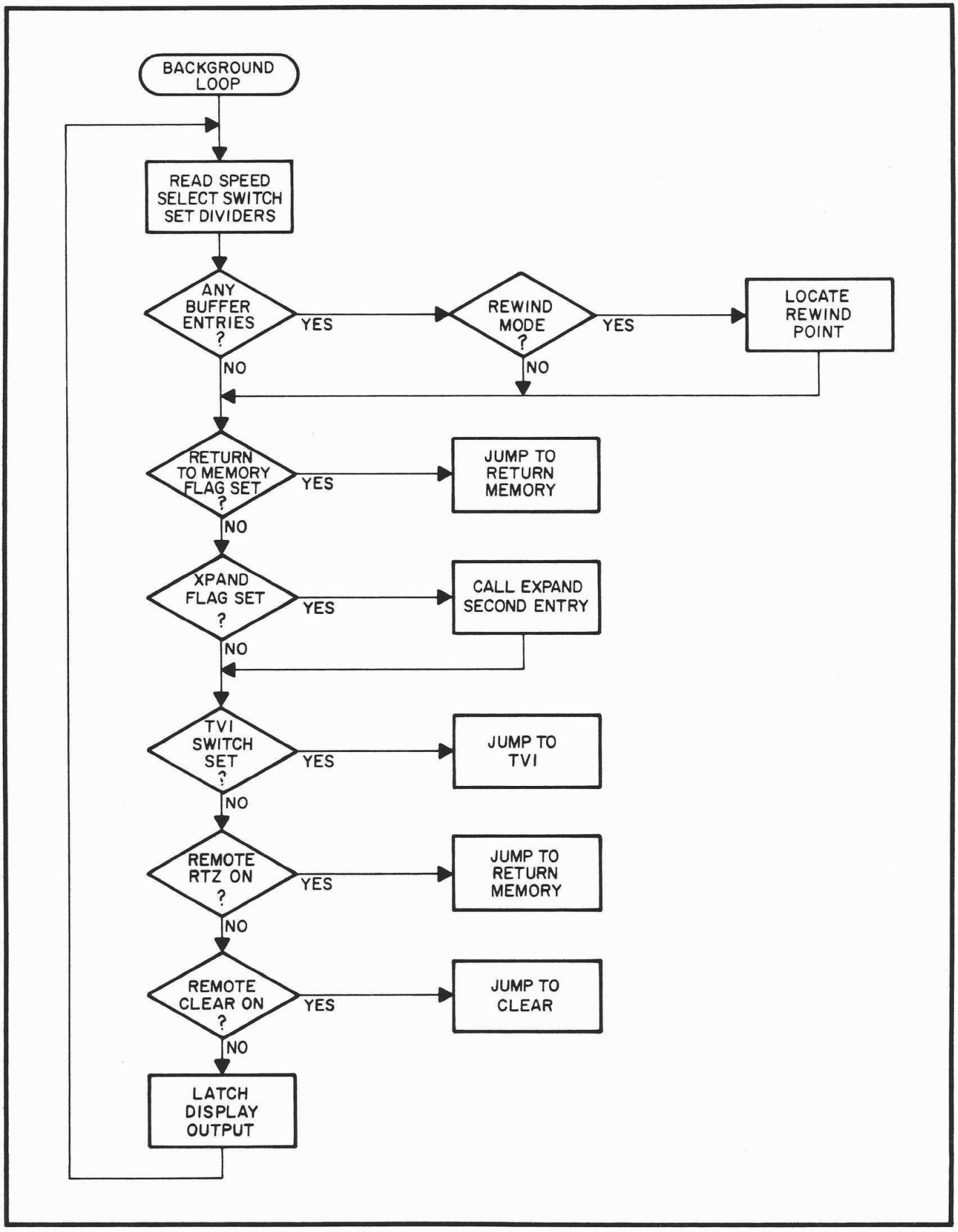


Figure 5-2 Background Loop Flow Chart

onto the bus and latches the address in the address latch. The momory then places the contents of that location on the bus for the processor to read. The microprocessor reads and writes data from and to the I/O ports using the command signals RD, WR, and I/OM.

Data from the I/O ports is sent to the display controllers to operate both LED displays and to the D to A converter to operate the reel motors. The I/O ports receive speed and direction information from the transport and commands from the keyboard and function switches.

5.3 Program Description

The program which determines the operation of the microprocessor is stored in the program memory. The stored program is organized into a background loop, subroutines which perform certain tasks, and interrupt service routines which handle the interrupts. A flowchart of the background program is included in this section to give a basic idea of the program structure.

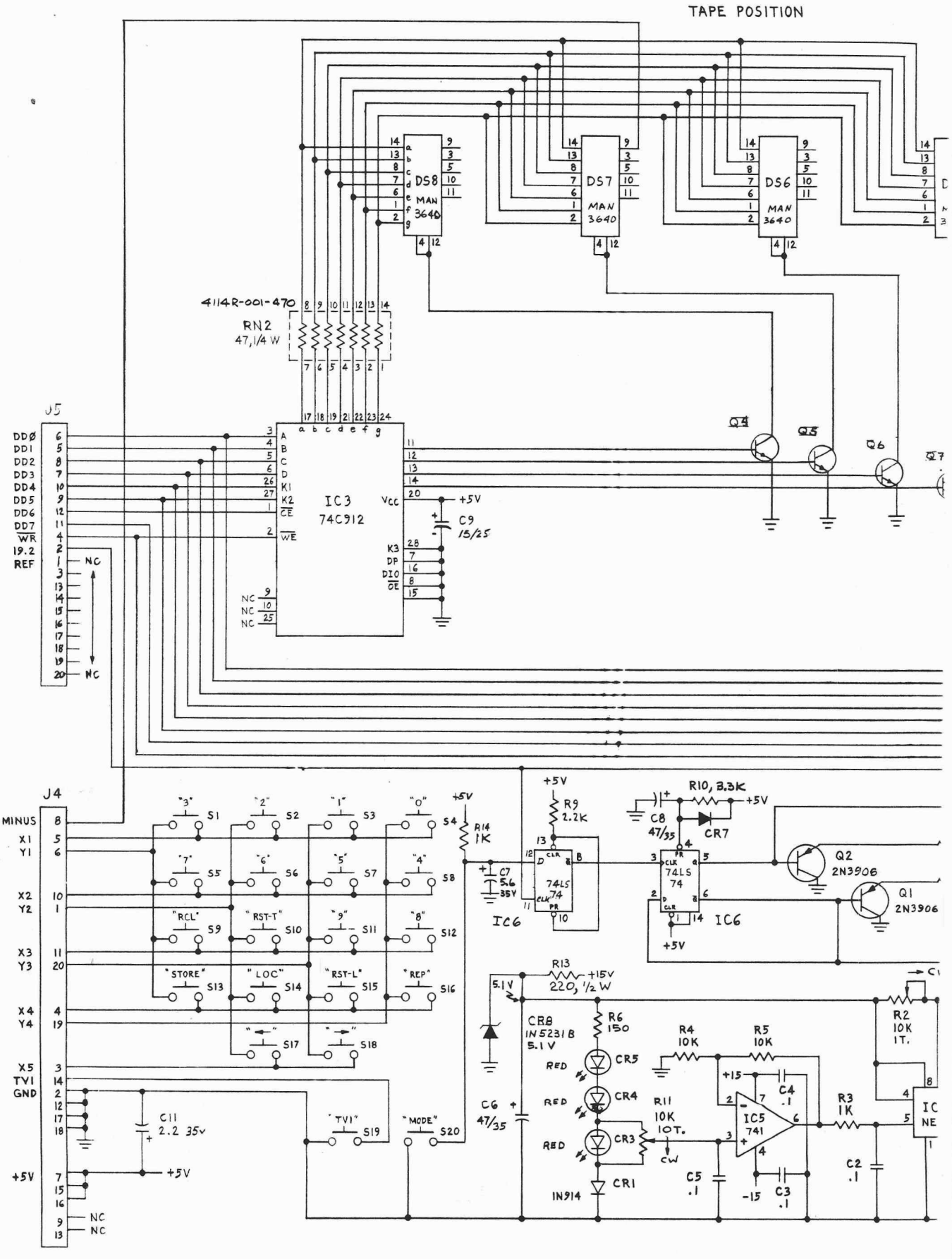
From power up, the processor executes instructions in the background loop program, Figure 5-2. In this loop, the processor reads speed information, poles various flags, and updates the display. Note that the displays are multiplexed; the processor sends data to the tape position display and the locate position display alternately. The speed switch information from the transport is used to normalize the displays so that they show the correct time for the speed selected.

If any flags are set when they are tested, the program jumps to the appropriate subroutine. When the subroutine function is completed, the program returns to the background loop. At any time an interrupt will cause the program to vector to the interrupt service routine. After servicing the interrupt, the program will return to the place in the background loop or subroutine where the interrupt occurred.

As an example, assume that the TVI switch is pressed, setting the TVI flag. When the program tests the TVI switch flag, it jumps to the TVI subroutine. This subroutine sets a timer and the capstan tachometer pulses are allowed to interrupt the processor through the interrupt logic. Every other capstan pulse causes a jump from the TVI routine to the capstan interrupt routine which counts the pulses. When the timer times out, the velocity is calculated, displayed, and the program returns to the background loop.

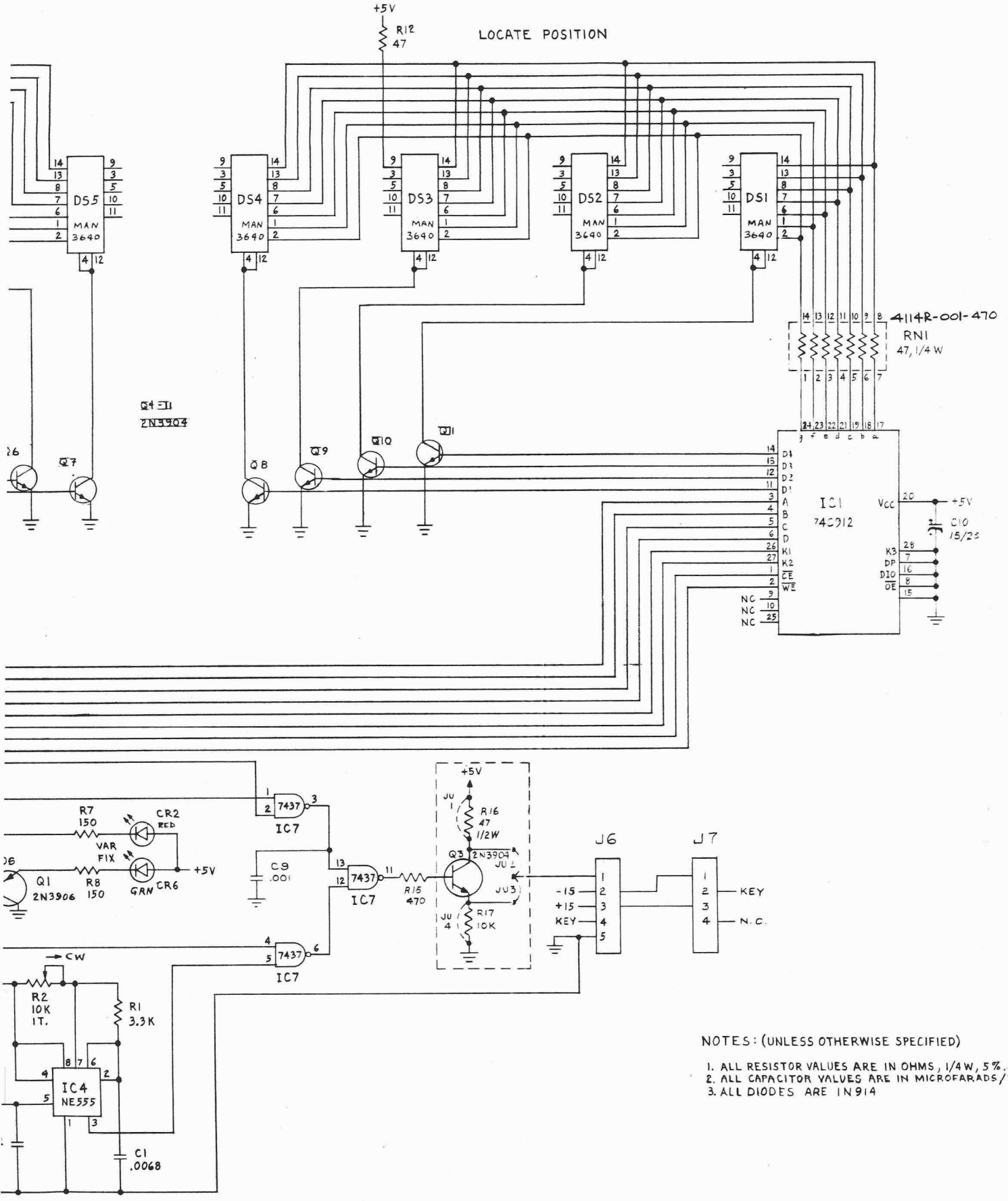
Interrupts are also generated by the display button switches and the roller guide tachometer pulses. Each time the microprocessor receives a roller guide pulse, its vectors to the roller guide interrupt service routine. This routine updates (increments or decrements) the display count and returns to the background loop or to the subroutine where the interrupt occurred.

Pressing a keyboard switch generates an interrupt which causes the program to jump to the switch interrupt routine. Here, the switch's numeric value is read and decoded. The switch value determines which subroutine is jumped to next. If, for example, the LOC switch is pressed, the return to memory flag gets set. The program jumps to the return to memory subroutine from the background to autolocate the tape to the position stored in the locate position display memory. Once the memory position is reached, the program returns to the background loop.



AL III REV 1

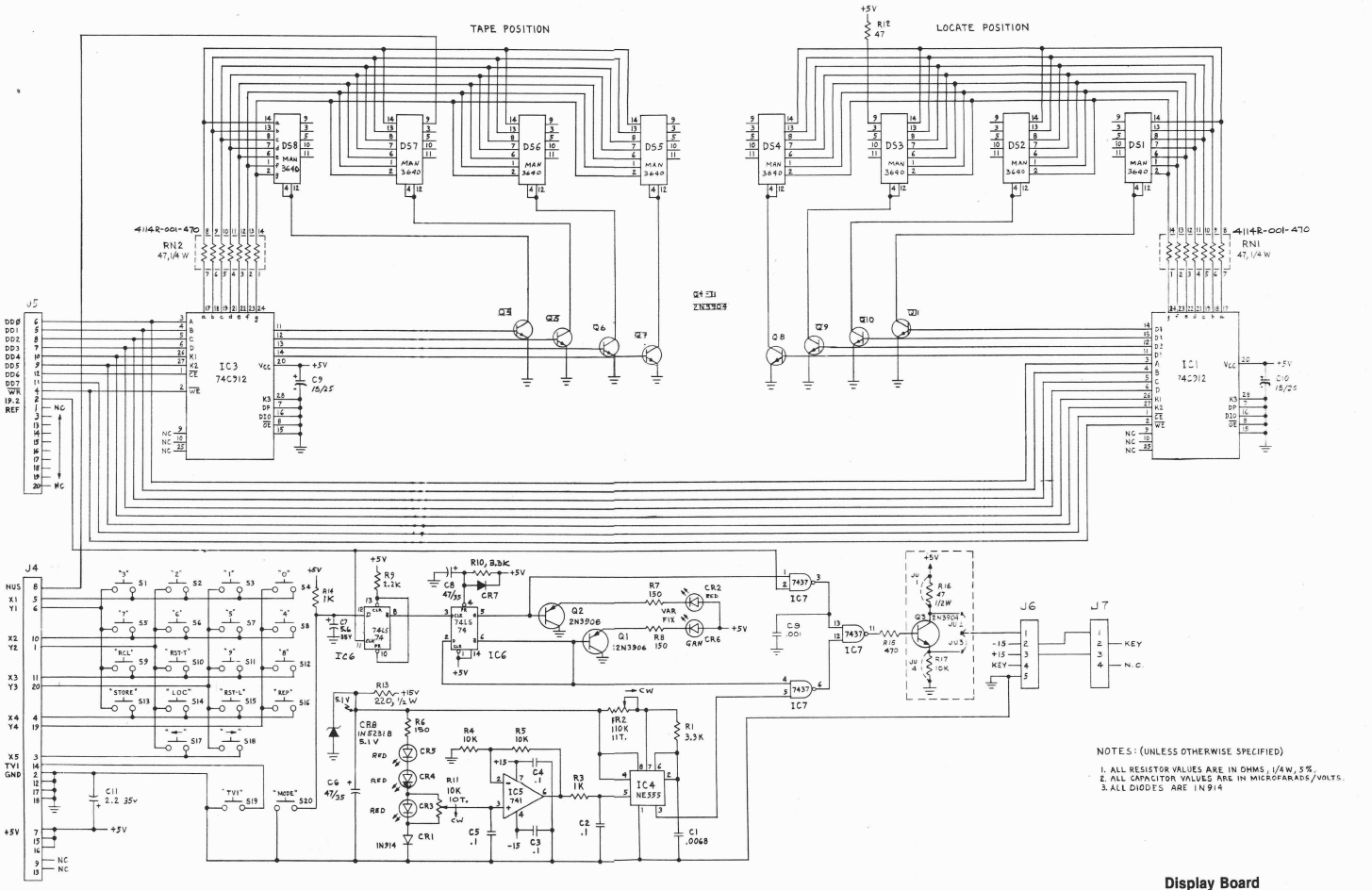
DISPLAY



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 5%.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS/VOLTS.
3. ALL DIODES ARE 1N914

