MODEL NO. ____________

SERIAL NO. ____________

MODELS 6X11 AND 6X12
SYNCHRONOUS READ ONLY
TAPE TRANSPORTS

PERTEC
PERIPHERAL EQUIPMENT

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OPERATING AND SERVICE MANUAL NO. 101903

FOREWORD

This manual provides operating and service instructions for the Synchronous Read Only Tape Transports, Models 6X11 and 6X12, manufactured by PERTEC Peripheral Equipment, Chatsworth, California.

The content includes a detailed description, specifications, installation instructions and checkout of the transport. Also included is the theory of operation and preventive maintenance instructions. Section VII contains the schematics and parts lists.

All graphic symbols used in logic diagrams conform to the requirements of MIL-STD-806 and all symbols used in schematic diagrams are as specified in MIL-STD-15.

The tape transport models covered by this manual are listed below.

Model	Format	Density (cpi)	Data Transfer Rate at 45 ips (KHz)
6611-000	9 Track	1600	72
6611-800	9 Track	1600/800	72/36
6811-000	9 Track	800	36
6811-500	7 Track	800/556	36/25
6811-200	7 Track	800/200	36/9
6511-200	7 Track	556/200	25/9
6812-500	9 Track 7 Track	800 800/556	36 36/25
6812-200	9 Track 7 Track	800 800/200	36 36/9
6812-520	9 Track 7 Track	800 556/200	36 25/9
6612-850	9 Track 7 Track	1600/800 800/556	72/36 36/25
6612-820	9 Track 7 Track	1600/800 800/200	72/36 36/9
6612-852	9 Track 7 Track	1600/800 556/200	72/36 25/9

SERVICE AND WARRANTY

This PERTEC product has been rigorously checked out by capable quality control personnel. The design has been engineered with a precise simplicity which should assure a new level of reliability. Ease of maintenance has been taken into consideration during the design phase with the result that all components (other than mechanical components) have been selected wherever possible from manufacturer s "off the shelf" stock. Should a component fail, it may be readily replaced from PERTEC or your local supplier. The unit has been designed for "plug-in" replacement of circuit boards or major components which will ensure a minimum of equipment down time.

PERTEC warrants products of its manufacture to be free from defects in design, workmanship, and material under normal and proper use and service for a period of twelve (12) months after the date of shipment. PERTEC agrees to repair or replace at the place of manufacture, without charge, all parts of said products which are returned, for inspection, to its factory within the applicable warranty period, provided such inspection discloses that the defects are as above specified and provided also that the equipment has not been altered or repaired other than with authorization from PERTEC and by its approved procedures, subjected to misuse, improper maintenance, negligence, or accident, damaged by excessive current or otherwise, or had its serial number or any part thereof altered, defaced or removed. This warranty is in lieu of all other warranties, expressed or implied, including those of merchantability or fitness for purpose.

Please read the instruction manual thoroughly as to operation, maintenance, and component reference list. Should you require additional assistance in servicing this equipment, please contact the following regional service centers. A trained service representative will be pleased to assist you.

SALES AND SERVICE REPRESENTATIVES

*Los Angeles, Calif.	(213) 882-0030	Munich, Germany	18-48-53
*Chicago, Ill.	(312) 696-2460	Nieuwkoop, Holland	2614
*Waltham, Mass.	(617) 890-0720	India	50443
Sydney, Australia	69-0444	Haifa, Israel	(04) 68234
Brussels, Belgium	2-480586	Milano, Italy	5462641
Toronto, Canada	(613) 224-1221	Tokyo, Japan	210-4602
Vancouver, Canada	(604) 926-3411	Oslo, Norway	550750
Naerum, Denmark	(01) 804200	Johannesburg, So. Africa	42-1939
*London, England	Reading 582-115	Madrid, Spain	2560265
Helsinki, Finland	460844	Solna, Sweden	820410
Clamart, France	6445530		

*Indicates PERTEC-operated service center

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SECTION I
GENERAL DESCRIPTION AND SPECIFICATIONS

1.1 INTRODUCTION

This section provides a physical description, functional description, and specifications for the Synchronous Read Only Tape Transports, Models 6X11 and 6X12, manufactured by PERTEC Peripheral Equipment, Chatsworth, California.

1.2 PURPOSE OF EQUIPMENT

The tape transport has the capability of reading digital data on either 7- or 9-track magnetic tape at speeds up to 45 inches per second (ips) in an NRZI or Phase Encoded (PE), American National Standards Institute (ANSI) and IBM compatible format.

The transport operates directly from 115v ac or 230v ac, single-phase, 48 to 420 Hz power.

1.3 PHYSICAL DESCRIPTION OF EQUIPMENT

The 6X11 and 6X12 Read Only transport is shown in Figure 1-1. It can accommodate tape reels up to 10-1/2 inches in diameter. All electrical and mechanical components necessary to operate the transport are mounted on the deck which is designed to be hinge-mounted in a standard 19-inch EIA rack.

Access to the printed circuit boards is from the rear. The hinged dust cover protects the magnetic tape, head, capstan, and other tape path components from dust and other contaminants.

Figure 1-1. Models 6X11 and 6X12 Tape Transport

The operational controls, which light when the relevant function is being performed, are mounted on a control panel on the front trim and are accessible with the dust cover door closed. Power is supplied through a strain-relieved cord with a standard 3-pin plug. Interface signals are routed through the printed circuit connectors that plug directly into the printed circuit boards.

1.4 FUNCTIONAL DESCRIPTION

Figure 1-2 shows a block diagram of the system. The transport utilizes a single capstan drive for controlling tape motion during the Synchronous Read and Rewind modes. Tape is under a constant tension of 8 ounces, thus eliminating the possibility of tape "cinch" when the tape reel is placed on a computer transport.

The capstan is controlled by a velocity servo. The velocity information is generated by a dc tachometer that is directly coupled to the capstan motor shaft and produces a voltage that is proportional to the angular velocity of the capstan. This voltage is compared to the reference voltage from the ramp generator using operational amplifier techniques and the difference is used to control the capstan motor. This capstan control technique gives precise control of tape accelerations and tape velocities, thus minimizing tape tension transients.

During a synchronous operation, tape is accelerated to the required velocity. The acceleration time is such that the tape velocity becomes constant before data signals are received.

Seven or nine data channels are presented to the interface. NRZI data are accompanied by a READ DATA STROBE (RDS) pulse derived from conventional ORed clock techniques. Phase Encoded (PE) data are self clocking but must be buffered and assembled by the customer.

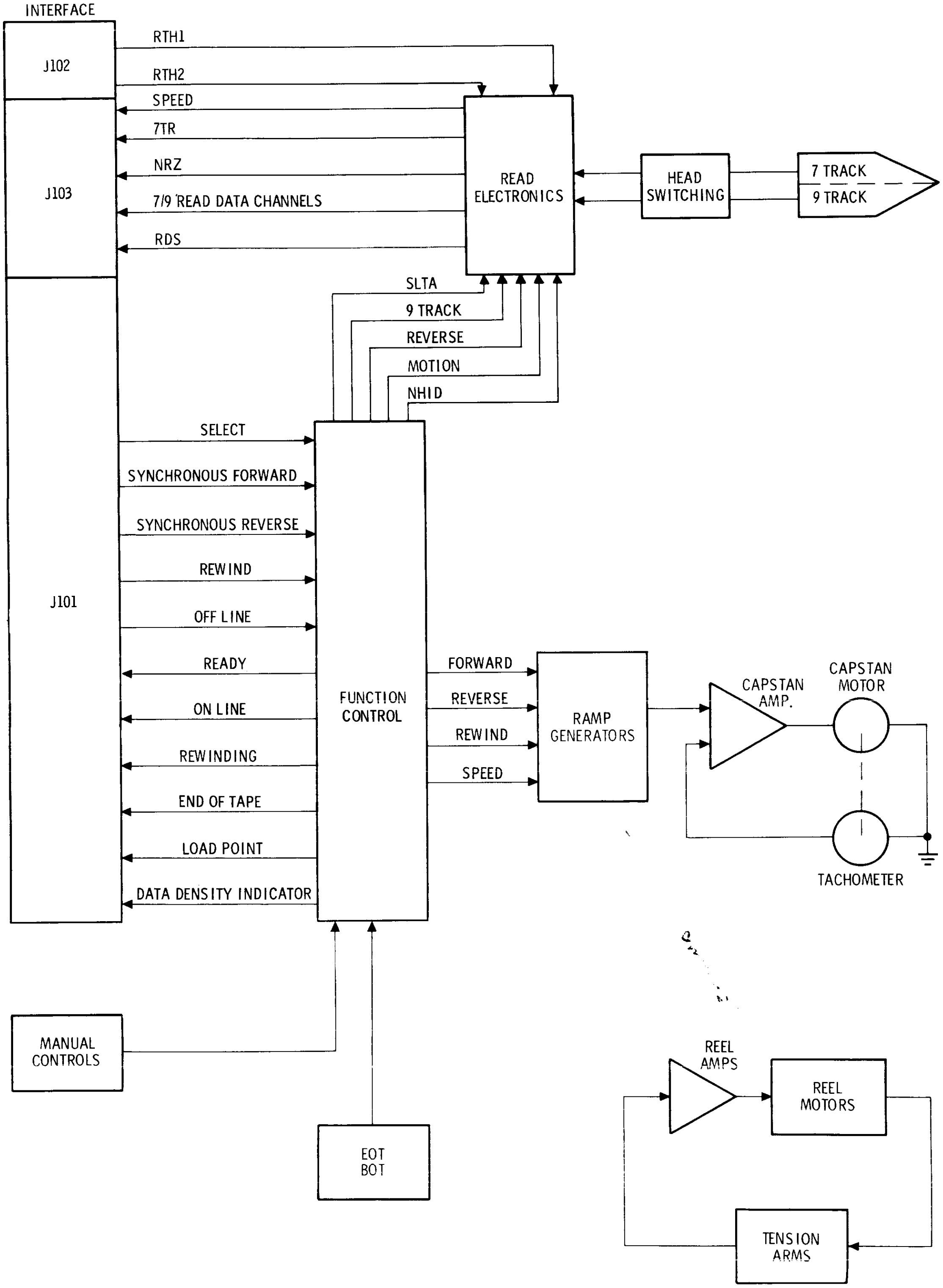


Figure 1-2. Block Diagram of Models 6X11 and 6X12 Tape Transport

The end of a record is detected in the customer controller and the tape commanded to decelerate in a controlled manner.

When operating in a "shuttling" mode (e.g., Synchronous Forward, Stop, Synchronous Reverse, and Stop), no turnaround delay is required between the end of one motion command and the beginning of the next motion command in the opposite direction.

In addition to the capstan control system, the transport consists of a mechanical tape storage system, supply and take-up reel servo systems, magnetic head and its associated electronics, and the control logic.

The mechanical storage system buffers the relatively fast starts and stops of the capstan from the high inertia of the supply and take-up reels. As tape is taken from, or supplied to, the storage system, a photoelectric sensor measures the displacement of the storage arm and feeds an error signal to the reel motor amplifier. This signal is amplified and used to control the reel motor such that the reel will either supply or take up tape to maintain the storage arm in its nominal operating position. The storage arm system is designed to give a constant tape tension as long as the arm is within its operating region. This path design minimizes tape wear because there is only relative motion of the tape oxide at the magnetic head.

The magnetic head reads the flux transitions on the tape under control of the data electronics. There are four possible format selections available, depending on the transport model. (Refer to the combinations available in dual format models as listed in the Foreword of this document.) These formats are: 9-track high density, 9-track low,density, 7-track high density, and 7-track low density.

The control logic operates on manual commands to enable tape, once loaded, to be brought to Load Point. At this stage, remote commands may control tape motion. The logic also provides rewind and unload functions in conjunction with the manual REWIND control.

The transport is also supplied with photoelectric sensors for detection of the Beginning of Tape (BOT) and End of Tape (EOT) tabs. The EOT signal is provided to the customer on an interface line while the BOT signal is used internally in the transport for control purposes.

The transport is designed with an interlock to protect the tape from damage due to component or power failure, or incorrect tape threading. A tape cleaner is provided to minimize tape contamination.

1.5 MECHANICAL AND ELECTRICAL SPECIFICATIONS

The mechanical and electrical specifications for the tape transport are shown in Table 1-1.

1.5.1 INTERFACE SPECIFICATIONS

Levels: True = Low = 0v to +0.4v (approximately)
False = High = +3v (approximately)
Pulses: Levels as above. Edge transmission delay over 20 feet of cable is not greater than 200 nanoseconds.

The interface circuits are designed so that a disconnected wire results in a false signal.

Figure 1-3 shows the configuration for which the transmitters and receivers have been designed.

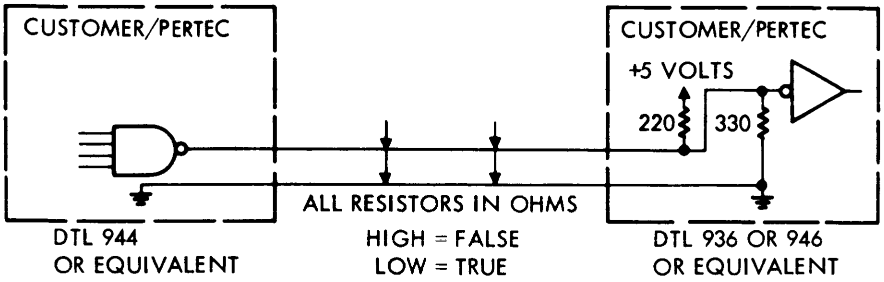


Figure 1-3. Interface Circuit

Table 1-1

Mechanical and Electrical Specifications

Tape (Computer Grade)	
Width	0.5 inches
Thickness	1.5 mil
Tape Tension	8.0 ounces
Reel Diameter	10.5 inches maximum
Recording Mode (ANSI and IBM Compatible)	NRZI and/or PE
Magnetic Head	Single or Dual Gap
Tape Speed	
Single Speed Models	45, 37.5, 25, 18.75, 12.5
Dual Speed Models	45/22.5, 37.5/18.75, 25/12.5
Instantaneous Speed Variation	±2%
Long Term Speed Variation	±1%
Rewind Speed	150 ips nominal
Interchannel Displacement Error*	
1600 cpi	250 µinches)
800 cpi	150 µinches
Stop/Start Time**	8.33 ±0.55 millisec (at 45 ips)
Stop/Start Displacement	0.19 ±0.02 inches
Beginning of Tape (BOT) and End of Tape (EOT) Detectors	Photoelectric*** IBM Compatible
Weight	85 pounds (maximum)
Dimensions	
Height	24.5 inches****
Width	19.0 inches
Depth (from mounting surface)	12.75 inches
Depth (total)	15.75 inches
Operating Temperature	2°C (35°F) to 50°C (122°F)
Non-Operating Temperature	-45°C (-50°F) to 71°C (160°F)
Operating Altitude	0 to 20,000 feet
Non-Operating Altitude	0 to 50,000 feet
Power	
Volts ac	95, 105, 115, 125, 190, 210, 220, 230, 240, 250
Watts (maximum on high line)	400
Hertz	47 to 420
Mounting	19 inches, Consistent with EIA Requirements
Electronics	All Silicon

*This is defined as the maximum displacement between any two bits of a character when reading an IBM master tape on the transport.

**Stop/Start time is inversely proportional to tape speed.

***Approximate distance from detection area to head gap equals 1.2 inches.

****Includes one-half-inch spacer that is shipped with the unit.

SECTION II
INSTALLATION AND INITIAL CHECKOUT

2.1 INTRODUCTION

This section contains a summary of interface lines, information for uncrating the transport, and the procedure for electrically connecting and initially checking out the transport.

2.2 UNCRATING THE TRANSPORT

The transport is shipped in a protective container to minimize the possibility of damage during shipping.

To uncrate the transport place the shipping container in the position indicated by the arrows on the container.

Open the shipping container and remove the packing material so the transport and its shipping frame can be lifted from the container.

Lift the transport out of the container using the shipping frame and set it down so there is access to both the front and rear of the deck.

Check the contents of the shipping container against the packing slip and investigate for possible damage. If there is any damage, notify the carrier.

Check the printed circuit boards and all connectors for correct installation. Check the plug-in relay on the printed circuit board associated with the heatsink to ensure that it is fully seated and good contact is established.

Check the identification label on the back of the tape deck for the correct model number and line voltage requirement. If the actual line voltage at the installation differs from that on the identification label, the power transformer taps should be changed as shown in Figure 4-3. The power switch indicator wire should not be moved.

2.3 POWER CONNECTIONS

A fixed, strain-relieved power cord is supplied for plugging into a polarized 115v outlet. For other power sockets, the power plug supplied must be removed and the correct plug installed.

2.4 INITIAL CHECKOUT PROCEDURE

Section III contains a detailed description of all of the controls. To check the proper operation of the transport before placing it in the system, follow the specified procedure.

(1) Connect the power cord (replace power plug and change power transformer wiring if necessary).

(2) Load tape on the transport as described in Paragraph 3.3.

(3) Turn the transport power on by depressing the POWER control.

(4) Depress the LOAD control momentarily to apply capstan-motor and reel-motor power.

(5) Depress the LOAD control momentarily a second time to initiate the Load sequence. The tape will move forward until it reaches the BOT tab, at which point it stops. The LOAD indicator should light when the BOT reaches the photosensor and remain lit until the tape moves off the load point. At this point, there will be no action when the LOAD control is depressed.

(6) Check ON LINE by depressing and releasing the control repeatedly and observing that the ON LINE indicator is alternately lit and extinguished.

(7) With the transport off-line (ON LINE indicator extinguished) depress and release the FORWARD control. The FORWARD control will be illuminated and the tape will wind from the supply reel to the take-up reel. After allowing several feet of tape to wind onto the take-up reel, depress and release the FORWARD control, tape motion will cease and the FORWARD control will become extinguished.

Check that if the transport is on-line the action of the FORWARD control is inhibited.

(8) Depress and release the REVERSE control. The REVERSE control will be illuminated and the tape will wind from the take-up reel to the supply reel. Depress and release the REVERSE control again, tape motion will cease and the REVERSE control will become extinguished.

Check that if the transport is on-line, the action of the REVERSE control is inhibited.

(9) Depress and release the FORWARD control to start forward tape motion. Depress and release the REVERSE control, the tape motion will decelerate to zero velocity, then accelerate in the reverse direction. Depress and release the FORWARD control, tape motion in the reverse direction will cease and the tape will accelerate in the forward direction. Depress and release the FORWARD control, tape motion will cease.

(10) Depress the REWIND control momentarily to initiate the Rewind mode and light the REWIND indicator. The tape will rewind past the BOT tab, enter the Load sequence,

return to the BOT tab and stop with the LOAD indicator lit. If the REWIND control is momentarily depressed when the tape is at BOT, the LOAD indicator will be extinguished, the REWIND indicator will light, and the tape will rewind until tape tension is lost. This action is used to unload tape. The reel can be removed as outlined in Paragraph 3.3.2.

(11) Visually check the components of the tape path for correct tape tracking (tape rides smoothly in the head guides, etc.)

2.5 INTERFACE CONNECTIONS

It is assumed that interconnection of PERTEC and Customer equipment uses a harness of individual twisted pairs, each with the following characteristics.

(1) Maximum length of 20 feet.

(2) Not less than one twist per inch.

(3) 22- or 24-gauge conductor with minimum insulation thickness of 0.01 inch.

It is important that the ground side of each twisted pair is grounded within a few inches of the board to which it is connected.

Three printed circuit edge connectors are supplied with each transport. These must be wired by the customer and strain relieved as shown in Figure 2-1. Interface signals are thus routed directly to and from the printed circuit boards. Table 2-1 shows the Input/Output lines required. Details relating to the interface are contained in Section III.

2.6 RACK MOUNTING THE TRANSPORT

The physical dimensions of the transport are such that it may be mounted in a standard 19-inch EIA rack; 24.5 inches of panel space is required. It requires a depth behind the mounting surface of at least 13 inches.

Figures 2-2 and 2-3 illustrate the procedure for mounting the transport as follows.

(1) Install the hinge pin blocks on the EIA rack (see Figure 2-2 for correct position) using 10-32 pan head screws. Do not fully tighten the screws. Place a No. 10 shim washer on each pin.

(2) Set the shipping frame down with the front door of the transport facing up (i.e., lying in a horizontal position). Remove the screws securing the Z-shaped shipping blocks to the frame.

CAUTION

SECURE THE EIA RACK SO THAT IT WILL NOT TIP OR MOVE WHEN THE TRANSPORT IS POSITIONED UPON THE HINGE PIN BLOCKS. TWO PERSONS SHOULD HANDLE THE TRANSPORT WHEN MOUNTING TO PREVENT DAMAGE TO THE DATA BOARDS OR OTHER ACCESSORY PARTS.

(3) Lift the transport out of the shipping frame and hang the transport on the hinge pin blocks (see Figure 2-3). Hang the transport by placing it up to the hinge pin blocks on an angle of 60 degrees to its closed position.

(4) Remove the Z-shaped shipping blocks from the tape deck.

(5) Adjust the hinge pin blocks on the EIA rack so that the transport hangs symmetrically in the rack. Tighten the screws.

(6) Open the tape deck to 90 degrees and install the safety blocks using 4-40 screws (see Figure 2-3).

(7) Check that the fastener engages behind the EIA rack.

(8) Clean the tape deck as described in the maintenance procedure.

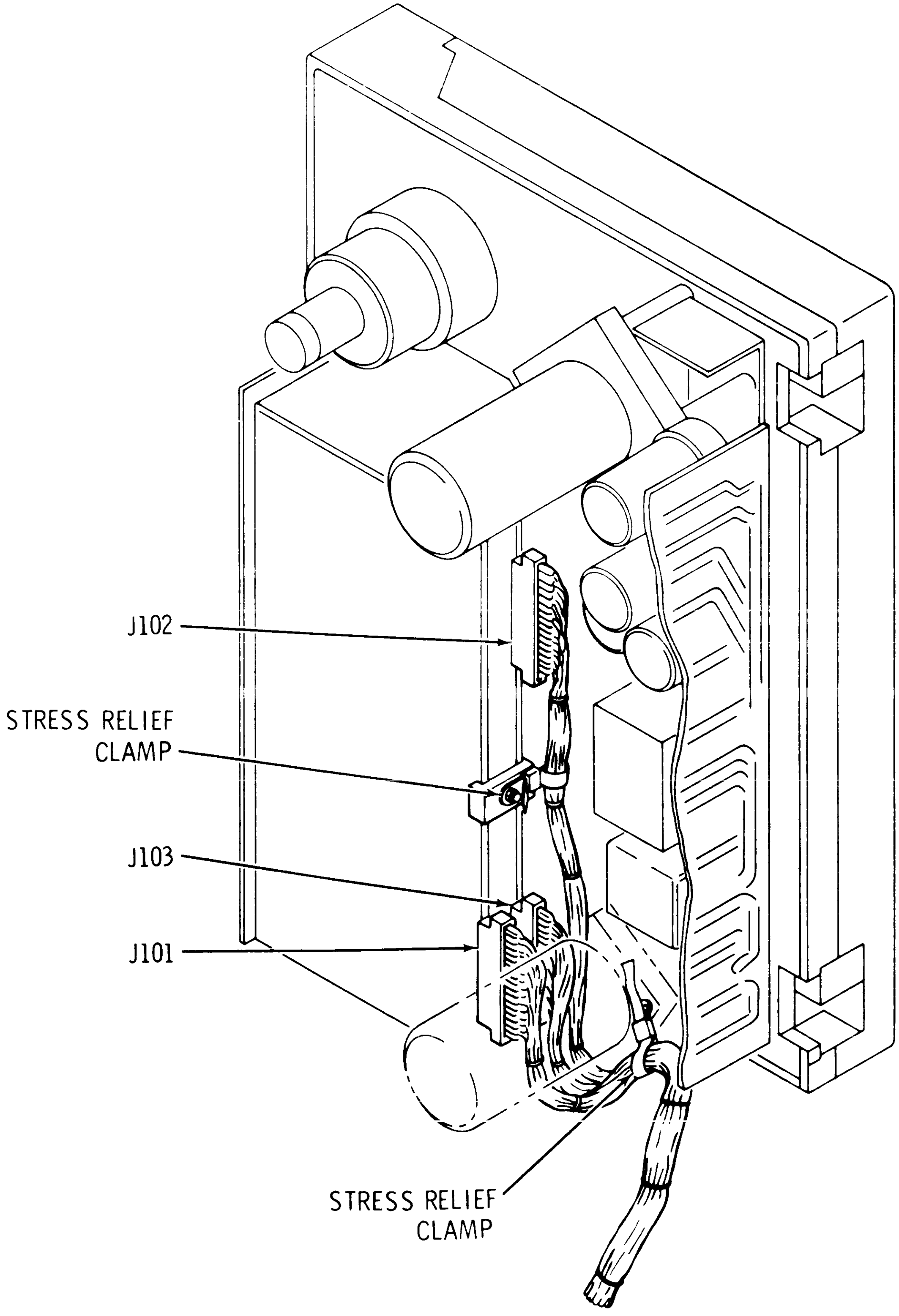


Figure 2-1. Interface Cable Installation

Table 2-1

Interface Connections

Transport Connector	36 Pin Etched PC Edge Connector
Mating Connector	36 Pin ELCO 00-6007-036-980-002

Connector (Reference Figure 2-1)	Live Pin	Ground Pin	Signal*
J101	J	8	→ SELECT (SLT)
	C	3	→ SYNCHRONOUS FORWARD Command (SFC)
	E	5	→ SYNCHRONOUS REVERSE Command (SRC)
	H	7	→ REWIND Command (RWC)
	L	10	→ OFF-LINE Command (OFFC)
	T	16	← READY (RDY)
	M	11	← ON-LINE Command (ONL)
	N	12	← REWINDING (RWD)
	U	17	← END OF TAPE (EOT)
	R	14	← LOAD POINT (LDP)
	F	6	← DATA DENSITY INDICATOR (DDI)
J102	E	5	→ READ THRESHOLD 1 (RTH1) Command
	F	6	→ READ THRESHOLD 2 (RTH2) Command
J103	2	B	← READ DATA STROBE (RDS)
	1	A	← READ DATA PARITY (RDP)
	3	C	← READ DATA 0 (RD0) } Omit for
	4	D	← READ DATA 1 (RD1) } 7-channel head
	8	J	← READ DATA 2 (RD2)
	9	K	← READ DATA 3 (RD3)
	14	R	← READ DATA 4 (RD4)
	15	S	← READ DATA 5 (RD5)
	17	U	← READ DATA 6 (RD6)
	18	V	← READ DATA 7 (RD7)
	10	L	← NON-RETURN TO ZERO (NRZ)
	11	M	← 7-TRACK (7TR)
	13	P	← SPEED

*See Section III for definitions of interface functions.

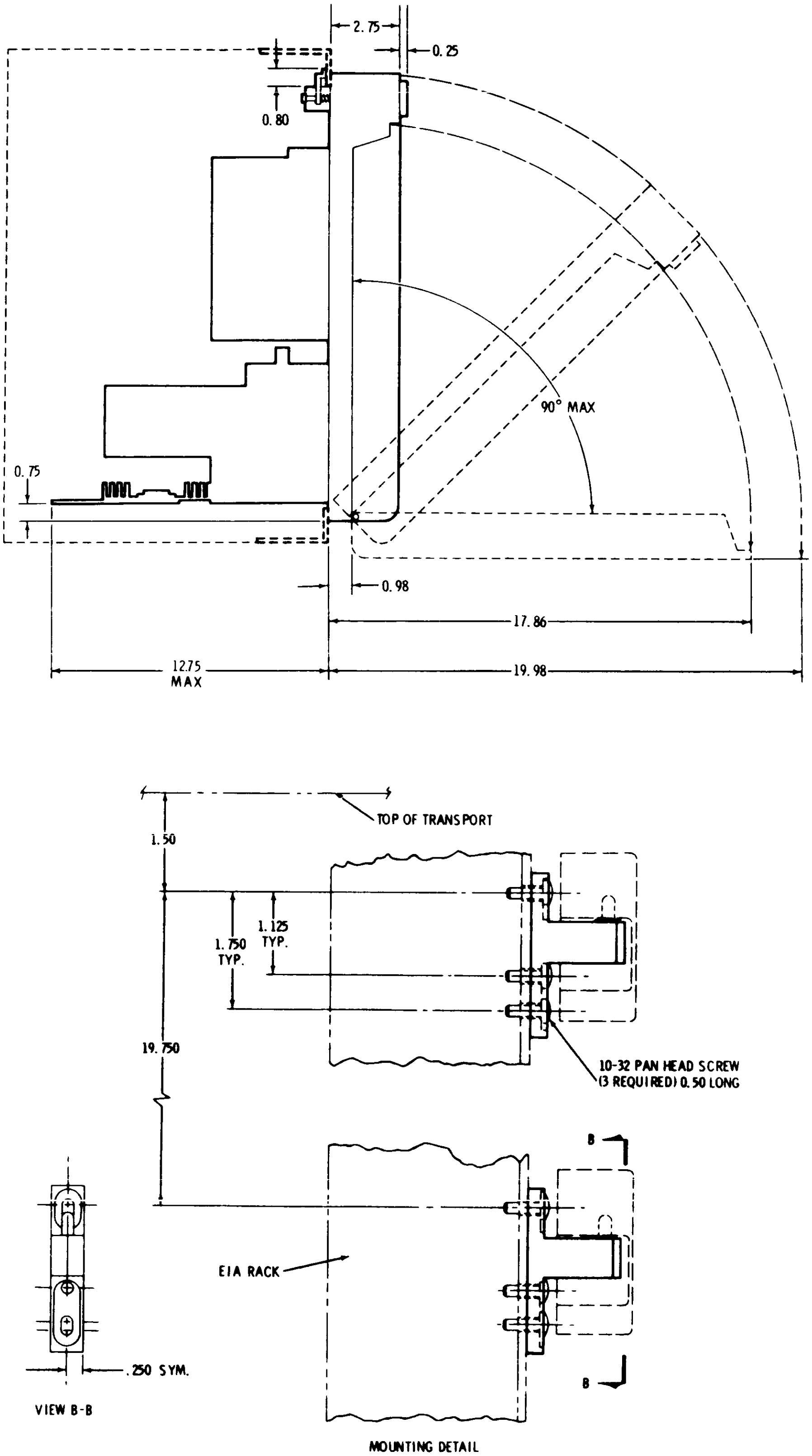


Figure 2-2. Rack Mounting the Transport

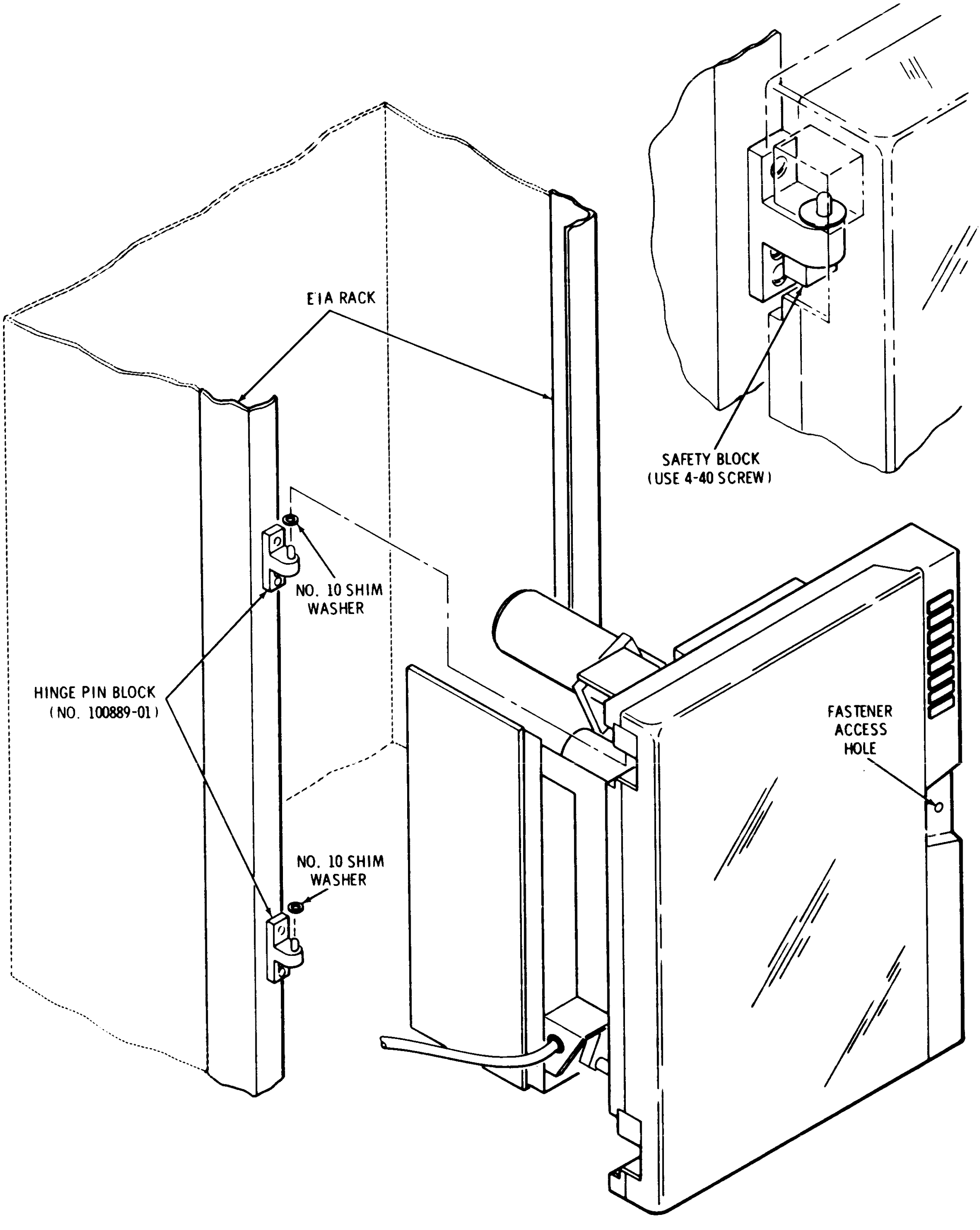


Figure 2-3. Installation Diagram

SECTION III
OPERATION

3.1 INTRODUCTION

This section explains the manual operation of the tape transport and defines the interface functions with regard to timing, levels, and interrelationships.

3.2 CLEANING THE HEAD AND GUIDES

The brief operation described in Paragraph 6.4 should be performed daily to realize the data reliability capabilities of the transport.

3.3 LOADING TAPE ON TRANSPORT

The Models 6X11 and 6X12 transports, in the position shown in Figure 3-1, have the supply reel (reel to be reproduced) at the bottom. The tape must unwind from the supply reel when the reel is turned in a clockwise direction.

To load a tape reel (maximum reel size is 10-1/2 inches in diameter with 2400 feet of tape), position the reel over the quick-release hub and depress the center plunger. This allows the reel to slip over the rubber ring on the hub. Press the reel evenly and firmly against the back flange of the hub with the center plunger depressed. Release the center plunger. The reel is now properly aligned in the tape path and ready for tape threading.

Thread the tape along the path shown in Figure 3-1. Wrap the tape leader onto the take-up reel so that the tape will be wound onto the reel when it is rotated clockwise. Wind several turns onto the take-up reel, then turn the supply reel counterclockwise until slack tape has been taken up.

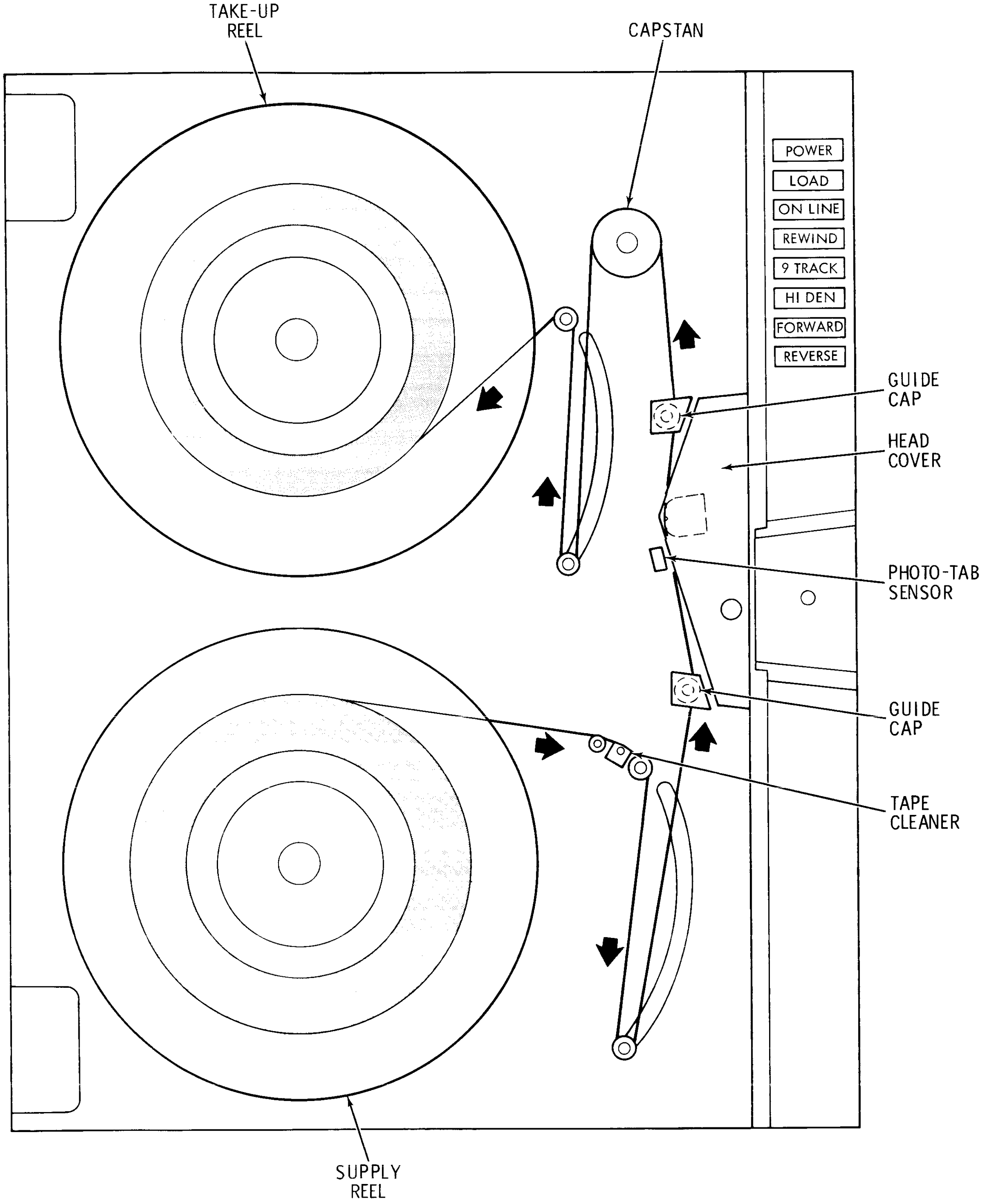


Figure 3-1. Tape Path and Controls

3.3.1 BRINGING TAPE TO LOAD POINT (BOT)

After the tape has been manually tensioned and checked for correct seating in the guides, then, to bring the tape to Load Point:

(1) Turn the power on by depressing the POWER control.

(2) Depress the LOAD control and release it. This applies power to the capstan and reel motors and brings the tape to the correct operating tension. The tape storage arms are now in the operating position.

CAUTION

CHECK THAT THE TAPE IS POSITIONED CORRECTLY ON ALL GUIDES OR TAPE DAMAGE MAY RESULT

(3) Depress the LOAD control a second time and release. This causes tape to move forward at the prescribed operating velocity. Check tape tracking in the guides again and close the dust cover.

CAUTION

THE DUST COVER SHOULD REMAIN CLOSED AT ALL TIMES WHEN TAPE IS ON THE TAKE-UP REEL. DATA RELIABILITY MAY BE IMPAIRED BY CONTAMINANTS IF THE COVER IS LEFT OPEN.

When the reflective BOT tab reaches the Load Point, the tape stops with the front edge of the tab approximately one inch from the magnetic head gap.

(4) Depress and release the ON LINE control. The transport is now ready to receive external commands.

3.3.2 UNLOADING THE TAPE

To unload a tape, complete the following procedure if the power has been switched off. (If power is on, start at step (3).)

(1) Turn the power on by depressing the POWER control.

(2) Depress the LOAD control and release, which applies tape tension.

(3) Depress the REWIND control and release. When the tape has rewound to the BOT tab, it comes to a controlled stop. The tape overshoots and the transport enters the Load sequence to bring the tape to rest at the BOT.

(4) Depress the REWIND control a second time and release. This initiates a further rewind action which continues until tension is lost.

(5) Open the dust cover and wind the end of the tape onto the supply reel. Depress the hub center plunger and remove the reel. Close the dust cover.

3.4 MANUAL CONTROLS

Eight operational controls with indicators are located on the control panel on the front of the transport (see Figure 3-1). The following paragraphs describe the function of these controls.

3.4.1 POWER

The POWER control is an alternate action switch/indicator which connects line voltage to the power transformer. When power is turned on: (1) all power supplies are established; (2) all of the motors are open-circuited (low value resistors are connected across the reel motors); and (3) a reset signal is applied to key control flip-flops.

3.4.2 LOAD

The LOAD control is a momentary switch/indicator. Depressing and releasing the control for the first time after power is switched on energizes the servo system by applying ground returns to all the motors and removes the reset signal. The tape will now be tensioned.

Depressing and releasing the LOAD control for the second time causes the tape to move to and stop at the Load Point. The transport is now ready to receive external commands. While the BOT tab is located over the photo-tab sensor (see Figure 3-1), the LOAD indicator is lit. The LOAD control is disabled after the second LOAD or manual REWIND command has been given and can only be re-enabled by loss of tape tension or restoration of power after power has been off.

3.4.3 ON LINE

The ON LINE control is a momentary switch/indicator which is enabled after an initial Load or Rewind sequence has been initiated. As an option, it may be set after tape has been tensioned.

Depressing and releasing the switch after an initial Load or Rewind sequence is initiated, switches the transport to an On-line mode and lights the indicator.

In the on-line condition the transport can accept external commands provided it is also Ready and Selected.

The transport will revert to the Off-line mode if any of the following occur.

(1) ON LINE is depressed a second time.

(2) An external Off-line command (OFFC) is received.

(3) Tape tension is lost.

3.4.4 REWIND

The REWIND control is a momentary switch/indicator which is enabled only in the Off-line mode. Depressing and releasing the control causes tape to rewind at 150 ips. On reaching the BOT tab, the rewind drive ceases and the Load sequence is automatically entered. The BOT tab will overshoot the photo-tab sensor, move forward, and stop at the Load Point.

If the REWIND control is depressed and released when the tape is at Load Point (LOAD indicator lit), the tape rewinds off the take-up reel and tension is lost.

The REWIND indicator is lit throughout any rewind operation including the subsequent Load sequence where relevant.

A manual REWIND command will override the Load sequence.

3.4.5 9 TRACK

The 9 TRACK control is an alternate action switch/indicator which is employed in relevant models of the Read Only Transport to condition the transport electronics for reading 7- or 9-track tapes. This control is used in conjunction with the HI DEN control detailed in Paragraph 3.4.6.

In transports equipped for dual format operation, depressing and releasing the 9 TRACK control illuminates the indicator and conditions the transport for reading 9-track tapes. When the indicator is extinguished, the transport is conditioned for reading 7-track tapes.

For 9-track-only transports the indicator is permanently illuminated; for 7-track-only transports the indicator is permanently extinguished.

NOTE

> Actuating the control on 9-track-only or 7-track-only transports will not affect the status of the transport.

3.4.6 HI DEN (High Density)

The HI DEN control is an alternate action switch/indicator which selects the packing density for both 7- and 9-track tapes.

When this control is illuminated and the 9 TRACK (Paragraph 3.4.5) control is illuminated the transport is conditioned to read 9-track, 1600 cpi (PE) tapes.

When this control is extinguished and the 9 TRACK control is illuminated, the transport is conditioned to read 9-track 800 cpi (NRZI) tapes.

When this control is illuminated and the 9 TRACK control is extinguished the transport is conditioned to read the higher of the two 7-track densities.

When this control is extinguished and the 9 TRACK control is also extinguished, the transport is conditioned to read the lower of the two 7-track densities.

The HI DEN control is permanently illuminated on the 9-track-only PE transports. The control is permanently extinguished on the 9-track-only NRZI models.

NOTE

> Actuating the HI DEN control on the 9-track-only PE models and the 9-track-only NRZI models will not affect the status of the transport.

3.4.7 FORWARD

The FORWARD control is a momentary action switch/indicator which is enabled only when the transport is in the Off-line mode.

When the control is depressed the tape is accelerated in the forward direction to the synchronous speed and the control is illuminated. When the switch is depressed again, the tape is decelerated to rest in a controlled manner and the control becomes extinguished.

Depressing the REVERSE control (Paragraph 3.4.8) while the tape is moving in the forward direction causes the tape to decelerate to zero velocity, then immediately accelerate to the synchronous speed in the reverse direction. The FORWARD control will become extinguished and the REVERSE control will be illuminated.

If the EOT tab is encountered while the tape is moving in the forward direction, tape motion will cease and the indicator will be extinguished. Depressing ON LINE or REWIND will also reset the FORWARD function.

3.4.8 REVERSE

The REVERSE control is a momentary action switch/indicator which is enabled only when the transport is in the Off-line mode.

When the control is depressed the tape is accelerated in the reverse direction to the synchronous speed and the control is illuminated. When the switch is depressed again, the tape is decelerated to rest in a controlled manner and the control becomes extinguished.

Depressing the FORWARD control (Paragraph 3.4.7) while the tape is moving in the reverse direction causes the tape to decelerate to zero velocity, then immediately accelerate to the synchronous speed in the forward direction. The REVERSE control will become extinguished and the FORWARD control will be illuminated.

If the BOT tab is encountered while the tape is moving in the reverse direction, tape motion will cease and the indicator will be extinguished. Depressing ON LINE or REWIND will also reset the REVERSE function.

3.5 INTERFACE INPUTS (CONTROLLER TO TRANSPORT)

All waveform names are chosen to correspond to the logical true condition. Receivers belong to the DTL 830 series where the True level is 0v and the False level is nominally +3v. Figure 1-3 is a schematic of the interface circuit.

3.5.1 SELECT (SLT)

This is a level which, when true, enables all the interface drivers and receivers in the transport, thus connecting the transport to the controller. It is assumed that all of the interface inputs discussed in the following paragraphs are gated with SELECT (SLT). An option is available which continuously enables the interface drivers.

3.5.2 SYNCHRONOUS FORWARD COMMAND (SFC)

This is a level which, when true, and the transport is Ready and On-line, causes tape to move forward at the specified velocity. When the level goes false tape motion ceases. The velocity profile is trapezoidal with nominally equal rise and fall times.

3.5.3 SYNCHRONOUS REVERSE COMMAND (SRC)

This is a level which, when true, and the transport is Ready and On-line, causes tape to move in the reverse direction at the specified velocity. When the level goes false tape motion ceases. The velocity profile is trapezoidal with nominally equal rise and fall times. An SRC shall be terminated upon encountering the BOT tab and ignored if given when the tape is at Load Point.

3.5.4 REWIND COMMAND (RWC)

This is a pulse which, if the transport is Ready and On-line, causes tape to move in the reverse direction at 150 ips. Upon reaching BOT, the rewind ceases and the Load sequence is automatically initiated. The tape now moves forward and comes to rest at the BOT tab.

The velocity profile shall be trapezoidal with equal rise and fall times of approximately 0.5 second.

The RWC is a minimum of 1 μsecond width under normal conditions. If, however, control is achieved by resetting the RWC with the Rewinding status signal (RWD) then the resultant RWC at the transport must be a minimum of 150 nanoseconds.

3.5.5 OFF-LINE COMMAND (OFFC)

This is a level or pulse of 1 μsecond minimum width which resets the On-line flip-flop to the false state, placing the transport under manual control. It is gated in the transport by SELECT (SLT) only, allowing an OFF-LINE command to be given while a rewind is in progress.

OFF-LINE must be separated by at least 1 μsecond from a REWIND command.

3.5.6 READ LOW THRESHOLD (RTH2) (NRZI OR PE)

This is a level which sets one of two read circuit threshold levels in the transport. When this line is true the low threshold level is selected. When this line is false the normal threshold level is selected. RTH2 must be held steady for the duration of each record. NRZI thresholds are approximately 20 percent and 10 percent, while PE thresholds are approximately 10 percent and 5 percent.

3.5.7 READ HIGH MARGIN (RTH1) (NRZI Only)

This is a level which selects a higher than normal (i.e., nominally 46 percent) character gate period. When this line is true, the high margin (60 percent of bit period) is selected. RTH1 must be held steady for the duration of each record.

3.6 INTERFACE OUTPUTS (TRANSPORT TO CONTROLLER)

It is assumed that all interface outputs discussed in the following paragraphs are gated with SELECT (SLT). Drivers are DTL 844 or TTL 7416 where the True level is approximately 0v and the False level is nominally +3v. An option is available which continually enables all interface output drivers.

3.6.1 READY (RDY)

This is a level which is true only when the transport is ready to accept any external command; i.e., when

(1) The tape tension is established.

(2) The initial LOAD or REWIND command has been completed.

(3) There is no subsequent REWIND command in progress.

(4) The transport is On-line.

3.6.2 ON-LINE

This is a level which is true when the On-line flip-flop is set. When true, the transport is under remote control. When false, the transport is under local control.

3.6.3 REWINDING (RWD)

This is a level which is true when the transport is engaged in any Rewind operation or the Load sequence following a Rewind operation.

3.6.4 END OF TAPE (EOT)

This is a level which is true for the duration of the EOT tab. Circuitry using this output should not assume that the transitions to an from the true state are clean.

3.6.5 LOAD POINT (LDP)

This is a level which is true when the interlocks are made, the BOT tab is under the photosensor, the initial Load sequence is complete, and the transport is not rewinding. After receipt of an SFC the signal will remain true until the BOT tab leaves the photosensor area.

3.6.6 DATA DENSITY INDICATOR (DDI)

This is a level which is false only when the transport is conditioned to read 7-track low density tape. The level shall be true for all other conditions.

3.6.7 NRZI INDICATOR (NRZ)

This is a level which is true only when the transport is conditioned to read NRZI tape. When false, the transport is conditioned to read PE tape.

3.6.8 SEVEN TRACK (7TR)

This is a level which is true only when the transport is conditioned to read 7-track tape. When false, the transport is conditioned to read 9-track tape.

3.6.9 SPEED

This is a level which is true only when a dual speed transport is conditioned to read at the low speed (PE mode). When false, the transport is conditioned to read at the high speed (nominal). This level is false for all single speed transports.

3.6.10 READ DATA (RDP, RD0-RD7)

3.6.10.1 NRZI

The individual bits of each data character are assembled into parallel form in a one-stage deskewing register. The register outputs drive the read data interface lines. A true level signifies a data 1.

The complete character shall be available by sampling RDP, RD0-RD7 simultaneously on the trailing edge of the Read Data Strobe (RDS).

3.6.10.2 Phase Encoded (PE)

The transport PE data are the outputs of 9 peak detectors individually gated with the outputs of the PE envelope detectors associated with each channel. A "no signal" is false. The value of a data bit is determined by the direction of the transition at the middle of the bit cell. A transition from false to true is a data 0, and, conversely, a transition from true to false is a data 1.

3.6.11 READ DATA STROBE (RDS)

This is a pulse with a nominal width of 2 μseconds for each data character read from tape.

NOTE

> RDS is applicable only to NRZI operation. The trailing edge of this pulse should be used to sample the Read Data lines.

3.7 INTERFACE TIMING

3.7.1 READ WAVEFORMS

Read waveforms for NRZI and PE format are illustrated in Section IV.

SECTION IV
THEORY OF OPERATION

4.1 INTRODUCTION

This section provides a description of the operation of the Models 6X11 and 6X12 Tape Transports.

The transport consists of the mechanical and electronic components necessary to handle magnetic tape in such a manner that data can be reproduced from a tape recorded on an IBM digital tape transport or its equivalent in Phase Encoded (PE) and/or NRZI formats.

The transport consists of the following components.

(1) Power supply
(2) Capstan drive system
(3) Tape storage and reel servo systems
(4) Magnetic head and associated tape guides and cleaner
(5) Data electronics
(6) Control logic and interlock system

4.2 ORGANIZATION OF THE TRANSPORT

A highly modular construction has been adopted with all of the major components and subassemblies interconnected by means of connectors rather than the more conventional wiring techniques; see Figure 4-1.

Three major printed circuit boards are employed. The first, the Servo and Power Supply PCBA, is mounted to a common heatsink extrusion which is secured to the power supply module. It contains the reel servo

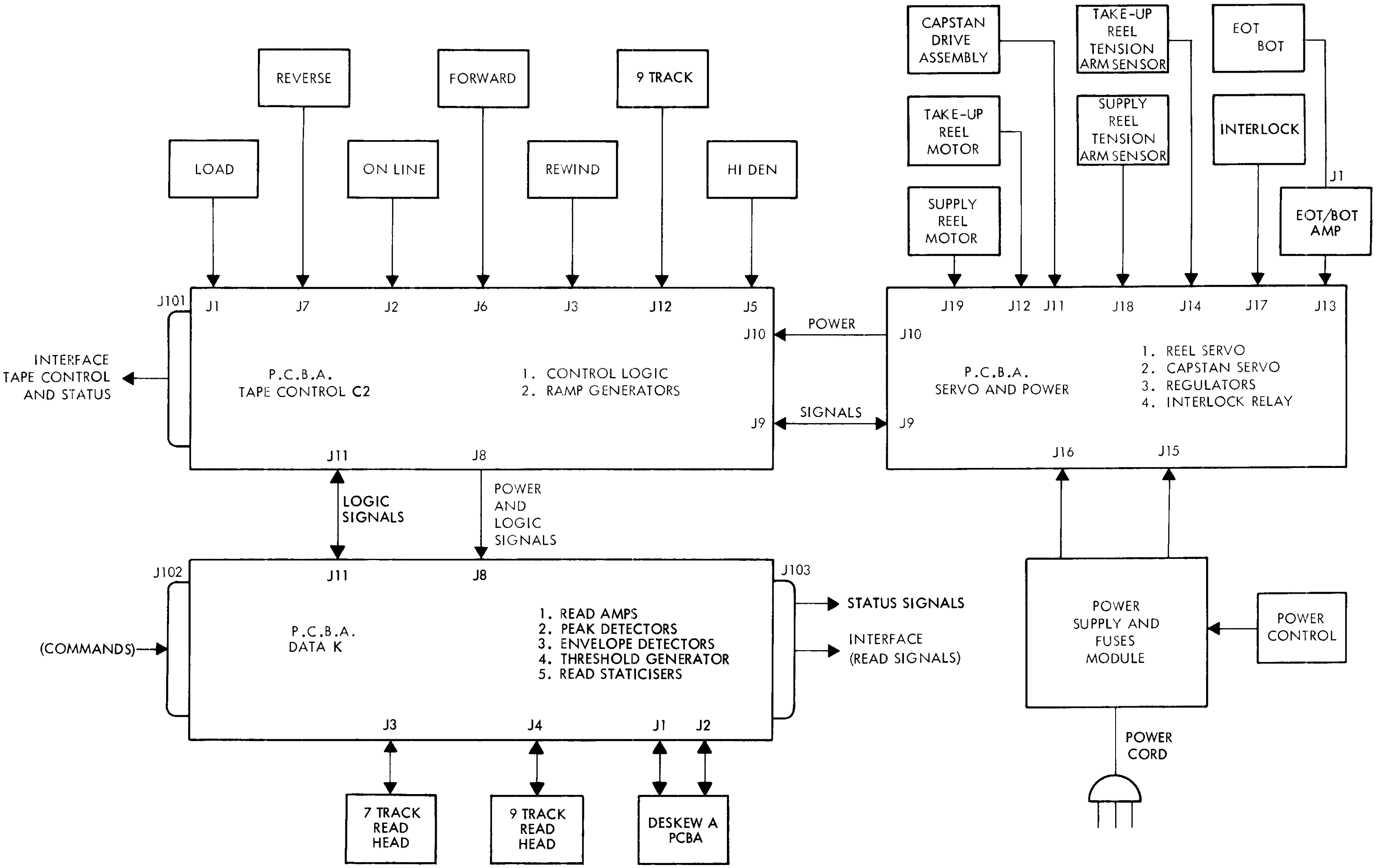


Figure 4-1. Organization of Models 6X11 and 6X12 Tape Transport

amplifiers, capstan servo amplifier, voltage regulators, photo-tab sensor amplifiers, and interlock relay. With the exception of the magnetic head and the manual control switches, all of the deck-mounted components (power supply, motors, tension arm position sensors, phototab sensors, etc.) plug directly into locations on the PCBA.

Two other boards are mounted in slide parallel to the rear of the deck plate; they are the Data PCBA which is closest to the deck plate, and the Tape Control PCBA.

The Data PCBA is concerned with the reading of PE and NRZI data. Read signals pass from the head connector to the relevant amplifiers, peak detectors, read staticisers, and transmitters. Digital read signals, together with a READ DATA STROBE (RDS) during an NRZI operation are transmitted by means of an interface edge connector. Digital read signals during a PE operation are passed via the same interface edge connector. DC power and control signals are obtained from the Tape Control PCBA via two cables.

The Tape Control PCBA provides control for the entire transport. Both the synchronous and rewind ramp generators are contained on the board, along with interface and control logic, lamp drivers, and power distribution for the data electronics. The printed circuit edge connector carries interface signals to and from the PCBA.

The cables from the three interface connectors are merged, strain relieved, and leave the transport.

A fourth board (approximately 2 × 4 inches) is mounted on a bracket at the rear of the tape deck. This is the EOT/BOT Amplifier PCBA.

4.3 FUNCTIONAL SUBSYSTEMS DESCRIPTION

4.3.1 POWER SUPPLY

Figure 4-2 is a block diagram of the power supply which is in two parts. The first part, the power supply module, is fastened to the deck plate and contains the power transformer, rectifier, capacitors, fuses, and a number of power resistors and diodes. Four unregulated supplies are generated at nominal voltages of ±45v and ±18v.

The second part consists of the ±10v and ±5v regulators which are located on the Servo and Power Supply PCBA. Interconnection between the two parts is provided by a cable from the power supply module which plugs into the Servo and Power Supply PCBA via two 9-pin connectors.

The transformer primary connections are shown in Figure 4-3 for several line voltages. Line voltage is connected to the transformer via the POWER control; the POWER control neon indicator is always connected across 115v ac, independent of selected line voltage. Unregulated dc (at a nominal ±18v under load) is used to power the motors and voltage regulators. Four regulated supplies are generated. The ±10v supplies can supply up to 1.0 amp. The ±5v supplies are adjusted and regulated, and can supply 2.0 amps and 1.0 amp, respectively.

Since digital ICs are widely used in the transport, an SCR for "crowbar" protection against an overvoltage or +5v supply failure has been included. If, for example, the +5v line rises to +8v, the SCR connected between +18v and 0v fires. This holds the voltage on the ICs down until the fuse blows a few milliseconds later.

The ±45v supplies are utilized by the reel servos during high-speed rewind operation so that the final amplifiers can supply the necessary drive voltage to the reel motors. The power diodes form part of the switch circuit that supplies the ±45v during rewind. The power resistors are used to reduce dissipation in the heatsink from the reel amplifier and the +5v regulator.

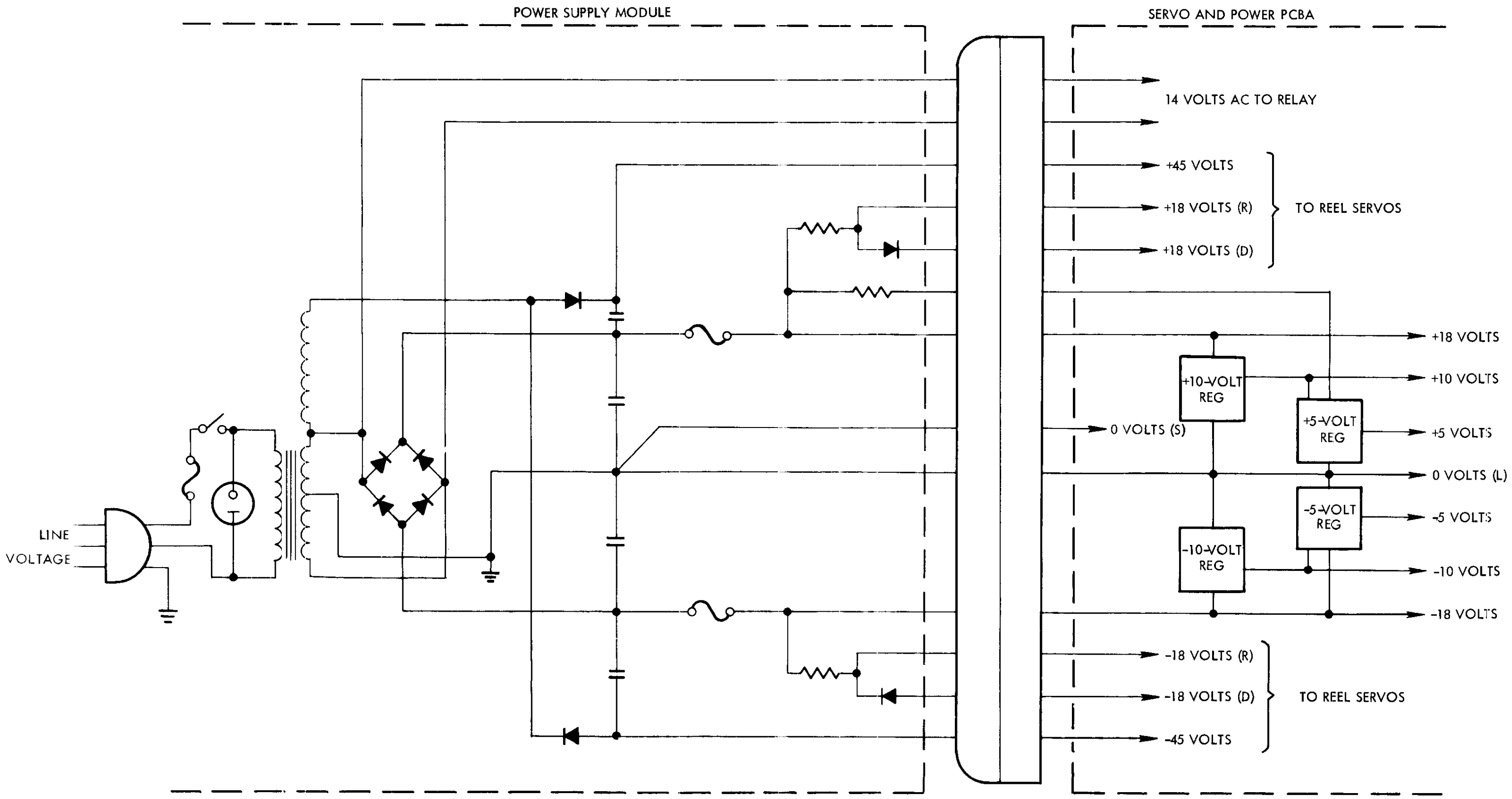
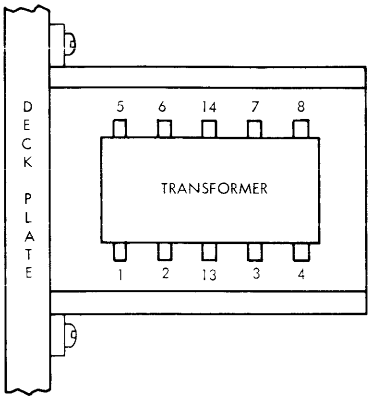


Figure 4-2. Block Diagram of Power Supplies



LINE VOLTAGE	LINE BETWEEN	LAMP	CONNECT
95	14 AND 3	1	3 TO 7 AND 13 TO 14
105	7 AND 2	4	2 TO 6 AND 3 TO 7
115	7 AND 1	3	1 TO 5 AND 3 TO 7
125	8 AND 1	3	1 TO 5 AND 4 TO 8
190	7 AND 13	4	3 TO 14
210	7 AND 2	4	3 TO 6
220	7 AND 1	3	3 TO 6
230	7 AND 1	3	3 TO 5
240	8 AND 1	3	3 TO 5
250	8 AND 1	3	4 TO 5

Figure 4-3. Transformer Primary Connections

4.3.2 CAPSTAN SERVO

Figure 4-4 is a block diagram of the capstan servo. It consists of three parts: the deck mounted capstan drive assembly consisting of the motor-tachometer combination and the capstan; the ramp generators on the Tape Control PCBA; and, the capstan drive amplifier on the Servo and Power Supply PCBA. A relay contact disconnects the motor when tape tension is lost.

A tape is moved by the capstan at a velocity determined by the velocity servo and the output of one of the two ramp generators. If the forward ramp generator is selected by the logic, the voltage at resistor R1 rises at a rate corresponding to the required start time of the tape. The amplifier then accelerates the motor and the tape; the feedback voltage from the tachometer produces current in resistor R4, which tends to reduce the amplifier input current produced by the selected ramp generator. The voltage at resistor R1 stops rising after the required start time and the velocity builds up to the point where the currents in resistors R4 and R1 are approximately equal and opposite.

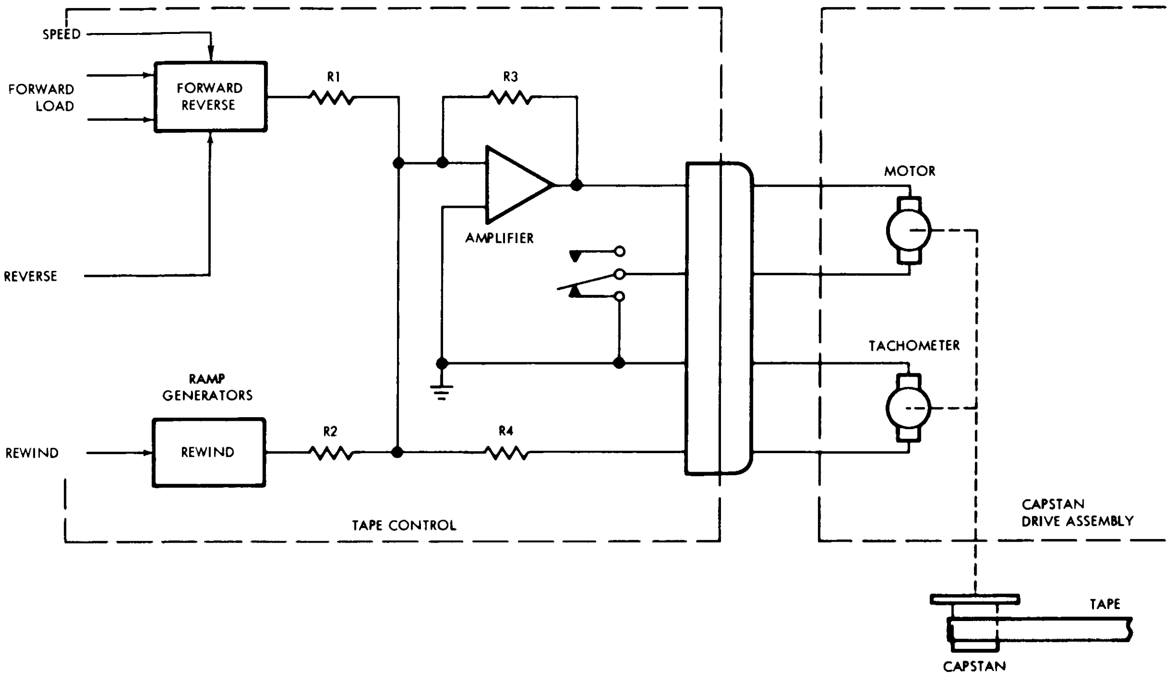


Figure 4-4. Capstan Servo Block Diagram

The Forward ramp generator is activated by the SYNCHRONOUS FORWARD command (SFC), FORWARD control activation, or a Load sequence. The Reverse ramp generator is activated by a SYNCHRONOUS REVERSE command (SRC), or REVERSE control activation. The Rewind ramp generator is activated by a REWIND command (RWC), either remote or manual. The SPEED command determines the level of the synchronous ramps. When the transport is in the standby condition, neither ramp generator is activated; in this case, the capstan position is maintained by motor friction.

Both Forward and Reverse ramps rise and fall in a time calculated to produce start-stop distances of 0.19 ±0.02 inch, e.g., 8.33 milliseconds for a 45 ips transport. Typical waveforms are shown in Figure 4-5.

The Rewind ramp rise and fall times are not critical; they are approximately 0.5 second and are chosen so as to allow the reel servos to keep up with the rise and fall in tape speed.

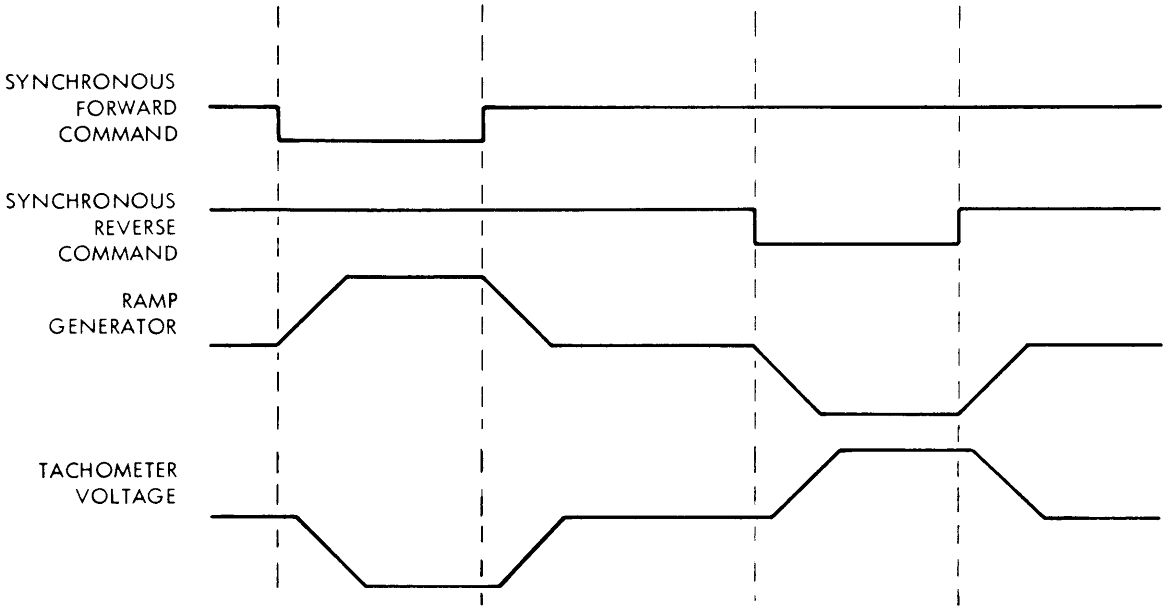


Figure 4-5. Typical Capstan Servo Waveforms

4.3.3 REEL SERVO SYSTEM

Identical position servos control the supply and take-up of tape by the reels. Figure 4-6 is a diagram of one complete reel servo together with part of a second and the relevant interconnections.

The components of the servo are: (1) tension arm position sensor, (2) pulleys, belt, tension arm, and tape reel, (3) reel motor, and (4) servo amplifiers on the Servo and Power Supply circuit board.

The tension arms establish tape tension and isolate the inertia of the reels from the capstan. Low-friction ball bearing guides are used to minimize tape tension variations. The angular position of the tension arm is sensed by a photosensitive potentiometer which produces a voltage output proportional to the arm position. This output is amplified and drives the reel motor in the direction to center the tension arm. The geometry of the tension arm and spring ensures that only negligible tape tension changes occur as the storage arm moves through a 60-degree arc.

There are two basic versions of the Servo and Power Supply PCBA.

(1) Servo and Power Supply "A" utilizes a low gain linear amplifier; this provides a critically damped linear servo system which can be used at tape speeds up to 37.5 ips.

(2) Servo and Power Supply "B" utilizes a high gain amplifier in conjunction with current limiting to provide a non-linear servo system. The Servo and Power Supply "B" enables operation to be extended to a tape speed of 45 ips without changing the mechanical and electromechanical components of the transport.

