MODEL NO. 8840A - 9 - 45

SERIAL NO.

MODEL T8X40A AND T8X60A
SYNCHRONOUS WRITE
SYNCHRONOUS READ
TAPE TRANSPORTS

PERTEC

SUBSIDIARY OF TRIUMPH-ADLER

OPERATING AND SERVICE MANUAL NO. 103380

FOREWORD

This manual provides operating and service instructions for the Synchronous Write/ Synchronous Read Tape Transports, Models T8X40A and T8X60A, manufactured by Pertec Computer Corporation, Chatsworth, California.

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

All graphic symbols used in logic diagrams conform to the requirements of ANSI Y32.14 and all symbols used in schematic diagrams are as specified in ANSI Y32.2.

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This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protetion against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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PACIFIC

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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 Write/Synchronous Read Tape Transports, Models T8X40A and T8X60A, manufactured by Pertec Computer Corporation, Chatsworth, California.

1.1.1 MODEL IDENTIFICATION

The model identification code employed within the T8000 family of tape transports is given in Figure 1-1.

1.2 PURPOSE OF EQUIPMENT

The transport has the capability of recording digital data on either 7- or 9-track magnetic tape, at speeds up to 1.143 m/s (45 ips) in an ANSI and IBM-compatible NRZI format. The data can be completely recovered when the tape is played back on any ANSI and IBM-compatible tape transport, or equivalent.

The transport can also synchronously read either 7- or 9-track magnetic tape, at speeds up to 1.143 m/s (45 ips), which has been recorded in ANSI and IBM-compatible NRZI format.

The Model T8X40A transport utilizes a dual-stack head which has the read and write heads separated by 3.81 mm (0.15 inch). This enables simultaneous write and read operations to be performed so data just recorded by the write head can be read by the read head after the tape has moved approximately 3.81 mm (0.15 inch). This technique allows writing and checking of data in a single pass.

8 4 0A 9 45

T 8 X X X - X - X

TAPE SPEED
- 45 = 1.143 m/s (45 ips)
- 37.5 = 0.953 m/s (37.5 ips)
- 25 = 0.635 m/s (25 ips)
- 18.75 = 0.476 m/s (18.75 ips)
- 12.5 = 0.318 m/s (12.5 ips)

TRACKS AND ADDITIONAL DATA DENSITIES
- 72 = 7-track with 8 c/mm (200 cpi) capability
- 75 = 7-track with 22 c/mm (556 cpi) capability
- 9 = 9-track
- 98 = 9-track dual format, NRZI and PE, 63/32 c/mm (1600/800 cpi)
- 500 = 9-track, 32 c/mm (800 cpi) and 7-track 32/22 c/mm (800/556 cpi) Read Only
- 850 = 9-track, 63/32 c/mm (1600/800 cpi) and 7-track 32/22 c/mm (800/556 cpi) Read Only
- 852 = 9-track, 63/32 c/mm (1600/800 cpi) and 7-track 22/8 c/mm (556/200 cpi) Read Only

HEAD TYPE
- 60 = Read/Write (Single Stack)
- 40 = Read After Write (Dual Stack)
- 12 = Read Only Multiple Format (Dual Stack)
- 11 = Read Only Multiple Format (Single Stack)

HIGHEST DATA DENSITY HANDLED
- 6 = 63 c/mm (1600 cpi)
- 8 = 32 c/mm (800 cpi)
- 5 = 22 c/mm (556 cpi)

8000 SERIES (TENSION ARM)

TAPE PRODUCT

Figure 1-1. Model Identification

The Model T8X60A transport utilizes a single head for both reading and writing data. Changing from the Read to the Write mode is accomplished through internal switching logic.

The transports are designed to operate directly from 95v to 250v, single phase, 47 to 400 Hz power.

1.3 PHYSICAL DESCRIPTION OF EQUIPMENT

The Model T8X40A Transport is shown in Figure 1-2 (Model T8X60A is identical in appearance). Tape reels up to 266.7 mm (10½ inches) in diameter may be used. All electrical and mechanical components necessary to operate the transports are mounted on the deck which is designed to be hinge mounted in a standard 482.6 mm (19-inch) EIA rack.

The transport is equipped with an erase head which is automatically activated when writing.

The hinged dust cover protects the magnetic tape, magnetic head, capstan, and other tape path components from dust and other contaminants.

The operational controls are mounted on a control panel on the front deck and are accessible with the dust cover door closed. The controls are illuminated when the associated functions are being performed. Power is supplied through a strain-relieved cord with a standard 3-pin plug. Interface signals are routed through three printed circuit connectors that plug directly into the printed circuit boards (PCBAs). Access to the PCBAs is from the rear of the transport, as shown in Figure 1-3.

1.4 FUNCTIONAL DESCRIPTION

Figures 1-4 and 1-5 are block diagrams of the T8X40A and T8X60A models, respectively. A single capstan drive is used for controlling tape motion during the Synchronous Write, Synchronous Read, and Rewind modes. Tape tension is maintained at 2 to 2.8 newtons (7.5 to 10 ounces).

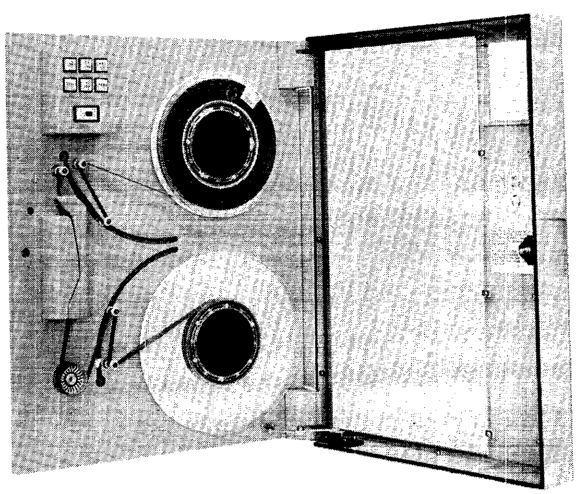


Figure 1-2. T8X40A/T8X60A Tape Transports, Front View

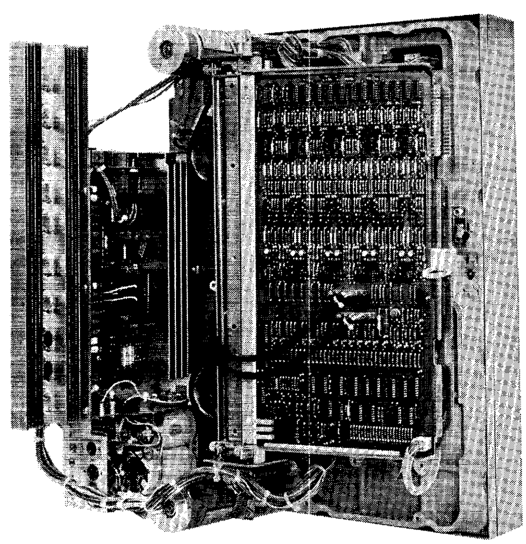


Figure 1-3. T8X40A/T8X60A Tape Transports, Rear View

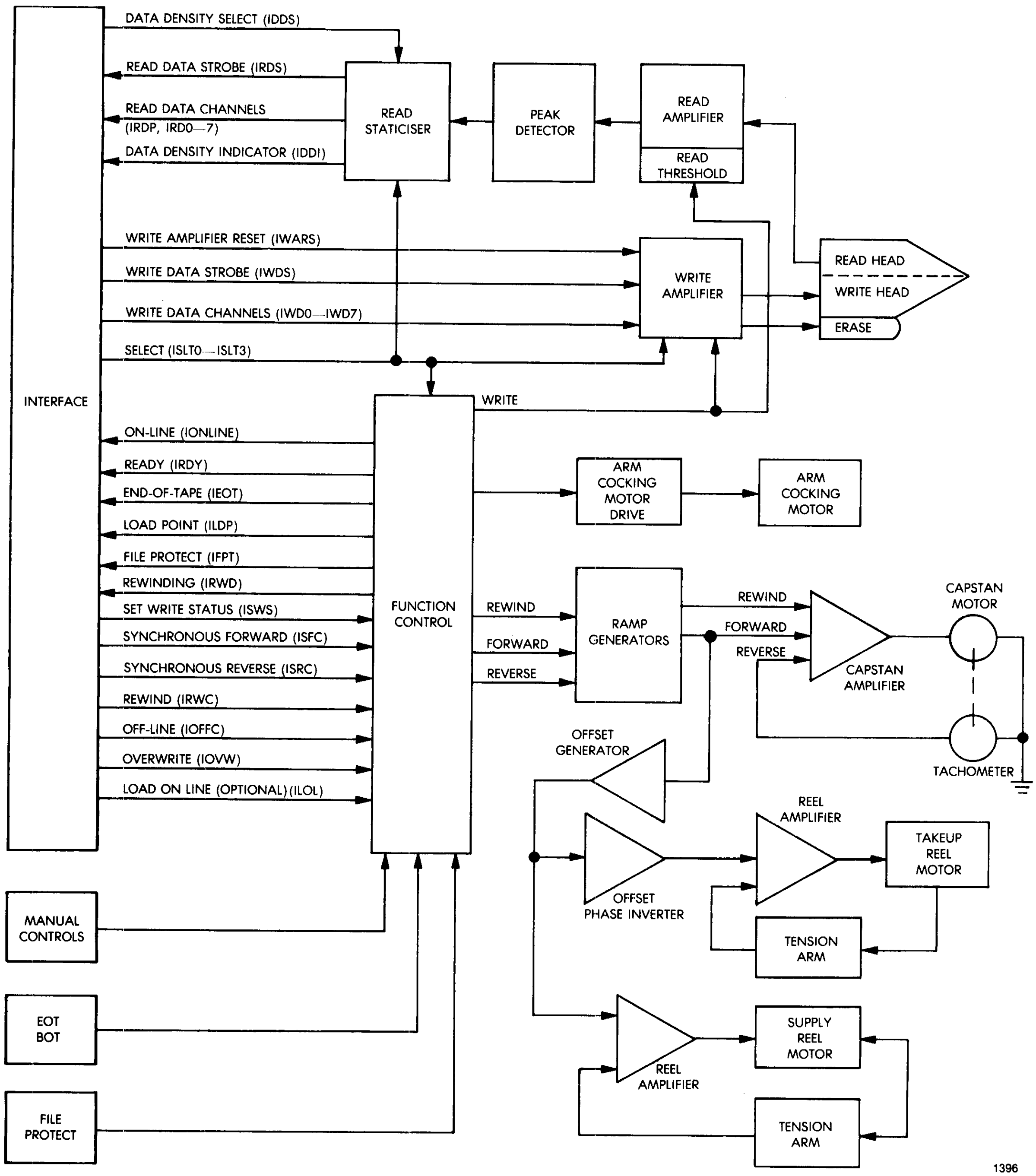


Figure 1-4. T8X40A Tape Transport Block Diagram

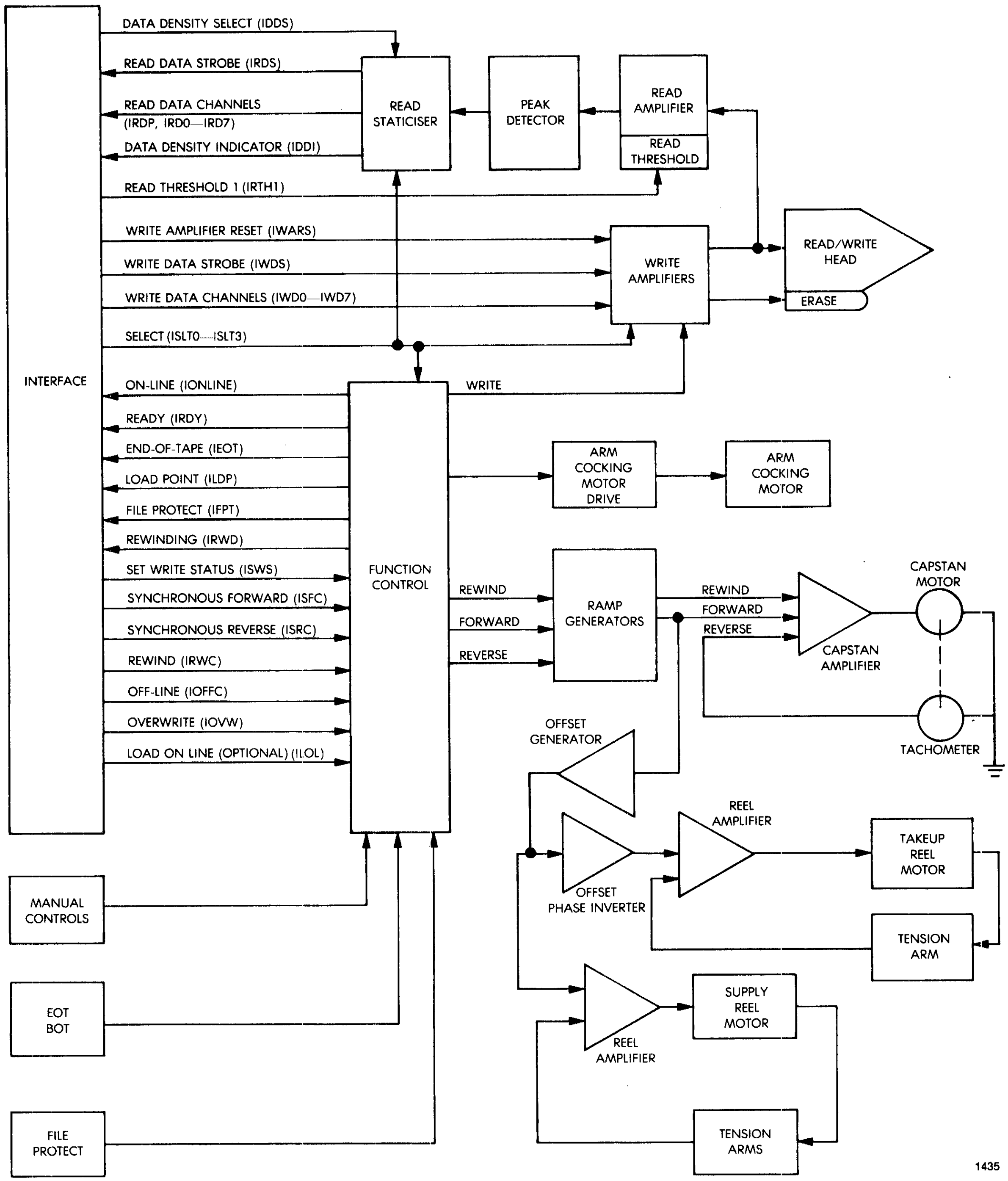


Figure 1-5. T8X60A Tape Transport Block Diagram

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

During a writing operation, tape is accelerated in a controlled manner to the required velocity. This velocity is maintained and data characters are written on the tape at a constant rate such that: Bit Density = Character Rate ÷ Tape Velocity. When data recording is complete, tape is decelerated to zero velocity in a controlled manner.

Since the writing operation relies on a constant tape velocity, Inter-Block Gaps (IBGs) containing no data must be provided to allow for tape acceleration and deceleration periods. Control of tape motion to produce a defined IBG is provided externally by the customer controller, in conjunction with the tape acceleration and deceleration characteristics defined within the transport.

During a read 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. They are accompanied by a READ DATA STROBE (IRDS) pulse derived by conventional ORed clock techniques.

The end of a record is detected in the customer's controller by using *Missing Pulse Detector* circuits and the tape is commanded to decelerate in a controlled manner.

The transport can operate in the Read mode in either the forward or reverse direction.

When operating in the *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. However, to preserve the normal stop/start times and distances, and to guarantee complete erasure of the gaps, the customer must ensure that tape motion has ceased before changing tape direction or Read/Write status.

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

The mechanical storage system buffers the relatively fast starts and stops of the capstan from the high inertia of the supply and takeup 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. The capstan ramp 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 tape path design minimizes tape wear because there is only relative motion of the tape oxide at the magnetic head and tape cleaner.

The magnetic head writes and reads the flux transitions on the tape under control of the data electronics. Switching from the Read After Write to the Read Only mode on the T8X40A is accomplished by remote command; switching from the Write to the Read mode on the T8X60A is also accomplished by remote command.

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

The transport is supplied with a photoelectric sensor for detection of the Beginning of Tape (BOT) and End of Tape (EOT) tab. The BOT and EOT signals are sent as a voltage level to the customer's equipment. The BOT signal is also 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

Table 1-1 details the mechanical and electrical specifications for the T8X40A; Table 1-2 details the mechanical and electrical specifications for the T8X60A. Both models are designed to qualify for UL approval.

1.6 INTERFACE SPECIFICATIONS

Levels: True = Low = 0 (approximately)
False = High = +3v (approximately)

Pulses: Levels as above. Edge transmission delay over approximately 6 metres (20 feet) of cable is not greater than 200 nsec.

The interface circuits are designed so any disconnected wire results in a false signal. Figure 1-6 shows the configuration for which the drivers and receivers have been designed.

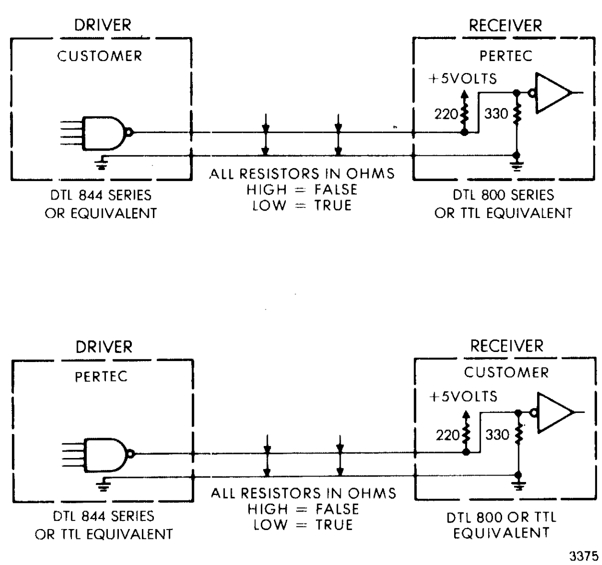


Figure 1-6. Interface Configuration

Table 1-1
Mechanical and Electrical Specifications, Model T8X40A

Tape (computer grade)	
Width	12.6492 ± 0.0508 mm (0.5 inch)
Thickness	0.0381 mm (1.5 mil)
Tape Tension	2.224 N (8.0 ounces)
Reel Diameter	266.7 mm (10.5 inches) maximum
Recording Mode (ANSI and IBM compatible)	NRZI
Data Densities	
9-track	32 c/mm (800 cpi)
7-track	32/22 c/mm (800/556 cpi)
7-track	22/8 c/mm (556/200 cpi)
7-track	32/8 c/mm (800/200 cpi)
Magnetic Head	Dual Stack (with Erase Head)
Tape Speed, Standard	1.143, 0.953, 0.635, 0.476, 0.317 m/s (45, 37.5, 25, 18.75, 12.5 ips)
Instantaneous Speed Variation	± 3% maximum
Long-Term Speed Variation	
Forward	± 1% maximum
Reverse	± 3% maximum
Rewind Speed	5.08 m/s (200 ips) nominal
Interchannel Displacement Error (Skew)	Refer to Paragraph 6.6.13
Stop/Start Time at 1.14 m/s (45 ips) (inversely proportional to tape speed; measured from 0 to 90% of actual speed)	8.33 ± 0.56 milliseconds
Stop/Start Displacement	4.83 ± 0.51 mm (0.19 ± 0.02 inch)
Beginning of Tape (BOT) and End of Tape (EOT) Detectors	Photoelectric (Note 1) IBM Compatible
Weight	38.6 kg (85 pounds)
Dimensions	
Height	622.3 mm (24.5 inches) (Note 2)
Width	482.6 mm (19.0 inches)
Depth (from mounting surface)	
with Multiple Transport Adapter	381.0 mm (15.0 inches) maximum
without Multiple Transport Adapter	317.5 mm (12.5 inches) maximum
Depth (total) without MTA	406.4 mm (16.0 inches)
Operating Temperature	2° to 50°C (35° to 122°F)
Non-operating Temperature	− 45° to 71°C (− 50° to 160°F)
Operating Altitude	0 to 6096 m (0 to 20,000 feet)
Non-operating Altitude	0 to 15,240 m (0 to 50,000 feet) maximum
Power	
Volts ac	95, 100, 110, 115, 125, 190, 200, 210, 215, 220, 225, 230, 235, 240, 250
Watts (maximum on high line)	
Standard Transport	300
Formatted Transport	360
Hertz	47 to 400
Mounting	Standard 482.6 mm (19-inch) EIA Rack
Electronics	All Silicon

NOTES:
1. Approximate distance from detection area to head gap equals 30.5 mm (1.2 inches).
2. Includes special filler panel.

Table 1-2
Mechanical and Electrical Specifications, Model T8X60A

Tape (computer grade)	
Width	12.6492 ± 0.0508 mm (0.5 inch)
Thickness	0.0381 mm (1.5 mil)
Tape Tension	2.224 N (8.0 ounces)
Reel Diameter	266.7 mm (10.5 inches) maximum
Recording Mode (ANSI and IBM compatible)	NRZI
Data Densities	
9-track	32 c/mm (800 cpi)
7-track	32/22 c/mm (800/556 cpi)
7-track	22/8 c/mm (556/200 cpi)
7-track	32/8 c/mm (800/200 cpi)
Magnetic Head	Single Stack (with Erase Head)
Tape Speed, Standard	1.143, 0.953, 0.635, 0.476, 0.317 m/s (45, 37.5, 25, 18.75, 12.5 ips)
Instantaneous Speed Variation	± 3% maximum
Long-Term Speed Variation	
Forward	± 1% maximum
Reverse	± 3% maximum
Rewind Speed	5.08 m/s (200 ips) nominal
Interchannel Displacement Error (Skew)	Refer to Paragraph 6.6.13
Stop/Start Time at 1.14 m/s (45 ips) (inversely proportional to tape speed; measured from 0 to 90% of actual speed)	8.33 ± 0.56 milliseconds
Stop/Start Displacement	4.83 ± 0.51 mm (0.19 ± 0.02 inch)
Beginning of Tape (BOT) and End of Tape (EOT) Detectors	Photoelectric (Note 1) IBM Compatible
Weight	38.6 kg (85 pounds)
Dimensions	
Height	622.3 mm (24.5 inches) (Note 2)
Width	482.6 mm (19.0 inches)
Depth (from mounting surface)	
with Multiple Transport Adapter	381.0 mm (15.0 inches) maximum
without Multiple Transport Adapter	317.5 mm (12.5 inches) maximum
Depth (total) without MTA	406.4 mm (16.0 inches)
Operating Temperature	2° to 50°C (35° to 122°F)
Non-operating Temperature	− 45° to 71°C (− 50° to 160°F)
Operating Altitude	0 to 6096 m (0 to 20,000 feet)
Non-operating Altitude	0 to 15,240 m (0 to 50,000 feet) maximum
Power	
Volts ac	95, 100, 110, 115, 125, 190, 200, 210, 215, 220, 225, 230, 235, 240, 250
Watts (maximum on high line)	
Standard Transport	300
Formatted Transport	360
Hertz	47 to 400
Mounting	Standard 482.6 mm (19-inch) EIA Rack
Electronics	All Silicon

NOTES:
1. Approximate distance from detection area to head gap equals 30.5 mm (1.2 inches).
2. Includes special filler panel.

SECTION II
INSTALLATION AND INITIAL CHECKOUT

2.1 INTRODUCTION

This section contains a summary of interface lines, information for uncrating the Model T8X40A or Model T8X60A Tape Transport, and the procedure for electrically connecting and performing the initial checkout of the transport.

2.2 UNCRATING THE TRANSPORT

The transport is shipped in a protective container which meets the National Safe Transit Specification (Project 1A, Category 1). The container is designed to minimize the possibility of damage during shipment. The following procedure describes the recommended method for uncrating the transport.

(1) Place the shipping container on a low, flat surface. Ensure that the carton is positioned so that the shipping label, model and serial number information are visible on the top surface of the carton.

(2) Remove or cut tape from around the top of the carton and open the flaps. Leave the four polyurethane corner blocks in place between the inner and outer cartons. Refer to Figure 2-1(A).