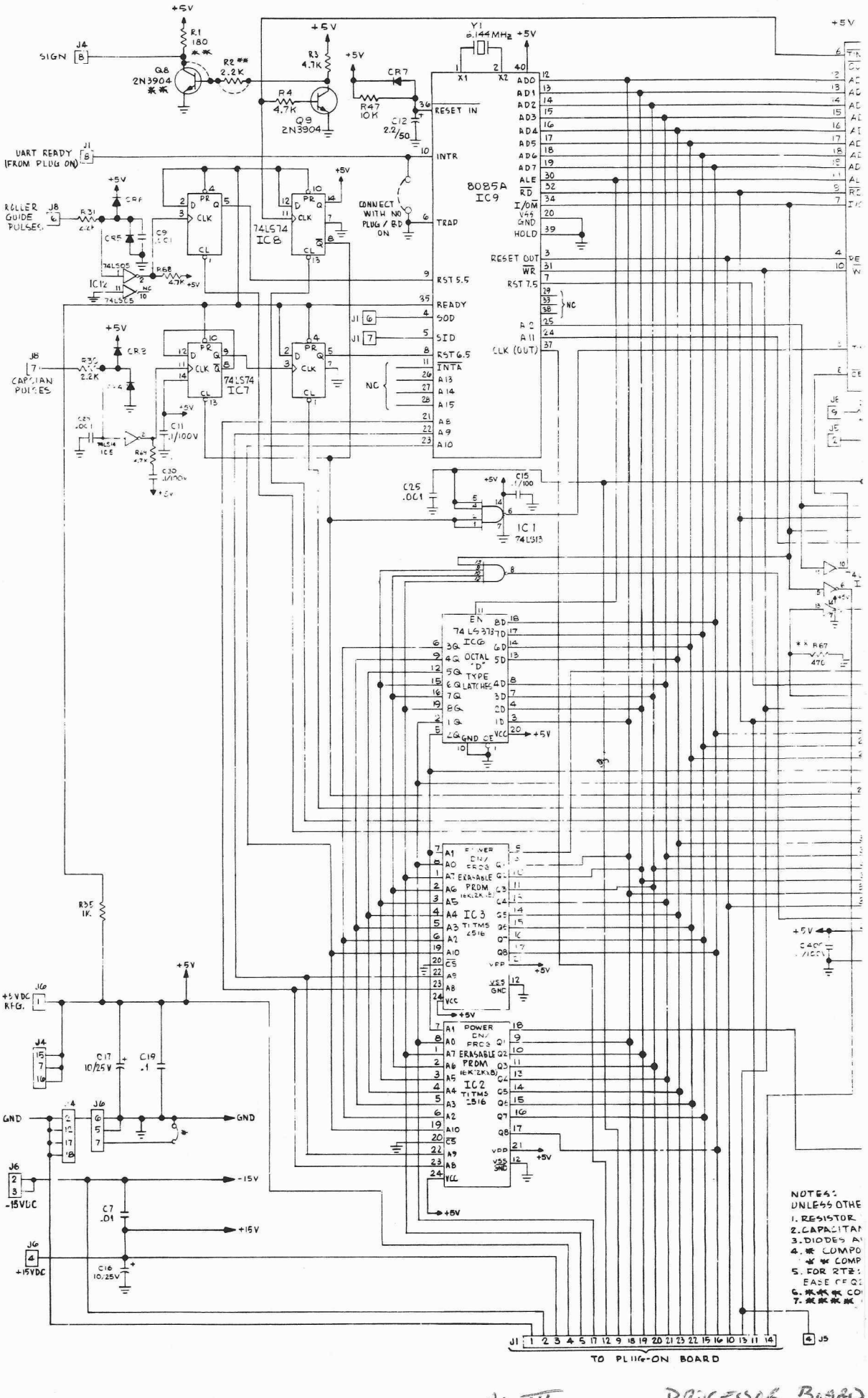
Display Board
SC2500D0610-01 rev I



ALIII REV 1
DISPLAY

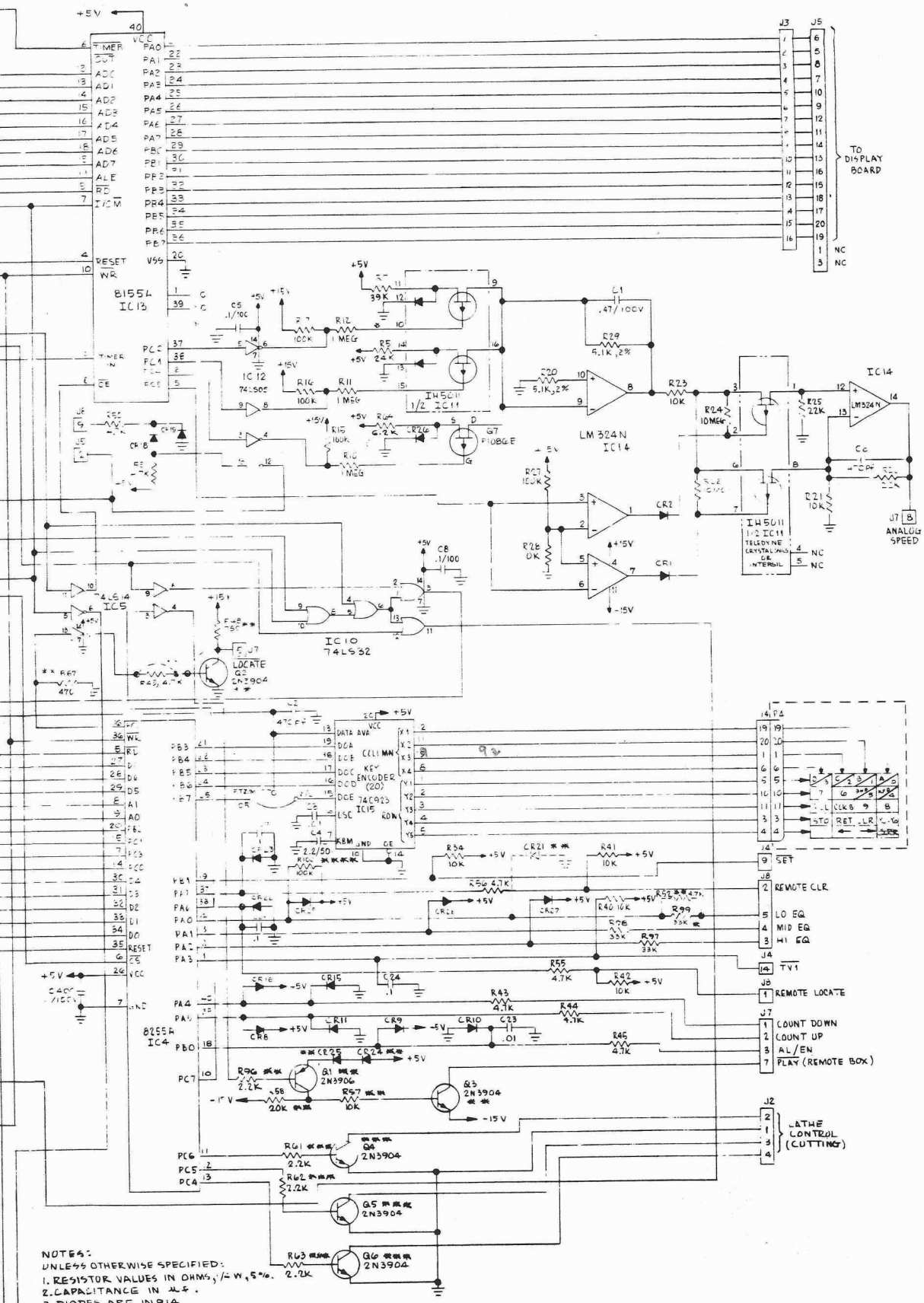
Display Board
SC2500D0610-01 rev I

JH-24



HL III

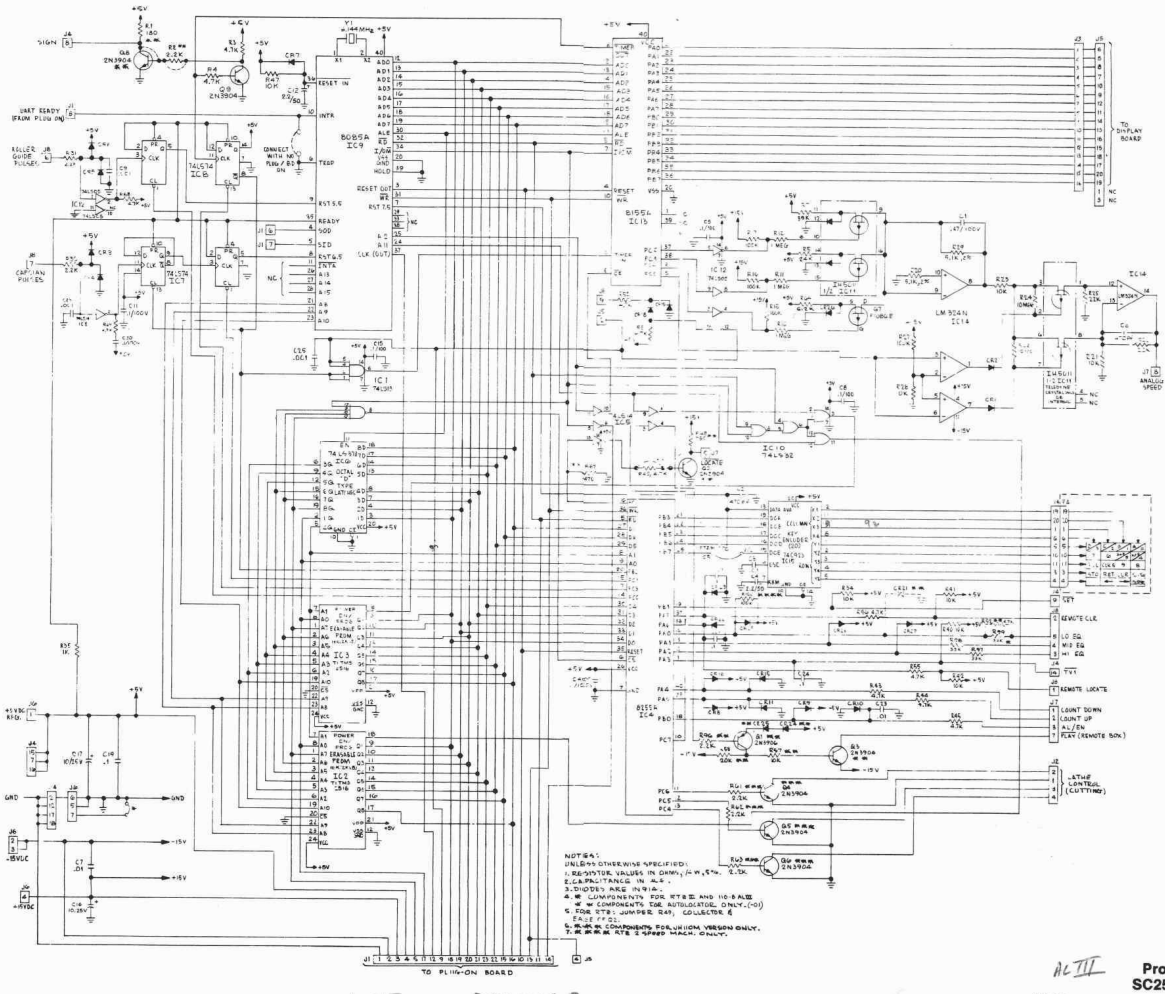
PROCESSOR BOARD



NOTES:
UNLESS OTHERWISE SPECIFIED:
1. RESISTOR VALUES IN OHMS, 1/4 W, 5%.
2. CAPACITANCE IN μF.
3. DIODES ARE IN914.
4. * COMPONENTS FOR RT2 III AND 110-8 AL III
   * * COMPONENTS FOR AUTOLOCATOR ONLY.(-01)
5. FOR RT2: JUMPER R49; COLLECTOR & EASE OF Q2.
6. * * * COMPONENTS FOR JH110M VERSION ONLY.
7. * * * * RT2 2 SPEED MACH. ONLY.

AL III

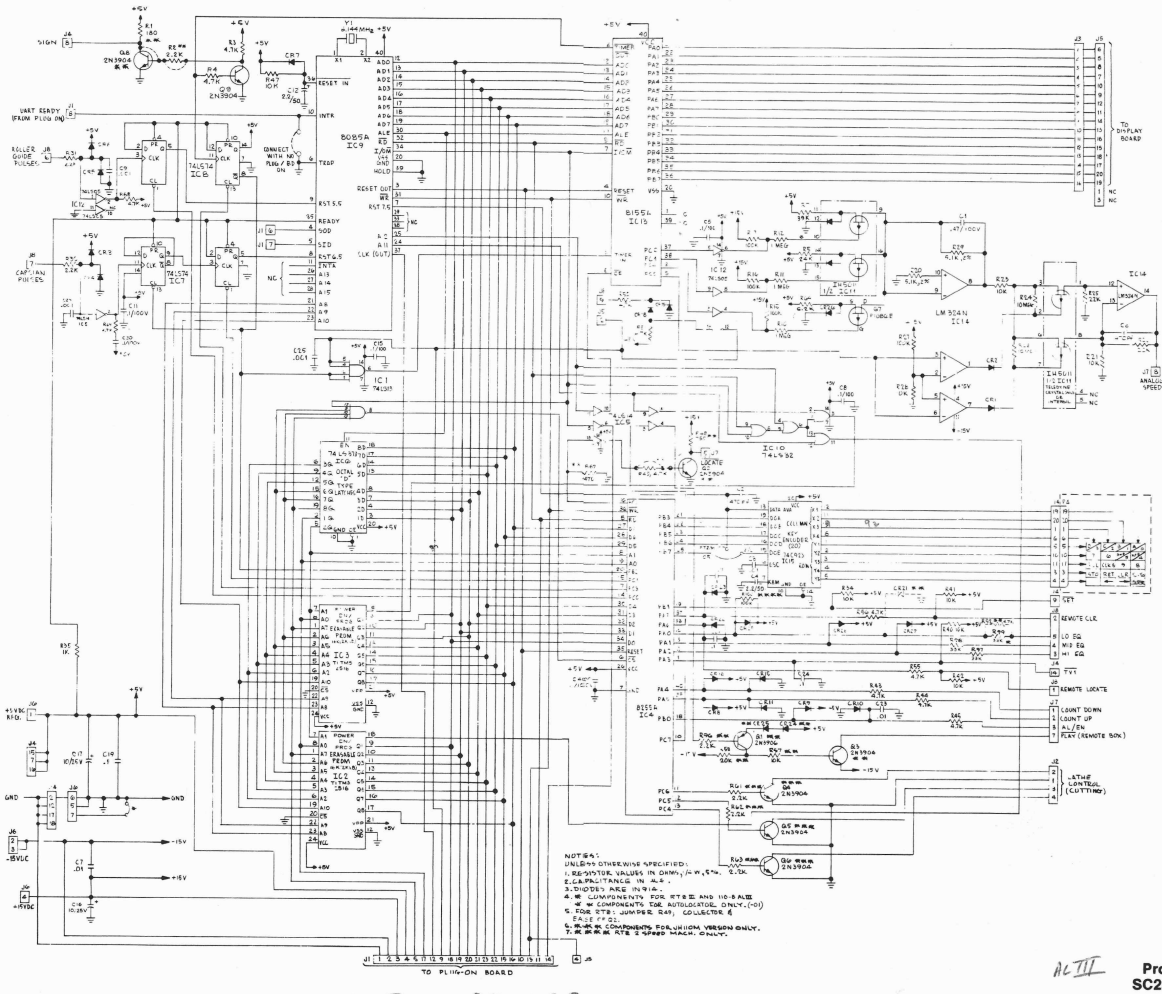
Processor Board
SC2500E0639 rev H



AL III PROCESSER B1

AL III

Processor Board
SC2500E0639 rev H



MCT

SERVICE BULLETIN

BULLETIN NO. 713

DATE 9-4-79

P.C. Bd. A/L Display P.C. Board PCA No. PCA 25E611

A/L Processor P.C. Board PCA 25E610

ECO No. 1130, 1131, 1132

THIS IS A MANDATORY CHANGE

REASON FOR CHANGE:

Suggested regrounding of A/L III to prevent microprocessor and system latch-up due to possible ground spikes.

DESCRIPTION OF CHANGE:

(See drawing on back of page).

STEP 1) Remove Gray wire from Processor P.C. Board (connector J6 pin 5).

STEP 2) Connect to the 5v regulator ground

STEP 3) Remove White/Blue wire from display P.C. Board. (connector J6 pin 5) connects to 5v regulator ground.

STEP 4) Connect 2 - 18ga Gray wires from the 5v regulator ground to connector J6 pin 5 of the processor board and to connector J6 pin 5 of the display board.

STEP 5) Bypass the input of the regulator to ground with a 100mf at 20v tantalum capacitor.

MCI

SERVICE BULLETIN

PRODUCT

BULLETIN NO. 720

DATE DECEMBER 10, 1979

PC BD. Processor Board NO. 2500-0611

REASON FOR CHANGE:

Improved reliability and performance for Autolocator III's.

DESCRIPTION OF CHANGE:

Step 1) Change R46 (100 ohm 2w) resistor from carbon composition to a ceramic for better heat dissipation.

Note: When replacing this resistor, space off of PC Board ¼".

Step 2) Delete capacitors C13 and C14 (22pf disc.).

This lessens the loading effect on the crystal clock oscillator (Y1).

Step 3) Change Zener diode (located near Q5 - play Remote Command Line from pin 10 of IC15-8255) from 1N5246 to 1N5248.

This change was done for better conduction of Q5.

Step 4) Add ground wire from C23 to anode side of CR10 and CR11.

Note: Determine the side of C23 that is connected to the ground rail.

Step 5) Change R30 from 1.2K to 470 ohm ¼ watt resistor and C10 from .001 mf to 470 pf disc.

Step 6) Change R31 from 4.7K to 470 ohm ¼ watt and C9 from .001 mf to 470 pf disc.

These two steps increase slew up rate and improving TVI stability.