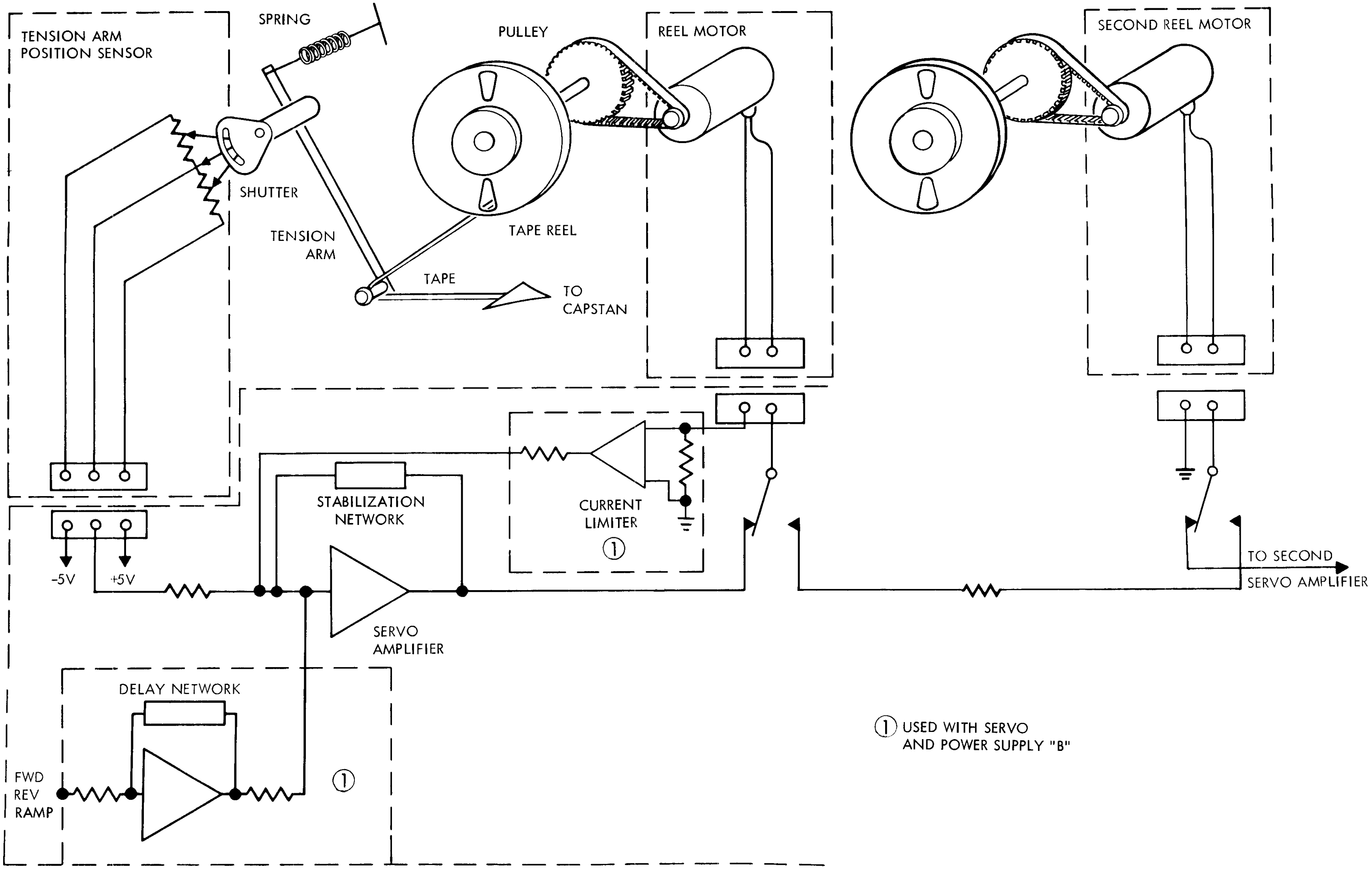


Figure 4-6. Reel Servo Diagram

4.3.3.1 Operation with Servo and Power Supply "A"

With tape stationary, the storage arms take a position such that the amplified tension arm sensor output, when applied to the reel motor, provides sufficient torque to balance the pull of the tension arm spring.

Initially, the sensor is set by rotating the shutter on the tension arm shaft so that the tension arms operate in the center of their range. The position of the tension arm changes for different steady-state tape velocities. This occurs because the amplifier output varies with the motor back-emf requiring corresponding changes in voltages from the sensor.

When the capstan injects a tape velocity transient in either direction, the arm moves and the sensor output changes, driving the reel motor in the direction to recenter the arm.

Each reel motor is driven by a linear amplifier with lead-lag servo stabilization. The zero of the stabilization network is at 2.7 Hz and the pole is at 12.8 Hz. The low-frequency gain of the amplifier is approximately 3.6 volts per volt. With 10v across the arm sensor, the sensor gain is 4.2 volts per radian and the motor gain is 10 radians per second per volt. The motor velocity is stepped down by a pulley ratio of 4 to 1, so that the open loop gain (reel velocity divided by arm displacement) is 37.5 radians per second per radian. Thus, the arm displacement for a change in tape velocity from 37.5 ips forward to 37.5 ips reverse (an empty reel: ±14.6 radians per second) is approximately 0.8 radian at 46 degrees.

Without tape, the arm rests against the stops and the tension arm limit switch opens, de-energizing the interlock relay. When the relay is de-energized, the two reel motors are disconnected from their respective amplifiers and connected together through a low resistor (see Figure 4-6), thus providing a dynamic braking effect. The characteristics of the system ensure that when power is lost in the Rewind mode, the two reels come to rest in such a manner that tape tension is never exceeded and significant tape spillage never occurs. The dynamic braking feature is also useful when tape tension is lost in the tape unload operation.

In the Rewind mode, the characteristics of the reel servos are altered by electronic switching as follows.

(1) The relevant parts of the two reel servo amplifiers are connected to +36v and -36v instead of +18v and -18v. This allows the amplifiers to supply sufficient output voltage to enable the reel servos to follow tape speeds of 150 ips.

(2) The low frequency gain of the servos is increased by a factor of approximately 2; in addition, a voltage from the Rewind ramp generator is added to the feedback from the tension arm sensor. Therefore, the displacement of the tension arm required to generate the necessary amplifier output at 150 ips is reduced, minimizing the tension arm stroke requirements.

4.3.3.2 Operation with Servo and Power Supply "B"

With tape stationary, the storage arms take a position such that the amplified tension arm sensor output, when applied to the reel motor, provides sufficient torque to balance the pull of the tension arm spring.

Initially, the sensor is set by rotating the shutter on the tension arm shaft so that the tension arms operate in the center of their range.

When the capstan injects a tape velocity transient in either direction the arm moves and the high gain amplifier, together with the current limiter, cause a predetermined current to flow in the reel motor in such a direction to recenter the arm. In addition, however, a voltage from the Forward/Reverse capstan ramp generator, suitably delayed, is subtracted from the arm sensor input. This causes the steady state displacement of the arm to be large in spite of the high amplifier gain so that storage associated with the complete arm movement is available when the capstan velocity reverses. The high amplifier gain ensures little variation in arm displacement as the reel velocity varies due to changes in effective reel diameter from an empty to full reel.

The amplifier gain is 33 volts per volt, the motor gain is 10 radians per second per volt, and the motor velocity is stepped down by 4 to 1. If the arm is displaced 0.4 radian (one-half of the total possible displacement) the output from the arm sensor gain (4.2 volts per radian) is 0.4 X 4.2 - 1.68v. The magnitude of the voltage from the Forward/Reverse ramp generator is 4.8v and the gain of the delay network is 0.305 volts per volt. Thus, the output of the delay network is 0.305 X 4.8 = 1.46v. The angular velocity of the reel is therefore

$$(1.68 - 1.46) \times 33 \times 10 \div 4 = 18 \text{ radians per second}$$

This corresponds to a linear tape speed of 45 ips for an empty reel (5-inch diameter). Thus, the arm displacement from 45 ips forward to 45 ips reverse is 0.8 radian. When the reel is full (10-inch diameter) the required velocity is only 9 radians per second. This requires an arm sensor input of 1.57v instead of 1.68v which corresonds to a change of arm displacement of 0.03 radian, or less than 10 percent.

The zeros of the stabilization network are at 1.45 Hz and 1.75 Hz and two poles at 0.3 Hz and 150 Hz.

Without tape, the arms rest against the stops and the tension arm limit switch opens, de-energizing the interlock relay. When the relay is de-energized, the two reel motors are disconnected from their respective amplifiers and connected together through a low resistor (see Figure 4-6), thus providing a dynamic braking effect. The characteristics of the system ensure that when power is lost in the Rewind mode, the two reels come to rest in such a manner that tape tension is never exceeded and significant tape spillage never occurs. The dynamic braking feature is also useful when tape tension is lost in the tape unload operation.

In the Rewind mode, the relevant parts of the two reel servos are connected to +36v and -36v instead of +18v and -18v. This allows the amplifiers to supply sufficient output voltage to enable the reel servos to follow tape speeds of 150 ips.

4.3.4 DATA ELECTRONICS

Information recorded in the NRZI mode is represented on tape by changes in direction of the magnetization between positive and negative saturation levels. A "1" bit is represented on tape by a flux polarity reversal, and a "0" bit by no change of flux polarity. Two NRZI tape formats are in general use. They are the IBM 727/729 7-track format which can operate at 200, 556, and 800 cpi, and the IBM 2400 9-track format which operates at 800 cpi.

The PE method of recording distinguishes between "1" and "0" bits on the tape by the direction of flux change. The PE system interprets a flux change toward the magnetization direction of the IBG as a "1" bit. A flux change in the opposite direction represents a "0" bit. A phase flux reversal is written between successive "1" bits or between successive "0" bits to establish proper polarity. Thus, up to two flux changes are required per bit for the PE method of data encoding.

The PE method of recording data differs from NRZI in that the NRZI method employs only one flux change in either direction to represent a "1" bit, and the lack of a flux change to represent a "0" bit.

Figure 4-7 illustrates the basic recording waveform components of the NRZI and PE modes. Note that in the PE mode the direction of magnetic flux change on the tape at the center of the bit cell determines its value (zero or one).

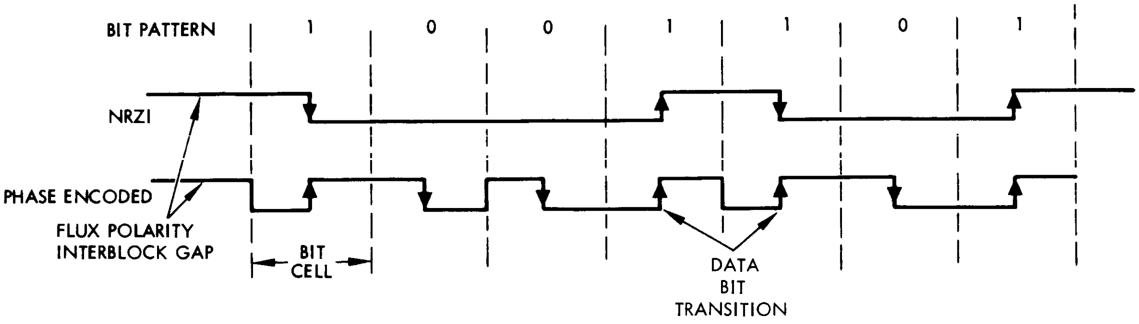
Figures 4-8 and 4-9 illustrate the relevant 9- and 7-track NRZI allocation and spacing. Figure 4-10 illustrates the relevant 9-track allocation, spacing, and format of 1600 cpi PE tapes.

Note that in the 9-track configuration, both NRZI and PE, consecutive data channels are not allocated to consecutive tracks. This organization increases tape system reliability because the most used data channels are located near the center of the tape. Consequently, they are least subject to errors caused by tape contamination.

The PE data block is preceded by a preamble consisting of 40 bytes of all zeros and one byte of all ones. Note that the data block is followed by a postamble which is the mirror image of the preamble, i.e., one byte of all ones followed by 40 bytes of all zeros.

NOTE

> Preamble and postamble bursts are configured so that during a Read Reverse operation their functions are interchangeable.



NOTES:

NRZI - ANY CHANGE IN POLARITY IS A "1" BIT
NO CHANGE IS A "0" BIT

PHASE ENCODED - DATA BIT TRANSITION IN DIRECTION OF IBG IS A "1" BIT
- DATA BIT TRANSITION OPPOSITE IN DIRECTION OF IBG IS A "0" BIT

Figure 4-7. PE and NRZI Recording Comparison

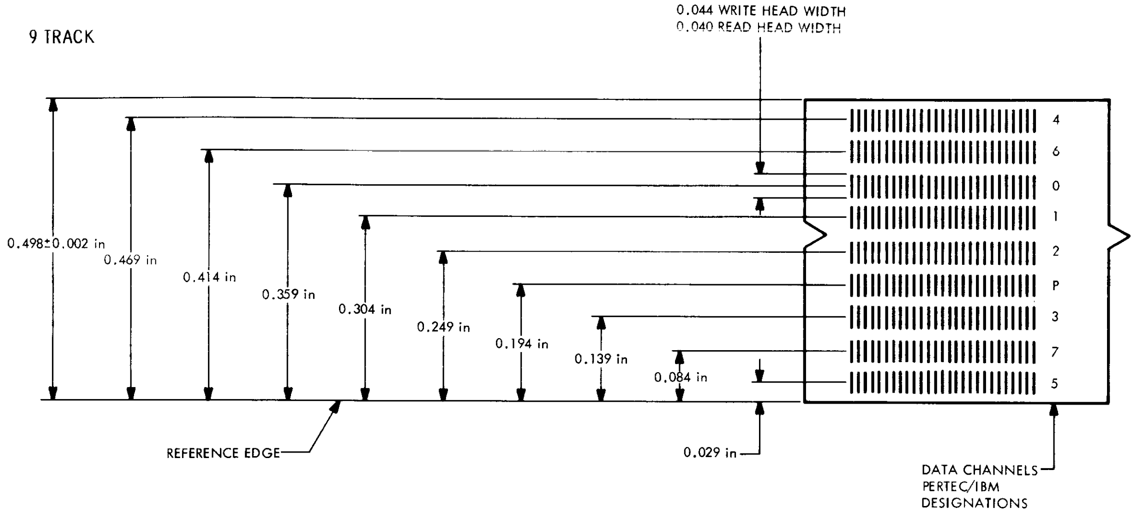


Figure 4-8. 9-Track NRZI Allocation and Spacing

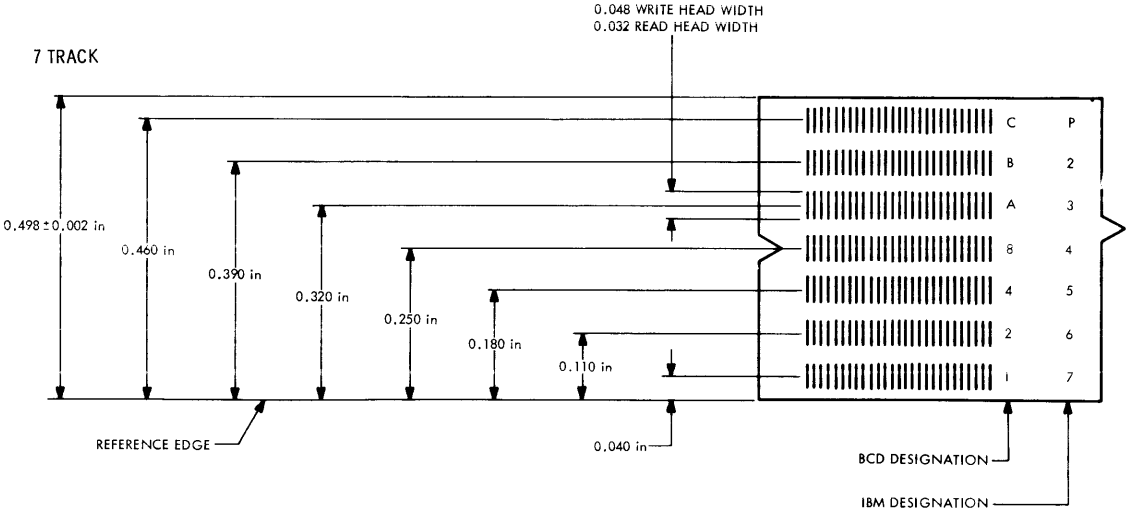


Figure 4-9. 7-Track NRZI Allocation and Spacing

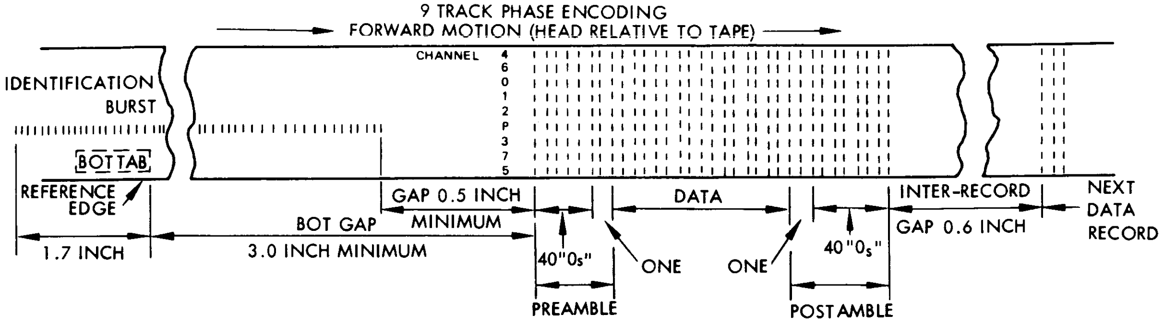


Figure 4-10. 9-Track PE Allocation and Format

Figures 4-11 and 4-12 illustrate waveforms representative of data written on a channel, along with the readback waveforms for NRZI and PE formats, respectively. Magnetization transitions recorded on tape are not perfectly sharp due to the limited resolution of the magnetic recording process.

During a Read operation, as tape passes over the Read head, any flux pattern recorded on tape (one or zero) generates a waveform in its appropriate data track. It is important to note that during a Read Reverse operation the Read signal is inverted, i.e., a PE one bit is a negative transition, and a PE zero bit is a positive transition.

The appropriate data electronics are capable of handling both 7- and 9-track NRZI formats and the 9-track PE format.

Solid state switching is employed to accomplish all format selection in the transport. Reproduction capability for 9-track 1600 and 800 cpi, as well as 7-track 800, 556, and 200 cpi tapes is provided; only two of the three available 7-track densities may be included on any one machine.

All formats require a minimum signal level for accurate data reproduction. For NRZI tapes this level is approximately 20 percent of the peak voltage output at the read head; for PE tapes this level is approximately 10 percent.

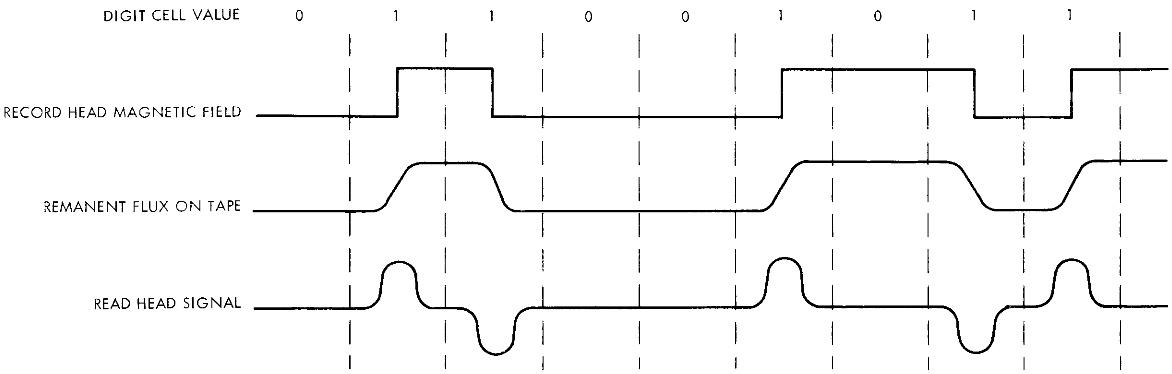


Figure 4-11. NRZI Write and Read Waveforms

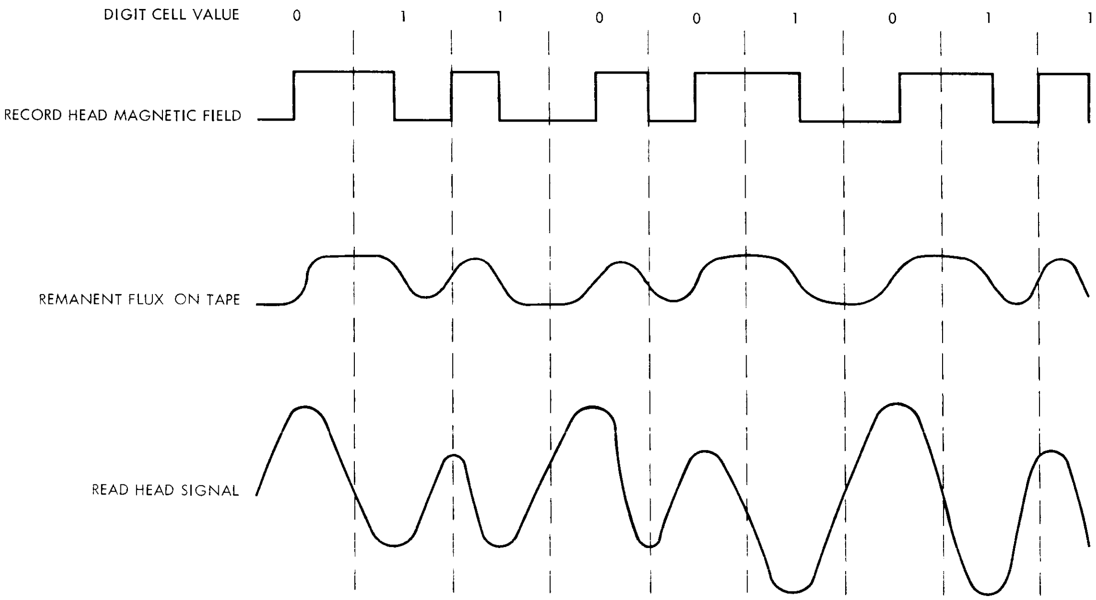


Figure 4-12. PE Write and Read Waveforms

These threshold levels prevent tape noise and sporadic signals from appearing on data since these unwanted signals are usually lower than the 20 and 10 percent levels established.

In extreme cases when the data signal drops below these thresholds, an extra low read recovery threshold level is employed. This extra low threshold level can be selected through the interface and reduces the threshold level to approximately 50 percent of its original value, i.e., 10 percent NRZI, 5 percent PE.

The data electronics in the Read Only transports do not include provision for deskewing PE data. The customer must provide this function through use of an external formatter or similar device.

There are two types of skew associated with reproducing NRZI data; these are static and dynamic.

Static skew is caused by misalignment of the head azimuth and gap scatter. Azimuth misalignment is normally corrected by adjusting the tape path over the read head. This procedure is explained in Paragraph 6.7.5. Dual stack models employ electronic static deskew since the tape path cannot be simultaneously aligned for both stacks.

Dynamic skew is normally caused by imperfections in tape tracking and is corrected for by use of the transport character gate. The character gate is an electronic "window" which opens upon receipt of the first data "one" bit from any track. The window stays open for nominally 46 percent of the bit-cell time. All other "ones" arriving during the time of this window are considered valid data for that byte. Should the tape be unreadable due to excessive skew, there is an extra long character gate which is selected by making IRTH1 true (low). This increases the character gate length to approximately 60 percent of a bit cell period.

4.3.4.1 Data Reproduction

The fundamentals of operation of the data recovery system (NRZI and PE) of the Read Only transports are described in the following paragraphs. Three reference figures are provided to be used in conjunction with this description. Figure 4-13* is a functional block diagram of the data recovery system and is used throughout this description. The diagram is keyed only to the text and to the relevant waveform illustration.

The following discussion will be based on the more complex model of the Read Only transport family (Model 6X12). To aid in understanding, the two formats (NRZI and PE) will be handled separately.

4.3.4.2 Data Reproduction - NRZI Operation

Figure 4-14* is a diagram (keyed to the text) illustrating the NRZI waveforms encountered when reading an NRZI tape. This diagram should be used in conjunction with Figure 4-13*.

Either the 7- or 9-track magnetic head is connected to the read preamplifier through a solid-state head switching network U1. The output of the preamplifier U2 is an amplified replica of the read head output. The preamplifier gain and bandwidth is adjusted for the appropriate head and format by the Gain and Bandwidth Control block U3.

NOTE

> Preamplifier bandwidth for PE operation is wider than for NRZI operation.

The output of the preamplifier is fed via the differentiator U4 to the voltage comparators U5 and U6. In the NRZI mode of operation the reference input to U5 and U6 is 0v. Therefore, U5 (non-inverting) and U6 (inverting) act as squaring circuits.

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*Foldout drawing, see end of this section.

Operation may be more clearly understood by referring to Figure 4-14*. As illustrated in the diagram, both the positive and negative going outputs of the preamplifier will result in sine wave outputs from the differentiator U4. The points at which the sine waves cross the 0v point occur at the peaks of the preamplifier output (which correspond to the flux transitions on the tape).

The slope of the differentiator output at the zero crossing is determined by the polarity of the preamplifier output, which in turn depends on the direction of the flux transition. The output voltage of the non-inverting amplifier (U5) changes from low to high whenever the differentiator output voltage changes from negative to positive (positive going data signal peak) and vice versa. Similarly, the output voltage of the inverting amplifier (U6) changes from low to high whenever the differentiator output voltage changes from positive to negative (negative going data signal peak).

A dc threshold voltage equal to 20 or 10 percent (depending on which threshold is selected) of the peak preamplifier output is generated in the NRZI threshold generator U26. This threshold reference voltage and its negative complement are fed to the reference inputs of voltage comparators U7 and U8. During NRZI operation, the NRZI/PE line at NOR gates U11 and U12 is high, enabling the outputs of the voltage comparators.

When the positive-going portion of the data signal from the preamplifier output exceeds the positive threshold level of the voltage comparator (U7) the output of the comparator goes low. This causes the output of NOR gate U11 to go high.

The high output of gate U11 enables gate U9 to pass the valid data from U5 since the data amplitude was sufficient to exceed the pre-determined threshold. The same process is performed for the negative-going portion of the data signal through devices U8, U6, U12, and U10.

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*Foldout drawing, see end of this section.

The outputs of NAND gates U9 and U10 are ORed by gate U13 and inverted by inverter U14. The resultant output waveform is a negative-going pulse for each data "one" read on that particular track.

For single stack head systems the output of inverter U14 is connected directly to the toggle input of staticiser flip-flop U20. The negative transition sets the flip-flop true since the K input is low and J is high.

The pulse train from inverter U14 contains all true displacement errors associated with azimuth error, gap scatter, and dynamic skew. In either 7- or 9-track transports, the azimuth error is corrected by aligning the tape path, and the gap scatter (limited to tight tolerances) is absorbed by the character gate.

In the case of the dual stack head system (7- and 9-track) the Deskew card is inserted between the output of inverter U14 and the toggle input of staticiser flip-flop U20. The one-shot (U16) period of the deskew channel is adjusted to delay the falling edge of its output by the period required to align that transition with those of all other channels.

NOTE

> The required delay changes when heads or tape travel directions are switched.

When the output of the staticiser flip-flop U20 is set to the true state, Q goes high and $\overline{Q}$ goes low. The flip-flop will remain in this state until reset via the Clear Direct (CD) input. The low output of $\overline{Q}$ is NORed with that of all other channels by gate U23. The output of gate U23 is a positive level which remains high from the first data "1" input to the staticiser clear pulse. The output (Q) of the staticiser is directly connected to the inverting output driver U21 which drives the interface line to a true (low) level when the staticiser is in the "1" state.

The high level of gate U23 output triggers a timing circuit in the character gate. The period of the character gate is approximately 50 percent of a bit cell period. At the end of this period a RDS pulse is generated. It is this pulse which strobes the data on the interface output lines. Shortly after the RDS pulse the staticiser flip-flops are cleared via the Staticiser Clear signal from the character gate. When IRTH1 is true, the character gate period is increased to approximately 60 percent of the bit cell period.

Testpoint 7 is an algebraic summing point of the pulse trains from all channels and is used when setting and checking transport skew performance. When a Deskew card is employed, additional skew testpoints are available for setting and checking skew.

The control logic (U25) of the Data PCBA operates on inputs supplied from the Tape Control PCBA. The output of the logic controls such functions as:

(1) Head selection

(2) Preamplifier gain/bandwidth

(3) NRZI and PE threshold levels

(4) NRZI and PE mode controls

(5) Deskew control

(6) Character gate period selection

It should be noted that portions of the data channel are not utilized in NRZI reproduction. These portions are the PE envelope detector U15, NAND gate U18, inverter U19, and driver U22. The NRZI/PE control line into gate U18 was continuously low, thus disabling the gate and keeping erroneous data from reaching the interface driver U22.

4.3.4.3 Data Reproduction - PE Operation

Figure 4-15* is a diagram (keyed to the text) illustrating the PE waveforms encountered when reading a PE tape. This diagram is to be used in conjunction with Figure 4-13. Functions common to both PE and NRZI which were previously discussed in Paragraph 4.3.4.2 will not be detailed.

As in NRZI operation, not all portions of each data channel are used. For PE operation the NRZI/PE select signal into gates U11 and U12 is held low. This effectively disables voltage comparators U7 and U8, thus NAND gates U9 and U10 are always enabled. The staticiser clear line is held continuously low, disabling the staticiser flip-flop U20 so that no erroneous data can reach the interface driver U21.

For the PE mode of operation, the 9-track head is connected to the preamplifier which, in turn, feeds the differentiator U4. In single speed transports, the frequency content of the data signal is considerably higher in the PE mode than in the NRZI mode. Therefore, it is necessary to switch the bandwidth (and therefore the gain) with a change of mode. This is accomplished by the Gain/Bandwidth control signal.

In dual speed transports the tape speed is halved to maintain the same data rate in both PE and NRZI modes of operation. In this case no bandwidth (or gain) switching occurs with a mode change.

As in NRZI operation, the output of U4 is fed to the two voltage comparator circuits U5 and U6. U5 acts as a squaring circuit whose edges correspond to the peaks of the read signal from the head. The output from U5 is thus a replica of the magnetization on the tape.

Before data is sent to the interface, it is gated with a signal called PE ENVELOPE which is generated as follows.

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*Foldout drawing, see end of this section.

In the PE mode, U6 acts as a voltage comparator whose reference (positive) input is set to a positive level equal to approximately 10 or 5 percent of the peak differentiator output (U4). The differentiator, rather than preamplifier, output is used because the differentiator characteristics result in amplitude equalization of the 1600 and 3200 frpi signals and also remove base line distortion effects associated with high density operation.

When the differentiator output exceeds the positive threshold, the output of voltage comparator U6 goes low, causing the output of NAND gate U10 to go high (the other input to U10 is always high). Thus, a positive pulse appears at the input to the envelope detector (U15) for each half-wave portion of the PE signal whose amplitude is sufficient to exceed the threshold. The PE envelope detector utilizes two timing circuits designed so that they are insensitive to the duration of the input pulses. The characteristics of the timing circuits are such that four consecutive input pulses to the PE envelope detector (U15) yield a true output. The absence of two consecutive input pulses after U15 has been enabled will cause the output to return to the false state.

If, during a record, the output of the PE envelope detector goes low, gate U18 will be disabled and the data flow will be interrupted. The external formatter will detect this loss of signal and, if possible, correct for it by use of the parity information for reconstruction.

In contrast to NRZI operation, there is no clock (Read Strobe) or deskewing circuitry associated with PE reproduction. All channels are completely independent. On dual speed models, the tape speed is reduced to one-half the NRZI speed when operating in the PE mode to yield the same data transfer rate as 800 cpi NRZI.

4.3.5 TAPE CONTROL SYSTEM

The second major electronic subsystem consists of the circuits necessary to control tape motion. This includes manual controls, interlocks, and logic. The operation can best be described by detailing the Bring-to-Load-Point sequence, subsequent tape motion commands, the Rewind sequence, and subsequent unloading of tape.

Figure 4-16* is a functional logic diagram of the tape control system and is used only for purposes of describing the system operation.

4.3.5.1 Bring-to-Load-Point System

The system will be described by considering the sequence required to bring a tape to the BOT or Load Point. Figure 4-17* shows the waveforms during the operation.

Associated with each of the manual control switches is a "switch clean-up" flip-flop (U1, U2, U25) which eliminates the problems of switch contact bounce. Relay K1 has four changeover contacts, three of which (K1A, K1B, and K1C) are used to disconnect the reel and capstan servo motors, and the fourth (K1D) is used in conjunction with the tension-arm limit switch as a system interlock. The tension-arm limit switch is operated by a cam on the supply reel tension arm and is closed when the cam is in its normal operating position. The tension-arm limit switch opens at both extremes of the arm travel so that protection against over-tension as well as under-tension conditions is provided.

4.3.5.2 Actuate POWER Control

When power is turned on initially (Plot 1), the relay contacts on the tension-arm limit switch are open. The INTLK signal is low and is connected either directly or through OR gate U30 to the reset inputs of the five control flip-flops RW1, RW2, RW3, Load, and FLR (U15, U16, U17, U18, and U31).

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*Foldout drawing, see end of this section.

4.3.5.3 Depress LOAD Control (First Time)

When the LOAD control is depressed for the first time (Plot 3), the relay driver for K1 is turned on, the four contacts close, activating the reel servos which tension the tape, thus closing the tension arm limit switch. The tension arm limit switch supplies an alternate source of base current for the relay driver, thus latching the relay (which remains activated after the LOAD control is released). When K1D closes, a high level appears at the INTLK output (Plot 2), removing the reset signal from the control flip-flops. Load flip-flop U18 is not set by the first operation of the LOAD control because, at the time the C input of U18 goes low (which normally sets the flip-flop), the INTLK signal is still holding the reset input low (closure of the relay contacts is delayed from the appearance of the command level by 2 or 3 milliseconds while the relay contacts close).

If, at any time, the tension arm moves outside its operating region, the interlock relay de-energizes, power is disconnected from the motors, and the INTLK signal returns to the low state, resetting the five control flip-flops.

4.3.5.4 Depress LOAD Control (Second Time)

When the LOAD control is depressed momentarily a second time (Plot 3), the following sequence occurs.

(1) Since the INTLK signal is high, the Load flip-flop U18 and the FLR flip-flop U31 set (Plots 4 and 5). The Q output of U18 is fed to one input of OR gate U21. The output of OR gate U21 goes low, enabling the Forward ramp generator that drives the capstan servo (not shown). Tape accelerates to the specified speed (Plot 9) and continues to move until the BOT tab reaches BOT sensor, at which time the BOT signal goes high, enabling one input of NAND gate U29. In addition, the single-shot is triggered, generating an 0.5-second negative-going waveform (NBOTD) (Plot 7).

(2) Since the LOAD waveform and the output of gate U28 are high at this time, NAND gate U29 is enabled (Plot 10) and the Load flip-flop is reset. This causes the tape to decelerate to rest with the photo-tab under the photo-tab sensor. At this time, all three inputs to NAND gate U41 are high so that the NLDP waveform is low (Plot 11), indicating that the transport is at Load Point and enabling the Load lamp driver.

(3) At the end of the 0.5-second delay, the NBOTD waveform (Plot 7) goes high and, since the other two inputs to NAND gate U38 are both high at this time, the NREADY waveform at the output of gate U38 goes low (Plot 8), enabling one input of NAND gate U39.

(4) The setting of the FLR flip-flop causes the NFLR waveform to go low, disabling NAND gate U10 and thus inhibiting the possibility of further manual LOAD commands.

4.3.5.5 Depress ON LINE Control

If the ON LINE control is momentarily depressed, On-line flip-flop U26 is set (if it is depressed a second time, U26 is reset), enabling the second input of NAND gate U39. The $\overline{Q}$ output of the flip-flop U26 enables the On-line lamp driver. The output of gate U39 goes high, indicating that the transport is Ready and On-line (RO). If the transport is also selected, the output of NAND gate U40, the Select, Ready, and On-line (SRO) waveform goes high.

When the transport is On-line, the output of the manual REWIND control flip-flop is disabled by NONLINE at gate U12.

If the transport is Selected, the ISLT[*] waveform is low. The following options are available.

(1) If W4 is not present, then the SLT waveform goes high true when the transport is Selected.

(2) If W4 is present, SLT only goes true if the transport is Selected and On-line.

(3) If W3 is not present, the SLTA waveform is permanently high and the status lines are enabled. This option is used when interrogation of transport status lines is required, whether the transport is Selected or not.

(4) If W3 is present, the status lines are gated with the SLT waveform.

When the FLR or INTLK signals are low, the On-line flip-flop is held reset by OR gates U23 and U24, ensuring that the On-line flip-flop cannot be set until the interlock has been made and the Load or Rewind sequence has been entered. The On-line flip-flop can also be reset from the interface by the OFF-LINE command (OFFC) via interface receiver U22 and OR gate U24.

An option is available allowing the On-line flip-flop to be set without entering the Load or Rewind sequence. This is accomplished by removing jumper W2 connecting FLR to the input of U23. See Paragraph 4.3.5.9.

The transport is now ready to receive external commands.

4.3.5.6 Operation From External Commands

Assuming the transport is Selected, Ready, and On-line (SRO is high), receipt of an SFC will cause the output of interface receiver U4 to go high and the output of NAND gate U6 to go low. The MOTION signal will

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[*] Interface lines connecting transport to controller are prefixed by "I".

go high and the Forward ramp generator will be enabled via OR gate U21. Reverse operation through receipt of an SRC is similar through U5 and U7.

If the BOT tab is encountered during the execution of an SRC, the BOT signal goes high, the NBOT signal goes low, and the single-shot is triggered. As a result, NAND gate U7 is disabled, inhibiting the action of SRC and the NBOTD waveform goes low for 0.5 second so that the transport becomes Not Ready for this period of time.

4.3.5.7 Operation From Control Panel - Forward Operation

Forward tape motion in response to a remote input command was described in Paragraph 4.3.5.6. When the transport is in the Off-line mode (NONLINE is true) and the FORWARD control is depressed, tape will advance at the specified speed until one of the following occur:

(1) The FORWARD control is depressed again.

(2) The REVERSE control is depressed.

(3) The transport is placed in the On-line mode.

(4) The EOT tab is encountered.

(5) A BOT tab is encountered.

(6) Tape tension is lost.

As described in Paragraph 3.4.8, activation of the REVERSE control while tape is advancing in response to activation of the FORWARD control will cause the tape to decelerate to rest, then immediately accelerate to the synchronous velocity in the reverse direction.

4.3.5.8 Operation From Control Panel - Reverse Operation

Reverse operation is identical to Forward operation described in Paragraph 4.3.5.7 except for direction of tape motion. The reverse flip-flop is not reset if an EOT tab is encountered.

4.3.5.9 Rewind Sequence, Case 1 – Tape Not at Load Point

This is the normal Rewind-to-Load-Point sequence that results from either a remote or manual command. Figure 4-18* shows the waveforms that occur during the operation.

In response to either a remote or manual command, the RW1 flip-flop is set (Plot 3). The Q output of the flip-flop enables the Rewind ramp generator via NAND gate U28 (since the $\overline{Q}$ output of the RW3 flip-flop is high at this time) and the tape accelerates to a reverse velocity of 150 ips (nominal) in approximately 0.5 second (Plot 13). In addition, when flip-flop RW1 is set, the output of gate U33 goes low, disabling NAND gate U38 and causing the SRO waveform to go false (Plot 12).

When the BOT tab is detected, flip-flop RW2 is set on the leading edge of the BOT waveform (Plot 6), flip-flop RW3 is set on the trailing edge (Plot 7) and the 0.5-second single-shot is triggered (Plot 8). The $\overline{Q}$ output of flip-flop RW3 goes low, disabling NAND gate U28. The output of gate U28 goes high, disabling the Rewind ramp generator so that the tape decelerates to rest.

At the end of the 0.5-second delay, the trailing edge of the NBOTD waveform is differentiated by differentiator δ2 generating a positive-going BOTDP pulse (Plot 9). Since the Q output of flip-flop RW3 is high at this time, Load flip-flop U18 is set via gates U9 and U11. This enables the Forward ramp generator.

The characteristics of the ramp generators are such that the BOT tab overshoots the photosensor and then returns. When the BOT tab is detected for the second time, the 0.5-second single-shot is triggered (Plot 8), NAND gate U29 is enabled and its output goes low, resetting the RW1, RW2, RW3, and Load flip-flops (Plots 3, 6, 7, and 10). The Forward ramp generator is thus disabled and the tape decelerates to rest.

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*Foldout drawing, see end of this section.

The delay between the LOAD waveform and NAND gate U29 ensures that the reset waveform is the appropriate length. At the end of the 0.5-second period, the NBOTD waveform goes high and, since the other two inputs are high at this time, gate U38 is enabled and the SRO waveform goes true.

The RW1 waveform (Plot 3) is true throughout the Rewind sequence and is used to generate the REWINDING (IRWD) interface waveform.

4.3.5.10 Rewind Sequence, Case 2 - Tape at Load Point

A manual REWIND command initiates the Rewind sequence as previously described. However, in this case the tape unwinds from the take-up reel and tape tension is lost. Remote REWIND commands are inhibited by the NBOT waveform on NAND gate U13, i.e., it is impossible to unload tape remotely - operator intervention is required.

4.3.5.11 Ready Mode from Tape Not at Load Point

An option is available which allows the transport to be placed in the Ready mode after a Power-off, Power-on sequence (e.g., in the middle of a reel). This is accomplished by removing jumper W2 which connects FLR to the input of U23.

When this option is present (by deleting jumper W2), depress the LOAD control once to establish tape tension, then depress the ON LINE control. The READY line will go true and the transport can accept remote commands.

4.3.5.12 Data Density Select

Data Density selection on Models 6X11 and 6X12 transports is accomplished manually by the front panel HI DEN switch/indicator. Interface data density select is available only on Read/Write transports and is not relevant to Read Only models. The NHID signal is passed to the Data PCBA to condition the appropriate density circuitry.

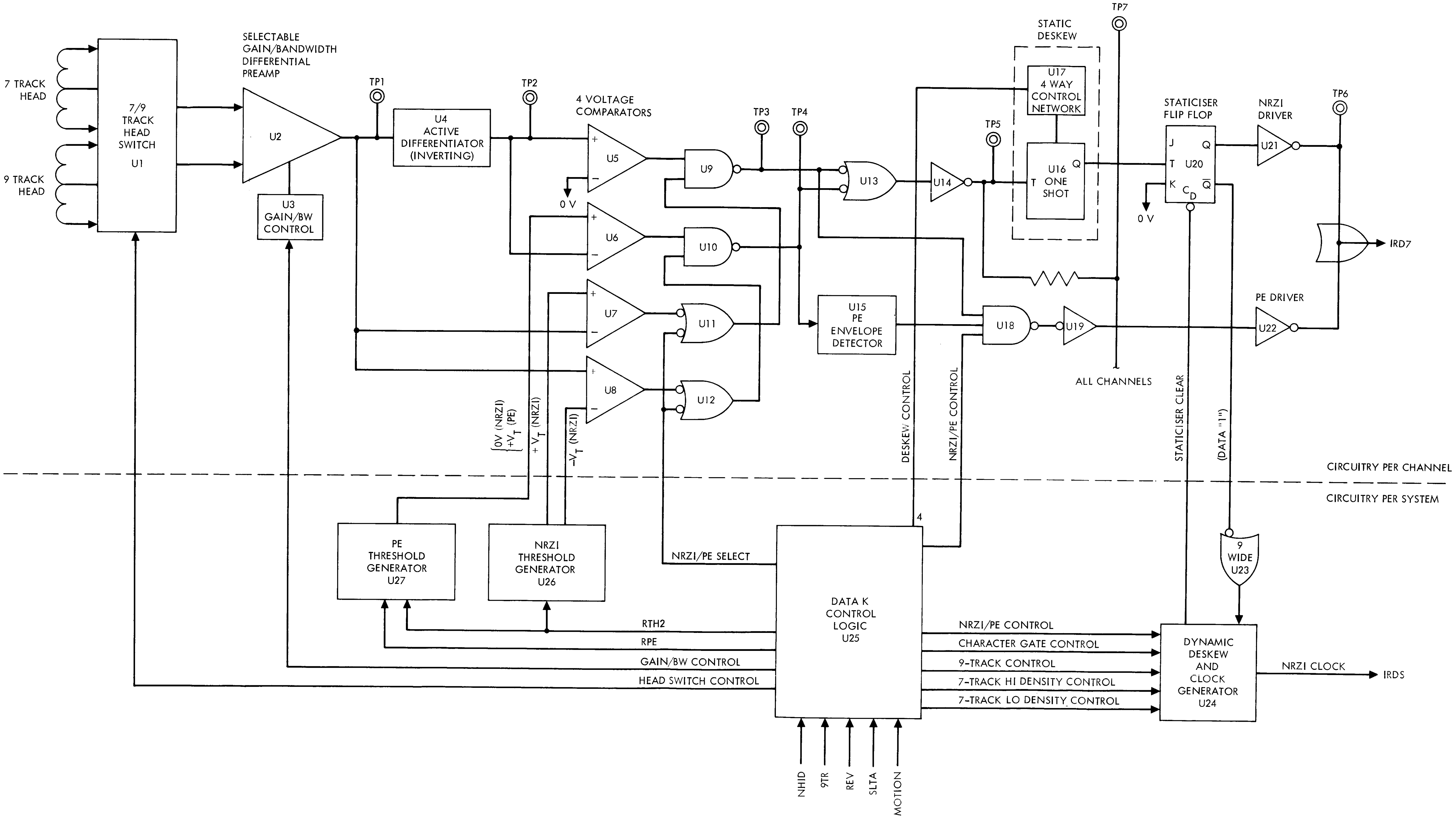


Figure 4-13. Functional Block Diagram, Data Recovery

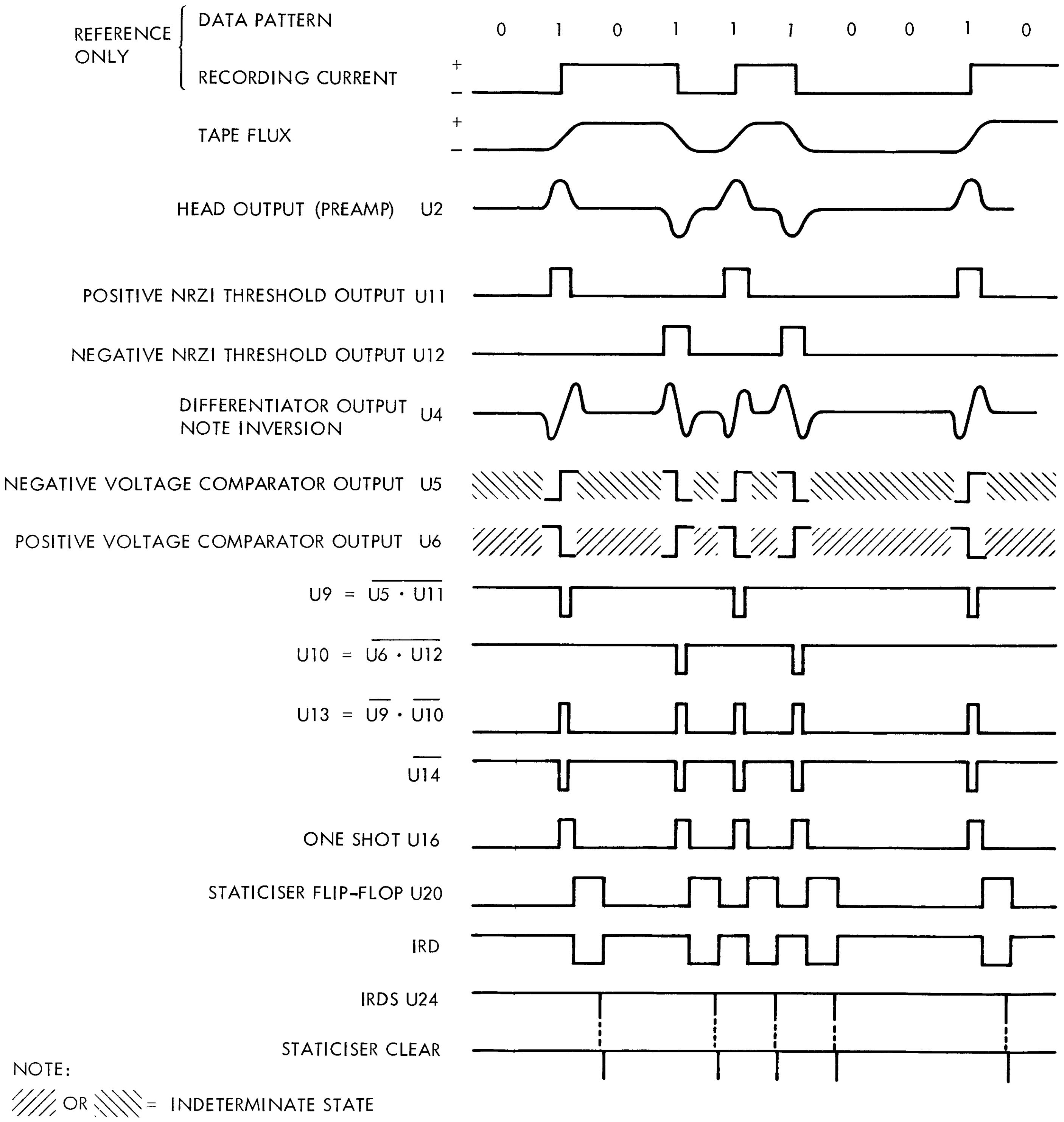


Figure 4-14. Timing Diagram, NRZI Data Reproduction

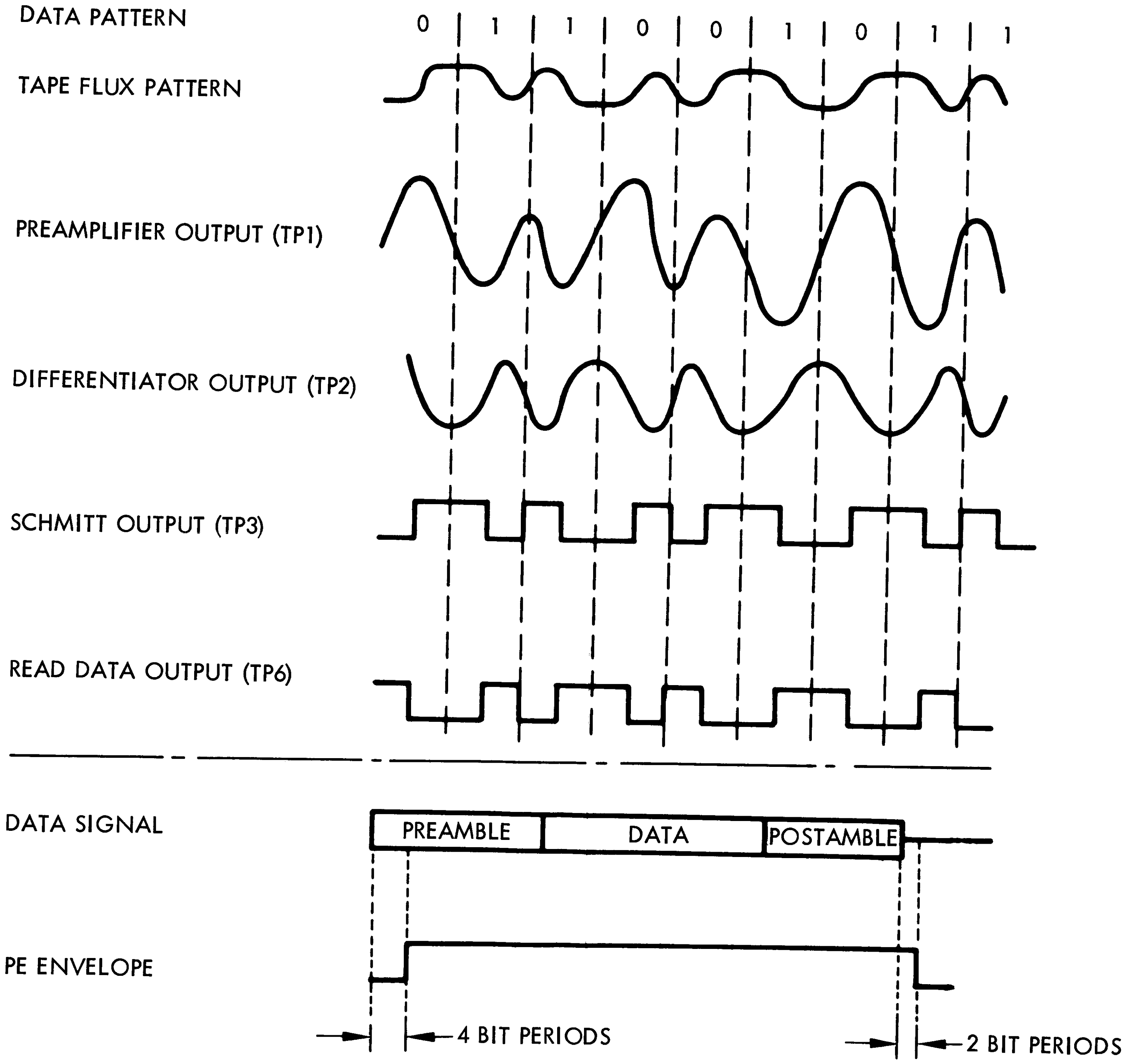
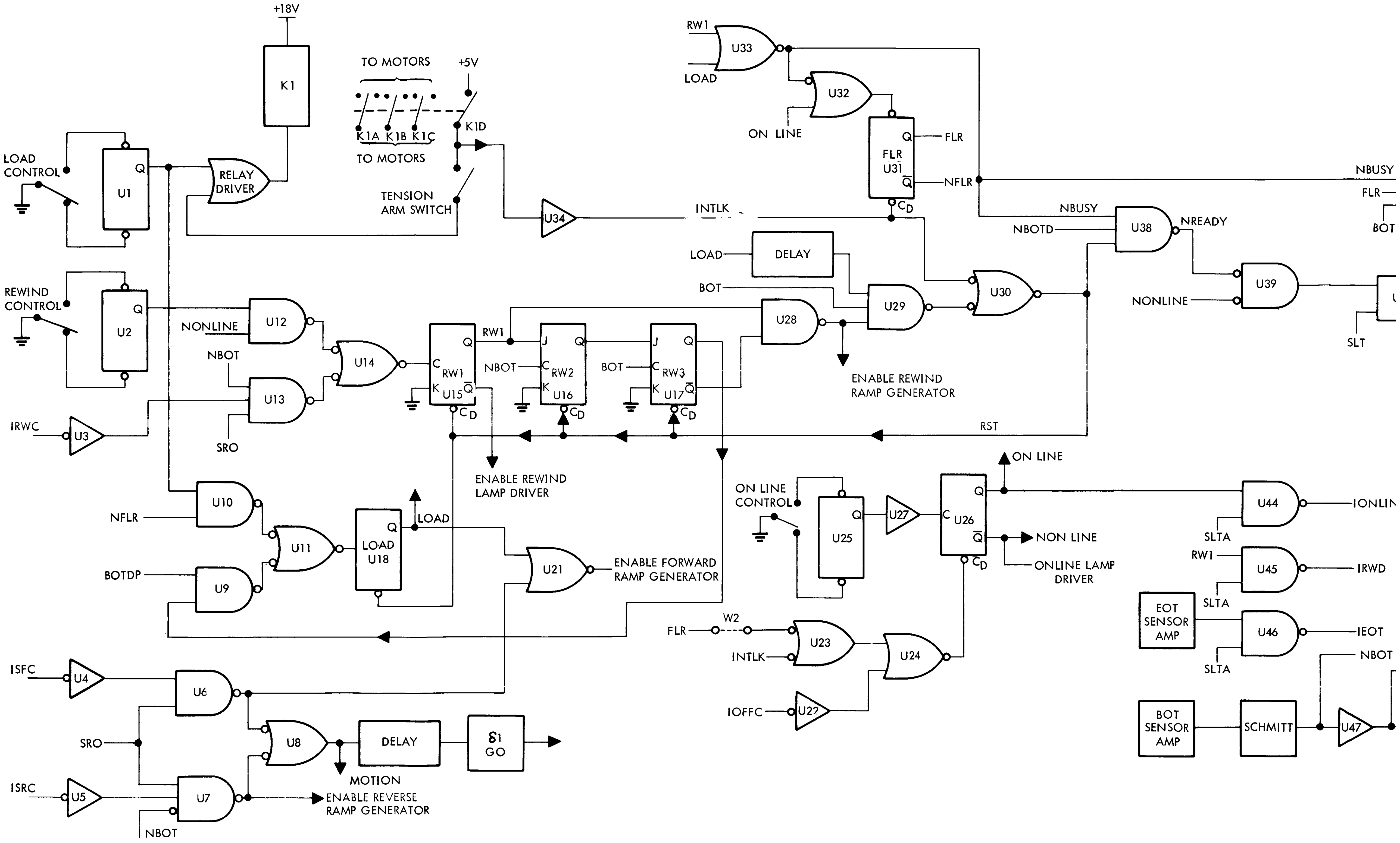


Figure 4-15. Timing Diagram, PE Data Reproduction


+18V
K1
TO MOTORS
+5V
K1A K1B K1C
K1D
TO MOTORS
TENSION ARM SWITCH
LOAD CONTROL
U1
Q
RELAY DRIVER
U34
INTLK
REWIND CONTROL
U2
Q
NONLINE
U12
NBOT
U13
U14
IRWC
U3
SRO
C
RW1
K
U15
Q
CD
RW1
J
C
K
RW2
U16
Q
NBOT
BOT
J
C
K
RW3
U17
Q
CD
CD
ENABLE REWIND LAMP DRIVER
RW1
U33
LOAD
U32
ON LINE
FLR
U31
Q
FLR
NFLR
CD
NBUSY
FLR
BOT
NBUSY
NBOTD
U38
NREADY
LOAD
DELAY
BOT
U29
U30
U28
ENABLE REWIND RAMP GENERATOR
NONLINE
U39
SLT
RST
U10
NFLR
U11
LOAD
U18
Q
LOAD
BOTDP
U9
U21
ENABLE FORWARD RAMP GENERATOR
ON LINE
ON LINE CONTROL
U25
Q
U27
C
U26
Q
CD
NON LINE
ONLINE LAMP DRIVER
U44
IONLIN
SLTA
RW1
U45
IRWD
SLTA
EOT SENSOR AMP
U46
IEOT
SLTA
NBOT
FLR
W2
U23
INTLK
U24
IOFFC
U22
ISFC
U4
U6
U8
DELAY
δ1 GO
SRO
MOTION
ISRC
U5
U7
ENABLE REVERSE RAMP GENERATOR
NBOT
BOT SENSOR AMP
SCHMITT
U47

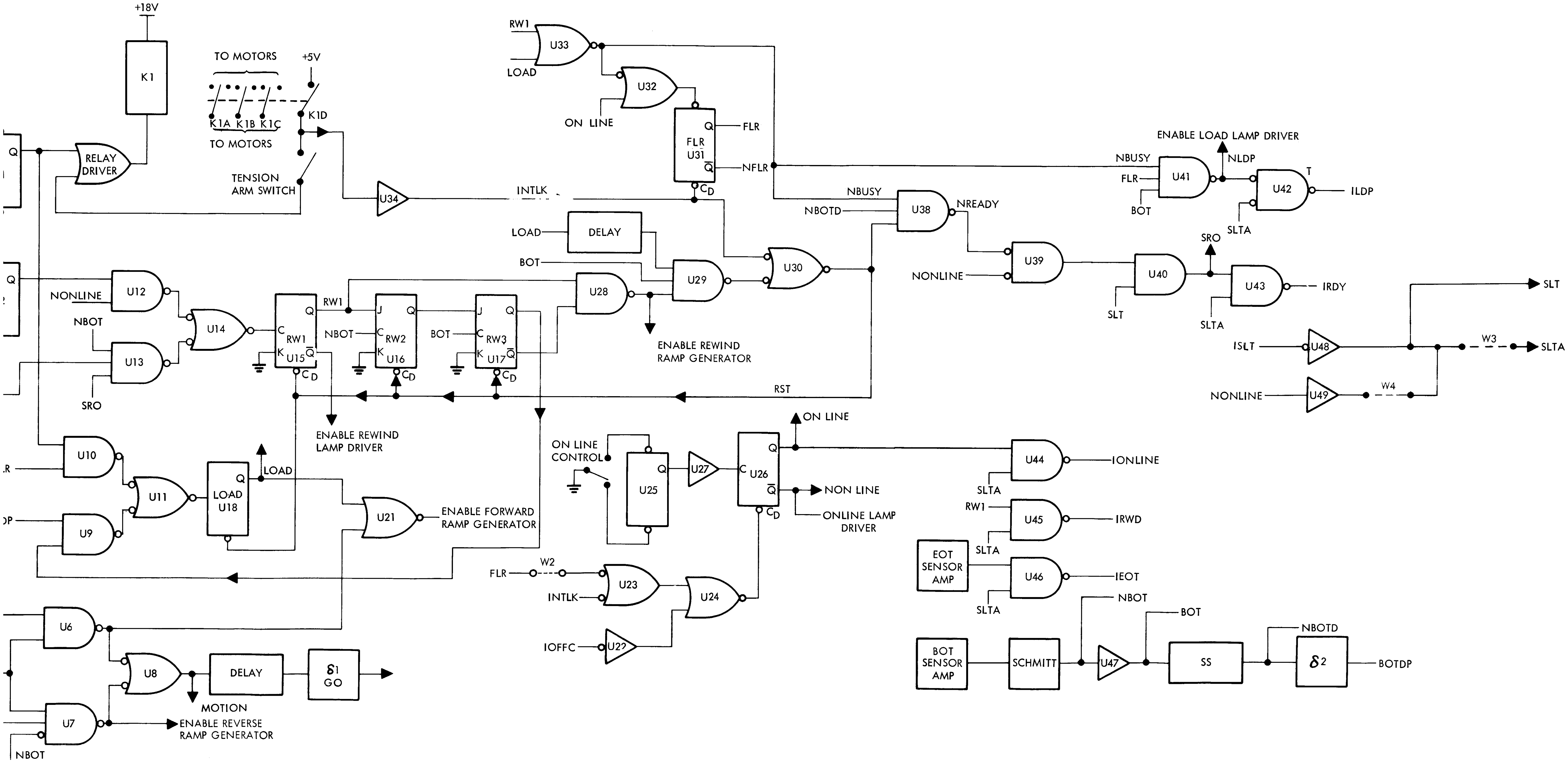


Figure 4-16. Block Diagram, Tape Control System

903B

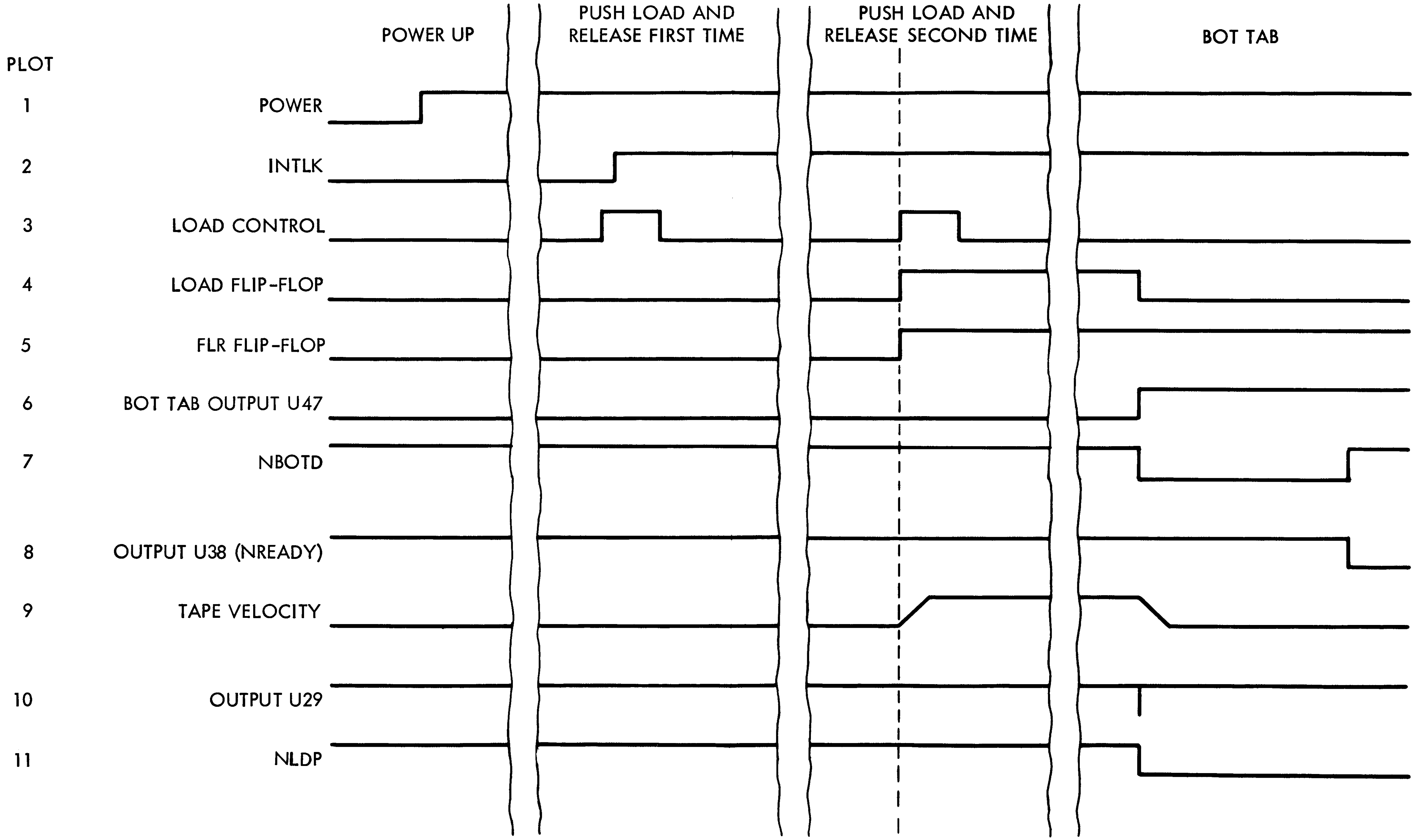


Figure 4-17. Timing Diagram, Bring-to-Load-Point Sequence

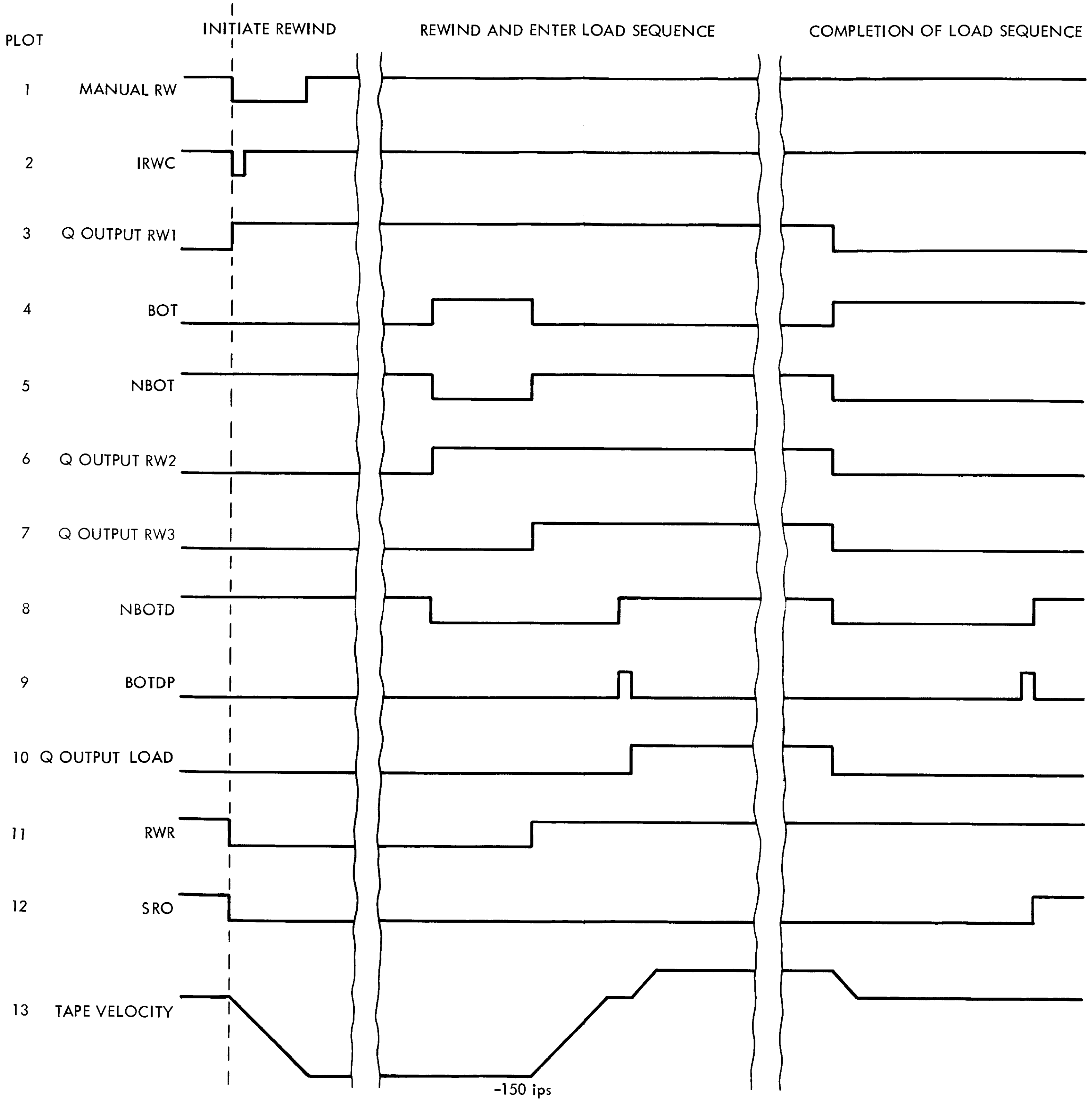


Figure 4-18. Timing Diagram, Rewind-to-Load-Point Sequence

SECTION V
PRINTED CIRCUIT BOARDS THFORY OF OPERATION

5.1 INTRODUCTION

This section contains the theory of operation of the printed circuit boards used in the Synchronous Read Only Tape Transports, Models 6X11 and 6X12. The schematic and assembly drawing for each board is contained at the end of Section VII.

A better understanding of the logic utilized in the tape transport can be gained when the operation of the J-K flip-flop is fully understood. The following paragraphs provide a brief summary of the operation of the 853 J-K flip-flop which is the type most commonly used in the system.

This flip-flop operates on a "Master-Slave" principle. A logic diagram of the flip-flop is shown in Figure 5-1. The flip-flop is designed so that the threshold voltage of AND gates 101 and 102 is higher than that of AND gates 103 and 104. Since operation depends exclusively on voltage levels, any waveform of the proper voltage levels can trigger the J-K flip-flop.

Assume that the trigger voltage is initially low. As the trigger voltage goes high, AND gates 103 and 104 are disabled. Subsequently, AND gates 101 and 102 are enabled by the trigger pulse, the J and K inputs, and the information previously stored at the output of the "slave" unit.

The J and K input information at this time is transferred to the input of the "master" unit. As the trigger voltage goes low, AND gates 101 and 102 are disabled. AND gates 103 and 104 are then enabled and the information stored in the "master" unit is transferred to the output of the "slave" unit.

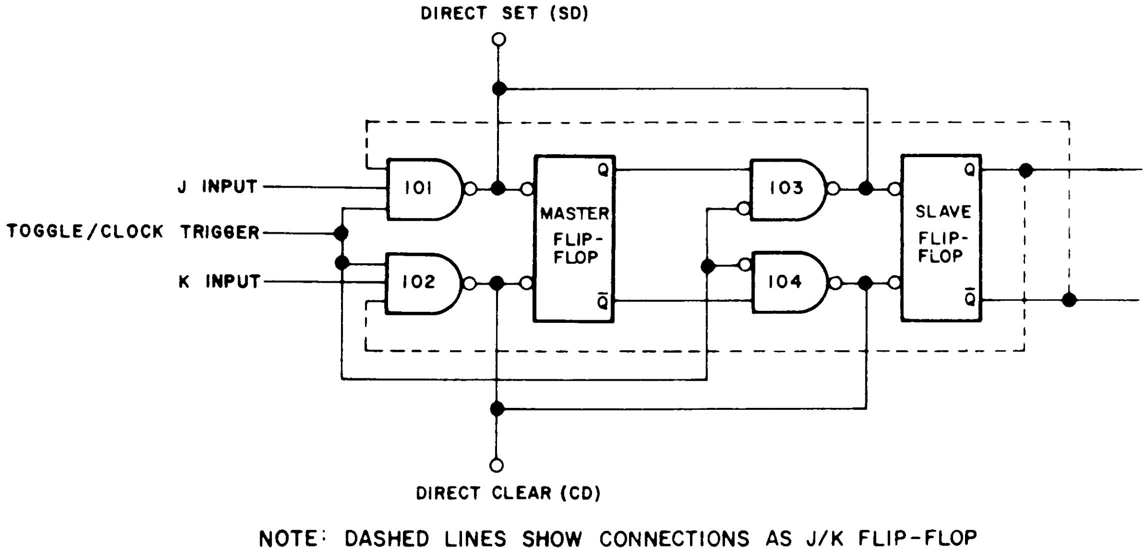


Figure 5-1. Simplified Logic Diagram, "Master-Slave" Flip-Flop

5.2 DATA K

The following is a description of the Data K printed circuit board assembly (refer to Schematic 101886 and Assembly 101887).