(3) Fold the outer carton flaps out and away from the carton.

(4) Remove the Operating and Service Manual from carton.

(5) Slit the tape holding the inner carton flaps together.

(6) With the four corner blocks still in place, rotate packing assembly 90 degrees to the position shown in Figure 2-1(B); rotate another 90 degrees until the packing assembly is resting upon the four corner blocks and is in the position shown in Figure 2-1(C).

NOTE

Leaving the corner blocks in place prevents the inner carton from dropping down, possibly causing damage to the transport.

(7) Lift the outer carton upward and away from the inner carton.

(8) Tilt the inner carton and remove the blocks at each corner and at the same time fold the inner carton flaps out and away from the carton.

(9) Lift the inner carton up and away from the steel shipping framework supporting the transport. Note that the transport is upside down. Invert the shipping framework 180 degrees.

(10) Before removing the protective cardboard surrounding the rear area of the transport from the shipping framework, remove the hardware kit stapled to it and remove the 12.7 mm (½-inch) filler panel taped to the left inboard side of the protective cardboard. Remove tape from the power cord and remove the protective cardboard from the shipping framework. Remove tie wrap that secures the card cage.

NOTE

Hardware kit contains all necessary hardware to place transport in service.

(11) Remove the tape from the transport door and head cover.

(12) Check the contents of the shipping container against the packing slip; check the contents for possible damage — notify the carrier immediately if any damage is noted.

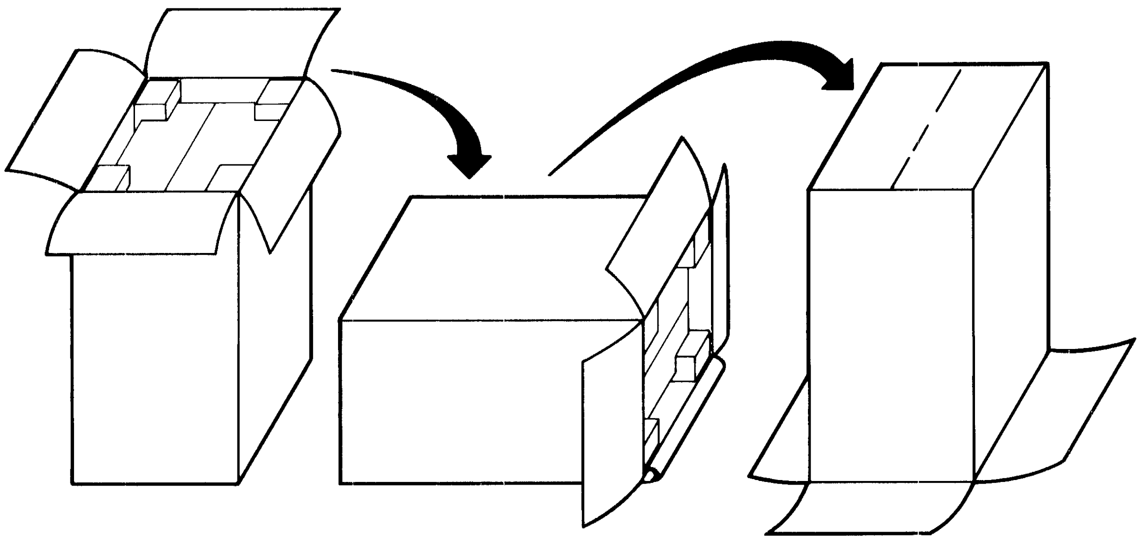


Figure 2-1. Carton Placement for Removal of Transport

(13) Check the identification label for the correct model number and line voltage requirement.

CAUTION

IF THE ACTUAL LINE VOLTAGE AT THE INSTALLATION DIFFERS FROM THAT ON THE IDENTIFICATION LABEL, THE CODED JUMPER PLUG ON POWER SUPPLY MUST BE CHANGED. REFER TO SECTION IV.

(14) Check all Molex connectors used in the tape transport and the plug-in relays on the PCBAs for full engagement with their mating parts.

2.3 POWER CONNECTIONS

A fixed, strain-relieved power cord is supplied for use in a polarized 115v outlet. For other power sockets, power plug supplied must be removed and replaced with the correct plug. Table 2-1 lists, in several languages, the color code for the supplied power cord.

2.4 INITIAL CHECKOUT PROCEDURE

Section III contains a detailed description of all transport controls and indicators. To check the operation of the transport before placing it in the system, the following procedure should be performed.

CAUTION

NEVER EXERT PRESSURE ON A TENSION ARM ROLLER WHILE ATTEMPTING TO MOVE THE ARM INTO THE OPERATING REGION FROM LOAD POSITION. DAMAGE TO THE ARM ACTUATOR GEAR MOTOR OR TO THE ROLLER GUIDE SHAFT MAY RESULT.

(1) Connect the power cord (replace power plug and change power jumper plug if necessary, as detailed in Section IV.)

(2) Set the transport POWER switch to ON.

Table 2-1
Power Cord Color Code

Black or Brown AC 'Hot' (Live)	**Nero o Marrone** (Vivo)	**Noir ou Brun** (haut Voltage)	**Negro o Moreno** (Vivo)	**Schwarz oder Braun** (Heiss)
White or Blue AC Return (Neutral) (Common)	**Bianco o Blue** AC Ritorno (Neutro) (Comune)	**Blanc ou Blue** AC Retour (Neutre) (Commun)	**Blanco o Azul** AC Neutro (Neutro) (Comun)	**Weiss oder Blau** AC Zuruck (Neutral) (Gemeinsamer)
Green or Green with Yellow Stripes Chassis (Ground)	**Verde o Verde con le Righe Gialle** Telaio (Terra o massa)	**Vert ou Vert avec Rayure Jaune** Chassis (Terre)	**Verde o Verde con Rayas Amarillas** Chasis (Tierra)	**Grün oder Grün mit Gelben Streifen** Chassis (Grund)

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

NOTE

If the transport is equipped with the Door Safety Switch option (Paragraph 3.4.10), ensure that the dust cover is closed or the Door Safety Switch is pulled to its outermost position.

(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. Tape will move forward and stop when it reaches the BOT tab. The LOAD indicator should illuminate when the BOT reaches the photosensor and remain illuminated until 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 the control repeatedly and observing that the ON LINE indicator is alternately illuminated and extinguished.

(7) With the deck open, i.e., Tape Control PCBA accessible, and the transport Off-line (ON LINE indicator extinguished), run one to two metres (several feet) of tape onto the takeup reel by activating the 3-position Maintenance switch located on the Tape Control PCBA. In the up position, the Maintenance switch causes the tape to move forward; in the center position, tape motion stops; in the down position, the tape moves in reverse. Refer to Paragraph 3.4.9 and Figure 3-5 for details concerning the use of the Maintenance Switch.

(8) With the transport Off-line, activate the Maintenance switch so that tape moves in reverse (Maintenance switch down). Check that if the transport is placed On-line, the action of the Maintenance switch is inhibited. Tape will move in reverse until the BOT tab reaches the photosensor, then it will stop.

(9) Using the Maintenance switch, run one to two metres (several feet) of tape onto the takeup reel. Momentarily depress the REWD control to initiate the Rewind mode and light the REWD indicator. Tape will rewind past the BOT tab, enter the Load sequence, return to the BOT tab, and stop with the LOAD indicator illuminated. If the REWD control is momentarily depressed when tape is at BOT, the LOAD indicator will be extinguished and the tape will run in reverse at a low speed until tape tension is lost. This action is used to unload the tape. The reel can now be removed as detailed in Paragraph 3.3.2.

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

If line voltage is lost during initial checkout of the transport, proceed as follows.

NOTE

The tape unit is designed to provide dynamic braking to the tape reels in case of power loss. Therefore, minimum tape spillage and no damage to the tape will occur.

(1) Set the power switch/indicator to OFF.

(2) Determine and correct the cause of power loss before reapplying power to the transport.

NOTE

Refer to Section VI for fuse sizes and maintenance procedures. Refer to Figure 7-4 and Table 7-4 for fuse locations and part numbers.

(3) Manually retension the tape and check for correct seating of the guides.

(4) Set the power switch/indicator to ON.

(5) Ensure that the ON LINE indicator is extinguished.

(6) Depress and release the LOAD control; power is now applied to the capstan and reel motors. Tape tension is also established and the tape storage arms move to their operating positions.

CAUTION

ENSURE THAT TAPE IS POSITIONED CORRECTLY ON ALL GUIDES OR TAPE DAMAGE WILL RESULT.

(7) Depress and release the REWD control; tape will rewind past the BOT tab, enter the Load sequence, return to BOT and stop with the LOAD indicator illuminated.

(8) Resume initial checkout of the transport.

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 approximately 6 metres (20 feet).

(2) Characteristic impedance of 110 to 150 ohms.

(3) 22- or 24-gauge conductor with minimum insulation thickness of 0.254 mm (0.01-inch).

It is important that the ground side of each twisted pair is grounded within approximately 50 mm (a few inches) of the board to which it is connected.

Three printed circuit edge connectors are required for each transport (ELCO Part No. 00-6007-036-980-002, Pertec Part No. 503-0036), which are supplied at no charge upon request. Each connector must be wired by the customer and strain relieved. Interface signals are thus routed directly to and from the PCBAs. Table 2-2 shows the input/output lines for the standard T8X40A transport; Table 2-3 shows the input/output lines for the standard T8X60A transport. Details relating to the interface are contained in Section III. Details of the interface signal input/output lines for the FT8000 series transports can be found in the Microformatter Addendum.

2.6 RACK MOUNTING THE TRANSPORT

The physical dimensions of the T8000 transport are such that it may be mounted in a standard 482.6 mm (19-inch) EIA rack; 622.3 mm (24.5 inches) of panel space, including a 12.7 mm (½-inch) spacer panel, is required. With the card cage closed, a depth of at least 305 mm (12 inches) behind the mounting surface is required. Figure 2-2 illustrates typical installation of the T8000 and FT8000 series transports. Figures 2-3 and 2-4 illustrate the interface connections and procedure for mounting the standard T8000 transport. Figures 2-5 and 2-6 show the interface connections and procedure for mounting the Formatted FT8000 transport. The figures should be referenced in conjunction with the following procedure.

CAUTION

THE TRANSPORT WEIGHS APPROXIMATELY 39 KILOGRAMS (85 POUNDS). CARE SHOULD BE TAKEN TO AVOID INJURY TO PERSONNEL OR DAMAGE TO THE TRANSPORT.

(1) Install the hinge pin blocks on the EIA rack (see Figure 2-4 or 2-6 for correct positioning). Do not fully tighten the screws. Place a shim washer on the top hinge 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.

(3) Hang the transport on the hinge pin blocks by lifting it up to the hinge pin blocks on a 45-degree angle to its closed position (see Figure 2-2).