8.6 AutoLocator III

The AutoLocator III contains a microprocessor which is, due to the speeds at which it operates, rather difficult to troubleshoot. The most practical way to maintain the microprocessor is to keep on hand a set of replacement IC chips. These ICs are relatively inexpensive, and therefore, the most cost effective way to troubleshoot. Swap the suspected IC chips with known good chips. Whenever desoldering of an IC chip is required, always use a DIP socket.

As a general rule, suspect external circuitry and connections to the microprocessor rather than the microprocessor itself. Verify the regulated voltages before assuming the failure of any chip. Use Table 8-7, it lists some common failures and possible cures.

Table 8-7

AutoLocator III Troubleshooting

No operation
- Check power; +5VDC (J6 pin 1) +15VDC (J6 pin 4) and 15VDC (J6 pins 2, 3).
- Check the oscillator crystal; (3.07MHz).

No tape position or velocity display
- Check CR3, 4, 5, and 6, and IC6 on the Processor Board.

No or malfunctioning TVI
- Check IC6 and IC8 on the Processor Board.
- Check for 19.2KHz on the IC12 pin 12 on the Processor Board when the TVI button is depressed.

No display except for the decimal point
- Check IC13 on the Processor Board (8155A).
- Check IC1 and IC3 on the Display Board.
- Check IC9 pin 37 on the Processor Board for 3.07MHz clock.

Tape position display malfunctioning
- Check for roller guide pulses to IC12 pins 1 and 2 on the Processor Board.
- Check for 19.2KHz injection frequency at IC12 pins 12, 13.
- Check IC8 on the Processor Board.

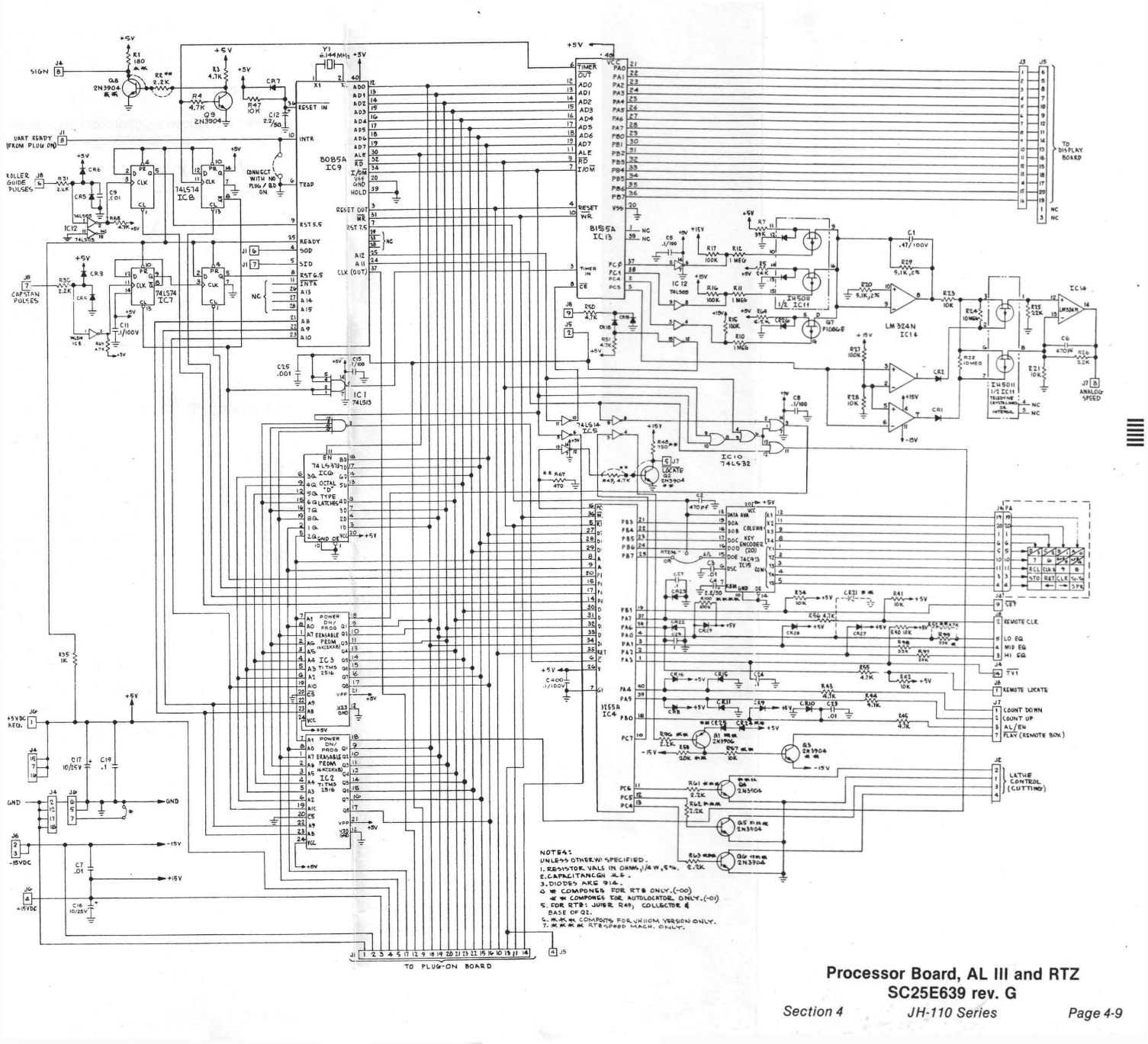
Tape position operates in one direction only
- Check IC14 on the Processor Board.

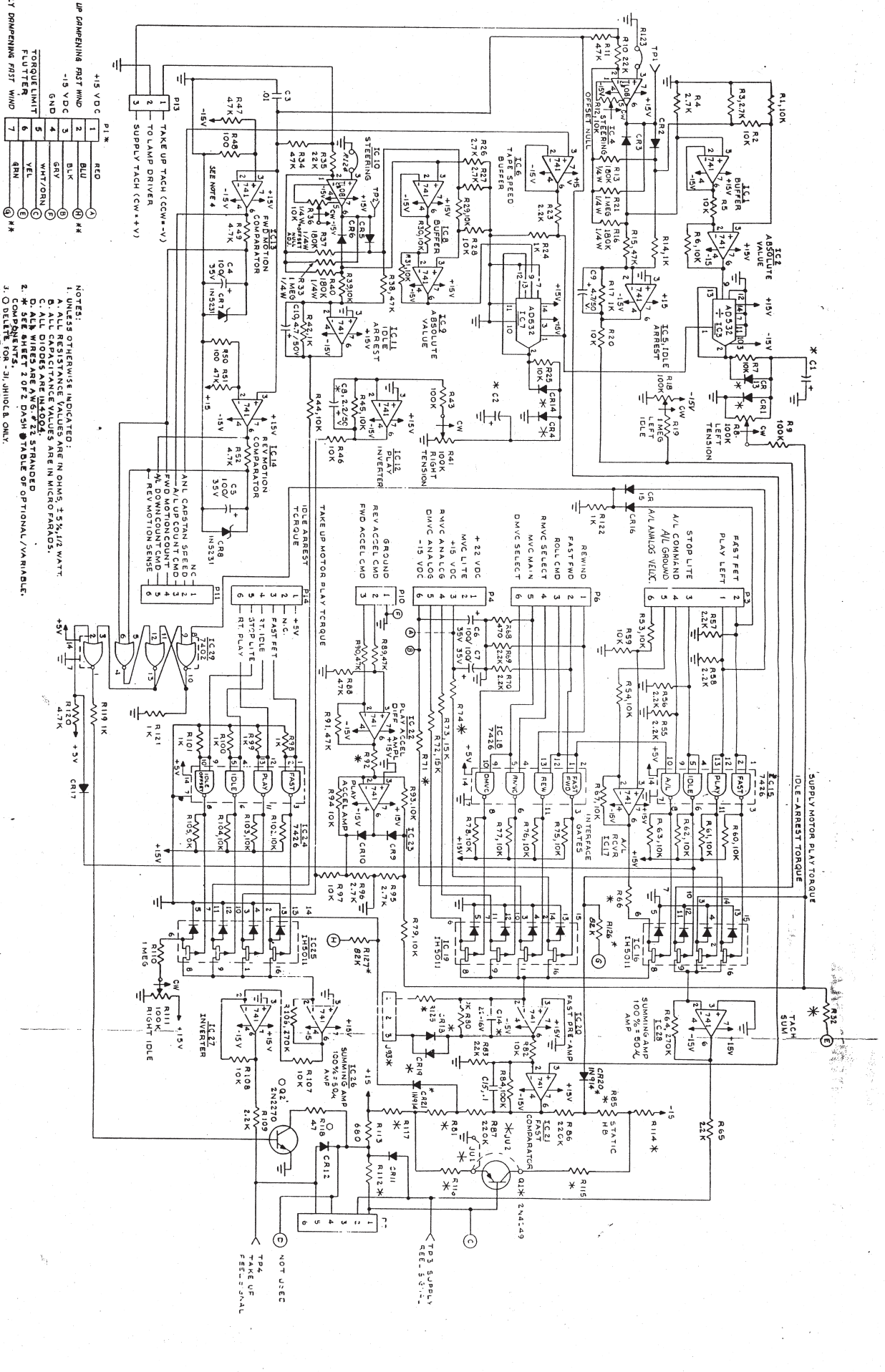
No response to keyboard commands
- Check keyboard switches.
- Check IC4 and IC15 on the Processor Board.

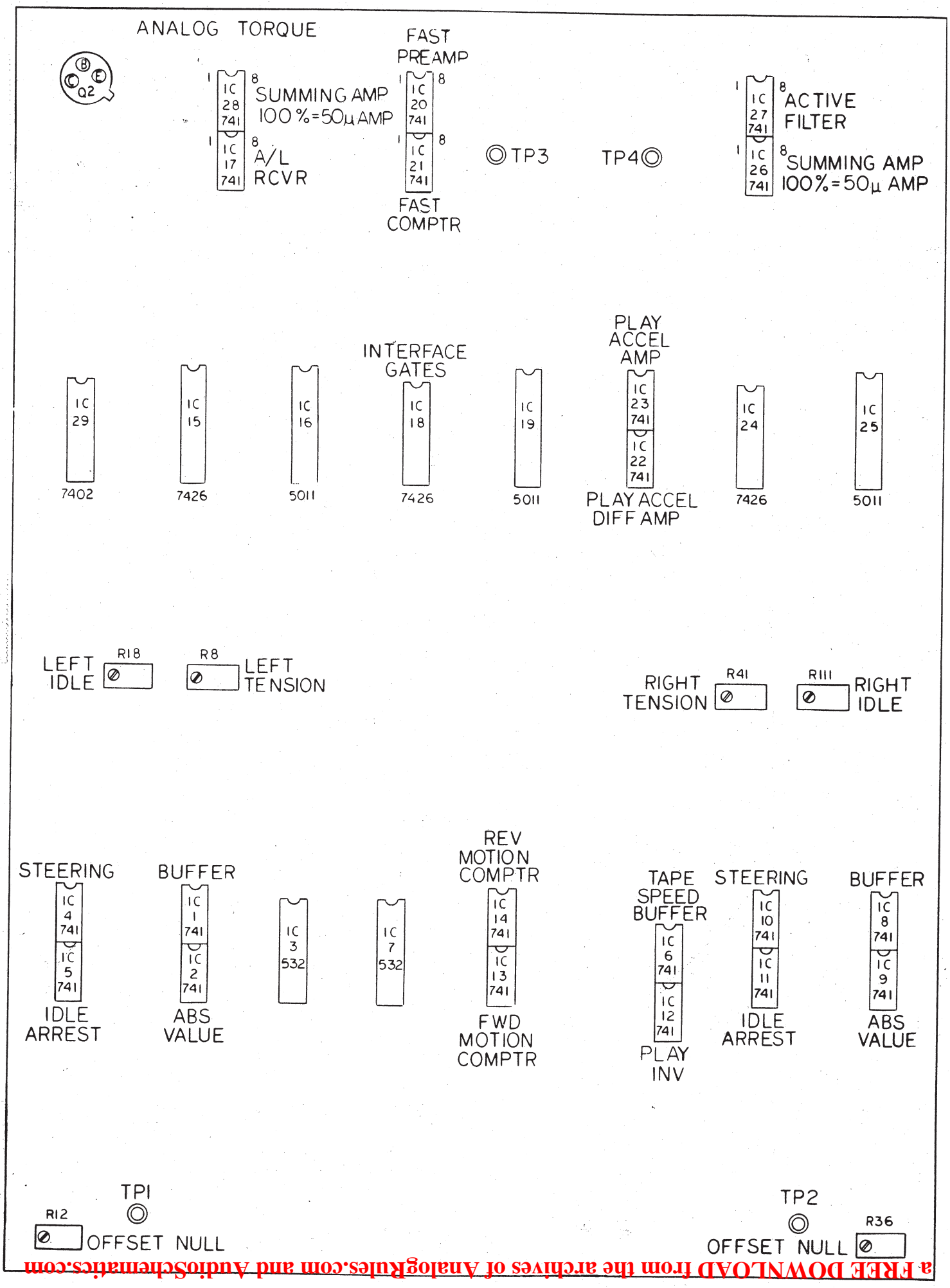
No velocity display
- Check for capstan pulses IC12 pins 10 and 11 on the Processor Board.
- Check IC12, CR3, CR4, and IC7 on the Processor Board.

No variable speed control
- Check the ±15 volts on the Display Board.
- Check IC4, 5, and 7 on the Display Board.

No mode change control
- Check IC6, Q1 and Q2 on the Display Board.
- Check Q1 and Q2 on the Processor Board.
- Check the mode LEDs on the front panel.
- Check J5 pin 2 for 19.2KHz injection frequency.