Data K is a multiple format Read Only PCBA which is approximately 16.5 inches long. Figure 5-2 illustrates the position of each connector and test point. Edge connectors J102 and J103 are located at each end along one edge. There are six additional connectors on the Data K. Connector J8 is employed to connect power and control signals from the Tape Control PCBA; J11 is used to connect additional logic signals from the Tape Control PCBA. J3 and J4 connect the 7- and 9-track read heads. J1 and J2 connect to the Deskew PCBA on 6X12 models; jumper assemblies are used at J1 and J2 for 6X11 models.

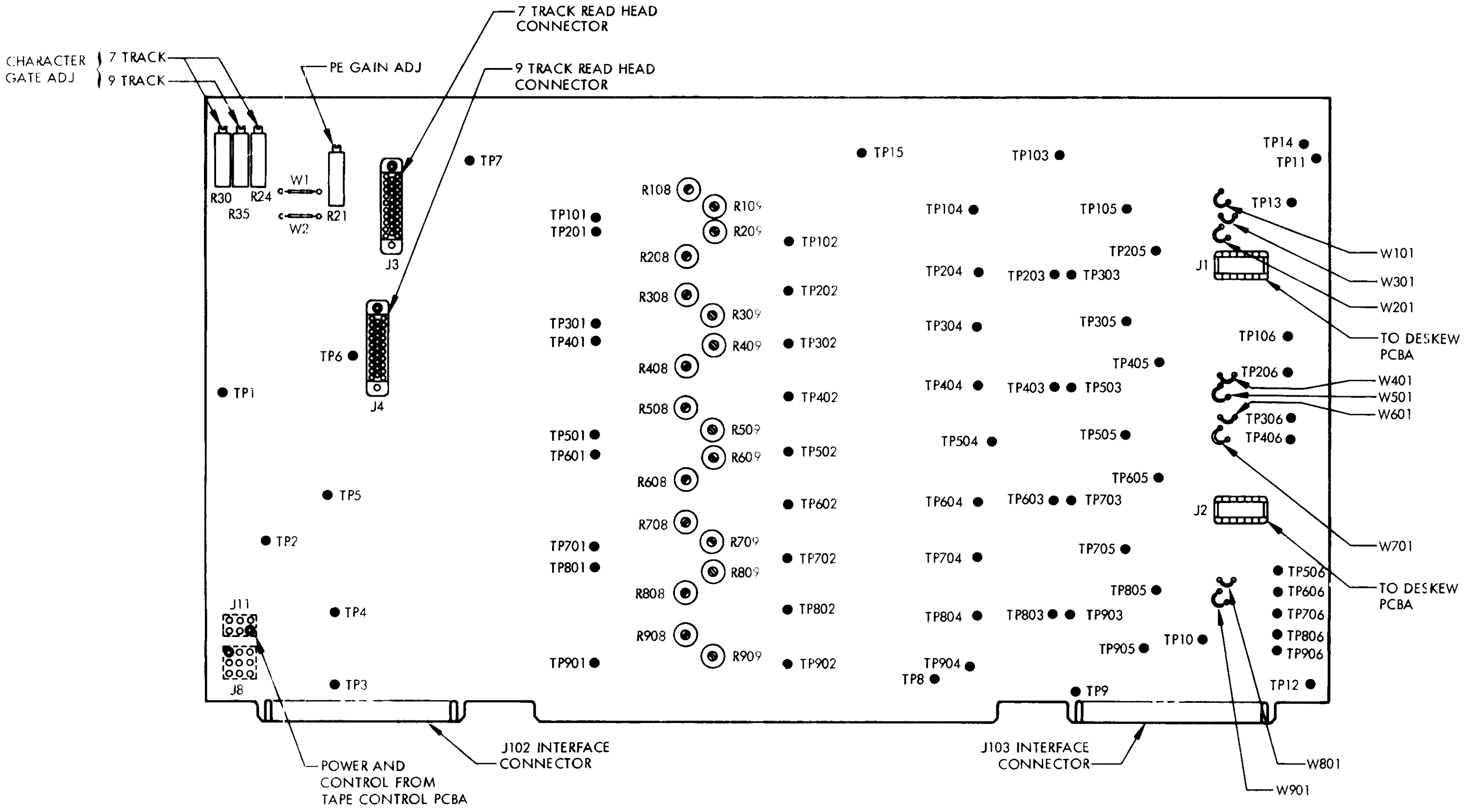


Figure 5-2. Data K PCBA, Connector and Test Point Placement

All data electronics for the transport, with the exception of the Deskew PCBA, are contained on the Data K printed circuit board. The Deskew PCBA is employed on dual gap 7/9-track (6X12) models for static deskew.

NOTE

> Not all components shown on Schematic 101886 are included or used in all versions of the Data K board.

5.2.1 CIRCUIT DESCRIPTION

The circuit board operation is described in reference to circuit 100 for Model 6X12, the most complex Read Only transport. The operation of circuits 200 through 900 is identical to that described for circuit 100.

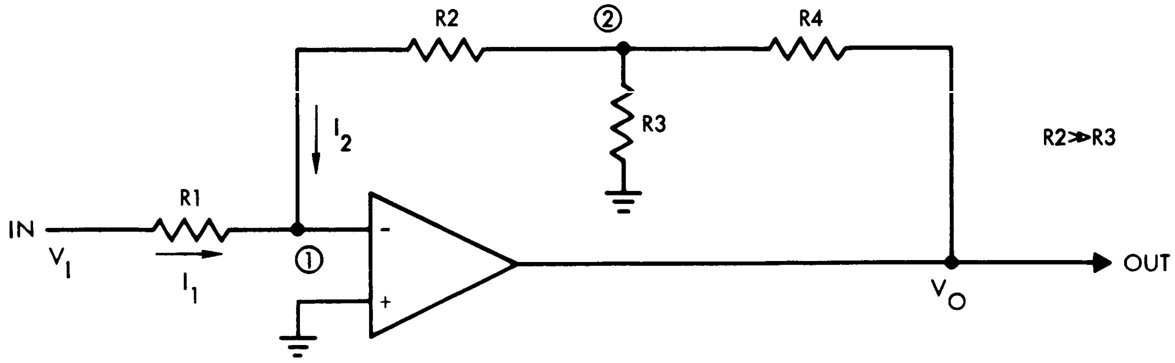
Since the data board is designed to operate in both NRZI and PE Read modes, each mode will be discussed individually. Circuits which are common to both NRZI and PE will be discussed under the NRZI portion.

Reference should also be made to the theory of operation and block diagram of Data K (Figure 4-13) presented in Section IV.

The read heads on 7-track models are connected to the Data K board via J3; 9-track models utilize J4 for this purpose. Only one head is connected to the preamplifier (U11B) at a time. This is accomplished by controlling the dc voltage of the head winding center-taps, which in turn forward- or reverse-biases CR101 and CR102, or CR103 and CR104. Switching is accomplished by the 7/9-track head switching circuit made up of Q1, Q9, and their associated circuitry. When a head is selected its center-tap is switched to +10v, forward-biasing the two diodes associated with the head. R101 and R102 serve as a dc return path for the diodes. The center-taps of the other read head are switched to -10v, thereby reverse-biasing the diodes associated with that head. This action isolates the de-selected head through the high impedance of the reverse-biased diodes. The impedance of the forward-biased diodes connecting the selected head is in the order of 100 ohms. C101 and C102 are dc blocking capacitors which prevent the 10v switching level from reaching the input of the operational amplifier U11B. C101 and C102, because of their relatively large values, do not affect the ac performance to the circuit.

R103 and R104 are the input resistors to the operational amplifier U11B. R103, in conjunction with the feedback network, determines the gain of the preamplifier. R104 and R105 are utilized to balance the input of the amplifier, which in turn determines the preamplifier common mode rejection ratio. R105 also provides a 0v reference for the operational amplifier.

C35 and C36 are decoupling capacitors for the ±10v power supplies. C103, R107 and C104 are compensating components for the operational amplifier. These components are required to control the open loop response of the preamplifier and to assure stability at all frequencies. The preamplifier features electrically selectable gain and bandwidth parameters. Consider the following example.



The gain of the system from input to output is determined by the ratio of feedback current (I2) to output voltage Vo. Because the operational amplifier has a very high open loop gain (approximately 45,000) the input voltage required for a specified output (up to the supply voltage) is negligible. The voltage at node ① is therefore nearly zero at all times. Furthermore, since the operational amplifier impedance is high (approximately 150 kΩ), its input current is negligible. Therefore, I1 = I2, since V ① = 0.

$$I1 = \frac{VI}{R1}$$

$$I2 = \frac{V2}{R2}$$

Since

$$R2 \gg R3,$$

$$V\textcircled{2} = Vo\ \frac{R3}{R3 + R4} \quad \text{(at low frequencies)}$$

Thus

$$\frac{VI}{R1} = \frac{V\textcircled{2}}{R\ 2} = Vo\ \frac{\left(\frac{R3}{R3 + R4}\right)}{R2}$$

Therefore

$$\frac{VO}{VI} = \text{gain} = \frac{R2}{R1}\ \frac{1}{\left(\frac{R3}{R3 + R4}\right)} = \frac{R2}{R1}\left(\frac{R3 + R4}{R3}\right)$$

It can therefore be said that the gain is equal to $\frac{R2}{R1} \times \frac{1}{\text{voltage divider ratio}}$ where the voltage divider is defined as R3 and R4. In the above example:

R1 = R103
R2 = R106
R3 = (set value of R108)
R4 = R111

The gain in the foregoing example was for the 7-track mode. C106 is a dc blocking capacitor and, because of it, there is no dc voltage divider action. The dc gain of the circuit is therefore lower than the ac gain, minimizing dc offset in the output.

Field effect transistors (FET) Q101 and Q102 each act as switches. When their gates are at -10v, they appear as open circuits (between drain and source). When the gates are forward-biased, they appear as near short circuits (≤100Ω). Causing Q102 to conduct places R109 in parallel with R108. This lowers the value of R3 in the previous example, which in turn increases the gain of the preamplifier. The preamplifier gain is increased in the 9-track mode to compensate for the reduced output of the 9-track head (with respect to that of the 7-track head). The use of two separate potentiometers allows for independent gain adjustments for both heads. This is required since the head track outputs are not matched to each other.

Turning Q101 on places R112 in parallel with R111. This lowers the value of R4 in the previous example, which decreases the gain for PE operation. The PE gain must be decreased to compensate for the 6 db per octave rise gain characteristic of differentiator U17B. PE operation is for 9-track tapes only, therefore, adjusting R109 for equal preamplifier outputs in all channels in the NRZI mode automatically balances the PE outputs as well.

The high frequency response of the preamplifier is rolled off at approximately three times the highest data frequency. This is done to improve the signal-to-noise ratio while minimizing phase non-linearities. The breakpoint in 7- and 9-track NRZI operation is defined by $f = \frac{1}{2\pi (R111)(C105)}$. It is therefore independent of gain. The corner frequency in PE operation is higher than in NRZI due to the parallel combination of R111 and R112. The ratio of corner frequencies is, in fact, inversely proportional to the ratio of gains.

The gain of the preamplifier, as described, is raised for 9-track NRZI operation and lowered for PE operation. The bandwidth is extended for PE operation. For models which are 7- or 9-track only, R109, R114, and Q102 are omitted. For PE- or NRZI-only models, R112, R113, and Q101 are omitted. R113 and R114 are gate current limiting resistors for Q101 and Q102. R110 provides an output current bias for U11B which reduces crossover distortion. The output of the preamplifier can be observed at TP101. Values for R103, R104, R111, R112, and C105 are functions of tape speed and head output.

The output of U11B is connected to an active differentiator and an NRZI threshold detector. The function of these circuits was described in Section IV.

The differentiator is of classical design with the addition of two high-frequency poles (rolloffs). The first pole is defined by $f = \frac{1}{2\pi (R117)(C108)}$, the second by $f = \frac{1}{2\pi (R115)(C107)}$. These break points roll off the high frequency response to improve the signal-to-noise ratio. The overall gain is controlled by the equation: $A = R117\,(2\pi f)\,(C107)$ (low frequency). As in the preamplifier, C109, R118, and C110 are compensation components for the operational amplifier. R116 provides a zero volt reference for the operational amplifier. C45 and C46 are power supply decoupling capacitors. The output of the differentiator can be observed at TP102.

U27 and U36 are employed as voltage comparators. Their outputs are coupled to two 3-input NAND gates. For ease in understanding their operation, the internal schematic has been depicted on Schematic 101886. Input polarities have been reversed with respect to those of the manufacturer, since the output considered will be the input of the NAND gate. The voltage comparator output is true (high) when the positive (+) input voltage is more positive than the negative (-) input voltage. The input resistor R122, in conjunction with the feedback resistor R126 and capacitor C114, provide positive feedback. This positive feedback is ac only with a time constant considerably less than a bit-cell period. It provides hysteresis at the time of output change to prevent multiple edge transitions.

U46 performs the functions of "NOR" and "INVERT". It is a standard DTL gate. TP105 is provided at the "OR" output of the NRZI peak detector. The output of the peak detector, a negative-going pulse for each "one" is connected through R130 to a skew test point for checking tape path alignment.

J1 (pin 12) connects the peak detector output to the input of the Deskew board (refer to Paragraph 5.3) or, if Deskew is not used, a jumper connects J1 (pin 12) to J1 (pin 3), the input to the DTL J-K staticiser flip-flop U56B.

The operation of the staticiser flip-flop is explained in Paragraph 5.1. Its output is connected to line driver U53A which is an open collector, high current, TTL inverter. U53A drives the interface line to a low level through its output transistor when the state of the staticiser flip-flop is a logical "1".

In PE operation, voltage comparator U27 is not used. Its common input (pin 6) is low, causing a logical "1" at both outputs, continuously enabling U36. PE data must be differentiated before threshold detection is possible. The output of voltage comparator U36 (pin 9) is used to drive the PE envelope detector (Q103, etc.) PE data are still passed through U46 and the Deskew board but are stopped at the staticiser flip-flop since its clear input is held continuously low during PE operation.

The PE envelope detector (Q103 and associated circuitry) serves to make a steady signal out of the always pulsing threshold detector output U36 (pin 9). R127 increases the output voltage of U36 in the high state from approximately 3.5v to 5v. A high input to CR105 signifies the data is of sufficient amplitude for valid data output.

This high input charges C115 (through CR105) from its "no data" state of approximately +2.3v to near +4.3v. The emitter of Q103 is connected to a +3v source. Since its base voltage (same as voltage across C115) is higher than its emitter voltage the transistor is cut off. When Q103 is cut off, R129 discharges C116 from +2.3v toward -5v. When the voltage across C116 passes through 0v, the output of the voltage comparator within U41-B goes high. This enables the gate of U41-B. C116 continues discharging until CR106 clamps its voltage at -0.7v. This improves recovery time at the end of the envelope.

As long as pulses continue to drive the envelope detector, C115 will remain charged, Q103 cut off, and the output of voltage comparator U41-B true.

After the last pulse has come through the threshold detector, C115 is allowed to discharge through R128 to +2.3v. The voltage does not go below +2.3v because the base emitter junction of Q103 clamps the level at approximately one diode drop below the +3v reference supply. This forward biasing causes Q103 to conduct. When Q103 conducts, it charges C116 back to +2.3v, thus disabling the output gate of U41-B (voltage comparator output goes low). The timing of the circuit is controlled by two time constants: R128-C115 and R129-C116. R128 and C115 determine the period after the receipt of the last threshold pulse until the envelope signal goes false. This period is typically set to two bit-cell periods. R129 and C116 determine the time from the receipt of the first threshold pulse to the transition to a true envelope state. This period is typically set to four bit-cell periods.

The gate of U41-B passes data (pin 8) when both the RPE and MOTION, and envelope signals are true. It also inverts the data which is corrected for by inverter U54-F. The output driver U53-F performs the line driver function.

Model 6611-000 Read Only Transports are equipped with jumpers W101 through W901 on the Data K board. These jumpers connect the NRZI inputs of line drivers U47, U50, and U53 to 0v, thus ensuring that the NRZI line drivers are disabled.

In addition to the data and clock outputs, there are three status signals appearing on the output lines of Data K. They are INRZ, I7TR, ISPEED. All these outputs are gated with SLTA. U57-A, U12-A, and U12-B are the output driver gates for these status signals. SPEED is true only on dual speed models when the transport is operating at the low speed (PE mode). Jumper W1 is installed for all other models to keep ISPEED false (high).

U57-B serves as a NOR gate for all staticiser flip-flops. Any staticiser going to a true output state causes its $\overline{Q}$ output to go low, thus making U57-B (pin 8) true (high). This true level enables the character gate (dynamic deskew and clock generator). There are three adjustment potentiometers for the character gate circuit; R35 controls the 9-track period, R30 and R24 control the 7-track High and Low densities, respectively. Transistors Q5, Q6, and Q7 determine which of the potentiometers are connected to the timing circuit. Only one potentiometer is enabled at any one time.

The period of the character gate is determined primarily by C11 and the setting of the potentiometers. When the output of the NOR gate (U57-B) is false (low), Q8 conducts through R31. When Q8 is conducting, the voltage across C11 is pulled up to nearly +5v through R37. This high state raises the voltage on the base of Q10 until it conducts. The conduction of Q10 causes Q13 to cut off, making TP2 high (approximately +5v). The base voltage of Q11 determines the threshold voltage (switching point) of Q10.

When the output of NOR gate U57-B goes true, Q8 cuts off. C11 begins discharging to -5v through (in the case of 9-track operation) CR1, R17, and R35. When the voltage across C11 passes through the threshold voltage of Q10 (minus the drop of CR4), transistor Q13 conducts. This signifies the end of the character gate period. R44 and C14 provide a small amount of ac hysteresis to prevent multiple edge transitions.

As previously mentioned, Q11 controls the threshold of Q10. Its base voltage equals the base threshold voltage of Q10. The base voltage of Q11 is set to a value determined by R50 and R49. This value is less than +0.7v. IRTH1 is true at this time (RTH1 = long character gate command). When IRTH1 goes high (false) transistor Q12 is turned on through R51. This pulls the base voltage of Q11 to +0.7v as limited by CR5. R52 is the pull-up and collector current limiting resistor. In this case, the threshold voltage of Q10 is now higher. Therefore, less time is required to reach the threshold since C11 started discharging from a positive voltage. This mode (RTH1 = false) yields the shorter of the two character gate periods.

Read Data Strobe (RDS) pulses are required for NRZI operation. The pulse is negative-going as seen at TP12 (interface output J103 pin 2). It is generated by differentiating the output of the character gate through C25 and R56 in parallel with R59. Its pulse width is approximately 2 μseconds.

After each RDS pulse, the staticiser flip-flops must be reset. This requires a pulse after the trailing edge of RDS. The integrator circuit (RC delay) formed by R58 and C26 perform this function. The input of U18-E and U18-F sees a true (high) level after RDS. This high signal causes the outputs of U18-F and U18-E to go low, thus clearing the staticiser flip-flops. When the flip-flops reset, the output of the "NOR" gate (U57-B) goes low, causing Q8 to conduct, charging C11 back to +5v, and resetting the character gate for the next byte of data. It should be noted that when there is no tape "MOTION" or the system is in the PE mode (MOTION and RPE levels are high), U6-A and U6-B will hold the input of U1-F low, thereby causing a continuous clear signal to all staticiser flip-flops. In 7-track operation, U18-D holds the unused staticiser flip-flops of Channels 0 and 1 in their cleared state.

Resistor R66 is a pull-up resistor for all unused inputs of voltage comparator U36 and its counterparts. U18-B and R64 form a high current driver which controls the mode of the NRZI threshold detectors.

Transistor Q15, in conjunction with resistors R60, R61, R62, and diode CR6 form a 3v source for the PE envelope detectors (e.g., Q103, Q104). C27 through C30 are decoupling capacitors.

U11-A and its associated circuitry form the PE threshold generator. When operating in the NRZI mode, the output of U11-A is 0v. In the PE mode the output voltage is one of two values, the nominal value is the highest. It is achieved by causing both Q3 and Q4 to conduct. This passes a current through R21, a voltage divider. The voltage at R21 is equal in sign and magnitude to the output voltage. The operational amplifier (U11-A) has a closed loop gain of one, as determined by R22 and R28. R23 does not affect the gain but balances the dc input impedance to reduce dc offset errors in the output. When IRTH2 goes true (low), the lower threshold voltage is selected. This is half of the nominal value and is achieved by turning Q4 off, reducing the current through R21 to half of its previous value.

C5, R29, and C6 are compensation components for the operational amplifier U11-A. Capacitors C21 through C24 are for decoupling.

The NRZI threshold generator is bi-polar (complementary voltages) and consists of U2 and its associated circuitry. The output has one of two values, nominal or low (half of nominal). The nominal value is determined by the ratio of R25 to the parallel combination of R13 and R14 times 5v. This yields a value of approximately 600 mv. When IRTH2 goes true (low), Q2 is turned off. This essentially doubles the input resistance, thereby cutting the output voltage in half. R13 and R14 are not equal because of the collector to emitter voltage drop of Q2. R20 provides a 0v reference for the operational amplifier and minimizes dc offset errors on the output. U2-B is a unity gain inverting amplifier employed to yield the inverse (positive voltage) of the output of U2-A. R32 and R39 are equal, thus yielding unity gain. R33 serves the same purpose as R20.

C3, R26, C4, C12, R40, and C13 are compensation components for both halves of operational amplifier U2. C17 through C20 and C7 through C10 are decoupling capacitors. All threshold voltages are available at test points (refer to Figure 5-2 for test point placement on the Data PCBA).

The 7/9-track head switching controller is made up of transistors Q1, Q9, and their associated circuitry. When 9-track is true, Q1 is conducting and Q9 is cut off. When 9-track is false (7-track is true), Q1 is cut off and Q9 is conducting. The transistor which is conducting has its collector voltage raised to approximately +10v, while the transistor which is cut off has its collector pulled to -10v via R12 or R42. Two polarized de-coupling capacitors are connected in series (back to back) to eliminate reverse voltage across any one capacitor. The 9-track FETs are also controlled by the output of Q1.

Q14 and associated components control the PE gain switching FETs in a like manner to the head switches.

In addition to the previously discussed circuits, there are severl control signals generated on the Data K board. The functions employed to generate the following terms are derived from control signals from the Tape Control board.

Function	Equivalent
7TR	N9TR (not 9TR)
FWD	NREV (not REV)
RNRZ	N (9TR ● HID) (not 9TR and HID)
RPE	9TR ● HID
HID	N (NHID) (not NOT HID)

5.3 DESKEW A

The following is a description of the Deskew A printed circuit board assembly (refer to Schematic 101891 and Assembly 101892).

The board contains all timing circuitry employed on dual gap 7/9-track models for static deskew. This function is accomplished by introducing a delay into the peak detected pulse of each channel so that the controlled delays of the deskew card add to the uncontrolled delays of the channel to yield equal delays for all channels.

The physical dimensions of the Deskew A board are approximately 4 inches by 8.5 inches. Figure 5-3 illustrates the position of each connector and test point. Two cable assemblies connect the Deskew to the Data PCBA. The deskew board is hinge-mounted to facilitate access to components on the Data board.

5.3.1 CIRCUIT DESCRIPTION

The circuit board operation is described in reference to circuit 100 (Parity channel) since the operation of the remaining channels are virtually identical.

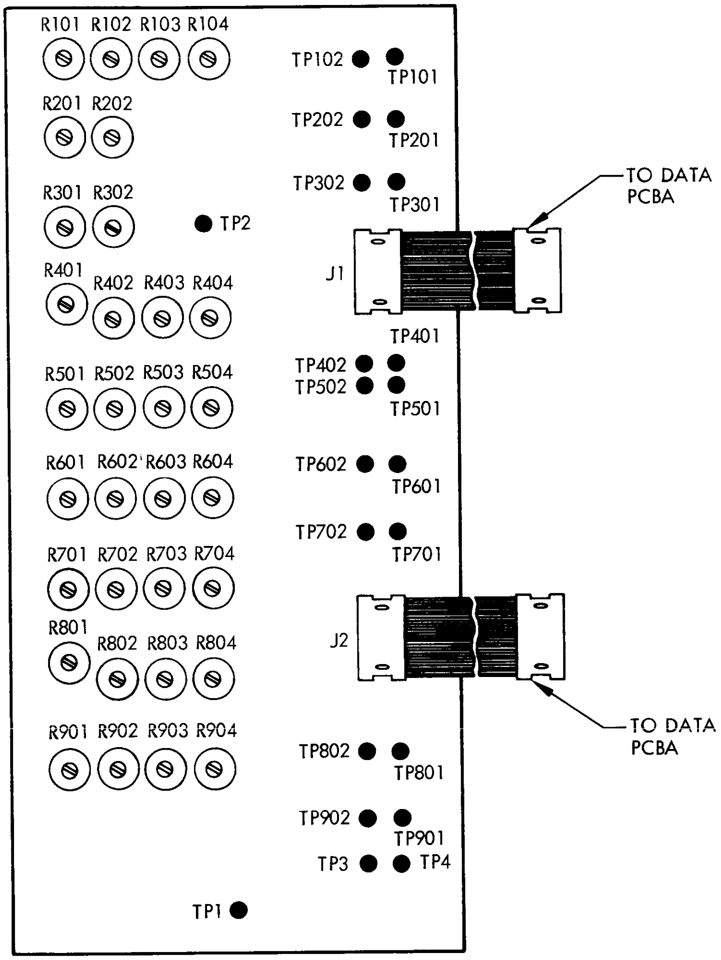


Figure 5-3. Deskew A PCBA, Connector and Test Point Placement

U10 is a monostable multivibrator (one-shot). When the signal level at inputs A1 and A2 goes from high to low, the output (Q) goes true (high) for a specified time. This specified time is approximated by the equation: T = 0.69 RC; where R = R potentiometer + R105, and C = C101. The potentiometer in the equation is one of four potentiometers which are electrically selectable. The potentiometers are selected when the line common to all channels is switched to +5v through transistors Q1, Q2, Q3, or Q4. When the output of the two input NAND gate (U1) goes low, the respective transistor is turned on, raising its collector from -10v to approximately +5v. Switching to +5v forward biases the diode in series with the potentiometers, thereby reducing the diode impedance to a negligible amount.

The first potentiometer (R101) determines the time delay in the forward direction for 9-track operation. R102 sets the 9-track reverse delay. R103 and R104 set the 7-track forward and reverse delays, respectively.

Capacitor C101's value is dependent upon the transport version, according to speed. The delay period is measured from the falling edge of the pulse at input A of U10 to the falling edge at the output Q.

Test points are provided on both the input and output of the one-shot (TP101, TP102). In addition to the individual test points, there are two test points common to all channels. A diode is connected from each input to a common test point (TP3) pulled up to +5v through R9. The first channel to receive a data "1" causes the level at TP3 to drop from +5v to approximately +1v. This test point may be used to externally trigger (synchronize) an oscilloscope to make setup adjustments on the one-shots. The output of each one-shot is connected to TP4 through a resistor (R106, etc.) This provides an analog signal similar to TP10 on the Data board. These test points facilitate checking and adjusting static skew.

C1 through C7 are power supply decoupling capacitors. It should be noted that circuits 200 and 300 have R201, R202, and R301, R302 and their associated diodes deleted on the Deskew A board. Circuits 200 and 300 are not utilized when playing back 7-track tapes.

5.4 TAPE CONTROL C2

The following is a description of the Tape Control C2 printed circuit board assembly (refer to Schematic 101881 and Assembly 101882).

The board contains the transport control logic together with the Capstan Servo ramp generator. The Tape Control circuit board is approximately 16.5 inches long with an edge connector (J101) at each end. This is the interface connector and is slotted to mate with a key in the mating plug. At the opposite end of the board is a row of connectors which are used to connect the manual control switches to the Tape Control circuit board. In addition, two connectors (J9 and J10) transmit power and control signals from the Servo and Power Supply circuit board to the Tape Control while connector J8 and/or J11 supply power and control signals to the Data circuit board. Figure 5-4 illustrates the position of each connector and test point.

5.4.1 CIRCUIT DESCRIPTION

A description of the logic sequences employed in the Tape Control circuit board is detailed in Paragraphs 4.3.5 through 4.3.5.12. The remaining circuitry is concerned with the generation of ramp signals for the capstan servo, format selection, and the BOT single-shot.

The Tape Control PCBA is interconnected to the other PCBAs by means of 13 cable assemblies which terminate in Molex plugs. Additionally, the Tape Control PCBA is equipped with three jumper connectors which configure the transport as required by the various models. Table 5-1 lists the connectors and the destination or function of the cabling.

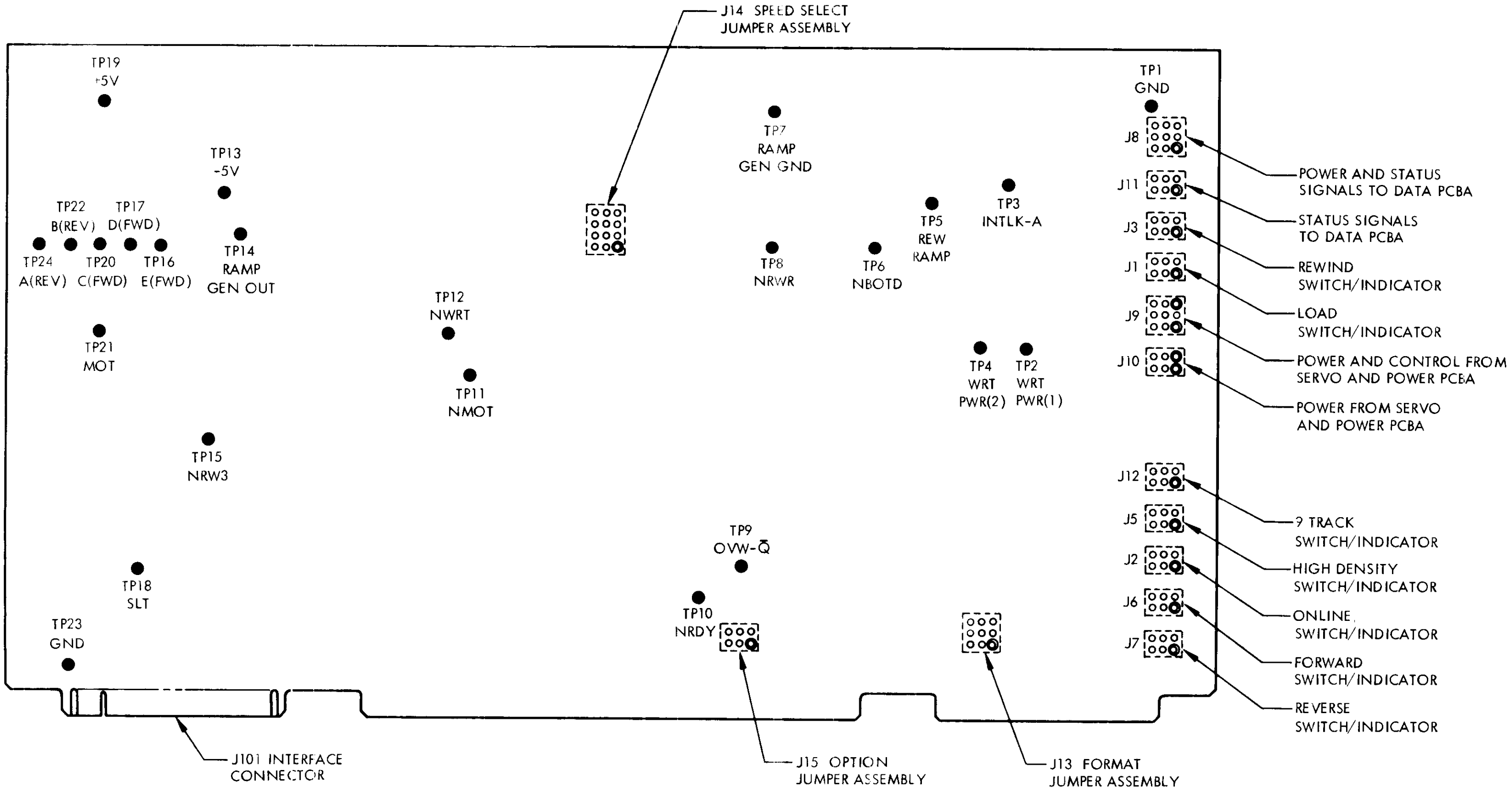


Figure 5-4. Tape Control C2 PCBA, Connector and Test Point Placement

Table 5-1

Transport Connector Cross Reference

Connector Number	Destination/Function
J1	LOAD Switch/Indicator
J2	ON LINE Switch/Indicator
J3	REWIND Switch/Indicator
J4*	WRT EN
J5	HI DEN Switch/Indicator
J6	FORWARD Switch/Indicator
J7	REVERSE Switch/Indicator
J8	Status Signals and Power to Data PCBA
J9	Ramp Generator Output to, and Control Signals from Power and Servo PCBA
J10	Power from Power and Servo PCBA
J11**	Status Signals to Data K PCBA
J12**	9 TRACK Switch/Indicator
J13	Format Select Jumper Assembly
J14	Speed Select Jumper Assembly
J15	Option Select Jumper Assembly
J101	Interface Connector

* Not utilized in Read Only transports.

** Not utilized in Read/Write transports.

Forward commands may be generated by the front panel FORWARD switch/indicator. Activation of the control operates a "latch" consisting of U4C and U4D which prevents switch contact bounce. The output of the latch is employed to toggle flip-flop U3A. The $\overline{Q}$ output of U3A is fed to the Forward ramp generator (circuit 900, input D) and to the associated lamp driver. The low state of the $\overline{Q}$ output activates the ramp generator and lamp driver.

The low-true interface SFC is received via J101 (pin C) inverted by U29C and passed to NAND gate U28A. SFC is gated at U28A with the Selected Ready On-Line (SRO) signal and fed to input C of the Forward ramp generator.

The output of U28A is also passed through NOR gate U28D and fed to inverters U13B and U13E. The output of U13E is the MOTION signal. Additionally, the output of U28D is delayed, inverted, differentiated, and fed to the base of transistor Q1. The negative-going signal on the base of Q1 causes the transistor to cut off, generating the positive-going GO pulse at the collector of transistor Q1.

NOTE

GO is employed on Read/Write systems only.

Reverse commands are generated in the same manner as described for SFC, except the REVERSE switch/indicator is employed. The $\overline{Q}$ output of flip-flop U3B drives the Reverse ramp generator input A.

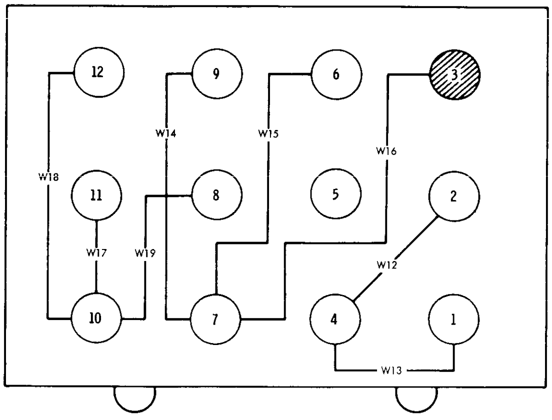
The low-true SRC is received via J101 (pin E) after which it operates in the same manner as the ISFC, with the exception that the inverted (high-true) ISRC is ANDed with the inverted BOT signal. This is done to ensure that tape motion will stop upon encountering the BOT tab when the transport is operating in the synchronous reverse mode. The two reverse commands are NORed by U28C to provide the REVERSE control signal for the Data and Deskew boards.

The Forward and Reverse ramp generator (circuit 900) converts the digital signals to analog levels with controlled transition times, which are the inputs to the capstan servo. The SFC, or SRC, is fed via transistors Q1 or Q2 to the dual operational amplifier circuits (U17A and U17B) whose output levels are determined by the +5v and -5v lines, and the ratio of R913 to R905 and R907, respectively. The circuit rise and fall times are determined by the +5v and -5v lines, R915, R916, R917, R918, and C904. Tape speed is a function of the current entering the capstan servo circuit located on the Servo and Power Supply PCBA from the output of the ramp generator. The proper current for the selected speed is provided by a voltage divider and one of the series resistors at the output of U17B.

On single speed transports, a jumper wire selects the resistance necessary to operate the transport at the specified speed. Figure 5-5 illustrates the proper jumper placement for the various tape speeds. Note that on dual speed machines, two jumpers are installed, selecting one of the three pairs of resistors R933 and R936, R934 and R937, or R935 and R938. Variable resistors R931 and R932 provide for minor speed adjustments.

Field Effect Transistors (FET) Q908 and Q909 are used as switching devices to select one of the two specified speeds on dual speed models. Q903 and Q904 select the appropriate ramp times for the two speeds. Bias for the gates of Q903, Q904, Q908 and Q909 is provided by a polarity reversing network consisting of Q905, Q906, and Q907 which is controlled by the HIGH SPEED signal from the speed control circuit at the base of transistor Q905.

The REWIND command is fed to circuit 800 which includes transistors Q801 and Q802. The rewind speed is determined by the -5v line to which transistor Q802 saturates when a rewind is in process, and a resistor in the capstan servo amplifier located on the Servo and Power Supply circuit board.



VIEWED FROM WIRE SIDE

P14 Part Number	Jumper Designation W12	W13	W14	W15	W16	W17	W18	W19	Synchronous Speed (ips)	Model Designator
101898-01			X						45.0	-45S
101898-02				X					37.5	-37.5S
101898-03					X				25.0	-25S
101898-04		X				X			22.5	-22.5S
101898-05		X					X		18.75	-18.75S
101898-06		X						X	12.5	-12.5S
101898-07	X		X			X			45.0/22.5	-45D
101898-08	X			X			X		37.5/18.75	-37.5D
101898-09	X				X			X	25.0/12.5	-25D

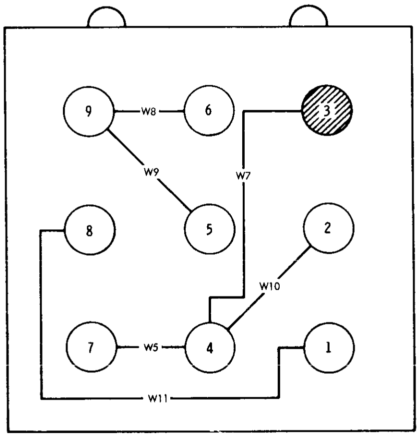
X = Jumper Installed.

Figure 5-5. Jumper Connections, SPEED

The rise and fall times of the REWIND command are determined by resistor R802 in conjunction with capacitors C801 and C802.

The BOT single-shot consists of the components in circuit 700. The circuit is triggered by the leading edge (positive-going) of the BOT waveform, producing a pulse approximately 0.5-second wide. This width is determined by capacitors C701 and C702 in conjunction with resistors R703 and R704. The single-shot pulse (NBOTD) is inverted and the trailing edge is differentiated by capacitor C5 in conjunction with resistors R24 and R25 and fed to inverter U19A. In this manner, a narrow pulse (BOTDP) is generated whose width is determined by capacitor C5 and resistors R24 and R25.

All Read Only transports are equipped with the 9 TRACK switch/indicator. The indicator is utilized in dual stack transports to select the 7-track or 9-track head. Transports equipped with only 7-track or 9-track heads do not utilize this switch; 9 TRACK is permanently extinguished on 7-track models and permanently illuminated on 9-track models. Figure 5-6 illustrates the proper jumper placement for the selection of either 7-track or 9-track heads.



VIEWED FROM
WIRE SIDE

P13 Part Number	W5	W7	W8	W9	W10	W11	Model Designation
	Jumper Designation						
101897-01				X	X		6611-000
101897-02		X		X			6611-800
101897-03		X	X				6612
101897-04				X			6811-000
101897-05		X					See Note 1
101897-06		X	X			X	6812
101897-07	X						See Note 2

X = Jumper Installed.

NOTES:

1 Models 6811-500, 6811-200, 6511-200 } 7 Track Read Only
6X40, 6X60 } 7 Track Read/Write (Local Density Select)

2 Models 6X40, 6X60 } 7 Track Read/Write (Remote Density Select)

Figure 5-6. Jumper Connections, FORMAT

Head selection is accomplished through use of jumpers W8 and W9. On 9-track only transports, jumper W9 is installed, disabling the switching contacts of the 9 TRACK switch/indicator. The input of inverter U1E is forced low (through jumper W9) causing the output of U1E (9 TR) to be continuously high (true). Note that when the input of U1E is held low, the switch/indicator lamp circuit is continuously enabled and the switch/indicator is permanently illuminated.

On 7-track only transports, both jumpers W8 and W9 are omitted. This forces the input of inverter U1E continuously high through resistor R35, therefore the output of U1E is continuously low (false). Note that the switch/indicator lamp circuit is disabled and the switch/indicator is permanently extinguished.

Machines equipped with dual gap heads utilize jumper W8. Jumper W9 is omitted allowing the switching contacts of the 9 TRACK switch/indicator to control the input to inverter U1E and the switch/indicator lamp circuit.

Transports which are equipped to operate in only the high density mode utilize jumper W10. Jumper W7 is omitted in these transports, thereby forcing the input of inverter U2E low through jumper W10. The output of U2E is therefore permanently high. Since the output of U2E is coupled to the input of inverter U2F, the output of U2F (NHID) is forced low. Note that the switch/indicator contacts are disabled. The switch/indicator is permanently illuminated since the low output of U2F continuously enables transistor Q301 (circuit 300).

In transports equipped to operate in only the low density mode, both jumpers W7 and W10 are omitted. The output of inverter U2E is therefore permanently high through resistor R36. Since the low output of U2E is directly coupled to the input of inverter U2F, the output of U2F is permanently high (true). The HI DEN switch/indicator switching contacts are permanently disabled and the lamp is extinguished due to transistor Q301 (circuit 300) being cut off.

Transports configured to operate in the dual density mode have only jumper W7 installed (W10 is omitted). The data density and indicator are controlled by the HI DEN switch/indicator.

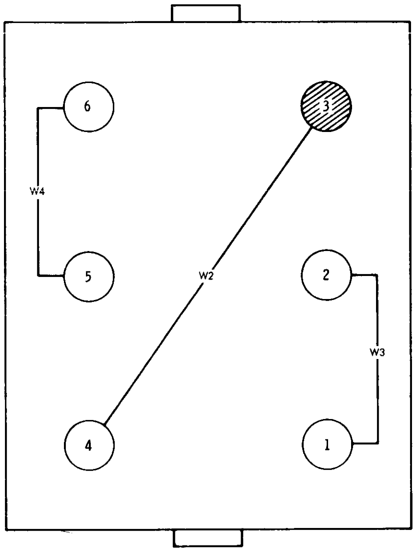
Jumper W11 is installed on the Model 6812 transport. This automatically disables the output of the HI DEN switch/indicator when the 9 TRACK switch/indicator is activated. As shown in Figure 5-6 jumpers W7, W8, and W11 are installed in J13 for Model 6812 transports. When the 9 TRACK control is depressed the following occurs: 0 volt is applied to the input of inverter U1E causing its output to go high; the high output of U1E drives the input of inverter U1F; the low output of U1F through jumper W11 is wire "ORed" at the input of inverter U2F; the output of U2F is therefore high regardless of the position of the switching contacts of the HI DEN switch/indicator.

When the HI DEN selection is made via the HI DEN switch/indicator on transports equipped for dual density operation, the input of U2E is connected to 0v via the contacts of the HI DEN switch/indicator. This causes NHID to be low and the transport is conditioned to read high density tapes. When the HI DEN switch/indicator is deactivated, NHID is high and the transport is conditioned to read low density tapes.

NOTE

> The interface Data Density Select feature is available on Read/Write transports only. On Read Only transports jumper W5 is omitted, thus disabling this external capability.

Certain options may be included on the transport to facilitate additional On-Line and interface output capabilities. Figure 5-7 illustrates the possible combination of jumpers W2, W3, and W4. Jumper W2 determines the On-Line capabilities of the transport. Transports are normally



VIEWED FROM
WIRE SIDE

P15 Part Number	Jumper Designations			Options Available		
	W2	W3	W4	A	B	C
101896-01				0	0	0
101896-02			X	0	0	1
101896-03		X		0	1	0
101896-04		X	X	0	1	1
101896-05	X			1	0	0
101896-06	X		X	1	0	1
101896-07	X	X		1	1	0
101896-08	X	X	X	1	1	1

X = Jumper Installed.

A = 0 Must have interlock to go on-line
A = 1 Must complete first load or viewed sequence to go on-line

B = 0 Output interface lines enabled continously
B = 1 Output interface lines enabled only when selected

C = 0 Transport selected when ISLT is true (Low)
C = 1 Transport selected when ISLT is true (Low) and on-line

Figure 5-7. Jumper Connections, OPTIONS

supplied with jumper W2 installed which protects the transport from being placed On-Line until after FLR (First Load or Rewind) goes true. When jumper W2 is omitted the transport can be placed On-Line any time after the interlock has been completed, provided that IOFFC (Off-Line Input command) is false.

Jumper W3 determines the relationship between the SLT command and the SLTA command. SLT is generated by the inversion of ISLT through gate U23A. All interface inputs except IDDS are disabled when SLT is low (false). SLTA is controlled by the output of U23A when jumper W3 is installed, or SLTA is permanently high (true) through R15 when jumper W3 is omitted. All interface outputs are gated with SLTA and are disabled when SLTA is low.

The presence of jumper W3 causes the ON LINE command to be wire "ANDed" with SLT, requiring the transport to be selected by the interface and On-Line before SLT (and SLTA if W3 is installed) can go true. Transports are normally supplied with jumper W4 omitted.

5.5 SERVO AND POWER SUPPLY TYPES

The following are descriptions of the two Servo and Power Supply printed circuit board assemblies, only one of which is applicable to a particular tape transport. Refer to the part number marked on the Servo and Power PCBA to determine which assembly is installed.

Nomenclature	Schematic	Assembly
Servo and Power Supply - A	101020	101021
Servo and Power Supply - B	101261	101262

Servo and Power Supply - A (101021) is used for tape speeds up to and including 37.5 ips. Servo and Power Supply - B (101262) is used for tape speeds up to and including 45 ips.

A small (approximately 2 inches by 4 inches) EOT/BOT preamplifier printed circuit board (101949) is mounted on a special bracket at the rear of the tape deck. It is required in addition to the basic EOT/BOT circuitry already on the Servo and Power Supply PCBAs (101021 and 101262) to ensure correct operation due to the wide tolerance limits on the phototransistors used in the EOT/BOT sensor.

5.5.1 SERVO AND POWER SUPPLY - A (Schematic 101020 and Assembly 101021).

The Servo and Power Supply - A PCBA is approximately 18 inches long and contains the reel servo amplifiers, capstan servo amplifier, regulators, write enable and interlock circuitry, and the basic EOT/BOT sensor amplifier. The power transistors associated with the circuits are mounted on a heatsink.

The circuit board is secured to the heatsink by using screws that also serve as connections between the transistor cases and the printed circuitry.

Connections are made to the board via connectors which are strategically located with respect to their associated circuitry. Refer to Figure 5-8 for connector and test point placement. The connectors are used to:

(1) Connect all the deck-mounted assemblies to the board; e.g., power supply, motors, tension arm sensors, phototab sensors, Write Lockout assembly, and the tension arm limit switch.

(2) Feed power and signal levels to the Tape Control circuit board.

5.5.1.1 Circuit Description (Schematic 101020 and Assembly 101021)

The description of the circuit board consists of a discussion of the circuits associated with each of the connectors.

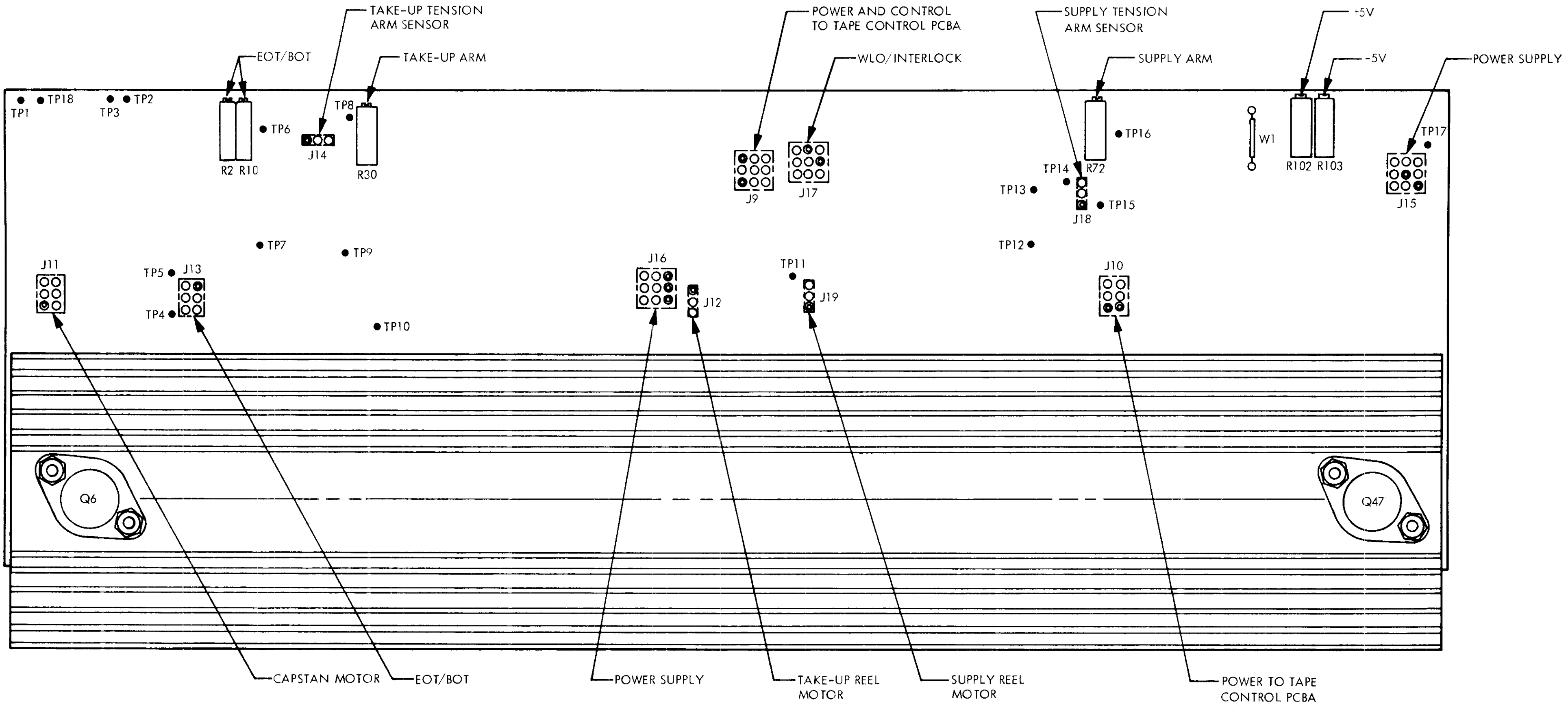


Figure 5-8. Servo and Power Supply A PCBA, Test Point and Connector Placement

J17 is used to connect the tension-arm interlock switch, the write lockout switch, and write lockout solenoid to the associated circuitry.

NOTE

> The write lockout switch and solenoid are not relevant to Read Only transports.

When the LOAD switch is depressed, the junction of resistors R120 and R121 is no longer grounded and base current is supplied to relay driver transistor Q56, turning it on. Relay K1 energizes, closing contacts 9 and 10, thus, establishing an alternate source of base current for transistor Q56 via the interlock switch. When the LOAD control is released, the relay remains energized, completing the circuits for the capstan and reel servo motors and supplying write power from the +5v line to the write circuits via relay contact 9 and 10.

For the capstan motor, the relay contact is placed in the ground return from the motor. For the reel motors, one side of each motor is grounded and the other connected to the appropriate amplifier output via the relay contact. When the relay is de-energized, the contacts connect the two reel motors together through a resistor (R41). This provides optimum regenerative braking conditions.

Diodes CR2, CR3, CR14, CR15, CR4, and CR5 prevent arcing of the relay contacts when they are opened.

The relay voltage is derived from an auxiliary ac supply that decays rapidly upon loss of line voltage. This ensures that the relay drops out, removing motor power (and write current) before the main power supplies have had time to decay to the point where inadvertent motor motion (or writing) could occur.

J13 connects the photo-tab sensors mounted on the head plate to the Servo and Power Supply - A PCBA, via the EOT/BOT Amplfier PCBA which is mounted on a bracket at the rear of the tape deck. Note that with the inclusion of this EOT/BOT Amplifier PCBA, potentiometers R2 and R10 on the Servo and Power Supply - A PCBA are no longer used for adjustments and should be always set fully clockwise. Refer to Paragraph 5.6 for a description of the EOT/BOT amplifier circuit.

The EOT sensor output drives emitter follower transistor Q2 via an RC network (R128, C32) which filters any spurious signals. The output of the emitter follower is fed to the interface transmitter on the Tape Control circuit board and is not used elsewhere.

The BOT signal is fed via an RC network (R127, C30) to a Schmitt trigger circuit to remove the possibility of multiple pulses at the leading and trailing edges of the BOT tab. The Schmitt trigger uses one-half of a dual operational amplifier IC (U1-A) connected in a positive feedback mode and set to switch at approximately 2.3v. The output of the BOT phototransistor and subsequently the output of the BOT amplifier system drops upon detection of the photo-tab. The output of the Schmitt trigger is inverted by transistor Q1 and connected to the Tape Control circuit board by J9.

J15 and J16 connect unregulated +18v and -18v, +45v and -45v, and the auxiliary 14v ac for the relay to the Servo and Power Supply circuit board. The +18v and -18v supplies are also fed via power diodes and power resistors in the power supply module (see Figure 4-2), to form the lines labeled +18v (D), -18v (D), +18v (R), and -18v (R), which are used in the reel servos and are connected to the Servo and Power Supply - A circuit board via J15 and J18.

Two pins are allocated to the high current lines to reduce the current density in the pins.

Two regulators supply a +5v and -5v to the digital ICs, phototab sensors, tension arm sensor lamps, indicator lamps, etc., and consist of two identical circuits whose outputs are set up by potentiometers R102 and R103. The +5v and -5v references are zener diodes CR16 and CR20. Diodes CR17 and CR19 improve the temperature stability of the supplies.

The zener diode references are also used by the +10v and -10v regulators. The majority of the current for the zener diodes is supplied from the +10v and -10v regulators via resistor R116 and diode CR18 for the +5v references and by resistor R99 and diode CR23 for the -5v reference. Resistors R97 and R98 provide the currents to prime the regulators. This system results in improved ripple characteristics for the regulator supplies.

A "crowbar" over-voltage protection circuit is provided and uses zener diode CR24 to detect an increase in the +5v level to +8v, in which case the SCR (CR25) is fired, which blows the +18v fuse on the power supply module and removes the +18v supply.

J11 connects the capstan motor assembly to the associated servo amplifier and relay contact. When the relay is energized, the ground return path of the motor is completed to 0v (S). The capstan servo amplifier uses one-half of a dual operational amplifier as an input stage and discrete transistors Q3, Q4, Q5, Q6, Q7, and Q8, to drive the high currents in the motor. Output transistors Q6 and Q8 are mounted on the heatsink.

In operation, defined currents are fed to the virtual ground input of the IC amplifier (Pin 9 of U1-B) from either the Forward/Reverse ramp generator or the Rewind ramp generator (depending on the operation mode of the transport). These currents are amplified and cause the capstan motor-tachometer to rotate. The output voltage from the tachometer is fed back to the virtual ground input of the IC in such phase as to produce negative feedback. This system is a velocity servo in which the motor roates at a speed such that the current from the tachometer is equal and opposite to that from the ramp generator.

The system is designed so that motor-tachometers from two different manufacturers (Electrocraft Corporation and Printed Motors, Inc.) can be used interchangeably. The tachometer voltage constants are different in the two cases, therefore two different tachometer feedback paths are provided; J11 pin 2 and resistors R23 and R24 for the Electrocraft Corporation's motor, J11 pin 1 and resistors R129 and R24 for the Printed Motors, Inc. motor. The overall gain of the tachometer input is (R15 + R17)/(R23 + R24) for the Electrocraft and (R15 + R17)/(R129 + R24) for the Printed Motors.

J14 and J18 connect the take-up and supply tension arm sensors to the reel servo amplifiers on the Servo and Power Supply - A circuit board.

The take-up servo circuit is a conventional dc amplifier with transient phase lead compensation. The low frequency gain is defined by the ratio of resistors (R48 + R44 + R43) to (R31 + R30). This gain can be changed using variable resistor R30 to compensate for variations in tension arm sensor sensitivity. With R30 in the mid-point, the low frequency gain is approximately 3. The high frequency gain is increased by capacitors C12 and C13 and resistor R125 to about 14. Output transistors Q16 and Q18 are located on the heatsink.

In the Rewind mode the characteristics of the reel servo amplifier are altered in the following manner.

(1) The loop gain is increased by a factor of approximately 2 by switching the resistor R46 into the circuit. This is accomplished from the rewind ramp command waveform via transistors Q19 and Q21.

(2) An offset signal is fed to the servo amplifier via R32.

(3) The +18v (D) return voltage is raised to +36v by switching in the 36v "regulator" circuit Q22, Q23, Q24, and Q25. The appropriate diode on the power supply module isolates the +36v supply from the +18v supply.

Items (1) and (2) result in a reduction in the arm movement required in the Rewind mode.

A current limiting circuit consisting of resistor R40 and transistor Q14 is used to hold the reel servo current in the -18v supply to less than 9 amps when the take-up tension arm is released (e.g., when the tape tension is lost at the end of an unload operation).

The supply servo operates in exactly the same manner except that:

(1) The gain switching utilizes resistor R78.

(2) The offset voltage is supplied via resistor R74.

(3) The current limiting components, resistor R94 and transistor Q39 are in the +18v supply.

(4) The -18v (D) return voltage is increased to -36v by the components Q26, Q27, Q28, and Q29.

5.5.2 SERVO AND POWER SUPPLY - B (Schematic 101261 and Assembly 101262)

The Servo and Power Supply - B circuit board (Assembly 101262) is approximately 18 inches long and contains the reel servo amplifiers, capstan servo amplifier, regulators, write enable and interlock circuitry, and the EOT/BOT sensor amplifier. The power transistors associated with the circuits are mounted on an 18-inch long heatsink.

The circuit board is secured to the heatsink by using screws that also serve as connections between the transistor cases and the printed circuit.

Connections are made to the board via connectors which are strategically located with respect to their associated circuitry. Refer to Figure 5-9 for connector and test point placement. The connectors are used to:

(1) Connect all the deck-mounted assemblies to the board; e.g., power supply, motors, tension arm sensors, photo-tab sensors, Write Lockout assembly, and the tension-arm limit switch.

(2) Feed power and signal levels to the Tape Control circuit board.

5.5.2.1 Circuit Description (Schematic 101261 and Assembly 101262)

The description of the circuit board consists of a discussion of the circuits associated with each of the connectors.

J17 is used to connect the tension-arm interlock switch, the write lockout switch, and write lockout solenoid to the associated circuitry.

NOTE

> The write lockout switch and solenoid are not relevant to Read Only transports.

When the LOAD switch is depressed, the junction of resistors R138 and R139 is no longer grounded and base current is supplied to relay driver transistor Q53, turning it on. Relay K1 energizes, closing contacts 9 and 10; thus, establishing an alternate source of base current for transistor Q53 via the interlock switch. When the LOAD control is released, the relay remains energized, completing the circuits for the capstan and reel servo motors and supplying write power from the +5v line to the write circuits via relay contacts 9 and 10.

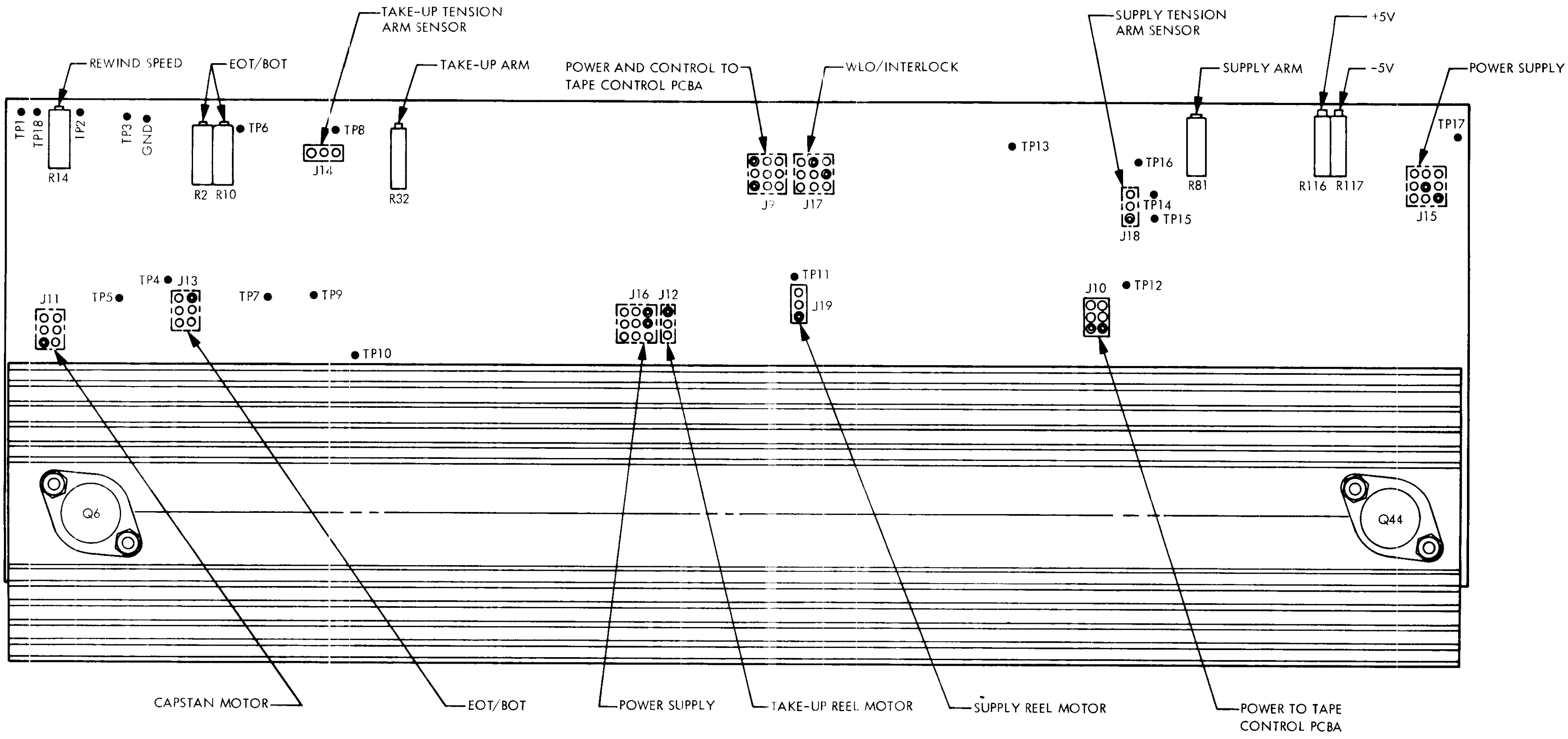


Figure 5-9. Servo and Power Supply B PCBA, Test Point and Connector Placement

For the capstan motor, the relay contact is placed in the ground return from the motor. For the reel motors, one side of each motor is grounded via a 0.03 ohm resistor, and the other connected to the appropriate amplifier output via the relay contact. When the relay is de-energized, the contacts connect the two reel motors together by a resistor (R76). This provides optimum regenerative braking conditions.

Diodes CR2, CR3, CR14, CR15, CR8, and CR9 prevent arcing of the relay contacts when they are opened.

The relay voltage is derived from an auxiliary supply that decays rapidly upon loss of line voltage. This ensures that the relay drops out, removing motor power (and write current) before the main power supplies have had time to decay to the point where inadvertent motor motion (or writing) could occur.

J13 connects the photo-tab sensors mounted on the head plate to the Servo and Power Supply - B circuit board via the EOT/BOT amplifier circuit card which is mounted on a bracket at the rear of the tape deck. Note that, with the inclusion of this EOT/BOT Amplifier PCBA, potentiometers R2 and R10 on the Servo and Power Supply card are no longer used for adjustments and should always be set fully clockwise. Refer to Paragraph 5.6.1 for a description of the EOT/BOT amplifier circuit.

The EOT sensor output drives emitter follower transistor Q2 via an RC network (R12, C3) which filters any spurious signals. The output of the emitter follower is fed to the interface transmitter on the Tape Control circuit board and is not used elsewhere.

The BOT signal is fed via an RC network (R4, C1) to a Schmitt trigger circuit to remove the possibility of multiple pulses at the leading and trailing edges of the BOT tab. The Schmitt trigger uses one-half of a dual operational amplifier IC (U1-A) connected in a positive feedback mode and set to switch at approximately 2.3v. The output of the BOT phototransistor drops upon detection of the photo-tab. The output of the Schmitt trigger is inverted by transistor Q1 and connected to the Tape Control circuit board by J9.

J15 and J16 connect unregulated +18v and -18v, +45v and -45v, and the auxiliary 14v ac for the relay to the Servo and Power Supply - B circuit board. The +18v and -18v supplies are also fed via power diodes and power resistors in the power supply module. See Figure 4-2 to form the lines labeled +18v (D), -18v (D), +18v (R), and -18v (R), which are used in the reel servos and are connected to the Servo and Power Supply - B circuit board via J15 and J16.

Two pins are allocated to the high current lines to reduce the current density in the pins.

Two regulators supply +5v and -5v to the digital ICs, phototab sensors, tension arm sensor lamps, indicator lamps, etc., and consist of two identical circuits whose outputs are set up by potentiometers R116 and R117. The +5v and -5v references are zener diodes CR16 and CR19. Diodes CR17 and CR18 improve the temperature stability of the supplies.

The zener diode references are also used by the +10v and -10v regulators. The majority of the current for the zener diodes is supplied from the +10v and -10v regulators via resistor R134 and diode CR20 for the +5v references and by resistor R119 and diode CR2 for the -5v reference. Resistors R115 and R118 provide the currents to prime the regulators. This system results in improved ripple characteristics for the regulator supplies.

A "crowbar" over-voltage protection circuit is provided and uses zener diode CR24 to detect an increase in the +5v level to 8v, in which case the SCR (SCR1) is fired, which blows the +18v fuse on the power supply module and removes the +18v from the regulators.

J11 connects the capstan motor assembly to the associated servo amplifier and relay contact. When the relay is energized, the ground return path of the motor is completed to 0v (S). The capstan servo amplifier uses one-half of a dual operational amplifier as an input stage and discrete transistors Q3, Q4, Q5, Q6, Q7, and Q8 to drive the high currents in the motor. Output transistors Q6 and Q8 are mounted on the heatsink.

In operation, defined currents are fed to the virtual ground input of the IC amplifier (pin 9 and U1-B) from either the Forward/Reverse ramp generator or the Rewind ramp generator (depending on the operation mode of the transport). These currents are amplified and cause the capstan motor-tachometer to rotate. The output voltage from the tachometer is fed back to the virtual input of the IC in such phase as to produce negative feedback. This system is a velocity servo in which the motor rotates at a speed such that the current from the tachometer is equal and opposite to that from the ramp generator.

The system is designed so that motors/tachometers from two different manufacturers (Electrocraft Corporation and Printed Motors, Inc.) can be used interchangeably. The tachometer voltage constants are different in the two cases, therefore two different tachometer feedback paths are provided; J11 pin 2 and resistors R18 and R19 for the Electrocraft motor; J11 pin 1 and resistors R17 and R19 for the Printed Motors, Inc. motor. The overall gain of the tachometer input is (R23 + R21)/R18 + R19) for the Electrocraft and (R23 + R21)/(R17 + R19) for the Printed Motors. Potentiometer R14 allows the Rewind speed to be adjusted.

J14 and J18 connect the take-up and supply tension arm sensors to the reel servo amplifiers on the Servo and Power Supply - B PCBA.

The take-up servo circuit is a conventional dc amplifier with lead-lag compensation. The low frequency gain is defined by the ratio of resistors R54 to (R34 + R35), and is approximately 33. The high frequency gain is increased by capacitors C11 and C12. Output transistors Q15 and Q17 are located on the heatsink.

The reel motor current is limited to approximately 8 amperes by amplifying (via U3B) the voltage developed by the reel motor current across resistor R77 and feeding this in proper phase to the input of the reel servo amplifier via pick-off diodes CR6 and CR7. Potentiometer R32 adjusts the amplitude of the take-up arm swing.

In the Rewind mode the characteristics of the reel servo amplifier are altered so that the +18v (D) return voltage is raised to +36v. This is accomplished by switching in the 36v regulator circuit Q20, Q21, Q22, and Q23. An appropriate diode on the power supply module isolates the +36v supply from the +18v supply.

The supply servo operates in the same manner. Potentiometer R81 adjusts the amplitude of the supply arm swing. In Rewind, the -18v (D) return voltage is increased to -36v by the components Q24, Q25, Q26, and Q27 which are supplied by unregulated -45v. The reel motor current limiting components are U3A, R114, CR12, and CR13.

5.6 EOT/BOT AMPLIFIER PCBA

The following is a description of the EOT/BOT amplifier circuit board assembly (refer to Schematic 101948 and Assembly 101949).

5.6.1 CIRCUIT DESCRIPTION

J1 connects the photo-tab sensor, mounted on the head plate to the EOT/BOT amplifier circuit board which is mounted on a bracket at the rear of the tape deck.

The amplifier is designed to operate on the differential output from the EOT and BOT sensors (both tabs are never allowed to be under the sensors simultaneously). This system is basically insensitive to changes in ambient conditions.

In operation, when neither the BOT tab nor the EOT tab is under the photosensor, the outputs of the BOT and EOT sensors are high (approximately +4v) and are adjusted to be equal within 0.1v by the use of variable resistors R9 and R3. The bases of Q2 and Q4 are therefore at approximately +4v so that diodes CR1 and CR2 are both forward biased by current flowing via R6 to ground. Thus the base of Q3 is 0.6v below that of Q2, and the base of Q4 is 0.6v below that of Q5. Hence, Q2 and Q1 and Q5 and Q6 are cut-off and the NBOT and NEOT outputs are high (pulled up by resistors on the Servo and Power Supply PCBA).

The characteristics of the photosensors are such that the "no tab" voltages, once set to be equal, track adequately with changes in ambient conditions to ensure that the NBOT and NEOT outputs remain high.

When the BOT tab moves under the sensor, its output drops towards zero volts. Thus the base of Q5 goes negative while that of Q4 remains referenced to the still high output of the EOT sensor. When the difference of voltage between the bases of Q5 and Q4 exceeds 0.6v, current flows in Q5, turning Q6 on. The NBOT output therefore goes low as required. Similarly when the EOT tab moves under the sensor, the NEOT output goes low.

The output of the EOT/BOT amplifier board is connected to J13 on the Servo and Power Supply PCBA.

SECTION VI
MAINTENANCE AND TROUBLESHOOTING

6.1 INTRODUCTION

This section provides information necessary to perform electrical and mechanical adjustments, parts replacement, and troubleshooting. Sections IV and V contain the theory of operation and schematics required for reference when electrical adjustments or troubleshooting are necessary.

6.2 FUSE REPLACEMENT

Fuses are located on the Power Supply module at the rear of the transport.

Line Fuse:	5 amp, 3AG, slow-blow, 125v ac and below, or 3 amp, 3AG, slow-blow, 190v ac, and above
+18v dc Fuse:	10 amp, 3AG
-18v dc Fuse:	10 amp, 3AG

6.3 SCHEDULED MAINTENANCE

The tape transport is designed to operate with a minimum of maintenance and adjustments. Replacement of parts is designed to be as simple as possible. Repair equipment is kept to a minimum and only common tools are required in most cases. A list of tools required to maintain the tape transport is given in Paragraph 6.8.

To assure that the transport operates at its optimum design potential and to assure high MTBF, a program of scheduled preventive maintenance is recommended. This schedule is given in Table 6-1.