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

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

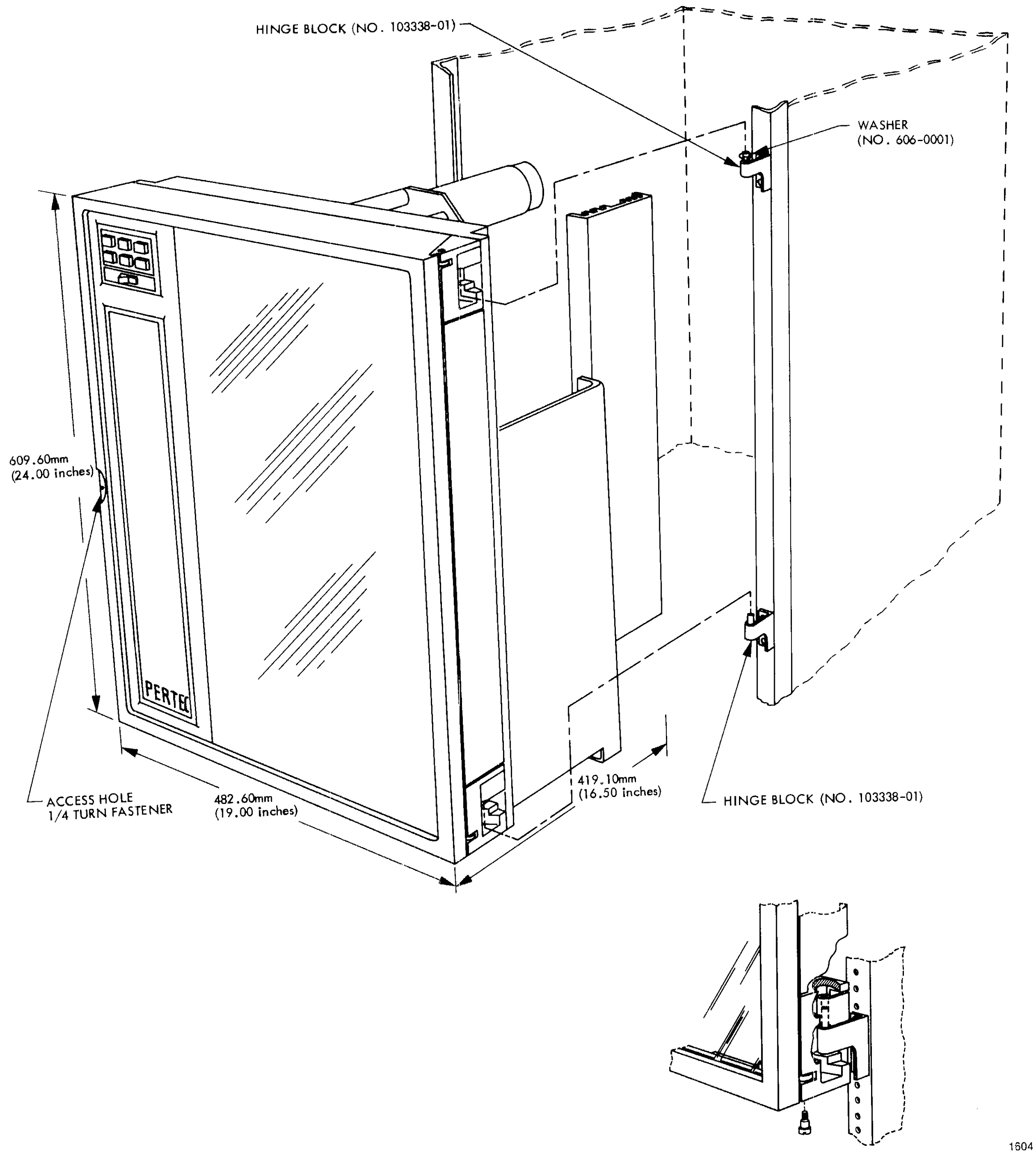


Figure 2-2. T8000 and FT8000 Series Transports, Installation Diagram

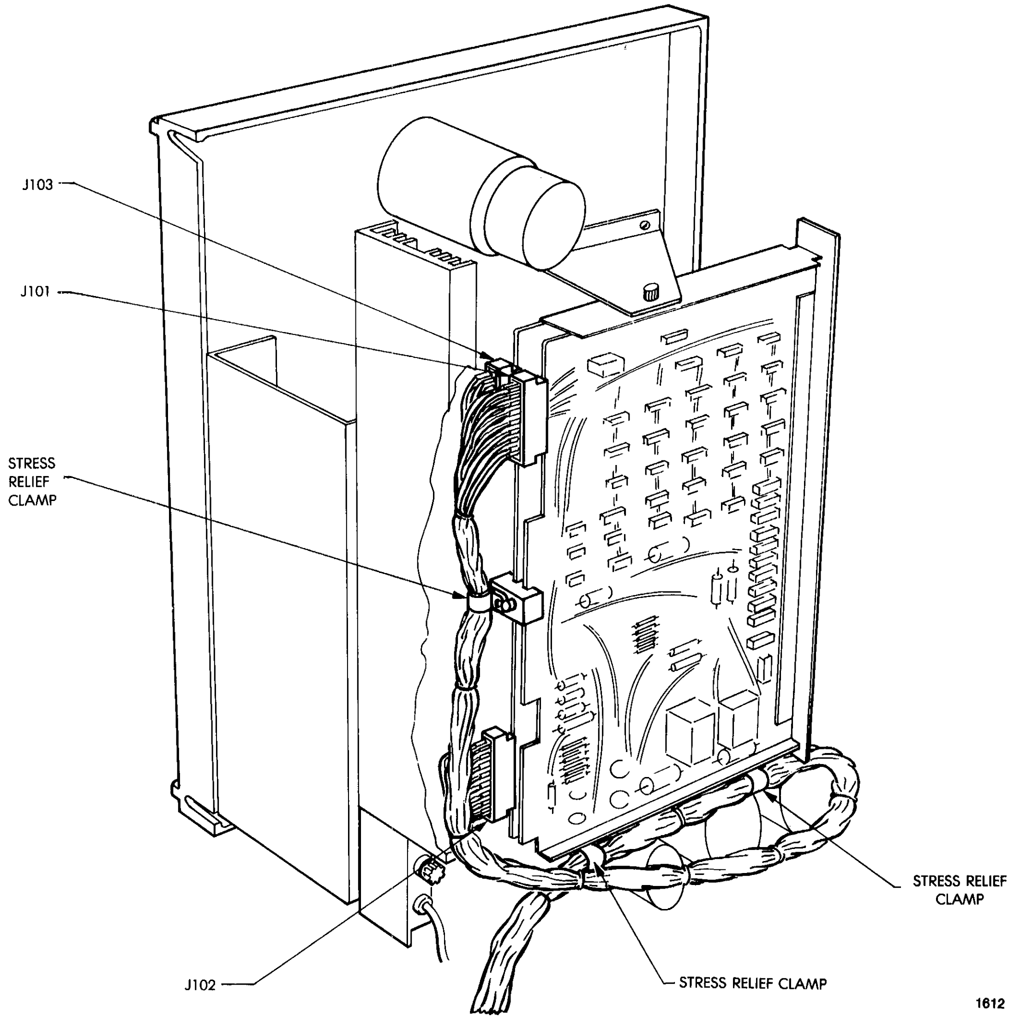


Figure 2-3. T8000 Series Transport, Interface Cable Connections

380M

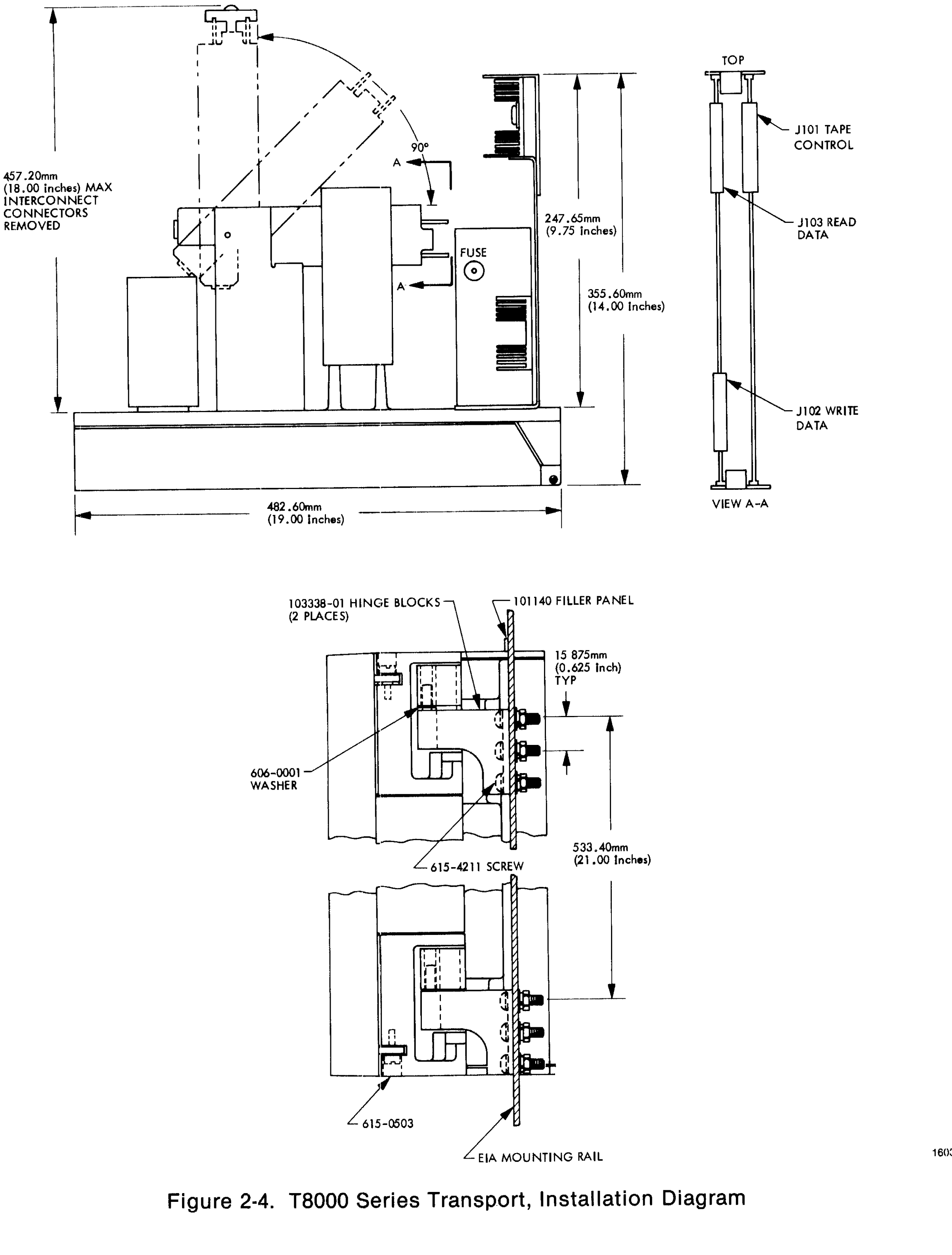


Figure 2-4. T8000 Series Transport, Installation Diagram

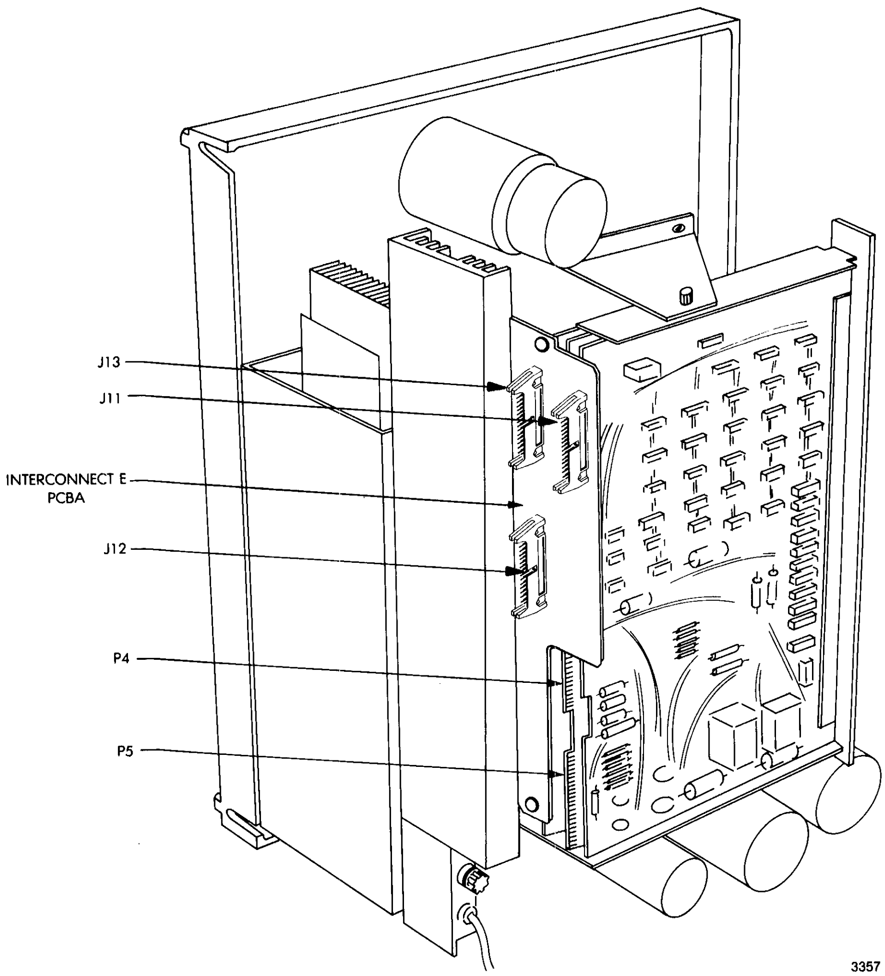


Figure 2-5. FT8000 Series Transport, Interface Cable Connections

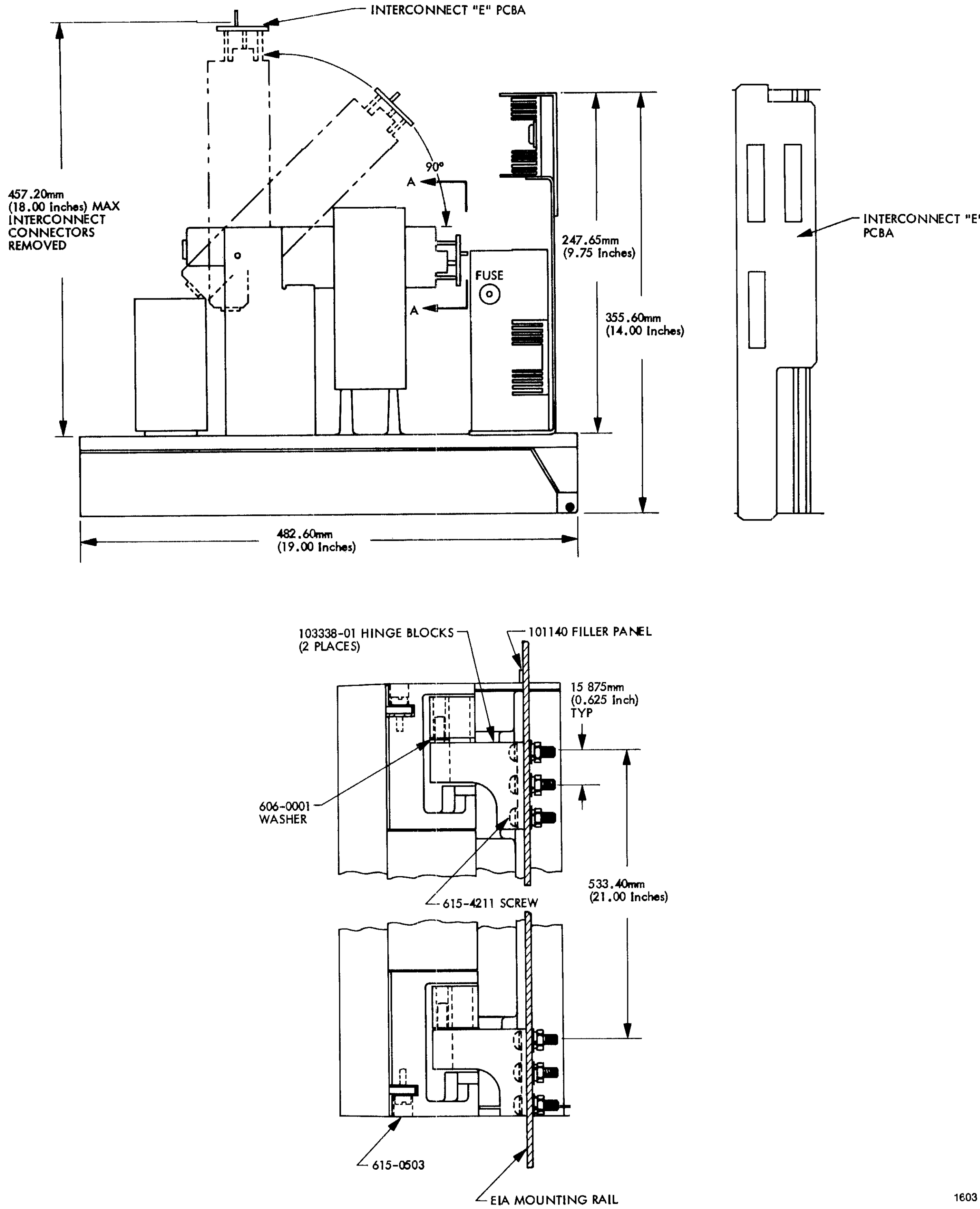


Figure 2-6. FT8000 Series Transport, Installation Diagram

Table 2-1
Interface Connections, Model T8X40A

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

Connector	Live Pin	Gnd Pin	Signal*
J101 Tape Control PCBA	D	4	DATA DENSITY SELECT (IDDS)
	F	6	DATA DENSITY INDICATOR (IDDI)
	1	2	LOAD ON LINE (ILOL)
	J	8	SELECT 0 (ISLT0)
	A	8	SELECT 1 (ISLT1)
	18	8	SELECT 2 (ISLT2)
	V	8	SELECT 3 (ISLT3)
	C	3	SYNCHRONOUS FORWARD COMMAND (ISFC)
	E	5	SYNCHRONOUS REVERSE COMMAND (ISRC)
	H	7	REWIND COMMAND (IRWC)
	L	10	OFF-LINE COMMAND (IOFFC)
	K	9	SET WRITE STATUS (ISWS)
	B	2	OVERWRITE Command (IOVW)
	T	16	READY (IRDY)
	M	11	ON-LINE (IONLINE)
	N	12	REWINDING (IRWD)
	U	17	END OF TAPE (IEOT)
	R	14	LOAD POINT (ILDP)
	P	13	FILE PROTECT (IFPT)
	15	—	WRITE AMPLIFIER RESET (IWARS)**
J102 Data PCBA	A	1	WRITE DATA STROBE (IWDS)
	C	3	WRITE AMPLIFIER RESET (IWARS)
	L	10	WRITE DATA PARITY (IWDP)
	M	11	WRITE DATA 0 (IWD0) } Omit for 7-Track
	N	12	WRITE DATA 1 (IWD1) } Omit for 7-Track
	P	13	WRITE DATA 2 (IWD2)
	R	14	WRITE DATA 3 (IWD3)
	S	15	WRITE DATA 4 (IWD4)
	T	16	WRITE DATA 5 (IWD5)
	U	17	WRITE DATA 6 (IWD6)
	V	18	WRITE DATA 7 (IWD7)
J103 Data PCBA	2	B	READ DATA STROBE (IRDS)
	1	A	READ DATA PARITY (IRDP)
	3	C	READ DATA 0 (IRD0) } Omit for 7-Track
	4	D	READ DATA 1 (IRD1) } Omit for 7-Track
	8	J	READ DATA 2 (IRD2)
	9	K	READ DATA 3 (IRD3)
	14	R	READ DATA 4 (IRD4)
	15	S	READ DATA 5 (IRD5)
	17	U	READ DATA 6 (IRD6)
	18	V	READ DATA 7 (IRD7)

*See Section III for definitions of interface functions.
**This signal must be grounded externally to J102 pin C of the Data PCBA.

Table 2-2
Interface Connections, Model T8X60A

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

Connector	Live Pin	Gnd Pin	Signal*
J101 Tape Control PCBA	D	4	DATA DENSITY SELECT (IDDS)
	F	6	DATA DENSITY INDICATOR (IDDI)
	1	2	LOAD ON LINE (ILOL)
	J	8	SELECT 0 (ISLT0)
	A	8	SELECT 1 (ISLT1)
	18	8	SELECT 2 (ISLT2)
	V	8	SELECT 3 (ISLT3)
	C	3	SYNCHRONOUS FORWARD COMMAND (ISFC)
	E	5	SYNCHRONOUS REVERSE COMMAND (ISRC)
	H	7	REWIND COMMAND (IRWC)
	L	10	OFF-LINE COMMAND (IOFFC)
	K	9	SET WRITE STATUS (ISWS)
	B	2	OVERWRITE Command (IOVW)
	T	16	READY (IRDY)
	M	11	ON-LINE (IONLINE)
	N	12	REWINDING (IRWD)
	U	17	END OF TAPE (IEOT)
	R	14	LOAD POINT (ILDP)
	P	13	FILE PROTECT (IFPT)
	15	—	WRITE AMPLIFIER RESET (IWARS)**
J102 Data PCBA	A	1	WRITE DATA STROBE (IWDS)
	C	3	WRITE AMPLIFIER RESET (IWARS)
	E	5	READ THRESHOLD 1 (IRTH1)
	L	10	WRITE DATA PARITY (IWDP)
	M	11	WRITE DATA 0 (IWD0) } Omit for 7-Track
	N	12	WRITE DATA 1 (IWD1) } Omit for 7-Track
	P	13	WRITE DATA 2 (IWD2)
	R	14	WRITE DATA 3 (IWD3)
	S	15	WRITE DATA 4 (IWD4)
	T	16	WRITE DATA 5 (IWD5)
	U	17	WRITE DATA 6 (IWD6)
	V	18	WRITE DATA 7 (IWD7)
J103 Data PCBA	2	B	READ DATA STROBE (IRDS)
	1	A	READ DATA PARITY (IRDP)
	3	C	READ DATA 0 (IRD0) } Omit for 7-Track
	4	D	READ DATA 1 (IRD1) } Omit for 7-Track
	8	J	READ DATA 2 (IRD2)
	9	K	READ DATA 3 (IRD3)
	14	R	READ DATA 4 (IRD4)
	15	S	READ DATA 5 (IRD5)
	17	U	READ DATA 6 (IRD6)
	18	V	READ DATA 7 (IRD7)

*See Section III for definitions of interface functions.
**This signal must be grounded externally to J102 pin C of the Data PCBA.

SECTION III
OPERATION

3.1 INTRODUCTION

This section explains the manual operation of the Model T8X40A and Model T8X60A Tape Transports and defines the interface functions with regard to timing, levels, and interrelationships.

3.2 CLEANING THE HEADS AND GUIDES

Perform the cleaning procedure described in Paragraph 6.4 daily to obtain maximum data reliability from the transport.

3.3 LOADING TAPE ON THE TRANSPORT

The supply reel (reel to be recorded or reproduced) is at the top, adjacent to the manual controls (see Figure 3-1). The tape must unwind from the supply reel when the reel is turned clockwise. Note that a write enable ring is required on the supply reel to close the interlocks that allow writing.

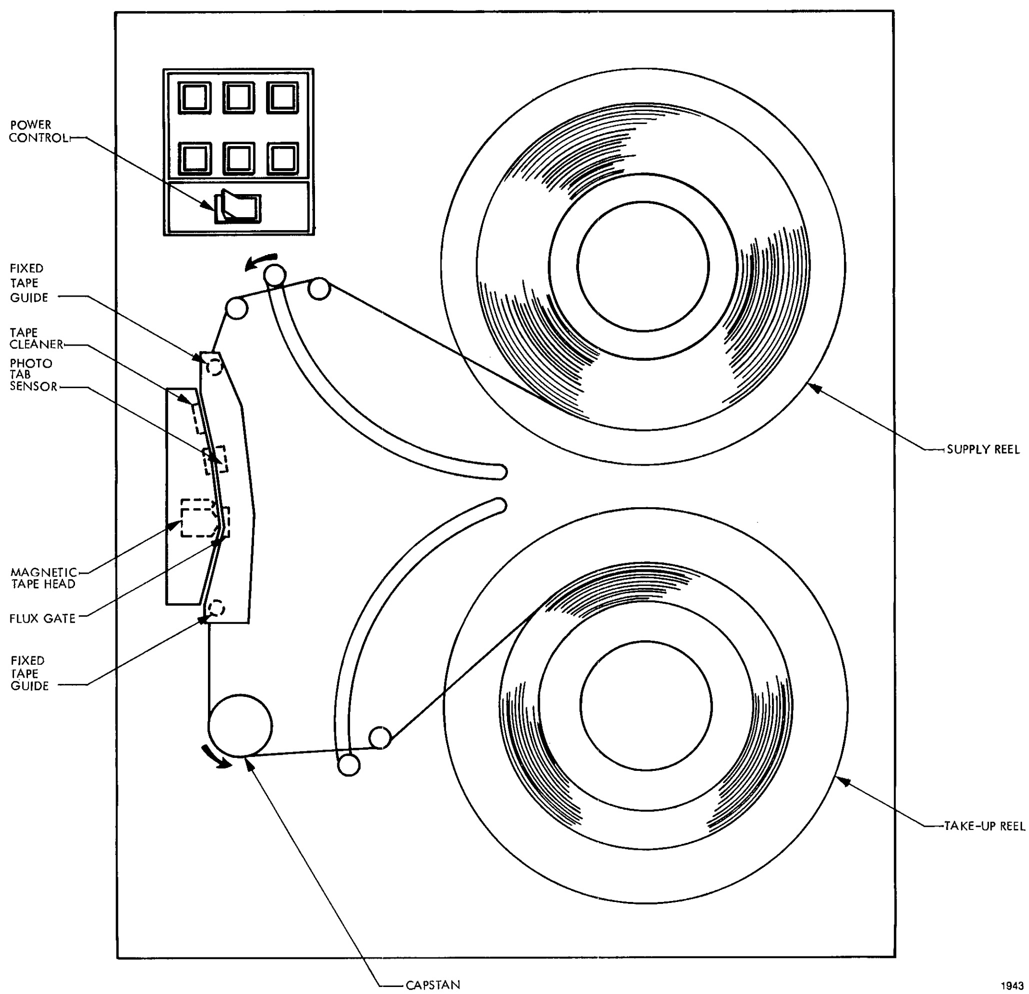


Figure 3-1. Tape Path

Tape loading is easily accomplished through use of a quick-release supply hub. Figure 3-2 shows the hub in the unlocked position, i.e., ready for mounting a 267 mm (10½-inch) reel of tape. When the hub is in the unlocked position, a red band is visible. A view of the hub with a reel of tape loaded and the latch in the locked position is shown in Figure 3-3.

Use the following procedure to load a reel of tape on the transport.

(1) Unlock the quick-release actuator on the supply reel by depressing the indented section of the latch exposing the red band.

(2) Position a reel of tape over the quick-release hub. The write enable ring (or slot) of the tape reel must be toward the transport.

NOTE

It is not necessary to hold the reel against the back flange of the hub. When the reel is placed on the hub, six reel-retaining pawls provide proper alignment of the reel.

(3) Lock the quick-release hub actuator by depressing the indented section.

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

NOTE

The transport is supplied with takeup reel installed. Refer to Section VI for installation and removal instructions.

3.3.1 BRINGING TAPE TO LOAD POINT (BOT)

If the transport is equipped with the Door Safety switch option, the dust cover must be closed during normal operation, thus permitting tape motion. For temporary, test, or maintenance purposes, tape can be moved with the dust cover open by pulling the Door Safety switch plunger to its outermost (detented) position. Refer to Paragraph 3.4.11.

After tape has been manually tensioned and checked for correct seating in the guides, bring tape to Load Point as follows.

(1) Set the Power switch to ON. The indicator will be illuminated.

(2) Depress and release the LOAD control. This enables the tension arm cocking motor, which causes the tension arms to move to the operating region. When the arms have moved to the three-quarter position of the total arm movement, power will be applied to the capstan and reel servos to bring the tape to the correct operating tension. The tape storage arms are now in the operating position.

CAUTION

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

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

CAUTION

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

When the reflective tab is at Load Point (BOT tab detected), the tape stops with the front edge of the tab approximately 25 mm (1 inch) from the magnetic head gap. The transport is now ready to receive external commands.

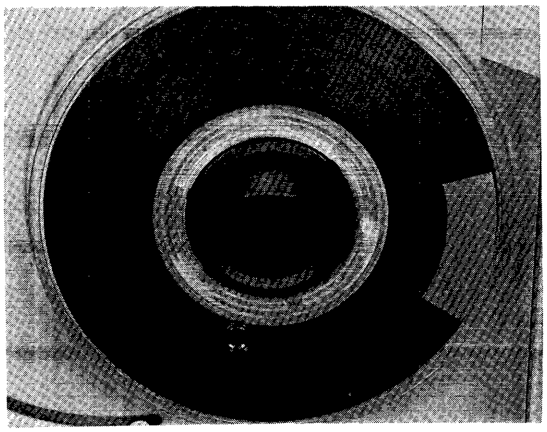


Figure 3-2. Supply Reel Hub, Unlocked

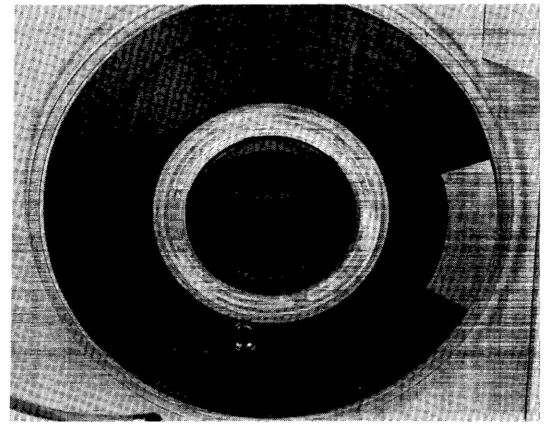


Figure 3-3. Supply Reel Hub, Locked

3.3.2 UNLOADING TAPE

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

(1) Set the power switch to ON. The indicator will be illuminated.

(2) Depress and release the LOAD control; tape will become tensioned.

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

(4) Depress and release the REWD control a second time. This initiates an unload action which moves tape in reverse at a low speed until tension is lost. The tension arms move to the tape threading position.

(5) Open the dust cover and wind the end of tape onto the supply reel.

(6) Unlock the quick-release actuator by depressing the indented section.

(7) Remove the reel of tape and close the dust cover.

3.4 MANUAL CONTROLS

Tape transports may be ordered for either vertical or horizontal rack mounting. Figure 3-4 shows the control panel orientation for transports mounted vertically and horizontally. Note that the Address Select switch is a customer option. Additionally, the customer may order certain switch and indicator engraving different from those shown in the illustrations. The WRT EN (Write Enable) indicator may be called either FILE PROT or FPT (File Protect). When the WRT EN option is specified, WRT EN becomes illuminated when it is possible to write on the tape. Conversely, when the FILE PROT option is specified and is illuminated, it is not possible to write, as explained in Paragraph 3.4.5. The following paragraphs explain typical control functions.

3.4.1 POWER ON/OFF

The POWER ON/OFF power control is a toggle action switch/indicator which connects line voltage to the power transformer. The indicator is illuminated when power is ON, and the +5v regulator is operating. When power is turned ON:

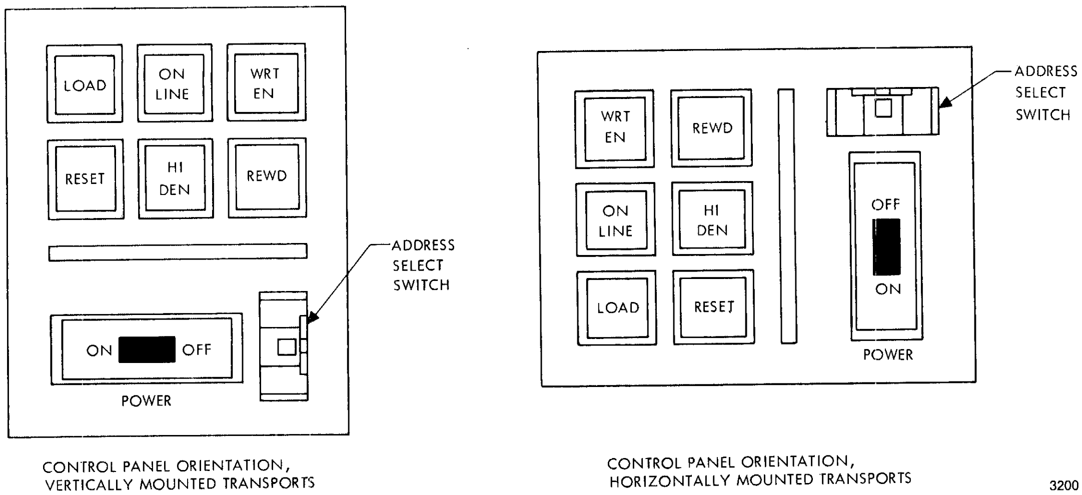


Figure 3-4. Control Panels for Vertically and Horizontally Mounted Transports

(1) All power supplies are established.
(2) All of the motors are open-circuited.
(3) A reset signal is applied to key control flip-flops.
(4) If the tape path is open, tension arms will move to the tape threading position.

3.4.2 LOAD

The LOAD control is a momentary switch/indicator. When the tension arms are in the retracted position, depressing and releasing the LOAD control for the first time energizes the servo systems by connecting the motors to the drive circuits. The servo systems are energized after the arms have moved more than three-quarters into the operating area and tape is tensioned. The reset signal is removed after the tension arm actuator motors have moved the arms out of the normal operating area.

When the tension arms are in the load position, depressing and releasing the control for the first time will start the tension arms moving into the operating area. The reset signal is removed and the tape is tensioned.

Depressing and releasing the LOAD control a second time causes tape to move to the Load Point and stop. The transport is now ready to receive external commands. While the BOT tab is located over the photosensor, the LOAD indicator is lit, indicating that the transport is ready for use. The LOAD control is disabled after the first LOAD or manual REWD 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. Depressing and releasing the switch changes the transport to an On-line mode and illuminates the indicator. In this condition, the transport can accept external commands provided it is also Ready and Selected.

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

(1) ON LINE is depressed a second time.

(2) External OFF-LINE COMMAND (IOFFC) is received.

(3) Tape tension is lost.

(4) RESET switch/indicator is depressed.

3.4.4 REWD (REWIND)

The REWD 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 5.08 m/s (200 ips) after an 0.1-second delay. Upon reaching the BOT tab, the rewind ceases and the Load sequence is automatically entered. The BOT tab will overshoot the photosensor, move forward, and stop at the Load Point.

If the REWD control is depressed and released when the tape is at Load Point (LOAD indicator illuminated), the tension arms will move to a position close to their stops and tape will move in reverse until tape tension is lost.

The REWD indicator is illuminated throughout any rewind operation, including the subsequent Load sequence. A manual Rewind command will override the Load sequence.

3.4.5 WRT EN (WRITE ENABLE)

The WRT EN indicator is illuminated when power is on and a tape reel with a write enable ring installed is mounted on the transport.

Figure 3-4 shows both the horizontal and vertical control panel configurations with the WRT EN (write enable) indicator installed. At the customer's option, a FILE PROT or FPT (file protect) indicator may be installed instead.

The WRT EN and FILE PROT indicators give the same information, but in different ways. The WRT EN indicator is illuminated when the write enable ring is installed in the supply reel, and the write function is enabled. The FILE PROT or FPT indicator is illuminated when the write enable ring is not installed in the supply reel, and the file is write protected; i.e., data cannot be written on the tape.

3.4.6 HI DEN (HIGH DENSITY)

The HI DEN control is an alternate action switch/indicator. It is provided in all models of the transport, but is relevant only to 7-track operation, where it determines the character packing density at which the Read electronics operate. When the indicator is lit, the transport is in the High Density mode; when off, the transport is in the Low Density mode. The following density combinations are available.

Model	Density Combination
T8860A-9	32 c/mm (800 cpi)
T8840A-9	32 c/mm (800 cpi)
T8860A-75	32/22 c/mm (800/556 cpi)
T8840A-75	32/22 c/mm (800/556 cpi)
T8860A-72	32/8 c/mm (800/200 cpi)
T8840A-72	32/8 c/mm (800/200 cpi)
T8560A-72	22/8 c/mm (556/200 cpi)
T8540A-72	22/8 c/mm (556/200 cpi)

For 9-track transports, only 32 c/mm (800 cpi) operation is allowed; thus, the switch is disabled and the indicator permanently illuminated. The switch is also disabled when the external Data Density Select (IDDS) option is used and the switch indicator reflects the state of the IDDS command.

3.4.7 RESET

The RESET control is a momentary action switch/indicator which stops all manual commands except Unload. Depressing the RESET switch when the transport is On-line causes the transport to revert to the Off-line mode.

3.4.8 ADDRESS SELECT SWITCH (OPTIONAL)

The Address Select switch is an option which must be specified when the transport is ordered. It is a 10-position rotary switch that provides selective addressing of four transports. The address (0—3) can be changed only when the transport is Off-line.