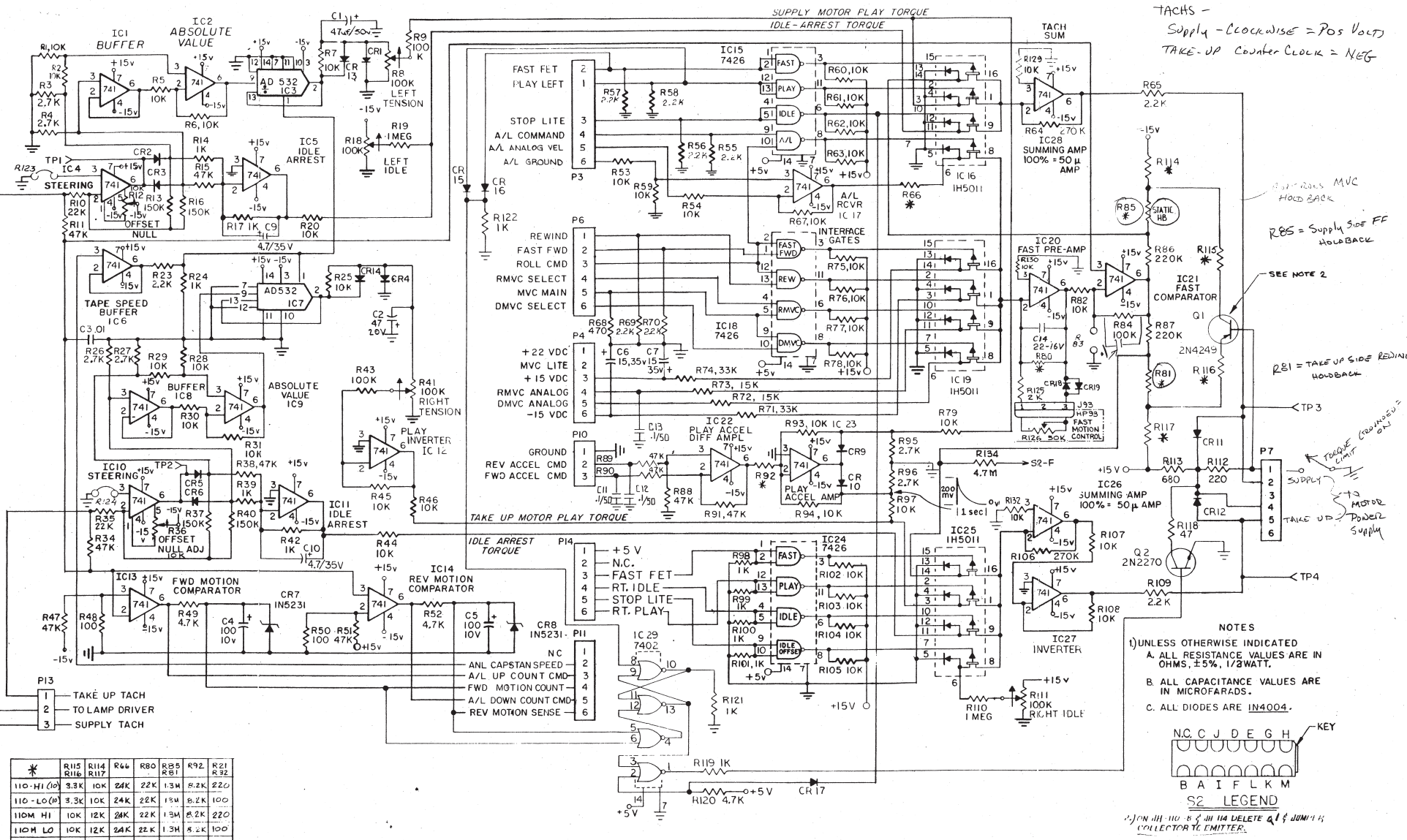






PARTS LIST — ANALOG TORQUE BOARD

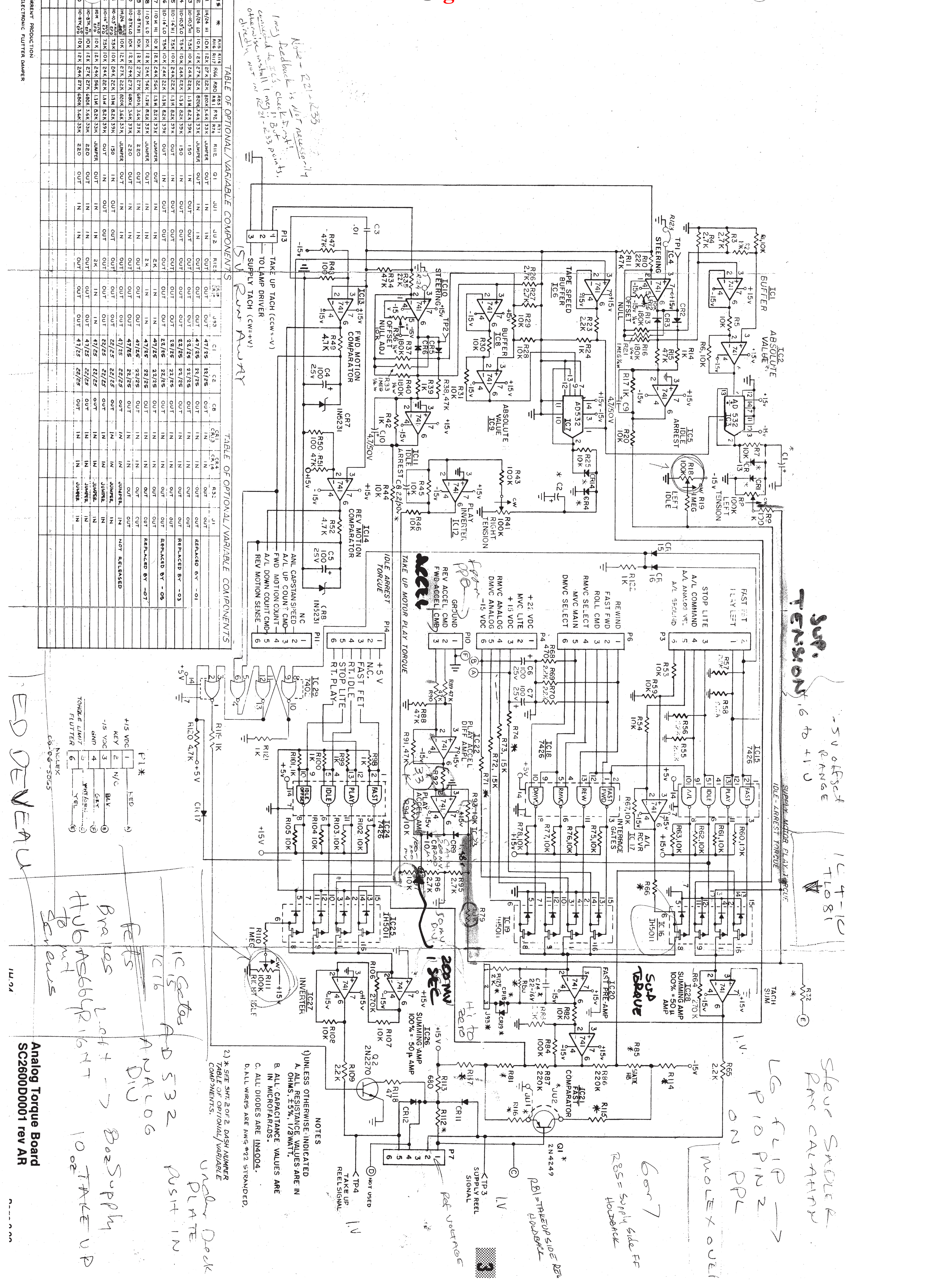
PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA2600-0001-01	ANALOG TORQUE JH-114-HI	1	
09-52-3030	MOLEX 3CIR PARA PC CONN	14	
1.0KOHM5%-½W	CARBON FILM RESISTOR	12	R14, 17, 24, 39, 42, 98-101, 119, 121, 122
1.0-MOHM5%-½W	CARBON FILM RESISTOR	2	R19, R110
10--KOHM5%-½W	CARBON FILM RESISTOR	42	R1, 2, 5, 6, 7, 20, 25, 28, 29, 30, 31, 44, 45, 46, 53, 54, 59-63, 67, 75-79, 82, 93, 94, 97, 102-105, 107, 108, 115, 116, 129, 130, 132
100--OHM5%-½W	CARBON FILM RESISTOR	2	R48, R50
100-KOHM5%-½W	CARBON FILM RESISTOR	3	R9, R43, R84
100MF10V-CLY	LYTIC CAPACITOR SIEMEN-D	2	C4, C5
12--KOHM5%-½W	CARBON FILM RESISTOR	2	R114, 117
14P-DIP-SKT	DIP SKT AIRES 14-511-10	2	
150-KOHM5%-½W	CARBON FILM RESISTOR	4	R13, 16, 37, 40
15MF25V-CLYRL	LYTIC RAD/LD SEALED (GP)	2	C6, C7
16P-DIP-SKT	DIP SKT AIRES 16-511-10	10	
1N4004	DIODE, RECTIFIER - SILICON	15	CR1-CR6, CR9-CR19
1N5231B-5.1V	DIODE, ZENER-SILICON 5.1V	2	CR7, CR8
2.2-KOHM5%-½W	CARBON FILM RESISTOR	9	R23, R55-R58, R65, R69, R70, R109
2.7-KOHM5%-½W	CARBON FILM RESISTOR	6	R3, 4, 26, 27, 95, 96
22--KOHM5%-½W	CARBON FILM RESISTOR	3	R10, R35, R80
220-KOHM5%-½W	CARBON FILM RESISTOR	2	R86, R87
27--KOHM5%-½W	CARBON FILM RESISTOR	1	R66
70-KOHM5%-½W	CARBON FILM RESISTOR	2	R64, R106
2N2270	XSTOR NPN AMPLIFIER SILICON	1	Q2
220-OHM5%-½W	CARBON FILM RESISTOR	3	R21, R32, R112
15--KOHM5%-½W	CARBON FILM RESISTOR	2	R72, R73
2N4249	TRANSISTOR	1	Q1
3.6-KOHM5%-½W	CARBON FILM RESISTOR	1	R92
33--KOHM5%-½W	CARBON FILM RESISTOR	2	R71, R74
4.7-KOHM5%-½W	CARBON FILM RESISTOR	3	R49, R52, R120
47---OHM5%-½W	CARBON FILM RESISTOR	1	R118
47--KOHM5%-½W	CARBON FILM RESISTOR	10	R11, 15, 34, 38, 47, 51, R88-91
470--OHM5%-½W	CARBON FILM RESISTOR	1	R68
22MF25V-CLYRL	CAPACITOR ELECTRONIC	1	C2
47MF63V-CLY	LYTIC CAPACITOR SIEMEN	1	C1
4:7MF35V-CLYRL	LYTIC RAD/LD SEALED (LL)	2	C9, C10
680--OHM5%-½W	CARBON FILM RESISTOR	1	R113
7402	QUAD 2-IN NOR	1	IC29
741CP	OP AMP	20	IC1, 2, 4-6, 8-14, 17, 20-23, 26-28
7426	QUAD 2-IN HVLT INTFACE N	3	IC15, IC18, IC24
820-KOHM5%-½W	CARBON FILM RESISTOR	2	R81, R85
:1MF50V-CCD20	CERAMIC DISC CAPACITOR	3	C11, C12, C13
:01MF50V-CCD20	CERAMIC DISC CAPACITOR 20%	1	C3
AD532J	MULTIPLIER-DIVIDER ANALOG	2	IC3, IC7
AP5-7D	PAD, TRANSISTOR TO-5 TYPE	1	
IH5011	QUAD ANALOG SW H-LEV 15V 16	3	IC16, IC19, IC25
TAPCPOT100K-18T	BU3299W-1-104/BK68WR100K	4	R8, R18, R14, R111
TAPCPOT10K-18T	BU3299W-1-103/BK68WR10K	2	R12, R36

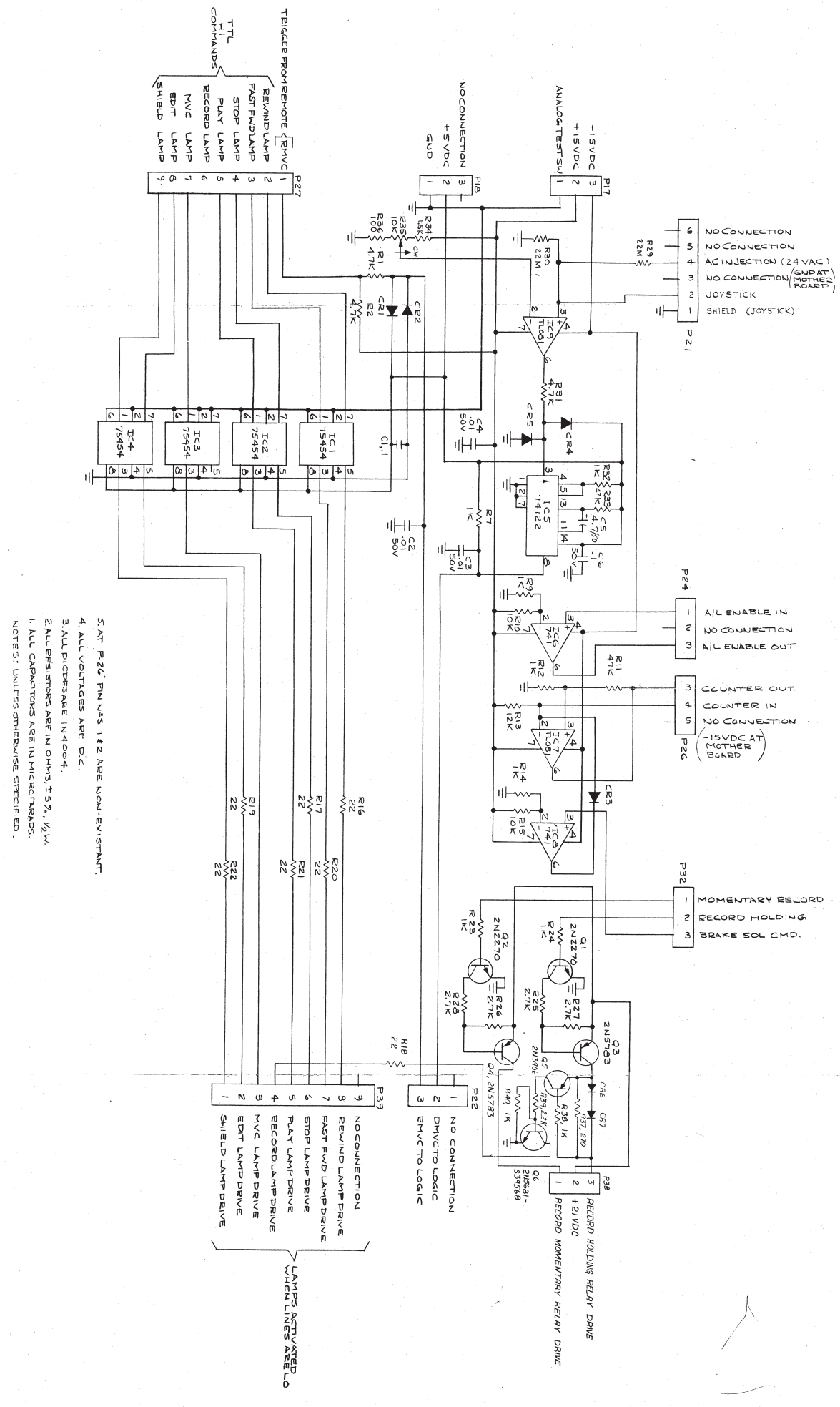


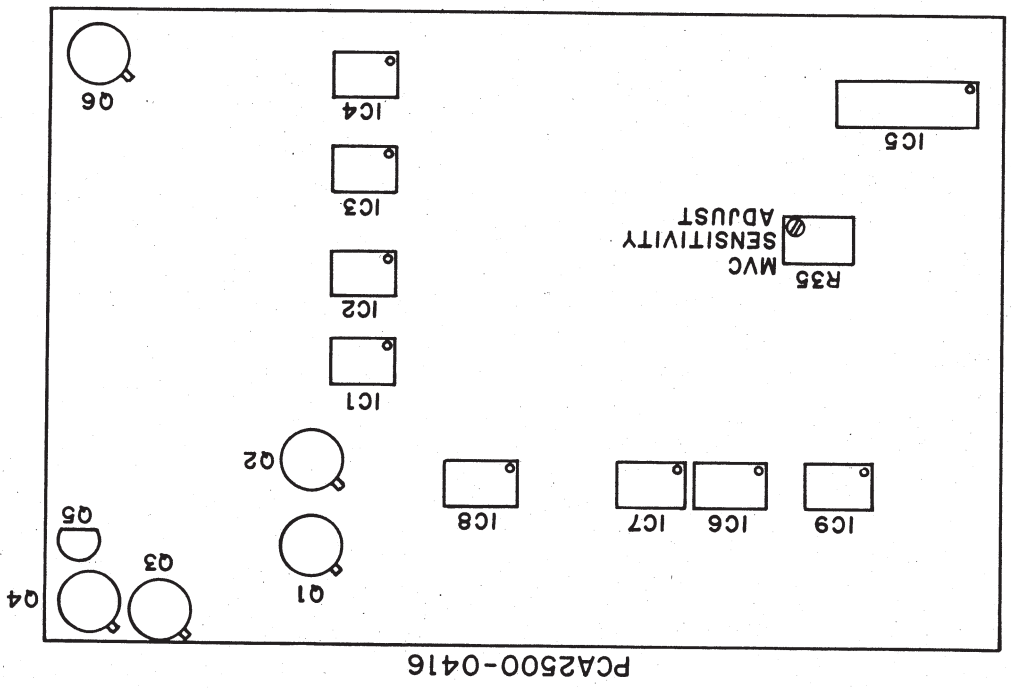
*	R115 R116	R114 R117	R46	R80	R85 R81	R92	R21 R32
110-HI (10)	3.3K	10K	24K	22K	1.3M	8.2K	220
110-LO (10)	3.3K	10K	24K	22K	1.3M	8.2K	100
110M HI	10K	12K	24K	22K	1.3M	8.2K	220
110M LO	10K	12K	24K	22K	1.3M	8.2K	100
110-8	10K	12K	27K	27K	680K	3.6K	220
110-14 HI	3.3K	10K	24K	22K	1.3M	8.2K	220
110-14 LO	3.3K	10K	24K	22K	1.3M	8.2K	100
114 HI	10K	12K	27K	22K	820K	3.6K	220
114 LO	10K	12K	27K	22K	820K	3.6K	100

Analog Torque Board
SC26D001

Section 3 *JH-110 SERIES* *Schematic 3*

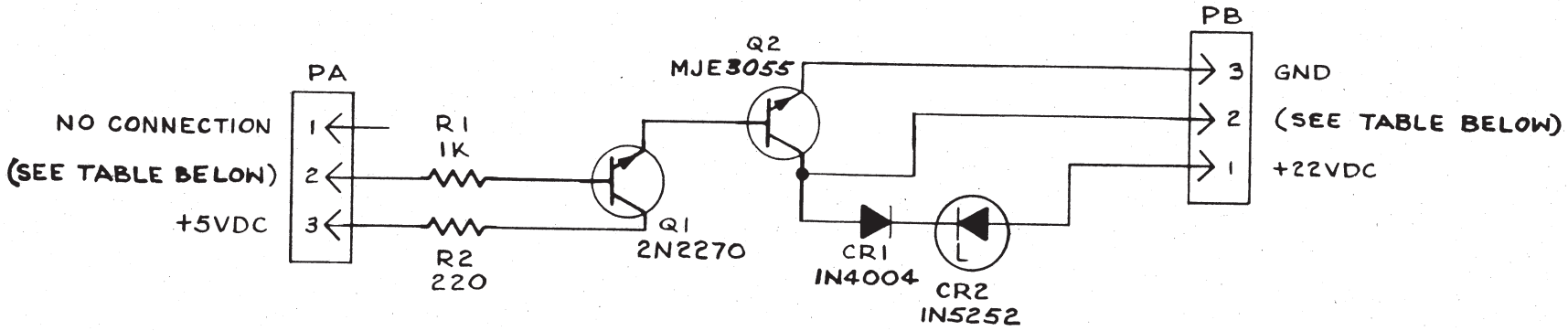






PARTS LIST — INTERFACE/LAMP DRIVER BOARD

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA2500-0415-00	LAMP DRIVER/INTERFACE BD	1	
08P-DIP-SKT	DIP SKT 8PIN ARIES 8-511	6	
09-52-3030	MOLEX 3CIR PARA PC CONN	15	P17, 18, 21, 22, 24, 26, 27, 32, 38, 39
1.0-KOHM5%-½W	CARBON FILM RESISTOR	7	R32, 9, 12, 14, 23, 24, 7
10--KOHM5%-½W	CARBON FILM RESISTOR	2	R10, R15
100--OHM5%-½W	CARBON FILM RESISTOR	1	R34, 36
12--KOHM5%-½W	CARBON FILM RESISTOR	1	R13
14P-DIP-SKT	DIP SKT ARIES 14-511-10	1	
16P-DIP-SKT	DIP SKT ARIES 16-511-10	1	
1N4004	DIODE, RECTIFIER - SILICON	5	CR1-5
2.7-KOHM5%-½W	CARBON FILM RESISTOR	4	R25-R28
22---OHM5%-½W	CARBON FILM RESISTOR	7	R16-22
22--MOHM5%-½W	CARBON FILM RESISTOR	2	R29, 30
2N2270	XSTOR NPN AMPLIFIER SIL	2	Q1, Q2
2N5783	XSTOR PNP SWTCH SILCN TO	2	Q3, Q4
4.7-KOHM5%-½W	CARBON FILM RESISTOR	3	R31, 1, 2
47--KOHM5%-½W	CARBON FILM RESISTOR	2	R33, 11
4:7MF35V-CLYRL	LYTIC RAD/LD SEALED (LL)	1	C5
74122	RETRIG MONO MULTI	1	IC5
741CP	OP AMP	2	IC6, IC8
75454	DUAL ERIPH NOR DRVR MOTO	4	IC1, 2, 3, 4
:01MF50V-CCD20	CERAMIC DISC CAP 20% TOL	3	C4, 3, 2
·1MF100V-CCD20	CERAMIC DISC CAPACITOR	1	C6
P5-7D	PAD, TRANSISTOR TO-5 TYPE	4	
TAPCPOT10K-18T	BU3299W-1-103/BK68WR10K	1	R35
TL081CP	OP AMP	2	IC7, IC9
TY-24M	CABLE TIE-MED ALLSTATE R	2	