Table 6-1

Preventive Maintenance Schedule

Maintenance Operation	Frequency (hours)	Quantity to Maintain	Time Required (minutes)	Manual Paragraph Reference
Clean Head, Guides, Roller Guides, and Capstan	8 (or start of operating day)	—	5	6.4
Clean Tape Cleaner	50	1	5	6.4
Check Skew, Tape Tracking, and Speed	500	—	15	6.7.5, 6.7.6, 6.6.10
Check Head Wear	2,500	1	3	6.7.7
Replace Reel Motors and Capstan Motor	10,000	3	30	6.7.10

6.4 CLEANING THE TRANSPORT

The transport requires cleaning in these major areas: head and associated guides, capstan, roller guides, and tape cleaner.

To clean the head and guides, use a lint-free cloth or cotton swab moistened in isopropyl alcohol or Du Pont Freon TF. Wipe the head carefully to remove all accumulated oxide and dirt.

CAUTION

ROUGH OR ABRASIVE CLOTHS SHOULD NOT BE USED TO CLEAN THE HEAD AND HEAD GUIDES. USE ONLY ISOPROPYL ALCOHOL OR DU PONT FREON TF. OTHER SOLVENTS, SUCH AS CARBON TETRACHLORIDE, MAY RESULT IN DAMAGE TO THE HEAD LAMINATION ADHESIVE.

To clean the capstan, use only a cotton swab moistened with isopropyl alcohol or Du Pont Freon TF to remove accumulated oxide and dirt.

To clean the roller guides, use a lint-free cloth or cotton swab moistened in isopropyl alcohol or Du Pont Freon TF. Wipe the guide surfaces carefully to remove all accumulated oxide and dirt.

CAUTION

DO NOT SOAK THE GUIDES WITH EXCESSIVE SOLVENT. EXCESSIVE SOLVENT MAY SEEP INTO THE PRECISION GUIDE BEARINGS, CAUSING CONTAMINATION AND A BREAKDOWN OF THE BEARING LUBRICANT.

Clean the tape cleaner by removing the Allen head retaining screw accessible at the top of the cleaner assembly. Remove the cleaner from the tape deck by firmly grasping the cleaner and pulling straight upward and away from the tape deck. When removed, loosen two side screws holding the cleaner blade to the housing and remove the blade. The accumulated oxide and dirt is then blown out of the housing and the blade and housing are cleaned with a cotton swab moistened with isopropyl alcohol or Du Pont Freon TF. Care should be taken to avoid particles of the cotton swab from adhering to the blade. The blade is then relocated on the housing and the two side retaining screws are tightened. The tape cleaner is reinstalled on the deck.

CAUTION

CARE SHOULD BE TAKEN TO ENSURE THAT THE TAPE CLEANER BLADE SURFACE IS PARALLEL TO THE TAPE AND THAT THE TAPE IS WRAPPED SYMMETRICALLY AROUND THE TAPE CLEANER (THE ENTRY ANGLE IS EQUAL TO THE EXIT ANGLE).

6.5 PART REPLACEMENT ADJUSTMENTS

Table 6-2 indicates the adjustments necessary when a part is replaced. Details of the adjustments are given in Paragraphs 6.6 through 6.7.16.

6.6 ELECTRICAL ADJUSTMENTS

Paragraphs 6.6.2 through 6.6.15.4 describe the test configurations, test procedures, adjustment procedures, and related adjustments for the +5v and -5v regulators, BOT and EOT amplifiers, ramp timing, tape speed, read amplifier gain, deskewing, threshold generator, and character gate.

The following equipment (or equivalent) is required.

(1) Oscilloscope, Tektronix 561 (vertical and horizontal sensitivity specified to ±3 percent accuracy).

(2) Digital Volt Meter, Fairchild 7050 (±0.1 percent specified accuracy).

(3) Counter Timer, Monsanto Model 100B (±0.1 percent specified accuracy).

(4) Master Skew Tape, IBM No. 432640.

(5) Optical Encoder, 500-Line, PERTEC No. 512-1100.

(6) Standard level tape, 1600 frpi (PE) or 800 cpi (NRZI) all-ones, 125 percent saturation, 7- or 9-track (as required).

6.6.1 ADJUSTMENT PHILOSOPHY

Acceptable limits are defined in each adjustment procedure, taking into consideration the assumed accuracy of the test equipment specified in Paragraph 6.6.

When the measured value of any parameter is within the specified acceptable limits NO ADJUSTMENTS should be made. Should the measured

Table 6-2

Part Replacement Adjustments

Part Replaced	Auxiliary Adjustments	Time Required (Minutes)	Manual Paragraph Reference
Control Switch	None	2	—
Photo-Tab Sensor	R3, R9 on EOT/BOT Amplifier PCBA, or R2, R10 on Servo and Power Supply PCBA	10	6.7.9, 6.6.7, 6.6.8
Tension Arm Sensor	Tension Arm Shutter, Arm Positioner (on Servo and Power PCBA)	10	6.7.2, 6.7.3 or 6.7.4
Limit Switch Assy	Tension Arm Shutter, Arm Positioner (on Servo and Power PCBA)	15	6.7.1
Capstan Drive Assy	Tape Path Alignment	30	6.7.10, 6.7.12
Reel Motors Assy	Belt Tension	10	6.7.14
Tape Control PCBA	Ramp Timing and Tape Speed	20	6.6.9, 6.6.10
Data PCBA	Read Amplifier Gain, Threshold Generator, Character Gate		6.6.12 or 6.6.13, 6.6.14, 6.6.15
Head	Read Amplifier Gain, Read Skew		6.6.12 or 6.6.13, 6.7.5 or 6.7.6
Servo and Power Supply PCBA	+5v and -5v Regulators, EOT/BOT Amplifiers, Reel Servo Gain, Rewind Speed (Servo and Power - B Only), Capstan Offset and Tension Arm	25	6.6.3, 6.6.4, 6.6.6, 6.6.7, 6.6.11

value fall outside the specified acceptable limits, adjustment should be made in accordance with the relevant procedure.

When adjustments are made, the value set should be the exact value specified (to the best of the operator's ability).

CAUTION

SOME ADJUSTMENTS MAY REQUIRE CORRESPONDING ADJUSTMENTS IN OTHER PARAMETERS. ENSURE CORRESPONDING ADJUSTMENTS ARE MADE AS SPECIFIED IN THE INDIVIDUAL PROCEDURES. THE +5 AND -5 REGULATOR VOLTAGES MUST BE CHECKED PRIOR TO ATTEMPTING ANY ELECTRICAL ADJUSTMENT.

6.6.2 SERVO AND POWER SUPPLY PCBA TYPES

One of two types of the Servo and Power Supply PCBA may be installed in the transport. See Paragraph 5.5 for details regarding these differences.

NOTE

The procedures relevant to different types of the Servo and Power Supply PCBA are written independently for each Servo and Power Supply type, where different procedures are affected. Care must be taken to ensure that the appropriate adjustments and reference designators apply to a particular transport.

6.6.3 +5V AND -5V REGULATORS (Servo and Power Supply - A, Assembly No. 101021 Only)

The +5v and -5v regulators are located on the Servo and Power Supply - A circuit board (101021) and are adjusted by means of variable resistors R102 and R103. The numerical value of the voltage difference, disregarding polarity, between the +5v and -5v lines must be less than 0.07v.

6.6.3.1 Test Configuration (Assembly No. 101021 Only)

(1) Load a reel of tape on the transport.

(2) Apply power to the transport.

(3) Depress and release the LOAD control to establish interlock and tension the tape.

(4) Depress and release the LOAD control a second time. Tape will advance to the load point and stop.

6.6.3.2 Test Procedure (Assembly No. 101021 Only)

(1) Using a Fairchild DVM Model 7050 (or equivalent) measure and note the voltage difference between TP19 (+5v) and TP7 (0v) on the Tape Control PCBA.

(2) Using a Fairchild DVM Model 7050 (or equivalent) measure and note the voltage difference between TP13 (-5v) and TP7 (0v) on the Tape Control PCBA.

(3) Acceptable Limits

(a) +5v Regulator
- +4.85v minimum
- +5.15v maximum

(b) -5v Regulator
- -4.85v minimum
- -5.15v maximum

(4) Compare the voltages obtained in Steps (1) and (2). Voltages must fall within the acceptable limits and the absolute difference between the +5v and -5v lines must be less than 0.07v.

6.6.3.3 Adjustment Procedure (Assembly No. 101021 Only)

When the acceptable limits are exceeded or the voltage difference between the +5v and -5v lines exceed 0.07v, the following adjustments are performed.

(1) Adjust variable resistor R102 on Servo and Power Supply - A PCBA to +5.0v as observed at TP19 on the Tape Control PCBA (using TP7 on the Tape Control PCBA as the 0v reference).

(2) Adjust variable resistor R103 on the Servo and Power Supply - A PCBA to -5.0v as observed at TP13 on the Tape Control PCBA (using TP7 on the Tape Control PCBA as the 0v reference).

6.6.3.4 Related Adjustments (Assembly No. 101021 Only)

The following areas must be checked and adjusted subsequent to adjusting the +5v and -5v regulators.

(1) Ramp Timing (Paragraph 6.6.9).

(2) Tape Speed (Paragraph 6.6.10).

(3) PE Threshold Level (Paragraph 6.6.14).

6.6.4 +5V AND -5V REGULATORS
(Servo and Power Supply - B, Assembly No. 101262 Only)

The +5v and -5v regulators are located on the Servo and Power Supply - B circuit board (101262) and are adjusted by means of variable resistors R116 and R117. The numerical value of the voltage difference, disregarding polarity, between the +5v and -5v lines must be less than 0.07v.

6.6.4.1 Test Configuration (Assembly No. 101262 Only)

(1) Load a reel of tape on the transport.

(2) Apply power to the transport.

(3) Depress and release the LOAD control to establish interlock and tension the tape.

(4) Depress and release the LOAD control a second time. Tape will advance to the load point and stop.

6.6.4.2 Test Procedure (Assembly No. 101262 Only)

(1) Using a Fairchild DVM Model 7050 (or equivalent) measure and note the voltage difference between TP19 (+5v) and TP7 (0v) on the Tape Control PCBA.

(2) Using a Fairchild DVM Model 7050 (or equivalent) measure and note the voltage difference between TP13 (-5v) and TP7 (0v) on the Tape Control PCBA.

(3) Acceptable Limits

(a) +5v Regulator
- +4.85v minimum
- +5.15v maximum

(b) -5v Regulator
- -4.85v minimum
- -5.15v maximum

(4) Compare the voltages obtained in Steps (1) and (2). Voltages must fall within the acceptable limits and the absolute difference between the +5v and -5v lines must be less than 0.07v.

6.6.4.3 Adjustment Procedure (Assembly No. 101262 Only)

When the acceptable limits are exceeded or the voltage difference between the +5v and -5v lines exceed 0.07v, the following adjustments are performed.

(1) Adjust variable resistor R116 on the Servo and Power Supply - B PCBA to +5.0v as observed at TP19 on the Tape Control PCBA (using TP7 on the Tape Control PCBA as the 0v (ground) reference).

(2) Adjust variable resistor R117 on the Servo and Power Supply - B PCBA to -5.0v as observed at TP13 on the Tape Control PCBA (using TP7 on the Tape Control PCBA as the 0v (ground) reference).

6.6.4.4 Related Adjustments (Assembly No. 101262 Only)

The following areas must be checked and adjusted subsequent to adjusting the +5v and -5v regulators.

(1) Ramp Timing (Paragraph 6.6.9).

(2) Tape Speed (Paragraph 6.6.10).

(3) EOT/BOT Amplifier (Paragraph 6.6.6).

(4) PE Threshold Level (Paragraph 6.6.14) (where applicable).

6.6.5 EOT/BOT AMPLIFIER SYSTEMS

One of two different EOT/BOT amplifier systems may be installed in the transport.

Two systems are in use in conjunction with Servo and Power Supply - A (Assembly 101021), and Servo and Power Supply - B (assembly 101262). Both assemblies have the EOT/BOT circuitry integrated on the board, and in some cases an additional EOT/BOT amplifier system has been included. This amplifier assembly (101949) is mounted on a small PCBA (approximately 2 by 4 inches) located on the Write Lockout bracket at the rear of the tape deck.

Paragraphs 6.6.6 through 6.6.8.4 detail the test and adjustment procedures associated with these Servo and Power Supply PCBAs.

6.6.6 EOT/BOT AMPLIFIER - Schematic 101948 and Assembly 101949

The EOT/BOT Amplifier is mounted on a small PCBA located on the Write Lockout bracket at the rear of the tape deck. The following procedure is employed in testing and adjusting the EOT/BOT Amplifier PCBA.

NOTE

> The +5v and -5v regulator voltages must be checked and adjusted prior to adjusting the EOT/BOT amplifier system. Measurements and adjustments should be made at room temperature.

6.6.6.1 Test Configuration (Assembly No. 101949)

(1) Load a reel of tape on the transport.

(2) Apply power to the transport.

(3) Depress and release the LOAD control to establish interlocks and tension the tape.

(4) Depress and release the LOAD control a second time. Tape will advance to the Load Point and stop.

6.6.6.2 Test Procedure (Assembly No. 101949)

(1) Advance tape until the reflective tab is past the photosensor.

(2) Using a Fairchild DVM Model 7050 (or equivalent) measure and note the off-tab voltage between TP1 (EOT) on the EOT/BOT Amplifier PCBA and TP17 (0v) on the Servo and Power Supply PCBA.

(3) Using a Fairchild DVM Model 7050 (or equivalent) measure and note the off-tab voltage between TP2 (BOT) on the EOT/BOT Amplifier PCBA and TP17 (0v) on the Servo and Power Supply PCBA.

(4) Acceptable Limits (off-tab)

- +2.00v minimum
- +4.50v maximum

(5) Compare the voltages obtained in Steps (2) and (3). Voltages must fall between the acceptable limits and the difference between TP1 (EOT) and TP2 (BOT) voltages must be less than 0.25v.

(6) Manually position tape until the reflective BOT tab is located under the photosensor.

(7) Measure and note the on-tab voltage between TP2 (BOT) on the EOT/BOT Amplifier PCBA and TP17 (0v) on the Servo and Power Supply PCBA.

(8) Advance tape until the EOT tab is positioned under the photosensor.

(9) Measure and note the on-tab voltage between TPl (EOT) on the EOT/BOT Amplifier PCBA and TP17 (0v) on the Servo and Power Supply PCBA.

(10) Acceptable Limits (on-tab)

- On-tab voltages measured in Steps (7) and (9) must be 0.8v less than voltages measured in Steps (3) and (2).

6.6.6.3 Adjustment Procedure (Assembly No. 101949)

When the acceptable limits are exceeded or the off-tab voltage difference compared in Paragraph 6.6.6.2, Step (5) is greater than 0.25v the following adjustments are performed.

(1) Verify that the adjusting screws of variable resistors R2 and R10 located on the Servo and Power Supply PCBA are turned fully clockwise.

(2) Position tape so that the EOT and BOT reflective tabs are clear of the photosensor area.

(3) Adjust variable resistor R3 on the EOT/BOT Amplifier PCBA to +4.0v as observed at TPl.

(4) Adjust variable resistor R9 on the EOT/BOT Amplifier PCBA to +4.0v as observed at TP2.

(5) Verify that the voltage at TPl on the EOT/BOT Amplifier PCBA is within 0.25v of the voltage at TP2. Repeat Steps (3) and (4) if required.

(6) Position tape so that the EOT reflective tab is located under the photosensor.

(7) Verify that the on-tab voltage at TPl of the EOT/BOT Amplifier PCBA falls within the limits specified in Paragraph 6.6.6.2, Step (10).

(8) Depress and release the REWIND control. Tape will rewind to the BOT, enter a load sequence, and stop.

(9) Verify that the on-tab voltage at TP2 of the EOT/BOT Amplifier PCBA falls within the limits specified in Paragraph 6.6.6.2, Step (10).

6.6.6.4 Related Adjustments (Assembly No. 101949)

- None.

6.6.7 BOT AMPLIFIER

On transports not equipped with an EOT/BOT Amplifier PCBA, circuitry connected to J13 on the Servo and Power Supply PCBA is utilized as the BOT amplifier. The following test and adjustment procedure is used.

NOTE

> The +5v and -5v regulator voltages must be checked and adjusted prior to adjusting the BOT amplifier system. Measurements and adjustments should be made at room temperature.

6.6.7.1 Test Configuration

(1) Load a reel of tape on the transport.

(2) Apply power to the transport.

(3) Depress and release the LOAD control to establish interlock and tension the tape.

(4) Depress and release the LOAD control a second time. Tape will advance to the Load Point and stop.

6.6.7.2 Test Procedure

(1) Manually position the BOT reflective tab clear of the photosensor area.

(2) Using a Fairchild DVM Model 7050 (or equivalent) measure and note the off-tab voltage between TP4 and TP17 (0v) on the Servo and Power Supply PCBA.

(3) Manually position tape so that the BOT reflective tab is positioned under the photosensor.

(4) Using a Fairchild 7050 (or equivalent) measure and note the on-tab voltage between TP4 and TP17 (0v) on Servo and Power Supply PCBA.

(5) Acceptable Limits

  (a) On-Tab
  - +0.9v maximum

  (b) Off-Tab
  - +3.0v minimum

6.6.7.3 Adjustment Procedure

When the acceptable limits are exceeded the following adjustments are performed.

(1) Position the BOT reflective tab under the photosensor.

(2) Adjust variable resistor R2 to obtain an on-tab voltage of +0.85v as observed at TP4.

(3) Position the BOT reflective tab clear of the photosensor.

(4) Check TP4 to ensure that the off-tab voltage is +3.0v (minimum).

6.6.7.4 Related Adjustments

- None.

6.6.8 EOT AMPLIFIER

On transports not equipped with an EOT/BOT Amplifier PCBA, circuitry connected to J13 on the Servo and Power Supply PCBA is used as the EOT amplifier. The following test and adjustment procedure is used.

NOTE

> The +5v and -5v regulator voltages must be checked and adjusted prior to adjusting the EOT amplifier system. Measurements and adjustments should be made at room temperature.

6.6.8.1 Test Configuration

(1) Load a reel of tape on the transport.

(2) Apply power to the transport.

(3) Depress and release the LOAD control to establish interlock and tension the tape.

(4) Depress and release the LOAD control a second time. Tape will advance to the Load Point and stop.

6.6.8.2 Test Procedure

(1) Manually position the EOT reflective tab clear of the photosensor area.

(2) Using a Fairchild DVM Model 7050 (or equivalent) measure and note the off-tab voltage between TP6 and TP17 (0v) on the Servo and Power Supply PCBA.

(3) Manually position the EOT reflective tab under the photosensor.

(4) Using a Fairchild 7050 (or equivalent) measure and note the on-tab voltage between TP6 and TP17 (0v) on Servo and Power Supply PCBA.

(5) Acceptable Limits
  (a) On-Tab
    - +0.3v maximum
  (b) Off-Tab
    - +2.8v minimum

6.6.8.3 Adjustment Procedure

When the acceptable limits are exceeded the following adjustments are made.

(1) Position the EOT reflective tab under the photosensor.

(2) Adjust variable resistor R10 to obtain an on-tab voltage of +0.2v as observed at TP6.

(3) Position the EOT reflective tab clear of the photosensor.

(4) Check TP6 to ensure the off-tab voltage is +2.8v (minimum).

6.6.8.4 Related Adjustments

- None.

6.6.9 RAMP TIMING

The four tape acceleration and deceleration ramps (Forward and Reverse, Start and Stop) are controlled by a single potentiometer adjustment located on the Tape Control PCBA. This adjustment controls the Start/Stop time, and is dependent upon the tape speed.

The ramp adjustment time is chosen to ensure that the correct Start/Stop distance is correlated to the specified Start/Stop time.

NOTE

> The +5v and -5v regulator voltages must be checked and adjusted prior to adjusting Ramp Timing. Measurements and adjustments should be made at room temperature.

6.6.9.1 Test Configuration

(1) Load a reel of tape on the transport.

(2) Apply power to the transport.

(3) Depress and release the LOAD control to establish interlocks and tension tape.

(4) Depress and release the LOAD control a second time. Tape will advance to the Load Point and stop.

(5) Depress and release the ON LINE control.

6.6.9.2 Test Procedure

(1) Connect a signal probe of a Tektronix Model 561 (or equivalent) oscilloscope to TP5 on the Tape Control PCBA.

(2) Connect the oscilloscope reference probe to TP17 (0v) on Tape Control PCBA.

(3) Apply a 5 Hz symmetrical square wave with a 3v amplitude (+3.0v to 0v) to the interface line ISFC (J101 pin C).

(4) Trigger the oscilloscope externally on the negative-going edge of the square wave input.

(5) Adjust the oscilloscope variable vertical (volt/div) control to display 0 to 100 percent of the ramp waveform over four large divisions of the oscilloscope graticule.

(6) Observe that the ramp adjustment time intersets 90 percent of the ramp amplitude (18 small divisions of oscilloscope graticule). Figure 6-1 illustrates ramp levels and timing.

NOTE

For reverse operation the ramp is a negative-going waveform.

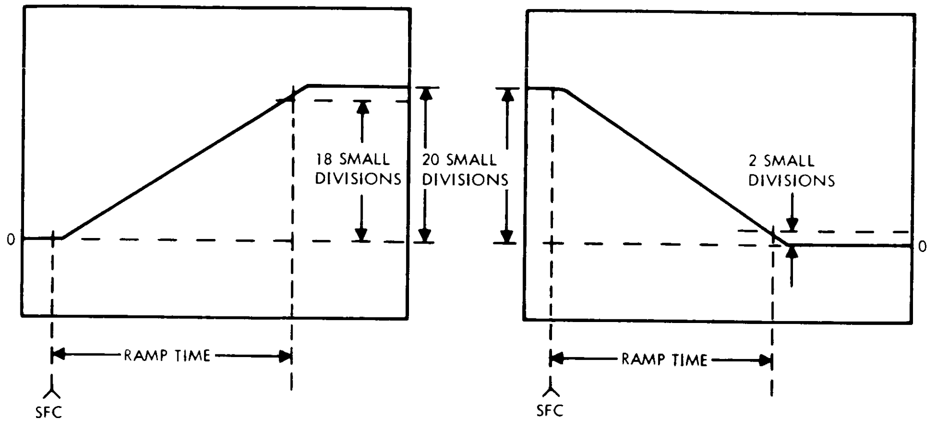


Figure 6-1. Ramp Levels and Timing

(7) Acceptable Limits (90 percent of actual speed)

  (a) 45 ips transports
  - 6.2 - 6.9 milliseconds

  (b) 37.5 ips transports
  - 7.3 - 8.1 milliseconds

  (c) 25 ips transports
  - 11.6 - 12.8 milliseconds

  (d) 22.5 ips transports
  - 13.1 - 14.5 milliseconds.

  (e) 18.75 ips transports
  - 16.0 - 17.6 milliseconds

  (f) 12.5 ips transports
  - 24.7 - 27.3 milliseconds

(8) Remove the square wave input from J101 pin C (ISFC) and apply the square wave input to ISRC line (J101 pin E).

(9) With the oscilloscope connected as specified in Step (5) observe that the reverse ramp timing is within the limits specified in Step (7).

6.6.9.3 Adjustment Procedure

When the acceptable limits are exceeded, the following adjustments are performed.

(1) Establish test configuration described in Paragraph 6.6.9.1.

(2) Perform test procedure described in Paragraph 6.6.9.2 Steps (1) through (5).

(3) Adjust the relevant variable resistor (R915 or R916) on the Tape Control PCBA to obtain ramp adjustment time as follows.

(a) 45 ips transports (~~R915~~)
- 6.5 milliseconds

(b) 37.5 ips transports (~~R915~~)
- 7.7 milliseconds

(c) 25 ips transports (~~R915~~)
- 12.2 milliseconds

R916

(d) 22.5 ips transports (~~R916~~)
- 13.8 milliseconds

(e) 18.75 ips transports (~~R916~~)
- 16.8 milliseconds

(f) 12.5 ips transports (~~R916~~)
- 26.0 milliseconds

R915

NOTE

Specified time results in oscilloscope display illustrated in Figure 6-1. The ramp adjustment time intersects 90 percent of ramp amplitude when accelerating and 10 percent of ramp amplitude when decelerating.

(4) Remove the square wave input from ISFC line (J101 pin C) and apply the square wave input to the interface line ISRC (J101 pin E).

(5) Observe oscilloscope display of reverse ramp and readjust R915 or R916 to obtain ramp time as specified in Step (3).

6.6.9.4 Related Adjustments

- None.

6.6.10 TAPE SPEED

Only the Synchronous Forward speed is adjustable. The Synchronous Reverse function utilizes the same voltage reference as Synchronous Forward and is not independently adjustable.

NOTE

> The +5v and -5v regulator voltages must be checked and adjusted prior to adjusting Tape Speed. Measurements and adjustments should be made at room temperature.

Two methods of tape speed adjustments are given. Paragraphs 6.6.10.1 through 6.6.10.4 describe the optical encoder method; Paragraphs 6.6.10.5 through 6.6.10.9 describe the strobe disk method.

6.6.10.1 Tape Speed - Optical Encoder Adjustment

Table 6-3 lists the nominal optical encoder counter frequency readings to which the 6000 Series transports are adjusted.

Table 6-3

Counter Frequency Readings

Tape Speed	Counter Frequency (Hz)
45.0	4500
37.5	3750
25.0	2500
22.5	2250
18.75	1875
12.5	1250

Tape speed may be calculated from the following formula used in conjunction with the specified counter timer.

$$V \text{ ips} = \text{Counter Frequency (Hz)} \times \frac{C}{500} \text{ inches}$$

where

C = Capstan circumference

NOTE

Capstan circumference for the 6000 Series transports is 5.00 inches.

6.6.10.2 Test Configuration (Optical Encoder Method)

(1) Couple an Optical Encoder PERTEC Part No. 512-1100 to the front of the capstan shaft. Five volts dc must be applied to the Optical Encoder lamp input (pins 1 and 2). This voltage can be obtained between TP19 (+5v) and TP23 (0v) on the Tape Control PCBA.

(2) Load a reel of tape.

(3) Apply power to the transport.

(4) Depress and release the LOAD control to establish interlocks and tension tape.

(5) Depress and release the LOAD control a second time. Tape will advance to the Load Point and stop.

6.6.10.3 Test Procedure (Optical Encoder Method)

(1) Connect input probes of Counter Timer Monsanto Model 100B (or equivalent) to pins 6 and 7 of the Optical Encoder PERTEC Part No. 512-1100.

(2) Depress and release the FORWARD control. Tape will move in the forward direction.

(3) Adjust the sample interval of the counter timer to monitor the encoder output over a one second interval.

(4) Acceptable Limits

(a) 12.5 ips
- 1262 Hz maximum
- 1238 Hz minimum

(b) 18.75 ips
- 1893 Hz maximum
- 1857 Hz minimum

(c) 22.5 ips
- 2273 Hz maximum
- 2227 Hz minimum

(d) 25.0 ips
- 2525 Hz maximum
- 2475 Hz minimum

(e) 37.5 ips
- 3787 Hz maximum
- 3713 Hz minimum

(f) 45.0 ips
- 4545 Hz maximum
- 4455 Hz minimum

(5) Depress and release the FORWARD control. Tape will decelerate to stop. Depress and release the REVERSE control. Tape will move in the reverse direction.

(6) With the Counter Timer connected as specified in Step (1) monitor the output of the optical encoder.

(7) The reverse tape speed, as monitored with the Counter Timer, must be within the following limits.

(a) 12.5 ips
- 1288 Hz maximum
- 1214 Hz minimum

(b) 18.75 ips
- 1929 Hz maximum
- 1818 Hz minimum

(c) 22.5 ips
- 2318 Hz maximum
- 2182 Hz minimum

(d) 25.0 ips
- 2575 Hz maximum
- 2425 Hz minimum

(e) 37.5 ips
- 3863 Hz maximum
- 3637 Hz minimum

(f) 45.0 ips
- 4635 Hz maximum
- 4365 Hz minimum

6.6.10.4 Adjustment Procedure (Optical Encoder Method)

When the forward or reverse tape speeds exceed the specified limits the following adjustments are performed.

(1) Establish the test configuration described in Paragraph 6.6.10.2.

(2) Perform the test procedure described in Paragraph 6.6.10.3, Steps (1) through (3).

(3) Depress the FORWARD control. Tape will move in the forward direction.

(4) Adjust the relevant variable resistor (R931 or R932) on the Tape Control PCBA for the following counter timer value.

  (a) 45 ips transports (R931)
    - 4500 Hz
  (b) 37.5 ips transports (R931)
    - 3750 Hz
  (c) 25.0 ips transports (R931)
    - 2500 Hz
  (d) 22.5 ips transports (R932)
    - 2250 Hz
  (e) 18.75 ips transports (R932)
    - 1875 Hz
  (f) 12.5 ips transports (R932)
    - 1250 Hz

NOTE

On dual-speed models it is necessary to adjust the potentiometer relevant to each speed. They function independently and may be adjusted in any sequence.

(5) Monitor the counter timer to ensure that the reverse speed is within the acceptable limits established in Paragraph 6.6.10.3, Step (7). Repeat Steps (2) through (5) as required.

6.6.10.5 Tape Speed - Strobe Disk Adjustment

The capstan mounted strobe disk may be used when making fine adjustments to the tape speed on 6000 Series Tape Transports.

Tape speed adjustments made using the strobe disk are accomplished by illuminating the capstan hub from a fluorescent light source and adjusting the capstan servo until the disk image, created by the pulsating light source, becomes stationary. Table 6-4 lists the available disks, synchronous tape speeds, and light source frequencies.

Some strobe disks have two or three concentric sets of strobe markings on each disk. The following rules apply to disks marked with multiple sets of strobe markings.

(1) Part No. 101744-02 (12.5/25 ips). The outer ring is used when the fluorescent light source is 60 Hz. The inner ring is used when the fluorescent light source is 50 Hz.

(2) Part No. 101744-03 (18.75/37.5 ips). There are three sets of strobe markings on this disk. The outer ring is used when checking and adjusting synchronous tape speeds of 18.75 or 37.5 ips from a 60 Hz fluorescent light source. The middle ring is used at a tape speed of 37.5 ips and from a 50 Hz light source. The inner ring is used at a tape speed of 18.75 ips from a 50 Hz light source.

(3) Part No. 101744-04 (20/40 ips). The outer ring is used when the fluorescent light is from a 60 Hz source. The inner ring is used when the fluorescent light source is from 50 Hz.

(4) Part No. 101744-05 (22.5/45 ips). The outer ring of strobe markings is used when checking and adjusting a

Table 6-4

Strobe Disks

PERTEC Part No.	Tape Speed (ips)	Light Source Frequency (Hz)
101744-02	12.5/25	60/50
101744-03	18.75/37.5	60/50
101744-04	20/40	60/50
101744-05	22.5/45	60/50
101744-06	24	60
101744-07	30	60/50

45/22.5

tape speed of 45 ips from a 60 Hz fluorescent light source. The middle ring is used at a tape speed of 22.5 ips from a 60 Hz light source. The inner ring is used at a tape speed of 22.5 ips from a 50 Hz light source.

(5) Part No. 101744-07 (30 ips). The outer ring is used when the fluorescent light source is 60 Hz. The inner ring is used when the fluorescent light source is 50 Hz.

The use of the capstan-mounted strobe disk should be limited to fine tape adjustments of the synchronous tape speed. When it is necessary to make gross speed adjustments (e.g., when replacing a Servo and Power Supply PCBA) refer to the test and adjustment procedures described in Paragraphs 6.6.10.1 through 6.6.10.4.

6.6.10.6 Test Configuration (Strobe Disk Method)

(1) Load a reel of tape on the transport.

(2) Apply power to the transport.

(3) Depress and release the LOAD control to establish interlocks and tension the tape.

(4) Depress and release the LOAD control a second time; tape will advance to the Load Point and stop.

(5) Illuminate the capstan mounted strobe disk with a fluorescent light source at the appropriate frequency.

6.6.10.7 Test Procedure (Strobe Disk Method)

(1) Establish the test configuration described in the foregoing paragraph.

(2) Depress and release the FORWARD control tape will move in the forward direction.

(3) Observe the appropriate strobe disk image; the image should appear stationary.

(4) On dual speed transports, Steps (2) and (3) must be repeated at the second speed.

6.6.10.8 Adjustment Procedure (Strobe Disk Method)

(1) Establish test configuration previously described.

(2) Adjust the relevant potentiometer on the Tape Control PCBA (R32 for forward speeds of 12.5, 18.75, and 22.5 ips, or R931 for forward speeds of 25.0, 37.5, and 45 ips) until the strobe disk image appears stationary for the appropriate tape speed.

6.6.11 REWIND SPEED (Applies to Servo and Power Supply - B, Assembly 101262)

The rewind speed should be between the following limits.

- 135 ips minimum
- 165 ips maximum

NOTE

The +5v and -5v regulator voltages must be checked and adjusted prior to adjusting the tape speed. Measurements and adjustments should be made at room temperature.

6.6.11.1 Test Configuration (Assembly 101262)

(1) Couple an Optical Encoder PERTEC Part No. 512-1100 to the front of the capstan shaft. Five volts dc must be applied to the Optical Encoder lamp input (pins 1 and 2). This voltage can be obtained between TP19 (+5v) and TP23 (0v) on the Tape Control PCBA.

(2) Load a reel of tape.

(3) Apply power to the transport.

(4) Depress and release the LOAD control to establish interlocks and tension the tape.

(5) Depress and release the LOAD control a second time. Tape will advance to the Load Point and stop.

6.6.11.2 Test Procedure (Assembly 101262)

(1) Connect input probes of Counter Timer Monsanto Model 1100B (or equivalent) to pins 6 and 7 of the Optical Encoder.

(2) With a full reel of tape on the take-up reel, depress and release the REWIND control.

(3) Adjust the sample interval of the counter timer to monitor the encoder output over a one-second interval.

(4) Acceptable limits

- 16,500 Hz maximum
- 13,500 Hz minimum

6.6.11.3 Adjustment Procedure (Assembly 101262)

(1) Establish the test configuration described in Paragraph 6.6.11.1.

(2) Perform the test procedure described in Paragraph 6.6.11.2.

(3) Adjust the variable resistor R14 on Servo and Power Supply to obtain a counter timer value of

- 15,000 Hz

This corresponds to 150 ips rewind speed.

6.6.11.4 Related Adjustments (Assembly 101262)

- None

6.6.12 READ PREAMPLIFIER GAIN (NRZI MODE)

In considering the overall gain of the read system, it is important to note that the output of the read head is particularly dependent upon the type of magnetic tape used and the condition of the tape, i.e., new or used.

A read preamplifier whose gain is adjusted too high will result in amplifier saturation; gain which is set too low will increase the susceptibility to data errors due to dropouts.

NOTE

> The 5v Regulators and Tape Speed must be checked and adjusted if necessary prior to adjusting the Read Preamplifier Gain.

6.6.12.1 Test Configuration

(1) Load an 800-cpi all-ones reference level tape (125 percent saturation), 7- or 9-track as appropriate, on the transport.

(2) Apply power to the transport.

(3) Depress and release the LOAD control to establish the interlock and tension the tape.

(4) Depress and release the LOAD control a second time; tape will advance to the Load Point and stop.

6.6.12.2 Test Procedure

On dual-stack machines the gain of the preamplifiers must be checked in both 7- and 9-track modes with the density switched low. Table 6-5 lists the conditions of the 9 TRACK and HI DEN switch/indicators for the various configurations. Note that some models do not utilize all of these capabilities.

Table 6-5

Format Selection Capability

Format	9 TRACK	HI DEN
1600 PE	X	X
9-Track 800 cpi	X	
7-Track High Density		X
7-Track Low Density		
"X" indicates switch/indicator is illuminated.		

(1) Select 7-track low density operation (where relevant) according to Table 6-5.

(2) Check that reference level tape is 7-track (9-track tape will not align with the 7-track read head)

(3) Depress and release the FORWARD control. Tape will move forward at the specified velocity.

(4) Using the signal probe of a Tektronix 561 oscilloscope (or equivalent) measure and record the peak-to-peak output amplitude of the read preamplifiers as observed at TP101 through TP901 on the Data PCBA. The oscilloscope vertical sensitivity should be set to display 1v per division (including any probe attenuation).

NOTE

TP201 and TP301 are not utilized on 7-track models.

(5) Unload 7-track reference level tape.

(6) Load 9-track reference level tape on the transport.

(7) Select 9-track low density operation (where relevant) according to Table 6-5.

(8) Repeat Steps (3) and (4).

(9) Acceptable limits

- 6.6v peak-to-peak (maximum)
- 5.0v peak-to-peak (minimum)

NOTE

The following test must be performed while operating the transport in first the forward direction, then in the reverse direction, in 7- and 9-track low density modes (where applicable).

(10) Using the signal probe of a Tektronix 561 oscilloscope (or equivalent) measure and record the peak-to-peak output amplitude of the differentiators as viewed at TP102 through TP902.

(11) Typical limits

- 6.0v peak-to-peak (maximum)
- 3.0v peak-to-peak (minimum)

NOTE

These levels are not critical and depend extensively upon the tape being reproduced.

6.6.12.3 Adjustment Procedure

When the acceptable limits are exceeded, the following adjustments are performed.

NOTE

The preamplifier may become unstable or sustain oscillation when the gain is reduced to an extremely low setting. This is of no consequence as this setting is well removed from operating settings.

(1) Establish the test configuration described in Paragraph 6.6.12.1. The 800-cpi all-ones reference level tape (125 percent saturation) is utilized regardless of the transport packing density. Use 7-track reference level tape if the transport has 7-track capability; otherwise, use 9-track reference level tape and proceed to Step (7).

(2) Select 7-track low density operation (where relevant) according to Table 6-5.

NOTE

On dual-stack models (6X12), the 7-track gain is set first and not touched again during the remainder of the adjustment procedure.

(3) Depress and release the FORWARD control. Tape will advance at the specified velocity.

(4) Using the signal probe of a Tektronix 561 oscilloscope (or equivalent) observe TP101, TP401 through TP901 on the Data PCBA. Adjust variable resistors R108, R408 through R908 associated with test points to 6.0v peak-to-peak.

(5) Unload the 7-track reference level tape.

(6) Load a 9-track reference level tape on the transport.

(7) Select 9-track low density operation (where relevant) according to Table 6-5.

(8) Using the signal probe of a Tektronix 561 oscilloscope (or equivalent) observe TP101 through TP901 on the Data PCBA. Adjust variable resistors R109, R208, R308, R409 through R909 associated with test points to 6.0v peak-to-peak. On 9-track-only models, adjust R108 through R908.

6.6.13 READ PREAMPLIFIER GAIN (PE MODE)

In considering the overall gain of the read system it is important to note that the output of the read head is particularly dependent upon the type of magnetic tape used and the condition of the tape, i.e., new or used.

Additionally, a read preamplifier whose gain is adjusted too high will result in amplifier saturation; gain which is set too low will increase the susceptibility to data errors due to dropouts.

NOTE

> The 5v Regulators and Tape Speed must be checked and adjusted if necessary prior to adjusting the Read Amplifier Gain.

6.6.13.1 Test Configuration (NRZI/PE or PE-Only Modes)

(1) Load a 1600 cpi (3200 frpi) reference level tape (125 percent saturation) on the transport.

(2) Apply power to the transport.

(3) Depress and release the LOAD control to establish the interlock and tension the tape.

(4) Depress and release the LOAD control a second time. Tape will advance to the load point and stop.

6.6.13.2 Test Procedure (NRZI/PE or PE-Only Modes)

The gains of the read amplifiers are checked with the transport operating in the PE mode.

(1) Select PE format, 9-track, high density.

(2) Depress and release the FORWARD control. Tape will advance at the specified velocity.

(3) Using the signal probe of a Tektronix 561 oscilloscope (or equivalent) measure and record the peak-to-peak

output amplitude of the read differentiators as viewed at TP102 through TP902 on the Data PCBA. The oscilloscope vertical sensitivity should be set to display 1.0v per division (including any probe attenuation).

(4) Acceptable limits

(a) Single-speed models
- 6.0v peak-to-peak (maximum)
- 3.5v peak-to-peak (minimum)

(b) Dual-speed models
- 2.6v peak-to-peak (maximum)
- 1.6v peak-to-peak (minimum)

6.6.13.3 Adjustment Procedure (NRZI/PE Modes)

When the acceptable differentiator output limits (in the PE mode) are exceeded on NRZI/PE modes, perform the gain adjustments described in Paragraph 6.6.12.3 (NRZI); repeat the test procedure detailed in Paragraph 6.6.13.2. If the acceptable differentiator limits are still exceeded, an adjustment of up to ±10 percent may be made to the NRZI read preamplifier gain.

6.6.13.4 Adjustment Procedure (PE-Only Modes)

When the acceptable limits are exceeded on PE-only mode transports (6611-000) the following adjustments are performed.

(1) Establish the test configuration described in Paragraph 6.6.13.1.

(2) Depress and release the FORWARD control; tape will advance at the specified velocity.

(3) Using the signal probe of a Tektronix 561 oscilloscope (or equivalent) observe TP102 through TP902 on the Data PCBA. Adjust variable resistors R108 through R908 associated with

test points to 5.5v peak-to-peak. PE operation is dependent upon differentiator output rather than preamplifier levels.

6.6.13.5 Related Adjustments

- None.

6.6.14 THRESHOLD GENERATOR

The PE threshold is adjustable in the Read Only Transport; the NRZI threshold is not adjustable. The following data concerning NRZI threshold values are given as an aid to troubleshooting only.

(1) RTH2 True
  (a) TP4
    - +330 millivolts (maximum)
    - +270 millivolts (minimum)
  (b) TP5
    - -330 millivolts (maximum)
    - -270 millivolts (minimum)

(2) RTH2 False
  (a) TP4
    - +660 millivolts (maximum)
    - +540 millivolts (minimum)
  (b) TP5
    - -660 millivolts (maximum)
    - -540 millivolts (minimum)

6.6.14.1 Test Configuration

(1) Load a 1600-cpi (3200-frpi) reference level tape (125 percent saturation) on the transport.

(2) Apply power to the transport.

(3) Depress and release the LOAD control to establish the interlock and tension the tape.

(4) Depress and release the LOAD control a second time. Tape will advance to the Load Point and stop.

6.6.14.2 Test Procedure

(1) Depress and release the FORWARD control. The tape will advance at the specified velocity.

(2) Using the signal probe of a Tektronix 561 oscilloscope (or equivalent) measure and record the peak-to-peak output voltage of the differentiators at TP102 through TP902 on the Data PCBA.

(3) Calculate the average of the nine peak-to-peak differentiator output voltages recorded in Step (2).

NOTE

> Average peak-to-peak differentiator output voltage must fall between 3.5v and 6.0v peak-to-peak.

(4) With RTH2 false, measure and record the voltage at TP7.

(5) Set RTH2 true by applying a ground to J102 pin F or to the junction of R1 and R2 (pin 1 of U1) on the Data PCBA.

(6) Measure and record the voltage at TP7 on the Data PCBA.

(7) Acceptable Limits

(a) RTH2 False

- 5.0 ±0.5 percent of value calculated in Step (3).

(b) RTH2 True

- 50 ±3 percent of value calculated in Step (7a).

(8) The voltage at TP7 must be 0 ±30mv in the NRZI mode.

6.6.14.3 Adjustment Procedure

When the acceptable limits are exceeded the following adjustments are performed.

(1) With RTH2 false, observe the threshold output voltage at TP7. Adjust R21, located on the Data PCBA, to the value calculated in Paragraph 6.6.14.2, Step (3).

(2) Set RTH2 true by applying a ground to J102 pin F, or to the junction of R1 and R2 on the Data PCBA.

(3) Observe the threshold output voltage at TP7; the voltage must be 50 ±5 percent of the value set in Step (1).

6.6.14.4 Related Adjustments

- None.

6.6.15 CHARACTER GATE

The Character Gate, located on the Data PCBA, is utilized during NRZI operation to set the period during which valid data are passed by the staticisers. The length of the gate is defined as the period from the rise (leading edge) of the waveform at TP1 to the rise (trailing edge) of the waveform at TP12. Potentiometer R35 sets the 9-track character gate length; R30 and R24 set the 7-track high density and low density character gate lengths, respectively. The adjustments are independent and may be set in any order.

NOTE

Tape Speed and Read Amplifier Gain must be checked and adjusted if necessary prior to adjusting the Character Gate.

6.6.15.1 Test Configuration

(1) Load an all-ones tape of the appropriate packing density and format on the transport.

(2) Apply power to the transport.

(3) Depress and release the LOAD control to establish the interlock and tension the tape.

(4) Depress and release the LOAD control a second time. Tape will advance to the Load Point and stop.

(5) Set the 9 TRACK and HI DEN switches to the appropriate mode.

(6) Connect a 220 ohm resistor from TP12 of the Data PCBA to +5v (TP19 on Tape Control PCBA).

(7) Apply a ground to TP11 on the Tape Control PCBA (this provides a motion command to the Data board).

(8) Depress and release the FORWARD control. Tape will advance at the specified velocity.

6.6.15.2 Test Procedure

(1) Connect the Trace One probe of a Tektronix 561 oscilloscope (or equivalent) to TP1 and the Trace Two probe to TP12 of the Data PCBA.

(2) Trigger the oscilloscope on Trace One (ac positive).

(3) Measure and record the period between the waveform rise at TP1 (Trace One) to the waveform rise at TP12 (Trace Two).

(4) Calculate the bit-cell time of the recorded tape by the following equation.

$$\tau = \frac{1}{DS}$$

$$T = 0.46\tau$$

$$T_{ul} = 0.48\tau \text{ (upper limit)}$$

$$T_{ll} = 0.44\tau \text{ (lower limit)}$$

where

D = Density (cpi)
S = Speed (ips)
T = Character Gate Length
τ = Bit - Cell Period

(5) Acceptable limits (nominal margin)

The value obtained in Step (3) is the actual character gate period. This value must be between T_{ul} and T_{ll} as calculated in Step (4).

(6) Set RTH1 true by grounding J101 pin E or the junction of R46 and R48 of the Data PCBA.

(7) Measure and record the period between the waveform rise at TP1 (Trace One) and the waveform rise at TP12 (Trace Two).

(8) Acceptable limits (high margin)

The value obtained in Step (7) is the actual character gate period. This value must be 60 ±3 percent of the bit cell time calculated in Step (4).

6.6.15.3 Adjustment Procedure

When the acceptable limits are exceeded the following adjustments are performed.

(1) Establish the test configuration detailed in Paragraph 6.6.15.1.

(2) Perform test procedure detailed in Paragraph 6.6.15.2, Steps (1) through (7).

(3) Observe the character gate length and set the appropriate variable resistor (R35, R30, or R24) to 46 percent of the bit cell period (τ).

NOTE

This procedure must be repeated for each available format.

6.6.15.4 Related Adjustments

- None.

6.7 MECHANICAL ADJUSTMENTS

6.7.1 TENSION ARM LIMIT SWITCH

When the tension arm is resting against its backstop the position of the limit switch roller, with respect to the cam, should be as shown in Figure 6-2 (Section A-A). At this time the switch contacts should be open. If the relative positions of the roller and cam are not as illustrated, the following adjustment is performed.

(1) Loosen the cam retaining set-screw.

(2) Rotate the cam on its shaft until the limit switch roller is in the position illustrated in Figure 6-2.

(3) Firmly tighten the cam retaining set-screw.

CAUTION

THE CAM RETAINING SET-SCREW MUST BE TIGHTENED SUFFICIENTLY TO PREVENT ROTATION OF THE CAM WHEN THE TENSION ARM IMPACTS ON ITS BACKSTOP.

The limit switch plate is slotted at one mounting screw and may be rotated about the second screw to facilitate setting the switching point of the limit switch. The plate should be rotated to a position where the limit switch trips with its roller one-half of the distance up the slope from its rest position. The switch should be closed when the roller moves on the cam lobe between the semi-circular cutouts.

Replacement of the limit switch is accomplished as follows.

(1) Unplug the limit switch connector P17 from J17 of the Servo and Power Supply PCBA.

(2) Remove yellow and green leads from the limit switch connector (P17) using an extractor tool.

(3) Remove the two mounting screws which mount the limit switch to its plate and remove the switch.

(4) Attach the new limit switch to the plate using the two mounting screws removed in Step (3).

(5) Adjust the limit switch position as described in the preceding paragraph.

(6) Tighten the two mounting screws and recheck position of the limit switch roller.

(7) Connect the limit switch connector (P17) to J17 of the Servo and Power Supply PCBA.

(8) Plug the connector (P14 for take-up reel sensor, P18 for supply reel sensor) into the respective jack on the Servo and Power Supply circuit board.

(9) Perform the relevant adjustment procedure.

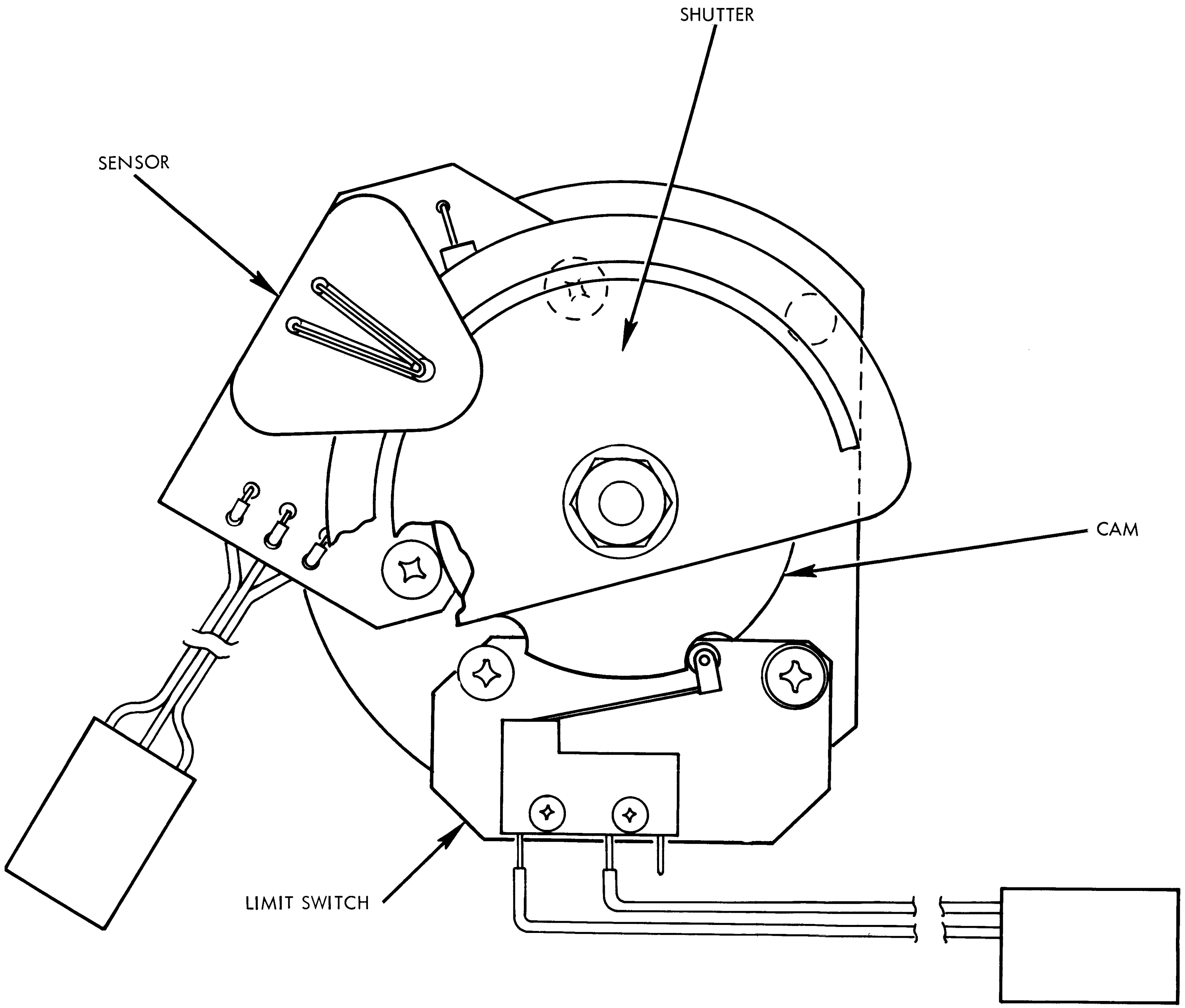
6.7.2 TENSION ARM POSITION SENSOR (Applies to Servo and Power Supply - A, Assembly 101021)

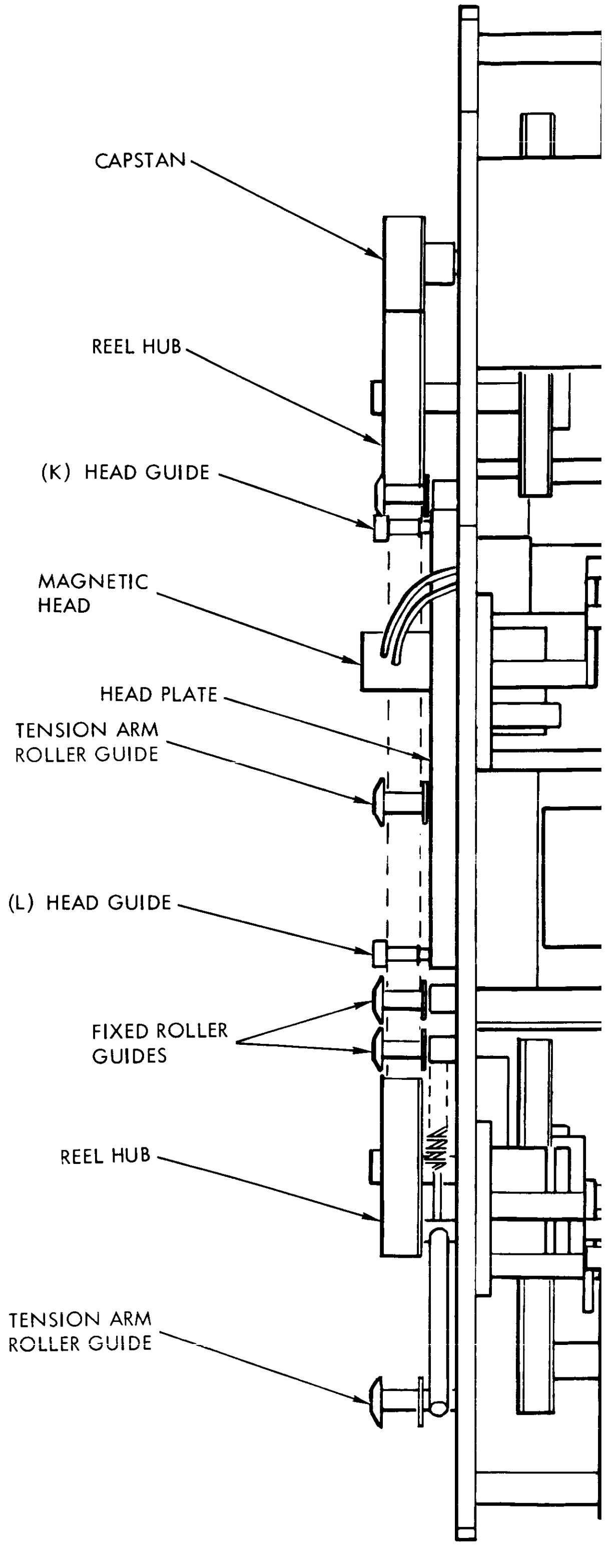
There are two tension arm position sensors: one on the take-up tension arm, and the second on the supply arm. Each of the sensors has a 3-pin plug which connects the output of the sensor to the reel servo amplifier on the Servo and Power Supply PCBA.

CAUTION

ENSURE THAT THE 5V REGULATORS, RAMP TIMING, AND TAPE SPEEDS ARE CORRECT AS DETAILED IN PARAGRAPHS 6.6.3 (OR 6.6.4), 6.6.9 AND 6.6.10, RESPECTIVELY, BEFORE ADJUSTING THE TENSION ARM POSITION SENSORS.

A-A


SHUTTER
SENSOR
CAM
LIMIT SWITCH


CAPSTAN
REEL HUB
(K) HEAD GUIDE
MAGNETIC HEAD
HEAD PLATE
TENSION ARM ROLLER GUIDE
(L) HEAD GUIDE
FIXED ROLLER GUIDES
REEL HUB
TENSION ARM ROLLER GUIDE

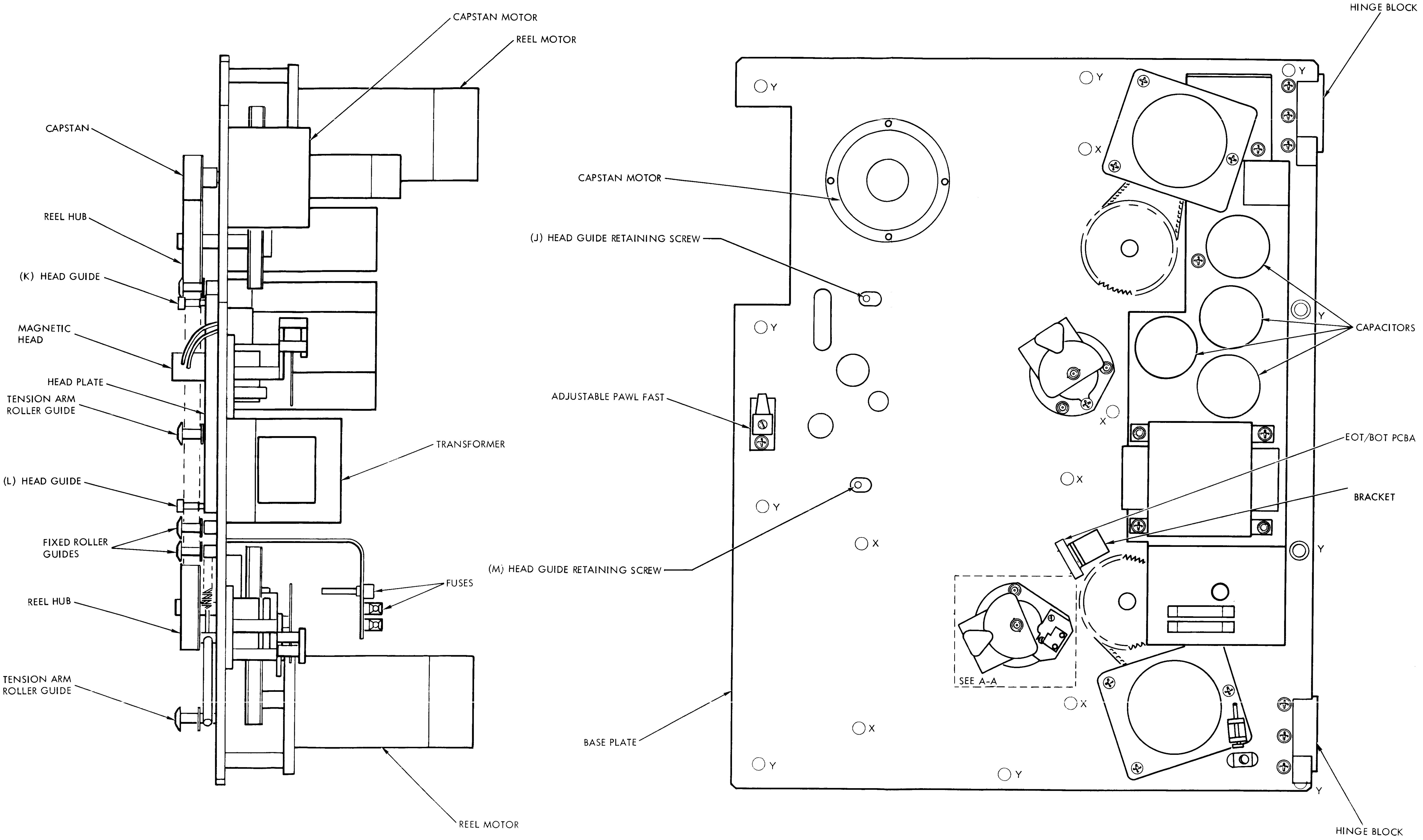


Figure 6-2. Tape Deck Diagram,
Rear View

6.7.2.1 Preliminary Adjustment (Assembly 101021)

The tension arm photosensors on the supply reel and take-up reel are initially adjusted as follows.

(1) Loosen the No. 10 retaining nut securing the shutter on the tension arm shaft in such a way that the shutter can be rotated by hand.

NOTE

Ensure that there is sufficient friction to prevent the setting from changing when the nut is tightened.

(2) To place the shutter in approximately the correct position, remove tape from the transport and rotate the shutter until moving the tension arm to the middle of its range stops reel motion.

NOTE

The LOAD control must be continuously depressed or the limit switch shorted to facilitate this procedure.

(3) Load tape on the transport.

(4) Establish an environment which ensures that the tension arm sensors are shielded from high ambient light. Failure to do so could result in a shift in the arm operating region when the unit is rack-mounted.

6.7.2.2 Take-up Arm Adjustment (Assembly 101021)

When the preliminary adjustments are completed, proceed as follows.

(1) Ensure that the take-up reel is nearly empty.

(2) Place the arm movement measuring tool PERTEC Part No. 101137 in position against the fixed guide near the top of the arm swing. The words "Top Arm" should be visible on the tool.

(3) Alternately depress the FORWARD and REVERSE controls to cause tape to "shuttle" back and forth.

(4) If Step (3) causes loss of tape tension by moving the supply arm to either switch point of the limit switch, retension tape by depressing LOAD. Move the supply arm shutter so that the arm rests in the center of its travel. Adjust R72 on the Servo and Power Supply PCBA 5 turns CW so as to reduce the total arm movement. Repeat this step as required.

(5) Note the total arm movement.

(6) Adjust variable resistor R30 on the Servo and Power Supply PCBA until the total arm movement is equal to the distance between the appropriate marks on the tool.

NOTE

> The actual arc of movement may not coincide with that specified on the tool because the shutter may not yet be in the correct position.

(7) Readjust the shutter position so that the arm of the arm movement and the mark on the tool coincide.

(8) The arm position in Forward and Reverse motion should coincide with the marks on the tool within +0.0, -0.5 inch.

(9) Torque the optical shutter retaining nut to 30 in/lbs, taking care that the shutter does not move.

6.7.2.3 Supply Arm Adjustment (Assembly 101021)

When the preliminary adjustments are completed, proceed as follows.

(1) Ensure that the supply reel is nearly empty.

(2) Place the arm movement measuring tool PERTEC Part No. 101137 in position against the fixed guide near the bottom of the arm stroke. The words "Bottom Arm" should be visible on the tool.

(3) Adjust the shutter, if necessary, so that the supply arm rests in the center of its travel.

(4) Alternately depress the FORWARD and REVERSE controls to cause tape to "shuttle" back and forth.

(5) Note the total arm movement.

(6) Adjust variable resistor R72 on the Servo and Power Supply PCBA until the total arm movement is equal to the distance between the appropriate marks on the tool.

NOTE

> The actual arc of movement may not coincide with that specified on the tool because the shutter may not yet be in the correct position.

(7) Readjust the shutter position so that the arm of the arm movement and the mark on the tool coincide.

(8) The arm position in Forward and Reverse motion should coincide with the mark on the tool within +0.0, -0.5 inch.

(9) Torque the optical shutter retaining nut to 30 in/lbs, taking care that the shutter does not move.

6.7.3 TENSION ARM POSITION SENSOR (Applies to Servo and Power Supply - B, Assembly 101262)

There are two tension arm position sensors: one on the take-up tension arm, and the second on the supply arm. Each of the sensors has a 3-pin plug which connects the output of the sensor to the reel servo amplifier on the Servo and Power Supply PCBA.

CAUTION

ENSURE THAT THE 5V REGULATORS, RAMP TIMING, AND TAPE SPEEDS ARE CORRECT AS DETAILED IN PARAGRAPHS 6.6.3 (OR 6.6.4), 6.6.9 , AND 6.6.10, RESPECTIVELY, BEFORE ADJUSTING THE TENSION ARM POSITION SENSORS.

6.7.3.1 Preliminary Adjustment (Assembly 101262)

The tension arm photosensors on the supply reel and take-up reel are initially adjusted as follows.

(1) Loosen the No. 10 retaining nut securing the shutter on the tension arm shaft in such a way that the shutter can be rotated by hand.

NOTE

Ensure that there is sufficient friction to prevent the setting from changing when the nut is tightened.

(2) To place the shutter in approximately the correct position, remove tape from the transport and rotate the shutter until moving the tension arm to the middle of its range stops reel motion.

NOTE

The LOAD control must be continuously depressed or the limit switch shorted to facilitate this procedure.

(3) Load tape on transport.

(4) Establish an environment which ensures that the tension arm sensors are shielded from high ambient light. Failure to do so could result in a shift in the arm operating region when the unit is rack-mounted.

6.7.3.2 Take-up Arm Adjustment (Assembly 101262)

When the preliminary adjustments are completed, proceed as follows.

(1) Ensure that the take-up reel is nearly empty.

(2) Place the arm movement measuring tool PERTEC Part No. 101137 in position against the fixed guide near the top of the arm swing. The words "Top Arm" should be visible on the tool.

(3) Move the take-up shutter so that the arm rests approximately in the center of its travel.

(4) Alternately depress the FORWARD and REVERSE controls to cause tape to "shuttle" back and forth.

(5) If Step (4) causes loss of tape tension because the supply arm exceeds its operating range, re-tension tape by depressing LOAD. Adjust R81 on Servo and Power Supply PCBA 5 turns CCW so as to reduce the total supply arm movement. Repeat this step as required.

(6) Adjust variable resistor R32 on Servo and Power Supply PCBA until the extreme arm movement is equal to the distance between the appropriate marks on the tool.

NOTE

The actual arc of movement may not coincide with that specified on the tool because the shutter may not yet be in the correct position.

(7) Readjust the shutter position so that the arc of the arm movement and the mark on the tool coincide.

(8) The arm position in Forward and Reverse motion should coincide with the marks on the tool within +0.0, -0.5 inch.

(9) Torque the optical shutter retaining nut to 30 in/lbs, taking care that the shutter does not move.

6.7.3.3 Supply Arm Adjustment (Assembly 101262)

When the preliminary adjustments are completed, proceed as follows.

(1) Ensure that the supply reel is nearly empty.

(2) Place the arm movement measuring tool PERTEC Part No. 101137 in position against the fixed guide near the bottom of the arm stroke. The words "Bottom Arm" should be visible on the tool.

(3) Adjust the shutter, if necessary, so that the supply arm rests in the center of its travel.

(4) Alternately depress the FORWARD and REVERSE controls to cause tape to "shuttle" back and forth.

(5) Note the total arm movement.

(6) Adjust variable resistor R81 on the Servo and Power Supply PCBA until the extreme arm movement is equal to the distance between the appropriate marks on the tool.

NOTE

The actual arc of movement not not coincide with that specified on the tool because the shutter may not yet be in the correct position.

(7) Readjust the shutter position so that the arm of the arm movement and the mark on the tool coincide.

(8) The arm position in Forward and Reverse motion should coincide with the marks on the tool within +0.0, -0.5 inch.

(9) Torque the optical shutter retaining nut to 30 in/lbs, taking care that the shutter does not move.

6.7.4 TENSION ARM SENSOR REPLACEMENT

The tension arm optical sensors are replaced as follows.

(1) Loosen the No. 10 retaining nut which secures the optical shutter to the tension arm.

(2) Rotate the shutter to clear the countersunk screws which retain the tension arm sensor printed circuit board to the deck standoffs.

(3) Remove two retaining screws from the tension arm sensor printed circuit board.

NOTE

Retain the two screws removed in Step (3). They will be used to mount the replacement sensor.

(4) Unplug the connector (P14 for take-up reel sensor, P18 for supply reel sensor) from the Servo and Power Supply PCBA and remove sensor assembly.

(5) Mount the replacement assembly on the deck standoffs using the two screws which were removed in Step (3).

(6) Plug the connector (P14 for take-up reel sensor, P18 for supply reel sensor) into the respective jack on the Servo and Power Supply PCBA.

(7) Perform the relevant adjustment procedure.

6.7.5 READ SKEW MEASUREMENT AND ADJUSTMENT - MODEL 6X11 TRANSPORTS

6.7.5.1 Test Configuration

(1) Perform the cleaning operation described in Paragraph 6.4.

(2) Perform the read amplifier checks and adjustments, if necessary, described in Paragraphs 6.6.12 and/or 6.6.13.

(3) Load an 800-cpi IBM Master Skew Tape (IBM No. 432640) (or equivalent) on the transport.

(4) Apply power to the transport.

(5) Depress and release the LOAD control to establish the interlock and tension the tape.

(6) Depress and release the LOAD control a second time. Tape will advance to the Load Point and stop.

(7) Set the 9 TRACK switch to the desired mode and the HI DEN switch off (extinguished).

6.7.5.2 Test Procedure

(1) Using a Tektronix 561 oscilloscope (or equivalent) observe the falling edge of the waveform observed at TP10 (SKEW) on the Data PCBA.

(2) With the oscilloscope connected as in Step (1) measure and record the length (in μseconds) of the falling edge of the waveform at TP10. This measurement should be taken between the 95- and 5-percent points of the waveform.

(3) Multiply the time obtained in Step (2) by the tape speed in inches per second (ips) to determine the skew in μinches.

NOTE

The observed waveform contains both the static and dynamic component of the total skew.

(4) If the total (dynamic and static) skew is less than 150 μinches, the tape path alignment is acceptable.

6.7.5.3 Adjustment Procedure

When the acceptable limits are exceeded, proceed as follows.

(1) Perform skew measurement procedure described in Paragraph 6.7.5.2.

(2) While observing the waveform at TP10 (SKEW) on the Data PCBA and the tape moving in the forward direction, ease the edge of the tape off the head guide cap toward the spring-loaded washer. This should be done on first one guide, then the other.

NOTE

Moving the tape one- to two-thousandths of an inch from one of the guides will reduce the skew to within the specified range.

(3) Observe the waveform and determine which movement (top guide or bottom guide) improves the display. If moving the tape off the top guide improved the display, the bottom guide should be shimmed.

NOTE

The shims are burr-free, etched, one-half of a thousandths inch thick berrylium copper.

(4) Remove the tape guide retaining screw (accessible from the rear of the deck) and remove the guide.

NOTE

When removing the guide care should be taken not to drop the spring and washer.

(5) Since the character spacing at 800 cpi is 1250 μinches, the actual skew can be calculated. The skew correction provided by the addition of one shim (each shim is 500 μinches thick) is $\frac{500}{12} = 42$ μinches. The number of shims used must satisfy the following.

(a) Skew must be reduced to a minimum consistent with the maximum number shims allowable.

(b) The maximum number of shims used must not exceed four.

Therefore, if, for example, the measured skew is 1800 µinches, four shims will yield a skew correction of 168 µinches (i.e., $4 \times \frac{500}{12} = 168$ µinches). This satisfies the requirements listed in (a) and (b).

(6) Insert the required number of shims and replace the head guides.

(7) Recheck skew measurement as described in Paragraph 6.7.3.2.

6.7.6 READ SKEW MEASUREMENT AND ADJUSTMENT - MODEL 6X12 TRANSPORTS

The Deskew PCBA is installed in the Model 6X12 Tape Transport to provide static deskew capability.

6.7.6.1 Test Configuration

(1) Perform the cleaning operation described in Paragraph 6.4.

(2) Perform the Read Amplifier checks and adjustments if necessary as described in Paragraphs 6.6.12 and/or 6.6.13.

(3) Load an 800 cpi IBM Master Skew Tape (IBM No. 432640) (or equivalent) on the transport.

(4) Apply power to the transport.

(5) Depress and release the LOAD control to establish the interlock and tension the tape.

(6) Depress and release the LOAD control a second time. Tape will advance to the Load Point and stop.

(7) Set the 9 TRACK switch to the desired mode and the HI DEN switch off (extinguished).

6.7.6.2 Test Procedure

(1) Using a Tektronix 561 oscilloscope (or equivalent) observe the falling edge of the waveform observed at TP4 (SKEW) on the Deskew PCBA.

(2) With the oscilloscope connected as in Step (1) measure and record the length (in μseconds) of the falling edge of the waveform at TP4. This measurement should be taken between the 95- and 5-percent points of the waveform.

(3) Multiply the time obtained in Step (2) by the tape speed in inches per second (ips) to determine the skew in μinches.

NOTE

The observed waveform contains both the static and dynamic components of the total skew.

(4) If the total (dynamic and static) skew is less than 150 μinches, no adjustment should be attempted.

(5) In the event that total skew is in excess of 150 μinches, determine if the dynamic skew exceeds 100 μinches.

NOTE

If dynamic skew is in excess of 100 μinches, the tape guiding system should be checked for dirt, wear, and alignment.