3.4.9 MAINTENANCE SWITCH

In addition to the manual controls and indicators located on the front panel, a 3-position toggle switch is provided on the Tape Control PCBA, as illustrated in Figure 3-5. This switch provides manual control of tape motion when the transport is in the Off-line mode.

When the switch is in the up position, tape will move in the forward direction at nominal speed; when the switch is in the center position, tape motion will cease; when the switch is in the down position, tape will move in reverse at nominal speed.

3.4.10 DOOR SAFETY SWITCH (OPTIONAL)

The Door Safety switch, located either at the right side of the control panel on vertically mounted transports, or at the top of the control panel on horizontally mounted transports, is a spring-loaded interlock that stops tape motion when the dust cover is open.

The switch has 3 positions. When the door is closed, the switch plunger is pushed in to permit tape motion. When the door is open, spring action moves the plunger to its center position. This stops the capstan and reel motors. To override the interlock, for test and adjustment purposes, use the Pertec Switch Retractor Tool, Part No. 617-0010. Hook the end of the tool under the plunger lip and pull the plunger out. It will remain detented in its override (outermost) position. Tape can then be moved by either the Maintenance switch, front panel controls, or interface control.

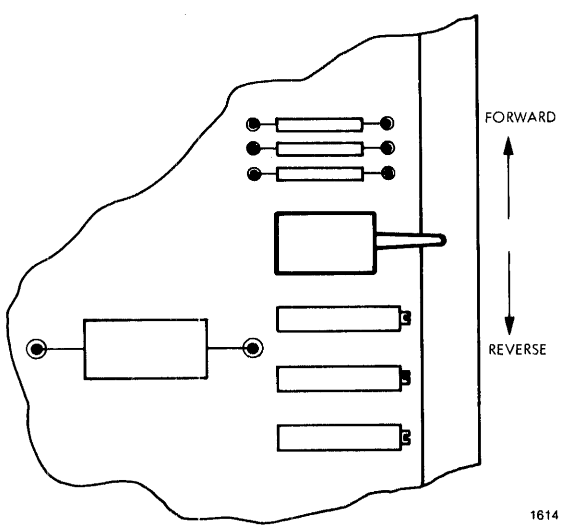


Figure 3-5. Maintenance Switch

3.5 INTERFACE INPUTS (CONTROLLER TO TRANSPORT)

All waveform names correspond to the logical true condition. Receiver logic levels are: 0v = true; and +3v = false. Figure 1-6 is a schematic of the interface circuit.

3.5.1 SELECT (ISLT)

ISLT is a level which, when true, enables all of 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.

3.5.2 SYNCHRONOUS FORWARD COMMAND (ISFC)

ISFC is a level which, when true and the transport is Ready (Paragraph 3.6.1) and On-line (Paragraph 3.6.4), causes tape to move forward at the specified velocity. When the level goes false, tape motion stops. The velocity profile is trapezoidal with nominally equal rise and fall times.

3.5.3 SYNCHRONOUS REVERSE COMMAND (ISRC)

ISRC is a level which, when true and the transport is Ready (Paragraph 3.6.1) and On-line (Paragraph 3.6.4), causes tape to move in reverse 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 ISRC will be terminated upon encountering the BOT tab, or ignored if given with the tape at Load Point.

3.5.4 REWIND COMMAND (IRWC)

IRWC is a pulse (minimum width of 1 microsecond) which, if the transport is Ready, causes tape to move in the reverse direction at 5.08 m/s (200 ips), after a 0.1-second delay. Upon reaching BOT, the rewind ceases and the Load sequence is automatically initiated. Tape moves forward and comes to rest at BOT. The REWD indicator is illuminated for the duration of the rewind and the following Load sequence. An IRWC is ignored if tape is already at BOT.

The velocity profile is trapezoidal with a rise time of approximately 1.0 second and a fall time of approximately 0.5 second.

3.5.5 SET WRITE STATUS (ISWS)

ISWS is a level that must be true for a minimum of 20 microseconds after the leading edge of an ISFC, when the Write mode of operation is required. The leading edge of the delayed ISFC is used to sample the ISWS signal and set the Write/Read flip-flop to the Write state.

If the Read mode of operation is required, the ISWS signal must be false for a minimum of 20 microseconds after the leading edge of an ISFC (or ISRC). The Write/Read flip-flop will be set to the read state.

3.5.6 WRITE DATA LINES (IWDP, IWD0—IWD7), 9-CHANNEL; IWDP, IWD2—IWD7, 7-CHANNEL)

These are levels which, when true at WRITE DATA STROBE (IWDS) time (with the transport in the Write mode), result in a flux reversal being recorded on the corresponding tape track. These lines must be held steady during the IWDS and for 0.5 microsecond before and after the IWDS pulse.

3.5.7 WRITE DATA STROBE (IWDS)

IWDS is a pulse (2 microseconds minimum width) for each character to be recorded. It samples each of the WRITE DATA lines and toggles the appropriate flip-flops in the write register when a 1 is written. The IWDP, IWD0—IWD7 levels must be steady during and for 0.5 microsecond before and after the IWDS. Toggling of the write register is initiated by the trailing edge of the IWDS.

The recording density is determined by tape speed and the frequency of the IWDS pulses. Frequency stability should normally be better than 0.25 percent.

An additional IWDS pulse, accompanied by the appropriate levels on IWDP, IWD0—IWD7 is required to write the Cyclic Redundancy Check Character (CRCC) in 9-channel systems, 4 character spaces after the last data character.

3.5.8 WRITE AMPLIFIER RESET (IWARS)

IWARS is a pulse (2 microseconds minimum width) which causes the Longitudinal Redundancy Check Character (LRCC) to be written onto tape 8 character spaces (4 character spaces for 7-channel) after the last data character has been written. The pulse resets the write register causing all channels to be erased in a uniform direction in the IBG. The LRCC is written coincident with the leading edge of this pulse.

3.5.9 OFF-LINE COMMAND (IOFFC)

IOFFC is a pulse (minimum width of 1 microsecond) which resets the On-line flip-flop to the false state, placing the transport under manual control. The pulse is gated by SELECT, allowing an OFF-LINE COMMAND to be given while a rewind is in progress. OFF-LINE must be separated from a REWIND COMMAND by at least 1 microsecond.

3.5.10 OVERWRITE (IOVW)

IOVW is a level which, when true, conditions appropriate circuitry in the transport to allow updating (rewriting) of a selected record. The transport must be in the Write mode to utilize the IOVW feature. The ISWS signal must be used in conjunction with IOVW when updating isolated records.

3.5.11 DATA DENSITY SELECT (IDDS) (OPTIONAL)

The IDDS level, when true, conditions the Read electronics to operate in the High Density mode, causes the HI DEN indicator to be illuminated, and causes the Data Density Indicator (IDDI) to go true. When this option is selected, the manual HI DEN switch is disabled.

3.5.12 READ THRESHOLD (IRTH)

The IRTH level is used only in the T8X60A transport. When true, it selects the higher of two read threshold levels. IRTH must be held steady for the duration of each record. The high threshold level would be selected only when a read-after-write data check is to be performed. When reading a prerecorded tape, the IRTH line should be false.

3.5.13 LOAD AND ON LINE (ILOL) (OPTIONAL)

ILOL is a pulse which, when true, enables a remote load sequence. A second pulse on this line, spaced a minimum of 1 second from the initial pulse, causes the transport to be placed On-line. This option must be specified when the transport is ordered.

3.6 INTERFACE OUTPUTS (TRANSPORT TO CONTROLLER)

All the interface outputs discussed in the following paragraphs are gated with SELECT and ON-LINE.

3.6.1 READY (IRDY)

IRDY is a level that is true when the transport is ready to accept any external command, i.e., when

(1) Tape tension is established.
(2) Initial LOAD or REWIND COMMAND has been completed.
(3) No subsequent REWIND COMMAND is in progress.
(4) Transport is on-line.

3.6.2 READ DATA (IRDP, IRD0—IRD7, 9-CHANNEL; IRDP, IRD2—IRD7, 7-CHANNEL)

The individual bits of each character are assembled into parallel form in a one-stage deskewing register. The register outputs drive the READ DATA (IRD) interface lines. The complete character is obtained by sampling the interface lines simultaneously with the trailing edge of IRDS.

3.6.3 READ DATA STROBE (IRDS)

IRDS is a pulse (1 microsecond minimum) for each data character read from tape. The trailing edge of this pulse is used to sample the READ DATA lines. Although the average time between adjacent IRDS pulses is 1 ÷ BV, where B is the bit density and V is the tape velocity, this may vary considerably because of skew and bit crowding effects.

3.6.4 ON-LINE (IONLINE)

IONLINE is a level that 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.

3.6.5 LOAD POINT (ILDP)

The ILDP level is true when the transport is Ready and the BOT tab is under the photosensor. The signal goes false after the tab leaves the photosensor area.

3.6.6 END OF TAPE (IEOT)

IEOT is a level which, when true, indicates that the EOT reflective tab is under the photosensor. Circuitry using this output should not assume that the transitions to and from the true state are clean.

3.6.7 REWINDING (IRWD)

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

3.6.8 FILE PROTECT (IFPT)

The IFTP level is true when power is ON and a reel of tape (without a write enable ring installed) is mounted on the transport.

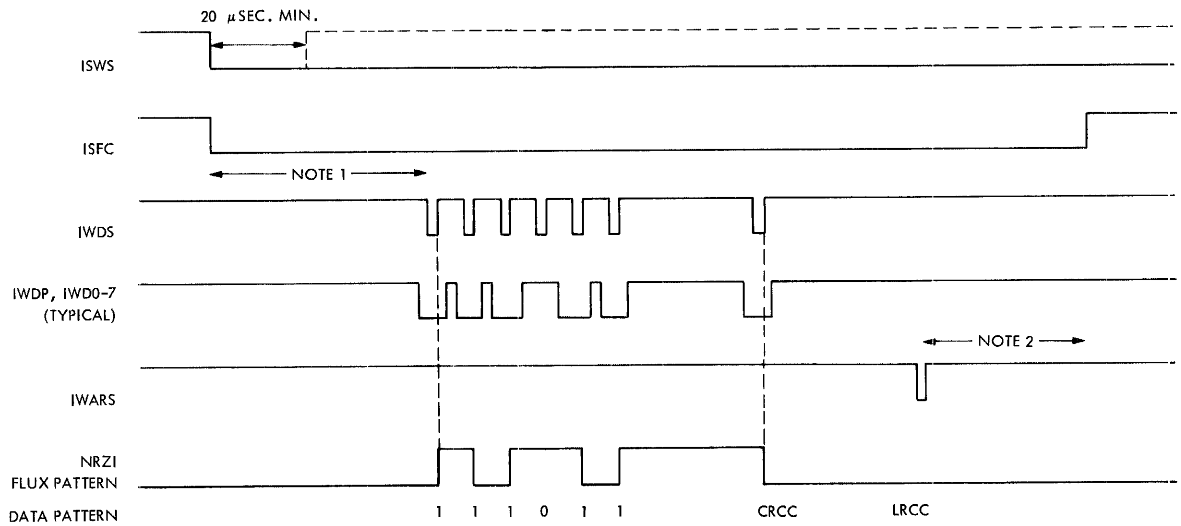
3.6.9 DATA DENSITY INDICATOR (IDDI)

IDDI is a level that is true when the Read electronics are conditioned to operate in the High Density mode. This condition can be created either by the external IDDS signal or the local HI DEN switch, depending on the option selected.

3.7 INTERFACE TIMING

3.7.1 WRITE AND READ WAVEFORMS

Figures 3-6 and 3-7 show the typical write and read waveforms. The controller generates all command waveforms.



NOTES:

1. PRE-RECORD DELAY SHOULD BE CALCULATED TO PRODUCE 88.90 mm (3.50 inches) OF TRAVEL WHEN STARTING FROM BOT; OTHERWISE 6.35 mm (0.25 inch) IN A 9-CHANNEL TRANSPORT AND 9.14 mm (0.36 inch) IN A 7-CHANNEL TRANSPORT.
2. THE POST-RECORD DELAY SHOULD BE CALCULATED TO PRODUCE 1.90 mm (0.075 inch) OF TRAVEL AFTER THE LRCC HAS BEEN DETECTED BY THE READ ELECTRONICS, BEFORE REMOVING THE SFC.

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Figure 3-6. Write Waveforms

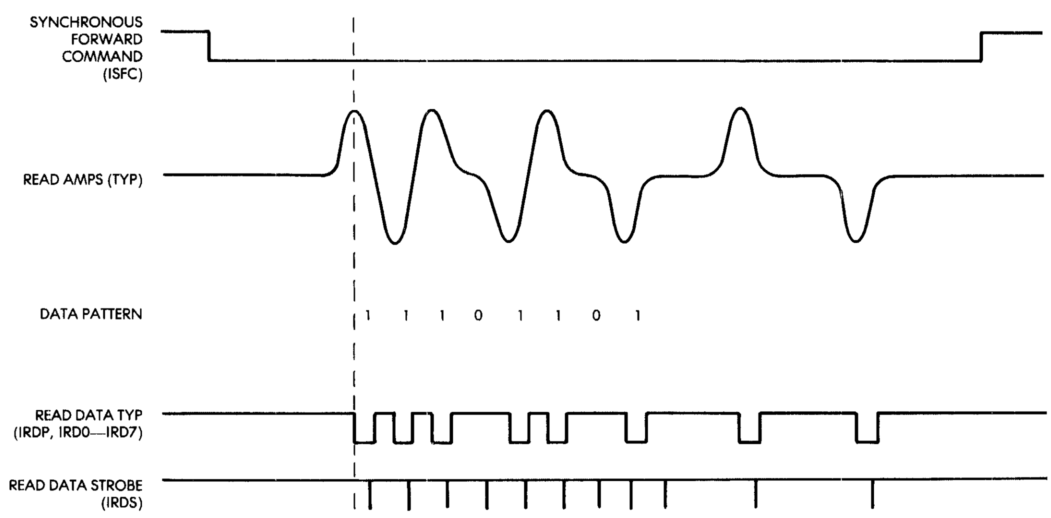


Figure 3-7. Read Waveforms

SECTION IV
THEORY OF OPERATION

4.1 INTRODUCTION

This section provides an operational description of the Model T8X40A and Model T8X60A Tape Transports.

The transports have the mechanical and electronic components necessary to handle tape in such a manner that data can be reproduced from a tape recorded on any ANSI and IBM compatible tape transport, and a tape can be recorded from which data can be completely recovered when played back on any ANSI and IBM compatible transport. The transports consist 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) Tape control system.

4.2 ORGANIZATION OF THE TRANSPORT

A highly modular construction technique has been adopted, with all of the major components and subassemblies interconnected by means of connectors rather than the more conventional wiring techniques. Refer to Figure 4-1 for the T8X40A transport configuration, and to Figure 4-2 for the T8X60A configuration.

The Tape Control PCBA and the Data PCBA are mounted in a card cage parallel to the tape deck. The Tape Control PCBA contains the control logic, reel servo amplifiers, capstan servo amplifier, voltage regulators, photosensor amplifiers, and interlock relay. With the exception of the magnetic head, all of the deck-mounted components (power supply, motors, tension arm position sensors, photosensors, etc.) plug directly into the circuit board. A printed circuit edge connector carries the interface signals to and from the board.

The Data PCBA (nearest the deck) is dedicated to the writing and reading of data. Write data enters by means of a printed circuit edge connector. The signals are encoded and the results transferred to the write head. Read signals enter the PCBA via the head connector (second of the two) and are applied to the amplifiers, peak detectors, envelope detectors, and transmitters. Digital read signals, together with a READ DATA STROBE (IRDS), are transmitted by means of a second interface edge connector.

Dc power and three control levels are obtained from the Tape Control PCBA via a single harness.

4.3 FUNCTIONAL DESCRIPTION

4.3.1 POWER SUPPLY

Figure 4-3 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. Two unregulated supplies are generated at nominal voltages of +18v and −18v.

The second part consists of the +10v, −10v and +5v, −5v regulators which are located on the Tape Control PCBA. Interconnection between the two parts is provided by a harness from the power supply module which plugs into the Tape Control J PCBA via a 9-pin and a 6-pin connector.

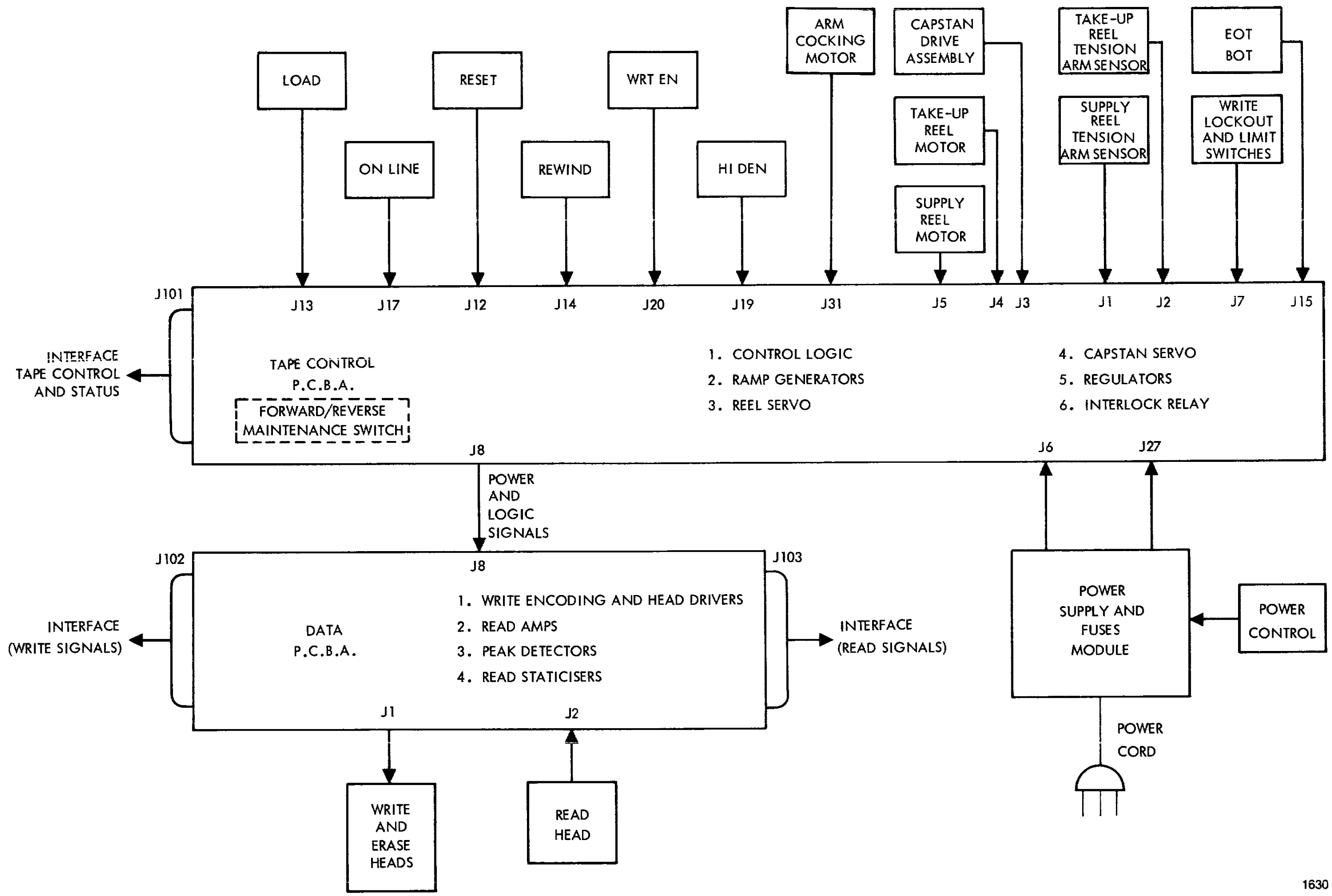


Figure 4-1. T8X40A Tape Transport Organization

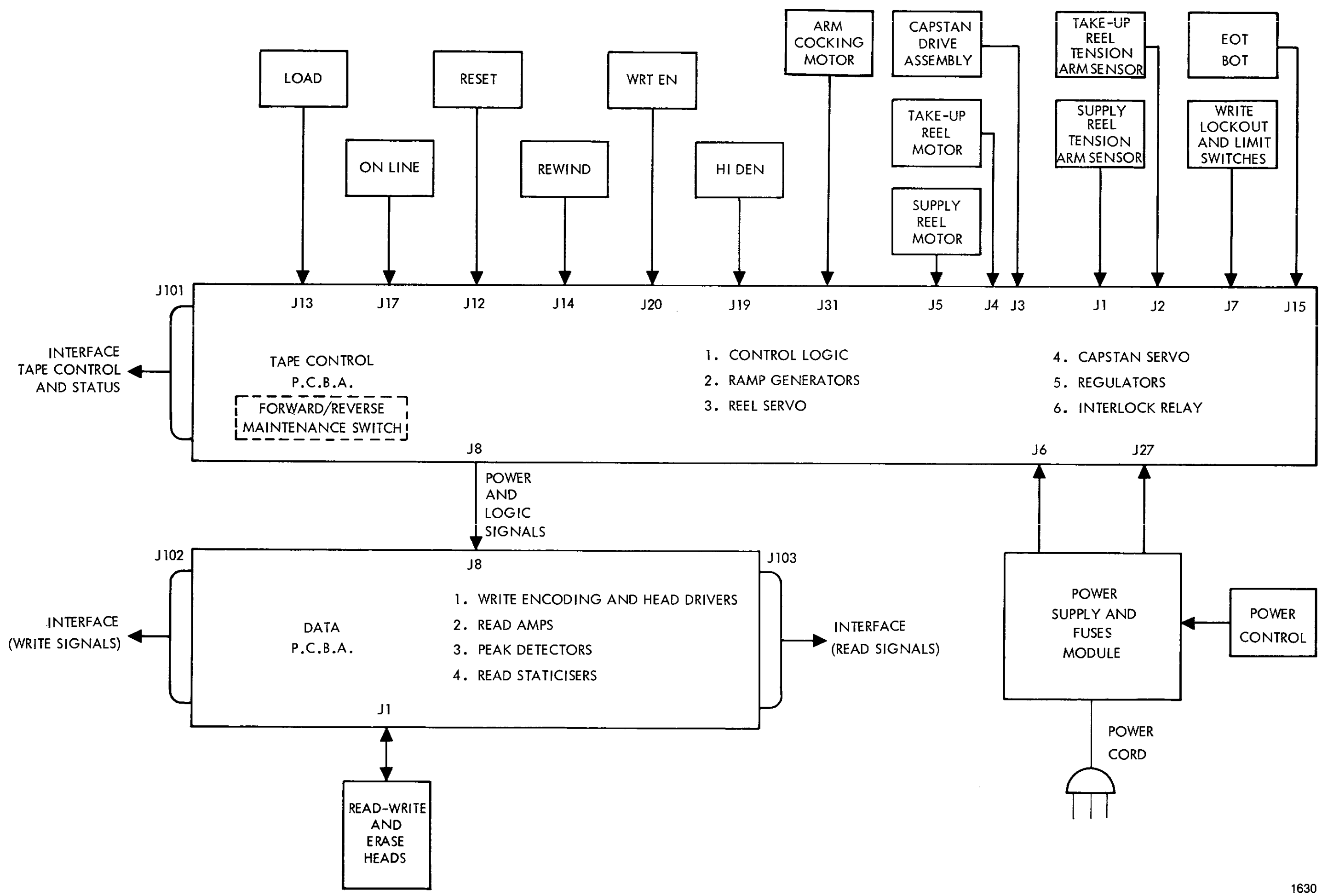


Figure 4-2. T8X60A Tape Transport Organization

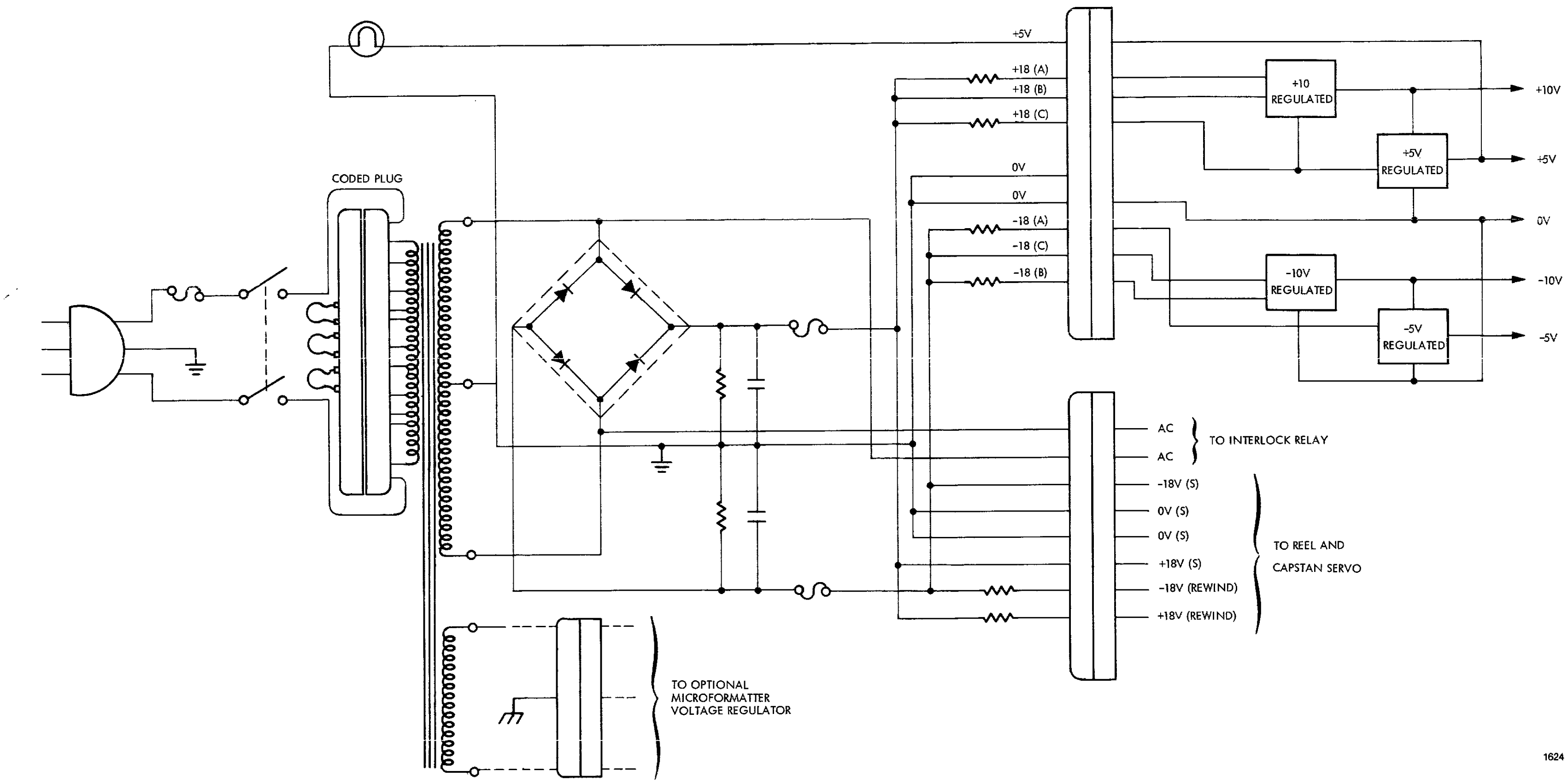


Figure 4-3. Power Supply Block Diagram

Selection of proper ac voltage taps on the power transformer is facilitated through use of a coded jumper plug assembly shown in Figure 4-4. A cross reference of various line voltages to jumper plug assemblies, part numbers, and pin connections is also shown.