DRIVER BD	PA	PA-2 FUNCTION	PB	PB-2 FUNCTION
BRAKE SOL.	P41	BRAKE LOGIC COMM.	P37	BRAKE SOL. DRIVE
PLAY SOL.	P35	PLAY LOGIC COMMAND	P34	PLAY SOL. DRIVE
"Z" ROLLER SOL.	P30	"Z" ROLLER LOGIC COMM	P29	"Z" ROLLER SOL. DRIVE
LIFTER SOL.	P25	LIFTER LOGIC COMM.	P23	LIFTER SOL. DRIVE
SHIELD SOL.	P20	SHIELD LOGIC COMM.	P16	SHIELD SOL. DRIVE

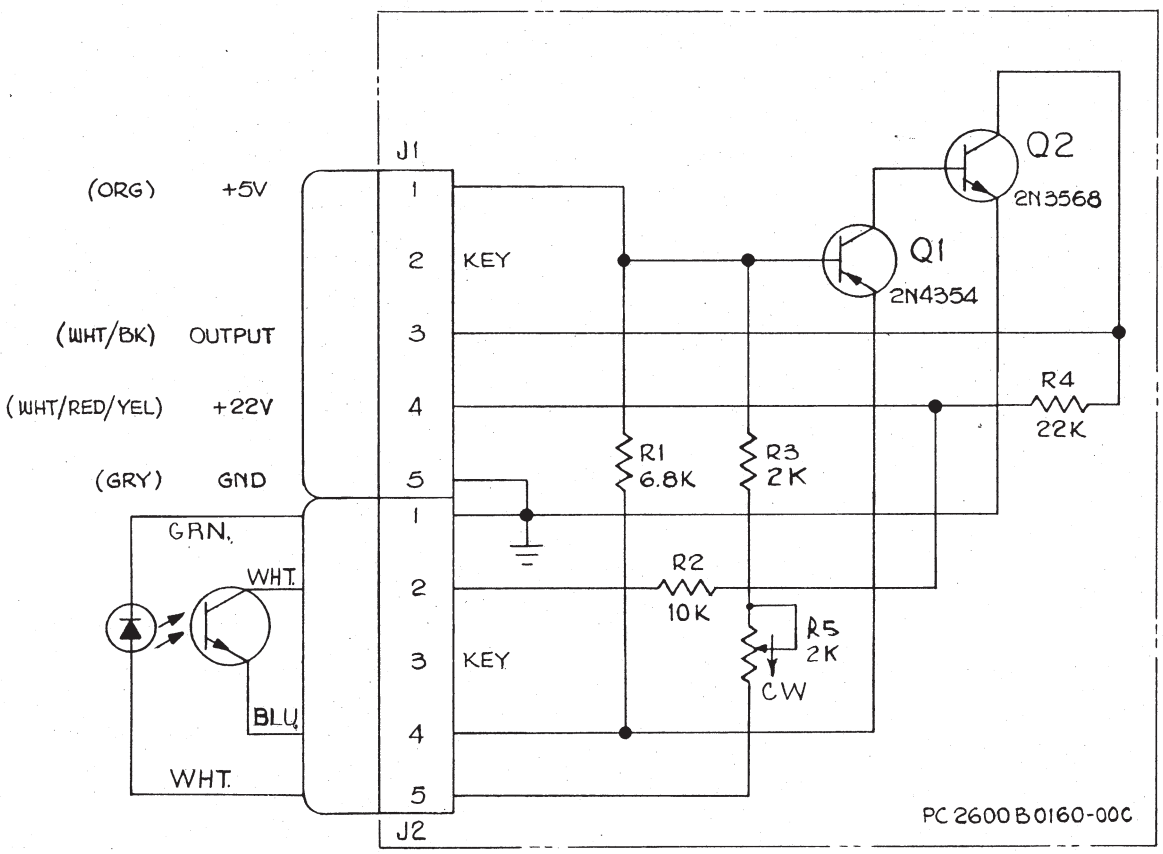
Solenoid Driver Board
SD2500-10401-2005

PARTS LIST — PHOTO SENSOR BOARD

PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA2600-0160-00	PCA PHOTO SENSOR BD	1	
09-66-1101	MOLEX 10PIN RIGHT ANGLE	1	J1, J2
10--KOHM5%-¼W	CARBON FILM RESISTOR	1	R2
150-KOHM5%-¼W	CARBON FILM RESISTOR	1	R3
22--KOHM5%-¼W	CARBON FILM RESISTOR	1	R4
2N4354	XSTOR PNP AMPL	1	Q1
6.8-KOHM5%-¼W	CARBON FILM RESISTOR	1	R1
AP5-7D	PAD, TRANSISTOR TO-5 TYPE	1	
MC-2600-0161-01	BRACKET, MTG, PHOTO-SENSOR	1	
PN3568-5	XSTOR NPN AMPL	1	Q2
SAPCPOT500-18T	BU3299X-1-501/BK68XR500	1	
TAPCPOT500-18T	BU3299W-1-501/BK68WR500	1	R5

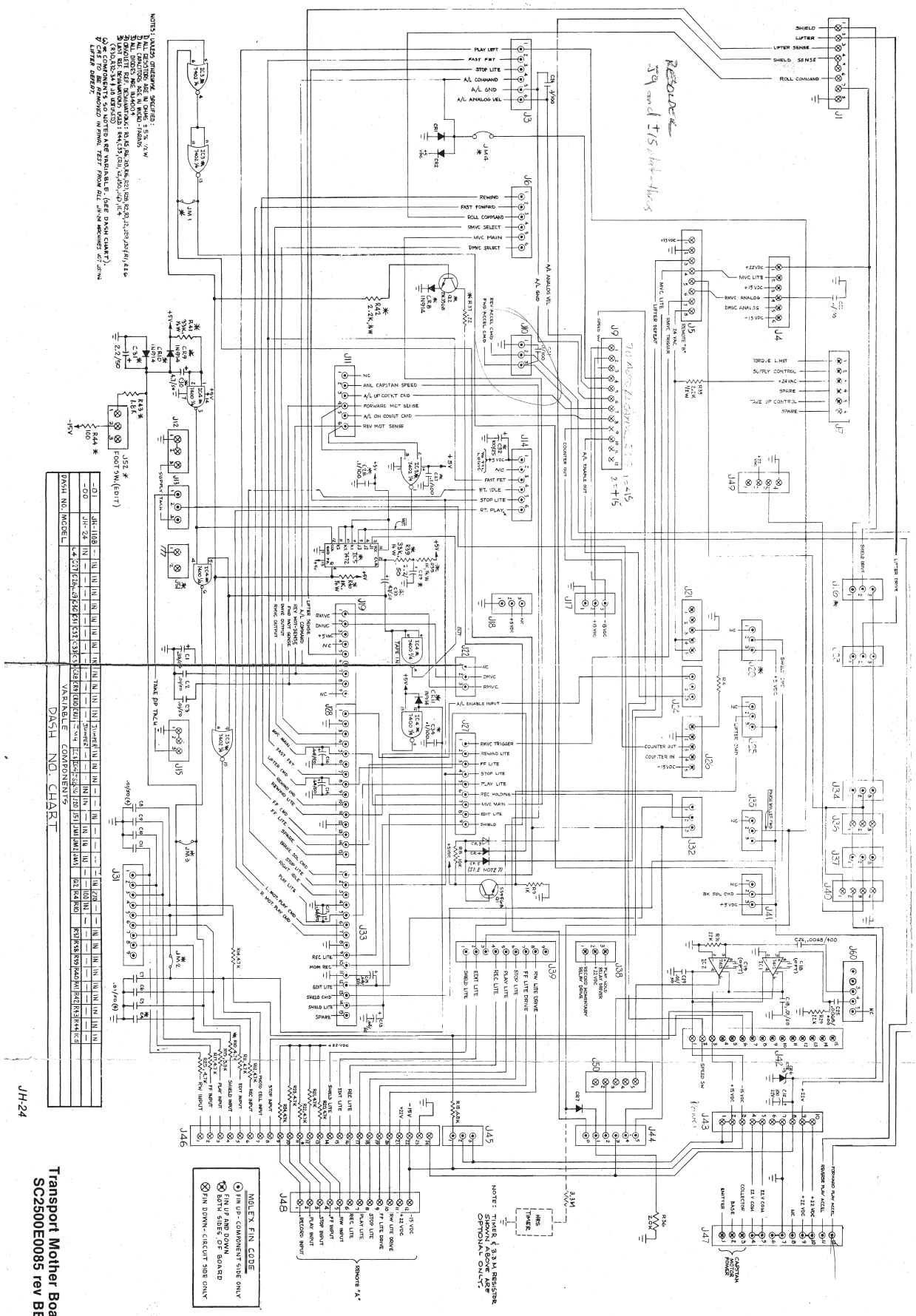
PARTS LIST — SOLENOID DRIVER BOARD

ART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA2500-0042-00	PCA, SOLENOID DRIVER ASSY	1	
09-64-1031	MOLEX 3PIN NON-LOCK 3/4	2	PA, PB
1.0-KOHM5%-½W	CARBON FILM RESISTOR	1	R1
1N4004	DIODE, RECTIFIER - SILICON	1	CR1
1N5252B-24V	DIODE, ZENER-SILCN 24V-5%	1	CR2
220--OHM5% ½W	CARBON FILM RESISTOR	1	R2
2N2270	XSTOR NPN AMPLIFIER	1	Q1
AP5-7D	PAD, TRANSISTOR TO-5 TYPE	1	
MJF-3055	XSTOR NPN HI PWR AMP SI	1	Q2



NOTE:

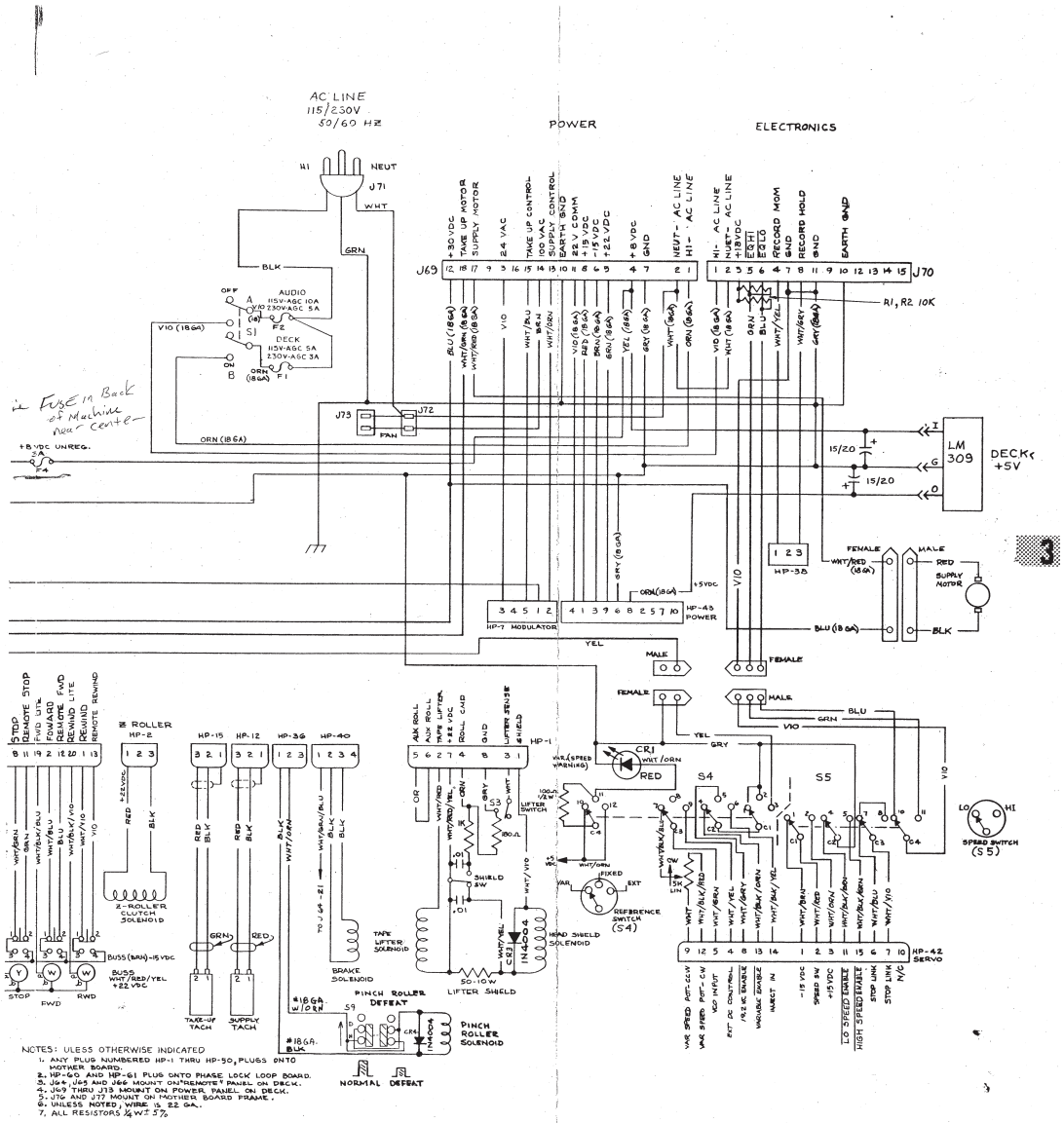
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4 W, 5%.



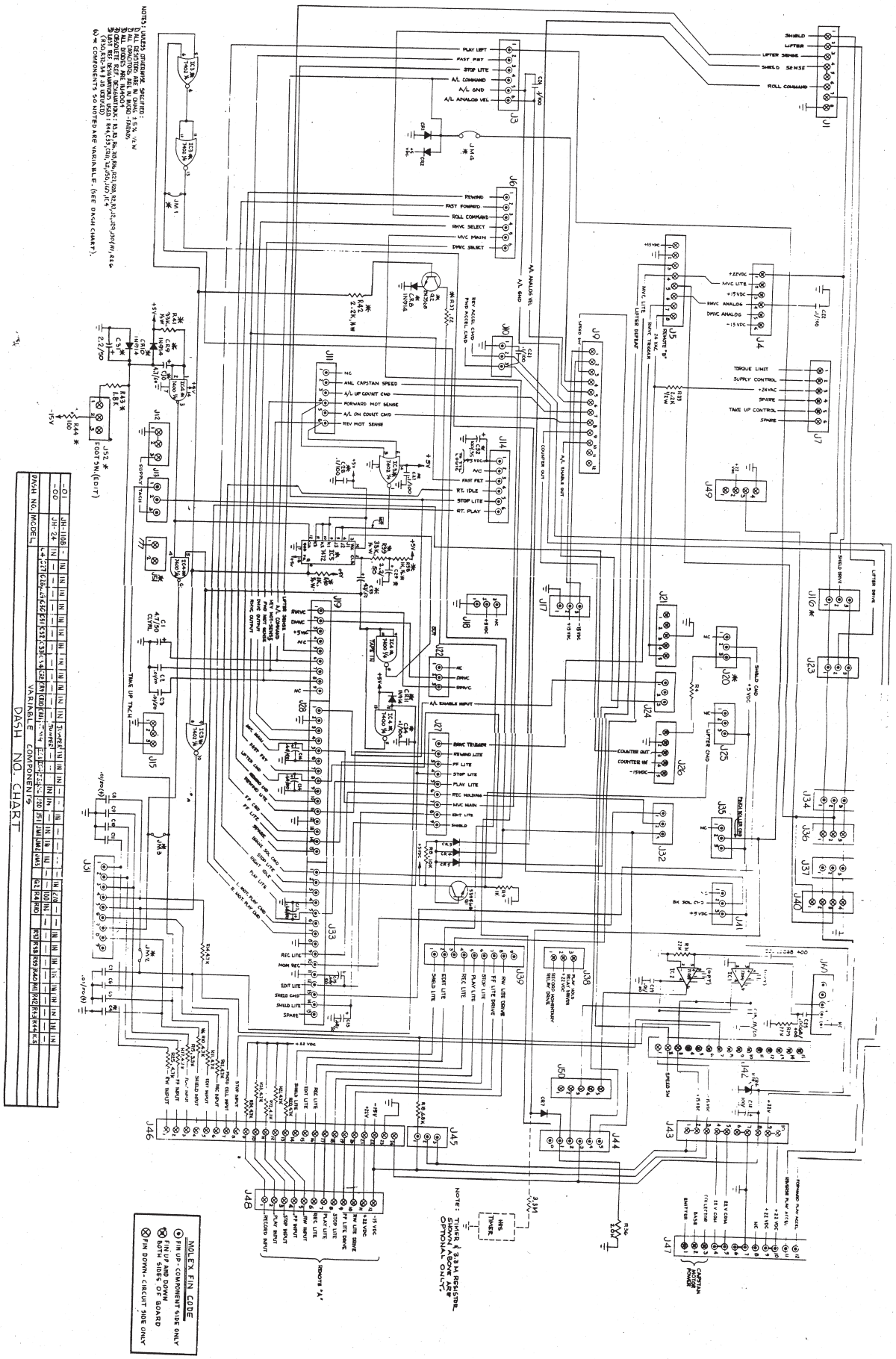
Transport Mother Board
SC2500E0085 rev BB