(6) If dynamic skew is less than 100 inches and the total skew exceeds 150 inches, proceed with the adjustment procedure in Paragraph 6.7.6.3.

NOTE

This test procedure should be performed in both directions for both 7- and 9-track low density modes of operation (where applicable).

6.7.6.3 Adjustment Procedure

(1) Establish test configuration described in Paragraph 6.7.6.1, Steps (1) through (7).

(2) Connect the Trace One of a Tektronix 561 oscilloscope (or equivalent) to TP3 (SYNC) of the Deskew PCBA.

(3) Place the transport in the appropriate operational mode and trigger the oscilloscope (ac negative) on the falling edge of the SYNC waveform observed at TP3.

(4) Using the oscilloscope Trace Two probe, inspect the input test point of each channel (TP101, TP401 through TP901 on 7-track models, TP101 through TP901 on 9-track models). Note the channel which exhibits the waveform with the latest falling edge.

(5) Trigger the oscilloscope ac positive. Connect the Trace One probe to the output test point (TP102 through TP902) of the channel determined in Step (4) to display the output pulse of the one-shot.

(6) Adjust the appropriate variable resistor listed below for the channel observed in Step (5) to the one-shot minimum pulse width plus 10 percent.

(a)	R101 through R901	9-Track Forward
(b)	R102 through R902	9-Track Reverse
(c)	R103, R403 through R903	7-Track Forward
(d)	R104, R404 through R904	7-Track Reverse

(7) Using the oscilloscope Trace Two probe, observe the output test point (TP102 through TP902) of each of the remaining channels and adjust the appropriate variable resistor so that the falling edge of Traces One and Two coincide.

NOTE

It may not be possible to match the falling edges of Traces One and Two exactly. Dynamic skew must be averaged out.

(8) Using the Trace One probe of the oscilloscope (trigger ac negative) observe TP4 (SKEW). The total skew observed should be less than 150 μinches.

(9) Repeat this procedure for all possible modes of operation; i.e., 9-track Forward, 9-track Reverse, 7-track Forward, and 7-track Reverse.

NOTE

It is only necessary to make these adjustments at 800 cpi for both dual- and single-stack heads.

6.7.7 HEAD REPLACEMENT

The head may require replacement for one of two reasons: internal fault in the head or cable, or wear. The first reason can be established by reading a master tape; the second can be verified by measuring the depth of the wear on the head crown. In those heads which have "guttering" (grooves cut on the crown, each side of the tape path), the head should be replaced when it has worn down to the depth of the gutter. In those heads which do not have guttering, the head wear should be measured with a brass shim that is ten-thousandths of an inch thick. The shim width should be less than the minimum tape width (0.496 inch). The shim should be replaced in the worn portion of the head crown with one side butted against the outer worn step. When the upper surface of the shim is below the unworn surface of the head crown (i.e., the head has worn to a depth of greater than 0.010 inch), the head should be replaced.

Replacement of the head is accomplished as follows.

(1) Remove the head cover.

(2) Disconnect the head connector from the Data PCBA.

(3) Remove Data and Tape Control PCBAs.

(4) Loosen the two screws that attach the head to the deck.

(5) Ease the head cable through the hole in the deck.

(6) Check the replacement head for particles adhering to the mounting surface.

NOTE

The mounting surface must be free of all foreign substances or excessive skew will result.

(7) Route the head connector and cable through the overlay and the deck.

(8) Attach the head with the two screws loosened in Step (4). The read surface of the head should incline approximately

five degrees toward the supply reel to equalize tape wrap angles.

(9) Mate the cable connector(s) to J3 (7-track) and/or J4 (9-track) on Data PCBA and install Data and Tape Control PCBAs in place.

(10) Set up the read amplifier gains as described in Paragraph 6.6.12 or 6.6.13.

(11) Observe the skew and adjust as necessary using procedure detailed in Paragraph 6.7.5 or 6.7.6.

(12) Replace the head cover.

6.7.8 PHOTO-TAB SENSOR REPLACEMENT

Replacement of the photo-tab sensor is accomplished as follows.

(1) Disconnect the cable connecting the photo-tab sensor to the Servo and Power Supply PCBA or the EOT/BOT Amplifier PCBA, as applicable.

(2) Remove the screw that retains the sensor assembly; the screw is accessible from the rear of the deck.

(3) Loosen the screws that retain the overlay.

(4) Remove the pins from the plug by using the extractor tool and feed the pins through the hole in the deck then through the hole in the head plate.

(5) Insert the cable of the replacement photosensor through the head plate and deck.

(6) Replace the connector pins in the plastic connector body as follows.

  (a) Brown wire - pin 1
  (b) Red wire - pin 2
  (c) Orange wire - pin 3
  (d) Yellow wire - pin 4

(7) Align the surface of the photosensor parallel to the tape and tighten the retaining screw.

(8) Adjust the relevant BOT and EOT amplifiers as previously described.

6.7.9 REMOVAL OF TRIM AND OVERLAY

Some adjustments require removal of the vinyl overlay and trim on the front deck of the transport. The following procedure is followed when access is required.

(1) Loosen the two screws at the top of the door that secure the mounting block to the plastic door (do not remove the screws).

(2) Slide the door with respect to the mounting to align the hole in the door with the corresponding hole in the block.

(3) Insert a rod of less than 1/16-inch diameter in a hole at the top of the door and push down the spring plunger, releasing the top of the door.

(4) Carefully pull the top of the door forward approximately two inches. Ease the door downward to clear the bottom spring plunger and remove the door.

(5) Remove the spring plungers from the hinge blocks using the Vlier spring plunger wrench (No. VW-52).

(6) Unplug the Molex and magnetic tape head connectors from the Tape Control and Data PCBAs, and remove the boards.

NOTE

Ensure each cable bundle is identified to enable correct re-installation.

(7) Remove the supply reel, take-up reel, and head cover.

(8) Remove the tape guide shields.

(9) Remove the eleven 4-40 screws around the outer perimeter of the trim assembly identified as "Y" on Figure 6-2.

(10) Remove the five 4-40 screws holding the overlay to the base plate identified as "X" on Figure 6-2.

(11) Ease the trim slowly out past the tape guides and the head. Gentry pry out the plastic trim to clear the hinge blocks. Remove the trim and overlay, taking care to clear the door stop arm.

6.7.10 CAPSTAN MOTOR ASSEMBLY REPLACEMENT.

Replacement of the capstan motor assembly is accomplished as follows.

(1) Remove trim as described in Paragraph 6.7.9.

(2) Disconnect the capstan motor connector from J11 of the Servo and Power Supply PCBA.

(3) Remove the four mounting screws from the capstan motor assembly. Remove the motor. Discard any shims under the motor mounting screws.

(4) Mount the replacement capstan assembly and replace the four retaining screws.

NOTE

The mounting surface must be free of all foreign substances to ensure the perpendicularity of the capstan to the tape path.

(5) Connect the plug which connects the motor to J11 of the Servo and Power Supply PCBA.

(6) Perform a check of the read system skew as described in Paragraph 6.7.5 or 6.7.6.

6.7.11 TAPE PATH ALIGNMENT

Alignment of the supply and take-up guide rollers to the head guides is accomplished by using PERTEC Tape Alignment Tool Part No. 102173-01. This alignment tool is also used to establish guide roller parallelism and the positioning of each tape reel.

CAUTION

THE TOOL IS PRECISION MADE. IT MUST BE HANDLED WITH CARE TO AVOID DAMAGE, ESPECIALLY TO ALL SURFACES. WHEN NOT IN USE, ATTACH THE CROSSBAR TO THE U-FRAME USING THE THUMBSCREWS LOCATED AT EACH END OF THE CROSSBAR. STORE IN A PROTECTIVE AREA.

6.7.11.1 Transport Preparation

Refer to Figure 3-1 for location of parts referred to in Steps (1) and (3).

(1) Remove the protective cover enclosing the head and the tape guides by firmly grasping the cover and pulling away from the tape deck.

(2) Remove the upper and lower plastic tape guide caps; the Phillips head screws that secure the caps in place are accessible from the rear of the tape deck.

(3) Protect the tape path area of the head from damage and contamination.

(4) Remove trim and overlay as outlined in Paragraph 6.7.9.

CAUTION

WHEN REMOVING OVERLAY, CARE MUST BE TAKEN TO PREVENT OVERLAY FROM COMING IN PHYSICAL CONTACT WITH THE HEAD.

(5) Remove guide caps from the fixed head guides with an Allen wrench. Prevent loosening of the guide post retaining screws "J" and "M" (accessible from the rear of the transport) by engaging and holding a second Allen head wrench into each respective screw head to prevent turning (refer to Figure 6-2). Removal of the guide caps will enable installation of the tape alignment tool U-frame onto the tape guide posts.

6.7.12 TAKE-UP GUIDE ROLLER ALIGNMENT

Perform Transport Preparation procedure described in Paragraph 6.7.11.1.

6.7.12.1 Take-up Guide Roller Height Check

(1) Install the U-frame to the guide posts. Ensure that the wide end of the U-frame is toward the top of the tape deck. Insert a thumbscrew through mounting hole "b", and one through mounting hole "c" (see Figure 6-3). Tighten each thumbscrew finger tight.

(2) Install the crossbar to the underside of the wide end of the U-frame through the mounting hole "a" as shown in Figure 6-3. Use threaded screw hole at either end of the crossbar. Do not tighten thumbscrew until Step (3) is completed.

(3) Place the crossbar between the flanges of the take-up arm guide roller with the take-up arm positioned away from its end stop, shown as crossbar position "A" in Figure 6-3. Tighten the crossbar thumbscrew finger tight to the U-frame.

(4) Determine that the crossbar is centered between the flanges of the guide roller. If not centered, a guide roller height adjustment is required.

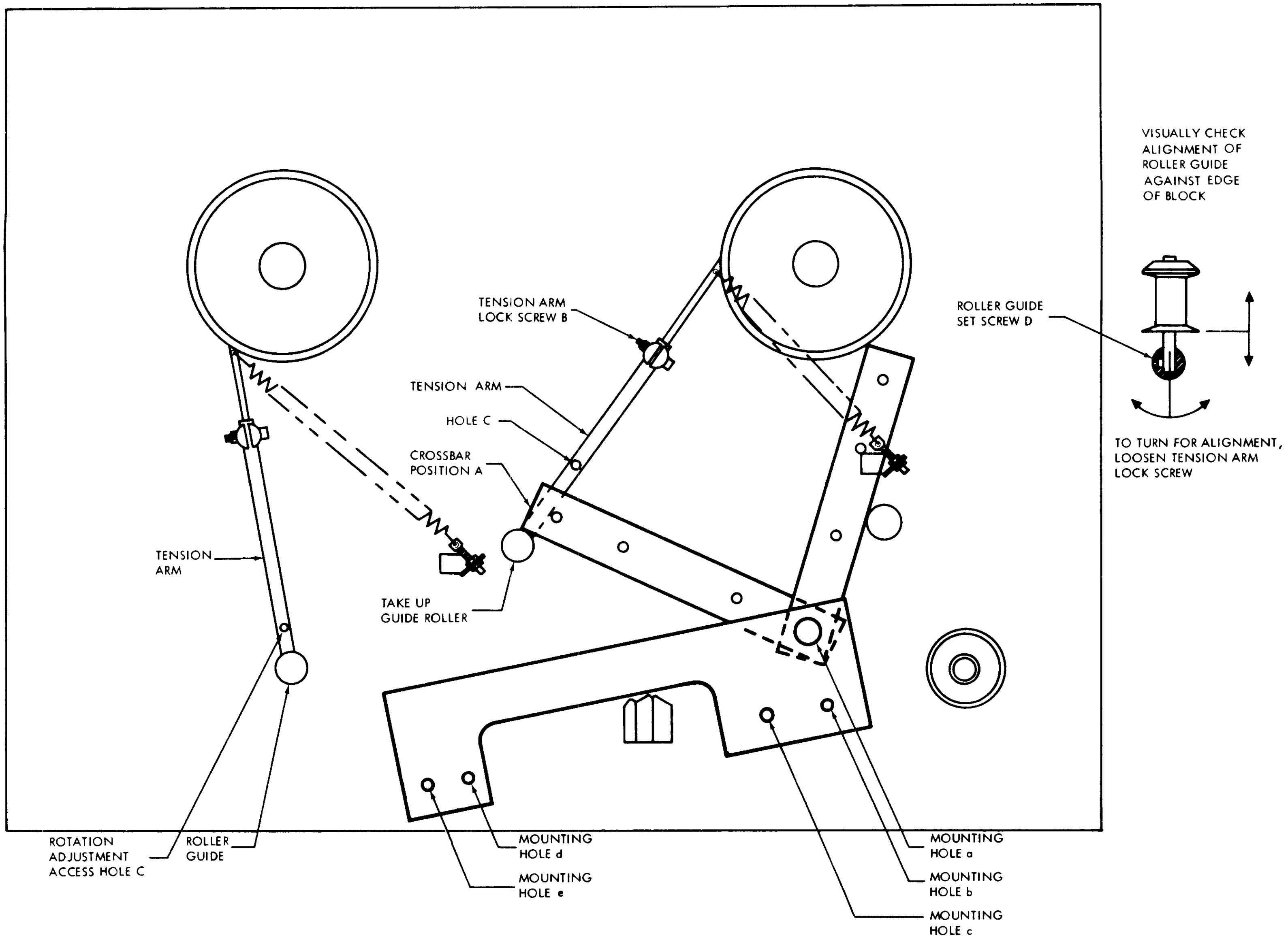


Figure 6-3. Take-up Guide Roller Alignment

6.7.12.2 Take-up Guide Roller Height Adjustment

If the take-up arm height check performed in Paragraph 6.7.12.1 indicates that a height adjustment is required, proceed as follows.

(1) With the crossbar placed as in Step (3), Paragraph 6.7.12.1, and the guide roller still positioned away from its end stop, loosen take-up guide roller set-screw "D" located on the take-up tension arm. (See Figure 6-3.)

(2) Center the guide roller flanges on the crossbar.

(3) When height is established, tighten the take-up guide roller set-screw "D".

6.7.12.3 Take-up Guide Roller Parallelism Check

(1) Install the tape path alignment tool as described in Paragraph 6.7.12.1, Steps (1) through (4).

(2) Observe an equal, but minimal, space between the flat (tape) area of the take-up guide roller and the bottom (narrow surface) of the crossbar.

(3) If the space is unequal from edge to edge, or if it is greater at one end, an adjustment between the two surfaces is required.

6.7.12.4 Take-up Guide Roller Parallelism Adjustment

If the take-up tape guide roller parallelism check performed in Paragraph 6.7.12.3 indicates that an adjustment is required, proceed as follows.

(1) Engage an Allen wrench in the head of tension arm lock-screw "B" (Figure 6-3) and, by using an open-end wrench loosen the tension arm lock-nut. Loosen the lock-nut so that the tension arm can be rotated by inserting a suitable rod or tool into the through-hole "C" on the tension arm.

(2) Rotate the tension arm until the face of the guide roller and the narrow crossbar surface are parallel. Test by observing a minimum and equal amount of light between the two adjacent surfaces.

(3) Recheck height of guide roller.

(4) Tighten tension arm lock-screw "B" to a torque setting of 25 in/lbs, nominal.

6.7.12.5 Take-up Reel Flange Centering Check and Adjustment

Install the tape path alignment tool as described in Paragraph 6.7.12.1, Step (1).

(1) Remove the crossbar and retaining thumbscrew.

(2) Install the crossbar so that it falls between the flanges of the take-up reel shown as crossbar position "B" in Figure 6-3. Tighten thumbscrew finger tight.

(3) With the crossbar secured in place, observe centering of the narrow surfaces of the crossbar between the take-up reel flanges.

(4) If one surface of the crossbar is closer to one edge of the reel flange than the other, center the reel by loosening the two reel hub retaining screws located on the take-up reel hub. Equalize flange-to-crossbar distances and retighten hub screws.

6.7.12.6 Reassembly

After take-up adjustments have been completed, the following operations are performed.

(1) Clean and install guide caps, overlay, and trim.

(2) Make a general inspection of tape deck to ensure that all items removed or disconnected are in place and ready to function.

(3) Refer to Paragraph 6.7.13.7 for the care of the alignment tool.

6.7.13 SUPPLY GUIDE ROLLER ALIGNMENT

Perform Transport Preparation procedure described in Paragraph 6.7.11.1.

6.7.13.1 Supply Guide Roller Height Check

(1) Install the U-frame to the guide posts. Ensure that the wide end of the U-frame is toward the bottom of the tape disk. Insert a thumbscrew through mounting hole "b" and one through mounting hole "e" (see Figure 6-4). Tighten each thumbscrew finger tight.

(2) Install the crossbar to the underside of the wide end of the U-frame through mounting hole "a" as shown in Figure 6-4. Use threaded screw hole at either end of the crossbar. Do not tighten thumbscrew until Step (3) is completed.

(3) Place the crossbar between the flanges of the supply arm guide roller with the supply arm positioned away from its end stops. Tighten the thumbscrew finger tight on to the U-frame.

(4) Determine that the crossbar is centered between the flanges of the supply guide roller. If not centered, a guide roller height adjustment is required.

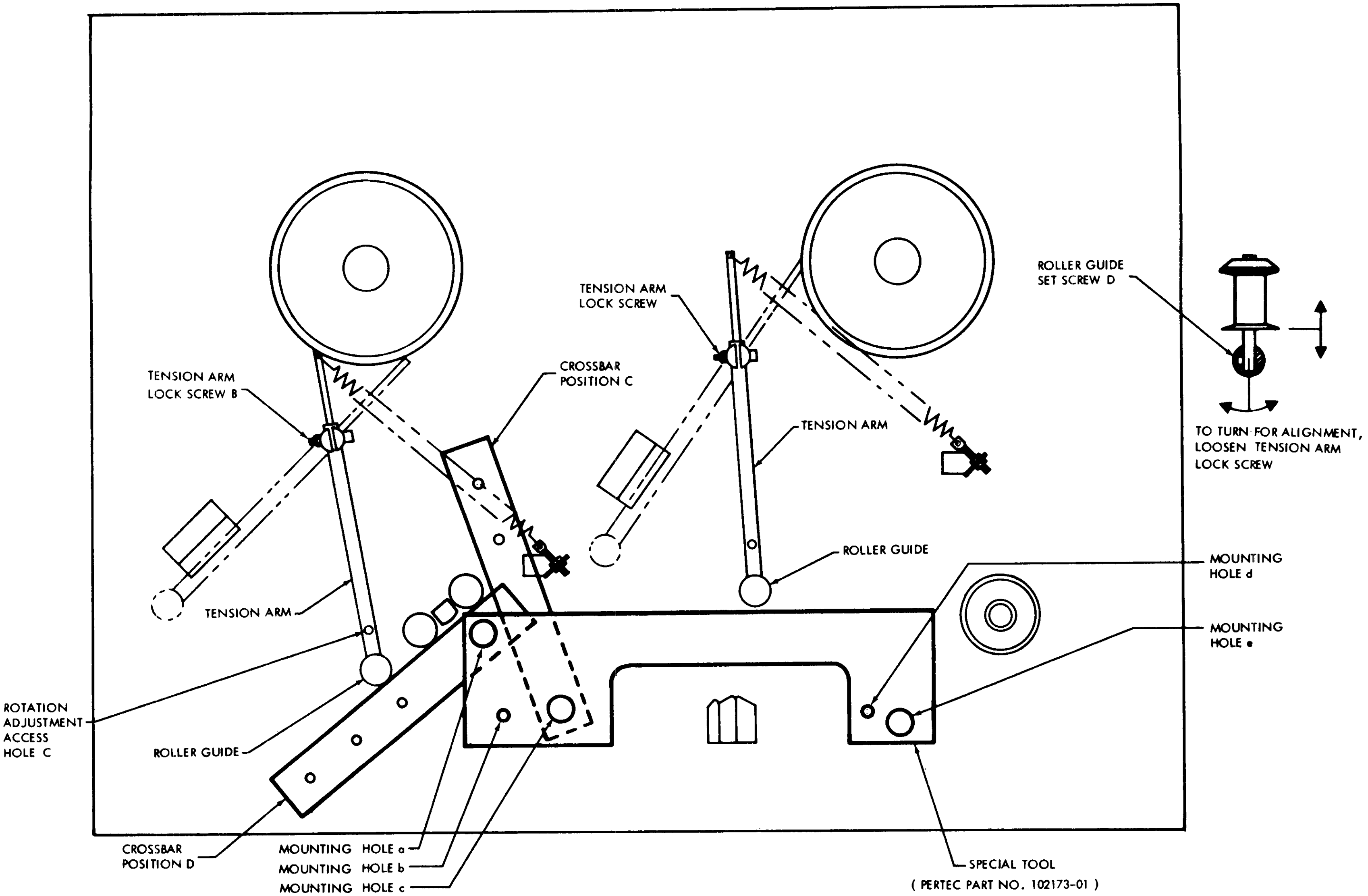


Figure 6-4. Supply Guide Roller Alignment

6.7.13.2 Supply Guide Roller Height Adjustment

If the supply guide roller check performed in Paragraph 6.7.13.1 indicates that a height adjustment is required, proceed as follows.

(1) With the crossbar placed as in Step (3), Paragraph 6.7.11.1, and the guide roller still positioned away from the end stop, loosen supply guide roller set-screw "D" located on the supply tension arm (see Figure 6-4).

(2) Center the guide roller flanges on the crossbar.

(3) When height is established, tighten supply guide roller set-screw "D".

6.7.13.3 Supply Guide Roller Parallelism Check

(1) Perform Supply Guide Roller Height Check and Adjustment procedures detailed in Paragraphs 6.7.13.1 and 6.7.13.2, respectively.

(2) With the crossbar installed as described in Paragraph 6.7.13.1, observe an equal, but minimal, space between the flat (tape) area of the supply roller and the bottom (narrow surface) of the crossbar.

(3) If the space is unequal from edge to edge, or it is greater at one end, an adjustment between the two surfaces is required.

6.7.13.4 Supply Guide Roller Parallelism Adjustment

If the supply guide roller parallelism guide check performed in Paragraph 6.7.13.3 indicates that an adjustment is required, proceed as follows.

(1) Engage an Allen wrench in the head of tension arm lock-screw "B" (Figure 6-4) and, by using an open end wrench,

loosen tension arm lock-nut. Loosen the lock-nut so that the tension arm can be rotated by inserting a suitable rod or tool into rotation adjustment through hole "C" in the tension arm.

(2) Rotate the tension arm until the face of the guide roller and the narrow crossbar surface ara parallel. Test by observing an equal, but minimum, amount of light between the two adjacent surfaces.

(3) Recheck height of guide roller.

(4) Tighten tension arm lockscrew "B" to a setting of 25 in/lbs nominal.

6.7.13.5 Supply Reel Flange Centering Check and Adjustment

Install the tape path alignment tool as described in Paragraph 6.7.13.1, Steps (1) through (4).

(1) Remove the crossbar and retaining thumbscrew.

(2) Place an empty tape reel onto the supply hub.

(3) Install the crossbar with thumbscrew through mounting hole "C". Use threaded screw holes at either end of crossbar.

(4) Swing crossbar into place between the flanges of the supply reel as shown in Figure 6-4, position "C". Tighten thumbscrew finger tight.

(5) With crossbar secured in place, observe centering of the narrow surfaces of the crossbar between the supply reel flanges.

(6) If one surface of the crossbar is closer to the edge of the reel flange than the other, center the reel by loosening the two reel hub retaining screws located on the supply reel hub. Equalize flange to crossbar distances and retighten the hub screws.

6.7.13.6 Reassembly

After supply adjustments have been completed, the following operations are performed.

(1) Clean and install guide caps, overlay, and trim.

(2) Make a general inspection of tape deck to ensure that all items removed or disconnected are in place and ready to function.

6.7.13.7 Care of Alignment Tool

For storage, assemble crossbar to U-frame using thumbscrews through mounting holes "C" and "D". Both thumbscrews will engage with threaded holes at each end of the crossbar.

The third thumbscrew should be threaded into one of the threaded holes on the crossbar for storage.

6.7.14 REEL SERVO BELT TENSION

The toothed belts that couple the motors to the reel hubs must have sufficient tension to prevent the teeth from skipping or servo instability due to backlash. The belts must not have excessive tension as this will cause overloading of the motor or reel shaft bearings in the radial direction. The belt tension can be adjusted as follows.

(1) Loosen the three screws that fasten the motor mounting plate to the deck standoffs.

NOTE

The slots in the motor mounting plate allow motion of the motor in the line of action of belt tension.

(2) Adjust the pulley so that the timing belt is snug. Note the last belt tooth that is completely seated in a slot on the large pulley (refer to Figure 6-5).

(3) Count two to three teeth from the last engaged tooth. Hold the large pulley to ensure that it does not turn. Depress the toothed belt at the point between the second and third teeth with sufficient force to deflect the belt flush against the gear.

CAUTION

DO NOT APPLY EXCESSIVE FORCE ON THE TOOTHED BELT.

(4) Adjust the drive motor assembly so that the second tooth is firmly engaged in a slot on the large pulley, but the third belt tooth is not engaged.

(5) Tighten the three screws on the motor mounting plate and recheck for the condition in Step (2).

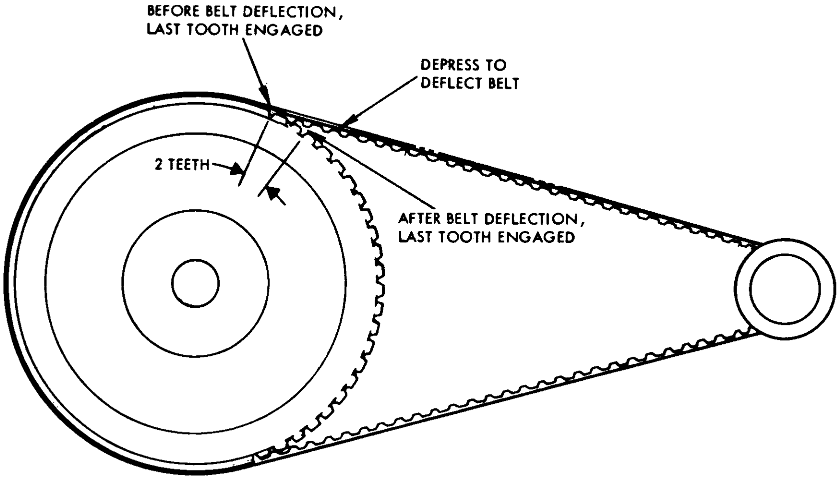


Figure 6-5. Reel Servo Belt Tension Adjustment

6.7.15 TAPE TENSION ADJUSTMENT

Tape tension is controlled by the spring attached to each of the tension arms. The tension is adjusted by means of the anchor screws. Figure 6-6 shows the measurement and the adjustment of the supply tape tension. A 2-foot length of tape with loops at each end is used and, after moving the trim as described in Paragraph 6. 7. 9, tape is mounted as shown. A 1-pound force gauge is used to measure tape tension. Care must be taken to zero the scale in the correct orientation of the gauge and to pull on the tape in the direction shown. The anchor screw is adjusted until the tension is 8 ounces with the arm in the center of its operating region.

Figure 6-7 shows the measurement and adjustment of the take-up tape tension. Using the same piece of tape mounted as shown, with the gauge zeroed against the correct orientation, the anchor screw is adjusted until tape tension is 8 ounces with the arm in the center of its operating region.

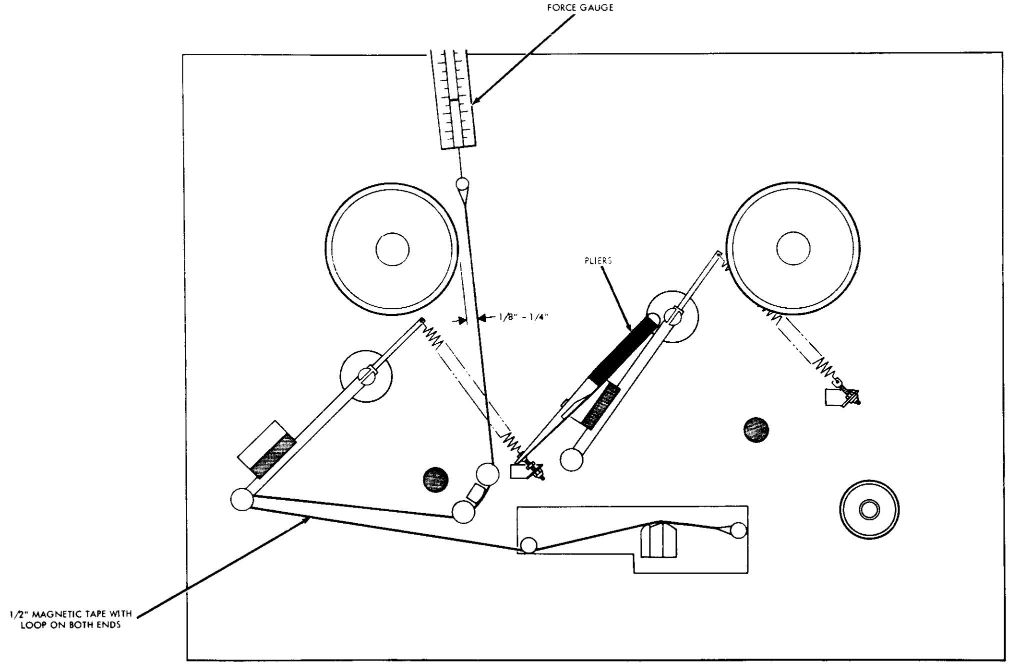


Figure 6-6. Supply Tape Tension Adjustment

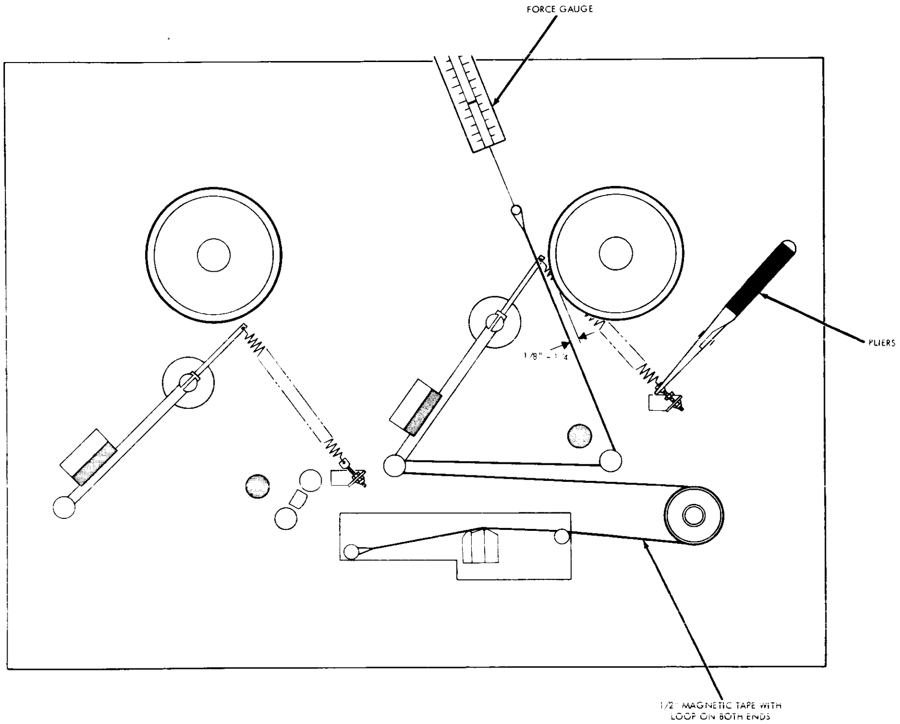


Figure 6-7. Take-up Tape Tension Adjustment

6.8 MAINTENANCE TOOLS

The following list of tools is required to maintain the tape transport.

(1) Hex socket keys for 5/32, 1/8, 3/32 set screws, and a splined drive socket key for a 4-40 set screw.

(2) Open-end wrenches for 3/16- 1/4, 5/16-, and 3/8-inch bolts.

(3) Long-nose pliers.

(4) Phillips screwdriver set.

(5) Standard blade screwdriver set.

(6) Soldering aid.

(7) Soldering iron.

(8) One-pound force gauge.

(9) Lint-free cloth.

(10) Cotton swabs.

(11) Isopropyl alcohol or DuPont Freon TF.

(12) Torque wrench, 0 - 35 in/lbs.

(13) PERTEC Part No. 102173-01 Tape Path Alignment Tool (tension arm guide alignment).

(14) PERTEC Part No. 101137 Arm Movement Measuring Tool (take-up arm adjustment).

(15) Molex pin extractor.

(16) Vlier, spring plunger wrench VW-52.

6.9 TROUBLESHOOTING

Table 6-6, System Troubleshooting chart, provides a means of isolating faults, possible causes, and remedies. The troubleshooting chart is used in conjunction with the schematics and assembly drawings in Section VII.

Table 6-7

System Troubleshooting

Symptom	Probable Cause	Remedy or Test	Reference
Tape does not tension and the capstan rotates freely when the LOAD control is depressed for the first time after threading tape.	Interlock relay K1 does not close.	Check relay operation. Replace if necessary. If relay is inoperative, check collector voltage of relay driver transistor (Q56 on Servo/ Power PCBA or Q54 on Servo/ Power "B" PCBA) with LOAD control depressed. It should be <+1v; if not, observe J9-6 on Servo/ Power PCBA. It should switch from 0v to +5v when LOAD control is depressed. If so, fault is relay driver component. Otherwise, fault is LOAD control switch or interconnect cable between J9s on Tape Control and Servo/Power PCBAs.	Paragraph 5.5.1.1 5.5.2.1
Tape is tensioned when the LOAD control is depressed, but tension is lost when control is released.	Limit switch inoperative.	Adjust or replace if necessary.	Paragraph 6.7.1
	Relay latching contacts 9 and 10 do not make.	Check that voltage at J9-7 goes to +5v when LOAD control is depressed.	Paragraph 5.5.1.1 5.5.2.1
Tape unwinds or tension arm hits stop when LOAD control is depressed for the first time.	Tape is threaded improperly.	Rethread tape.	Paragraph 3.3
	Optical shutter on tension arm is loose.	Adjust for correct arm swing and tighten to 35 in-lb.	Paragraph 6.7.2 or 6.7.3

Table 6-7

System Troubleshooting (Continued)

Symptom	Probable Cause	Remedy or Test	Reference
Tape unwinds or tension arm hits stop when LOAD control is depressed for the first time (Continued)	Fault in tension arm sensor.	Observe TP8 (take-up) or TP16 (supply) on Servo/Power PCBA while moving the tension arm. Voltage should move from approximately +2.5v to -2.5v as tension arm is moved upward.	Paragraph 6.7 through 6.7.3.3, 5.4.1 through 5.5.2.1
	Fault in reel servo amplifier.	Check that movement of reels is in response to tension arm position without tape on the transport. (Hold LOAD control depressed.)	Paragraph 6.7 through 6.7.3.3, 5.4.1 through 5.5.2.1
	Fault in capstan servo amplifier.	Check that capstan is not in motion when LOAD control is depressed without tape on the transport.	Paragraph 5.4.1 through 5.5.2.1
Transport loses tape tension when LOAD control is depressed for the second time.	Supply tension arm is moving past switching point of limit switch.	Check that limit switch action is adjusted properly. If adjustment is correct, adjust R72 on Servo/Power PCBA clockwise (R81 on Servo/Power "B" PCBA - counterclockwise) until tape tension can be maintained.	Paragraph 6.7.2 or 6.7.3, 5.4.1 through 5.5.2.1
		Readjust supply tension arm swing.	Paragraph 6.7 through 6.7.15
Tape tension is not maintained between capstan and take-up reel when LOAD control is depressed for the second time.	Take-up tension arm is moving to lower stop.	Check that optical shutter has not moved. Readjust R30 on Servo/Power PCBA (R32 on Servo/Power "B" PCBA) for correct take-up arm swing.	Paragraph 6.7.2 or 6.7.3, 5.4.1 through 5.5.2.1

Table 6-7

System Troubleshooting (Continued)

Symptom	Probable Cause	Remedy or Test	Reference
Transport does not respond to second LOAD command.	Capstan servo not receiving ramp command.	Check that SPEED (option) plug on Tape Control PCBA is installed. Check TP3 on Servo/Power PCBA for positive ramp input. Check TP14 on Tape Control PCBA for positive ramp to +5v. Check TP16 on Tape Control PCBA for switching from +5v to 0v on second LOAD command.	Paragraph 5.4.1
Tape does not stop at BOT and/or EOT marker tab.	Photo-tab dirty.	Clean or replace.	Paragraph 6.7.8
	Photosensor.	Check that light source is illuminated. Check TP2 (BOT) or TP1 (EOT) on EOT/BOT Amplifier PCBA for +1.6v with the appropriate tab under photosensor.	Paragraph 6.6.6
	Photosensor amplifier.	Check that voltages above switch to approximately +4v as tab is moved from under photosensor. Readjust if necessary R9 (BOT) or R3 (EOT) on EOT/BOT Amplifier PCBA.	Paragraph 6.6.6
	Tape Control not receiving photo-tab command.	Check U16-9 (BOT) or U13-13 (EOT) on Tape Control PCBA for switching from approximately +3.5v to 0v as tab is moved under photosensor.	Paragraph 5.4.1
	Logic fault.	Check U21-6 on Tape Control PCBA for reset command (0v) as BOT tab is moved under photosensor. Check U3-4 on Tape Control PCBA for reset command (0v) as EOT tab is moved under photosensor.	Paragraph 5.4.1

Table 6-7

System Troubleshooting (Continued)

Symptom	Probable Cause	Remedy or Test	Reference
Tension arm oscillates when tape motion ceases.	Tension arm movement is restricted by servo amplifier adjustment.	Readjust tension arm swing to correct limits.	Paragraph 6.7.2 or 6.7.3
Capstan creeps slowly when tape is tensioned.	Accumulation of dc offset errors in ramp generator and capstan servo amplifier.	Remove SPEED (option) plug. If creeping stops, fault is in ramp generator. Check U17 on Tape Control PCBA for static dc offset. Check Q901 and Q902 for balance. If creeping remains with SPEED (option) plug removed, fault is in capstan servo amplifier. Check U1-B on Servo/Power PCBA for static dc offset. Also check Q3 and Q4 in capstan servo amplifier.	Paragraph 5.4, 5.4.1, 5.5.1.1 or 5.5.2.1
	Ineffective grounding through interconnecting cables.	Measure potential difference between TP7 RAMP GEN GND on Tape Control PCBA and the left end of C6 (nearest the heatsink) on Servo/Power PCBA or TP19 GND (below TP3) on Servo/Power "B" PCBA. If 25mv, check J9-2 connections on Tape Control and Servo/Power PCBAs.	Paragraph 5.4.1
Tape tensions and moves normally at forward or reverse speed in response to depressing LOAD control only once.	Logic fault.	Check TP3 on Servo/Power PCBA for presence of forward or reverse ramp. Check test points 16, 17, 20, 22, and 24 on Tape Control for source of faulty command. If none, check Q901 and Q902 on Tape Control PCBA for shorts.	Paragraph 5.4

Table 6-7

System Troubleshooting (Continued)

Symptom	Probable Cause	Remedy or Test	Reference
Tape tensions and moves normally at rewind speed in response to depressing LOAD control only once.	Logic fault.	Check TP2 on Servo/Power PCBA for presence of rewind ramp (-5v). Check Q802 for short and Q801 for open on Tape Control PCBA. Check TP8 on Tape Control for faulty rewind ramp command (0v) from rewind flip-flops U26 and U24-B.	Paragraph 5.4
Tape loads normally but transport does not respond to manual FORWARD and/or REVERSE commands.	Logic fault.	Check CR904 (forward) and/or CR901 (reverse) for open. Check TP17 (forward) and/or TP24 (reverse) for switching from +5v to 0v when switch is depressed.	Paragraph 5.4
	Switch inoperative.	Check U4-5 (forward) and/or U4-1 (reverse) on Tape Control PCBA for switching from +5v to 0v when switch is depressed.	Paragraph 5.4
Transport does not respond to REWIND command.	Rewind ramp generator.	Check Q802 for open, Q801 for for short, CR801 and CR802 on Tape Control PCBA.	Paragraph 5.4
	Logic fault.	Check TP8 on Tape Control PCBA for presence of rewind command (0v) when REWIND control is depressed after completing load sequence.	Paragraph 5.4
	Switch inoperative.	Check U20-5 on Tape Control PCBA for switching from +5v to 0v when switch is depressed.	Paragraph 3.4

Table 6-7

System Troubleshooting (Continued)

Symptom	Probable Cause	Remedy or Test	Reference
Transport does not respond to ISFC (Interface Synchronous Forward Command) or ISRC (Interface Synchronous Reverse Command).	Transport is off-line.	Check that ON LINE indicator is illuminated. Check U15-6 for false (0v) level.	Paragraph 3.4
	Transport is not selected.	Check TP18 on Tape Control PCBA for true (+5v) level.	Paragraph 3.4
	Transport is not ready.	Check TP10 on Tape Control PCBA for false (0v) level.	Paragraph 3.4
	Ramp generator logic.	Check TP20 (forward) and/or TP22 (reverse) on Tape Control PCBA for low-true (0v) level during the appropriate commands. Check CR902 and CR903 on Tape Control PCBA for open.	Paragraph 5.4
No data output (NRZI or PE modes)	Head improperly connected.	Check for correct head connection.	Figure 4-1
	Faulty head switching circuit.	Check selected head center taps for greater than +8v dc bias.	Paragraph 5.2
	No motion command.	Check Tape Control or interconnect cable. Motion command will not be generated unless TP11 (NMOT) on Tape Control is grounded.	Paragraph 5.4
	Defective power supply.	Check test points on Power and Servo PCBA.	Paragraph 6.6.3 or 6.6.4

Table 6-7

System Troubleshooting (Continued)

Symptom	Probable Cause	Remedy or Test	Reference
No data output (NRZI mode)	Excessively high threshold voltage.	Check TP4 and TP5 on Tape Control PCBA for 600 or 300 millivolts ±5%.	Paragraph 6.6.14
	Jumpers A1 and A2 or Deskew PCBA not connected.	Connect as required.	Figure 4-1.
	Transport in PE mode.	Switch to NRZI mode.	Table 6-6.
	Faulty character gate.	Check TP1 and TP2, and TP105 through TP905 on Tape Control PCBA.	Paragraph 6.6.15
No data output (PE mode)	Excessively high threshold voltage.	Check TP7 for less than +300 millivolts.	Paragraph 6.6.14.1 through 6.6.14.4
	Transport in NRZI mode.	Switch to PE mode.	Table 6-6.
	3-volt supply out.	Check TP8 for +3.0 ±0.3v dc.	Paragraph 5.2
Excessive data errors (NRZI mode)	Incorrect preamplifier gains.	Check TP101 through TP901 for 6.0 ±0.6v peak-to-peak at 800 cpi.	Paragraph 6.6.14 through 6.6.14.4
	Incorrect threshold	Check TP4 and TP5 for 600 or 300 millivolts ±5%.	Paragraph 4.3.4.1, 5.2, Figure 4-13, 4-14.
	Defective differentiator.	Check TP102 through TP902 for 4.0 +2v -1v peak-to-peak at 800 cpi.	Paragraph 4.3.4.1, 5.2, 6.6.12.2, Figure 4-13, 4-14
	Faulty voltage comparator.	Check TP103 through TP903 and TP104 through TP904 for negative-going pulses.	Figure 4-13, 4-14

Table 6-7

System Troubleshooting (Continued)

Symptom	Probable Cause	Remedy or Test	Reference
Excessive data errors (NRZI mode) (cont'd)	Defective gate.	Check TP105.	Figure 4-13, 4-14
	Excessive skew.	Check TP10 on 6X11 transports, or TP4 on Deskew PCBA on 6X12 transports, for less than 150 μinches total.	Paragraph 6.7.5
	Dirty tape path.	Clean head, guides, capstan, and tape cleaner.	Paragraph 6.4
	Incorrect mode.	Select correct mode.	Table 6-6.
	Incorrect tape speed.	Check encoder.	Paragraph 6.6.10 through 6.6.10.8
	Incorrect ramp timing.	Check TP14 on Tape Control PCBA.	Paragraph 6.6.9 through 6.6.9.4
	Incorrect character gate period.	Check character gate adjustments for desired mode (TP1 and TP12).	Paragraph 6.6.15 through 6.6.15.4
	Low threshold selected.	Disconnect P102 for check.	Paragraph 4.3.4.2, 5.2.1
	Long character gate.	Disconnect P102 for check.	Paragraph 4.3.4.2, 5.2.1
Excessive data errors (PE modes).	Incorrect mode.	Select 9 TRACK and HI DEN.	Table 6-6.
	Incorrect tape speed.	Check encoder.	Paragraph 6.6.10 through 6.6.10.8
	Incorrect ramp timing.	Check TP14 on Tape Control PCBA.	Paragraph 6.6.9 through 6.6.9.4

Table 6-7

System Troubleshooting (Continued)

Symptom	Probable Cause	Remedy or Test	Reference
Excessive data errors (PE mode) (cont'd)	Incorrect threshold.	Check TP7 for less than +300 millivolts and greater than +100 millivolt.	Paragraph 4.3.4.3, 5.2.1
	Incorrect 3-volt supply.	Check TP8 for +3.0 ±0.3v dc.	Paragraph 5.2.1
	Incorrect preamplifier gains.	Check TP102 through TP902 for 2.0v to 6.0v peak-to-peak.	Paragraph 6.6.13, through 6.6.13.5
	Faulty voltage comparator.	Check TP103 through TP903 and TP104 through TP904.	Paragraph 4.3.4.3, 5.2.1, Figure 4-13, 4-15
	Incorrect envelope	Check signal side of C116 through C916 for correct time constants.	Paragraph 4.3.4.3, 5.2.1, Figure 4-13, 4-15
	Character gate enabled.	Check TP2 for 0v ±0.5v.	Paragraph 4.3.4.3, 5.2.1
	Dirty tape path.	Clean head, guides, capstan, and tape cleaner.	Paragraph 6.4
	Low threshold.	Disconnect P102 for check.	Paragraph 4.3.4.3. 5.2.1

SECTION VII

SCHEMATICS, PARTS LISTS, LOGIC LEVELS AND WAVEFORMS

7.1 INTRODUCTION

This section includes the schematics, assembly drawings, parts lists, and logic level and waveform definitions.

7.2 SPARE PARTS

Table 7-1 provides a description of the spare parts. The Customer should always include model number and serial number of the transports when ordering replacement parts.

7.3 PART NUMBER CROSS REFERENCE

Table 7-2, Part Number Cross Reference, provides a cross reference to manufacturer part numbers from PERTEC part numbers.

7.4 LOGIC LEVELS AND WAVEFORMS

The transport control and interface logic uses the DTL800 series of logic elements. Logic levels are defined as follows.

+5v	logical true
+0.4v	logical false

All basic waveform names are chosen to correspond to the logical true condition, e.g., SET WRITE STATUS (SWS) enables the write circuits when it is logically true (+5v), or disables the write circuits when it is logically false (0v).

The inverse of a waveform is denoted by the prefix "N". Therefore, NBOT will be 0.4v when the BOT tab is under the photosense head, or +5v otherwise.

All interface lines connecting the transport to the controller are prefixed by "I". Each line must be terminated at the receiver end of the cable by a 220/330-ohm divider chain between +5v and 0v.

All interface waveforms are low-true with logic levels as follows.

+3v	logical false
0.4v	logical true

For example, ISFC (SYNCHRONOUS FORWARD command) will be 0.4v when the transport is being driven in the forward direction, or +3v otherwise.

The Glossary contains the waveform mnemonics referred to in this manual.

Table 7-1

Spare Parts List

1.	Fixed Guide Assembly	101026-01
2.	Roller Guide Assembly	100808-01
3.	Hub, up to and Including 37.5 ips	100792-01
	45 ips	102761-02
4.	Grip Ring, Reel Retainer, Take-up and Supply Hubs	
	(for 100792-01 Hubs)	100117-01
	(for 102761-02 Hubs)	102277-01
5.	Tension Arm Sensor	100858-02
6.	Photo-Tab Sensor	100807-02
7.	Reel Servo Motor	101004-01
8.	Capstan	100562-01
9.	Capstan Drive Assembly	101073-01
10.	Strobe Disk, 12.5/25 ips	101744-02
	18.75/37.5 ips	101744-03
	20.0/40.0 ips	101744-04
	22.5/45.0 ips	101744-05
	24.0 ips	101744-06
	30.0 ips	101744-07
11.	Tape Cleaner	100811-01
12.	Magnetic Head, 7-track NRZI	510-5287
	9-track NRZI	510-5289
	9-track NRZI/PE	510-5469
	7/9-track NRZI/PE	510-8179
13.	Tape Control C2 PCBA	101882-*
14.	Data K PCBA	101887-*
15.	Deskew A PCBA	101892-*
16.	Servo and Power Supply - A PCBA	101021-*
	- B PCBA	101262-*
17.	EOT/BOT Amplifier PCBA	101949-01
18.	Servo Drive Belt	610-0007
19.	Door Latch	615-4410
20.	Front Door Assembly	101090-01-**
21.	Controls Assembly	
	(a) LOAD (Horizontal Marking)	505-1803
	(Vertical Marking)	505-1814
	(b) ON LINE (Horizontal Marking)	505-1804
	(Vertical Marking)	505-1815
	(c) REWIND (Horizontal Marking)	505-1805
	(Vertical Marking)	505-1816
	(d) 9 TRACK (Horizontal Marking)	505-1830
	(Vertical Marking)	505-1834
	(e) HI DEN (Horizontal Marking)	505-1807
	(Vertical Marking)	505-1818
	(f) FORWARD (Horizontal Marking)	505-1828
	(Vertical Marking)	505-1832
	(g) REVERSE (Horizontal Marking)	505-1829
	(Vertical Marking)	505-1833
22.	POWER Control (Horizontal Marking)	505-1801
	(Vertical Marking)	505-1812
23.	Fuse, 3AG, 5 Amp, SB	663-3550
	3 Amp, SB	663-3530
24.	Fuse, 3AG, 10 Amp, FB	663-3100
25.	Relay, 4PDT, 12v, 3 Amp	502-1242
26.	Microswitch	506-6360

*Specify version as detailed on schematic.

**Specify logo.

Table 7-2

Part Number Cross Reference

PERTEC Part Number	Manufacturer (or equivalent)	Description or Part Number*
Carbon Comp. Resistors		
100 - 1525	Allen Bradley, Speer	RC07 (1500 ohms, 5%, 1/4 watt)
101 - 1525		RC20 (1500 ohms, 5%, 1/2 watt)
102 - 1525		RC32 (1500 ohms, 5%, 1 watt)
103 - 1525		RC42 (1500 ohms, 5%, 2 watts)
Precision Resistor		
104 - 2612	Corning, IRC	RL20C, (26, 100 ohms, 1%, 1/4 watt)
Variable Resistors		
Multi-turn		
121 - 1010	Beckman Helipot	79PR100, (100 ohms, 10%, 3/4 watt)
Single turn		
122 - 5020	Spectrol	53-1-1-502 (5000 ohm, 10%, 1/2 watt)
Dipped Mica Capacitors		
130 - 1515	El Menco	CM05CJ03 (150 picofarads, 500 volts, 5%)
Mylar Capacitors		
131 - 1540	Cornell - Dubilier	WMF1P15 (0.15 µfarads, 100 volts, 10%)
Solid Tantalum Capacitors		
132 - 2752	Kemet	TK2R7W35 (2.7 µfarads, 35 volts, 20%)

*For resistors and capacitors typical part numbers only are shown.

Table 7-2

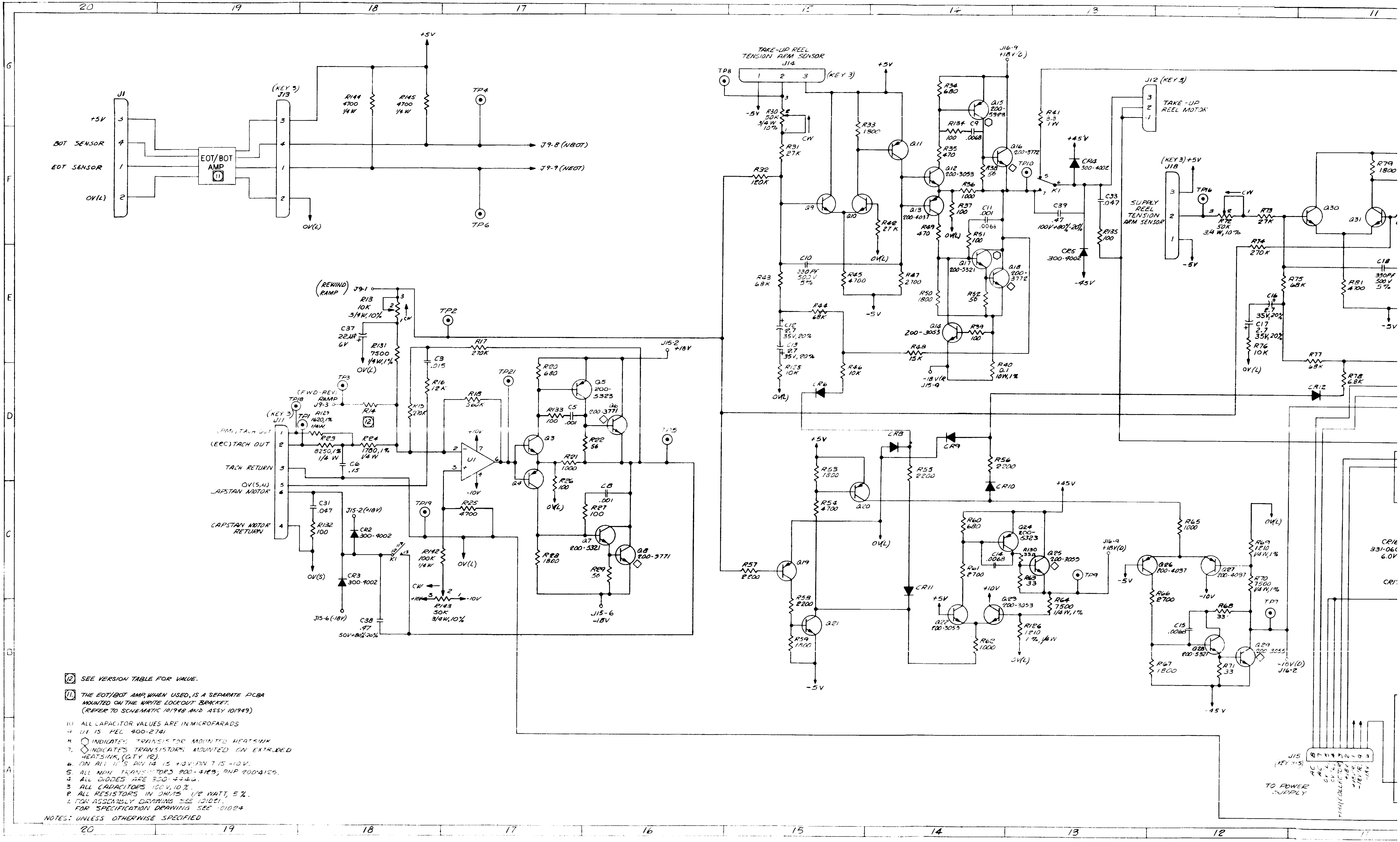
Part Number Cross Reference (continued)

PERTEC Part Number	Manufacturer (or equivalent)	Description or Part Number*
Aluminum Electrolytic Capacitors		
133 - 7060	Mallory	MTA70E20 (70 μfarads, 20 volts -10 +100%)
Transistors		
200 - 4123	Motorola	2N4123 (NPN switching)
200 - 4125	Motorola	2N4125 (PNP switching)
200 - 3053	RCA	2N3053 (NPN, T05, medium power)
200 - 5321	RCA	2N5321 (NPN, T05)
200 - 5323	RCA	2N5323 (PNP, T05)
200 - 4037	RCA	2N4037 (PNP, T05, medium power)
200 - 3771	RCA	2N3771 (NPN T03)
200 - 3772	RCA	2N3772 (NPN T03)
200 - 3055	RCA	2N3055 (NPN, T03, power)
204 - 4393	Motorola	2N4393 (FET, T0-18)
Diodes		
300 - 4002	Motorola	1N4002
300 - 4446	TI	1N4446 (logic diode)
Rectifier Bridge		
320 - 9622	Motorola	MDA 962-2 (100 volts, 10 amps)

Table 7-2

Part Number Cross Reference (continued)

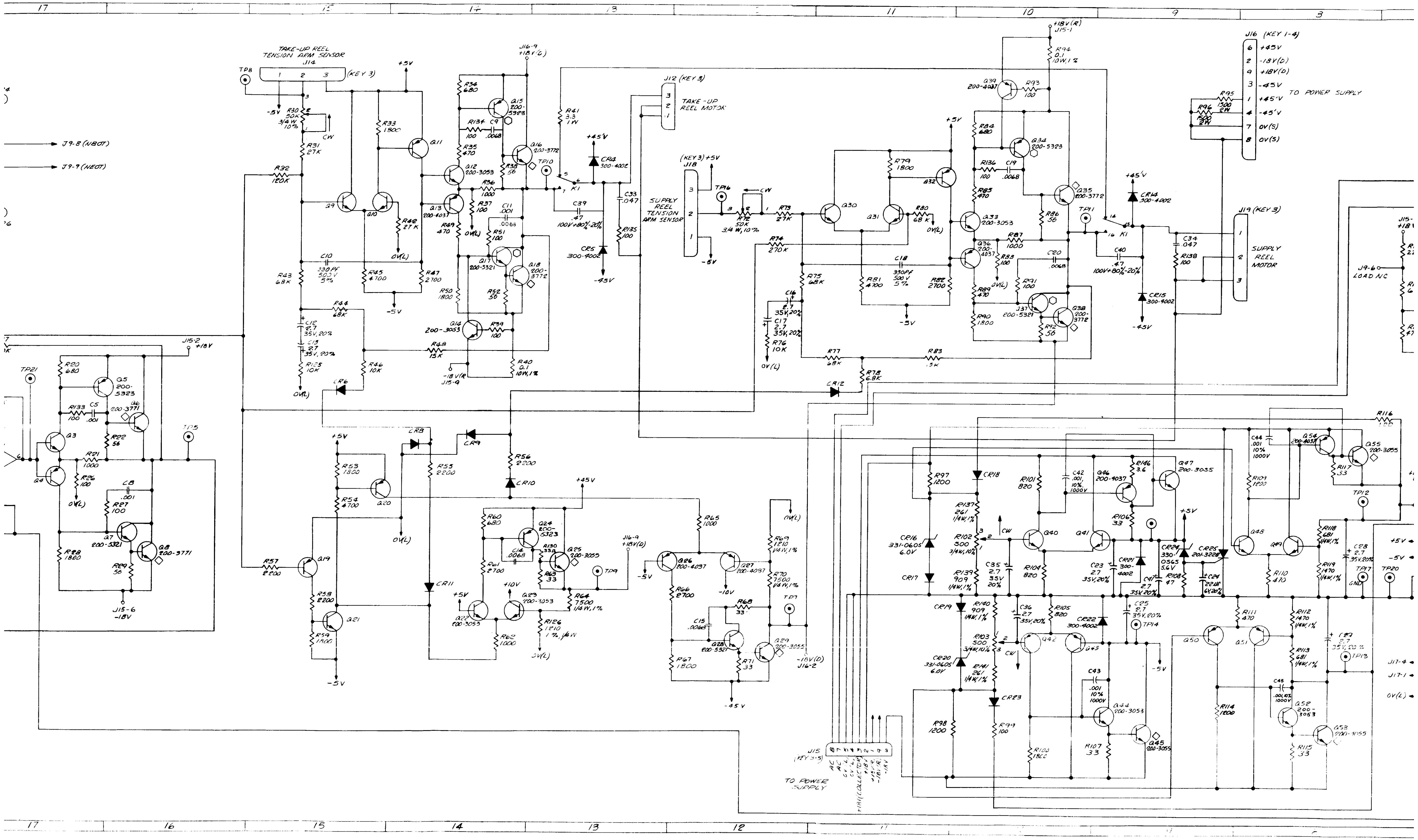
PERTEC Part Number	Manufacturer (or equivalent)	Description or Part Number*
Zener Diodes		
330 - 0685	Motorola	1N4736A (6.8 volts, 5%)
Operational Amplifier		
400 - 1437	Motorola	MC1437L
Digital IC		
700 - 8360	Motorola	MC836P
700 - 8440	Motorola	MC844P
700 - 8450	Motorola	MC845P
700 - 8460	Motorola	MC846P
700 - 8530	Motorola	MC853P
700 - 4121	TI	SN74121N
700 - 5107	TI	SN75107N

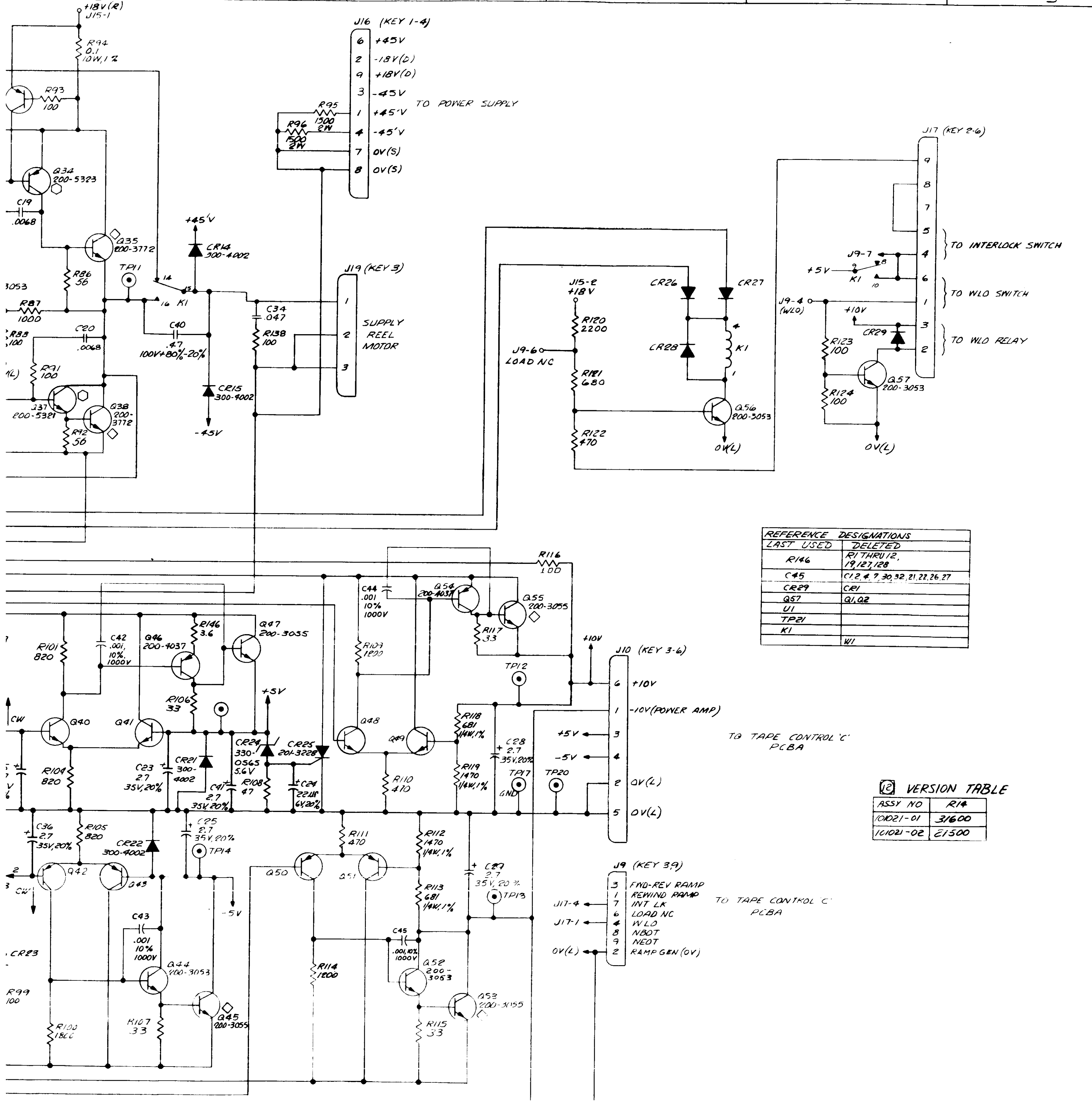


12 SEE VERSION TABLE FOR VALUE.

11. THE EOT/BOT AMP, WHEN USED, IS A SEPARATE PCBA MOUNTED ON THE WRITE LOCKOUT BRACKET. (REFER TO SCHEMATIC 101948 AND ASSY 101949)

10 ALL CAPACITOR VALUES ARE IN MICROFARADS
9 U1 IS PEC 400-2741
8 ⬡ INDICATES TRANSISTOR MOUNTED HEATSINK
7. ◇ INDICATES TRANSISTORS MOUNTED ON EXTRUDED HEATSINK, (QTY 12).
6. ON ALL IC'S PIN 14 IS +10V; PIN 7 IS -10V.
5. ALL NPN TRANSISTORS 200-4123; PNP 200-4125.
4. ALL DIODES ARE 300-4446.
3. ALL CAPACITORS 100V, 10%.
2. ALL RESISTORS IN OHMS 1/2 WATT, 5%.
1. FOR ASSEMBLY DRAWING SEE 101021.
FOR SPECIFICATION DRAWING SEE 101024.
NOTES: UNLESS OTHERWISE SPECIFIED


17
15
14
13
11
10
9
8
TAKE-UP REEL
TENSION ARM SENSOR
J14
(KEY 3)
TP8
+5V
J16-9
+18V(L)
R30 50K 3/4W 10%
CW
-5V
J9-8 (NBOT)
J9-9 (NEOT)
R31 27K
R32 120K
R33 1800
R34 680
Q15 200-5323
Q11
Q9
Q10
R42 27K
0V(L)
R134 100
C9 .0068
R35 470
Q12 200-3053
Q16 200-3772
R38 56
R36 1000
Q13 200-4037
R37 100
R49 470
C11 .001
R51 100
Q17 200-5321
Q18 200-3772
R43 68K
C10 330PF 500V 5%
R45 4700
R47 2700
R50 1800
R52 56
R44 68K
C12 2.7 35V,20%
C13 2.7 35V,20%
R125 10K
R46 10K
R48 15K
Q14 200-3053
R39 100
R40 0.1 10W,1%
-18V(R)
J15-9
TP10
K1
R41 3.3 1W
+45V
CR4 300-4002
C39 .47 100V+80%-20%
CR5 300-4002
-45V
C33 .047
R135 100
J12 (KEY 3)
TAKE-UP REEL MOTOR
(KEY 3) +5V
J18
SUPPLY REEL TENSION ARM SENSOR
TP16
R72 50K 3/4W,10%
R73 27K
R74 270K
Q30
Q31
R80 68K
R79 1800
Q32
R81 4700
C18 330PF 500V 5%
R82 2700
R75 68K
C16 2.7 35V,20%
C17 2.7 35V,20%
R76 10K
R77 68K
R83 .5K
R78 6.8K
CR12
CR6
+18V(R)
J15-1
R94 0.1 10W,1%
Q39 200-4037
R93 100
R84 680
Q34 200-5323
R136 100
C19 .0068
Q35 200-3772
R85 470
Q33 200-3053
R86 56
R87 1000
Q36 200-4037
R88 100
C20 .0068
R89 470
R91 100
Q37 200-5321
Q38 200-3772
R90 1800
R92 56
TP11
C40 .47 100V+80%-20%
CR14 300-4002
CR15 300-4002
C34 .047
R138 100
J19 (KEY 3)
SUPPLY REEL MOTOR
J9-6
LOAD NC
J16 (KEY 1-4)
6 +45V
2 -18V(D)
9 +18V(D)
3 -45V
1 +45'V
4 -45'V
7 0V(S)
8 0V(S)
R95 1500 2W
R96 1500 2W
TO POWER SUPPLY
J15-2 +18V
TP21
R20 680
Q5 200-5323
Q6 200-3771
R133 100
C5 .001
R22 56
Q3
Q4
R21 1000
R26 100
C8 .001
R27 100
Q7 200-5321
Q8 200-3771
R28 1800
R29 56
J15-6 -18V
TP5
CR8
CR9
R56 2200
CR10
+5V
R53 1800
R55 2200
Q20
R54 4700
R57 2200
Q19
R58 2200
Q21
R59 1800
CR11
+45V
R60 680
Q24 200-5323
C14 .0068
R130 33
Q25 200-3055
R61 2700
R63 33
TP9
+10V
Q22 200-3053
Q23 200-3053
R64 7500 1/4W,1%
R62 1000
R126 1210 1% 1/4W
J16-9 +18V(D)
R65 1000
Q26 200-4037
Q27 200-4037
-10V
R66 2700
R68 33
C15 .0068
Q28 200-5321
R67 1800
R71 33
Q29 200-3055
R69 1210 1/4W,1%
R70 7500 1/4W,1%
TP7
-18V(D)
J16-2
J15 (KEY 3-5)
AC AC 0V(L) 0V(L) +18V(COLLECTOR) +18V +15V(R) -18V(R) -18V
TO POWER SUPPLY
R97 1200
CR18
R137 261 1/4W,1%
R101 820
C42 .001 10% 1000V
Q46 200-4037
R146 3.6
Q47 200-3055
CR16 331-0605 6.0V
R102 500 3/4W,10%
CW
Q40
Q41
R106 33
CR17
C35 2.7 35V 20%
R104 820
C23 2.7 35V,20%
CR21 300-4002
CR24 330-0565 5.6V
CR25 201-3228
R108 47
C24 22μF 6V,20%
R139 909 1/4W,1%
C47 2.7 35V,20%
CR19
R140 909 1/4W,1%
C36 2.7 35V,20%
R105 820
CR22 300-4002
C25 2.7 35V,20%
TP14
R103 500 3/4W,10%
Q42
Q43
CR20 331-0605 6.0V
R141 261 1/4W,1%
CR23
C43 .001 10% 1000V
Q44 200-3053
Q45 200-3055
R98 1200
R99 100
R100 1800
R107 33
C44 .001 10% 1000V
Q54 200-4037
Q55 200-3055
R117 33
R116 100
R109 1200
TP12
Q48
Q49
R118 681 1/4W,1%
C28 2.7 35V,20%
R110 470
R119 1470 1/4W,1%
TP17 GND
TP20
R111 470
R112 1470 1/4W,1%
Q50
Q51
C27 2.7 35V,20%
R113 681 1/4W,1%
TP13
C45 .001,10% 1000V
R114 1200
Q52 200-3053
Q53 200-3055
R115 33
+5V
-5V
J17-4
J17-1
0V(L)
J15-
+18V
J9-6
17
16
15
14
13
12



REVISIONS					
REV	DESCRIPTION	DATE	DR	CHK	APPR
A	ERN 2 BN	7/30	ML	DB	[illegible]
B	ECN 942	9/15/9	JC	JT	BA
C	ECN 1044	[illegible]	JC	[illegible]	BA
D	ECN 1089	[illegible]	JDP	JDP	BA
E	ECN 1181	[illegible]	[illegible]	[illegible]	BA
F	ECN 1325	[illegible]	JT	[illegible]	BA
G	ECN 1488	[illegible]	TB	[illegible]	[illegible]
H	ECN 1683	[illegible]	TB		[illegible]
J	ECN 1729	[illegible]	WSZ	[illegible]	
K	ECN 2041	[illegible]	WSZ	[illegible]	
L	ECN 2205A	[illegible]	WSZ	[illegible]	
M	ECN 2247	[illegible]	WSZ	[illegible]	
N	ECN 2289	[illegible]	TB	[illegible]	[illegible]
P	ECN 2518	5/10/[illegible]	TB	[illegible]	[illegible]
R	ECN 3324	3/16/72	[illegible]	[illegible]	RCA
S	ECN 4528	11-27-72	JC	[illegible]	RCA
T	ECN 4595	11-27-72	JC	[illegible]	RCA
U	ECN 5354	[illegible]	[illegible]	[illegible]	[illegible]
V	ECN 6183	[illegible]	[illegible]	[illegible]	[illegible]
W	ECN 6640	9-5-74	[illegible]	[illegible]	[illegible]

REFERENCE DESIGNATIONS	
LAST USED	DELETED
R146	R1 THRU 12, 19,127,128
C45	C1,2,4,7,30,32,21,22,26,27
CR29	CR1
Q57	Q1,Q2
U1	
TP21	
K1	
	W1

⑫ VERSION TABLE

ASSY NO	R14
101021-01	31600
101021-02	21500

101021	
NEXT ASSY	1ST USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010
.XXX ± .005
$\frac{X}{X} \pm \frac{1}{32}$
ANGULAR ± 1/2°
✓
BREAK ALL SHARP CORNERS APPROX. 010

FINISH:

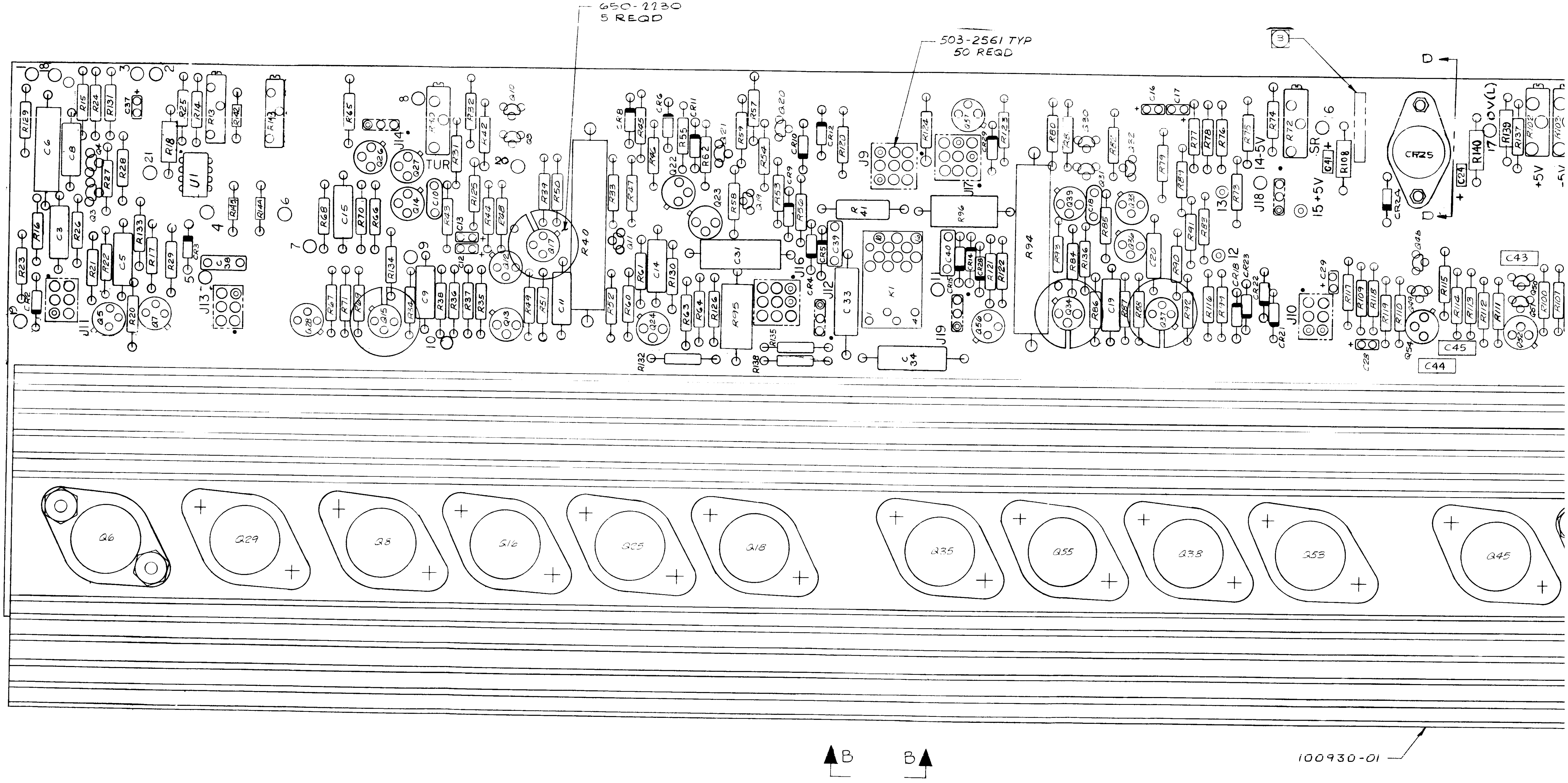
SIGNATURES	DATE
DR M. LAURENCE	7/ /69
CHK D. BLANDING	7/30/69
DES	
ENGR B. ADAMS	[illegible]
ENGR ESD	8/1/9

MATL:

PEC PERIPHERAL EQUIPMENT CORPORATION

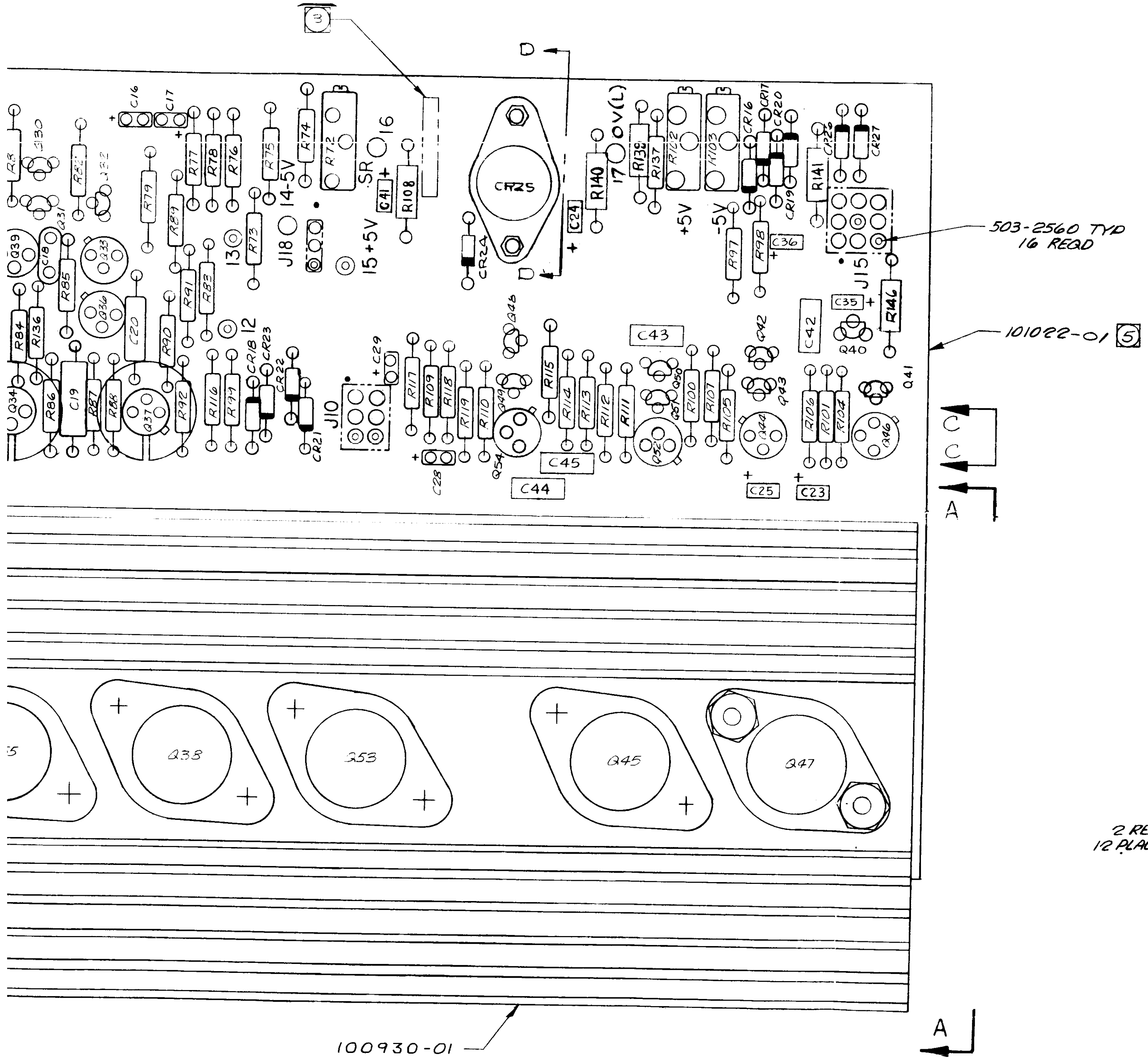
TITLE SCHEMATIC - SERVO POWER SUPPLY A

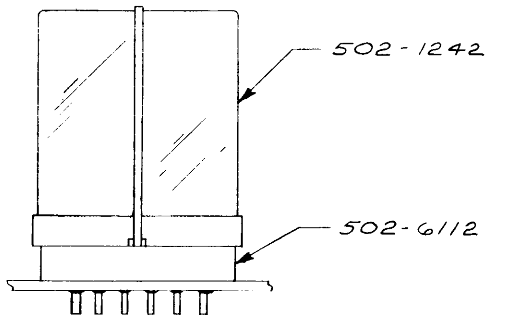
SIZE J
CODE IDENT NO.
DWG NO. 101020
REV W
SCALE NONE
DO NOT SCALE DWG
SHEET 1 OF 1


650-2230
5 REQD
503-2561 TYP
50 REQD
D
D
B
B
100930-01
CR25
J9
J10
J11
J12
J13
J14
J16
J17
J18
J19
K1
U1
R40
R94
R95
R96
C31
C33
C34
C43
C44
C45
14-5V
15+5V
17 OV(L)
+5V
-5V
SR
TUR
Q6
Q29
Q8
Q16
Q25
Q18
Q35
Q55
Q38
Q53
Q45

REV	DESCRIPTION	DATE	DR	CHK	APPR
AH	ECN 6183	9/?/74			
AJ	ECN 6640	9-5-74	SOL		

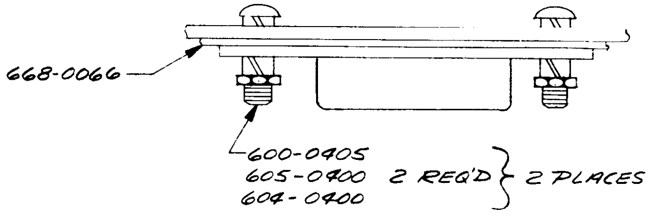
REV	DESCRIPTION	DATE	DR
Y	ECN 2212		T.E
Z	ECN 2289	1/20/71	T.B
AA	ECN 2517	5/17/71	
AB	ECN 3324	3/16/72	
AC	ECN 4528	11-21-72	
AD	ECN 4595	11-27-72	
ADI	ECN 5186		
AE	ECN 5354	8/8/73	
AF	ECN 5730A	11/7/73	T.L.
AG	ECN 6067	3/6/74	T.L.