Line voltage is connected to the transformer via the POWER control. Unregulated dc, +18v, −18v under load, powers the motors; the voltages also serve as inputs to the voltage regulators. Four regulated supplies are generated. The +10v and −10v supplies can supply up to 1.0 amp. The +5v and −5v supplies are adjusted, regulated, and can supply 3.0 amps and 1.0 amp, respectively. The POWER indicator lamp is connected across the regulated +5v dc. Connections may be provided to the optional microformatter 5v regulator.

Overvoltage protection on all regulated supplies is provided by a SCR *crowbar* circuit. The SCRs are connected between the +18v and 0v and between the −18v and 0v. The activation of either SCR will blow the applicable fuse and turn off the regulators on the other supply line. A short circuit on any regulator output will turn off all of the regulators.

4.3.2 CAPSTAN DRIVE SYSTEM

Figure 4-5 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; and the capstan drive amplifier on the Tape Control PCBA. Relay contacts disconnect the motor from the amplifier when tape tension is lost. When the motor is disconnected, a low resistance path to ground is established for enhancing the capstan motor stop profile.

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, 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.

The Forward ramp generator is activated by the SYCHRONOUS FORWARD COMMAND (ISFC) or a Load sequence. The Reverse ramp generator is activated by a SYNCHRONOUS REVERSE COMMAND (ISRC) and the Rewind ramp generator by a REWIND COMMAND (IRWC), either remote or manual. When the transport is in the standby condition, neither ramp generator is activated. In this case, the velocity servo holds the capstan stationary.

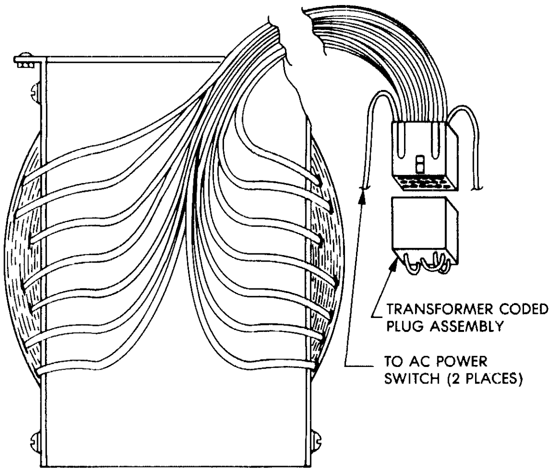
Both Forward and Reverse ramps rise and fall in a time calculated to produce start-stop distances of 4.826 ±0.5 mm (0.19 ±0.02 inch), e.g., 11.5 milliseconds for a 0.635 m/s (25 ips) transport. Typical waveforms are shown in Figure 4-6.

The Rewind ramp rise and fall times are not critical; they are approximately 2 seconds for start and 0.5 second for stop. They are chosen so as to allow the reel servos to keep up with the rise and fall in tape speed.

4.3.3 TAPE STORAGE AND REEL SERVO SYSTEMS

Identical non-linear position servos control the supply and takeup of tape by the reels. Figure 4-7 is a diagram of one complete reel servo together with part of a second and the relevant interconnections.

The components of the servo are: tension-arm position sensor; pulleys, belt, tension arm, and tape reel; reel motor; and, servo amplifiers (delay network, current limiter, and power amplifier) on the Tape Control PCBA.



AC LINE VOLTAGE	CODE NO.	CONNECT				CONNECT	
		PIN 2 TO	PIN 23 TO	PIN 1 TO	PIN 24 TO	FROM	TO
95	104533-01	3	19	8	16		
100	104533-02	6	19	11	16		
110	104533-03	9	19	14	16		
115	104533-04	6	22	11	17		
125	104533-05	9	22	14	17		
190	104533-06	3	19			8	16
200	104533-07	6	19			11	16
210	104533-08	6	19			14	16
215	104533-09	6	22			11	16
220	104533-10	9	19			14	16
225	104533-11	9	22			11	16
230	104533-12	6	22			11	17
235	104533-13	9	22			14	16
240	104533-14	6	22			14	17
250	104533-15	9	22			14	17

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Figure 4-4. Transformer Primary Connections

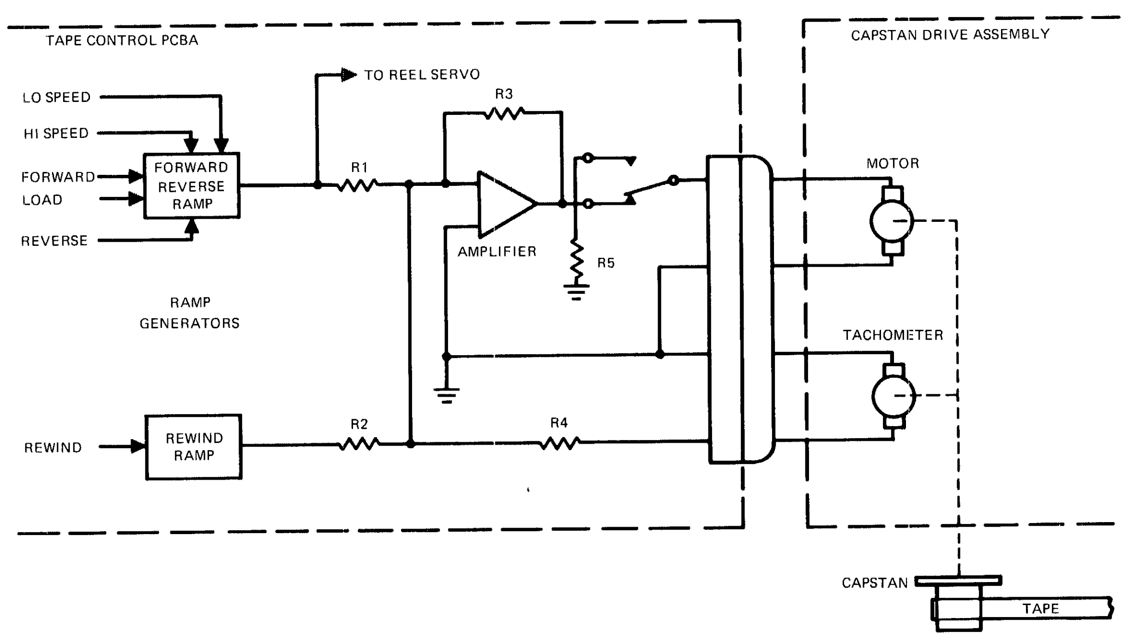

Figure 4-5. Capstan Servo Block Diagram

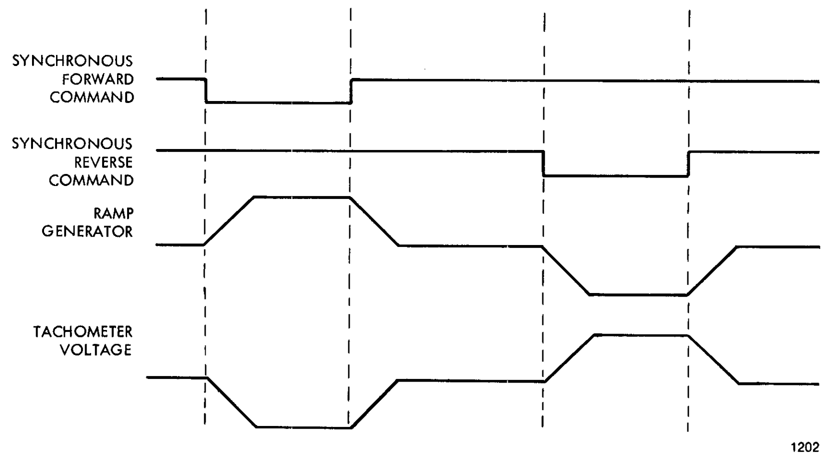

Figure 4-6. Typical Capstan Servo Waveforms

The tension arms estabish 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.

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 tension arm spring torque.

Initially, when the tension arm is in the center of its range, the sensor is set by rotating the shutter on the tension arm shaft for + 0.6v output at the emitter of the input transistor of the stabilization network.

When the capstan injects a tape velocity transient in either direction, the arm moves and the high gain amplifier, together with the current limiter, causes a predetermined current to flow in the reel motor in such a direction to stop the arm at a predetermined position. In addition, 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 the effective reel diameter from an empty to full reel condition.

Without tape, the arms rest against the stops and the tension arm limit switch is open, de-energizing the interlock relay. When the relay is de-energized, the two reel motors are disconnected from their respective amplifiers and connected to ground (the supply motor directly, and the takeup motor via a resistor); 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 proper tape tension is not exceeded and significant tape spillage does not occur. The dynamic braking feature is also useful when tape tension is lost in the tape unload operation.

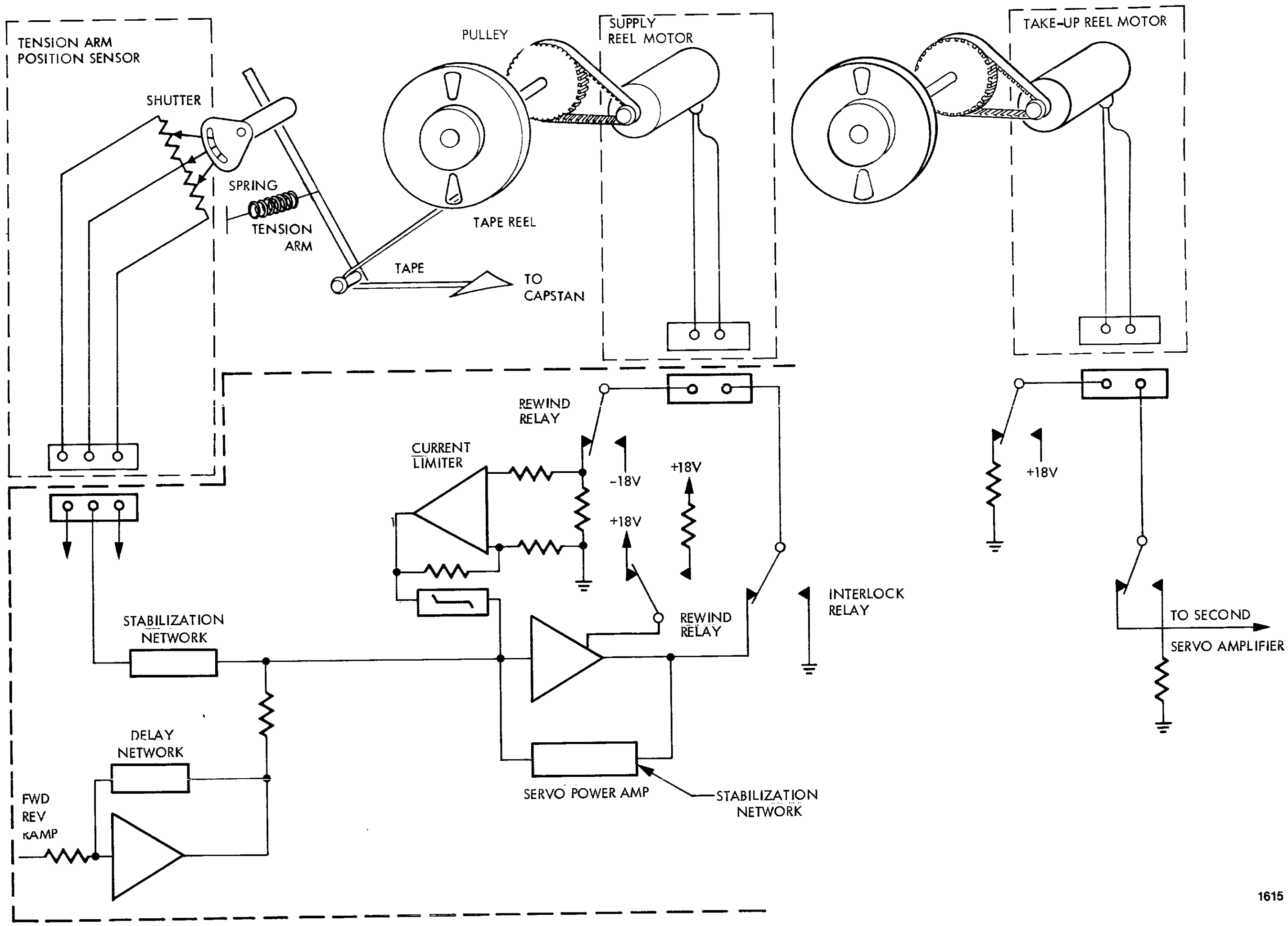

Figure 4-7. Reel Servo Diagram

The reel motors operate from two voltage sources supplied by the power supply. One source supplies the reel servo amplifiers when tape is transported, the other voltage source enables the reel motors to rewind tape onto the supply at 5.08 m/s (200 ips). Transfer of the reel motor voltages is accomplished by a relay on the Tape Control PCBA.

4.3.4 DATA ELECTRONICS

Information is recorded in the NRZI mode, i.e., a 1 on the information line causes a change in direction of magnetization between positive and negative saturation levels. Two tape formats are in general use: the IBM 727/729 7-track format which can operate at 8, 22, and 32 c/mm (200, 556, and 800 cpi); and, the IBM 2400 9-track format which operates at 32 c/mm (800 cpi).

Figures 4-8 and 4-9 illustrate the relevant 9- and 7-track allocation and spacing. In the 9-track system, 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.

Figure 4-10 illustrates the waveforms that occur on a channel during a write operation; readback waveforms are also shown. Magnetization transitions recorded on the tape are not perfectly sharp because of the limited resolution of the magnetic recording process.

During a Read operation, the amplifier readback voltage is full-wave rectified (because no significance is attributable to the sign of the readback voltage) and clipped to remove baseline noise. This is necessary because there is no read signal output for a recorded 0. The output of the rectifier is peak detected and a pulse generated for each 1 recorded. These pulses are applied to a set of read staticisers and then to the interface.

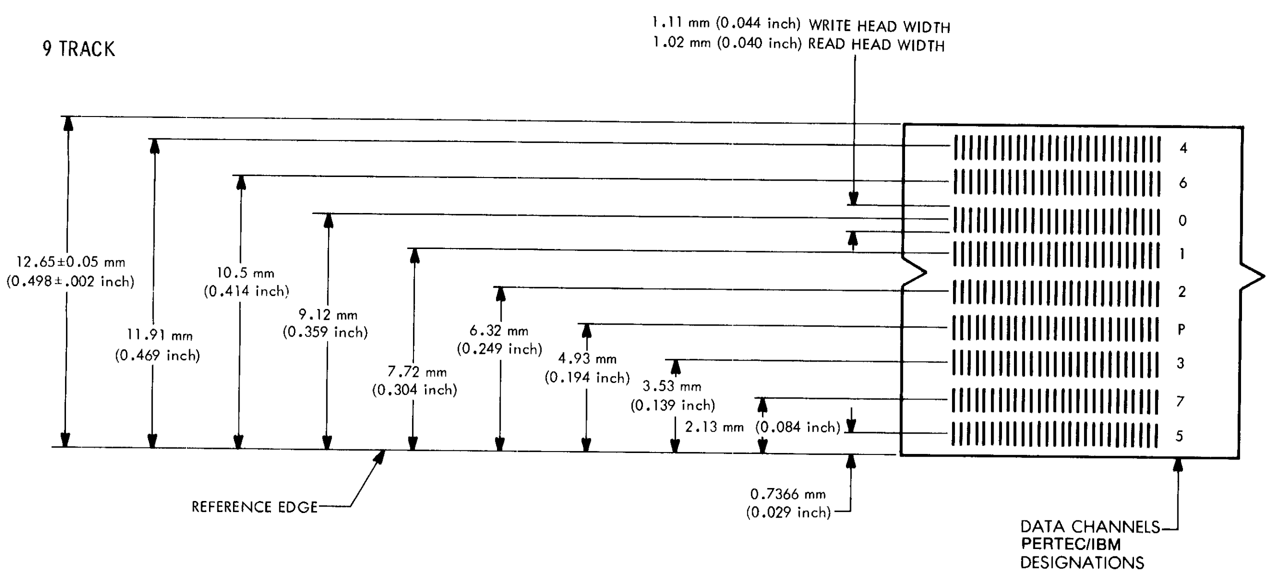

Figure 4-8. 9-Track Allocation and Spacing

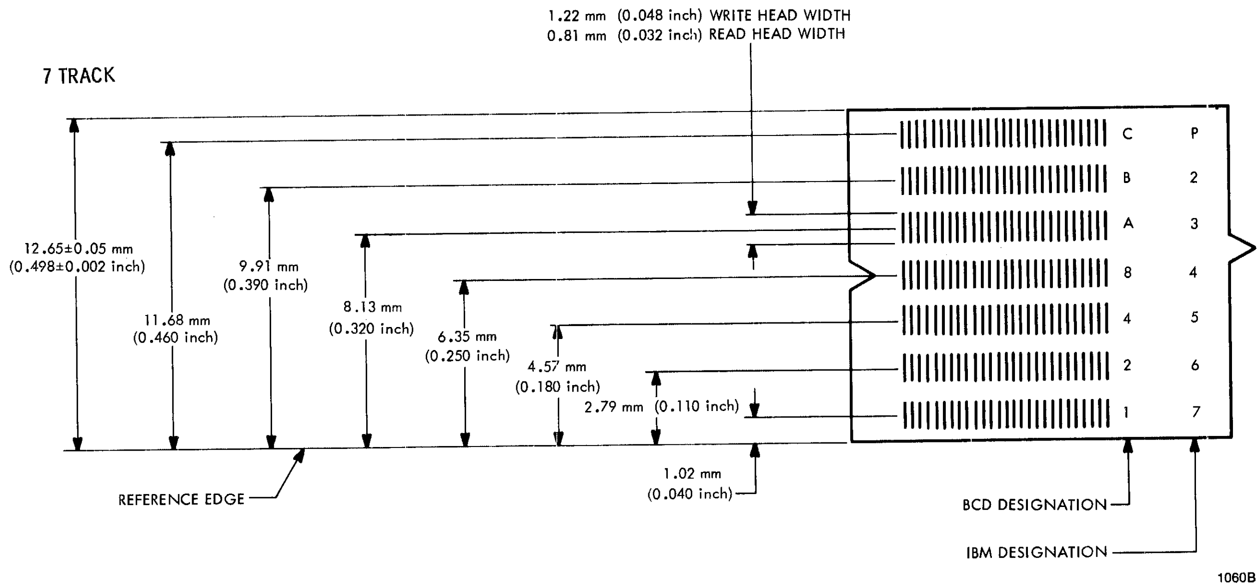

Figure 4-9. 7-Track Allocation and Spacing

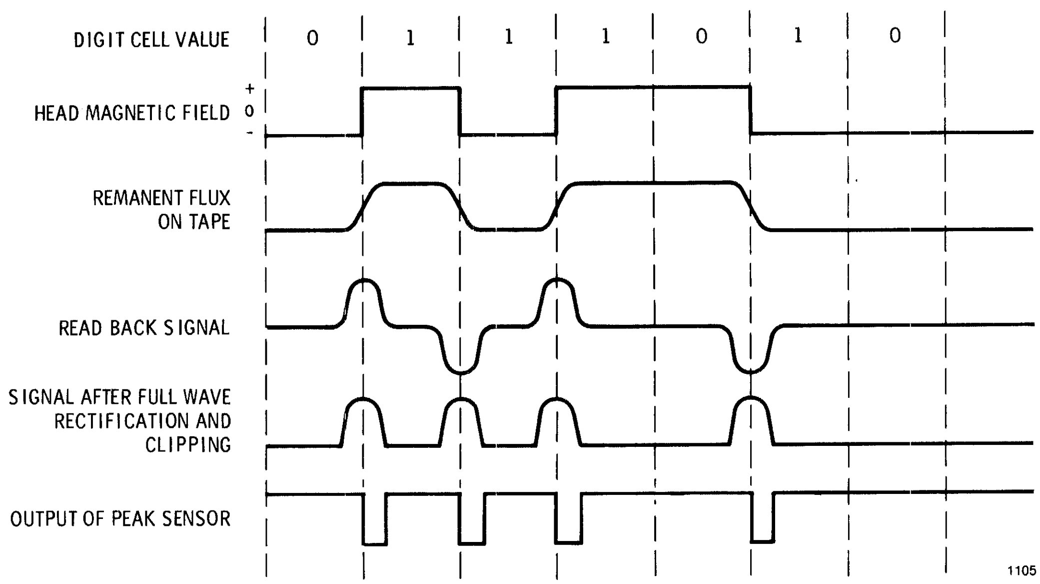

Figure 4-10. Write and Read Waveforms

Figures 4-11* and 4-12* are functional logic diagrams of one channel of data electronics and the relevant common control logic for T8X40A and T8X60A, respectively, and are to be used only for purposes of describing system operation.