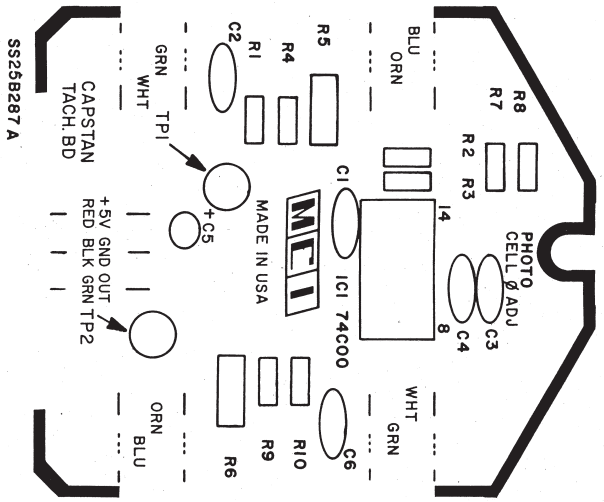
PARTS LIST — TRANSPORT MOTHER BOARD

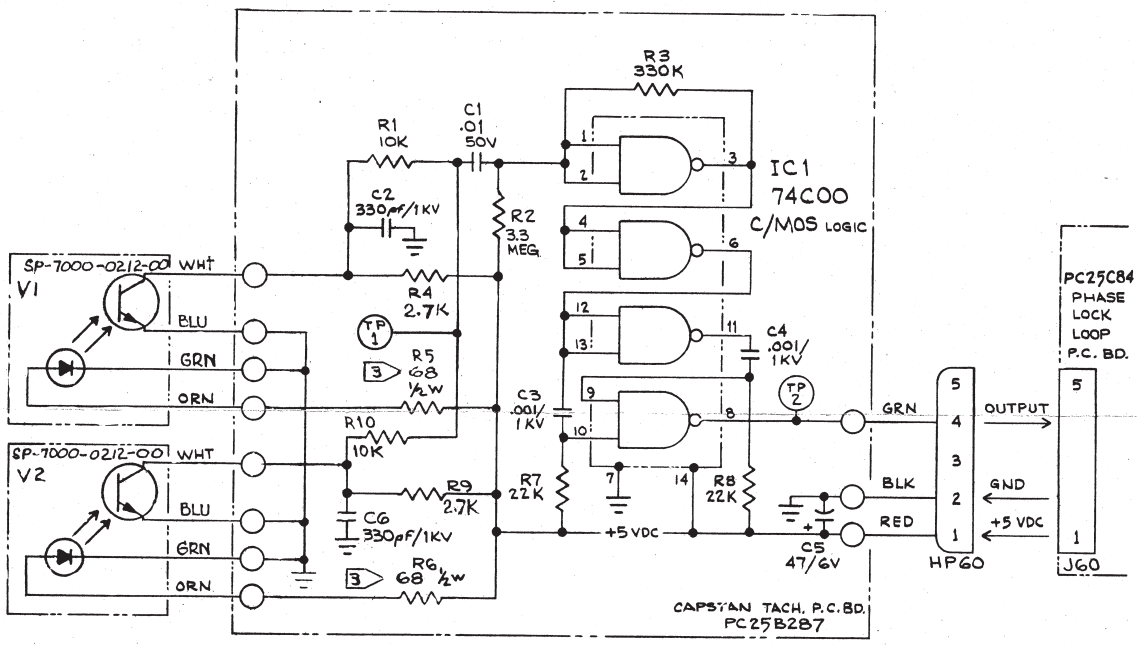
PART NUMBER	DESCRIPTION	QUAN.	DESIGNATOR
PCA2500-0085-00	PCA MOTHER BD ASSY JH-24	1	
08P-DIP-SKT	DIP SKT 8PIN ARIES 8-511	2	
09-52-3030	MOLEX 3CIR PARA PC CONN	9	
09-56-1032	MOLEX 3PIN LOCK 1-3/16"	6	
09-56-1042	MOLEX 4PIN LOCK 1-3/16"	5	
09-56-1052	MOLEX 5PIN LOCK 1-3/16"	3	
09-64-1032	MOLEX 3PIN NON-LOCK 15/16"	7	
09-64-1033	MOLEX 3PIN NON-LOCK 1-3/16"	2	
09-64-1042	MOLEX 4PIN NON-LOCK 15/16"	1	
09-64-1062	MOLEX 6PIN NON-LOCK 15/16"	4	
09-64-1082	MOLEX 8PIN NON-LOCK 15/16"	1	
09-64-1083	MOLEX 8PIN NON-LOCK 1-3/16"	1	
09-64-1092	MOLEX 9PIN NON-LOCK 15/16"	2	
09-64-1123	MOLEX 12PIN NON-LOCK 1-3/16"	2	
09-65-1031	MOLEX 3PIN LOCK 3/4"	4	
09-65-1041	MOLEX 4PIN LOCK 3/4"	2	
09-65-1051	MOLEX 5PIN LOCK 3/4"	1	
09-65-1081	MOLEX 8PIN LOCK 3/4"	2	
09-65-1101	MOLEX 10PIN LOCK 3/4"	1	
09-65-1121	MOLEX 12PIN LOCK 3/4"	4	
.0-KOHM5%-½W	CARBON FILM RESISTOR	4	R9, R38, R40, R42
0-KOHM5%-½W	CARBON FILM RESISTOR	1	R8
00-KOHM5%-½W	CARBON FILM RESISTOR	2	R4, R44
00MF10V-CLY	LYTIC CAPACITOR SIEMEN-D	1	C12
20-HC-129-VA	TIME LAPSE IND 75-36 CUR	1	M1
N4004	DIODE, RECTIFIER - SILICON	10	CR1, 2, 3, 4, 5, 7, 8, 9, 10, 11
.0-KOHM5%-½W	CARBON FILM RESISTOR	1	R36
.2-KOHM5%-½W	CARBON FILM RESISTOR	1	
2-KOHM5%-½W	CARBON FILM RESISTOR	2	R31, R37
N5681-S39568	XSTOR NPN AMPLIFIER	1	Q2
3-KOHM5%-½W	CARBON FILM RESISTOR	2	R39, R41
.3-MOHM5%-½W	CARBON FILM RESISTOR	1	R26
.7-KOHM5%-½W	CARBON FILM RESISTOR	12	R10, 11, 12, 14, 15, 17, 20-25
:7MF25V-CLYRL	LYTIC RAD/LD SEALED (LL)	2	C1, C33
.8-KOHM5%-½W	CARBON FILM RESISTOR	1	R18
0068MF400V-CMY	MYLAR CAPACITOR MEPCO SR	2	C25, C26
01MF50V-CCD20	CERAMIC DISC CAP 20% TOL	13	C2-C11, C18, C19, C28
MF50V-CCD20	CERAMIC DISC CAPACITOR	4	C21, C22, C24, C27
8MF50V-CLYRL	LYTIC RAD/LD SEALED (LL)	5	C13, 14, 15, 16, 17
P5-T	PAD, TRANSISTOR TO-5 TYPE	1	
CTE-15V	DIODE, SURGISTOR	1	CR6
P-7100-0063-00	SPACER, AMATOM 8155-A-06	4	
_0810P	OP AMP	2	IC1, IC2
402	QUAD 2-IN NOR	1	IC3
400	QUAD 2-IN NAND	1	IC4
472	J-K FLIP-FLOP	1	IC5
N2270	TRANSISTOR NPN	1	Q1



Interconnect Harness
SC9000D0163 rev C







NOTES.

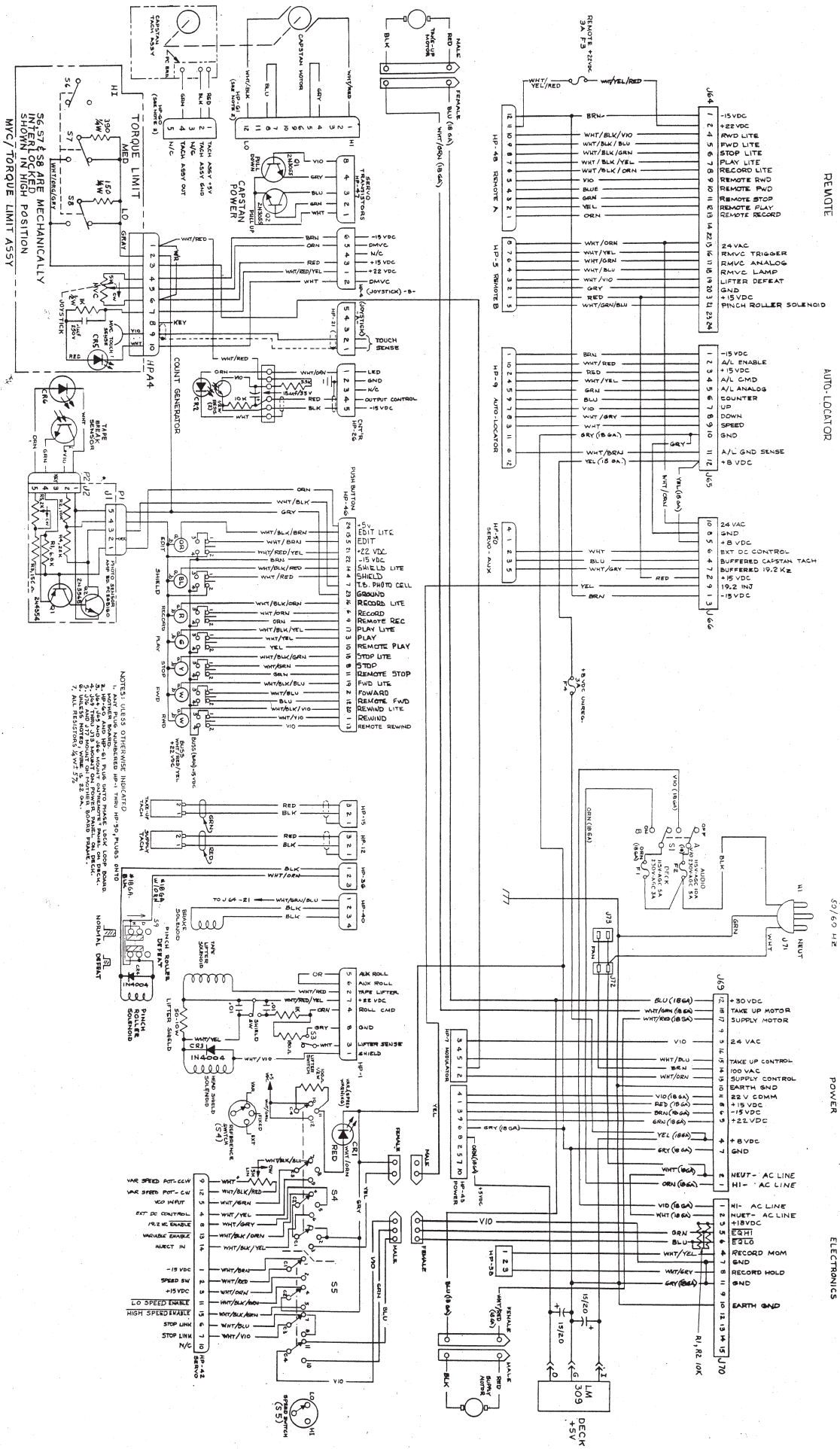
1.) UNLESS OTHERWISE SPECIFIED:
ALL RESISTOR VALUES ARE IN OHMS, 1/4 W, 5%;
ALL CAPACITOR VALUES ARE IN MICROFARADS.

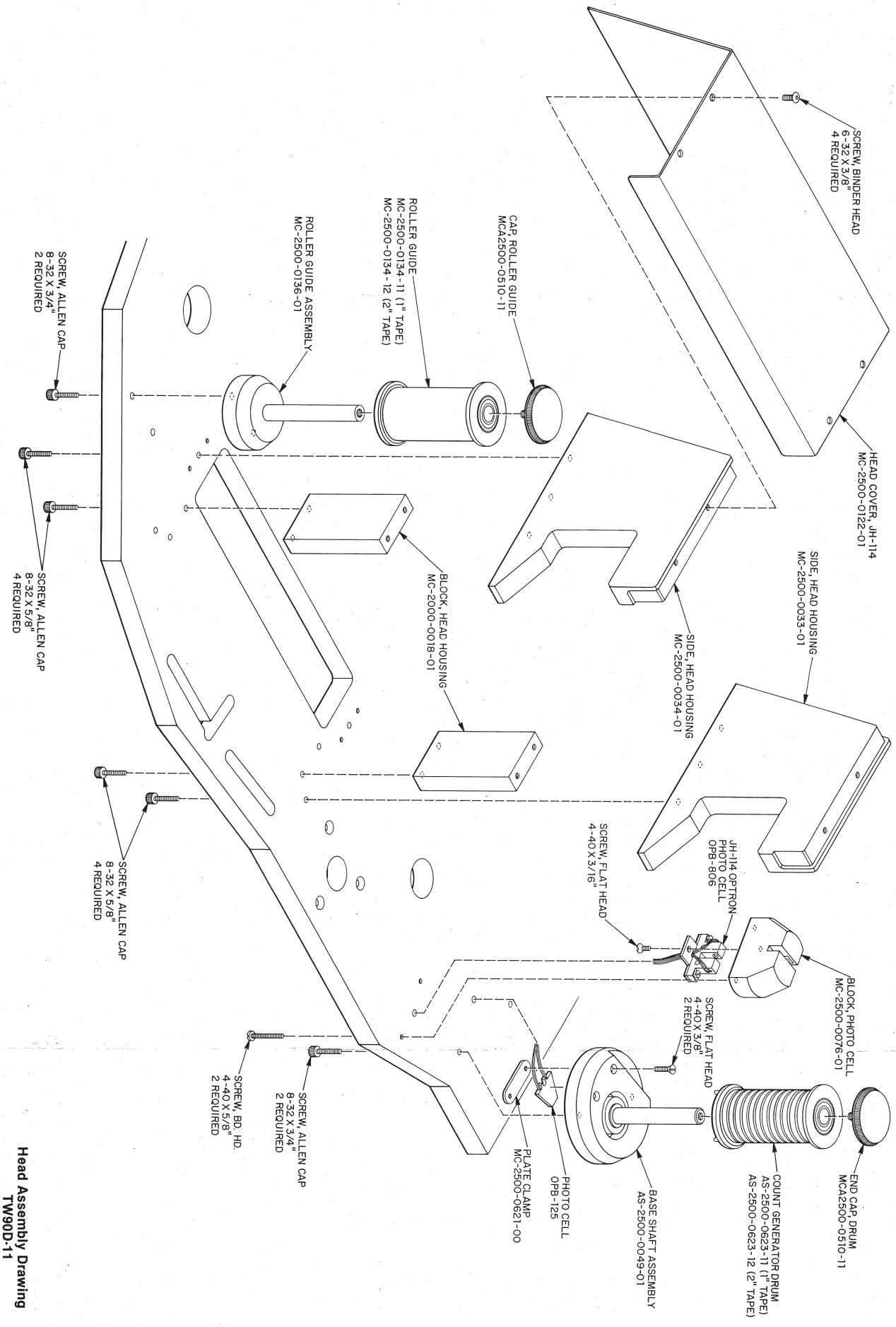
2.) TP1 & TP2 ARE SWAGED TERM. POSTS.

3 > R5 & R6 ARE NOMINAL VALUES; MAY CHANGE AT FINAL CHECKOUT.

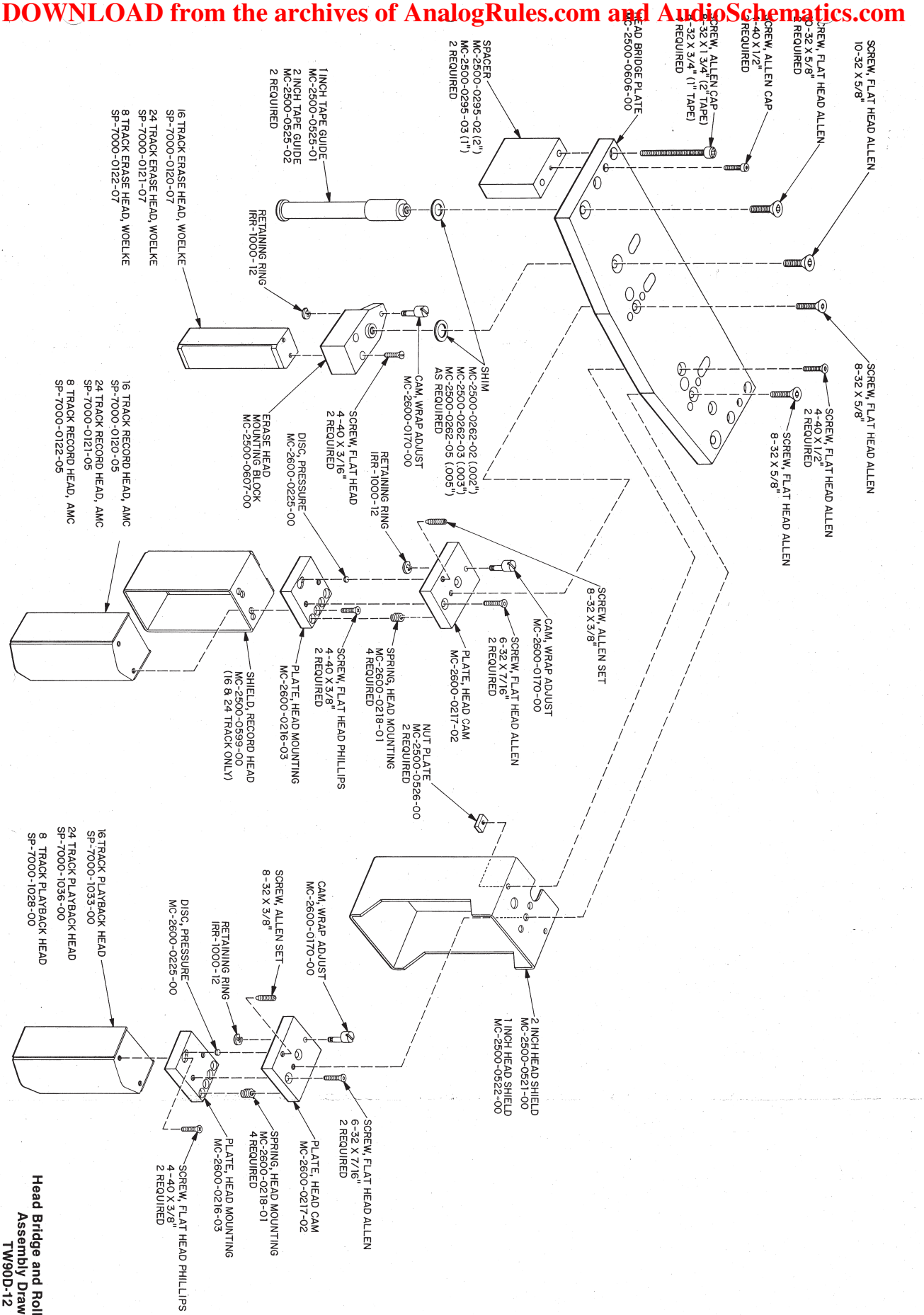
4.) USE LEADS AS SUPPLIED WITH V1 & V2.