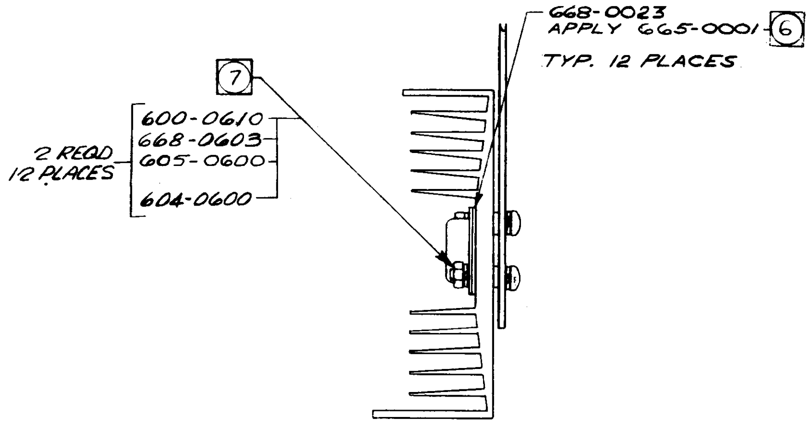


VIEW B-B
SCALE : NONE

(OTHER COMPONENTS NOT SHOWN FOR CLARITY PURPOSES)



VIEW D-D
ROTATED 90°
COUNTER CLOCKWISE



VIEW A-A
SCALE: 1/1

TABLE I 4

PART NO.	REF DESIGNATION
101-1015	R26,27,37,39,51,88,91,93, 99,116,123,124,132-136 138
101-1025	R21,36,62,65,87,
101-1035	R46,76,125
100-1045	R142
101-1225	R109,114, 97,98
101-1235	R16
101-1245	R32
100-4725	R144,145
101-0365	R146
101-1535	R48,83
101-4705	R108
101-1825	R28,33,50,53,59,67,79,90,100
101-5605	R22,29,38,52,86,92
104-1471	R112,119
101-2225	R55,56,57,58,120
101-2725	R47,61,66,82
101-2735	R31,42,73
101-2745	R15,17, 74
104-2610	R137,141
104-9090	R139,140
101-4715	R35,49,85,89,110,111,122
101-4725	R25,45,54,81
132-2262	C24
101-5645	R18
101-6825	R78
101-6835	R43,44,75,77,80
101-8215	R101,104,105
102-0335	R41
103-1525	R95,96
104-1211	R69,126
104-1621	R129
101-6815	R20,34,60,84, 121
101-3305	R63,71,106,107,115,
	117,68,130
121-1030	R13
135-4740	C39,40
135-1002	C42 THRU 45

TABLE I (CON'T)

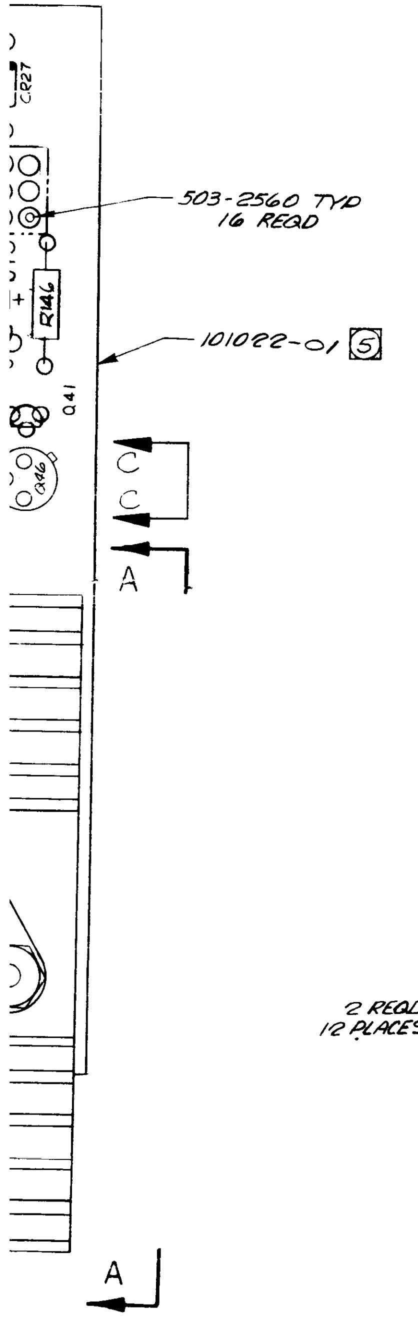
PART NO.	REF DESIGNATION
104-6810	R113,118
104-1781	R24
104-8251	R23
104-7501	R64,70,131
110-0011	R40,94
121-5010	R102,103
121-5030	R30,72,143
130-3315	C10,18,
131-1020	C5,8,
131-1530	C3
131-1540	C6
131-6820	C9,11,14,15,19,20
132-2752	C12,13,16,17,23, 25,41,
	28,29, ,35,36
201-3228	CR25
300-4002	CR2,3,4,5,14,15,21,22
300-4446	CR6 ,8,9,10,11,12,
	17,18,19,
	23,26,27,28,29,
330-0565	CR24
502-1242	K1
200-3055	Q25,29,45,47,53,55
132-2262	C37
200-3772	Q16,18,35,38
200-4123	Q3,9,10, 21,30
	31,40,41,48,49
200-4125	Q4,11,19,20,32,42,43,50,5
200-3771	Q6,8
200-3053	Q12,14,22,23,33,52
	44,56,57
200-4037	Q13,26,27,36,46,39,54
200-5321	Q17,37,28,7
200-5323	Q15,34,5,24
131-4730	C31,33,34
400-2741	U1
331-0605	CR16,CR20
135-4740	C38

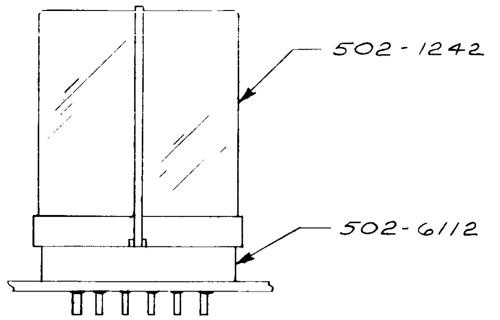
REV	DESCRIPTION	DATE	DR	CHK	APPR
AH	ECN 6183	7/3/74	[illegible]	[illegible]	[illegible]
AJ	ECN 6640	7-5-74	SOL	[illegible]	[illegible]

REV	DESCRIPTION	DATE	DR	CHK	APPR
Y	ECN 2272	[illegible]	T.E	[illegible]	[illegible]
Z	ECN 2289	1/20/71	T.B		[illegible]
AA	ECN 2517	5/17/71	[illegible]	[illegible]	[illegible]
AB	ECN 3324	3/16/72	[illegible]	[illegible]	[illegible]
AC	ECN 4528	11-27-72	[illegible]	[illegible]	[illegible]
AD	ECN 4595	11-27-72	[illegible]	[illegible]	[illegible]
ADI	ECN 5186	6-26-73	[illegible]	[illegible]	[illegible]
AE	ECN 5354	8/9/73	[illegible]	[illegible]	[illegible]
AF	ECN 5730A	11/7/73	T.L.	[illegible]	[illegible]
AG	ECN 6067	3/6/74	T.L.	[illegible]	[illegible]

REV	DESCRIPTION	DATE	DR	CHK	APPR
L	ECN 1443		TF	[illegible]	[illegible]
M	ECN 1448A		[illegible]		[illegible]
N	ECN 1485A	3-6-70	T.B	[illegible]	[illegible]
P	ECN 1489A	3-17-70	AB	[illegible]	BA
R	ECN 1543A	[illegible]	[illegible]	[illegible]	[illegible]
S	ECN 1682	5-15-70	TB	[illegible]	[illegible]
T	ECN 1735 (OBSOLETED)	12/22/70	TB	[illegible]	[illegible]
U	ECN 2132	12/20/70	T.B	[illegible]	[illegible]
V	ECN 2198A	12/22/70	T.B	[illegible]	[illegible]
W	ECN 2248	12/30/70	T.B	R.M.	[illegible]

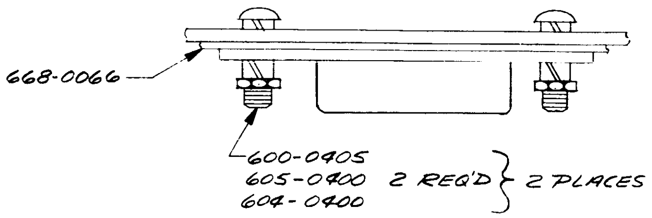
REV	DESCRIPTION
A	EP11-2DX
B	ECN 1001
C	ECN 1016
D	ECN 1020
E	ECN 1043
F	ECN 1090
G	ECN 1139
H	ECN 1141
J	ECN 1333
K	ECN 1325





VIEW B-B
SCALE: NONE

(OTHER COMPONENTS NOT SHOWN FOR CLARITY PURPOSES)



VIEW D-D
ROTATED 90°
COUNTER CLOCKWISE

7 BEFORE INSTALLING TRANSISTORS TO HEATSINK EXTREME CARE MUST BE TAKEN TO SEE THAT ALL BURRS AND MISC. CHIPS OF METAL ARE WIPED OFF ENTIRE MOUNTING SURFACES.

6 MINIMUM OF 90° COVERAGE REQD ON ALL TRANSISTORS ON HEATSINK (665-0001 SILICONE GREASE) APPLIED BOTH SIDES OF MICA WASHERS. ALL SCREWS (600-0610) MUST BE TORQUED 12"LBS (TYP ALL PLACES).

5 **THIS ASSY SHALL BE MADE FROM PROCESS BOARD 101022-01 REV 'V'**

4 FOR PART NO'S WHICH ARE NOT AFFECTED BY VERSION NO. SEE TABLE I.

3 MARK PART NO 101021 INCLUDING VERSION NO. AND VERSION ISSUE LETTER.

2. ASSEMBLE PER STANDARD MANUFACTURING METHODS.

1. REF DWGS: SCHEMATIC-101020
SPECIFICATION-101024

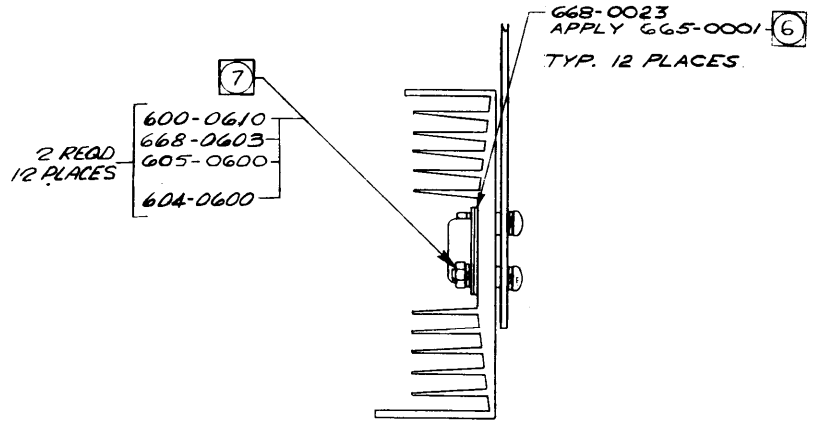
NOTES: UNLESS OTHERWISE SPECIFIED

TABLE I 4

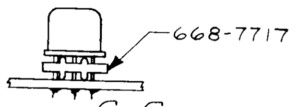
PART NO.	REF DESIGNATION
101-1015	R26,27,37,39,51,88,91,93, 99,116,123,124,132-136 138
101-1025	R21,36,62,65,87,
101-1035	R46,76,125
100-1045	R142
101-1225	R109,114, 97,98
101-1235	R16
101-1245	R32
100-4725	R144,145
101-0365	R146
101-1535	R48,83
101-4705	R108
101-1825	R28,33,50,53,59,67,79,90,100
101-5605	R22,29,38,52,86,92
104-1471	R112,119
101-2225	R55,56,57,58,120
101-2725	R47,61,66,82
101-2735	R31,42,73
101-2745	R15,17. 74
104-2610	R137,141
104-9090	R139,140
101-4715	R35,49,85,89,110,111,122
101-4725	R25,45,54,81
132-2262	C24
101-5645	R18
101-6825	R78
101-6835	R43,44,75,77,80
101-8215	R101,104,105
102-0335	R41
103-1525	R95,96
104-1211	R69,126
104-1621	R129
101-6815	R20,34,60,84, 121
101-3305	R63,71,106,107,115,
	117,68,130
121-1030	R13
135-4740	C39,40
135-1002	C42 THRU 45

TABLE I(CON'T)

PART NO.	REF DESIGNATION
104-6810	R113,118
104-1781	R24
104-8251	R23
104-7501	R64,70,131
110-0011	R40,94
121-5010	R102,103
121-5030	R30,72,143
130-3315	C10,18,
131-1020	C5,8,
131-1530	C3
131-1540	C6
131-6820	C9,11,14,15,19,20
132-2752	C12,13,16,17,23, 25,41,
	28,29, ,35,36
201-3228	CR25
300-4002	CR2,3,4,5,14,15,21,22
300-4446	CR6,8,9,10,11,12,
	17,18,19,
	23,26,27,28,29,
330-0565	CR24
502-1242	K1
200-3055	Q25,29,45,47,53,55
132-2262	C37
200-3772	Q16,18,35,38
200-4123	Q3,9,10, 21,30
	31,40,41,48,49
200-4125	Q4,11,19,20,32,42,43,50,51
200-3771	Q6,8
200-3053	Q12,14,22,23,33,52
	44,56,57
200-4037	Q13,26,27,36,46,39,54
200-5321	Q17,37,28,7
200-5323	Q15,34,5,24
131-4730	C31,33,34
400-2741	U1
331-0605	CR16,CR20
135-4740	C38



VIEW A-A
SCALE: 1/1



VIEW C-C
TYPICAL : 25 PLACES
ROTATED 90° CW

VERSION TABLE

ASSEMBLY	R14
101021-01	104-3162
101021-02	104-2152

PART NO. 101021- REV

TOP ASSY	6000
NEXT ASSY	1ST USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010
.XXX ± .005
$\frac{X}{X}$ ± $\frac{1}{32}$
ANGULAR
± 1/2°
BREAK ALL SHARP CORNERS
APPROX. 010

FINISH:

THE INFORMATION HEREON IS THE PROPERTY OF PERIPHERAL EQUIPMENT CORPORATION. NO REPRODUCTION OR UNAUTHORIZED USE SHALL BE MADE.

SIGNATURES		DATE
DR	M. [illegible]	8-4-69
CHK	J. Tsungquin	8-5-69
DES		
ENGR	[illegible]	[illegible]
ENGR	[illegible]	8/19/9

MATL:

PEC
PE
EQUIPMEN

TITLE PCBA-
SERVO/POWE

SIZE E
CODE IDENT. NO.
DWG NO. 101
SCALE 2/1
DO NOT SCALE

ESCRIPTION	DATE	DR	CHK	APPR
	9/7/74			
	9-5-74	SDL		

REVISIONS

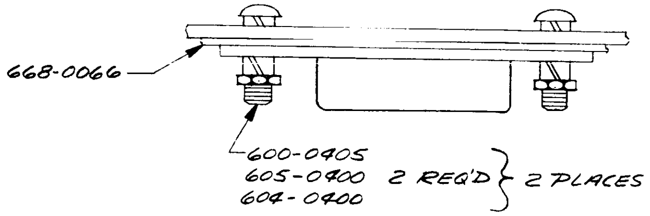
REV	DESCRIPTION	DATE	DR	CHK	APPR
Y	ECN 2212		T.E		
Z	ECN 2289	11/20/71	T.B		
AA	ECN 2517	5/17/71	T.B.L.		GBR
AB	ECN 3321	3/16/72			
AC	ECN 4528	11-27-72		GBR	
AD	ECN 4595	11-27-72			
ADI	ECN 5186	6-26-73			
AE	ECN 5354	8/9/73			
AF	ECN 5730A	11/7/73	T.L.		
AG	ECN 6067	3/6/74	T.L.		

REVISIONS

REV	DESCRIPTION	DATE	DR	CHK	APPR
L	ECN 1443		TB		
M	ECN 1448A				
N	ECN 1485A	3-6-70	TB		BA
P	ECN 1489A	3-17-70			BA
R	ECN 1543A				BA
S	ECN 1682	5-15-70	TB		
T	ECN 1735 (OBSOLETED)	12/22/70	T.B		
U	ECN 2132	12/22/70	T.B		
V	ECN 2198A	12/22/70	T.B		
W	ECN 2248	12/22/70	T.B		

REVISIONS

REV	DESCRIPTION	DATE	DR	CHK	APPR
A	EPII-2DX	8/15/9		J.T.	
B	ECN 1001	9-9-9		HFJn	
C	ECN 1016	10-1-9		HFJn	
D	ECN 1020	10-1-9		HFJn	
E	ECN 1043	10-1-9		HFJn	
F	ECN 1093	10-10-9	HFJn	HFJn	BA
G	ECN 1139	10/29/69		HFJn	BA
H	ECN 1141	10/29/69		HFJn	BA
J	ECN 1333	1/15/70		J.T.	BA
K	ECN 1325	1/22/70	J.T.		BA



VIEW D-D
ROTATED 90°
COUNTER CLOCKWISE

7 BEFORE INSTALLING TRANSISTORS TO HEATSINK EXTREME CARE MUST BE TAKEN TO SEE THAT ALL BURRS AND MISC. CHIPS OF METAL ARE WIPED OFF ENTIRE MOUNTING SURFACES.

6 MINIMUM OF 90° COVERAGE REQD ON ALL TRANSISTORS ON HEATSINK (665-0001 SILICONE GREASE) APPLIED BOTH SIDES OF MICA WASHERS. ALL SCREWS (600-0610) MUST BE TORQUED 12"LBS (TYP ALL PLACES).

5 THIS ASSY SHALL BE MADE FROM PROCESS BOARD 101022-01 REV 'V'

4 FOR PART NO'S WHICH ARE NOT AFFECTED BY VERSION NO. SEE TABLE I.

3 MARK PART NO 101021 INCLUDING VERSION NO. AND VERSION ISSUE LETTER.

2. ASSEMBLE PER STANDARD MANUFACTURING METHODS.

1. REF DWGS: SCHEMATIC-101020
SPECIFICATION-101024

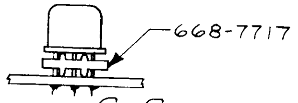
NOTES: UNLESS OTHERWISE SPECIFIED

TABLE I 4

PART NO.	REF DESIGNATION
101-1015	R26,27,37,39,51,88,91,93, 99,116,123,124,132-136 138
101-1025	R21,36,62,65,87,
101-1035	R46,76,125
100-1045	R142
101-1225	R109,114, 97,98
101-1235	R16
101-1245	R32
100-4725	R144,145
101-0365	R146
101-1535	R48,83
101-4705	R108
101-1825	R28,33,50,53,59,67,79,90,100
101-5605	R22, 29, 38,52,86,92
104-1471	R112,119
101-2225	R55,56,57,58,120
101-2725	R47,61,66,82
101-2735	R31,42,73
101-2745	R15,17. 74
104-2610	R137,141
104-9090	R139,140
101-4715	R35,49,85,89,110,111,122
101-4725	R25,45,54,81
132-2262	C24
101-5645	R18
101-6825	R78
101-6835	R43,44,75,77,80
101-8215	R101,104,105
102-0335	R41
103-1525	R95,96
104-1211	R69,126
104-1621	R129
101-6815	R20,34,60,84, 121
101-3305	R63,71,106,107,115,
	117, 68, 130
121-1030	R13
135-4740	C39,40
135-1002	C42 THRU 45

TABLE I (CON'T)

PART NO.	REF DESIGNATION
104-6810	R113,118
104-1781	R24
104-8251	R23
104-7501	R64,70,131
110-0011	R40,94
121-5010	R102,103
121-5030	R30,72,143
130-3315	C10,18,
131-1020	C5,8,
131-1530	C3
131-1540	C6
131-6820	C9,11,14,15,19,20
132-2752	C12,13,16,17,23, 25,41,
	28,29, ,35,36
201-3228	CR25
300-4002	CR2,3,4,5,14,15,21,22
300-4446	CR6 ,8,9,10,11,12,
	17,18,19,
	23,26,27,28,29,
330-0565	CR24
502-1242	K1
200-3055	Q25,29,45,47,53,55
132-2262	C37
200-3772	Q16,18,35,38
200-4123	Q3,9,10, 21,30
	31,40,41,48,49
200-4125	Q4,11,19,20,32,42,43,50,51
200-3771	Q6,8
200-3053	Q12,14,22,23,33,52
	44,56,57
200-4037	Q13,26,27,36,46,39,54
200-5321	Q17,37,28,7
200-5323	Q15,34,5,24
131-4730	C31,33,34
400-2741	U1
331-0605	CR16,CR20
135-4740	C38



VIEW C-C
TYPICAL : 25 PLACES
ROTATED 90° CW

VERSION TABLE

ASSEMBLY	R14
101021-01	104-3162
101021-02	104-2152

PART NO. 101021- REV

TOP ASSY	6000
NEXT ASSY	1ST USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010
.XXX ± .005
$\frac{X}{X} \pm \frac{1}{32}$
ANGULAR ± 1/2°
✓
BREAK ALL SHARP CORNERS APPROX. 010
FINISH:

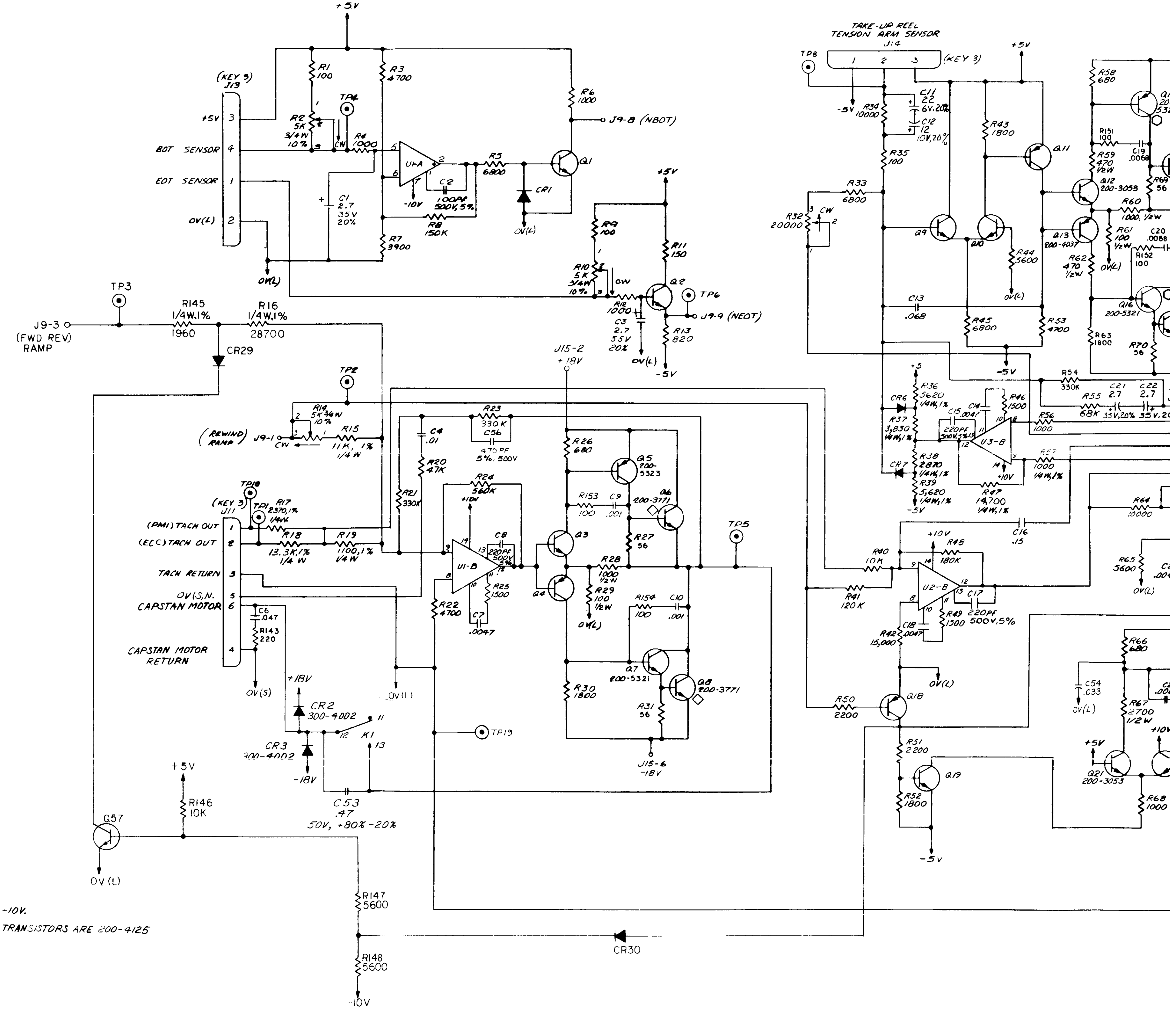
SIGNATURES		DATE
DR	M. [illegible]	8-4-69
CHK	J. Tenngren	8-8-69
DES		
ENGR		[illegible]
ENGR		8/9/69

MATL:

PEC PERIPHERAL EQUIPMENT CORPORATION

TITLE PCBA-
SERVO/POWER SUPPLY A

SIZE	CODE IDENT. NO.	DWG NO.	REV
E		101021	
SCALE 2/1		DO NOT SCALE DWG	SHEET 1 OF 7



11. ALL 1/2 WATT RESISTORS ARE 5%.

10. ALL CAPACITOR VALUES ARE IN MICROFARADS.

9. ALL IC'S ARE PEC 400-1437.

8. ⬡ INDICATES TRANSISTOR MOUNTED HEATSINK.

7. ◇ INDICATES TRANSISTORS MOUNTED ON EXTRUDED HEATSINK, QTY 12 REQD.

6. ON ALL IC'S PINS 14 & 15 ARE +10V; PINS 7 & 15 ARE -10V.

5. ALL NPN TRANSISTORS ARE 200-4123; ALL PNP TRANSISTORS ARE 200-4125

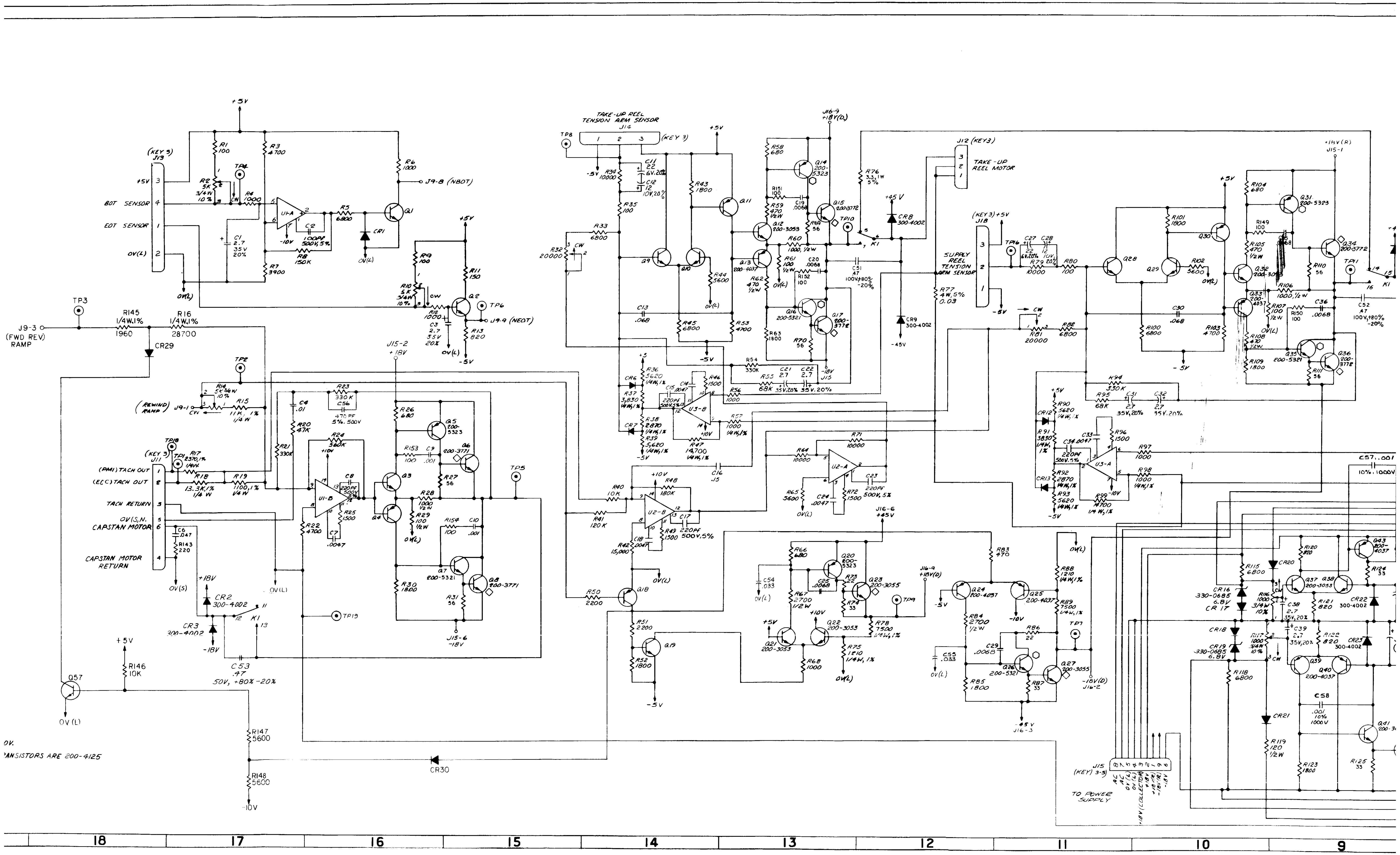
4. ALL DIODES ARE 300-4446.

3. ALL CAPACITORS 100V, 10%.

2. ALL RESISTORS IN OHMS 1/4 WATT, 5%.

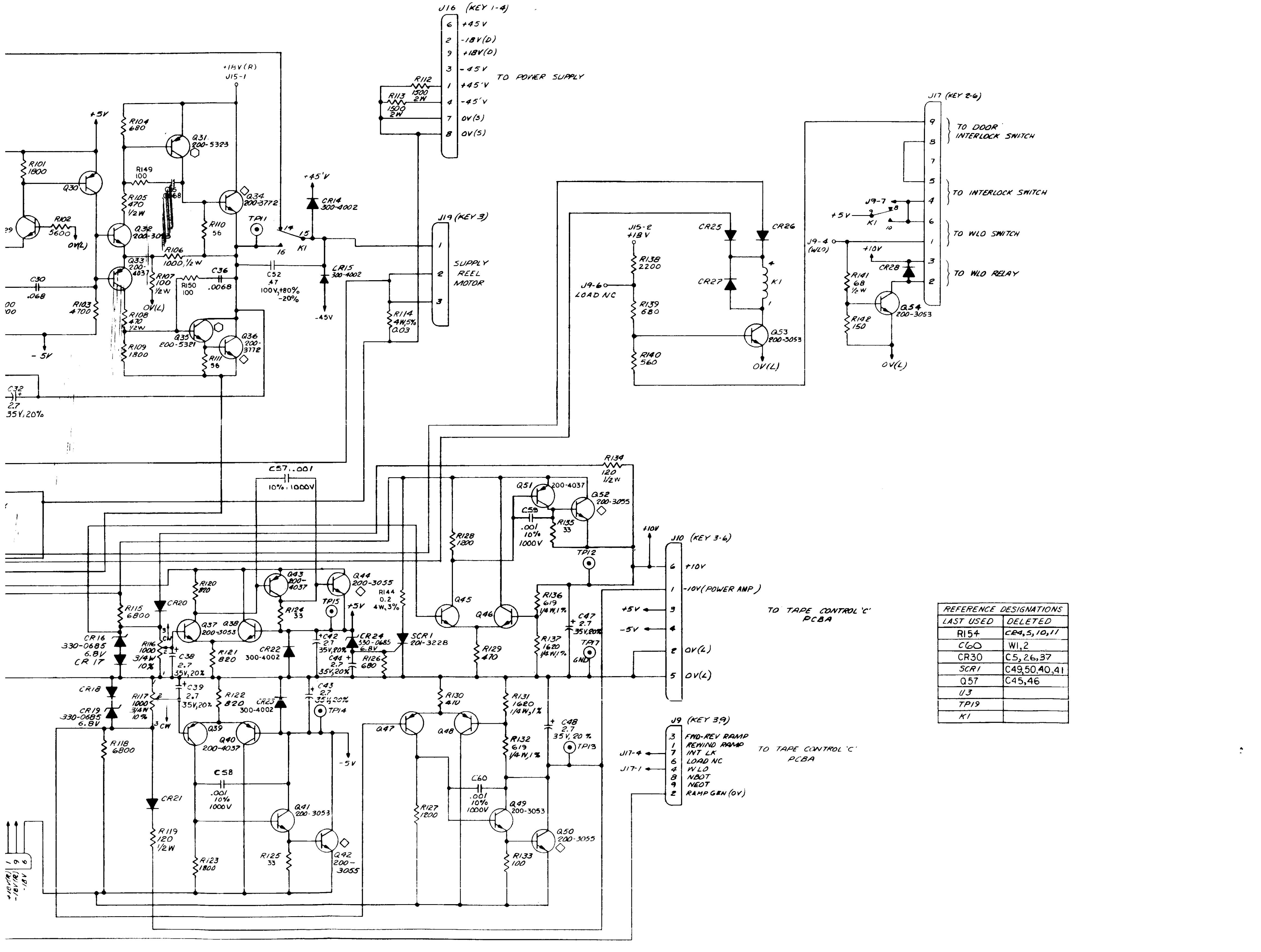
1. FOR ASSEMBLY DRAWING SEE 101262.
FOR SPECIFICATION DRAWING SEE 101265.

NOTES: UNLESS OTHERWISE SPECIFIED



+5V
(KEY 3) J13
+5V 3
BOT SENSOR 4
EOT SENSOR 1
OV(L) 2
R1 100
R2 5K 3/4W 10%
TP4
CW
R3 4700
R4 1000
U1-A
C1 2.7 35V 20%
C2 100PF 500V,5%
R5 6800
R6 1000
J9-8 (NBOT)
Q1
CR1
R7 3900
R8 150K
-10V
OV(L)
+5V
R9 100
R10 5K 3/4W 10%
R11 150
R12 1000
C3 2.7 35V 20%
Q2
TP6
J9-9 (NEOT)
R13 820
-5V
TP3
J9-3
(FWD REV) RAMP
R145 1/4W,1% 1960
R16 1/4W,1% 28700
CR29
TP2
R14 5K 3/4W 10%
R15 11K, 1% 1/4 W
(REWIND) RAMP
J9-1
(KEY 3) J11
TP18
TP1
R17 2370,1% 1/4W
(PMI) TACH OUT 1
(ECC) TACH OUT 2
TACH RETURN 3
OV(S,N) 5
CAPSTAN MOTOR 6
CAPSTAN MOTOR RETURN 4
R18 13.3K,1% 1/4 W
R19 1100,1% 1/4 W
R21 330K
C4 .01
R20 47K
R23 330 K
C56 470 PF 5% 500V
R24 560K
+10V
U1-B
C8 220PF 500V 5%
R25 1500
C7 .0047
R22 4700
J15-2 +18V
R26 680
Q5 200-5323
R153 100
C9 .001
Q6 200-3771
Q3
Q4
R27 56
R28 1000 1/2 W
R29 100 1/2W
R154 100
C10 .001
Q7 200-5321
Q8 200-3771
R30 1800
R31 56
J15-6 -18V
TP5
TP19
C6 .047
R143 220
OV(S)
OV(L)
+18V
CR2 300-4002
CR3 300-4002
-18V
K1
C53 .47 50V, +80% -20%
+5V
R146 10K
Q57
OV (L)
R147 5600
R148 5600
-10V
CR30
OV.
TRANSISTORS ARE 200-4125
TAKE-UP REEL TENSION ARM SENSOR
J14
(KEY 3)
TP8
-5V
R34 10000
C11 22 6V,20%
C12 12 10V,20%
R35 100
R33 6800
R32 20000
CW
+5V
R43 1800
Q11
Q9
Q10
R44 5600
C13 .068
R45 6800
R53 4700
-5V
+5
R36 5620 1/4W,1%
CR6
R37 3,830 1/4W,1%
CR7
R38 2870 1/4W,1%
R39 5,620 1/4W,1%
-5V
C14 .0047
C15 220PF 500V,5%
R46 1500
U3-B
+10V
R47 14700 1/4W,1%
R56 1000
R57 1000 1/4W,1%
R54 330K
R55 68K
C21 2.7 35V,20%
C22 2.7 35V,20%
J16-9 +18V(D)
R58 680
Q14 200-5323
R151 100
C19 .0068
R59 470 1/2W
Q15 200-3772
Q12 200-3053
R69 56
TP10
R60 1000, 1/2W
Q13 200-4037
R61 100 1/2W
C20 .0068
R152 100
R62 470 1/2W
Q16 200-5321
Q17 200-3772
R63 1800
R70 56
-18V J15
C51 47 100V,+80% -20%
R76 3.3, 1W 5%
+45V
CR8 300-4002
K1
CR9 300-4002
-45V
J12 (KEY 3)
TAKE-UP REEL MOTOR
R77 4W, 5% 0.03
C16 .15
+10V
R48 180K
R40 10K
R41 120K
U2-B
C17 220PF 500V,5%
R49 1500
C18 .0047
R42 15,000
OV(L)
R50 2200
Q18
R51 2200
Q19
R52 1800
-5V
R64 10000
R71 10000
U2-A
C23 220PF 500V,5%
R65 5600
C24 .0047
R72 1500
OV(L)
J16-6 +45V
R66 680
Q20 200-5323
C54 .033
C25 .0068
R73 22
Q23 200-3055
R74 33
TP9
R67 2700 1/2W
+10V
+5V
Q21 200-3053
Q22 200-3053
R78 7500 1/4W,1%
R75 1210 1/4W,1%
R68 1000
OV(L)
J16-9 +18V(D)
R83 470
Q24 200-4037
Q25 200-4037
-5V
-10V
R88 1210 1/4W,1%
R89 7500 1/4W,1%
R84 2700 1/2W
C29 .0068
R86 22
TP7
C55 .033
Q26 200-5321
Q27 200-3055
R85 1800
R87 33
+45V J16-3
-18V(D) J16-2
(KEY 3) +5V J18
TP16
C27 22 6V,20%
C28 12 10V, 20%
R79 10000
R80 100
SUPPLY REEL TENSION ARM SENSOR
CW
R81 20000
R82 6800
Q28
Q29
R101 1800
R102 5600
Q30
R100 6800
C30 .068
R103 4700
-5V
R94 330K
R95 68K
C31 2.7 35V,20%
C32 2.7 35V,20%
+5V
R90 5620 1/4W,1%
CR12
R91 3830 1/4W,1%
C34 .0047
C33 220PF 500V,5%
R96 1500
U3-A
R97 1000
R98 1000 1/4W,1%
CR13
R92 2870 1/4W,1%
R93 5620 1/4W,1%
-5V
R99 14700 1/4 W,1%
-10V
+18V(R) J15-1
+5V
R104 680
Q31 200-5323
R149 100
C35 .0068
R105 470 1/2W
Q34 200-3772
Q32 200-3053
R110 56
TP11
K1
R106 1000, 1/2W
Q33 200-4037
R107 100 1/2W
R150 100
C36 .0068
C52 47 100V,+80% -20%
R108 470 1/2W
Q35 200-5321
Q36 200-3772
R109 1800
R111 56
C57 .001 10% 1000V
R120 820
Q43 200-4037
R115 6800
CR20
R124 33
Q37 200-3053
Q38
CR16 330-0685 6.8V
CR17
R116 1000 3/4W 10%
C38 2.7 35V,20%
R121 820
CR22 300-4002
CR18
CR19 330-0685 6.8V
R117 1000 3/4W 10%
C39 2.7 35V,20%
R122 820
CR23 300-4002
CW
Q39 200-4037
Q40
R118 6800
C58 .001 10% 1000V
CR21
Q41 200-3
R119 120 1/2W
R123 1800
R125 33
J15 (KEY 3-5)
AC AC OV(L) OV(LCOLLECTOR) +18V(R) +18V(D) -18V(R) -18V
TO POWER SUPPLY
18
17
16
15
14
13
12
11
10
9

REVISIONS					
REV	DESCRIPTION	DATE	DR	CHK	APPR
B	ERN 2-VP	10770	T.B.		
C	ECN 2173	1/25/71	T.B		
D	ECN 2317A	1/25/71	T.B		
E	ECN 2350	2/12/71	T.B		
F	ECN 2361B	2/12/71	T.B		
G	ECN 2370A	2/19/71	T.B		ABR
H	ECN 2374A	2/24/71	T.B		
J	ECN 2424A	3/4/71	T.B		
K	ECN 2425	3/12/71			
L	ECN 2680	11/4/71			RCA
M	ECN 2821	12/21/71			RCA
N	ECN 3167	12/21/71			RCA
P	ECN 4528	11-27-72			RCA
R	ECN 6139		RHS		
S	ECN 6483B				
T	ECN 6563				
U	ECN 7049				



REFERENCE DESIGNATIONS	
LAST USED	DELETED
R154	CR4,5,10,11
C60	W1,2
CR30	C5,26,37
SCR1	C49,50,40,41
Q57	C45,46
U3	
TP19	
K1	

101262	6000
NEXT ASSY	1ST USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010 ANGULAR
.XXX ± .005 ± 1/2°
X/X ± 1/32 ✓
BREAK ALL SHARP CORNERS
APPROX. .010

THE INFORMATION HEREON IS THE PROPERTY OF PERIPHERAL EQUIPMENT CORPORATION. NO REPRODUCTION OR UNAUTHORIZED USE SHALL BE MADE

SIGNATURES	DATE
DR John Waters	
CHK	
DES	
ENGR	
ENGR	

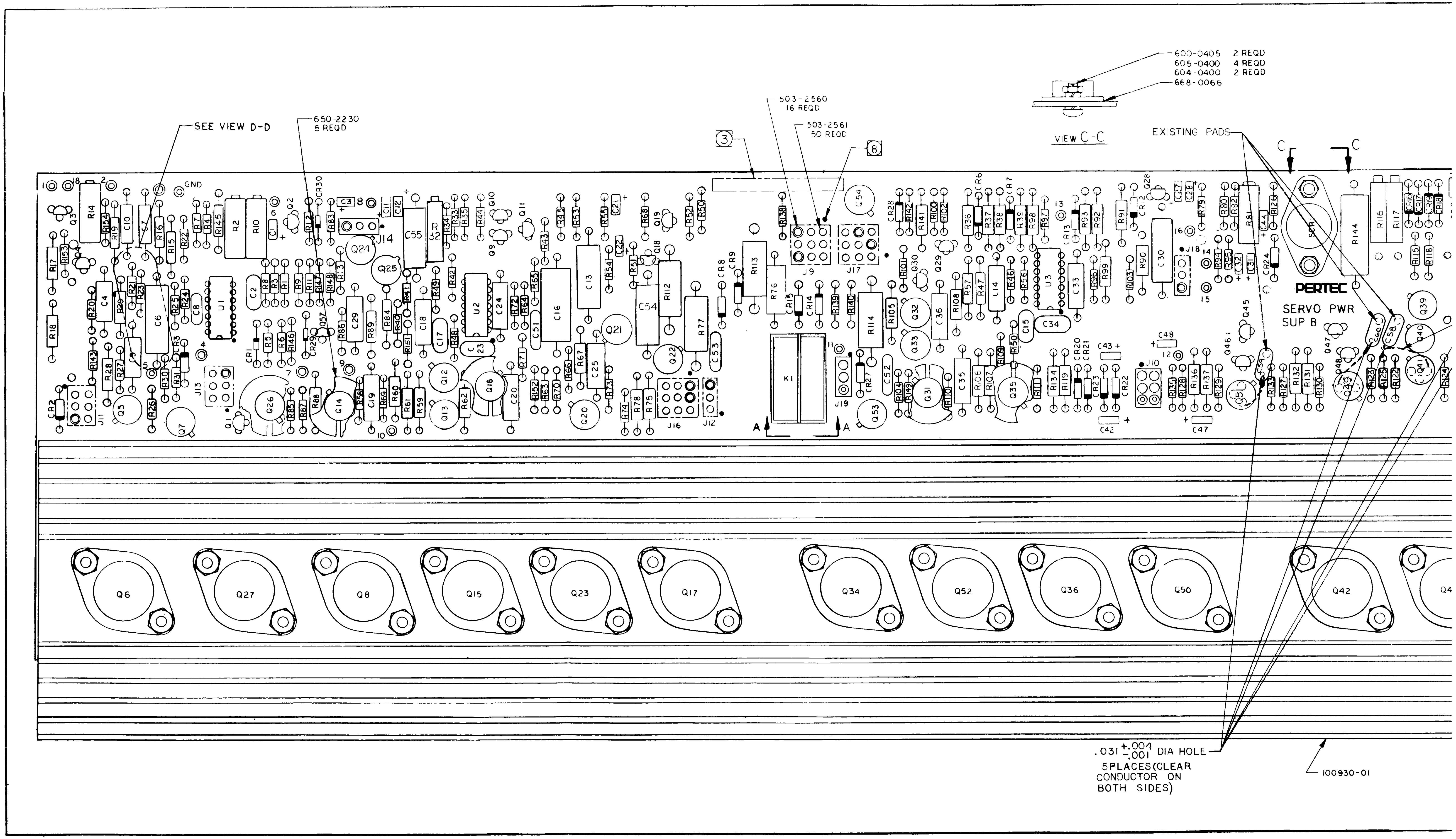
FINISH:

MATL:

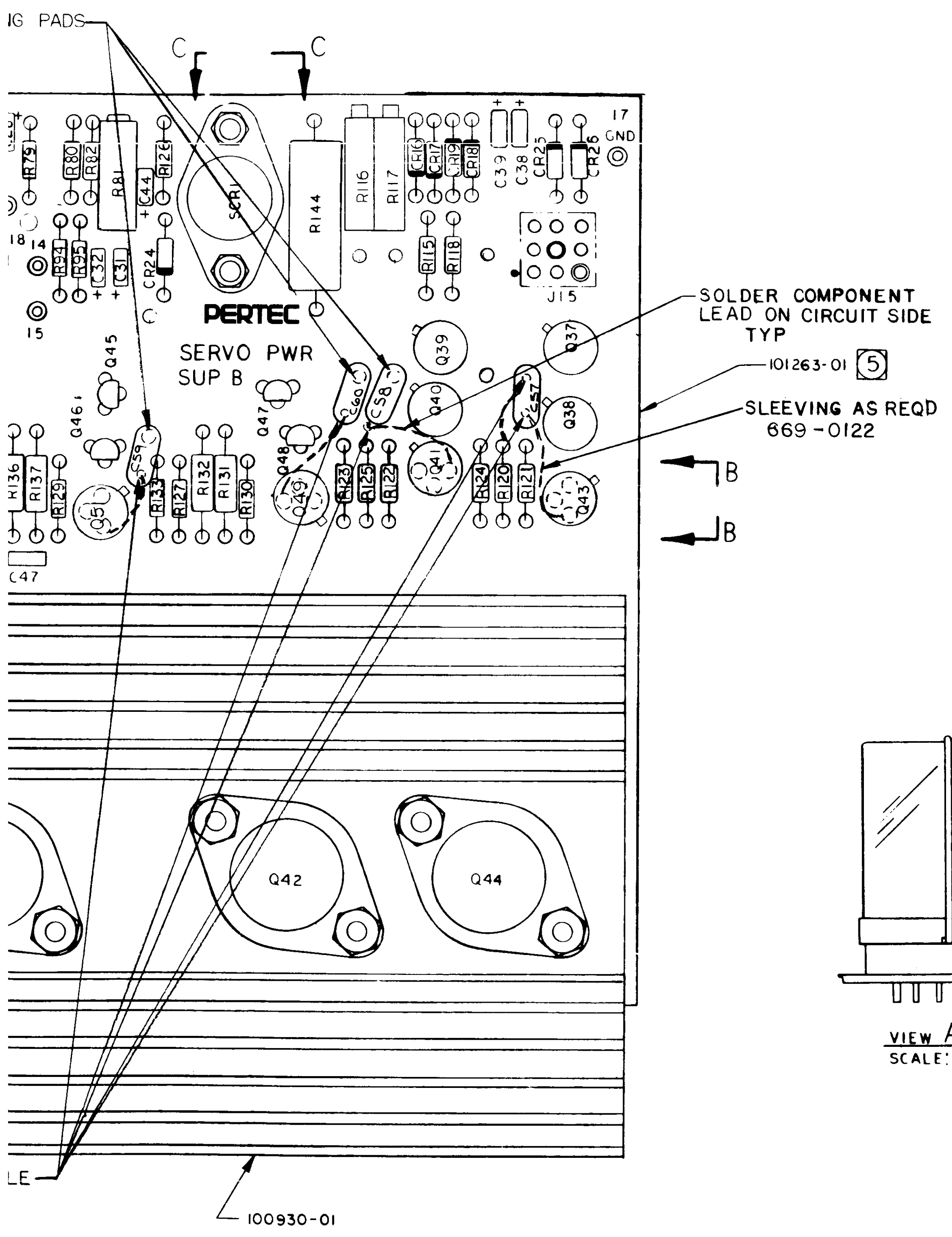
PEC PERIPHERAL EQUIPMENT CORPORATION

TITLE SCHEMATIC
SERVO POWER SUPPLY
"B"

SIZE J
CODE IDENT NO
DWG NO. 101261
REV U
SCALE NONE
DO NOT SCALE DWG
SHEET 1 OF 1


600-0405 2 REQD
605-0400 4 REQD
604-0400 2 REQD
668-0066
VIEW C-C
503-2560
16 REQD
503-2561
50 REQD
3
8
SEE VIEW D-D
650-2230
5 REQD
EXISTING PADS
C
C
GND
PERTEC
SERVO PWR
SUP B
SCR1
K1
A
A
J9
J10
J11
J12
J13
J14
J16
J17
J18
J19
U1
U2
U3
Q6
Q27
Q8
Q15
Q23
Q17
Q34
Q52
Q36
Q50
Q42
.031 $^{+.004}_{-.001}$ DIA HOLE
5PLACES(CLEAR
CONDUCTOR ON
BOTH SIDES)
100930-01

)-0405 2 REQD
5-0400 4 REQD
I-0400 2 REQD
3-0066



⑧ DOT INDICATES PIN I ON CONNECTORS AND IC'S.

⑦ BEFORE INSTALLING TRANSISTORS TO HEATSINK EXTREME CARE MUST BE TAKEN TO SEE THAT ALL BURRS AND MISC. CHIPS OF METAL ARE WIPED OFF ENTIRE MOUNTING SURFACE.

⑥ MINIMUM OF 90%COVERAGE REQD ON ALL TRANSISTORS ON HEATSINK, WITH 665-0001 SILICONE GREASE APPLIED BOTH SIDES OF MICA WASHERS. ALL SCREWS 600-0610 MUST BE TORQUED 12 IN. LBS. (TYP 12 PLACES).

⑤ THIS ASSY SHALL BE MADE FROM PROCESS BOARD 101263-01 REV K AND SUBSEQUENT.

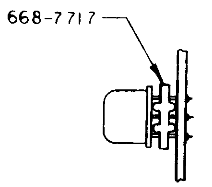
④ FOR PART NO.S WHICH ARE NOT AFFECTED BY VERSION NO. SEE TABLE I.

③ RUBBER STAMP PART NO., INCLUDING VERSION NO. AND VERSION ISSUE LETTER.

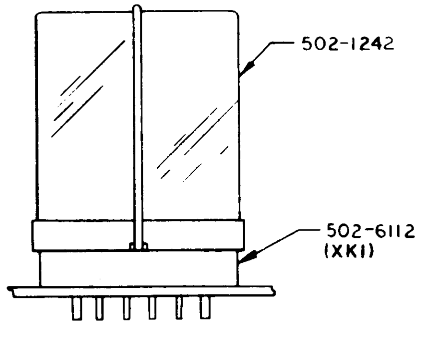
2. ASSEMBLE PER STANDARD MANUFACTURING METHODS.

1. REF DWGS: SCHEMATIC - 101261
SPECIFICATION - 101265

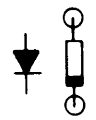
NOTES: UNLESS OTHERWISE SPECIFIED



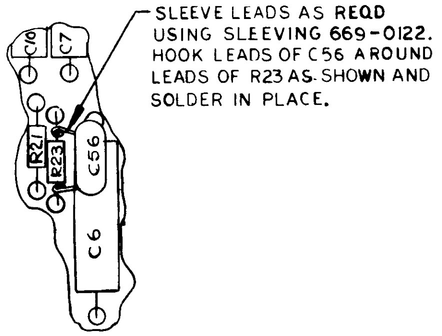
VIEW B-B
TYP 24 PLACES
(TO-5 MTG CONFIG)



VIEW A-A
SCALE: NONE

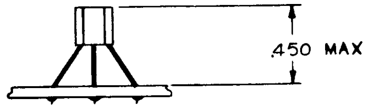


DIODE ORIENTATION



SLEEVE LEADS AS REQD USING SLEEVING 669-0122. HOOK LEADS OF C56 AROUND LEADS OF R23 AS SHOWN AND SOLDER IN PLACE.

VIEW D-D
MOUNTING OF
CAPACITOR C56



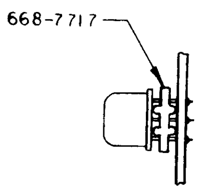
TYPICAL TRANSISTOR
MTG HEIGHT (TO-92)

TABLE I ④

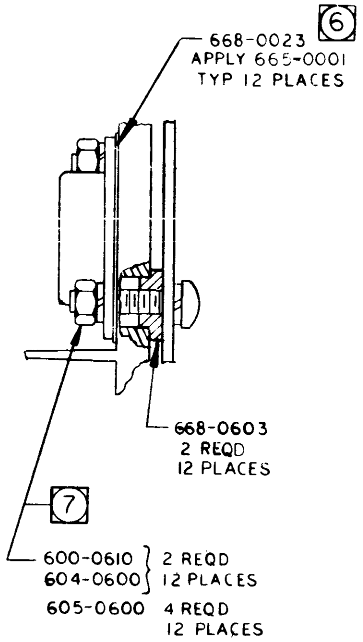
PART NO.	REF DESIGNATION
100-1015	R1,9,35,80,149-154
100-5605	R27,31,69,70,110,111
100-2215	R143
100-1035	R34,64,71,79,146,40
100-1225	R127,128
100-1245	R41
100-1515	R11,142
100-1525	R25,46 49 72,96
100-1545	R8
100-1825	R30,63,52,85,109, R123,43,101
100-2225	R50,51,138
100-4735	R20
100-3345	R54,94,21,23
115-0002	R144
100-3925	R7
100-4725	R3,22,53,103,
100-1535	R 42
100-5645	R24
100-5625	R44,65,102,147,148
100-6835	R55,95
100-5615	R140
100-6815	R26,104,126,139,58,66
100-8215	R13,120,121,122
101-1215	R119,134
101-1025	R28,60,106
101-4715	R59,62,105,108
103-1525	R112,113
115-0003	R77,114
104-1001	R57,98
104-1101	R19
104-1211	R75,88
104-1472	R99,47
104-1621	R131,137
104-6190	R132,136
104-7501	R78,89
104-1102	R15
104-1332	R18
104-1961	R145

TABLE I (CONT)

PART NO.	REF DESIGNATION
104-2872	R16
104-2871	R38,92
104-3831	R37,91
102-0335	R76
121-1020	R116,117
121-2030	R32,81
121-5020	R2,10,14
130-1015	C2,
130-2215	C8,15,17,23,34
131-1020	C9,10
131-1540	C16
131-4720	C7,14,18,24,33
131-4730	C6,
131-6820	C19,20,25,29,35, 36
132-2262	C11,27
132-2752	C1,3,21,22,31,32,38, 39,42,43,44,47,48
100-1845	R48
100-1025	R4,6,12,56,68,97
100-2205	R73,86
100-4715	R83,129,130
101-1015	R29,61,107
101-2725	R67,84
200-3053	Q12,21,22,32,37,38, 41,53,54,49
200-3055	Q23,27,42,44,50,52
200-5323	Q14,31,5,20
200-3771	Q6,8
200-3772	Q15,17,34,36,
200-4123	Q1,2,3,9,10,19,28,29, 45,46,57
200-4125	Q4,11,18,30,47,48,
200-4037	Q13,51,24,25,33,39 40,43
200-5321	Q16,35,26,7
132-1262	C12,28
131-3330	C54,55
130-1015	C2



VIEW B-B
TYP 24 PLACES
(TO-5 MTG CONFIG)



REVISIONS					
REV	DESCRIPTION	DATE	DR	CHK	APPR
B	ERN 2-VP	[illegible]	[illegible]	[illegible]	KGA
C	ECN 2172	1/21/71	T.B	[illegible]	RGA
D	ECN 2317A	1/21/71	T.B	[illegible]	K.G.A.
E	ECN 2351A	2/12/71	T.B	[illegible]	ABR
F	ECN 2361A	2/12/71	T.B	[illegible]	ABR
G	ECN 2370A	2/15/71	T.B	[illegible]	ABR
H	ECN 2376B	2/26/71	T.B	[illegible]	ABR
J	ECN 2424A	3/4/71	T.B	[illegible]	ABR
K	ECN 2395	3/15/71	T.B	[illegible]	ABR
L	ECN 2592	5/19/71	T.B	[illegible]	ABR
M	ECN 2680	11/9/71	DC	[illegible]	RCA
N	ECN 3167	12/23/71	DC	JBR	RA
P	ECN 3777	6/2/72	C.J.	[illegible]	PST
R	ECN 4522	10/11/72	CJ	JBR	RCA
S	ECN 4410	11/13/72	J.M.	[illegible]	RA
S1	ECN 5182	7/10/73	MAK	[illegible]	[illegible]
T	ECN 532[illegible]	9/25/73	[illegible]	[illegible]	[illegible]
U	ECN 6069	3/6/74	[illegible]	JBR	[illegible]
V	ECN 6139	3/14/74	RAS	[illegible]	[illegible]
W	ECN 6483B	7/18/74	[illegible]	JBR	[illegible]
Y	ECN 6563	8/14/74	[illegible]	JBR	[illegible]
Z	ECN 7049	1/20/75	[illegible]	JBR	[illegible]

ION
4
11
6, 40
09,
48
58,66

TABLE I (CONT)

PART NO.	REF DESIGNATION
104-2872	R16
104-2871	R38, 92
104-3831	R37, 91
102-0335	R76
121-1020	R116, 117
121-2030	R32, 81
121-5020	R2, 10, 14
130-1015	C2,
130-2215	C8, 15, 17, 23, 34
131-1020	C9, 10
131-1540	C16
131-4720	C7, 14, 18, 24, 33
131-4730	C6,
131-6820	C19, 20, 25, 29, 35, 36
132-2262	C11, 27
132-2752	C1, 3, 21, 22, 31, 32, 38, 39, 42, 43, 44, 47, 48
100-1845	R48
100-1025	R4, 6, 12, 56, 68, 97
100-2205	R73, 86
100-4715	R83, 129, 130
101-1015	R29, 61, 107
101-2725	R67, 84
200-3053	Q12, 21, 22, 32, 37, 38, 41, 53, 54, 49
200-3055	Q23, 27, 42, 44, 50, 52
200-5323	Q14, 31, 5, 20
200-3771	Q6, 8
200-3772	Q15, 17, 34, 36,
200-4123	Q1, 2, 3, 9, 10, 19, 28, 29, 45, 46, 57
200-4125	Q4, 11, 18, 30, 47, 48,
200-4037	Q13, 51, 24, 25, 33, 39 40, 43
200-5321	Q16, 35, 26, 7
132-1262	C12, 28
131-3330	C54, 55
130-1015	C2

TABLE I (CONT)

PART NO.	REF DESIGNATION
300-4002	CR2, 3, 8, 9, 14, 15, 22, 23
300-4446	CR1, 6, 7, 12, 13, 17, 18, 20 21 25 26 27 28 29 30
201-3228	SCR1
330-0685	CR 16, 19, 24,
131-6830	C13, 30
100-6825	R5, 33, 45, 82, 100, 115, 118
101-6805	R141
104-2371	R17
104-5621	R36, 39, 90, 93
135-4741	C51, 52
502-1242	K1
502-6113	XK1
400-1437	U1, 2, 3
100-5605	R27, 31, 69, 70, 110, 111
100-3305	R74, 87, 124, 125, 133, 135
135-4740	C53

TABLE I (CONT)

PART NO.	REF DESIGNATION
130-4715	C56
131-1030	C4
135-1002	C57, 58, 59, 60,

PART NO. 101262- REV

TOP ASSY	6000
NEXT ASSY	1ST USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010
.XXX ± .005
X/X ± 1/32
ANGULAR ± 1/2°
✓
BREAK ALL SHARP CORNERS
APPROX. 010
FINISH:

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SIGNATURES		DATE
DR	Livingston	7-30-70
CHK	[illegible]	[illegible]
DES		
ENGR	[illegible]	[illegible]
ENGR	[illegible]	

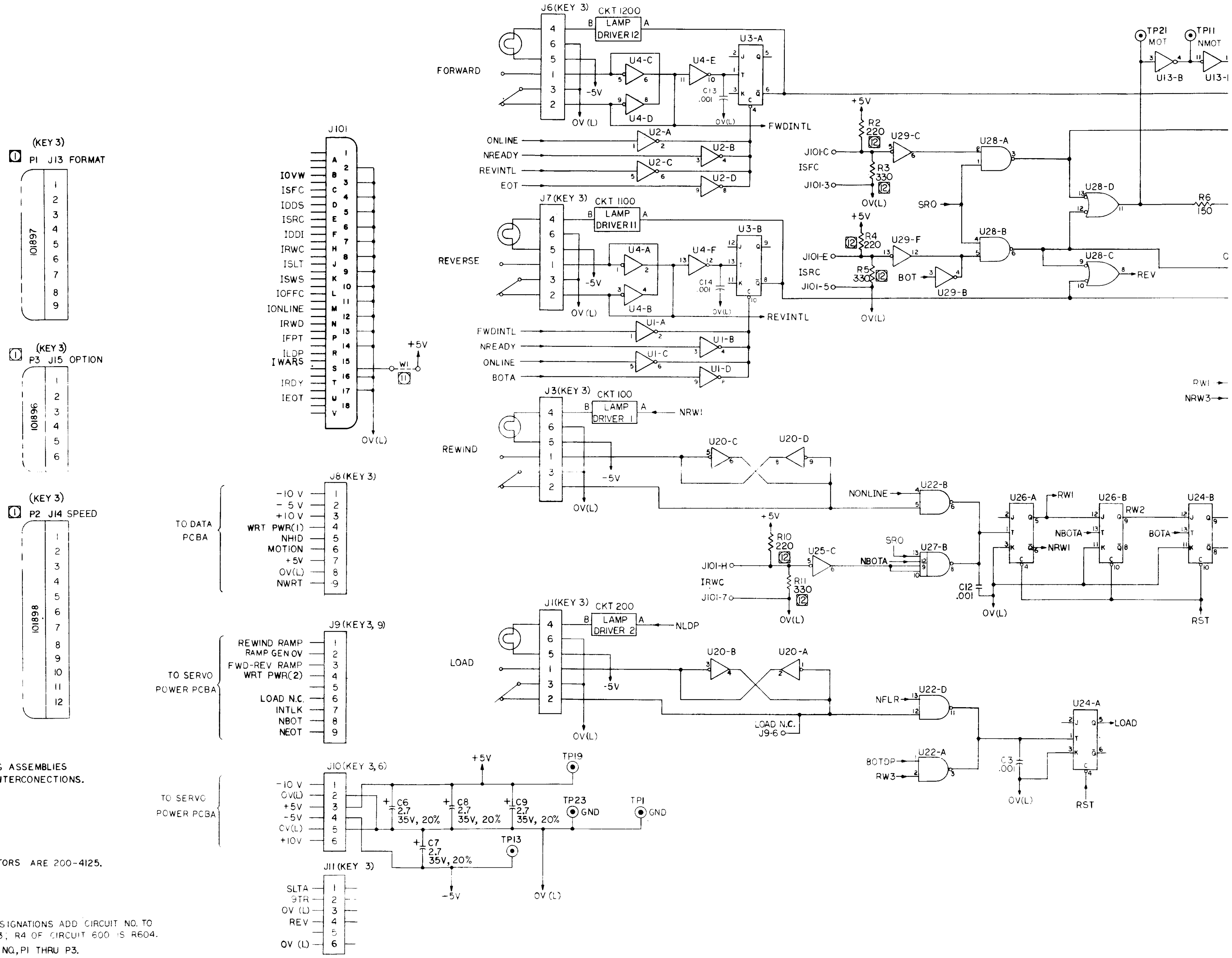
MATL:

PEC
PERIPHERAL
EQUIPMENT CORPORATION

TITLE PCBA-
SERVO/POWER SUPPLY
B

SIZE	CODE IDENT. NO.	DWG NO.	REV
E		101262	Z

SCALE 2/1 DO NOT SCALE DWG SHEET 1 OF 1



⑫ VERSIONS WITHOUT TERMINATOR RESISTORS ARE FOR USE WITH MTA.