4.3.4.1 Operation with Dual- and Single-Stack Heads

The T8X40A transport utilizes a dual-stack head which enables simultaneous read and write operations to take place, thus allowing writing and checking of data in a single pass.

Gap scatter in both the write and read heads is held within tight limits so that correction is not necessary. Conversely, the azimuth angle of both heads is not held within such tight limits and correction is therefore necessary.

The read head azimuth adjustment is provided by shimming the fixed head guides adjacent to the head so that the tape tracks at 90 degrees to the read head gap. Since the write and read heads are constructed in the same block, an independent method of azimuth adjustment is required for the write head. This is achieved electronically by triggering the write waveform generator for different channels sequentially and at such times that the azimuth error in the write head is minimized.

The T8X60A transport utilizes a single-stack head for both read and write operations. Azimuth alignment is accomplished by shimming the fixed head guides adjacent to the head so the tape will track at exactly 90 degrees to the head gap. Since the same gap is used for both reading and writing, no additional azimuth compensation is necessary.

4.3.4.2 Data Recording (Dual-Stack Model T8640A)

Figure 4-13 is a timing diagram for data recording. Refer to Schematic 101710 for Data E19 details and Schematic 102333 for Tape Control J details.

Assume that the transport is Selected, Ready, On-line and has a write enable ring installed. When an ISFC is received, the MOTION signal generated on the Tape Control PCBA goes high. Therefore, MOTION is high at the input of AND gate U8. The rising edge of MOTION generates the GO pulse which is used to clock the Write flip-flop, U41B, located on the Tape Control PCBA. If the SET WRITE STATUS line (ISWS) is active (low) at this time, U41B will be set putting the transport in the Write mode. This causes logic term NWRT to become low active, causing the following:

(1) The direct clear, C_D, is removed from U4.

(2) The direct clear is removed from U9, thus enabling the Write Deskewing circuit.

(3) WRT PWR becomes +5v dc.

(4) The erase driver transistor, Q4, is energized.

The ISFC (Plot 1) also enables the ramp generator, which causes tape to accelerate to the prescribed velocity (Plot 2). After a time (T1) determined by the required IBG displacement, the WRITE DATA (IWD) inputs, together with the IWDS, are supplied to the interface connector.

IWD is received by interface receiver U1, and, when true, enables one input of AND gate U2. The IWDS pulse is received by interface receiver U5 and applied to U2. The output of U2 is thus a positive-going pulse at IWDS time whose leading edge enables the J input of the J-K write waveform generator flip-flop U4 directly, and the K input via OR gate U3. Since the clock input of U4 is high at this time, the master section of U4 is toggled whenever the IWD signal is true.

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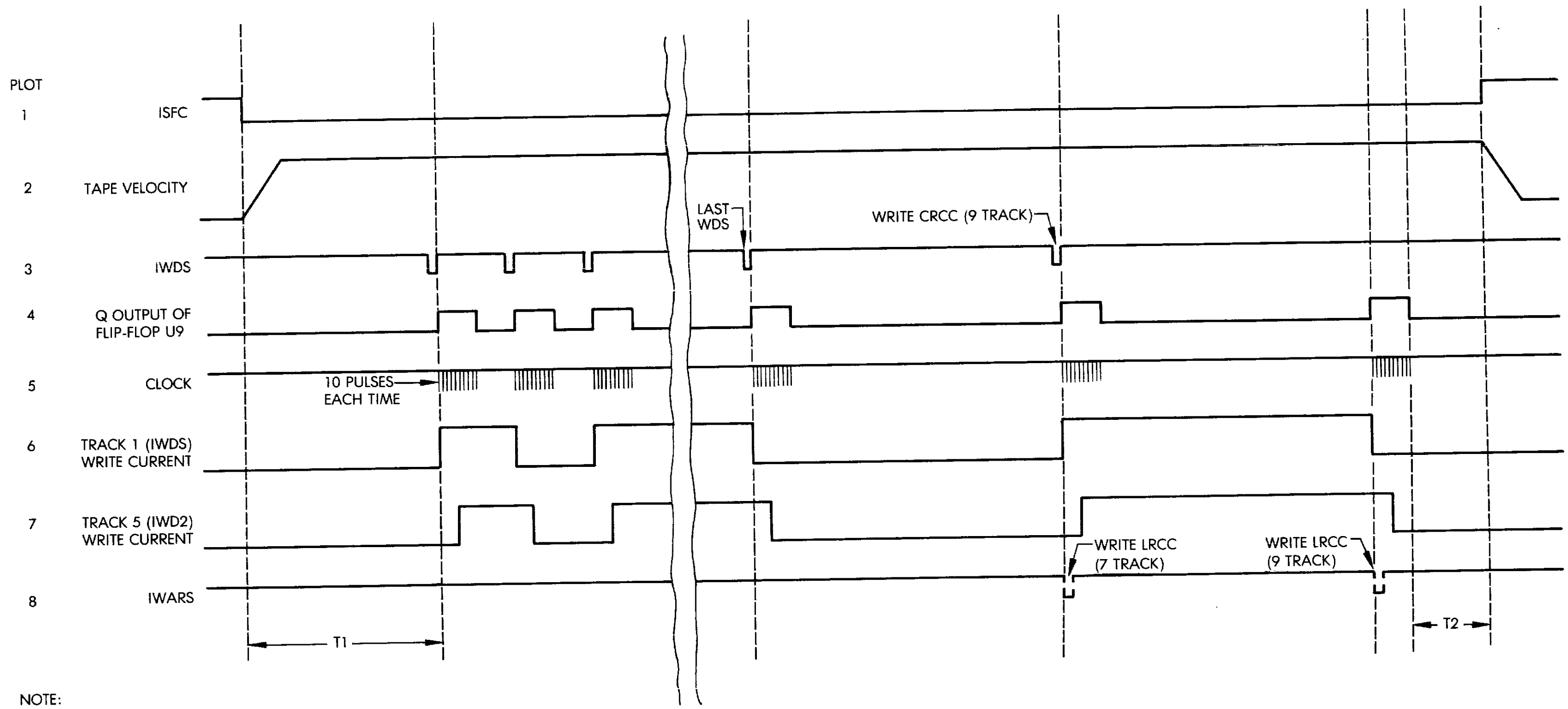
*Foldout drawing, see end of this section.



NOTE:

1. DIAGRAM IS FOR 9-TRACK OPERATION. FOR 7-TRACK OPERATION, THE IWDS PULSE (LABELED WRITE CRCC) AND THE IWARS PULSE (LABELED WRITE LRCC (9-TRACK)) ARE OMITTED AND THE DOTTED IWARS PULSE (LABELED WRITE LRCC (7-TRACK)) IS USED.

Figure 4-13. Data Recording Timing Diagram (T8X40A)

Each IWDS (Plot 3) is also applied to flip-flop U9 which is set on the trailing edge (Plot 4). This unclamps the oscillator, which then generates a series of pulses at a high frequency (Plot 5). The pulses are applied to the shift register, which produces ten negative-going outputs consecutively on ten wires.

The nine outputs (T1—T9) are used to toggle the output (slave) sections of the write waveform generator flip-flops in the appropriate time order so as to achieve azimuth deskewing of the recording system. Plots 6 and 7 show the write current in the IWD5 and IWD2 channels for a 9-track system. The tenth output (T10) resets U9, terminating the sequence of events. In practice, the oscillator frequency is adjusted to compensate for the azimuth error in the particular head being used.

Both outputs of U4 are applied to head driver transistors Q1 and Q2, which cause current to flow in one half or the other of the center-tap head winding. Consequently, magnetization on the tape is maintained in the appropriate direction between changeovers and changes direction for each 1 bit to be recorded (as required by the IBM NRZI format).

At the end of each record, check characters have to be recorded and an IBG inserted. Figures 4-14 and 4-15 show the IBM IBG format for 9- and 7-track systems, respectively.

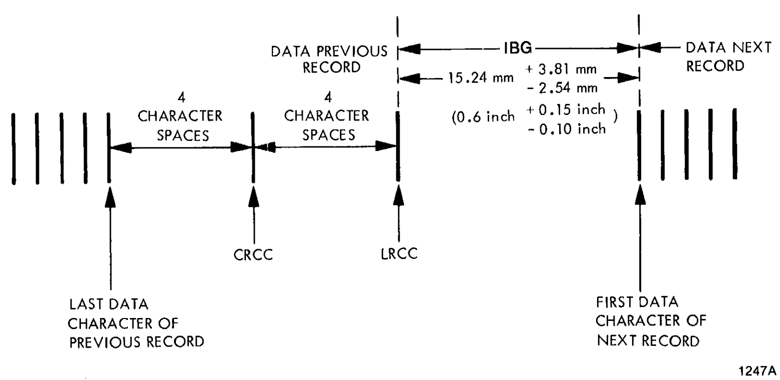


Figure 4-14. 9-Track IBG Format

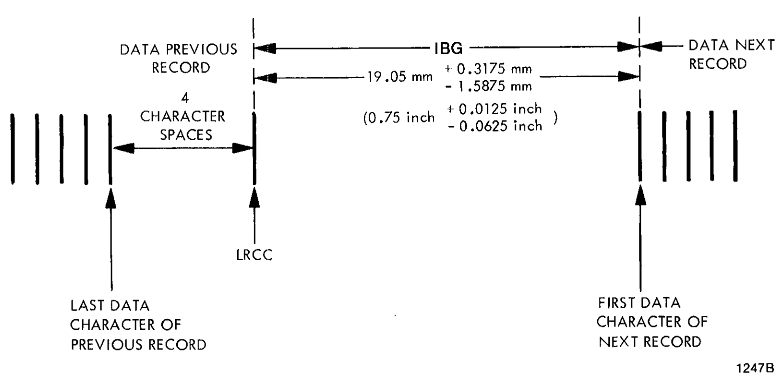


Figure 4-15. 7-Track IBG Format

In a 9-track system, both a CRCC and LRCC are written. The CRCC is supplied by the customer to the interface, together with a single IWDS signal whose trailing edge is separated by four character times from the trailing edge of the last IWDS. The LRCC is written by resetting all the write waveform generator flip-flops using the IWARS signal received by interface receiver U6. The timing of this reset operation is controlled by the leading edge of the IWARS signal, which should be separated by 8 character times from the trailing edge of the last IWDS (Plot 8).

The output of U6 is applied to OR gate U3 and the positive-going output is applied to the K input of the write waveform generator flip-flops and resets the master sections of these flip-flops. In addition, the leading edge of the IWARS signal is differentiated and sets U9. A sequence of pulses is produced as described, which toggles the write waveform generator flip-flops to the reset state in the appropriate order. The LRCC is written such that the total number of magnetization transitions in any track is even.

In a 7-track system, only the LRCC is written; this is achieved again by the IWARS signal. Consequently, the leading edge must be separated 4 character times from the trailing edge of the last IWDS.

When the LRCC has been recorded, the ISFC goes false after the post-record delay time (T2), the ramp generator is disabled and the tape decelerates to zero velocity.

The IBG displacement consists of the following.

(1) The stop distance: the distance traveled during the tape deceleration period to zero velocity.

(2) The start distance: the distance traveled while tape is accelerating to the prescribed velocity.

(3) An additional distance determined by the pre-record time (T1), from the ISFC going true to the time of the first IWDS and the post-record time (T2), from the LRCC to ISFC going false. (Time delays T1 and T2 are provided by the customer's controller.)

A file gap is used to separate files of information on tape. This is identified by a special character on the tape followed by its LRCC. Figures 4-16 and 4-17 describe the IBM file gap formats for 9- and 7-track systems.

A file gap is inserted under external control by the customer controller. An ISFC is given, followed at the appropriate time by the File Mark character (a 1 in data bit positions IWD4, 5, 6, and 7 for 7-track systems, and a 1 bit in positions IWD3, 6, and 7 for 9-track systems), together with its IWDS, followed by the LRCC (written using the IWARS signal) after 4 character times in a 7-track system and after 8 character times in a 9-track system.

4.3.4.3 Overwrite Operation (Model T8X40A)

The Overwrite function (IOVW) allows updating (rewriting) of a selected record. The new data block to be inserted must be exactly the same length as the data block being replaced. This restriction is necessary since replacing a block of data with a block longer than the original could result in an IBG distance which is less than the minimum allowed, or in writing over the next record. If the new data is shorter than the existing block, errors could result since some unerased portion of the old data would remain.

Additionally, when write and erase currents are switched off abruptly, there is a small area of tape which is influenced by the collapsing magnetic fields of the heads. This constitutes flux transients on the tape which appear as spurious signals when read back.

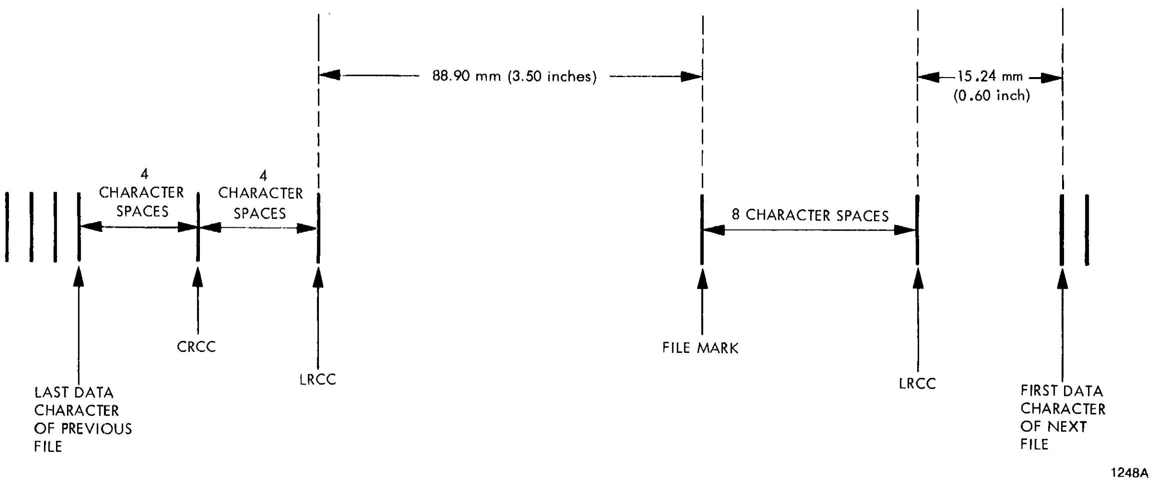


Figure 4-16. 9-Track File Gap Format

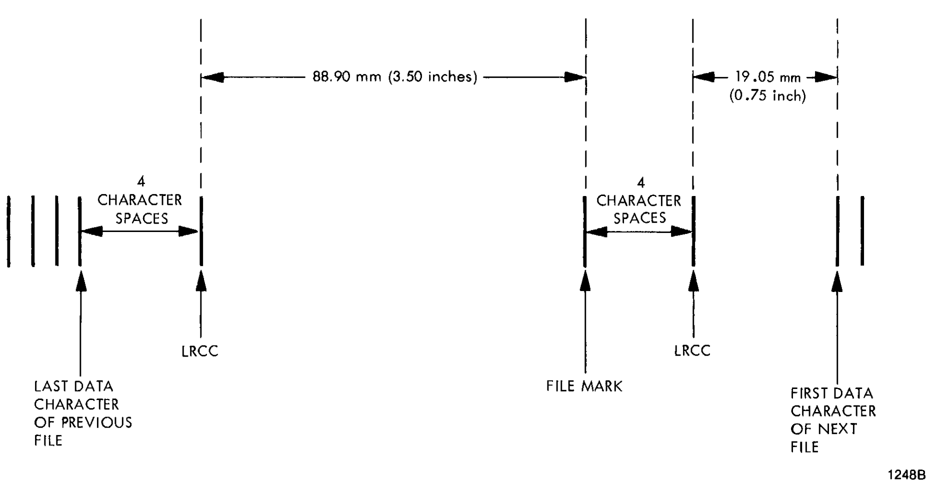


Figure 4-17. 7-Track File Gap Format

The Overwrite feature has effectively eliminated this problem by turning the write current off slowly while tape is still in motion.

NOTE

Refer to Pertec Application Note, Editing Pre-Recorded Tapes, 6000/7000 Series Tape Transports (Document No. 70711) for Overwrite control and timing restrictions.

To update a previously recorded record, the transport must be Selected, Ready, On-line, and have a write enable ring installed. Additionally, the IOVW signal from the controller must be true and coincident with ISWS and ISFC.

Overwrite operation is terminated by the IWARS signal disabling the WRT PWR circuitry. This action causes the write current to ramp down to zero as the tape decelerates to rest. The transient pulse, generated when the write current is switched off, is spread over a longer distance on the tape and produces a negligible signal on replay.

4.3.4.4 Data Recording (Single-Stack Model T8X60A)

Figure 4-18 is a timing diagram for data recording. Refer to Schematic 101720 for Data (D1) details and Schematic 102333 for Tape Control J details.

Assume that the transport is Selected, Ready, On-line, and has a write enable ring installed. When an ISFC is received, the MOTION signal generated on the Tape Control CPBA goes high. Therefore, MOTION is high at the input of AND gate U8. The rising edge of MOTION generates the GO pulse which isused to clock the Write flip-flop U41B, located on the Tape Control PCBA. If the ISWS line is active (low) at this time, U41B will set putting the transport in the Write mode. This causes logic term NWRT to become low active, causing the following:

(1) The direct clear, C_D, is removed from U4.

(2) WRT PWR becomes +5v dc.

(3) The erase driver transistor, Q4, is energized.

The ISFC also enables the ramp generator, which causes tape to accelerate to the prescribed velocity. After a time (T1) determined by the required IBG displacement, the WRITE DATA (IWD) inputs, together with the IWDS, are supplied to the interface connector.

IWD is received by interface receiver U1 (see Figure 4-12) and, when true, enables both the J and K inputs of flip-flop U5. IWDS signals are received by interface receiver U2 and will cause U5 to change state on the trailing edge of the strobe, provided the IWD signal is true at this time.

The characteristics of the flip-flop are such that the IWD signal must be stable (in the appropriate direction) throughout the period of the strobe.

Both outputs of U5 are applied to the head driver circuit, which cause current to flow in one half or the other of the center-tap head winding. Consequently, magnetization on the tape is maintained in the appropriate direction between changeovers and changes direction for each 1 bit to be recorded (as required by the NRZI format).

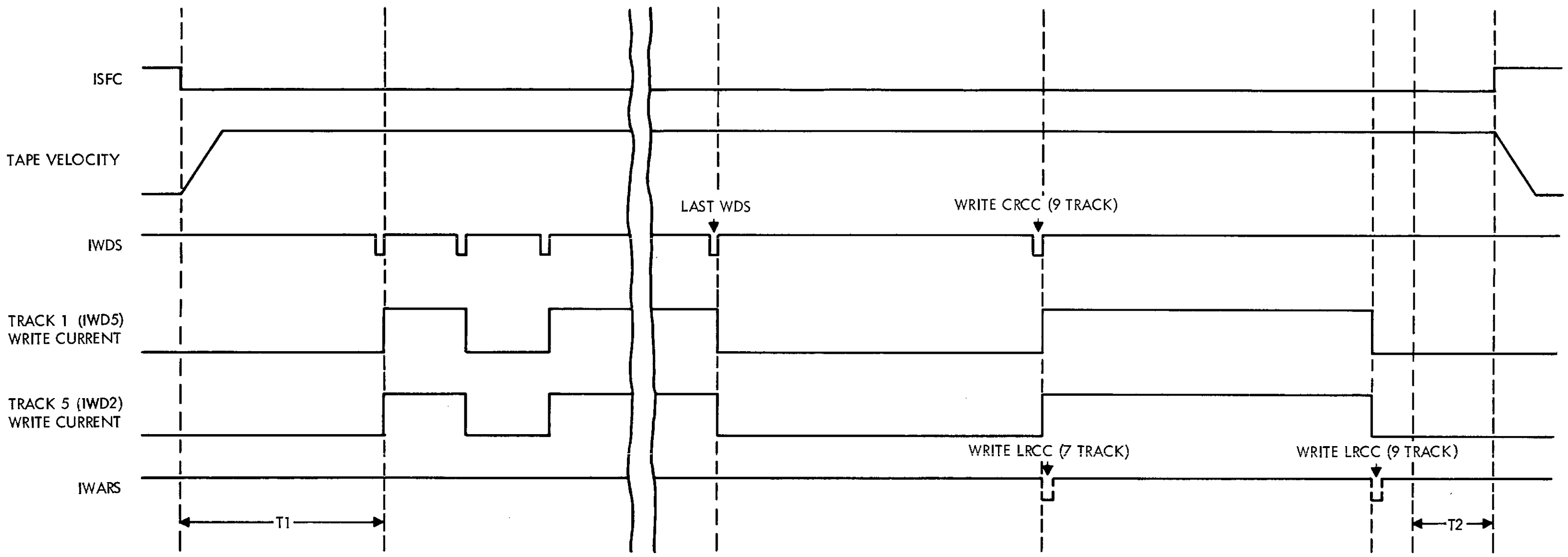
At the end of each record, check characters have to be recorded and an IBG inserted. Figures 4-19 and 4-20 show the IBM IBG format for 9- and 7-track systems, respectively.

In a 9-track system, both a CRCC and LRCC are written. The CRCC is supplied by the customer to the interface, together with a single IWDS signal whose trailing edge is separated by 4 character times from the trailing edge of the last IWDS. The LRCC is written by resetting all the write flip-flops with OR gate U6, using the IWARS signal received by interface receiver U4. The write flip-flops are reset on the leading edge of IWARS, which should be separated by 8 character times from the trailing edge of the last IWDS.

The LRCC is written such that the total number of magnetization transitions in any track is even.

In a 7-track system, only the LRCC is written; this is achieved again by the IWARS signal. Consequently, the leading edge must be separated 4 character times from the trailing edge of the last IWDS.

When the LRCC has been recorded, ISFC goes false, the ramp generator is disabled and the tape decelerates to zero velocity.



NOTES:

1. DIAGRAM IS FOR 9-TRACK OPERATION. FOR 7-TRACK OPERATION, THE IWDS PULSE (LABELED WRITE CRCC) AND THE IWARS PULSE (LABELED WRITE LRCC (9-TRACK)) ARE OMITTED AND THE DOTTED IWARS PULSE (LABELED WRITE LRCC (7-TRACK)) IS USED.

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Figure 4-18. Data Recording Timing Diagram (T8X60A)

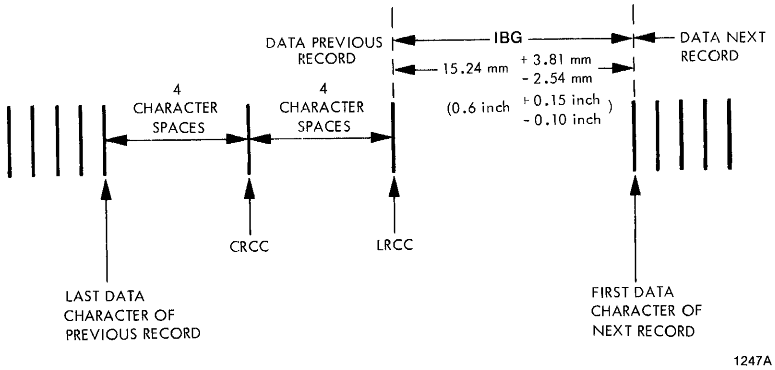

Figure 4-19. 9-Track IBG Format

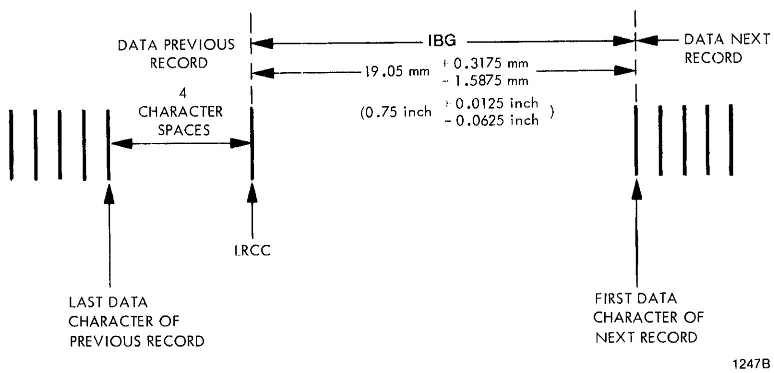

Figure 4-20. 7-Track IBG Format

The IBG displacement consists of the following.