5.) WIRES TO HP60 ARE 22 AWG, 7 STRAND.

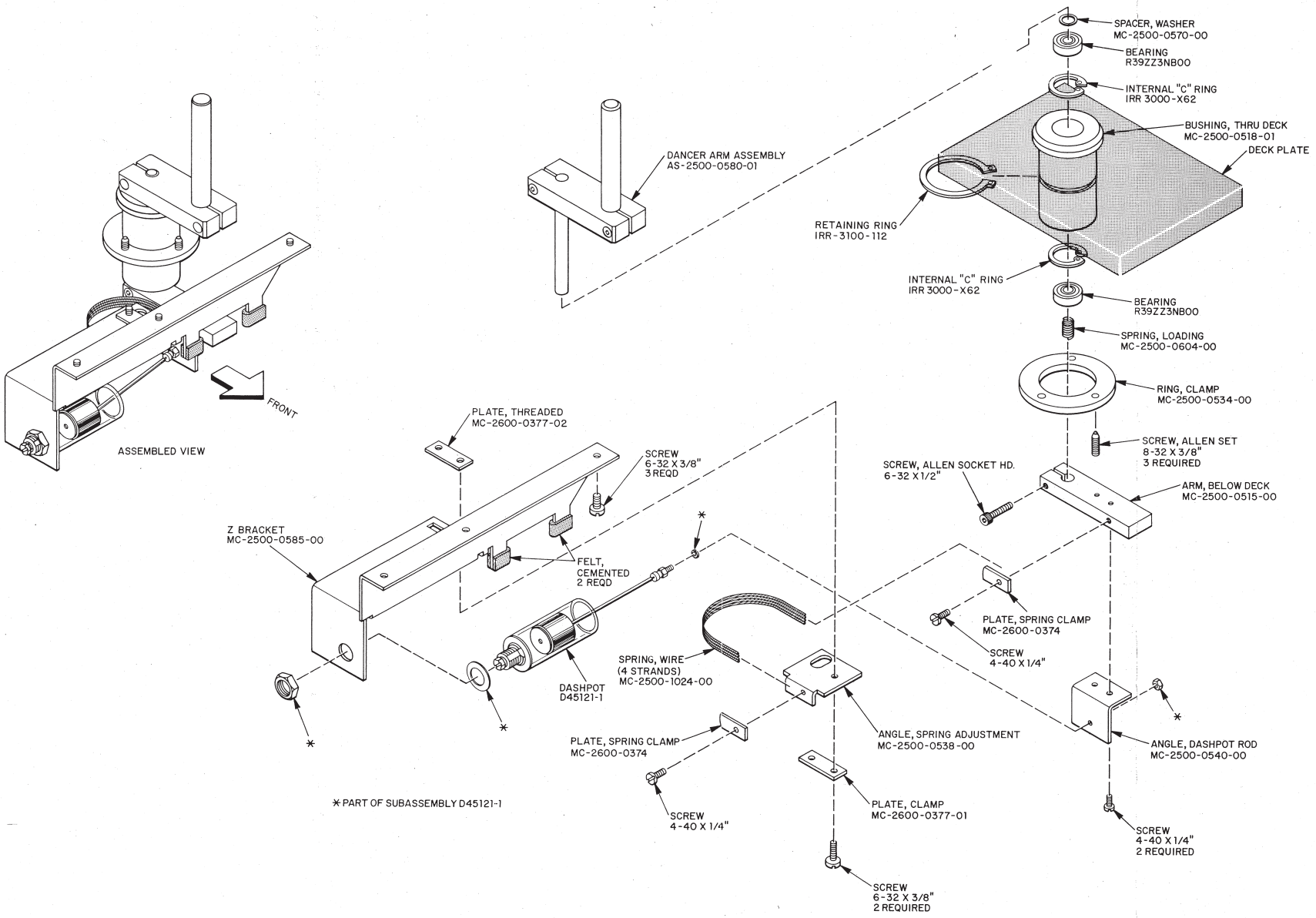




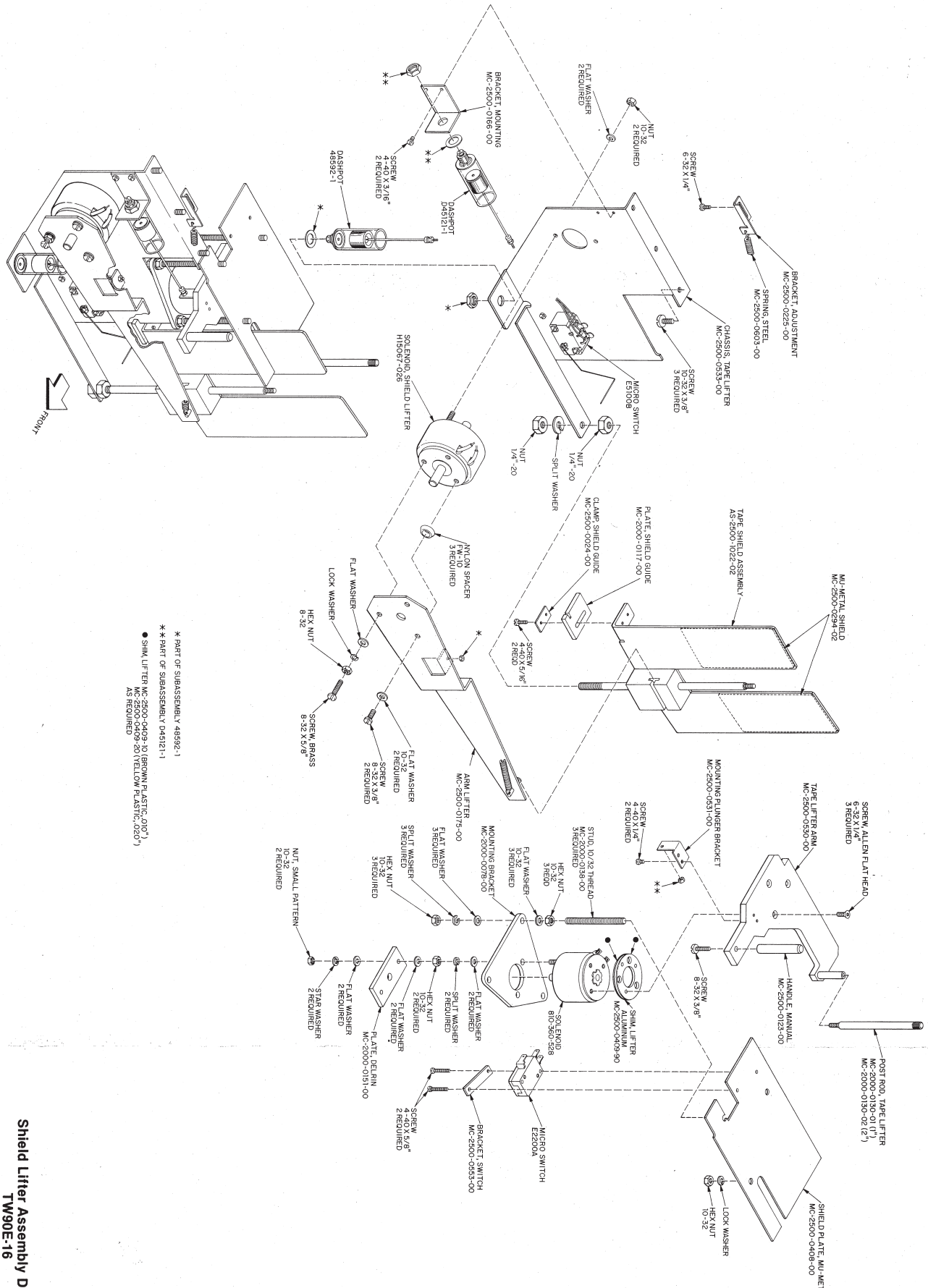
Head Assembly Drawing
TW90D-11



Head Bridge and Roller Guide Assembly Drawing TW90D-12



Dancer Arm Assembly Drawing
TW90D-10

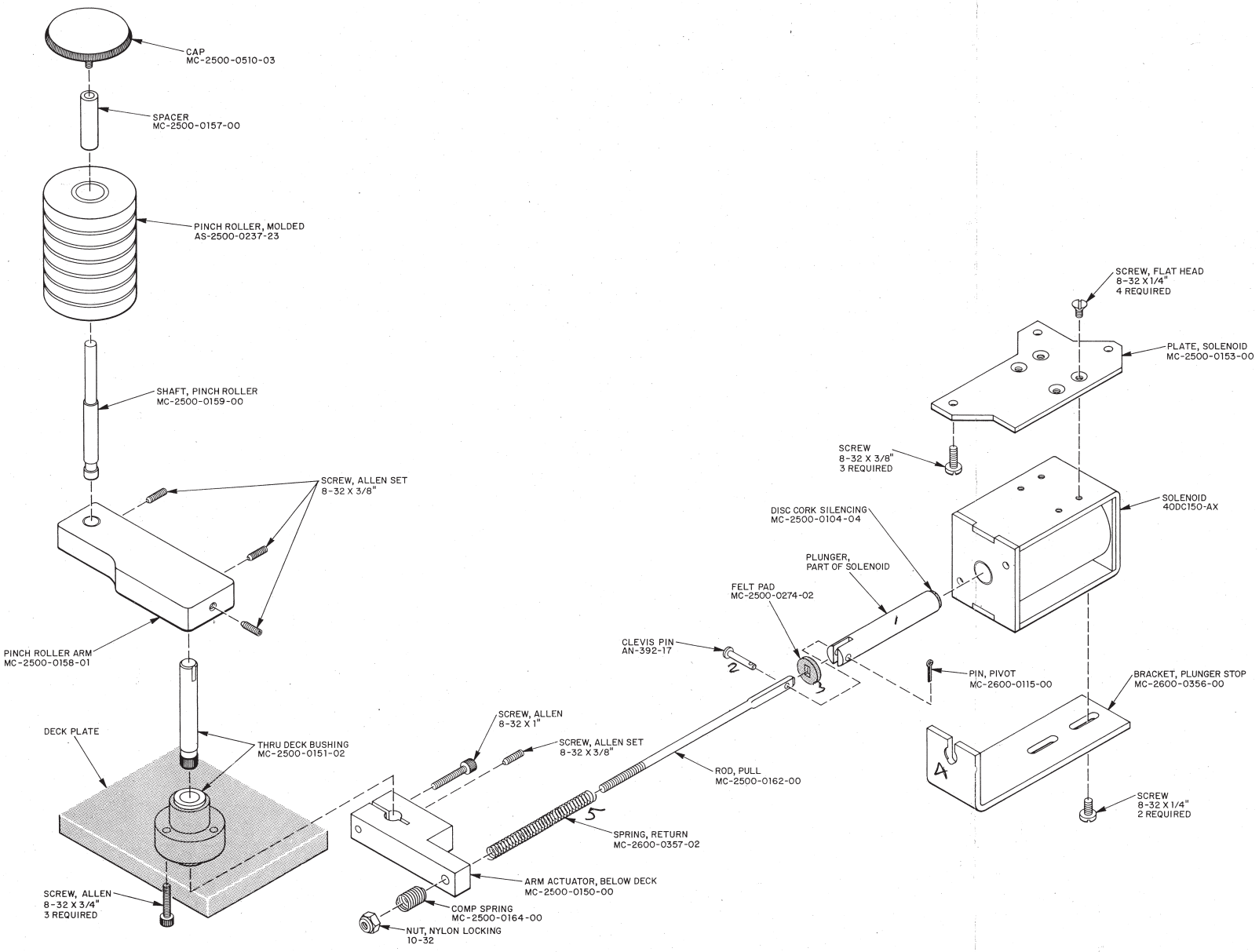


* PART OF SUBASSEMBLY 48592-1

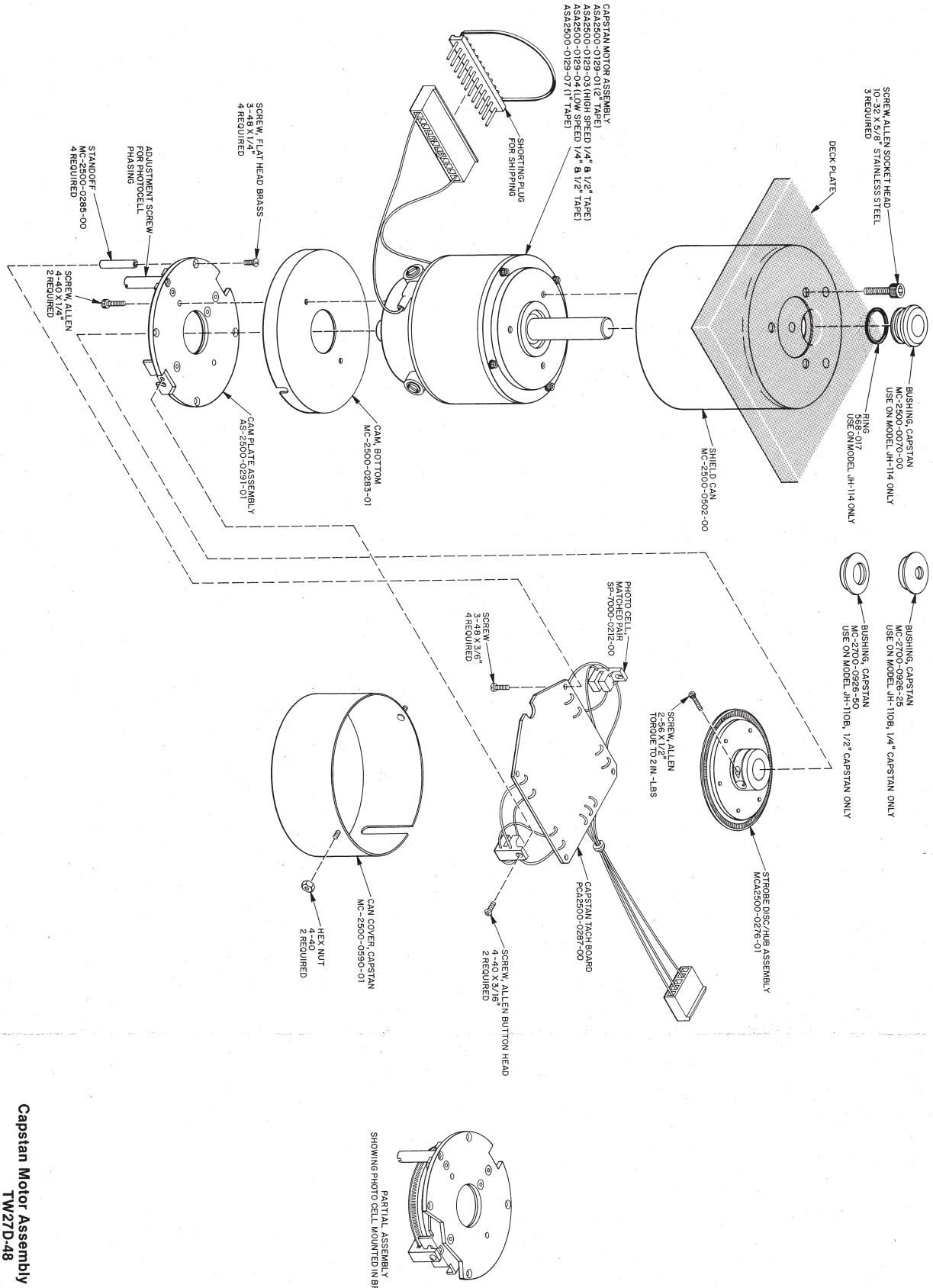
** PART OF SUBASSEMBLY D45121-1

● SHIM LIFTER MC-2500-0409-10 (BROWN PLASTIC, .010")
MC-2500-0409-20 (YELLOW PLASTIC, .020")