⑪ SEE VERSION TABLE FOR USAGE.

⑩ JUMPER WIRES W2 THRU W19 ARE PART OF JUMPER PLUG ASSEMBLIES P1-P3. SEE APPROPRIATE VERSION FOR CORESPONDING INTERCONECTIONS.

9. U1,2,4,8,13,16,19,20,25,29 ARE PEC 700-8360.
U6,11,12,14,21,23,27,10 ARE PEC 700-8440.
U5,9,18,22,28 ARE PEC 700-8460.
U3,7,15,24,26 ARE PEC 700-8530.
U17 IS PEC 400-1437.

8. ON ALL DIGITAL IC'S: PIN 14 IS +5V, PIN 7 IS 0V.

7. ALL NPN TRANSISTORS ARE 200-4123. ALL PNP TRANSISTORS ARE 200-4125.

6. ALL DIODES ARE 300-4446.

5. ALL CAPACITORS IN MICROFARADS, 100V, 10%.

4. ALL RESISTORS IN OHMS, 5%, 1/4W.

3. FOR ASSY DWG SEE 101882 FOR SPEC DWG SEE 101885.

② REF DESIGNATORS ARE NOT COMPLETE. FOR COMPLETE DESIGNATIONS ADD CIRCUIT NO. TO DESIGNATOR FOR EXAMPLE: CR3 OF CIRCUIT 700 IS CR703; R4 OF CIRCUIT 600 IS R604.

① SEE VERSION TABLE ON TOP ASSY FOR COMPLETE PART NO., P1 THRU P3.

NOTES: UNLESS OTHERWISE SPECIFIED:

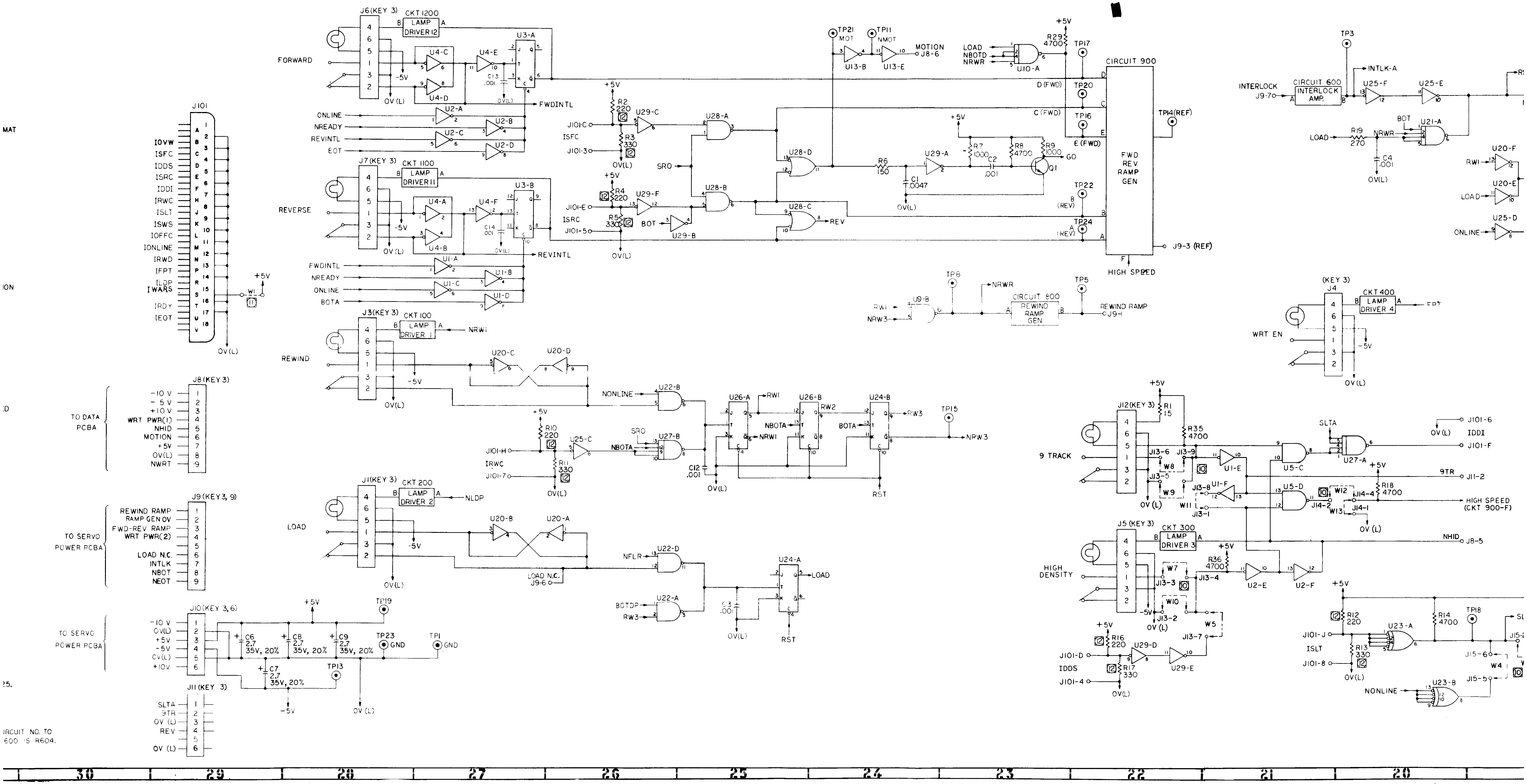
MAT

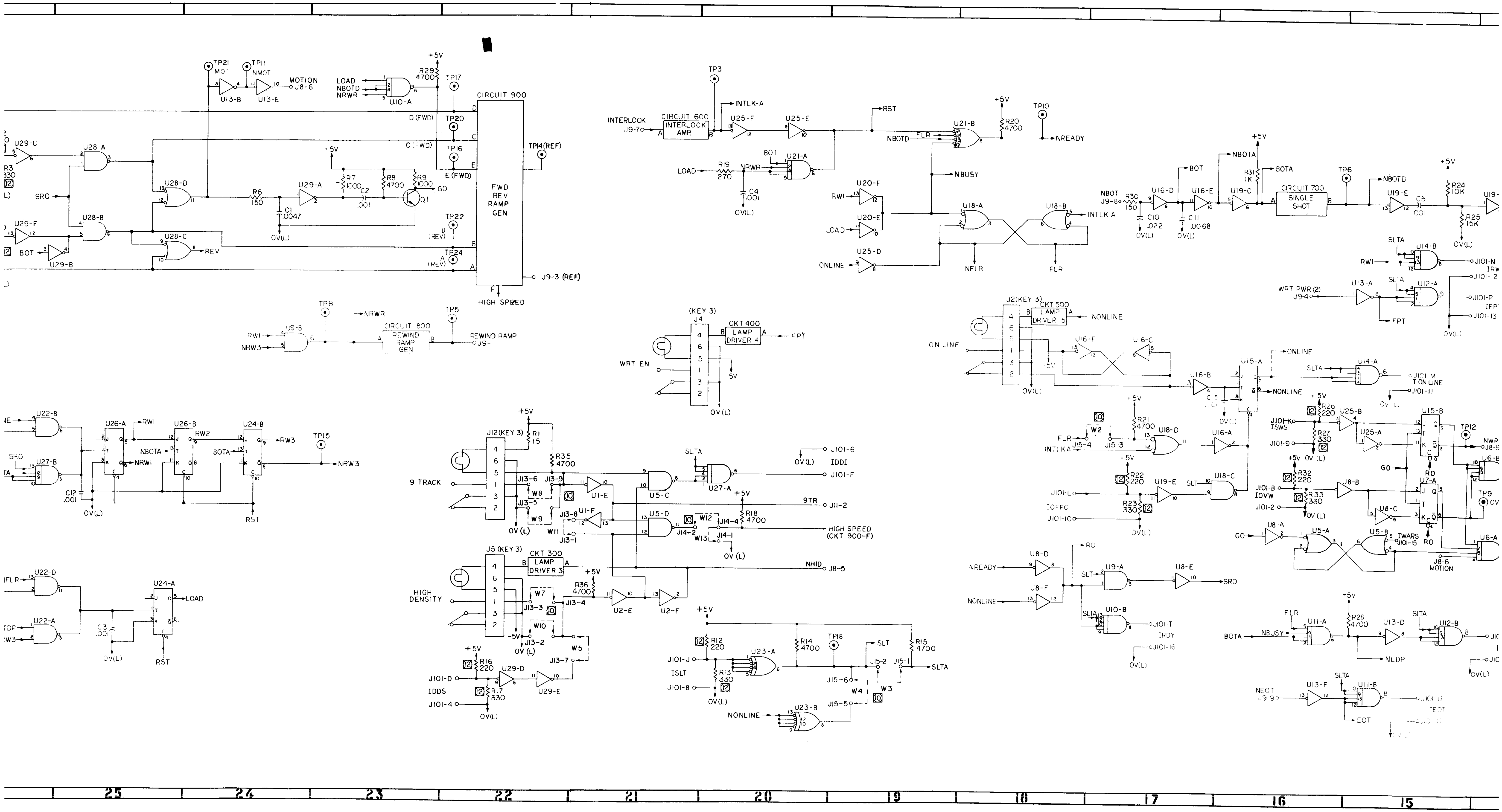
ION

:D

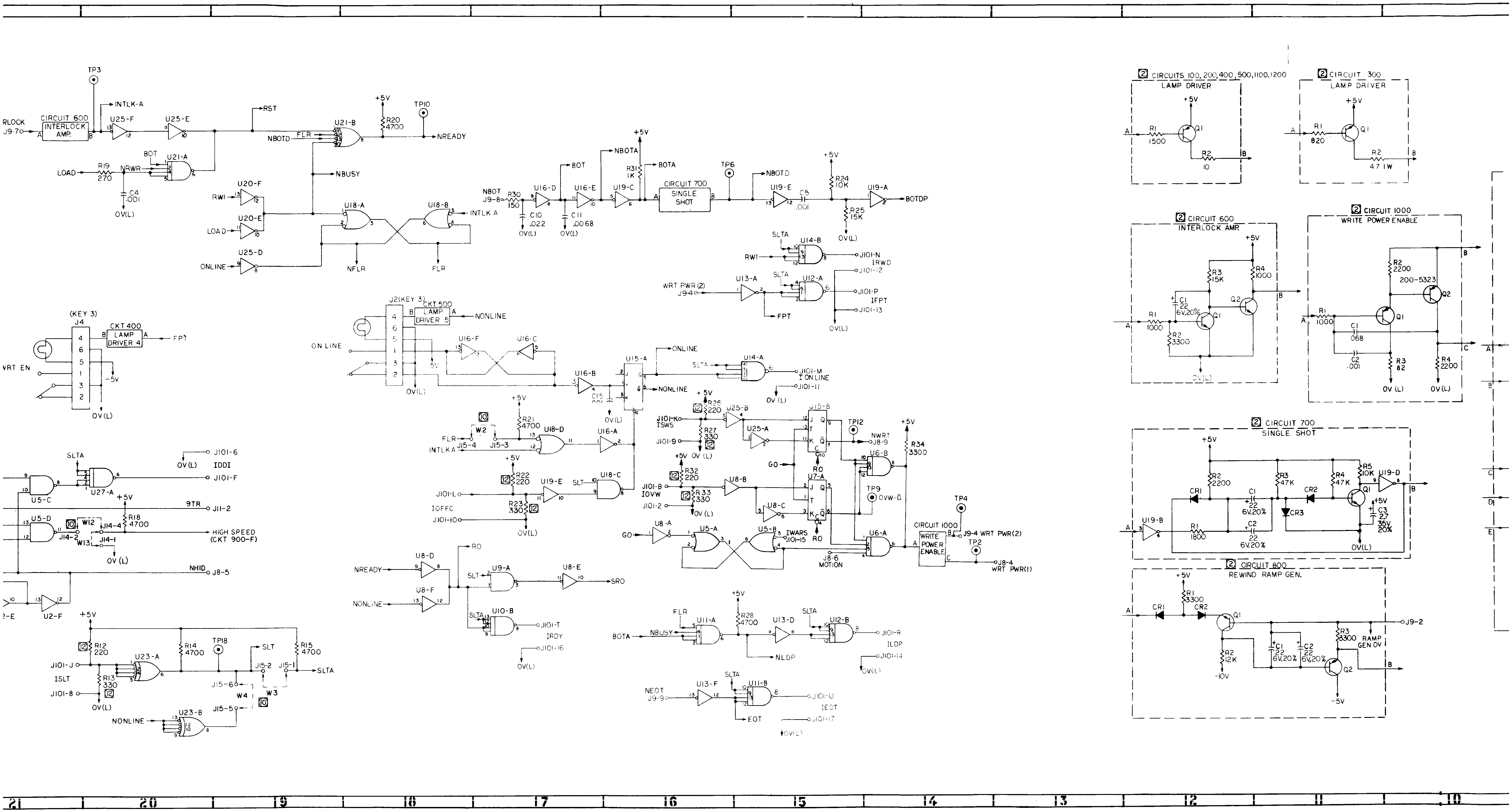
25.

IRCUIT NO. TO
600 IS R604.



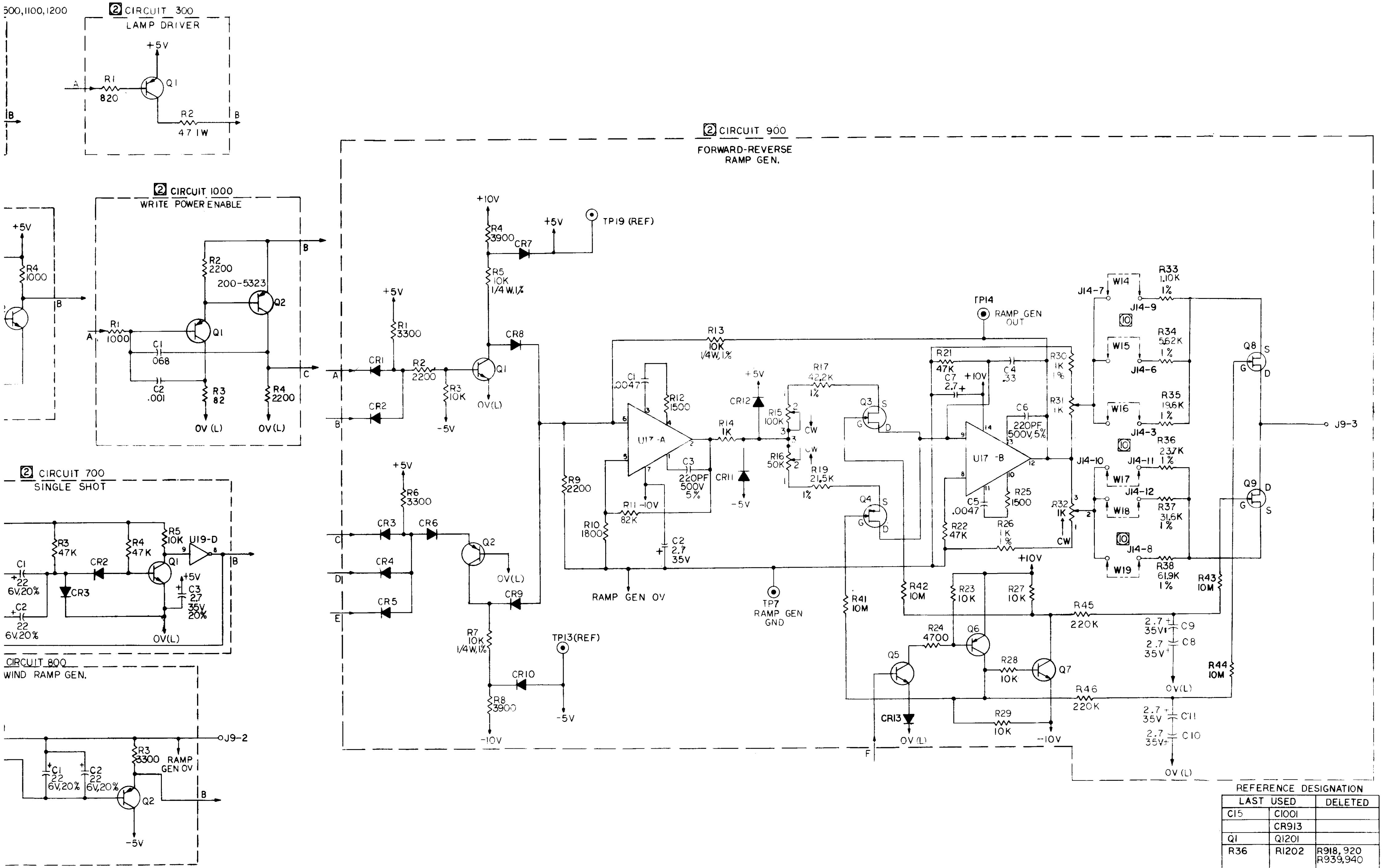


TP21 MOT
TP11 NMOT
U13-B
U13-E
MOTION J8-6
LOAD
NBOTD
NRWR
U10-A
+5V
R29 4700
TP17
CIRCUIT 900
D (FWD)
TP20
C (FWD)
TP16
E (FWD)
FWD REV RAMP GEN
TP14 (REF)
U29-C
U28-A
R3 330
SRO
U28-D
R6 150
C1 .0047
OV(L)
U29-A
R7 1000
C2 .001
R8 4700
R9 1000
Q1
GO
U29-F
U28-B
U28-C
REV
TP22 B (REV)
TP24 A (REV)
BOT
U29-B
J9-3 (REF)
HIGH SPEED
TP8
NRWR
CIRCUIT 800 REWIND RAMP GEN
TP5
REWIND RAMP J9-1
RWI
NRW3
U9-B
U22-B
U26-A
RWI
U26-B
RW2
NBOTA
NRWI
U24-B
BOTA
RW3
TP15
NRW3
U27-B
C12 .001
RST
U22-D
IFLR
U24-A
LOAD
U22-A
C3 .001
INTERLOCK J9-7
CIRCUIT 600 INTERLOCK AMP.
TP3
INTLK-A
U25-F
U25-E
RST
LOAD
R19 270
NRWR
BOT
U21-A
C4 .001
U21-B
NBOTD
FLR
+5V
R20 4700
TP10
NREADY
NBUSY
U20-F
RWI
U20-E
U18-A
U18-B
INTLK A
U25-D
ONLINE
NFLR
FLR
(KEY 3) J4
CKT 400 LAMP DRIVER 4
FPT
WRT EN
-5V
J12 (KEY 3)
R1 15
R35 4700
9 TRACK
J13-6
J13-9
W8
U1-E
J13-5
W9
J13-8
U1-F
W11
J13-1
U5-C
SLTA
U27-A
J101-6 IDDI
J101-F
9TR J11-2
R18 4700
U5-D
W12
J14-4
J14-2
J14-1
W13
HIGH SPEED (CKT 900-F)
J5 (KEY 3)
CKT 300 LAMP DRIVER 3
HIGH DENSITY
NHID J8-5
W7
R36 4700
J13-3
J13-4
U2-E
U2-F
W10
J13-2
W5
J13-7
R16 220
U29-D
U29-E
J101-D
IDDS
R17 330
J101-4
R12 220
J101-J
ISLT
R13 330
J101-8
U23-A
R14 4700
TP18
SLT
R15 4700
J15-2
J15-1
SLTA
J15-6
W4
W3
J15-5
NONLINE
U23-B
NBOT J9-8
R30 150
C10 .022
U16-D
NBOT
C11 .0068
U16-E
R31 1K
NBOTA
BOTA
U19-C
CIRCUIT 700 SINGLE SHOT
TP6
NBOTD
U19-E
C5 .001
R24 10K
R25 15K
U14-B
J101-N
IRW
WRT PWR (2) J9-4
U13-A
U12-A
J101-12
J101-P
IFPT
J101-13
J2 (KEY 3)
CKT 500 LAMP DRIVER 5
NONLINE
ON LINE
U16-F
U16-C
U15-A
ONLINE
U14-A
J101-M
I ONLINE
J101-11
U16-B
C15
NONLINE
R26 220
U25-B
U15-B
TP12
R21 4700
W2
FLR
J15-4
J15-3
INTLKA
U18-D
U16-A
J101-K ISWS
R27 330
U25-A
J101-9
NWR J8-9
R22 220
U19-E
U18-C
R32 220
U8-B
J101-L IOFFC
R23 330
J101-B IOVW
R33 330
U7-A
U8-C
J101-2
J101-10
TP9
GO
U8-A
U5-A
U5-B
IWARS J101-15
RO
U6-A
J8-6 MOTION
NREADY
U8-D
RO
U9-A
U8-E
SRO
U8-F
U10-B
J101-T IRDY
J101-16
FLR
U11-A
R28 4700
U13-D
U12-B
BOTA
NBUSY
NLDP
NEOT J9-9
U13-F
U11-B
J101-U IEOT
EOT
J101-17
25
24
23
22
21
20
19
18
17
16
15



TP3
INTLK-A
RLOCK J9-7
CIRCUIT 600 INTERLOCK AMP.
U25-F
U25-E
RST
U21-B
+5V
R20 4700
TP10
NREADY
NBOTD
FLR
LOAD
R19 270
NRWR
BOT
U21-A
C4 .001
OV(L)
NBUSY
RWI
U20-F
U20-E
U18-A
U18-B
INTLK A
ONLINE
U25-D
NFLR
FLR
NBOT J9-8
R30 150
C10 .022
U16-D
U16-E
C11 .0068
U19-C
BOT
NBOTA
R31 1K
BOTA
CIRCUIT 700 SINGLE SHOT
TP6
NBOTD
U19-E
C5 .001
R24 10K
R25 15K
U19-A
BOTDP
SLTA
U14-B
J101-N IRWD
WRT PWR (2) J9-4
U13-A
U12-A
J101-12
J101-P IFPT
J101-13
FPT
(KEY 3) J4
CKT 400 LAMP DRIVER 4
FPT
WRT EN
-5V
J2(KEY 3)
CKT 500 LAMP DRIVER 5
NONLINE
ON LINE
U16-F
U16-C
U16-B
U15-A
C15 .001
ONLINE
NONLINE
U14-A
J101-M I ON LINE
J101-11
R21 4700
W2
U18-D
U16-A
J15-4
J15-3
INTLKA
R22 220
U19-E
U18-C
J101-L IOFFC
J101-10
R23 330
J101-K ISWS
R26 220
U25-B
R27 330
U25-A
U15-B
TP12
NWRT J8-9
R34 3300
J101-9
GO
U6-B
R0
J101-B IOVW
R32 220
U8-B
U7-A
TP9 OVW-Q̄
R33 330
J101-2
U8-C
U8-A
U5-A
U5-B
IWARS J101-15
J8-6 MOTION
U6-A
CIRCUIT 1000 WRITE POWER ENABLE
TP4
J9-4 WRT PWR(2)
TP2
J8-4 WRT PWR(1)
SLTA
U5-C
U27-A
J101-6
IDDI
J101-F
9TR
J11-2
U5-D
W12
J14-4
J14-2
W13
J14-1
R18 4700
HIGH SPEED (CKT 900-F)
NHID
J8-5
U2-F
+5V
R12 220
U23-A
R14 4700
TP18
SLT
R15 4700
J101-J ISLT
R13 330
J101-8
J15-2
J15-1
J15-6
SLTA
W4
W3
J15-5
NONLINE
U23-B
R0
U8-D
NREADY
U9-A
U8-E
SRO
U8-F
NONLINE
U10-B
J101-T IRDY
J101-16
FLR
U11-A
R28 4700
U13-D
U12-B
BOTA
NBUSY
J101-R ILDP
NLDP
J101-14
NEOT J9-9
U13-F
U11-B
J101-U IEOT
EOT
J101-17
CIRCUITS 100, 200, 400, 500, 1100, 1200 LAMP DRIVER
R1 1500
Q1
R2 10
CIRCUIT 300 LAMP DRIVER
R1 820
R2 47 1W
CIRCUIT 600 INTERLOCK AMP.
R3 15K
R4 1000
C1 22 6V,20%
Q2
R1 1000
R2 3300
CIRCUIT 1000 WRITE POWER ENABLE
R2 2200
200-5323
R1 1000
C1 .068
C2 .001
R3 82
R4 2200
CIRCUIT 700 SINGLE SHOT
R2 2200
R3 47K
R4 47K
R5 10K
U19-D
CR1
CR2
CR3
C1 22 6V,20%
C3 2.7 35V 20%
U19-B
R1 1800
C2 22 6V,20%
CIRCUIT 800 REWIND RAMP GEN.
R1 3300
CR1
CR2
J9-2
R3 3300
RAMP GEN OV
C1 22 6V,20%
C2 22 6V,20%
R2 12K
-10V
-5V
21
20
19
18
17
16
15
14
13
12
11
10

REVISIONS					
REV	DESCRIPTION	DATE	DR	CHK	APPR
B	ERN 2-WR	12/72	SR		
C	ECN 2253		TB		
D	ECN 2372	3-22-71			
E	ECN 2610	4/3/71	B		
F	ECN 3968	9-22-72	D.C		RCA
G	/6003	2-7-74			



VERSION TABLE

101882 DASH NO.	R2,4,10,12,16, 22,26,32 ⑫	R3,5,11,13,17, 23,27,33 ⑫	W1 ⑪ 100373-02	USAGE
-01	USE	USE	OMIT	STANDARD TRANSPORT
-02	OMIT	OMIT	USE	USE WITH MTA WITH CUSTOMER CONTROLLER
-03	OMIT	OMIT	OMIT	USE WITH MTA WITH PERTEC FORMATTER

REFERENCE DESIGNATION

LAST USED		DELETED
C15	C1001	
	CR913	
Q1	Q1201	
R36	R1202	R918, 920 R939,940
J15		
TP23		
W19		W6
U29		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010
.XXX ± .005
X/X ± 1/32
ANGULAR ± 1/2°
✓
BREAK ALL SHARP CORNERS
APPROX. .010

THE INFORMATION HEREON IS THE PROPERTY OF PERIPHERAL EQUIPMENT CORPORATION. NO REPRODUCTION OR UNAUTHORIZED USE SHALL BE MADE.

SIGNATURES	DATE
DR	
CHK	
DES	
ENGR	
ENGR	

NEXT ASSY	1ST USED ON
APPLICATION	

FINISH:

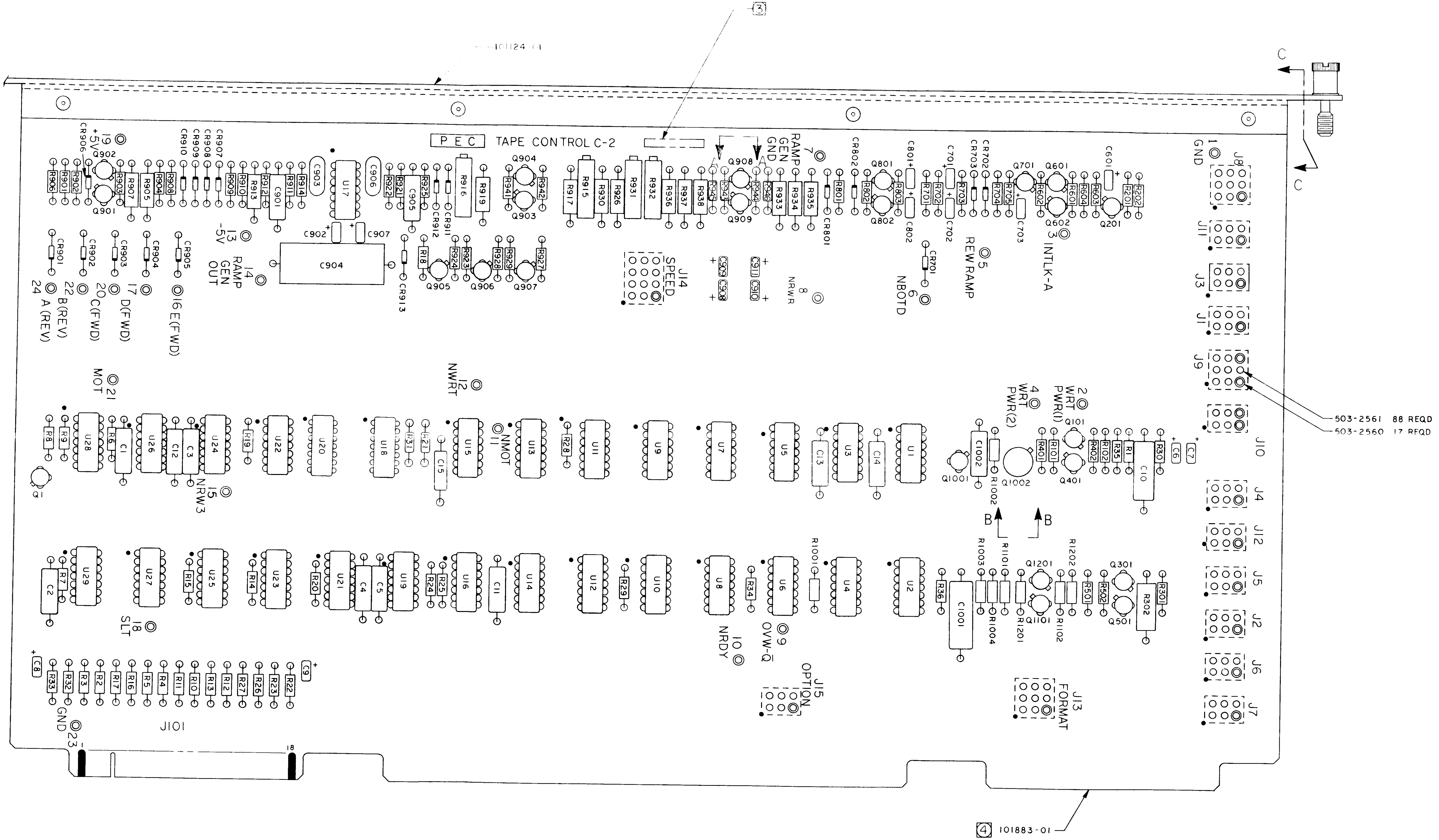
MATL:

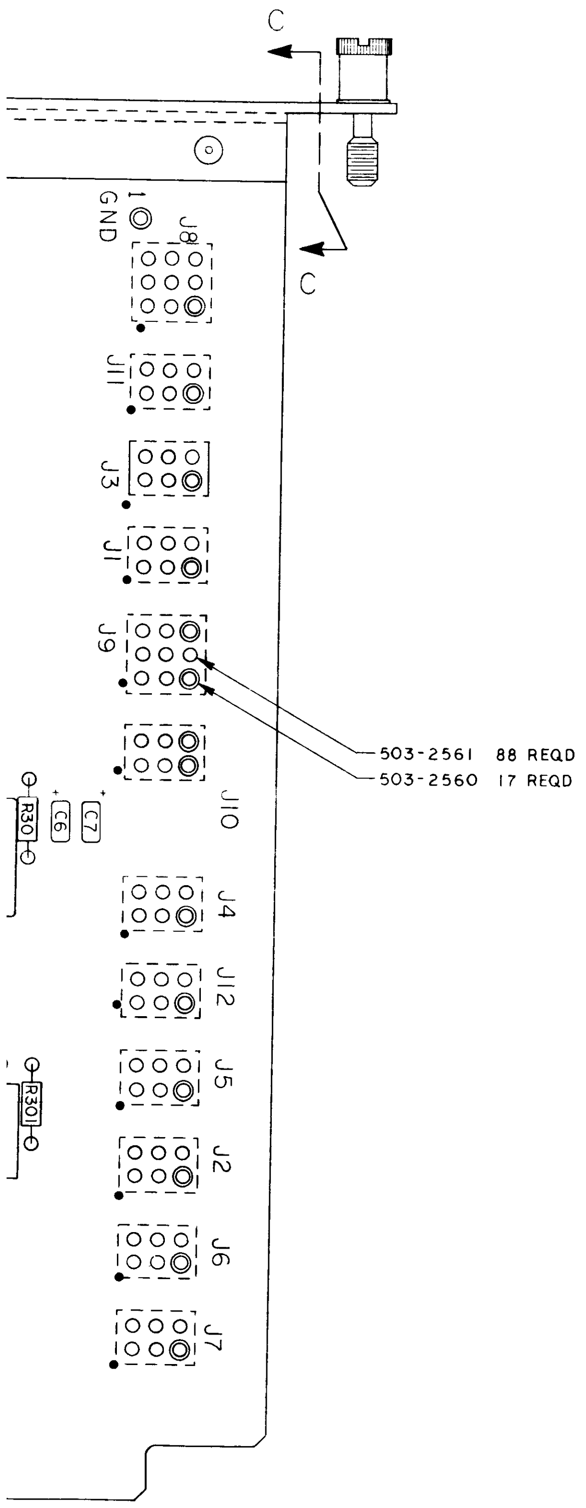
PEC PERIPHERAL EQUIPMENT CORPORATION

TITLE
SCHEMATIC DIAGRAM
TAPE CONTROL C2

SIZE	CODE IDENT NO.	DWG NO.	REV
J		101881	G

SCALE
DO NOT SCALE DWG
SHEET OF


PEC TAPE CONTROL C-2
③
101124-01
C
C
19 +5V
13 -5V
14 RAMP GEN OUT
24 A (REV)
22 B(REV)
20 C(FWD)
17 D(FWD)
16 E(FWD)
7 RAMP GEN GND
8 NRWR
6 NBOTD
5 REW RAMP
3 INTLK-A
1 GND
J14 SPEED
21 MOT
12 NWRT
11 NMOT
15 NRW3
4 WRT PWR(2)
2 WRT PWR(1)
B
B
18 SLT
10 NRDY
9 OVW-Q
J15 OPTION
J13 FORMAT
23 GND
J101
1
18
J8
J11
J3
J1
J9
J10
J4
J12
J5
J2
J6
J7
503-2561 88 REQD
503-2560 17 REQD
④ 101883-01



⑤ VERSIONS WITHOUT TERMINATOR RESISTORS, ARE FOR USE WITH MTA.

④ THIS ASSY SHALL BE MADE FROM PROCESS BOARD 101883-01 REV D AND SUBSEQUENT.

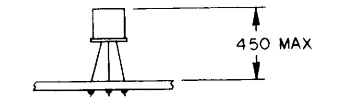
③ RUBBER STAMP ASSY PART NO. INCLUDING VERSION AND ISSUE LETTER.

2. ASSEMBLE PER STANDARD MFG METHODS.

1. REFERENCE DRAWINGS: SCHEMATIC – 101881
SPECIFICATION – 101885

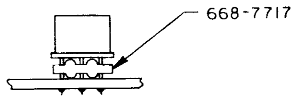
NOTES: UNLESS OTHERWISE SPECIFIED:

REV	
A	ERN 2-
B	ECN 22
C	ECN 23
D	ECN
E	ECN 310
F	ECN 38
G	ECN
G	ECN 517
H	ECN 600



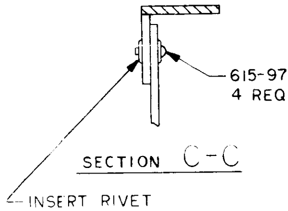
VIEW A-A

TYP TRANSISTOR MTG HEIGHT TO-18

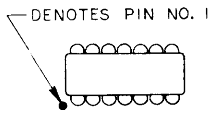


VIEW B-B

TO-5 MTG CONFIGURATION



SECTION C-C



I C ORIENTATION

TABLE I

PART NO.	REF DESIGNATION
100-1005	R102, 202, 402, 502, 1102, 1202
100-1025	R7, 9, 31, 601, 604, 914, 1C01
100-1035	R24, 705, 903, 923 927, 928, 929
100-1065	R941-944
100-1235	R802
100-1505	R1
100-1515	R6, 30
100-1525	R101, 201, 401, 501, 912, 925, 1101, 1201
100-1535	R25, 603
100-1825	R701, 910
100-2225	R702, 902, 909, 1002, 1004
100-2715	R19
100-3325	R34, 602, 801, 803, 901, 906
100-3925	R904, 908
100-4725	R8, 14, 15, 18, 20, 21, 28, 29, 35, 36, 924
100-4735	R703, 704, 921, 922
100-8205	R1003
100-8215	R301
100-8235	R911
100-2245	R945, 946
102-4705	R302
104-5621	R934
104-1001	R926, 930
104-1002	R905, 907, 913
104-2152	R919
104-1962	R935
104-2372	R936
104-1101	R933
104-4222	R917
104-3162	R937
104-6192	R938

TABLE I

PART NO.	REF DESIGNATION
121-1020	R931, 932
121-1040	R915
121-5030	R916
130-2215	C903, 906
131-1020	C2-5, 12-15, 1002
131-2230	C10
131-3340	C904
131-4720	C1, 901, 905
131-6820	C11
131-6830	C1001
132-2262	C601, 701, 702, 801, 802
132-2752	C6-9, 703, 902, 907-911
200-4123	Q1, 601, 602, 701, 901, 905, 907
200-4125	Q101, 201, 301, 401, 501, 801, 802, 902, 906, 1001, 1101, 1201
200-5323	Q1002
204-4393	Q903, 904, 908, 909
300-4446	CR701, 702, 703, 801, 802, 901-913
400-1437	U17
700-8360	U1, 2, 4, 8, 13, 16, 19, 20, 25, 29
700-8440	U6, 10, 11, 12, 14, 21, 23, 27
700-8460	U5, 9, 18, 22, 28
700-8530	U3, 7, 15, 24, 26

REFERENCE DESIGNATION VER	PART NO.		
	-01	-02	-03
R2, 4, 10, 12, 16, 22, 26, 32	100 2215	OMIT	OMIT
R3, 5, 11, 13, 17 23, 27, 33	100-3315	OMIT	OMIT
W1	OMIT	100373-02	OMIT

PART NO. 101882-

TOP ASSY	
NEXT ASSY	1ST USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010
.XXX ± .005
$\frac{X}{X} \pm \frac{1}{32}$
ANGULAR
± 1/2°
✓
BREAK ALL SHARP CORNERS
APPROX. 010

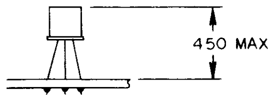
FINISH:

THE INFORMATION HERE
PROPERTY OF PERIPHERA
CORPORATION. NO REPR
UNAUTHORIZED USE SHA

SIGNATURES
DR L. G. Smith
CHK
DES
ENGR
ENGR

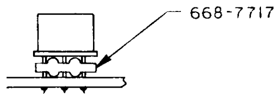
MATL:

REVISIONS					
REV	DESCRIPTION	DATE	DR	CHK	APPR
A	ERN 2-WR	11/6/70	L.G.S.		
B	ECN 2252	12/23/70	TB		
C	ECN 2372	3-22-71	TB		
D	ECN 2410	6/8/71	TB		
E	ECN 3105A	6/29/72	RAS	GH	
F	ECN 3811	6/29/72	RAS	GH	
G	ECN 4908	9-22-72	D.C.	PR2	HA
G1	ECN 5176	7/9/73		PR2	
H	ECN 6003	2-1-74			



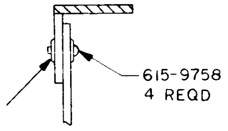
VIEW A-A

ANSISTOR MTG HEIGHT TO-18



VIEW B-B

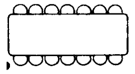
MTG CONFIGURATION



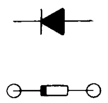
ECTION C-C

RIVET
HIS SIDE

OTES PIN NO. 1



C ORIENTATION

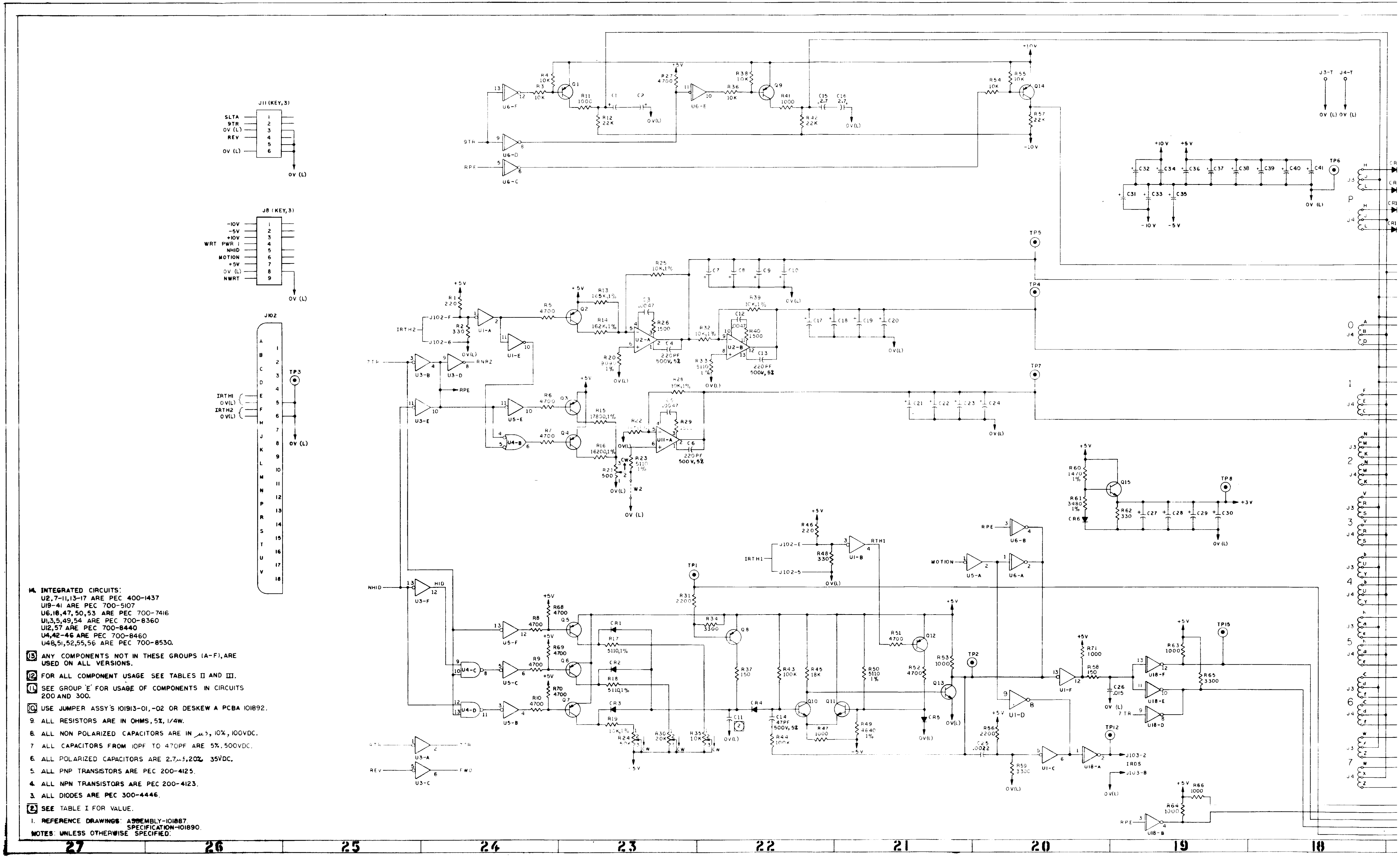


PART NO. 101882- REV

DIODE ORIENTATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: .XX ± .010 .XXX ± .005 $\frac{X}{X} \pm \frac{1}{32}$ ANGULAR ± 1/2° ✓ BREAK ALL SHARP CORNERS APPROX. .010	THE INFORMATION HEREON IS THE PROPERTY OF PERIPHERAL EQUIPMENT CORPORATION. NO REPRODUCTION OR UNAUTHORIZED USE SHALL BE MADE.	PEC PERIPHERAL EQUIPMENT CORPORATION
	SIGNATURES / DATE DR L. G. Smith 11/6/70 CHK DES ENGR ENGR	TITLE PCBA TAPE CONTROL C2
TOP ASSY / NEXT ASSY / 1ST USED ON / APPLICATION	FINISH:	MATL:

SIZE	CODE IDENT. NO.	DWG NO.	REV
E		101882	H
SCALE 2/1		DO NOT SCALE DWG	SHEET 1 OF 1



14. INTEGRATED CIRCUITS:
U2,7-11,13-17 ARE PEC 400-1437
U19-41 ARE PEC 700-5107
U6,18,47,50,53 ARE PEC 700-7416
U1,3,5,49,54 ARE PEC 700-8360
U12,57 ARE PEC 700-8440
U4,42-46 ARE PEC 700-8460
U48,51,52,55,56 ARE PEC 700-8530.

⑬ ANY COMPONENTS NOT IN THESE GROUPS (A-F), ARE USED ON ALL VERSIONS.

⑫ FOR ALL COMPONENT USAGE SEE TABLES II AND III.

⑪ SEE GROUP 'E' FOR USAGE OF COMPONENTS IN CIRCUITS 200 AND 300.

⑩ USE JUMPER ASSY'S 101913-01,-02 OR DESKEW A PCBA 101892.

9. ALL RESISTORS ARE IN OHMS, 5%, 1/4W.

8. ALL NON POLARIZED CAPACITORS ARE IN μf, 10%, 100VDC.

7. ALL CAPACITORS FROM 10PF TO 470PF ARE 5%, 500VDC.

6. ALL POLARIZED CAPACITORS ARE 2.7μf, 20% 35VDC.

5. ALL PNP TRANSISTORS ARE PEC 200-4125.

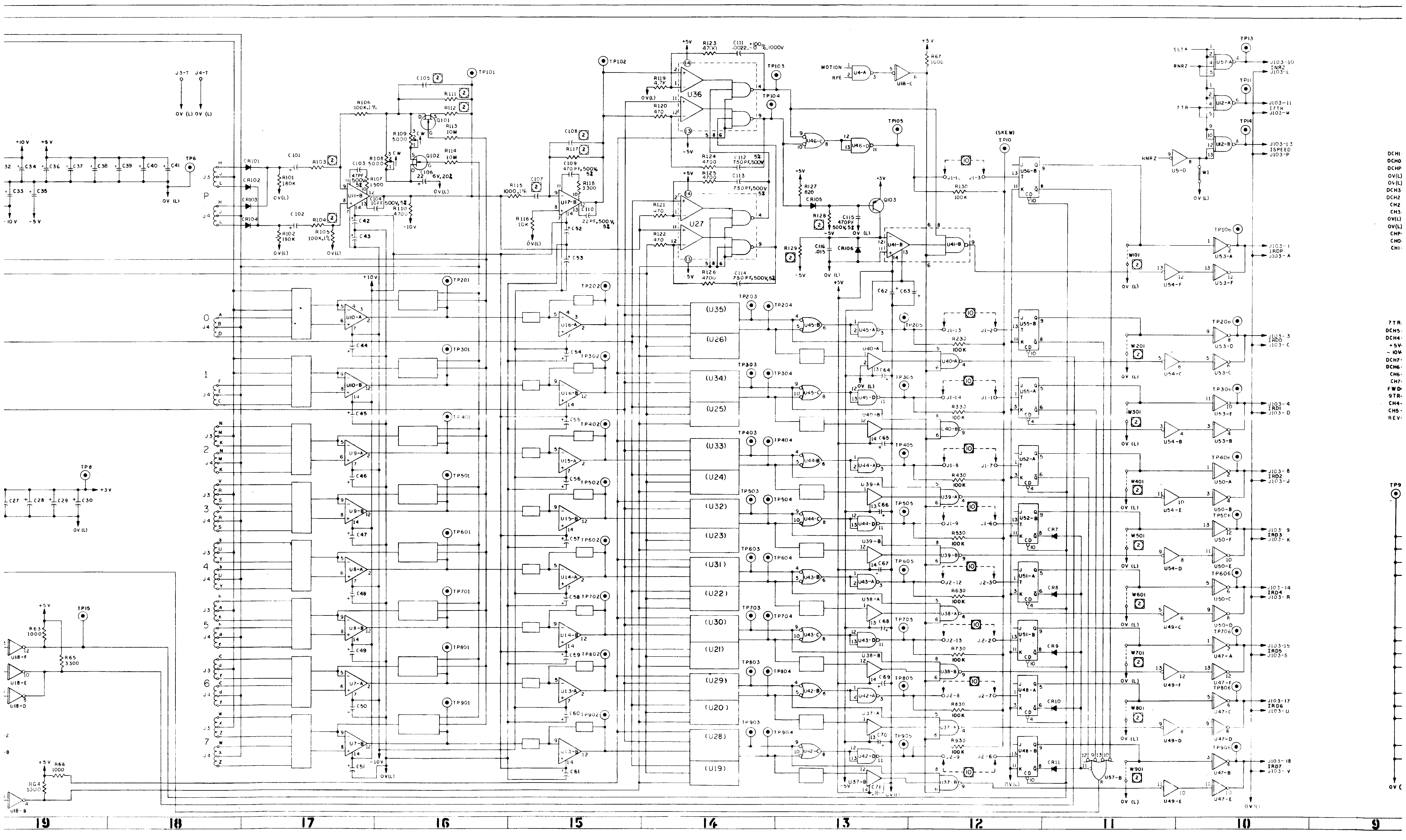
4. ALL NPN TRANSISTORS ARE PEC 200-4123.

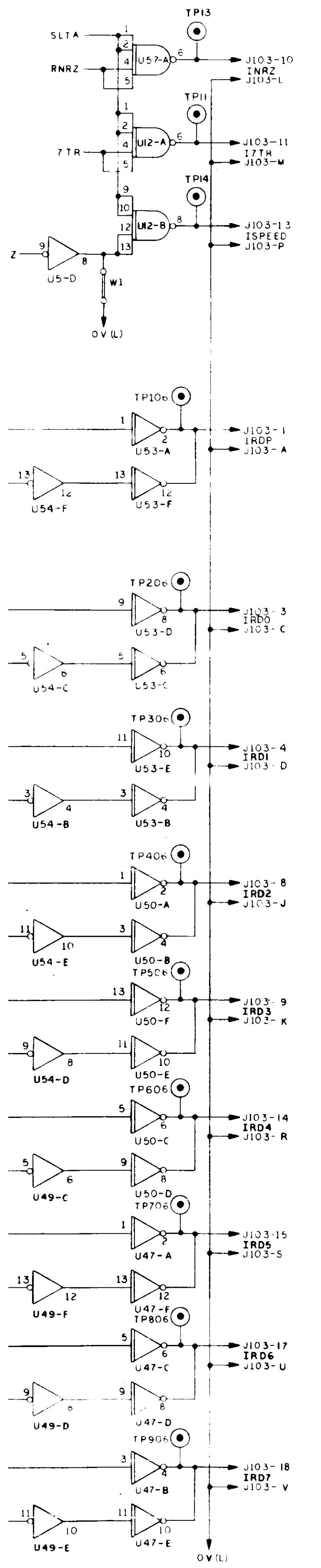
3. ALL DIODES ARE PEC 300-4446.

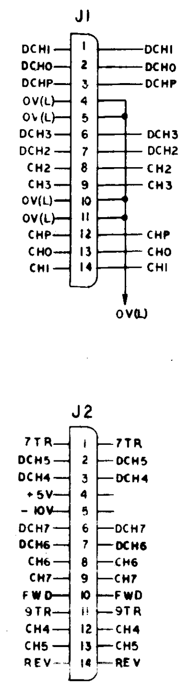
② SEE TABLE I FOR VALUE.

1. REFERENCE DRAWINGS: ASSEMBLY-101887. SPECIFICATION-101890.

NOTES: UNLESS OTHERWISE SPECIFIED:


J3-T
J4-T
0V (L) 0V (L)
+10V
+5V
-10V
-5V
TP6
TP8
+3V
TP15
R63 1000
R65 3300
R66 1000
R64 1000
U18-F
U18-E
U18-D
U18-B
CR101
CR102
CR103
CR104
C101
C102
R101 180K
R102 180K
R103
R104
R105 100K,1%
R106 100K,1%
C103 47PF 500V 5%
R107 1500
R108 5000
R109 5000
C104 10PF 500V,5%
R110 470
U11-B
C42
C43
C105
TP101
R111
R112
R113 10M
R114 10M
Q101
Q102
C106 22 6V,20%
TP102
C107
R115 1000,1%
R116 10K
C108
R117
C109 470PF,500V,5%
R118 3300
C110 22PF,500V,5%
U17-B
C52
C53
+5V
R123 4700
C111 .0022,+100%-0%,1000V
R119 4.7K
R120 470
U36
-5V
R124 4700
C112 750PF,500V
R125 4700
C113 750PF,500V
R121 470
R122 470
U27
R126 4700
C114 750PF,500V,5%
TP103
TP104
MOTION
RPE
U4-A
U18-C
R67 1000
U46-C
U46-D
TP105
R127 820
CR105
Q103
R128
C115 470PF 500V,5%
R129
C116 .015
CR106
U41-B
C62
C63
(SKEW) TP10
J1-L
J1-3
R130 100K
U56-B
SLTA
RNRZ
U57-A
TP13
J103-10 INRZ J103-L
TP11
7TR
U12-A
J103-11 I7TR J103-M
TP14
U12-B
J103-13 ISPEED J103-P
U5-D
W1
W101
U54-F
TP106
U53-A
J103-1 IRDP J103-A
U53-F
0
1
2
3
4
5
6
7
J3
J4
U10-A
U10-B
U9-A
U9-B
U8-A
U8-B
U7-A
U7-B
C44 C45 C46 C47 C48 C49 C50 C51
TP201 TP301 TP401 TP501 TP601 TP701 TP801 TP901
U16-A
U16-B
U15-A
U15-B
U14-A
U14-B
U13-A
U13-B
C54 C55 C56 C57 C58 C59 C60 C61
TP202 TP302 TP402 TP502 TP602 TP702 TP802 TP902
(U35) (U26) (U34) (U25) (U33) (U24) (U32) (U23) (U31) (U22) (U30) (U21) (U29) (U20) (U28) (U19)
TP203 TP204 TP303 TP304 TP403 TP404 TP503 TP504 TP603 TP604 TP703 TP704 TP803 TP804 TP903 TP904
U45-B U45-C U44-B U44-C U43-B U43-C U42-B U42-C
U45-A U45-D U44-A U44-D U43-A U43-D U42-A U42-D
U40-A U40-B U39-A U39-B U38-A U38-B U37-A U37-B
C64 C65 C66 C67 C68 C69 C70 C71
TP205 TP305 TP405 TP505 TP605 TP705 TP805 TP905
J1-13 J1-2 J1-14 J1-1 J1-8 J1-7 J1-9 J1-6 J2-12 J2-3 J2-13 J2-2 J2-8 J2-7 J2-9 J2-6
R230 100K R330 100K R430 100K R530 100K R630 100K R730 100K R830 100K R930 100K
U55-B U55-A U52-A U52-B U51-A U51-B U48-A U48-B
CR7 CR8 CR9 CR10 CR11
U57-B
W201 W301 W401 W501 W601 W701 W801 W901
U54-C U54-B U54-E U54-D U49-C U49-F U49-D U49-E
TP206 TP306 TP406 TP506 TP606 TP706 TP806 TP906
U53-D U53-C U53-E U53-B U50-A U50-B U50-F U50-E U50-C U50-D U47-A U47-F U47-C U47-D U47-B U47-E
J103-3 IRD0 J103-C
J103-4 IRD1 J103-D
J103-8 IRD2 J103-J
J103-9 IRD3 J103-K
J103-14 IRD4 J103-R
J103-15 IRD5 J103-S
J103-17 IRD6 J103-U
J103-18 IRD7 J103-V
0V (L)
DCH1 DCH0 DCHP 0V(L) 0V(L) DCH3 DCH2 CH2 CH3 0V(L) 0V(L) CHP CH0 CH1
7TR DCH5 DCH4 +5V -10V DCH7 DCH6 CH6 CH7 FWD 9TR CH4 CH5 REV
TP9
19
18
17
16
15
14
13
12
11
10
9





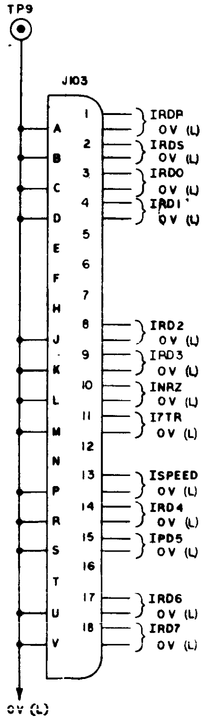


TABLE III ⑫ ⑬

GROUP A-9 TRACK GAIN SWITCHING	
Q102,402-902	
R109,409-909,114,414-914	
GROUP B-PE GAIN SWITCHING	
Q14,101-901	
R54,55,57,112-912,113-913	
GROUP C-NRZ1 (7 CHANNELS ONLY)	
U2,19-24,27,42,43,44,46,48,51, U52,56,57	
CR1-5, 7-11	
Q2,5-8,10-13	
R5,8,9,10,13,14,17-20,25,26, R31-34,37,39,40,43,44,45,47, R49-53,58,68-71, R121,421-921,122,422-922, R125,425-925,126,426-926, R130,430-930	
C3,4,7-14,17,20,25,26, C113,413-913,114,414-914	J1, 2
GROUP D-PE	
U37-41	
CR6,105-905,106-906	
Q15,103-903	
R60,61,62,127-927,128-928, R129-929,21	
C27-30,115-915,116-916	
GROUP E-BASIC CHANNELS 200/300	
U10,16,34,35	
CR201,301,202,302,203,303, CR204,304	
R201,301,202,302,203,303, R204,304,205,305,206,306, R207,307,208,308,210,310, R211,311,215,315,216,316, R217,317,218,318,219,319, R220,320,223,323,224,324	
C201,301,202,302,203,303, C204,304,205,305,206,306, C207,307,208,308,209,309, C210,310,211,311,212,312	
GROUP F-NRZ1 CHANNELS 200/300	
U25,26,45,55,	
R35,221,321,222,322,225, R325,226,326,230,330	
C213,313,214,314	

TABLE I ②

DASH NO.	MODEL NO	TRACKS	MODES	R103-903 R104-904 1/4W, 1%	⑪ C105-905 500 VDC 5%	⑪ R111-911 1/4W 1%	R112-912 1/4W 1%	⑪ C107-907 100 VDC 10%	⑪ C108-908 500 VDC 5%	⑪ R117-917 1/4W 1%	R128-928 1/4W 1%	R129-929 1/4W 5%	C11 100 VDC 10%	R24 R30	J3	J4	W1	W2	W101 401-901	W 201, 301	–		
-01	6611-000-45S	9	PE	14.7K	100PF	17.8K	—	.001	47PF	9.09K	196K	10K	—	OMIT	OMIT	USE	USE	OMIT	USE	USE			
-02	-37.5S	↑	↑	10K	150PF	13.3K	—	.001	68PF	11K	215K	12K	—	↑	↑	↑	↑	↑	↑	↑			
-03	-25S			10K	150PF	19.6K	—	.0015	150PF	11K	348K	18K	—										
-04	-22.5S			10K	150PF	21.5K	—	.0015	150PF	12.1K	383K	18K	—										
-05	-18.75S		↓	5.11K	330PF	11K	—	.0022	220PF	10K	422K	22K	—						↓	↓			
-06	-12.5S		PE	5.11K	330PF	16.2	—	.0033	330PF	11K	681K	33K	—						USE	USE			
-07	6611-800-45S		PE/NRZ	14.7K	47PF	51.1K	68.1K	.001	47PF	9.09K	196K	10K	.0015						OMIT	OMIT			
-08	-37.5S		↑	10K	68PF	42.2K	56.2K	.001	68PF	11K	215K	12K	.0022						↑	↑			
-09	-25S			10K	68PF	61.9K	82.5K	.0015	150PF	11K	348K	18K	.0033										
-10	-22.5S			10K	68PF	68.1K	90.9K	.0015	150PF	12.1K	383K	18K	.0033										
-11	-18.75S			5.11K	150PF	34.8K	46.4K	.0022	220PF	10K	422K	22K	.0047				↓						
-12	-12.5S			5.11K	150PF	51.1K	68.1K	.0033	330PF	11K	681K	33K	.0068				USE						
-13	-45D			14.7K	100PF	28.7K	—	.001	100PF	9.09K	383K	18K	.0015				OMIT						
-14	-37.5D	↓		10K	150PF	21.5K	—	.001	150PF	11K	422K	22K	.0022	↓	↓		OMIT						
-15	-25D	9		10K	150PF	28.7K	—	.0015	330PF	11K	631K	33K	.0033	OMIT	OMIT		OMIT						
-16	6612-8XX-45S	7/9		14.7K	47PF	51.1K	68.1K	.001	47PF	9.09K	196K	10K	.0015	USE	USE		USE						
-17	-37.5S	↑		10K	68PF	42.2K	56.2K	.001	68PF	11K	215K	12K	.0022	↑	↑		↑						
-18	-25S			10K	68PF	61.9K	82.5K	.0015	150PF	11K	348K	18K	.0033										
-19	-22.5S			10K	68PF	68.1K	90.9K	.0015	150PF	12.1K	383K	18K	.0033										
-20	-18.75S			5.11K	150PF	34.8K	46.4K	.0022	220PF	10K	422K	22K	.0047				↓						
-21	-12.5S			5.11K	150PF	51.1K	68.1K	.0033	330PF	11K	681K	33K	.0068				USE						
-22	-45D			14.7K	100PF	28.7K	—	.001	100PF	9.09K	383K	18K	.0015				OMIT						
-23	-37.5D	↓	↓	10K	150PF	21.5K	—	.001	150PF	11K	422K	22K	.0022	↓	↓		OMIT	↓					
-24	-25D	7/9	PE/NRZ	10K	150PF	28.7K	—	.0015	330PF	11K	681K	33K	.0033	USE	USE		OMIT	OMIT					
-25	6811-000-45S	9	NRZ	14.7K	47PF	51.1K	—	.001	100PF	9.09K	—	—	.0015	OMIT	OMIT		USE	USE					
-26	-37.5S	↑	↑	10K	68PF	42.2K	—	.001	150PF	11K	—	—	.0022	↑	↑		↑	↑					
-27	-25S			10K	68PF	61.9K	—	.0015	220PF	11K	—	—	.0033										
-28	-22.5S			10K	68PF	68.1K	—	.0015	220PF	12.1K	—	—	.0033										
-29	-18.75S	↓		5.11K	150PF	34.8K	—	.0022	330PF	10K	—	—	.0047	↓	↓	↓				↓			
-30	-12.5S	9		5.11K	150PF	51.1K	—	.0033	470PF	11K	—	—	.0068	OMIT	OMIT	USE				OMIT			
-31	6X11-X00-45S	7		14.7K	47PF	51.1K	—	.001	100PF	9.09K	—	—	.0015	USE	USE	OMIT				USE			
-32	-37.5S	↑		10K	68PF	42.2K	—	.001	150PF	11K	—	—	.0022	↑	↑	↑				↑			
-33	-25S			10K	68PF	61.9K	—	.0015	220PF	11K	—	—	.0033										
-34	-22.5S			10K	68PF	68.1K	—	.0015	220PF	12.1K	—	—	.0033										
-35	-18.75S	↓		5.11K	150PF	34.8K	—	.0022	330PF	10K	—	—	.0047			↓				↓			
-36	-12.5S	7		5.11K	150PF	51.1K	—	.0033	470PF	11K	—	—	.0068			OMIT				USE			
-37	6812-XX0-45S	7/9		14.7K	47PF	51.1K	—	.001	100PF	9.09K	—	—	.0015			USE				OMIT			
-38	-37.5S	↑		10K	68PF	42.2K	—	.001	150PF	11K	—	—	.0022			↑				↑			
-39	-25S			10K	68PF	61.9K	—	.0015	220PF	11K	—	—	.0033										
-40	-22.5S			10K	68PF	68.1K	—	.0015	220PF	12.1K	—	—	.0033										
-41	-18.75S	↓	↓	5.11K	150PF	34.8K	—	.0022	330PF	10K	—	—	.0047	↓	↓			↓	↓	↓			
-42	-12.5S	7/9	NRZ	5.11K	150PF	51.1K	—	.0033	470PF	11K	—	—	.0068	USE	USE			USE	OMIT	OMIT			
-43	6611-000-75S	9	PE	19.6K	100PF	10K	—	.001	68PF	5.11K	110K	5.6K	—	OMIT	OMIT		↓	OMIT	USE	USE			
-44	6611-800-75S	9	PE/NRZ	↑	33PF	38.3K	90.9K	↑	68PF	↑	110K	5.6K	.001	OMIT	OMIT		USE	↑	OMIT	OMIT			
-45	-75D	9	↑		100PF	19.6K	—		150PF		215K	10K	↑	OMIT	OMIT		OMIT		↑	↑			
-46	6612-8XX-75S	7/9	↓		33PF	38.3K	90.9K		68PF		110K	5.6K		USE	USE		USE	↓					
-47	-75D	7/9	PE/NRZ		100PF	19.6K	—		150PF		215K	10K		USE	USE	↓	OMIT	OMIT		↓			
-48	6811-000-75S	9	NRZ		33PF	38.3K	—		↑		—	—		OMIT	OMIT	USE	USE	USE		OMIT			
-49	6X11-X00-75S	7	NRZ	↓	33PF	38.3K	—	↓	↓	↓	—	—	↓	USE	USE	OMIT	USE	USE	↓	USE			
-50	6812-XX0-75S	7/9	NRZ	19.6K	33PF	38.3K	—	.001	150PF	5.11K	—	—	.001	USE	USE	OMIT	USE	USE	OMIT	OMIT			

TABLE II ⑫

DASH NO.	GROUPS A	B	C	D	E	F
-01	OMIT	OMIT	OMIT	USE	USE	OMIT
-02	↑	↑	↑	↑	↑	↑
-03						
-04						
-05		↓	↓			↓
-06		OMIT	OMIT			OMIT
-07		USE	USE			USE
-08		↑	↑			↑
-09						
-10						
-11		↓				
-12		USE				
-13		OMIT				
-14	↓	OMIT				
-15	OMIT	OMIT				
-16	USE	USE				
-17	↑	↑				
-18						
-19						
-20		↓				
-21		USE				
-22		OMIT				
-23	↓	↑		↓		
-24	USE			USE		
-25	OMIT			OMIT		
-26	↑			↑		
-27						
-28						
-29					↓	↓
-30					USE	USE
-31					OMIT	OMIT
-32					↑	↑
-33						
-34						
-35	↓				↓	↓
-36	OMIT				OMIT	OMIT
-37	USE				USE	USE
-38	↑				↑	↑
-39						
-40						
-41	↓		↓	↓		↓
-42	USE	↓	USE	OMIT	↓	USE
-43	OMIT	OMIT	OMIT	USE	USE	OMIT
-44	OMIT	USE	USE	↑	↑	USE
-45	OMIT	OMIT	↑			↑
-46	USE	USE		↓		
-47	USE	OMIT		USE	↓	↓
-48	OMIT	OMIT		OMIT	USE	USE
-49	OMIT	OMIT	↓	OMIT	OMIT	OMIT
-50	USE	OMIT	USE	OMIT	USE	USE

REVISIONS

REV	DESCRIPTION	DATE	DR	CHK	APVD
A	ERN 2-ZK				
B	ECN2359				
C	ECN2429				
D	ECN 2647				
E	ECN 3325				
F	ECN 3306				
G	ECN 3568				
H	ECN 6208				

REFERENCE DESIGNATION

LAST USED		DELETED
C71	C916	
CR11	CR906	
Q15	Q903	Q202,302
R71	R930	R209,309 R214,314
TP15	TP906.	
U57		

NEXT ASSY	1ST USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010
.XXX ± .005
ANGULAR ± 1/2°
✓
BREAK ALL SHARP CORNERS
APPROX. .010
FINISH:

THE INFORMATION HEREON IS THE PROPERTY OF PERIPHERAL EQUIPMENT CORPORATION. NO REPRODUCTION OR UNAUTHORIZED USE SHALL BE MADE.