(1) The stop distance: the distance traveled during the tape deceleration period to zero velocity.

(2) The start distance: the distance traveled while tape is accelerating to the prescribed velocity.

(3) An additional distance determined by the pre-record time (T1), from the ISFC going true to the time of the first IWDS and the post-record time (T2), from the LRCC to ISFC going false. (Time delays T1 and T2 are provided by the customer's controller.)

A file gap is used to separate files of information on tape. This is identified by a special character on the tape followed by its LRCC. Figures 4-21 and 4-22 describe the IBM file gap formats for 9- and 7-track systems.

A file gap is inserted under external control by the customer controller. An ISFC is given, followed at the appropriate time by the File Mark character (a 1 in data bit positions IWD4, 5, 6, and 7 for 7-track systems, and a 1 bit in positions IWD3, 6, and 7 for 9-track systems), together with its IWDS, followed by the LRCC (written using the IWARS signal) after 4 character times in a 7-track system and after 8 character times in a 9-track system.

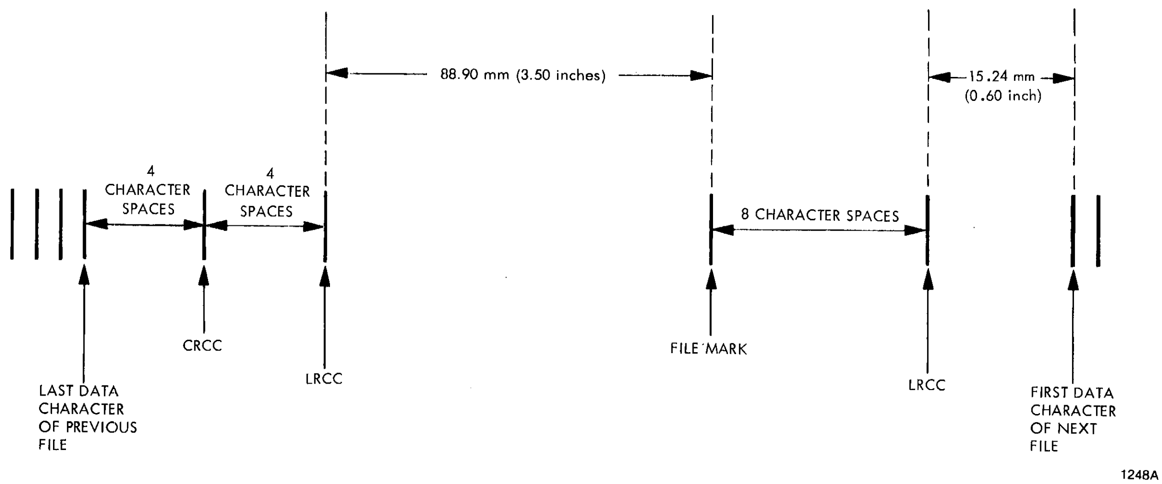

Figure 4-21. 9-Track File Gap Format

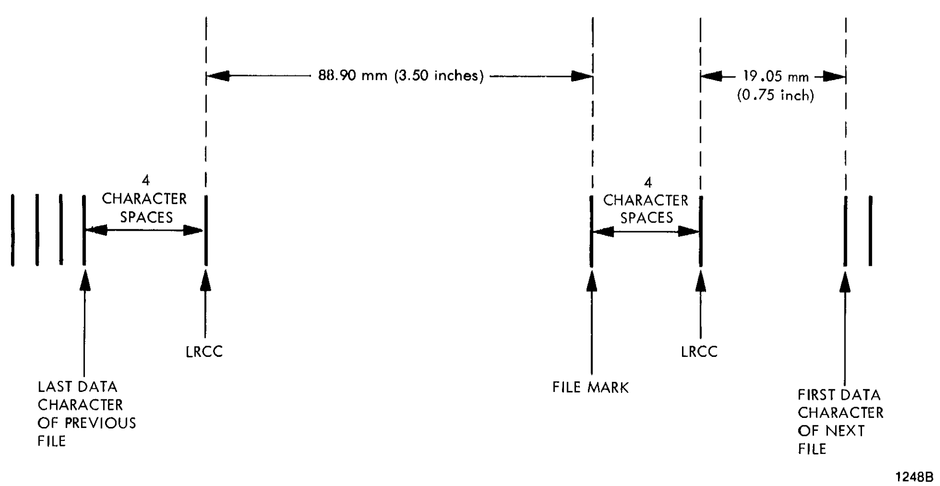

Figure 4-22. 7-Track File Gap Format

4.3.4.5 Overwrite Operation (Model T8X60A)

The Overwrite function (IOVW) allows updating (rewriting) of a selected record. The new data block to be inserted must be exactly the same length as the data block being replaced. This restriction is necessary since replacing a block of data with a block longer than the original could result in an IBG distance which is less than the minimum allowed, or in writing over the next record. If the new data block is shorter than the existing block, errors could result since some unerased portion of the old data would remain.

Additionally, when write and erase currents are switched off abruptly, there is a small area of tape which is influenced by the collapsing magnetic fields of the heads. This constitutes flux transients on the tape which appear as spurious signals when read back.

The Overwrite feature has effectively eliminated this problem by turning the write current off slowly while tape is still in motion.

NOTE

Refer to Pertec Application Note, Editing Pre-Recorded Tapes, 6000/7000 Series Tape Transports (Document No. 70711) for Overwrite control and timing restrictions.

To update a previously recorded record, the transport must be Selected, Ready, On-line, and have a write enable ring installed. Additionally, the IOVW signal from the controller must be true and coincident with ISWS and ISFC.

Overwrite operation is terminated by the IWARS signal disabling the WRT PWR circuitry. This action causes the write current to ramp down to zero as the tape decelerates to rest. The transient pulse, generated when the write current is switched off, is spread over a longer distance on the tape and produces a negligible signal on replay.

4.3.4.6 Data Reproduction (Dual-Stack Model T8X40A)

When an ISFC is received, the following occurs.

(1) The MOTION signal generated on the Tape Control PCBA goes true so that the output of OR gate U15 correspondingly goes high, thus removing the reset signal from the read staticiser flip-flops.

(2) The Forward ramp generator is enabled and tape accelerates to the prescribed velocity.

Data signals from the magnetic head at a level of approximately 48 mv peak-to-peak are routed by a shielded cable to the read amplifier. The amplifier output at a level of approximately 10.5v peak-to-peak is full-wave rectified and baseline clipped. The clip level is variable and is under the control of the NWRT waveform.

In a dual-stack transport, the read system always operates whether the transport is in the Write or Read mode. However, in the Write mode where the reading facility is used to check the data that have been recorded, the NWRT waveform is low and a high clip level of 45 percent is generated. This ensures that data are written with enough margin to enable data recovery when the tape is read on another transport.

If the transport is in the Read mode, the NWRT waveform is high and a clip level of approximately 20 percent is generated, which is only sufficient to reject system noise. After clipping, the signal is applied to a feedback differentiator which generates an edge bearing a fixed time relationship (ideally zero delay) to the peak of the input signal. This edge is differentiated by $\delta 2$ to form a pulse for each 1 bit detected. Figure 4-23, Plots 1 and 2, show outputs from the read amplifier for two different channels. In general, skew will exist between the signals as shown. Plots 3 and 4 are the pulse outputs from the peak detector differentiator for the two channels.

The output pulse from differentiator $\delta 2$ is applied to the clock input of the read staticiser flip-flop U14. This flip-flop is set on the negative-going edge of the pulse (Plots 5 and 6).

The Q output from U14 is applied to interface driver U16 while the $\overline{Q}$ output is applied to OR gate U11, where it is ORed with the corresponding outputs of the other channels so that the first data 1 of a character causes the output of U11 to go high (Plot 7), enabling the rundown circuit. The circuit is set for half a character period and at the end of this time the output goes low. This edge is differentiated by $\delta 3$ and generates a 2-microsecond IRDS (Plot 8), which is applied to interface driver U17.

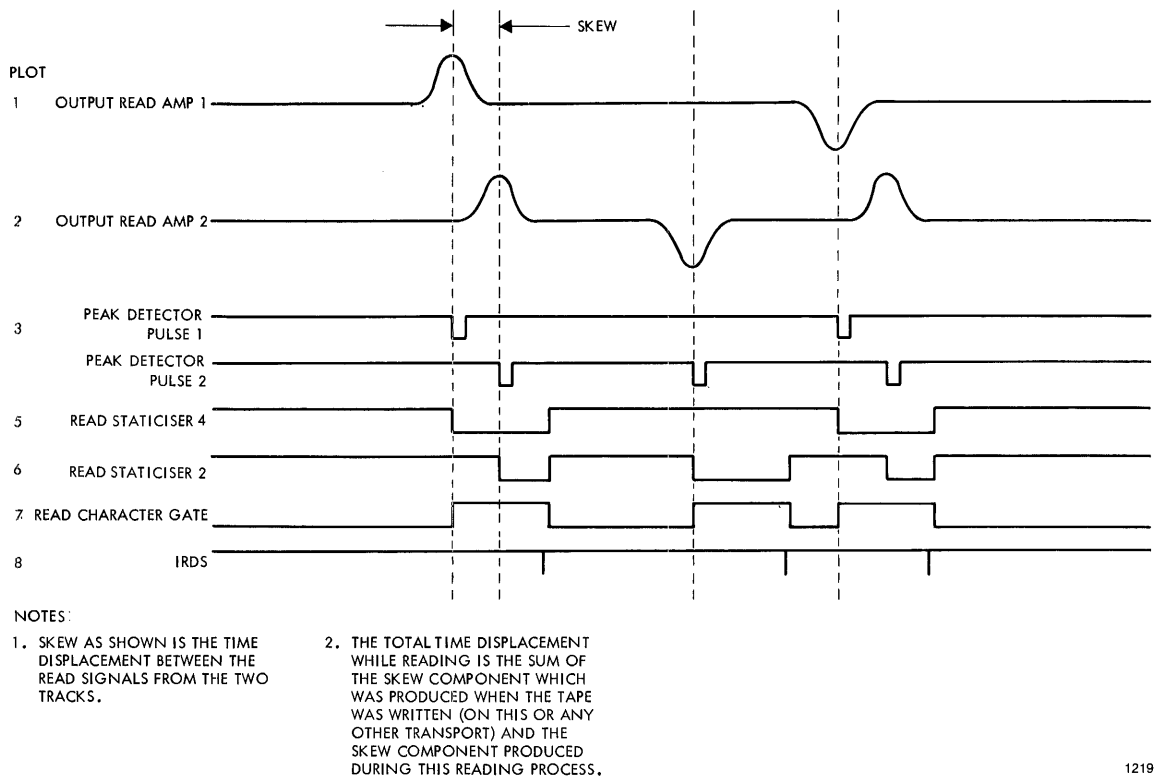

Figure 4-23. Data Reproduction Timing Diagram

The output of the run-down circuit is also delayed and resets the read staticiser flip-flops via OR gate U15. This causes the $\overline{Q}$ outputs of all the read staticiser flip-flops to go high and the run-down circuit is clamped back to its quiescent level. The delay in the loop prevents the READ DATA (IRD) interface lines from resetting before the trailing edge of IRDS.

After the last character of a record has been read (the LRCC), the ISFC goes false, the Forward ramp generator is disabled, and tape decelerates to rest. In addition, the MOTION signal goes false, applying a reset signal to flip-flop U14 via OR gate U15. (Reproduction in reverse is identical.)

By varying the timing of the run-down circuit, the read staticiser may be used at different packing densities as required for 7-track operation. Control of this timing is provided by the HI DEN manual control on the transport via OR gate U13. Alternatively, the IDDS interface line can be used to provide the same function.

4.3.4.7 Data Reproduction (Single-Stack Model T8X60A)

When an ISFC is received, the following occurs.

(1) The MOTION signal generated on the Tape Control PCBA goes true so that the output of OR gate U16 correspondingly will go high, thus removing the reset signal from the read staticiser flip-flops.

(2) The Forward ramp generator is enabled and tape accelerates to the prescribed velocity.

Data signals from the magnetic head at a level of approximately 48 mv peak-to-peak are routed by a shielded cable to the connector on the Data PCBA. When the transport is in the Read mode, both Q1 and Q2 are turned off (see Figure 4-12). The read amplifier boosts the signal level to 12v peak-to-peak. The signal is full-wave rectified and baseline clipped. The clip level is variable and is controlled by the READ THRESHOLD (IRTH) interface line. A false level results in a 20-percent clip level and should be used when performing a read-after-write check. The high clip level ensures that data are written with enough margin to ensure data recovery when the tape is read on another transport.

After clipping, the signal is applied to a differentiator which generates an edge bearing a fixed time relationship (ideally zero delay) to the peak of the input signal. This edge is differentiated by $\delta 1$ to form a pulse for each 1 bit detected. Figure 4-23, Plots 1 and 2, show outputs from the read amplifier for two different channels. In general, skew will exist between the signals as shown. Plots 3 and 4 are the pulse outputs from the peak detector differentiator for the two channels.

The output pulse from differentiator $\delta 1$ is applied to the clock input of the read staticiser flip-flop U11. This flip-flop is set on the negative-going edge of the pulse (Plots 5 and 6).

The Q output from U11 is applied to interface driver U13 while the $\overline{Q}$ output is applied to OR gate U7, where it is ORed with the corresponding outputs of the other channels so that the first data 1 of a character causes the output of U7 to go low (Plot 7), enabling the run-down circuit. The circuit is set for half a character period and at the end of this time the output goes low. This edge is differentiated by $\delta 2$ and generates a 2-microsecond IRDS (Plot 8), which is applied to interface driver U12.

The output of the run-down circuit is also delayed and resets the read staticiser flip-flops via OR gate U10. This causes the $\overline{Q}$ outputs of all the read staticiser flip-flops to go high and the run-down circuit is clamped back to its quiescent level. The delay in the loop prevents the IRD interface lines from resetting before the trailing edge of IRDS.

After the last character of a record has been read (the LRCC), the ISFC goes false, the Forward ramp generator is disabled, and tape decelerates to rest. In addition, the MOTION signal goes false, applying a reset signal to flip-flop U11 bia OR gate U10. (Reproduction in reverse is identical.)

By varying the timing of the run-down circuit, the read staticiser may be used at different packing densities as required for 7-track operation. Control of this timing is provided by the HI DEN manual control on the transport via OR gate U9. Alternatively, the IDDS interface line can be used to provide the same function.

4.3.5 TAPE CONTROL SYSTEM

The tape control system consists of the manual controls, interlocks, and logic circuits necessary to control tape motion. The operation can best be described by detailing the Bring-to-Load-Point sequence, Forward/Reverse tape motion commands, the Rewind sequence, and subsequent unloading of tape.

Figure 4-24* is a functional logic diagram of the tape control system and should be referred to for the following discussion. In most cases component labels are compatible with those designated on Tape Control Schematic No. 102333.

Cleanup flip-flops, which eliminate the problems of switch contact bounce, are associated with four manual control switches: U5A, U5C with LOAD; U19B, U19C with ON LINE; U6B, U6E with REWIND; and U4B, U4E with RESET. Relay K1 has four changeover contacts,

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*Foldout drawing, see end of this section.

three of which (K1A, K1B, and K1C) are used to connect the reel and capstan servo motors, while 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 remains closed when the cam is within its normal operating region. The limit switch opens at both extremes of the arm travel so that protection against over-tension as well as under-tension conditions is provided.

4.3.5.1 Bring-to-Load-Point Sequence

The system will be described by considering the sequence required to bring a tape to the BOT (Load Point) when the arms are in the tape threading position and there is no tape in the path. Figure 4-25 shows the waveforms which are generated during this operation.

When power is initially applied (Plot 1), the Interlock and Arm-Up-Stop switches will be open. INTLK (U13A) and RST (U13B) will be low. RST resets control flip-flops RW1 (U17B), RW2 (U17A), RW3 (U23A), and LOAD (U29A). The low levels of RW1 and LOAD made NBUSY (U31B) high. Thus, flip-flop FLR (U37A, U37D) is reset. RAC (across R254, C63—C65) is initially low and resets flip-flop UNL (U23B). RAC also resets flip-flops U21A and U21B via gates U9B and U9A. RAC goes high after the delay of the RC network (Plot 2).

When a reel of tape is mounted and the tape path is closed, TIP (U12A) goes high (Plot 3). With NRAC (U16E) and NTIP (U18B) low, CLR (U16F) becomes high (Plot 4).

Depressing the LOAD switch/indicator for the first time momentarily sets the LOAD control cleanup flip-flop (U5A,U5C) (Plot 5). All inputs to gate U9C become high and flip-flop U21B is toggled. The Q output of U21B, ANDed with the high output of the 0.75 second single-shot causes the output of U47A to go low and transistors Q15 and Q16 to turn on (Plot 7). Therefore, the arm actuator motor begins to turn and the tension arms begin to move (supply tension arm moves down; takeup tension arm moves up). The Arm-Up-Stop switch returns to its NC condition.

When the tension arms reach the end of their operating range, the normally open (NO) contact of the arm down-stop switch closes. This causes the NSTAC to go low and the STAC (Plot 10) to go high. NSTAC going low activates the 0.75 second single-shot causing its output to go low, inhibiting U7B. When U7B output goes high, U47A, Q15, and Q16 are deactivated and the arm actuator motor stops.

STAC going high causes the output of U8B to go low. The interlock relay driver is activated and relay K1 latches, connecting the transport motors to their respective amplifiers. Tape is tensioned, the tension arm interlock switch closes, and after a time delay determined by R40, R41 and C14, INTLK goes high (Plot 9). INTLK is inverted by U20C and the low level at the output holds the interlock relay driver U51A activated. Then, 0.75 second after tensioning, the single-shot output again goes to its stable (high) state (Plot 8) and resets flip-flop U21B via U3D, U9A and U15B. With the inputs to INTLK (U13E) low and NSTAC (U13C) low, RST goes high (Plot 11).

Depressing the LOAD switch/indicator a second time sets the LOAD control cleanup flip-flop again. The output of U10B goes low, toggles flip-flop LOAD (U29A) and sets it. This is true because RST at the reset input of U29A is high at this point in the sequence.

If the LOAD switch/indicator is originally depressed twice, the supply arm again moves down, the takeup arm moves up, tape is tensioned, and the LOAD flip-flop is set. In this case, flip-flop U21A sets when the LOAD switch/indicator is depressed a second time. After the Arm-Down-Stop switch NO contact is closed and the 0.75 second single-shot output returns to its stable (high) state, flip-flop U21B is reset and its $\overline{Q}$ output goes high. This causes a negative-going transition at the output of U10C which toggles and sets U29A via delay network R56 and C20.

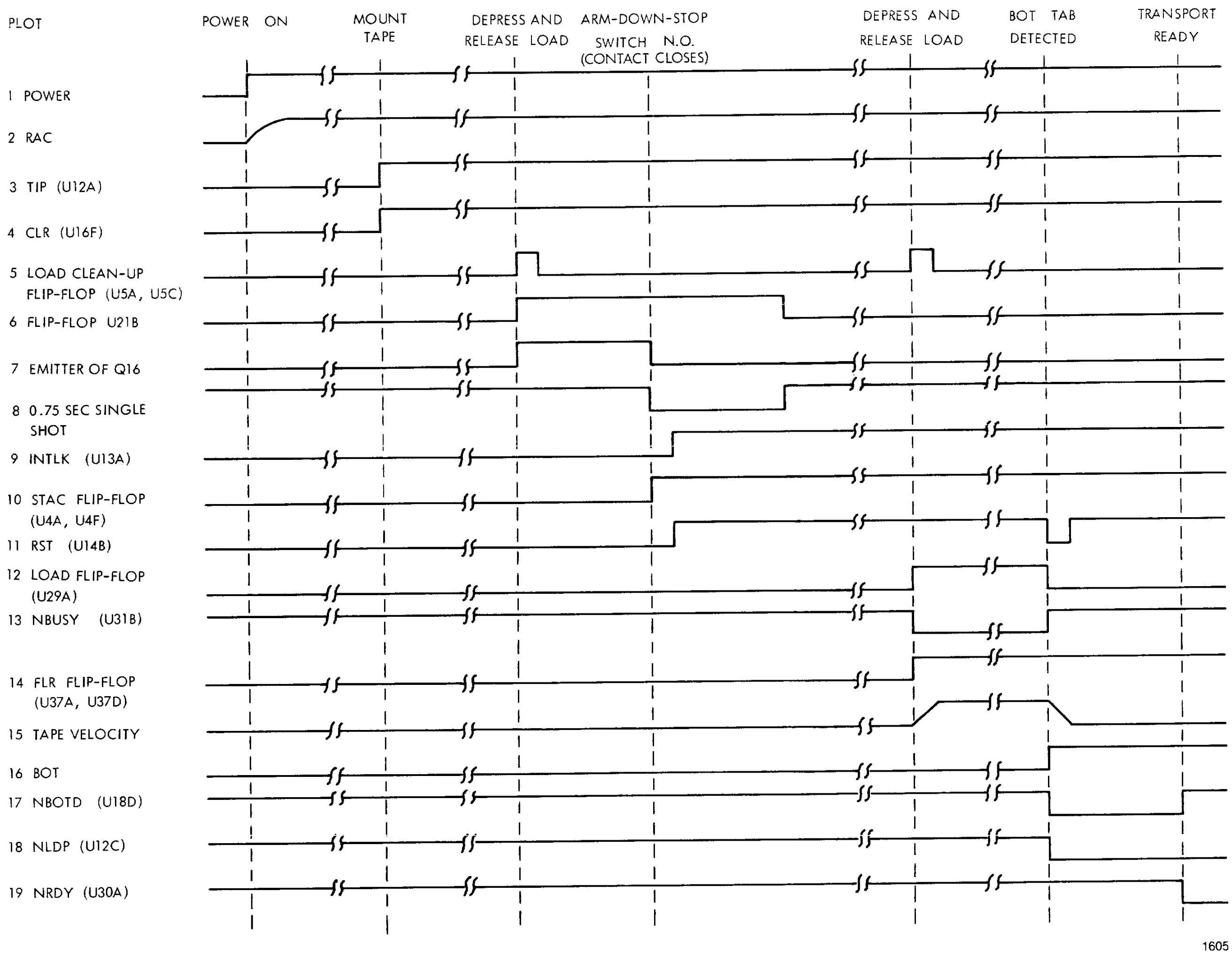


Figure 4-25. Bring-to-Load-Point Sequence Waveforms

If power is applied to a transport which has a reel of tape mounted and threaded, and the tension arms are in the operating position, depressing the LOAD control the first time causes the interlock relay drive to be activated and tape to be tensioned. In this case the STAC output is high, since the Arm-Down-Stop switch NC contact is open, and enables one input of U14A. When tape is in the tape path, the TIP input to U14A is also high. At the moment the LOAD control is depressed, all inputs to U14A become high. The negative-going output of U14A activates the interlock relay driver U51A. Once the interlock is made, RST at the reset input of flip-flop U29A becomes high; thus the LOAD flip-flop is enabled to respond to a toggle from the LOAD control. The LOAD flip-flop will set when the switch is depressed a second time.

At this point, the output of the LOAD flip-flop is high and flip-flop RW1 (U17B) is still reset (RW1 low). NBUSY (U31B) goes low (Plot 13) and sets flip-flop FLR (Plot 14). The low level of NFLR at the input of U10B inhibits the possibility of further manual LOAD commands.

Should the tension arms move outside of their operating regions, the limit or interlock switch opens. INTLK and RST become low. Thus, flip-flops FLR and LOAD are reset and the interlock relay driver is deactivated. Relay K1 deenergizes and power is disconnected from the motors.