AS REQUIRED

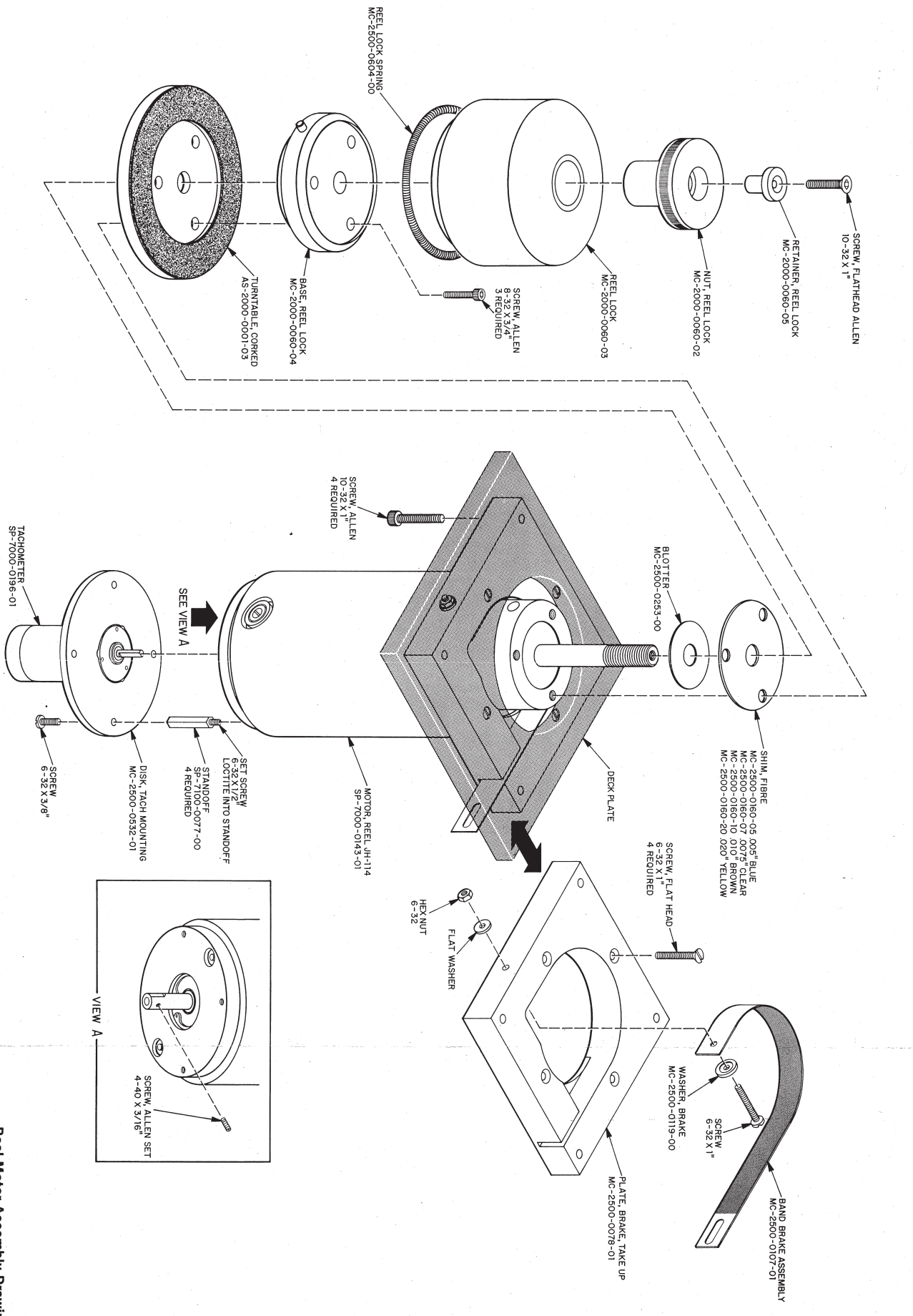
Shield Lifter Assembly Drawing
TW90E-16



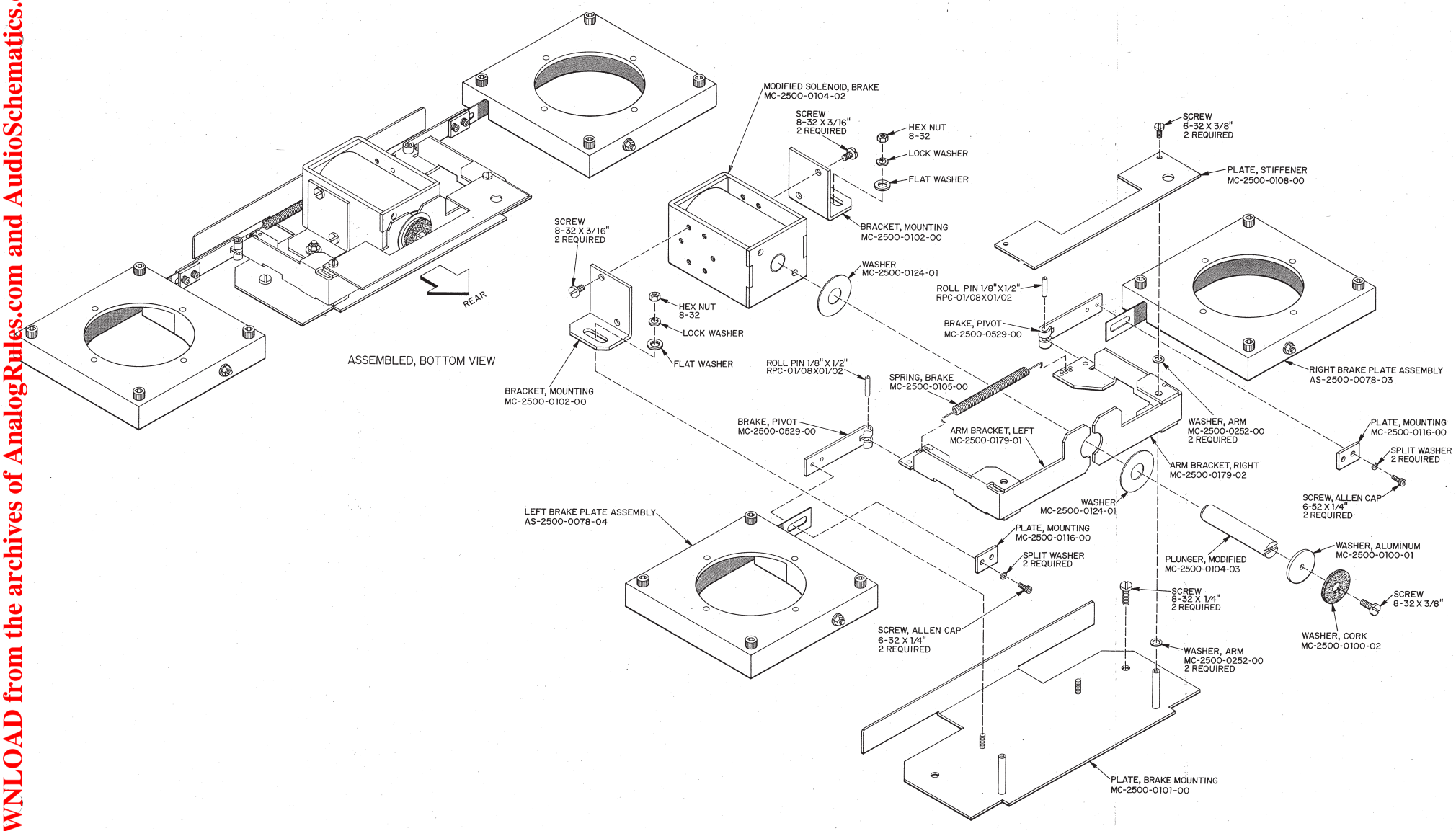
Pinch Roller Assembly Drawing
TW90D-13



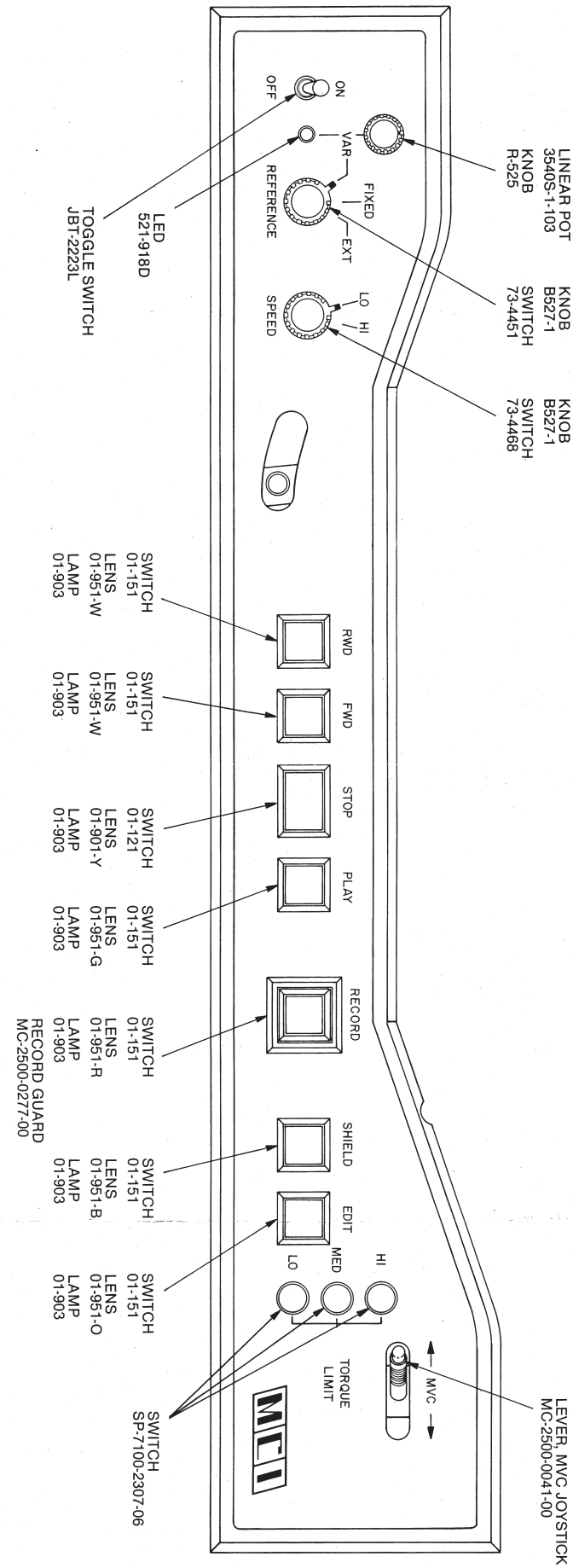
Capstan Motor Assembly Drawing
TW27D-48

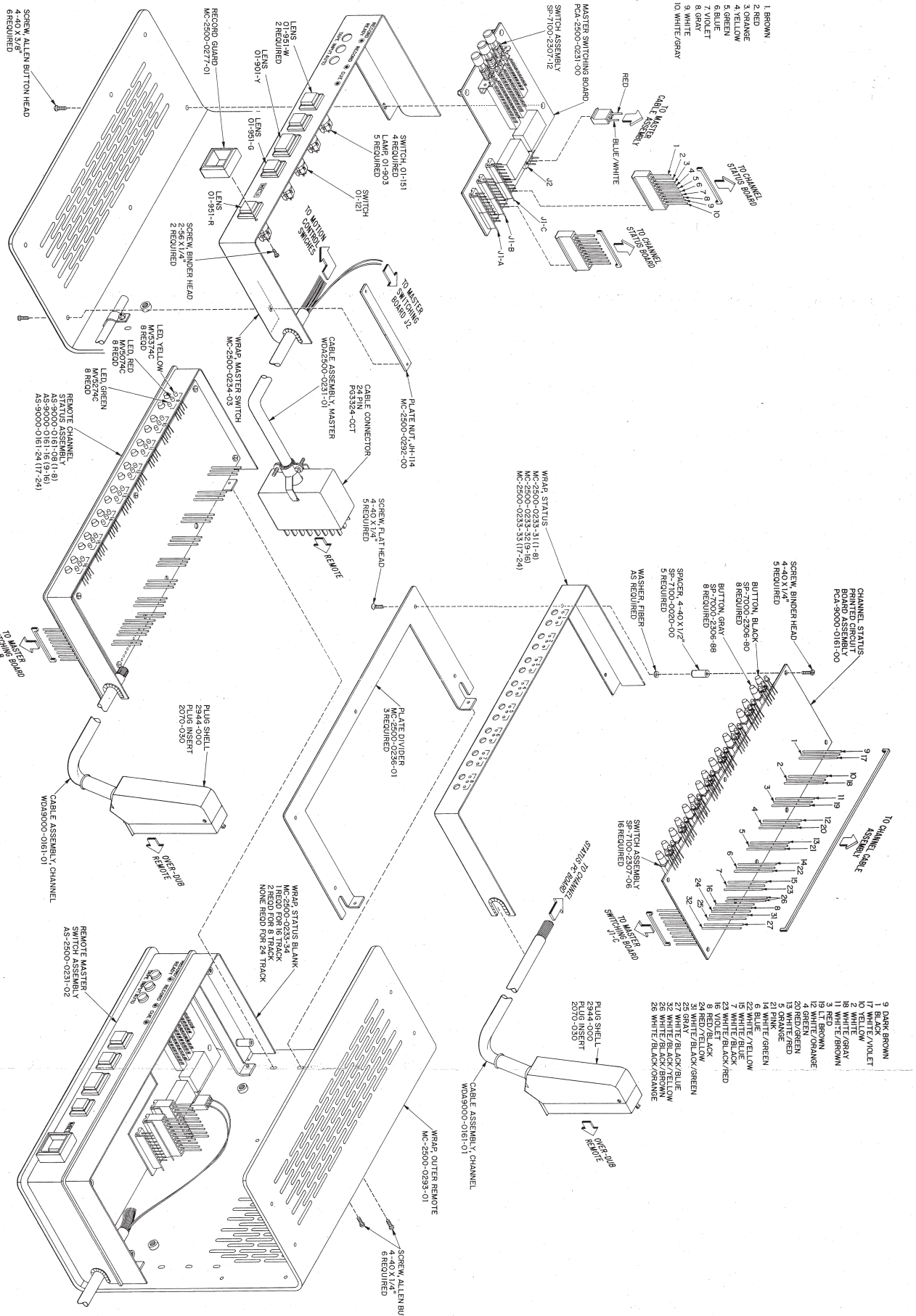


Reel Motor Assembly Drawing
TW90D-09



Brake Assembly Drawing
TW90E-15





Remote Control Assembly Drawing
TW90E-30

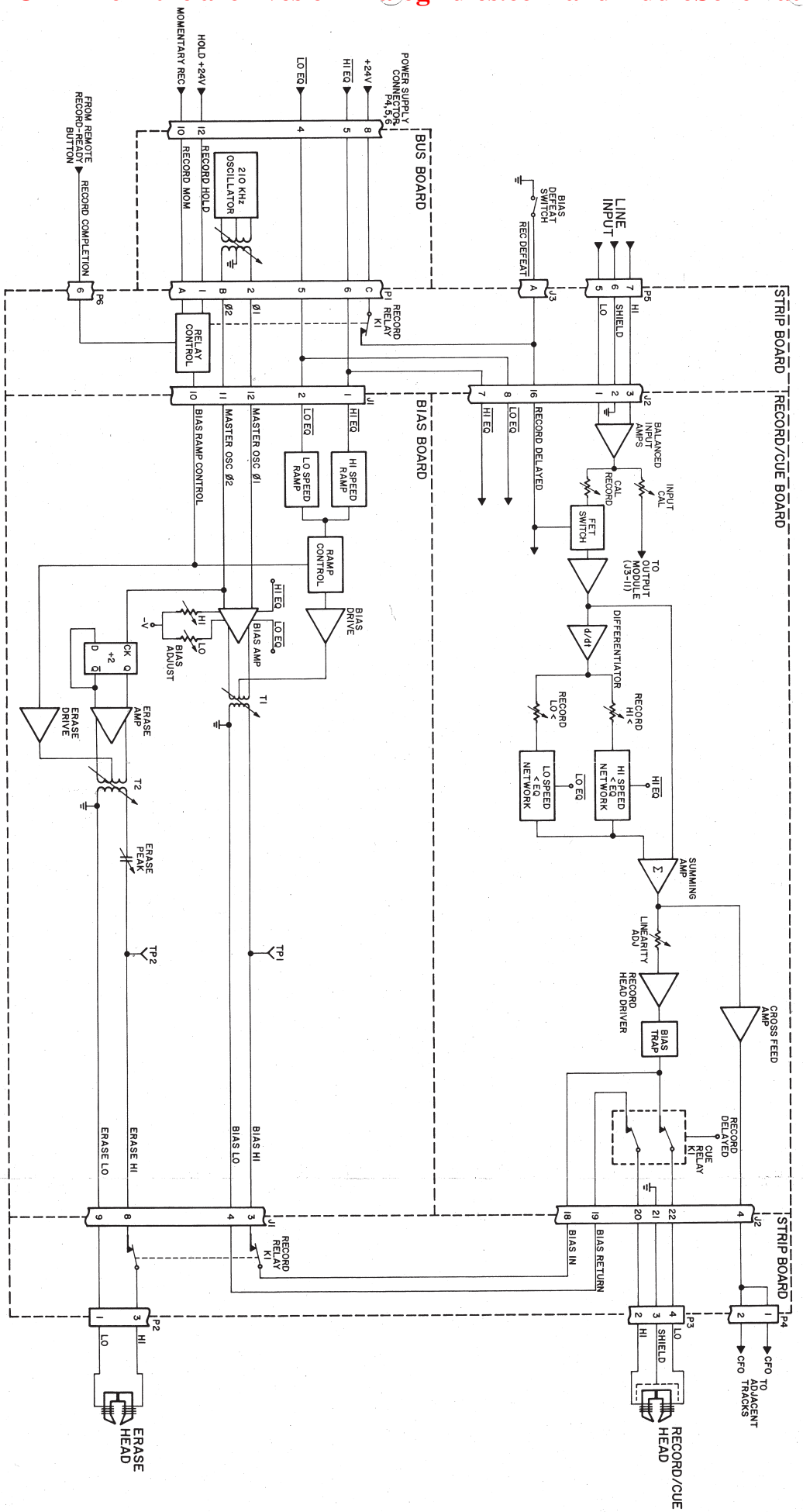


Figure 4-1 Record Block Diagram