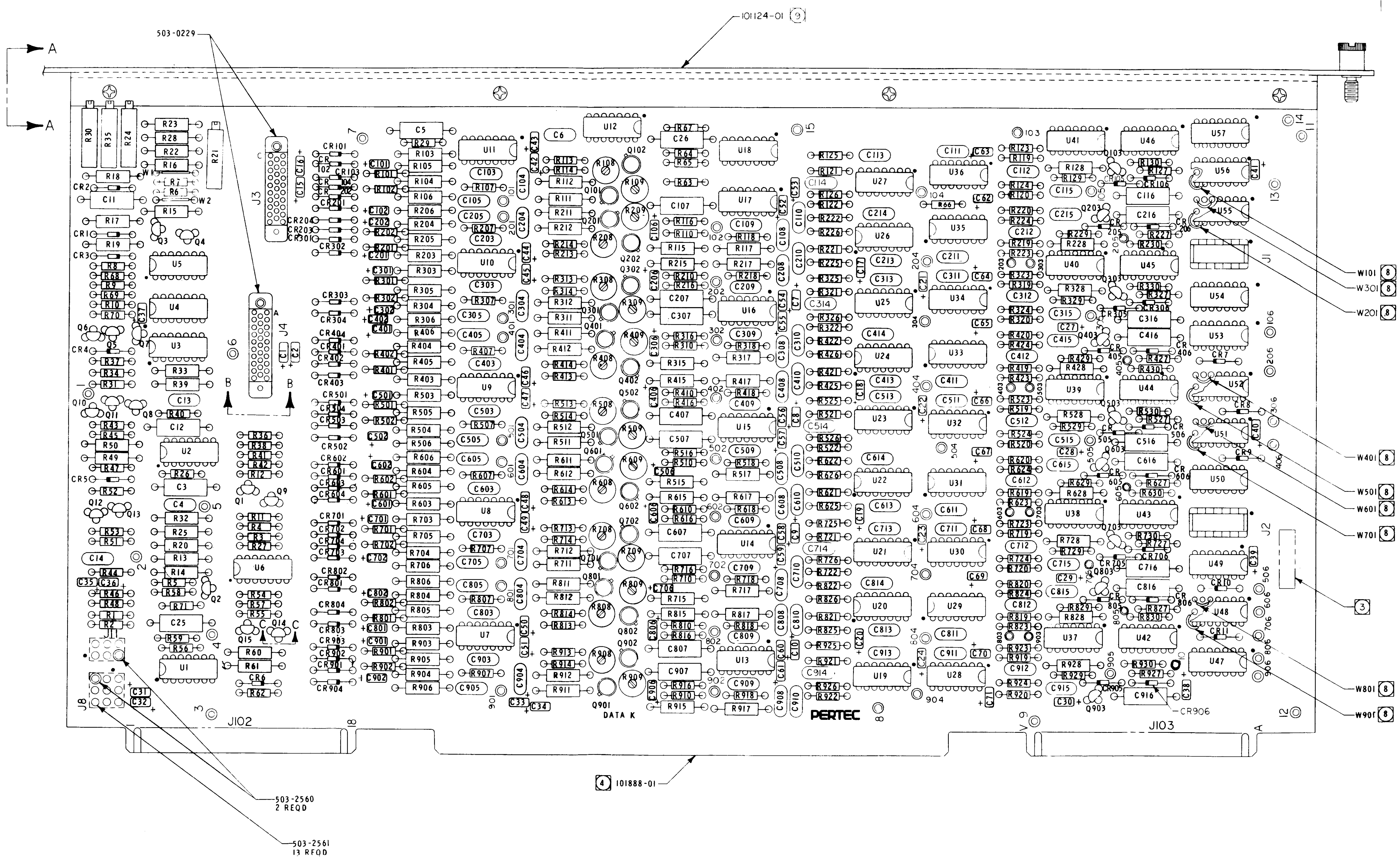
SIGNATURES	DATE
DR	
CHK	
DES	
ENGR	
ENGR	

MATL:

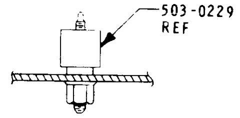
PEC PERIPHERAL EQUIPMENT CORPORATION

TITLE SCHEMATIC
DATA K
READ ONLY
MULTIPLE FORMAT

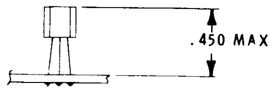
SIZE
DWG NO. 101886
REV H
SCALE
DO NOT SCALE DWG


101124-01 ⑨
503-0229
A
A
J3
J4
B
B
C
C
J102
J103
J1
J2
J8
PERTEC
DATA K
W101 ⑧
W301 ⑧
W201 ⑧
W401 ⑧
W501 ⑧
W601 ⑧
W701 ⑧
W801 ⑧
W901 ⑧
③
④ 101888-01
503-2560
2 REQD
503-2561
13 REQD

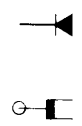
REV	
B	FRN P-ZK, C
D	ECN 2992
E	ECN 2648
F	ECN 3105A,
G	ECN 3325
H	ECN 3306
J	ECN 3389
K	ECN 3568
L	ECN 3383A
L1	ECN 5164
M	ECN 6208



SECTION B-B
MTG DETAIL
FOR J3 AND J4



VIEW C-C
TRANSISTOR MTG HEIGHT, TYP TO-92 & TO-18


DIODE ORI

⑨ BEFORE INSTALLING SUPPORT ANGLE, 101124-01, TO THE BOARD ASSY. APPLY VINYL TAPE 667-4476 TO THE P.C. BOARD AS SHOWN ON VIEW AA. TRIM TO CLEAR COMPONENTS AS REQD.

⑧ JUMPERS W101-901, MADE FROM 695-0026 WIRE AND 669-0122 SLEEVING, ARE TO BE USED IN LIEU OF I.C.'S, ONLY WHEN SO DESIGNATED BY TABLE II, SHEET 2.

⑦ SEE TABLE III FOR PART NO. OF COMPONENTS AFFECTED BY USAGE.

⑥ SEE TABLE II FOR COMPONENTS AFFECTED BY USAGE AND VALUE CHANGE.

⑤ SEE TABLE I FOR COMPONENTS NOT AFFECTED BY VERSION NO.

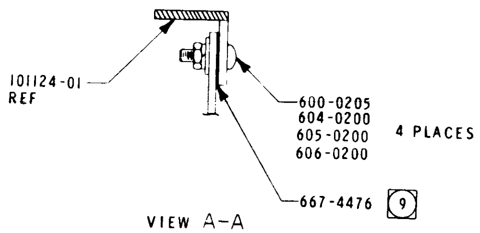
④ THIS ASSEMBLY SHALL BE MADE FROM PROCESS BOARD 101888-01 REV.'C'

③ RUBBER STAMP ASSEMBLY PART NO. INCLUDING VERSION AND ISSUE LETTER.

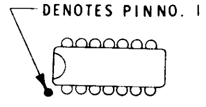
2. ASSEMBLE PER STANDARD MFG. METHODS.

1. REFERENCE DRAWINGS: SCHEMATIC 101886
SPECIFICATION 101890

NOTES: UNLESS OTHERWISE SPECIFIED.



VIEW A-A



IC ORIENTATION

PART NO. 10187-   RE

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010   ANGULAR
.XXX ± .005   ± 1/2°
X/X ± 1/32   ✓
BREAK ALL SHARP CORNERS
APPROX. 010

THE INFORMATION HEREON IS TH
PROPERTY OF PERIPHERAL EQUIP
CORPORATION. NO REPRODUCTIO
UNAUTHORIZED USE SHALL BE M

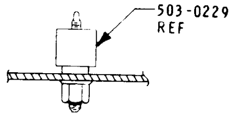
SIGNATURES
DR W. S. LeBeau
CHK
DES
ENGR R.A. NELSON
ENGR R. D. PETIT

TOP ASSY	ROT
NEXT ASSY	1ST USED ON
APPLICATION	

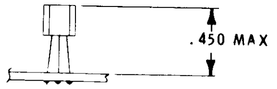
FINISH:

MATL:

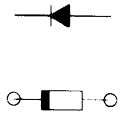
REVISIONS					
REV	DESCRIPTION	DATE	DR	CHK	APPR
B	ERN 2-2K, C ECN 2429	—	—	—	—
D	ECN 2992 & D1 ECN 3307	6.8.71	WSL	—	—
E	ECN 2648 REVISED & REDRAWN	11.30.71	WSL		
F	ECN 3105A, CANCELLED, NOT INCORPORATED	3/7/72			
G	ECN 3325	3/7/72			
H	ECN 3306	3/9/72			
J	ECN 3389	3/10/72	L.L.		
K	ECN 3568	4/24/72	L.L.		RA
L	ECN 3383A	8/23/72	D.C	K.K	RA
L1	ECN 5164	7/3/73			RCA
M	ECN 6208	5/29/74		CCA	



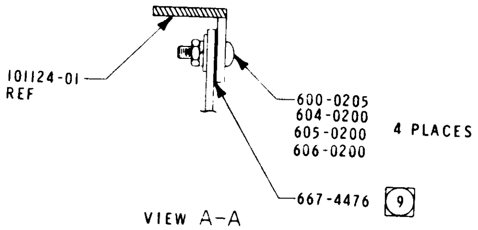
SECTION B-B
MTG DETAIL
FOR J3 AND J4



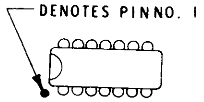
VIEW C-C
TRANSISTOR MTG HEIGHT, TYP TO-92 & TO-18



DIODE ORIENTATION



VIEW A-A



IC ORIENTATION

PART NO. 10187- REV

TOP ASSY	ROT
NEXT ASSY	1ST USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010
.XXX ± .005
X/X ± 1/32
ANGULAR ± 1/2°
✓
BREAK ALL SHARP CORNERS
APPROX. 010

FINISH:

THE INFORMATION HEREON IS THE PROPERTY OF PERIPHERAL EQUIPMENT CORPORATION. NO REPRODUCTION OR UNAUTHORIZED USE SHALL BE MADE.

SIGNATURES	DATE
DR W. S. LeBeau	6.8.71
CHK	
DES	
ENGR R.A. NELSON	1.21.71
ENGR R. D. PETIT	1.21.71

MATL:

PEC
PERIPHERAL
EQUIPMENT CORPORATION

TITLE
PCBA DATA K
READ ONLY
MULTIPLE FORMAT

SIZE	CODE IDENT. NO.	DWG NO.	REV
E		101887	M

SCALE 2/1
DO NOT SCALE DWG
SHEET 1 OF 3

REV	DESCRIPTION	DATE	DR	CHK	APPR
	SEE SHT 1				

TABLE I ⑤

PART NO.	REFERENCE DESIGNATION
400-1437	U7-9,11,13-15,17
700-5107	U28-33,36
700-7416	U6,18,47,50,53
700-8360	U1,3,5,49,54
700-8440	U12
700-8460	U4
100-2215	R1,46
100-3315	R2,48
100-4715	R120,420-920
100-1025	R11,41,63,64,66,67
100-1525	R29,107,407-907
100-2225	R56
100-3325	R59,65,118,418-918
100-4725	R6,7,27,110,410-910,119,419-919 R123,423-923,124,424-924
100-1035	R3,4,36,38,116,416-916
100-2235	R12,42
100-1845	R101,401-901,102,402-902
104-1001	R115,415-915
104-5111	R23
104-1002	R22,28
104-1622	R16
104-1782	R15
104-1003	R105,405-905,106,406-906
123-5020	R108,408-908
130-1005	C104,404-904
130-2205	C110,410-910
130-4705	C103,403-903
130-2215	C6
130-7515	C112,412-912
130-4715	C109,409-909
131-4720	C5
132-2752	C1,2,15,16,21-24,31-71, C101,401-901,102,402-902
132-2262	C106,406-906
135-2272	C111,411-911
200-4125	Q1,3,4,9,12
300-4446	CR101,401-901,102,402-902, CR103,403-903,104,404-904

TABLE II ⑥

DASH NO.	U2,19-24, U27,42-44, U46,48,51, U52,56,57	U37-41	U10,16, U34,35	U25,26, U45,55	R109,409-909, R114,414-914	R54,55,57, R113-913	R5,8-10,13,14, R17-20,25,26, R31-34,37,39, R40,43,44,45,47, R49-53,58,68-71 R121,421-921, R122,422-922, R125,425-925, R126,426-926, R130,430-930	R21,60,61,62, R127-927.	R201,301,202, R302,205, R305,206,306, R207,307,208, R308,210,310, R215,315, R216,316, R218,318,219,319, R220,320,223, R323,224,324	R35,221,321, R222,322,225, R325,226,326, R230,330	C3,4,7-10, C12-14, C17-20,25,26, C113,413-913, C114,414-914	C27-30, C115-915, C16-916	C201,301,202, C302,203,303, C204,304, C206,306, C209,309, C210,310,211, C311,212,312	C213,313, C214,314	CR1-5, CR7-11	CR6,105-905 CR106-906	CR201,301 CR202,302 CR203,303 CR204,304	Q102, Q402-902	Q14, Q101-901	Q2,5-8 Q10-13	Q15, Q103 -903	J1,2	J3	J4	W1	W2	⑧ W401 -901	W 301	H24 R30	DASH NO
-01	OMIT	USE	USE	OMIT	OMIT	OMIT	OMIT	USE	USE	OMIT	OMIT	USE	USE	OMIT	OMIT	USE	USE	OMIT	OMIT	OMIT	USE	OMIT	OMIT	USE	USE	OMIT	USE	USE	OMIT	01
-02																														02
-03																														03
-04																														04
-05																														05
-06	OMIT			OMIT		OMIT	OMIT			OMIT	OMIT			OMIT	OMIT				OMIT	OMIT		OMIT					USE	USE		06
-07	USE			USE		USE	USE			USE	USE			USE	USE				USE	USE		USE					OMIT	OMIT		07
-08																														08
-09																														09
-10																														10
-11																														11
-12						USE													USE						USE					12
-13						OMIT													OMIT						OMIT					13
-14						OMIT													OMIT						OMIT					14
-15					OMIT	OMIT												OMIT	OMIT				OMIT		OMIT				OMIT	15
-16					USE	USE												USE	USE				USE		USE				USE	16
-17																														17
-18																														18
-19																														19
-20																														20
-21						USE													USE						USE					21
-22						OMIT													OMIT						OMIT					22
-23																									OMIT					23
-24		USE			USE			USE				USE				USE		USE			USE		USE		OMIT	OMIT			USE	24
-25		OMIT			OMIT			OMIT				OMIT				OMIT		OMIT			OMIT		OMIT		USE	USE			OMIT	25
-26																														26
-27																														27
-28																														28
-29																														29
-30			USE	USE					USE	USE			USE	USE			USE						OMIT	USE				OMIT	OMIT	30
-31			OMIT	OMIT					OMIT	OMIT			OMIT	OMIT			OMIT						USE	OMIT				USE	USE	31
-32																														32
-33																														33
34																														34
-35																														35
-36			OMIT	OMIT	OMIT				OMIT	OMIT			OMIT	OMIT			OMIT	OMIT						OMIT				USE		36
-37			USE	USE	USE				USE	USE			USE	USE			USE	USE						USE				OMIT		37
-38																														38
-39																														39
-40																														40
-41																														41
-42.	USE	OMIT		USE	USE		USE	OMIT		USE	USE	OMIT		USE	USE	OMIT		USE		USE	OMIT	USE	USE			USE	OMIT	OMIT	USE	42
-43	OMIT	USE		OMIT	OMIT	OMIT	OMIT	USE		OMIT	OMIT	USE		OMIT	OMIT	USE		OMIT	OMIT	OMIT	USE	OMIT	OMIT			OMIT	USE	USE	OMIT	43
-44	USE			USE	OMIT	USE	USE			USE	USE			USE	USE			OMIT	USE	USE		USE	OMIT		USE		OMIT	OMIT	OMIT	44
-45					OMIT	OMIT												OMIT	OMIT				OMIT		OMIT				OMIT	45
-46					USE	USE												USE	USE				USE		USE				USE	46
-47		USE			USE	OMIT		USE				USE				USE		USE	OMIT		USE		USE		OMIT	OMIT			USE	47
-48		OMIT	USE	USE	OMIT			OMIT	USE	USE		OMIT	USE	USE		OMIT	USE	OMIT			OMIT		OMIT	USE	USE	USE		OMIT	OMIT	48
-49		OMIT	OMIT	OMIT	OMIT			OMIT	OMIT	OMIT		OMIT	OMIT	OMIT		OMIT	OMIT	OMIT			OMIT		USE	OMIT	USE	USE		USE	USE	49
-50	USE	OMIT	USE	USE	USE	OMIT	USE	OMIT	USE	USE	USE	OMIT	USE	USE	USE	OMIT	USE	USE	OMIT	USE	OMIT	USE	USE	OMIT	USE	USE	OMIT	OMIT	USE	50

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: .XX ± .010 ANGULAR .XXX ± .005 ± 1/2° $\frac{X}{X} \pm \frac{1}{32}$ ✓ BREAK ALL SHARP CORNERS APPROX. .010	THE INFORMATION HEREON IS THE PROPERTY OF PERIPHERAL EQUIPMENT CORPORATION. NO REPRODUCTION OR UNAUTHORIZED USE SHALL BE MADE	PEC	PERIPHERAL EQUIPMENT CORPORATION	
	SIGNATURES / DATE DR CHK DES ENGR ENGR	TITLE	PCBA DATA K READ ONLY MULTIPLE FORMAT	
NEXT ASSY / 1ST USED ON APPLICATION	FINISH:	MATL:	SIZE E / CODE IDENT. NO. / DWG NO. 101887	REV M
			SCALE / DO NOT SCALE DWG	SHEET 2 OF 3

REVISIONS					
REV	DESCRIPTION	DATE	DR	CHK	APPR
	SEE SHEET 1				

TABLE II CONT.

DASH NO.	R203,303 R204,304	R211, 311	R217, 317	C205,305	C207, 307	C208,308	R103,403-903 R104,404-904
-01	104-1472	104-1782	104-9091	130-1015	131-1020	130-4705	104-1472
-02	104-1002	104-1332	104-1102	130-1515	131-1020	130-6805	104-1002
-03	104-1002	104-1962	104-1102	130-1515	131-1520	130-1515	104-1002
-04	104-1002	104-2152	104-1212	130-1515	131-1520	130-1515	104-1002
-05	104-5111	104-1102	104-1002	130-3315	131-2220	130-2215	104-5111
-06	104-5111	104-1622	104-1102	130-3315	131-3320	130-3315	104-5111
-07	104-1472	104-5112	104-9091	130-4705	131-1020	130-4705	104-1472
-08	104-1002	104-4222	104-1102	130-6805	131-1020	130-6805	104-1002
-09	104-1002	104-6192	104-1102	130-6805	131-1520	130-1515	104-1002
-10	104-1002	104-6812	104-1212	130-6805	131-1520	130-1515	104-1002
-11	104-5111	104-3482	104-1002	130-1515	131-2220	130-2215	104-5111
-12	104-5111	104-5112	104-1102	130-1515	131-3320	130-3315	104-5111
-13	104-1472	104-2872	104-9091	130-1015	131-1020	130-1015	104-1472
-14	104-1002	104-2152	104-1102	130-1515	131-1020	130-1515	104-1002
-15	104-1002	104-2872	104-1102	130-1515	131-1520	130-3315	104-1002
-16	104-1472	104-5112	104-9091	130-4705	131-1020	130-4705	104-1472
-17	104-1002	104-4222	104-1102	130-6805	131-1020	130-6805	104-1002
-18	104-1002	104-6192	104-1102	130-6805	131-1520	130-1515	104-1002
-19	104-1002	104-6812	104-1212	130-6805	131-1520	130-1515	104-1002
-20	104-5111	104-3482	104-1002	130-1515	131-2220	130-2215	104-5111
-21	104-5111	104-5112	104-1102	130-1515	131-3320	130-3315	104-5111
-22	104-1472	104-2872	104-9091	130-1015	131-1020	130-1015	104-1472
-23	104-1002	104-2152	104-1102	130-1515	131-1020	130-1515	104-1002
-24	104-1002	104-2872	104-1102	130-1515	131-1520	130-3315	104-1002
-25	104-1472	104-5112	104-9091	130-4705	131-1020	130-1015	104-1472
-26	104-1002	104-4222	104-1102	130-6805	131-1020	130-1515	104-1002
-27	104-1002	104-6192	104-1102	130-6805	131-1520	130-2215	104-1002
-28	104-1002	104-6812	104-1212	130-6805	131-1520	130-2215	104-1002
-29	104-5111	104-3482	104-1002	130-1515	131-2220	130-3315	104-5111
-30	104-5111	104-5112	104-1102	130-1515	131-3320	130-4715	104-5111
-31	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	104-1472
-32	↑	↑	↑	↑	↑	↑	104-1002
-33							104-1002
-34							104-1002
-35	↓	↓	↓	↓	↓	↓	104-5111
-36	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	104-5111
-37	104-1472	104-5112	104-9091	130-4705	131-1020	130-1015	104-1472
-38	104-1002	104-4222	104-1102	130-6805	131-1020	130-1515	104-1002
-39	104-1002	104-6192	104-1102	130-6805	131-1520	130-2215	104-1002
-40	104-1002	104-6812	104-1212	130-6805	131-1520	130-2215	104-1002
-41	104-5111	104-3482	104-1002	130-1515	131-2220	130-3315	104-5111
-42	104-5111	104-5112	104-1102	130-1515	131-3320	130-4715	104-5111
-43	104-1962	104-1002	104-5111	130-1015	131-1020	130-6805	104-1962
-44	↑	104-3832	↑	130-3305	↑	130-6805	↑
-45		104-1962		130-1015		130-1515	
-46		104-3832		130-3305		130-6805	
-47	↓	104-1962	↓	130-1015	↓	130-1515	
-48	104-1962	104-3832	104-5111	130-3305	131-1020	130-1515	
-49	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	↓
-50	104-1962	104-3832	104-5111	130-3305	131-1020	130-1515	104-1962

DASH NO.	R111, 411-911	R112-912	R117, 417-917	R128-928	R129-929	C105, 405-905	C107, 407-907	C108, 408-908	C11
-01	104-1782	OMIT	104-9091	104-1963	100-1035	130-1015	131-1020	130-4705	OMIT
-02	104-1332	↑	104-1102	104-2153	100-1235	130-1515	131-1020	130-6805	↑
-03	104-1962		104-1102	104-3483	100-1835	130-1515	131-1520	130-1515	
-04	104-2152		104-1212	104-3833	100-1835	130-1515	131-1520	130-1515	
-05	104-1102	↓	104-1002	104-4223	100-2235	130-3315	131-2220	130-2215	↓
-06	104-1622	OMIT	104-1102	104-6813	100-3335	130-3315	131-3320	130-3315	OMIT
-07	104-5112	104-6812	104-9091	104-1963	100-1035	130-4705	131-1020	130-4705	131-1520
-08	104-4222	104-5622	104-1102	104-2153	100-1235	130-6805	131-1020	130-6805	131-2220
-09	104-6192	104-8252	104-1102	104-3483	100-1835	130-6805	131-1520	130-1515	131-3320
-10	104-6812	104-9092	104-1212	104-3833	100-1835	130-6805	131-1520	130-1515	131-3320
-11	104-3482	104-4642	104-1002	104-4223	100-2235	130-1515	131-2220	130-2215	131-4720
-12	104-5112	104-6812	104-1102	104-6813	100-3335	130-1515	131-3320	130-3315	131-6820
-13	104-2872	OMIT	104-9091	104-3833	100-1835	130-1015	131-1020	130-1015	131-1520
-14	104-2152	OMIT	104-1102	104-4223	100-2235	130-1515	131-1020	130-1515	131-2220
-15	104-2872	OMIT	104-1102	104-6313	100-3335	130-1515	131-1520	130-3315	131-3320
-16	104-5112	104-6812	104-9091	104-1963	100-1035	130-4705	131-1020	130-4705	131-1520
-17	104-4222	104-5622	104-1102	104-2153	100-1235	130-6805	131-1020	130-6805	131-2220
-18	104-6192	104-8252	104-1102	104-3483	100-1835	130-6805	131-1520	130-1515	131-3320
-19	104-6812	104-9091	104-1212	104-3833	100-1835	130-6805	131-1520	130-1515	131-3320
-20	104-3482	104-4642	104-1002	104-4223	100-2235	130-1515	131-2220	130-2215	131-4720
-21	104-5112	104-6812	104-1102	104-6813	100-3335	130-1515	131-3320	130-3315	131-6820
-22	104-2872	OMIT	104-9091	104-3833	100-1835	130-1015	131-1020	130-1015	131-1520
-23	104-2152	↑	104-1102	104-4223	100-2235	130-1515	131-1020	130-1515	131-2220
-24	104-2872		104-1102	104-6813	100-3335	130-1515	131-1520	130-3315	131-3320
-25	104-5112		104-9091	OMIT	OMIT	130-4705	131-1020	130-1015	131-1520
-26	104-4222		104-1102	↑	↑	130-6805	131-1020	130-1515	131-2220
-27	104-6192		104-1102			130-6805	131-1520	130-2215	131-3320
-28	104-6812		104-1212			130-6805	131-1520	130-2215	131-3320
-29	104-3482		104-1002			130-1515	131-2220	130-3315	131-4720
-30	104-5112		104-1102			130-1515	131-3320	130-4715	131-6820
-31	104-5112		104-9091			130-4705	131-1020	130-1015	131-1520
-32	104-4222		104-1102			130-6805	131-1020	130-1515	131-2220
-33	104-6192		104-1102			130-6805	131-1520	130-2215	131-3320
-34	104-6812		104-1212			130-6805	131-1520	130-2215	131-3320
-35	104-3482		104-1002			130-1515	131-2220	130-3315	131-4720
-36	104-5112		104-1102			130-1515	131-3320	130-4715	131-6820
-37	104-5112		104-9091			130-4705	131-1020	130-1015	131-1520
-38	104-4222		104-1102			130-6805	131-1020	130-1515	131-2220
-39	104-6192		104-1102			130-6805	131-1520	130-2215	131-3320
-40	104-6812		104-1212			130-6805	131-1520	130-2215	131-3320
-41	104-3482		104-1002	↓	↓	130-1515	131-2220	130-3315	131-4720
-42	104-5112	↓	104-1102	OMIT	OMIT	130-1515	131-3320	130-4715	131-6820
-43	104-1002	OMIT	104-5111	104-1103	100-5625	130-1515	131-1020	130-6805	OMIT
-44	104-3832	104-9092	↑	104-1103	100-5625	130-3305	↑	130-6805	131-1020
-45	104-1962	OMIT		104-2153	100-1035	130-1515		130-1515	↑
-46	104-3832	104-9092		104-1103	100-5625	130-3305		130-6805	
-47	104-1962	OMIT		104-2153	100-1035	130-1515		130-1515	
-48	104-3832	↑		OMIT	OMIT	130-3305		↑	
-49	104-3832	↓	↓	OMIT	OMIT	130-3305	↓	↓	↓
-50	104-3832	OMIT	104-5111	OMIT	OMIT	130-3305	131-1020	130-1515	131-1020

TABLE III ⑦

PART NO.	REFERENCE DESIGNATION
400-1437	U2,10,16
700-5107	U19-27,34,35,37-41
700-8440	U57
700-8460	U42-46
700-8530	U48,51,52,55,56
100-1515	R37,58
100-3315	R62
100-4715	R220,320,121-921,122-922
100-1025	R47,53,71
100-1525	R26,40,207,307
100-2225	R31
100-8215	R127 - 927
100-3325	R34,218,318
100-4725	R5,8-10,51,52,68-70,210,310,R223,323, 224,324,125-925,126-926,219,319
100-1035	R54,55,216,316
100-1835	R45
100-2235	R57
100-1045	R43,44,130-930
100-1845	R201,301,202,302
100-1065	R113-913,114,414-914
104-1001	R215,315
104-1471	R60
104-3481	R61
104-4641	R49
104-5111	R17,18,33,50
104-9091	R20
104-1002	R19,25,32,39
104-1003	R205,305,206,306
104-1623	R14
104-1653	R13
123-5020	R208,308,109,409-909
121-5010	R21
121-1030	R35
121-2030	R30
121-5030	R24
130-1005	C204,304
130-2205	C210,310
130-4705	C14,203,303
130-2215	C4,13
130-7515	C212,312,113-913,114-914
130-4715	C209,309,115-915
131-2220	C25
131-4720	C3,12
131-1530	C116-916, C26
132-2752	C7-10,17-20,27-30,201,301,202,302
132-2262	C206,306
135-2272	C211,311
300-4446	CR1-11,201,301,202,302,203,303, CR204,304,105-905,106-906
200-4123	Q10,11,13,15
200-4125	Q2,5-8,14,103-903
204-4393	Q101-901,102,402-902
503-0229	J3,4
503-0043	J1,2
100373-02	W1,2

NEXT ASSY	1ST USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010 ANGULAR
.XXX ± .005 ± 1/2°
X/X ± 1/32 ✓
BREAK ALL SHARP CORNERS
APPROX. .010

FINISH:

THE INFORMATION HEREON IS THE PROPERTY OF PERIPHERAL EQUIPMENT CORPORATION. NO REPRODUCTION OR UNAUTHORIZED USE SHALL BE MADE.

SIGNATURES	DATE
DR	
CHK	
DES	
ENGR	
ENGR	

MATL.

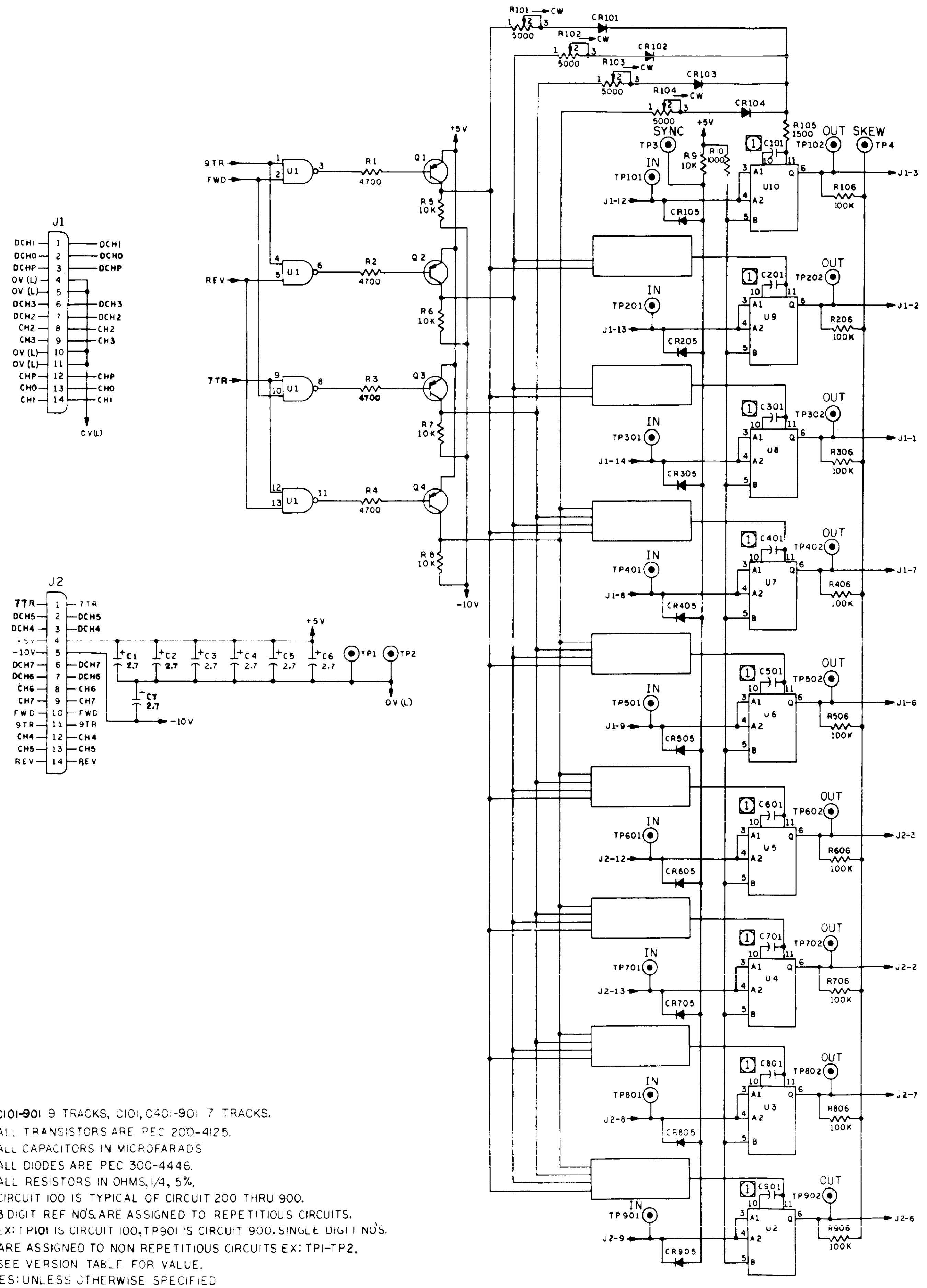
PEC PERIPHERAL EQUIPMENT CORPORATION

TITLE PCBA
DATA K
READ ONLY
MULTIPLE FORMAT

SIZE	CODE IDENT. NO.	DWG NO.	REV
E		101887	M

SCALE ______ DO NOT SCALE DWG SHEET 3 OF 3

REVISIONS					
REV	DESCRIPTION	DATE	DR	CHK	APPD
A	ERN 2-YS				
B	ECN 3289		G.F.O.		



8

VERSION	SPEED (IPS)	HEAD (TRACK)	CIRCUITS USED	C101 THRU C901	R101-R901 CR101-CR901	R102-R902 CR102-CR902	R103-R903 CR103-CR903	R104-R904 CR104-CR904	R206 R306 CR205 CR305
-01	45	7/9	ALL	.0022	USE	USE	USE	USE	USE
-02	37.5	7/9	ALL	.0033	USE	USE	USE	USE	USE
-03	25/22.5	7/9	ALL	.0047	USE	USE	USE	USE	USE
-04	18.75	7/9	ALL	.0068	USE	USE	USE	USE	USE
-05	12.5	7/9	ALL	.01	USE	USE	USE	USE	USE
-06	75	7/9	ALL	.0015	USE	USE	USE	USE	USE
-07									
-08									
-09									
-10									
-11	45	9	ALL	.0022	USE	USE	OMIT	OMIT	USE
-12	37.5	9	ALL	.0033	USE	USE	OMIT	OMIT	USE
-13	25/22.5	9	ALL	.0047	USE	USE	OMIT	OMIT	USE
-14	18.75	9	ALL	.0068	USE	USE	OMIT	OMIT	USE
-15	12.5	9	ALL	.01	USE	USE	OMIT	OMIT	USE
-16	75	9	ALL	.0015	USE	USE	OMIT	OMIT	USE
-17									
-18									
-19									
-20									
-21	45	7	100,400-900	.0022	OMIT	OMIT	USE	USE	OMIT
-22	37.5	7	100,400-900	.0033	OMIT	OMIT	USE	USE	OMIT
-23	25/22.5	7	100,400-900	.0047	OMIT	OMIT	USE	USE	OMIT
-24	18.75	7	100,400-900	.0068	OMIT	OMIT	USE	USE	OMIT
-25	12.5	7	100,400-900	.01	OMIT	OMIT	USE	USE	OMIT
-26	75	7	100,400-900	.0015	OMIT	OMIT	USE	USE	OMIT

REFERENCE DESIGNATIONS

LAST USED		DELETED
R906	R10	R203,204
C901	C7	R303,304
CR905		CR203,204
	Q4	CR303,304
TP902	TP4	

8 C101-901 9 TRACKS, C101, C401-901 7 TRACKS.
7. ALL TRANSISTORS ARE PEC 200-4125.
6. ALL CAPACITORS IN MICROFARADS
5. ALL DIODES ARE PEC 300-4446.
4. ALL RESISTORS IN OHMS, 1/4, 5%.
3. CIRCUIT 100 IS TYPICAL OF CIRCUIT 200 THRU 900.
2. 3 DIGIT REF NO'S ARE ASSIGNED TO REPETITIOUS CIRCUITS. EX: TP101 IS CIRCUIT 100, TP901 IS CIRCUIT 900. SINGLE DIGIT NO'S. ARE ASSIGNED TO NON REPETITIOUS CIRCUITS EX: TP1-TP2.
1 SEE VERSION TABLE FOR VALUE.
NOTES: UNLESS OTHERWISE SPECIFIED

101892	RDT-6000
NEXT ASSY	1ST USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010 ANGULAR
.XXX ± .004 ± 1/2°
± 1/32 ✓
BREAK ALL SHARP CORNERS APPROX. .010
FINISH:

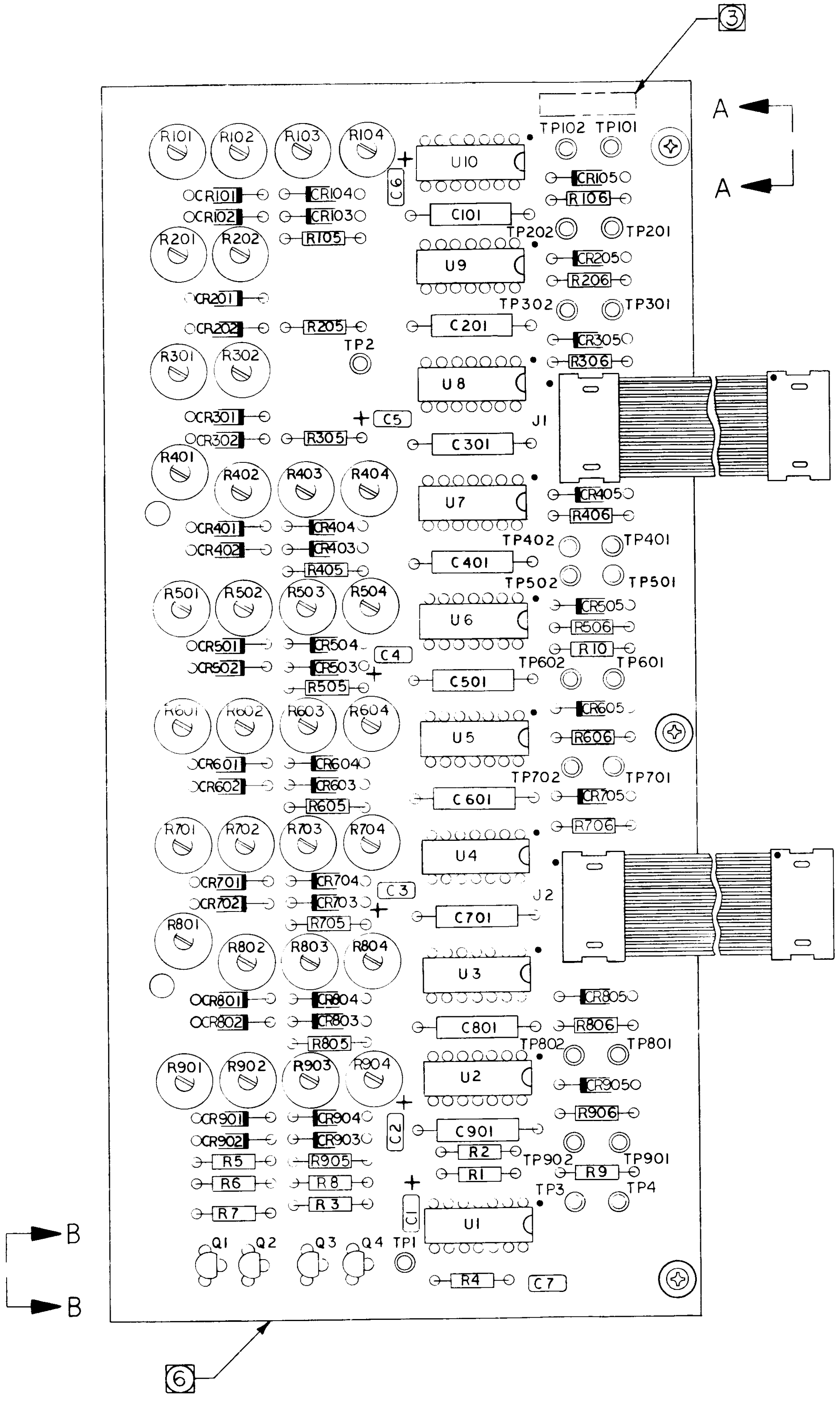
SIGNATURES	DATE
DR	
CHK	
DES	
ENGR	
ENGR	

MATL:

PEC
PERIPHERAL EQUIPMENT CORPORATION

TITLE SCHEMATIC DESKEW-A

SIZE E
DWG NO. 101891
REV B
SCALE
DO NOT SCALE DWG
SHEET 1 OF 1



NOTES: UNLESS OTHERWISE SPECIFIED:

1. REF DWG: SCHEMATIC-101891
SPECIFICATION-101895

2 ASSEMBLE PER STANDARD MFG METHODS.

③ RUBBER STAMP ASSY PART NO INCLUDING VERSION AND ISSUE LETTER.

④ FOR PART NO'S WHICH ARE NOT AFFECTED BY VERSION NO. SEE TABLE I.

⑤ FOR PART NO'S WHICH ARE AFFECTED BY VERSION NO. SEE TABLE II.

⑥ THIS ASSY SHALL BE MADE FROM PROCESS BOARD 101893-01 REV A.

④ TABLE I

PART NO	REF DESIGNATION
100-1025	R10
100-1035	R5-9
100-1045	R106,406-906
100-1525	R105,405-905
100-4725	R1-4
132-2752	C1-7
200-4125	Q1-4
300-4446	CR105,405-905
700-4121	U2-7,10
700-8460	U1
101591-02	J1,2

⑤ TABLE II

REFERENCE DESIGNATION	PART NUMBERS							
IPS	45	37.5	25/22.5	18.75	12.5	75		
VER	-01	-02	-03	-04	-05	-06	-07	-08
R101,401-901	123-5020	123-5020	123-5020	123-5020	123-5020	123-5020		
R201,301	↑	↑	↑	↑	↑	↑		
R102,402-902								
R202,302								
R103,403-903	↓	↓	↓	↓	↓	↓		
R104,404-904	123-5020	123-5020	123-5020	123-5020	123-5020	123-5020		
R205,305	100-1525	100-1525	100-1525	100-1525	100-1525	100-1525		
R206,306	100-1045	100-1045	100-1045	100-1045	100-1045	100-1045		
C101,401-901	131-2220	131-3320	131-4720	131-6820	131-1030	131-1520		
C201,301	131-2220	131-3320	131-4720	131-6820	131-1030	131-1520		
CR101,401-901	300-4446	300-4446	300-4446	300-4446	300-4446	300-4446		
CR201,301	↑	↑	↑	↑	↑	↑		
CR102,402-902								
CR202,302								
CR103,403-903								
CR104,404-904	↓	↓	↓	↓	↓	↓		
CR205,305	300-4446	300-4446	300-4446	300-4446	300-4446	300-4446		
U8,9	700-4121	700-4121	700-4121	700-4121	700-4121	700-4121		

⑤ TABLE II (CONT)

REFERENCE DESIGNATION	PART NUMBER										
IPS	75					45	37.5	25/22.5	18.75	12.5	75
VER	-16	-17	-18	-19	-20	-21	-22	-23	-24	-25	-26
R101,401-901	123-5020					—	—	—	—	—	—
R201,301	↑					—	—	—	—	—	—
R102,402-902	↓					—	—	—	—	—	—
R202,302	123-5020					—	—	—	—	—	—
R103,403-903	—					123-5020	123-5020	123-5020	123-5020	123-5020	123-5020
R104,404-904	—					123-5020	123-5020	123-5020	123-5020	123-5020	123-5020
R205,305	100-1525					—	—	—	—	—	—
R206,306	100-1045					—	—	—	—	—	—
C101,401-901	131-1520					131-2220	131-3320	131-4720	131-6820	131-1030	131-1520
C201 301	131-1520					—	—	—	—	—	—
CR101,401-901	300-4446					—	—	—	—	—	—
CR201,301	↑					—	—	—	—	—	—
CR102,402-902	↓					—	—	—	—	—	—
CR202,302	300 4446					—	—	—	—	—	—
CR103,403-903	—					300-4446	300-4446	300-4446	300-4446	300-4446	300-4446
CR104,404-904	—					300-4446	300-4446	300-4446	300-4446	300-4446	300-4446
CR205,304	300-4446					—	—	—	—	—	—
U8,9	700-4121					—	—	—	—	—	—

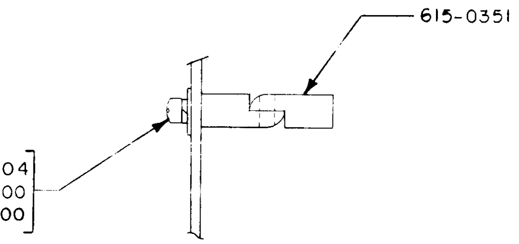
600-0404
605-0400
606-0400

TRA

REVISIONS					
REV	DESCRIPTION	DATE	DR	CHK	APPR
A	ERN 2-YS	1/5/71	WS		R.G.N.
B	ECN 2695	[illegible]/71	KIND		
C	ECN 3289	2/29/72	G.F.B.		

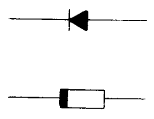
⑤ TABLE II

PART NUMBERS														
45	37.5	25/22.5	18.75	12.5	75					45	37.5	25/22.5	18.75	12.5
-01	-02	-03	-04	-05	-06	-07	-08	-09	-10	-11	-12	-13	-14	-15
-5020	123-5020	123-5020	123-5020	123-5020	123-5020					123-5020	123-5020	123-5020	123-5020	123-5020
↑	↑	↑	↑	↑	↑					↑	↑	↑	↑	↑
										↓	↓	↓	↓	↓
										123-5020	123-5020	123-5020	123-5020	123-5020
↓	↓	↓	↓	↓	↓					——	——	——	——	——
-5020	123-5020	123-5020	123-5020	123-5020	123-5020					——	——	——	——	——
-1525	100-1525	100-1525	100-1525	100-1525	100-1525					100-1525	100-1525	100-1525	100-1525	100-1525
-1045	100-1045	100-1045	100-1045	100-1045	100-1045					100-1045	100-1045	100-1045	100-1045	100-1045
-2220	131-3320	131-4720	131-6820	131-1030	131-1520					131-2220	131-3320	131-4720	131-6820	131-1030
-2220	131-3320	131-4720	131-6820	131-1030	131-1520					131-2220	131-3320	131-4720	131-6820	131-1030
-4446	300-4446	300-4446	300-4446	300-4446	300-4446					300-4446	300-4446	300-4446	300-4446	300-4446
↑	↑	↑	↑	↑	↑					↑	↑	↑	↑	↑
										↓	↓	↓	↓	↓
										300-4446	300-4446	300-4446	300-4446	300-4446
										——	——	——	——	——
↓	↓	↓	↓	↓	↓					——	——	——	——	——
-4446	300-4446	300-4446	300-4446	300-4446	300-4446					300-4446	300-4446	300-4446	300-4446	300-4446
-4121	700-4121	700-4121	700-4121	700-4121	700-4121					700-4121	700-4121	700-4121	700-4121	700-4121

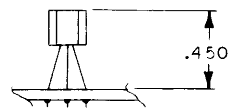


VIEW A-A
TYP 3 PLACES

UMBER				
37.5	25/22.5	18.75	12.5	75
-22	-23	-24	-25	-26
——	——	——	——	——
——	——	——	——	——
——	——	——	——	——
——	——	——	——	——
3-5020	123-5020	123-5020	123-5020	123-5020
3-5020	123-5020	123-5020	123-5020	123-5020
——	——	——	——	——
——	——	——	——	——
1-3320	131-4720	131-6820	131-1030	131-1520
——	——	——	——	——
——	——	——	——	——
——	——	——	——	——
——	——	——	——	——
——	——	——	——	——
0-4446	300-4446	300-4446	300-4446	300-4446
0-4446	300-4446	300-4446	300-4446	300-4446
——	——	——	——	——
——	——	——	——	——

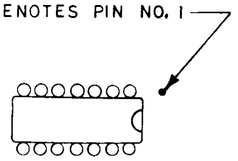


DIODE ORIENTATION



VIEW B-B
TRANSISTOR MTG HEIGHT (TO 92)

DENOTES PIN NO. 1



I C ORIENTATION

TOP ASSY	ROT - 6000
NEXT ASSY	1ST USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010
.XXX ± .005
$\frac{X}{X} \pm \frac{1}{32}$
ANGULAR
± 1/2°
✓
BREAK ALL SHARP CORNERS
APPROX. 010

FINISH:

THE INFORMATION HEREON IS THE PROPERTY OF PERIPHERAL EQUIPMENT CORPORATION. NO REPRODUCTION OR UNAUTHORIZED USE SHALL BE MADE.

SIGNATURES	DATE
DR W. S. LeBrun	1/5/71
CHK	
DES	
ENGR R. A. Nelson	1/25/71
ENGR	

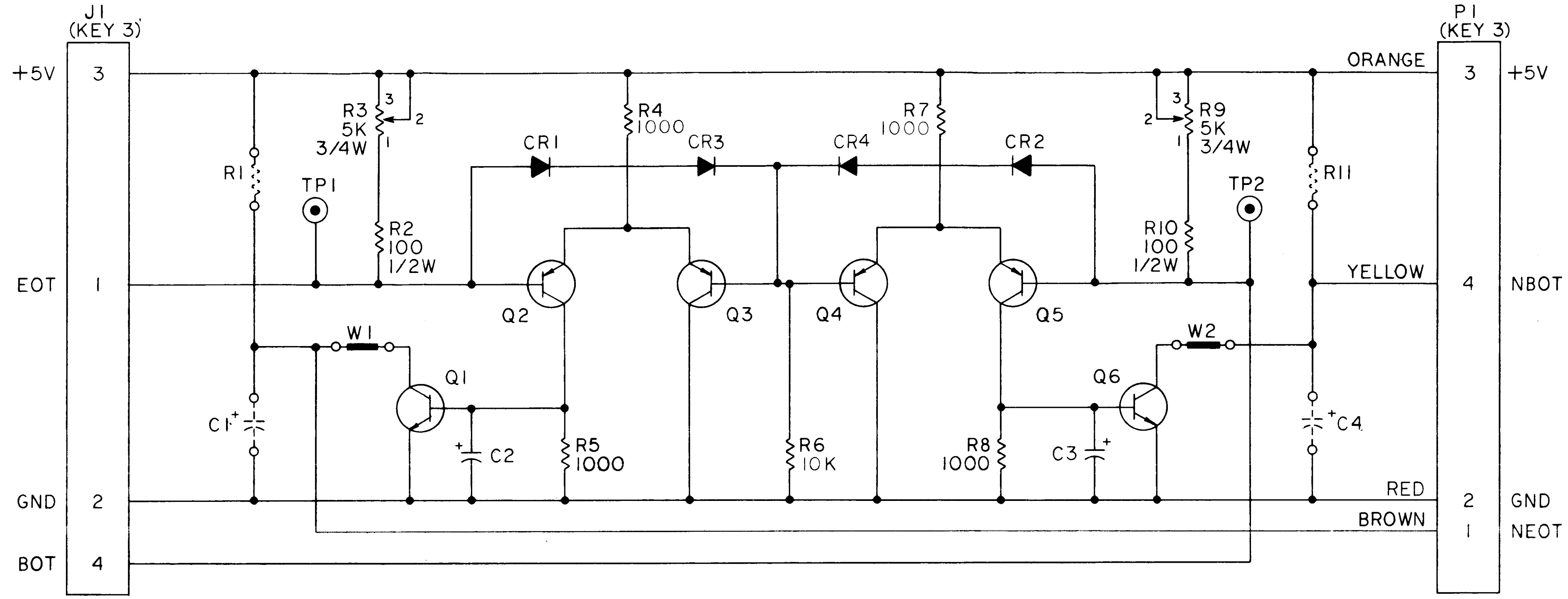
MATL:

PEC
PERIPHERAL
EQUIPMENT CORPORATION

TITLE
PCBA
DESKEW-A

SIZE	CODE IDENT. NO.	DWG NO.	REV
E		101892	C
SCALE 2:1		DO NOT SCALE DWG	SHEET 1 OF 1

REVISIONS					
REV	DESCRIPTION	DATE	DR	CHK	APPR
A	ERN 2-UG	9/22/70			
B	ECN 4726A	1-10-73			RCA
C	ECN 5105	5-2-73	C.W.		RCA



NOTES: UNLESS OTHERWISE SPECIFIED:

1. REFERENCE DRAWINGS: ASSEMBLY—101949
   SPECIFICATION—101952
2. ALL CAPACITORS ARE 2.7UF, 35V, ±20%.
3. ALL RESISTORS ARE 1/4W, ±5%.
4. ALL NPN TRANSISTORS ARE PEC 200-4123.
5. ALL PNP TRANSISTORS ARE PEC 200-4125.
6. ALL DIODES ARE PEC 300-4446.

NEXT ASSY	1ST USED ON
101136	6000
100800	7000
101129	6000

APPLICATION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010
.XXX ± .005
$\frac{X}{X} \pm \frac{1}{32}$
ANGULAR
± 1/2°
✓
BREAK ALL SHARP CORNERS
APPROX. .010

FINISH:

THE INFORMATION HEREON IS THE PROPERTY OF PERIPHERAL EQUIPMENT CORPORATION. NO REPRODUCTION OR UNAUTHORIZED USE SHALL BE MADE.

SIGNATURES	DATE
DR L. G. Smith	9/22/70
CHK	9/24/70
DES	
ENGR	9/29
ENGR	9/25/70

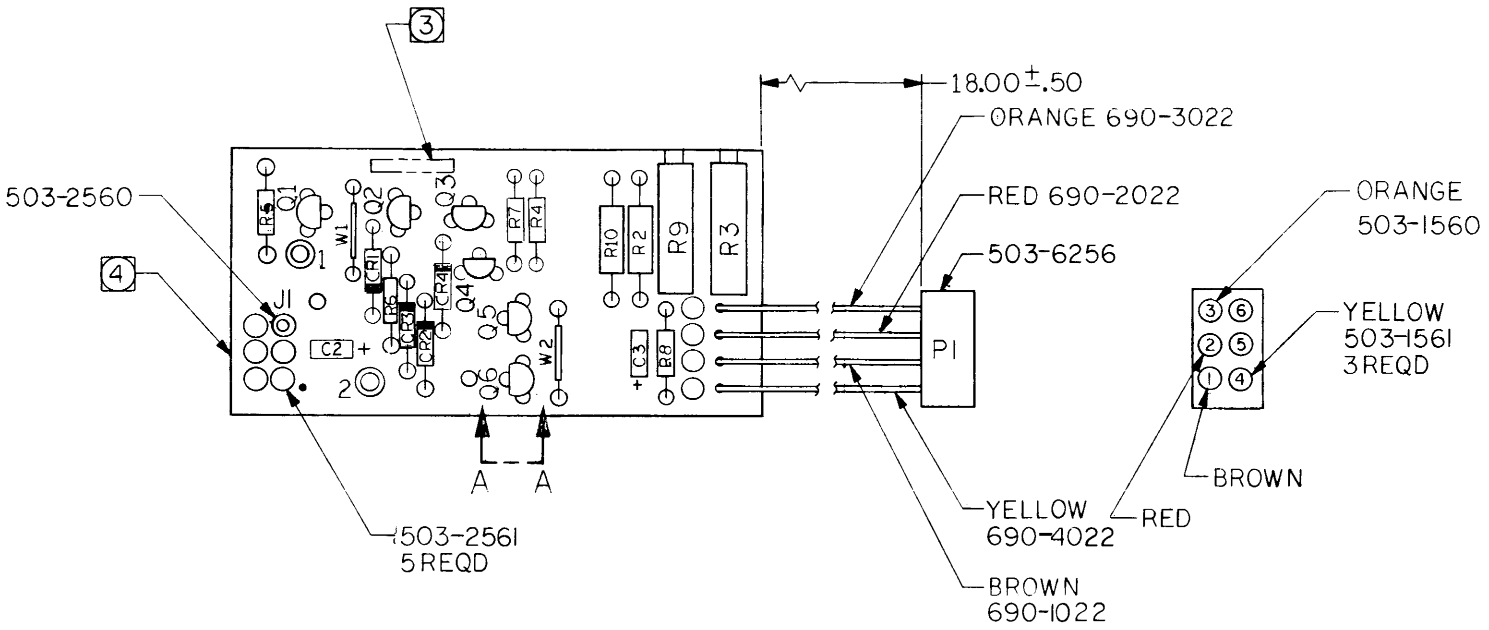
MATL:

PEC
PERIPHERAL
EQUIPMENT CORPORATION

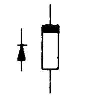
TITLE SCHEMATIC
EOT/BOT AMPLIFIER

SIZE D
CODE IDENT. NO.
DWG NO. 101948
REV C
SCALE
DO NOT SCALE DWG
SHEET 1 OF 1

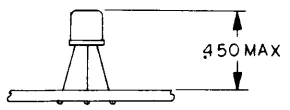
REVISIONS					
REV	DESCRIPTION	DATE	DR	CHK	APPR
B	ERN 2-UG	9-22-70			
C	ECN 2096	2/25/71	T.B		
D	ECN 4726A	1-10-73			
E	ECN 5105	5-2-73			
F	ECN 5930	9/12/73			
G	ECN 5703	11/14/73			



PART NO.	REF DESIGNATION
100-1025	R4,5,7,8
100-1035	R6
101-1015	R2,10
121-5020	R3,9
132-2752	C2,3
200-4123	Q1,6
200-4125	Q2, 3, 4, 5
300-4446	CR1,2,3,4
100373-02	W1, 2



DIODE ORIENTATION



TYP TRANSISTOR MTG HEIGHT

VIEW A-A

PART NO. 101949- REV

④ THIS ASSEMBLY SHALL BE MADE FROM PROCESS BOARD 101950-01 REVG AND SUBSEQUENT.

③ MARK PART NO. 101949 INCLUDING VERSION NO. AND VERSION ISSUE LETTER.

2. ASSEMBLE PER STANDARD MANUFACTURING METHODS.

1. REFERENCE DRAWINGS: SCHEMATIC 101948
SPECIFICATION 101952

NOTES: UNLESS OTHERWISE SPECIFIED.

101136	6000
100800	7000
101129	6000
NEXT ASSY	1ST USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010
.XXX ± .005
$\frac{X}{X} \pm \frac{1}{32}$
ANGULAR ± 1/2°
✓
BREAK ALL SHARP CORNERS APPROX. 010

FINISH:

SIGNATURES	DATE
DR	9/21/70
CHK	9/24/70
DES	
ENGR	9/24/70
ENGR	9/25/70

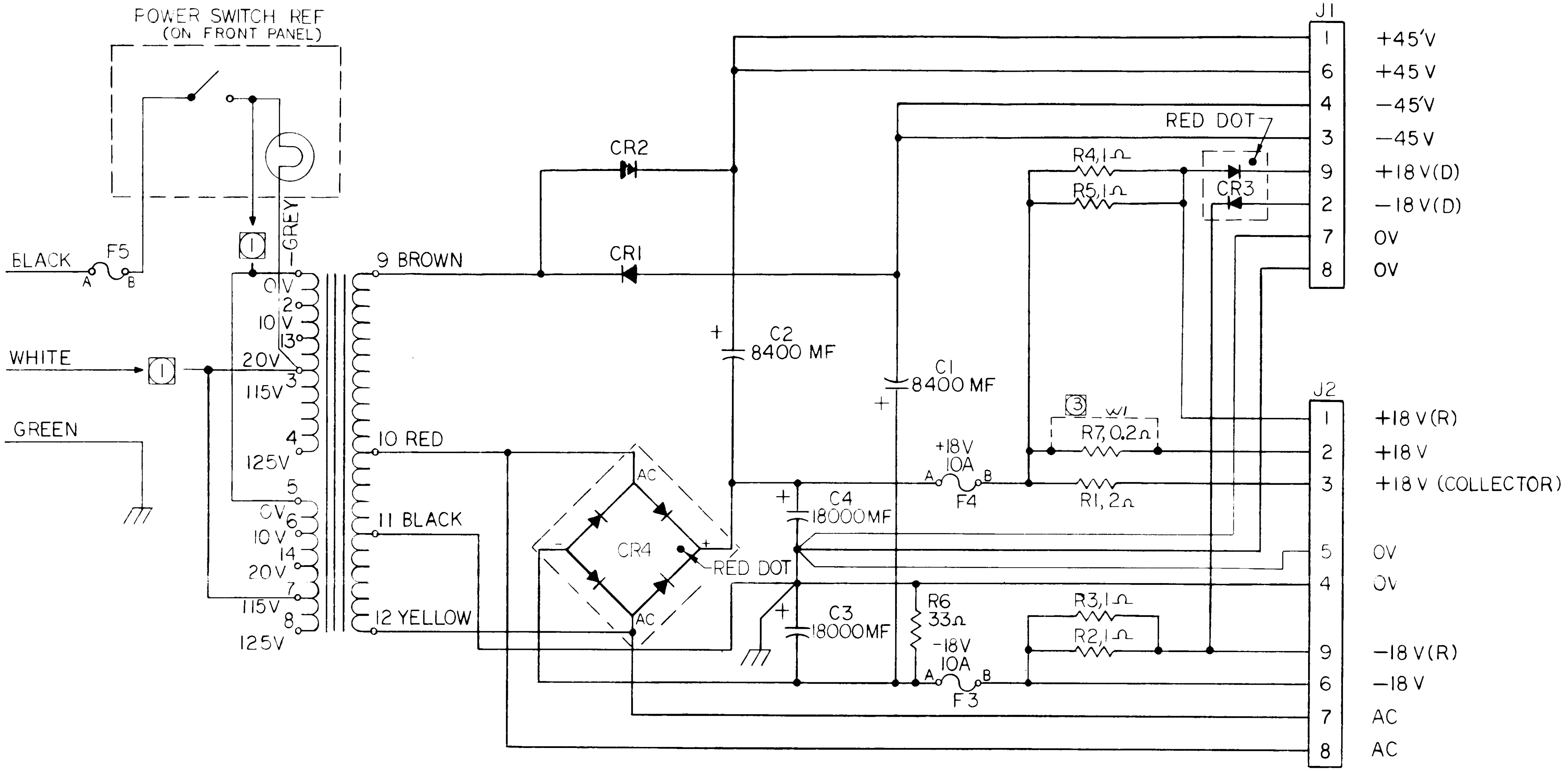
MATL:

PEC PERIPHERAL EQUIPMENT CORPORATION

TITLE PCBA
EOT/BOT AMPLIFIER

SIZE D
CODE IDENT. NO.
DWG NO. 101949
REV G
SCALE 2/1
DO NOT SCALE DWG
SHEET 1 OF 1

REVISIONS					
REV	DESCRIPTION	DATE	DR	CHK	APPR
A	ERN 2-GR	8-1-69	EMS		BA
B	ECN 2194	1/13/71	GB		
C	ECN 2367	3-23-71			
D	ECN 2746A	7-13-71	T.B		
E	ECN 3362	6/29/72	RAS		TRCA
F	ECN 5299	7/16/73			



① TABLE I

TERMINAL CONNECTORS FOR LINE VOLTAGE VARIATIONS				
LINE VOLTS	LINE INPUT		LAMP	CONNECT
	(WHT)	(BLK)	(GREY)	
95	14	3	1	3 TO 7 & 13 TO 14
105	7	2	4	2 TO 6 & 3 TO 7
115	7	1	3	1 TO 5 & 3 TO 7
125	8	1	3	1 TO 5 & 4 TO 8
190	7	13	4	3 TO 14
210	7	2	4	3 TO 6
220	7	1	3	3 TO 6
230	7	1	3	3 TO 5
240	8	1	3	3 TO 5
250	8	1	3	4 TO 5

NOTE: THIS CHART APPLIES TO POWER SUPPLY ASSY 100990-01 REV L AND SUBSEQUENT

VERSION	SPEED	W1
01	≤40 IPS	OMIT
02	>40 IPS	USE

③ T6000 45 IPS ONLY.

2. ALL RESISTORS ARE 20W, 5%

① FOR TRANSFORMER PRIMARY CONNECTIONS SEE TABLE I. (115V SHOWN)

NOTES: UNLESS OTHERWISE SPECIFIED

100990	6000
NEXT ASSY	1ST USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010
.XXX ± .005
X/X ± 1/32
ANGULAR ± 1/2°
✓
BREAK ALL SHARP CORNERS APPROX. 010

FINISH:

SIGNATURES	DATE
DR E. Stange	8-1-69
CHK	
DES	
ENGR	
ENGR	

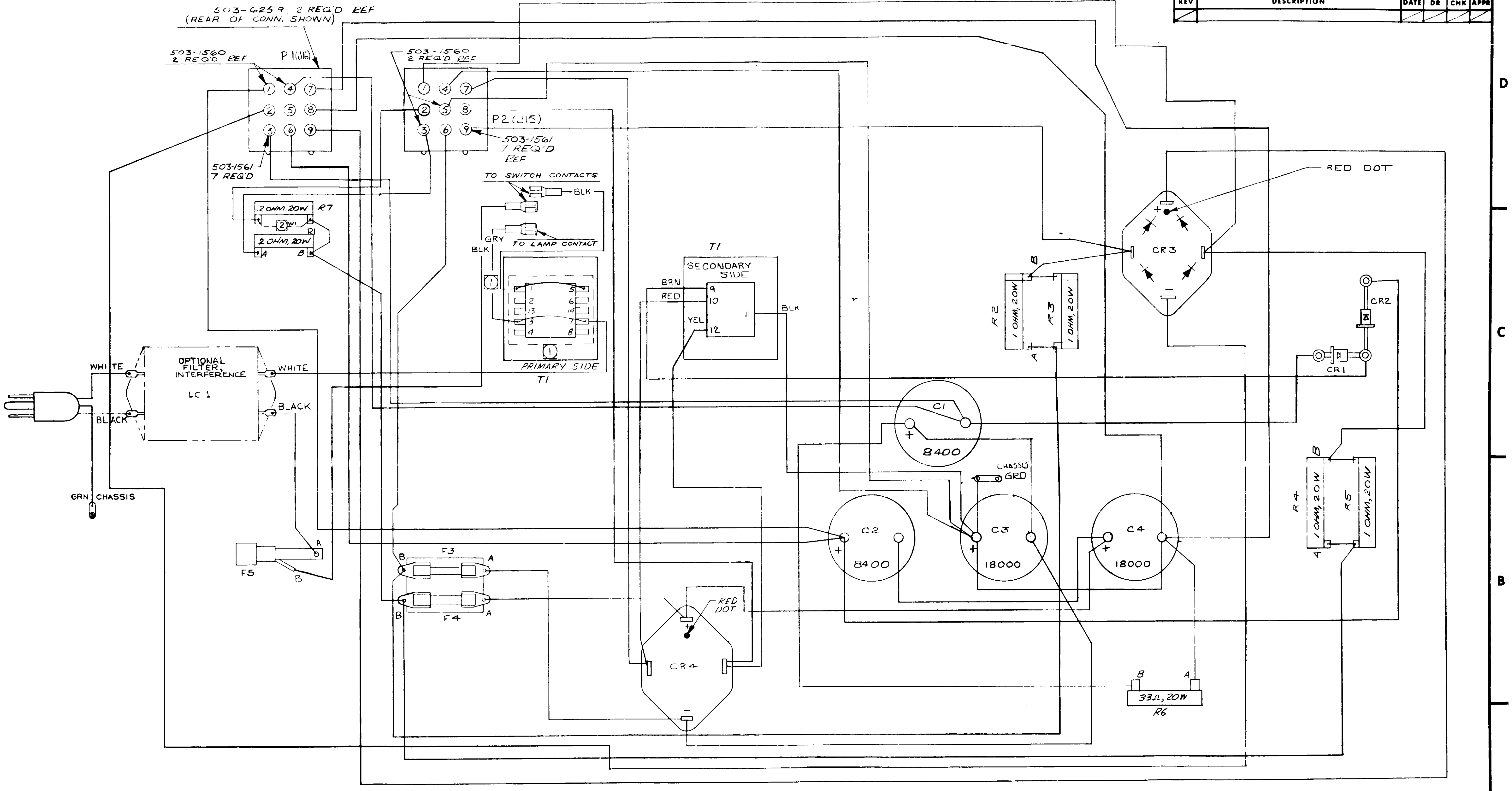
MATL:

PEC
PERIPHERAL EQUIPMENT CORPORATION

TITLE
SCHEMATIC -
POWER SUPPLY
6000

SIZE D
CODE IDENT. NO.
DWG NO. 101132
REV F
SCALE NONE
DO NOT SCALE DWG
SHEET 1 OF 1

REVISIONS					
REV	DESCRIPTION	DATE	DR	CHK	APPR



WIRING DIAGRAM

VERSION	SPEED	W1
-01	≤40 IPS	OMIT
-02	>40 IPS	USE

2. JUMPER R7 WITH W1 FOR -02 ASSEMBLY.

1. 115V CONNECTION SHOWN. FOR OTHER VOLTAGE CONNECTION, SEE 101132 PWR SUPPLY SCHEMATIC.

NOTES: UNLESS OTHERWISE SPECIFIED

100799-01	6000
NEXT ASSY	1ST USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ± .010
.XXX ± .005
$\frac{X}{X} \pm \frac{1}{32}$
ANGULAR
± 1/2°
✓
BREAK ALL SHARP CORNERS
APPROX. 010

FINISH:

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SIGNATURES		DATE
DR	9. Cettino	6/20/
CHK		
DES		
ENGR		
ENGR		

MATL:

PEC PERIPHERAL EQUIPMENT CORPORATION

TITLE
POWER SUPPLY ASSY

SIZE	CODE IDENT. NO.	DWG NO.	REV
D		100990	N

SCALE
DO NOT SCALE DWG
SHEET

APPENDIX A
GLOSSARY

GLOSSARY

Symbol	Description
B1B	Buffer 1 Busy
BCD10	Binary Coded Decimal
BOT*	Beginning of Tape
BOTD	Beginning of Tape Delay
BOTDP	Beginning of Tape Delay Pulse
BOTI	Beginning of Tape Input
BOTO	Beginning of Tape Output
CBY	Command Busy
CCS	Check Character Strobe
CMP1, 2	Clamp Waveform 1, 2
CPI	Characters Per Inch
CRC0 through CRC7	Cyclic Redundancy Check, Channels 0 through 7
CRCC	Cyclic Redundancy Check Character
CRCP	Cyclic Redundancy Check Parity
CT 0 through CT 7	Center Tap 0 through 7
CTP	Center Tap Parity
CT4	Count 4
CT8	Count 8
CUR	Clean-up Ramp
D8CT	Disable 8 Count
DBY	Data Busy
DDI	Data Density Indicator
DDS	Data Density Select
DDSX	Data Density Select External
DMC	Disable Manual Controls
EAO	Encoder Amplifier Output
ECC	Enable Check Character
ECD	Echo Check Disable
ECE	Echo Check Error
ECO0 through ECO7	Echo Check Output, Channels 0 through 7
ECOP	Echo Check Output Parity
ECR	Echo Check Reset
ECRC	Enable CRC
EEC	Enable Echo Check
EEP	Enable Encoder Pulse
EF	Erase Winding Finish
EFM	Enable File Mark
EOT*	End of Tape
EOTI	End of Tape Input

---

* An N preceding these symbols indicates a false condition.

GLOSSARY (continued)

Symbol	Description	Symbol	Description
EOTO	End of Tape Output	MOTION	Tape Motion as a result of SFC or SRC Command
EPNP	Encoder Pulse Narrow Powerful		
EPS	Erase Power Start	OFFC	Off-Line Input Command
EPW	Encoder Pulse Wide	OOLL	On-Line/Off-Line Lamp
ES	Erase Winding Start	ORD	OR'd Data
EWPC	Enable Write Power Control	OVW	Overwrite
EWRS	Enable Write/Read Status	PSO0 through PSO7	Peak Sensor Output, Channels 0 through 7
FGC	File Gap Command		
FGL	File Gap Lamp	PSOP	Peak Sensor Output Parity
FGR	File Gap Ramp	PSP	Peak Sensor Parity
FLR	First Load - or Rewind	RA01, RA02	Read Amplifier Track 0, Output 1, Output 2
FM	File Mark		
FPT	File Protect	RA11, RA12, RA21, etc.	Read Amplifier Track n, Output 1 or 2
GIP	Gap In Process		
HID	Hi Density	RAC	Read Amplifier Clamp
GRS	General Reset	RACT	Read Amplifier Center Tap
INTLK	Transport Interlock Signal	RAP1, RAP2	Read Amplifier Parity, Output 1, Output 2
IRGC	Record Gap Command		
LD	Lamp Driver	RD0 through RD7	Read Data, Channels 0 through 7
LDP	Load Point		
LFC	Load Forward Command	RDI	Relay Driver Input
LFR	Load Forward Ramp	RDP	Read Data Parity
LRCC	Longitudinal Redundancy Check Character	RDS	Read Data Strobe

GLOSSARY (continued)

Symbol	Description	Symbol	Description
RDY	Ready	SFL1 through SFL4	Step Forward Level 1 through 4
RF0 through RF7	Read Finish 0 through 7	SLT	Select Transport
RFP	Read Finish Parity	SRC	Synchronous Reverse Command
RGC	Inter-Record Gap Command	SRO	Select, Ready, and On Line
RGR	Inter-Record Gap Ramp	SWS	Set Write Status
RRS	Remote Reset	TAD	Turnaround Delay
RS0 through RS7	Read Start 0 through 7	TBY	Turnaround Busy
		TNT	Tape Not Tensioned
RSP	Read Start Parity	TRR	Transport Ready
RST	Reset	WARS	Write Amplifier Reset
RTH	Read Threshold	WCRC	Write CRC
RTN1	Front Panel Switches Ground Return 1	WD0 through WD7	Write Data, Channels 0 through 7
RWC	Rewind Command	WDP	Write Data Parity
RWD	Rewinding	WDS	Write Data Strobe
RWR	Rewind Ramp	WDSN	Write Data Strobe Narrow
RYC	Ready Command	WDSW	Write Data Strobe Wide
SBY	Start Busy Delay	WF0 through WF7	Write Finish, Channels 0 through 7
SFC	Synchronous Forward Command		
SFCD	Synchronous Forward Command Delayed	WFM	Write File Mark

GLOSSARY (continued)

Symbol	Description	Symbol	Description
WFP	Write Finish Parity		
WLO	Write Lockout		
WPC	Write Power Control		
W/RF0 through W/RF7	Write/Read Head Winding Finish, Channels 0 through 7		
W/RFP	Write/Read Head Winding Finish Parity		
WRO	Write/Read Output		
WRP	Write Pulse		
WRS	Write/Read Status		
W/RS0 through W/RS7	Write/Read Head Winding Start, Channels 0 through 7		
W/RSP	Write/Read Head Winding Start, Parity		
WRT EN	Write Enable		
WS0 through WS7	Write Start, Channels 0 through 7		
WSC	Write Step Command		
WSP	Write Start Parity		