When LOAD becomes high, the Forward ramp generator is enabled by the output of NAND gate U35A. NRWR is high at the input of U35A because it is the output of U38C, one input of which is low (RW1). NBOTD is high at the input of U35A because when power is turned ON and transients have died out, the output of the BOT single-shot will be high. Therefore, when LOAD goes high, the output of U35A goes low and enables the Forward ramp generator. Tape is then accelerated to the specified velocity (Plot 15) and continues to move until either the BOT tab is detected by the BOT sensor or the RESET control switch is depressed. If BOT is detected, BOT goes high (Plot 16) and triggers the single-shot. NBOTD goes low and remains low for the duration of the single-shot period, approximately 0.5 second (Plot 17). The low level of NBOTD sets U35A high and the Forward ramp generator is disabled. The tape decelerates and stops with the BOT tab under the photosensor. With NRWR and LOAD high, when BOT goes high, RST (U7A) goes low, resetting flip-flop LOAD. This in turn sets NBUSY (U31B) and, after some delay, RST high. With NBUSY, FLR, and BOT high, NLDP (U12C) goes low (Plot 18) enabling the lamp driver circuit of the LOAD switch, illuminating the lamp. The delay between the LOAD waveform and NAND gate U7A ensures that RST remains low for an appropriate length of time. After NBOTD returns to high, the ramp generator remains disabled by virtue of the low level of LOAD. Also, all inputs to U30A go high, thus NRDY goes low (Plot 19). If the RESET switch is depressed, cleanup flip-flop U4B, U4E is reset and RST goes low. The LOAD flip-flop is reset causing NBUSY and U35A to go high. The Forward ramp generator is disabled and tape comes to a stop. After the RESET switch is released, RST goes high and with NBOTD, FLR high, NRDY goes low.

4.3.5.2 Forward/Reverse Tape Motion — Manual Commands

Referring to Figure 4-24, if the On-line flip-flop (U27B) is reset and NRDY (U30A) is low, then RUN (U31C) is high and the transport will accept motion commands given via the Maintenance switch located on the Tape Control PCBA. If the On-line flip-flop is set, then NONLINE is low, the lamp driver circuit of the ON LINE switch/indicator is enabled and the lamp is illuminated. Therefore, when either the RESET or ON LINE switch is depressed, the lamp will be extinguished indicating that the On-line flip-flop is reset.

When the Maintenance switch is set to pull tape forward and neither BOT nor EOT tabs are encountered, all inputs to NAND gate U35B are high and the Forward ramp generator is enabled. Tape will advance at the specified velocity. When the EOT tab is encountered, NEOT at the input of U35B goes low and tape motion ceases. When the BOT tab is encountered (this is not a normal situation), tape will come to a stop for approximately 0.5 second and then resume speed (NBOTD, U18D, goes low setting NRDY, U30A, high and RUN, U31C, low for approximately 0.5 second).

When the Maintenance switch is set to pull tape in reverse and the BOT tab is not encountered, all inputs to NAND gate U35C are high and the Reverse ramp generator is enabled. Tape will move in reverse at the specified speed. When the BOT tab is encountered, NBOT at the input of U35C goes low and tape motion ceases.

If the RESET switch is depressed while tape is in motion, NRDY (U30A) goes high, RUN goes low, and tape motion ceases. When the switch is released, RUN goes high and tape motion is resumed.

4.3.5.3 Forward/Reverse Tape Motion — External Commands

Referring to Figure 4-24, if SRO output of gate U34A is high, the transport will accept motion commands received via interface lines ISFC (U20A) and ISRC (U20B). SRO will be high when:

(1) NRDY at the input of U34D is low.

(2) NONLINE at the input of U34B is low, i.e., On-line flip-flop U27B is set.

(3) SLT at the input of U34C is high, i.e., interface line ISLT (U40B) is low.

When interface line ISFC goes low and the BOT tab is not encountered, the output of U28A goes low and the Forward ramp generator is enabled. The tape advances at the specified velocity. When the BOT is encountered, NRDY will go high for approximately 0.5 second; during the time interval SRO will go low and tape motion will cease.

When interface line ISRC goes low and the BOT tab is not encountered, U28D goes low and the Reverse ramp generator is enabled. Tape moves in reverse at the specified velocity. When the BOT tab is encountered, BOT at the input of U20E will go high and tape motion will cease. NRDY will also go high for approximately 0.5 second.

If the RESET switch is depressed during tape motion from external commands, the On-line flip-flop is reset and remains reset after the switch is released. SRO goes low and tape motion ceases until the On-line flip-flop is set again.

The following conditions must be met in order for the On-line flip-flop to set in response to a toggle input.

(1) RESET switch should not be depressed (NSRST at input of U19F should be low).

(2) Interface line IOFFC (U26A) should be high.

(3) Tape must not be unloading (UNL at the input of U19E should be low).

When the preceding conditions are met, the following will enable the transport to be placed in the On-line mode.

(1) Tape is tensioned. INTLK at the input of U26C is high and the FLR flip-flop is set (LOAD switch has been depressed twice). Depressing the ON LINE switch will place the transport On-line.

(2) Tape is tensioned. LOAD switch has been depressed once and jumper W12 is removed (optional). Depressing ON LINE switch will place the transport On-line.

(3) Tape is not tensioned, jumpers W12 and W18 are removed, and W19 is inserted, or jumpers W18 and W19 are inserted and W12 is removed and either the ISLT interface line is low or W17 is inserted (optional). When the first negative-going pulse of 1.0 second minimum width at interface line ILOL (U8A) is received, the

output of U8C goes low and enables interlock relay driver U51B. Tape will now be tensioned and after a 1.0 second delay, when a second negative-going pulse is received, the output of U14B will go low, setting the On-line flip-flop.

NOTE

If tape is already tensioned, only one pulse must be received in order to set the flip-flop.

If the RESET switch is depressed while tape is in motion, NRDY (U30A) goes high, RUN goes low, and tape motion ceases. When the switch is released, RUN goes high and tape motion is resumed.

4.3.5.4 Rewind Sequence

The Rewind sequence can be initiated when the tape is not at Load Point, i.e., when BOT is low. BOT low enables gates U11A, U11B and disables gate U22A. Figure 4-26 shows the waveforms that occur during the operation. The transport will go into the Rewind mode from either a remote or a manual command. If the On-line flip-flop U27B is reset and the REWD control switch is depressed (Plot 1), all inputs to NAND gate U11A become high (NUNL can go low only at Load point). Or, if SRO (U34A) is high and a negative-going pulse appears at interface line IRWC (U6D, Plot 2), all inputs to NAND gate U11B go high. In either case, flip-flop RW1 (U17B) is set (Plot 3) enabling the lamp driver circuit of the REWD switch, the lamp is illuminated and the Rewind sequence begins.

NAND gate U38C is enabled by the Q output of flip-flop RW1 and the $\overline{Q}$ output of flip-flop RW3 (U23A), and RW3 is reset at this time. NRWR at the output of U38C goes low (Plot 10). The Q output of flip-flop RW1 also triggers the 0.3 second single-shot and enables NAND

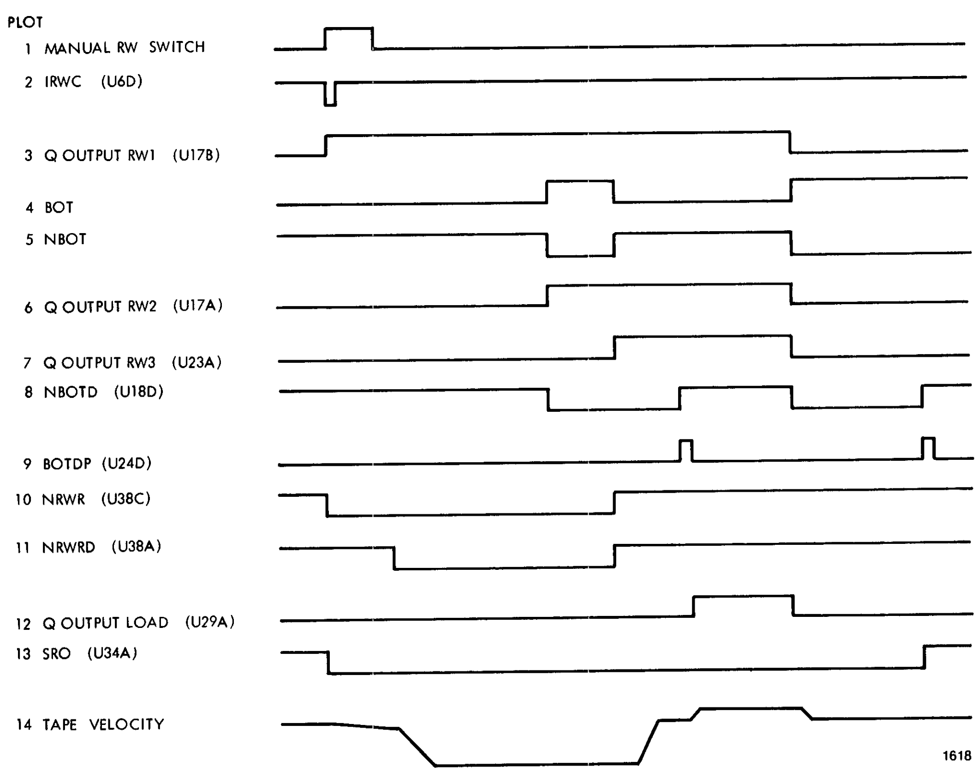


Figure 4-26. Rewind Sequence Waveforms

gate U38A after the delay of the single-shot. The output of U38A, NRWRD, goes low (Plot 11) and the Rewind ramp generator is enabled. Tape accelerates to a reverse velocity of 200 ips (nominal) in approximately 1.0 second (Plot 14).

Additionally, when flip-flop RW1 is set, NBUSY (U31B) goes low and sets NRDY high. Thus, the output of gate U34D, RO, goes low, disables NAND gate U34C, and causes the SRO waveform to go low (Plot 13) for the situation where the Rewind sequence was initiated under remote command (ISLT was low).

When the BOT tab is detected (Plot 4), flip-flop RW2 (U17A) is set (Plot 6) and the 0.5 second single-shot NBOTD (U18D) is triggered (Plot 8) on the leading edge of the BOT waveform while flip-flop RW3 is set on the trailing edge (Plot 7). The Q output of flip-flop RW3, NRW3, goes low, disabling NAND gates U38A and U38C. NRWR and NRWRD go high and the Rewind ramp generator is disabled. The tape decelerates to a stop.

At the end of the 0.5 second delay, the trailing edge of the NBOTD waveform is differentiated by differentiator ∂2 (U18E,U24D) generating a positive-going BOTDP pulse (Plot 9). Since the Q output of flip-flop RW3 is high at this time, flip-flop LOAD is set (Plot 12) via gate U10A and the delay network. This enables the Forward ramp generator, and the Load sequence is initiated.

As the BOT tab overshoots the photosensor and returns, it is detected for the second time and triggers the 0.5 second single-shot NBOTD again. The Forward ramp generator is disabled and tape comes to a stop. Since LOAD was set high, NAND gate U7A is enabled and its output, RST, goes low, resetting the LOAD, RW1, RW2, and RW3 flip-flops. At the end of the 0.5 second delay, NBOTD waveform goes high setting NRDY (U30A) low. Since the other inputs are high at this time, gate U34C is enabled and SRO goes high (if the sequence was initiated by remote command).

If at any point during the rewind sequence the RESET switch is depressed, RST goes low and resets LOAD, RW1, RW2, and RW3 flip-flops. NRWRD, NRDY go high and SRO, RUN go low. Hence, either the Rewind ramp generator or Forward ramp generator is deactivated depending upon the time in the rewind sequence when the RESET switch was depressed. Tape comes to a stop. If the sequence was initiated under remote control, SRO goes high after the switch is released.

4.3.5.5 Unloading of Tape

If tape is at Load Point (BOT high) and the On-line flip-flop is reset, then in response to a manual REWIND command, all inputs to gate U22A become high and flip-flop UNL is set. The $\overline{Q}$ output generates the AOS signal (U16D) which is used to position the tension arms close to the stops. NUNL also enables interlock relay driver U51A, the Rewind ramp generator, and switches the generator output to approximately one-tenth of the normal voltage. Thus, the tape moves in reverse at 20 ips (nominal).

When tape tension is lost, INTLK goes low. As tape clears the head plate area, NTIP at the input of U16A goes high resetting the UNL flip-flop. Hence, the interlock relay driver and Rewind ramp generator are disabled.

With the Arm-Up-Stop switch NC contacts closed, the tape path cleared, the Interlock switch open, and flip-flop U21B reset, all inputs to gate U30B become high. The low output of U30B activates U47A, causing Q15 and Q16 to turn on. The arm actuator motor begins to move and positions the tension arms in the tape threading position. The Arm-Up-Stop switch NO contacts close causing the output of U30B to go high. Thus, U47A is deactivated and transistors Q15, Q16 are turned off. The arm actuator motor stops and the unloading cycle terminates.

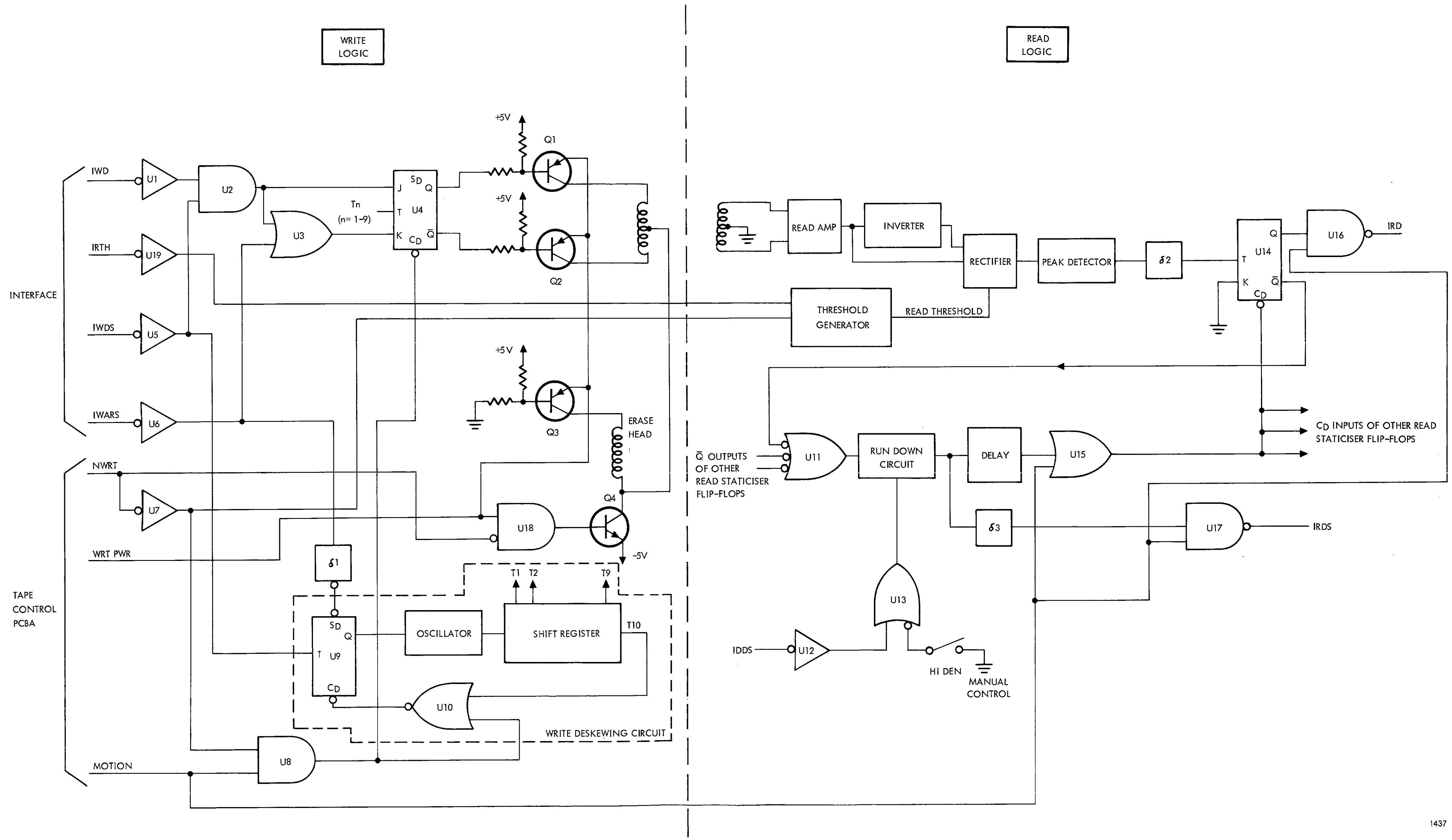


Figure 4-11. One Channel of Data Electronics (T8X40A)

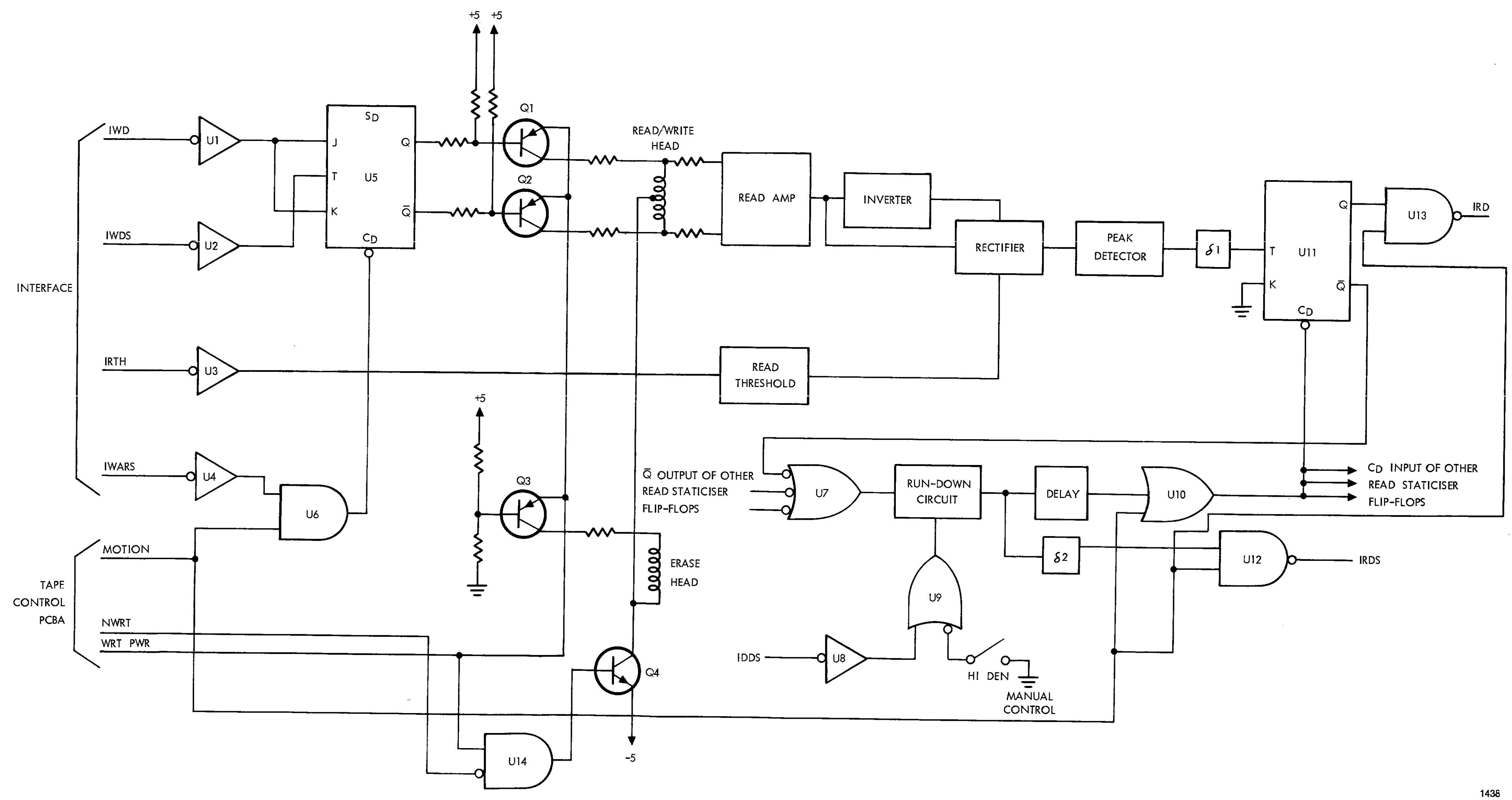
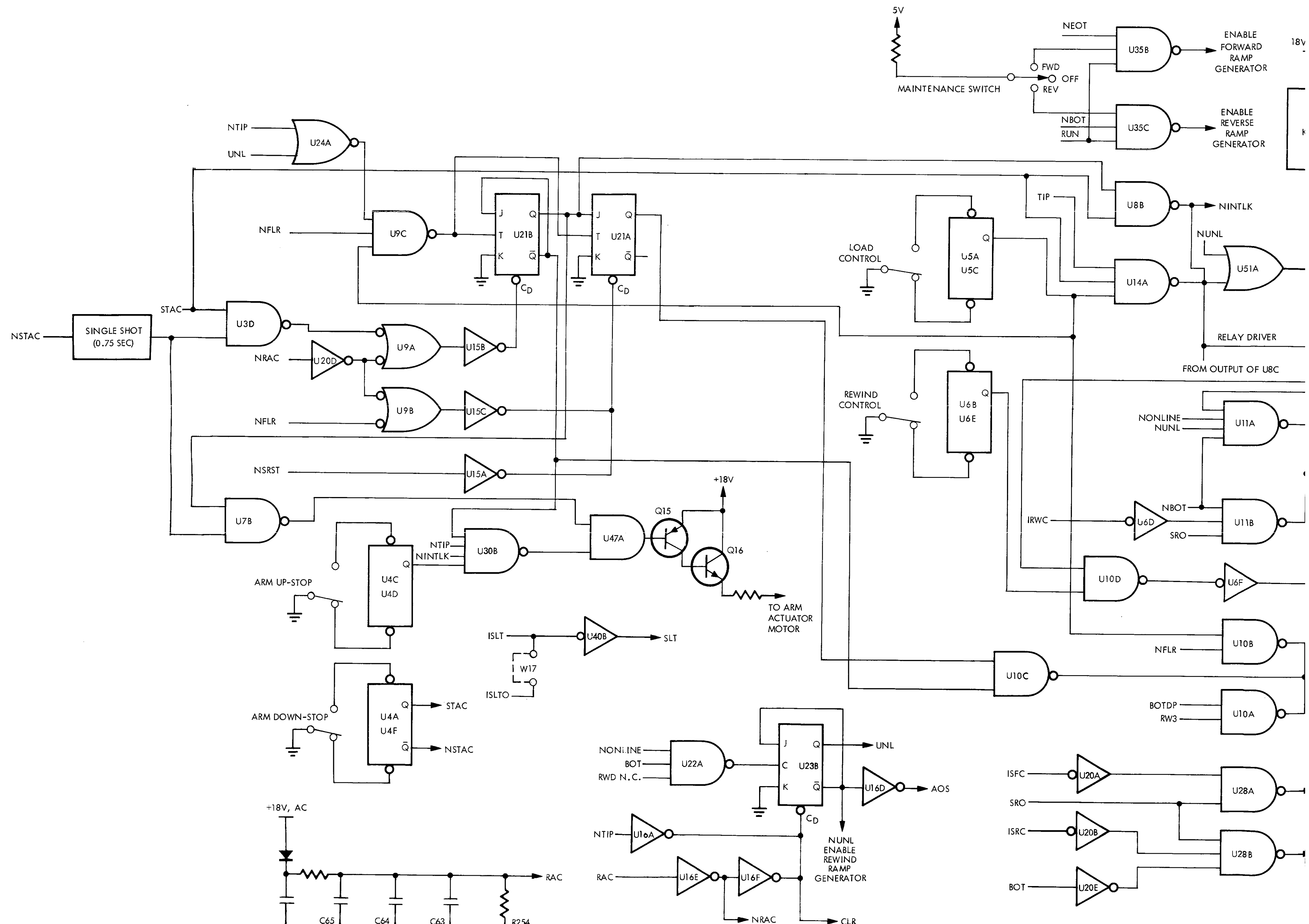


Figure 4-12. One Channel of Data
Electronics (T8X60A)



5V
NEOT
U35B
ENABLE FORWARD RAMP GENERATOR
FWD
OFF
REV
MAINTENANCE SWITCH
NBOT
RUN
U35C
ENABLE REVERSE RAMP GENERATOR
NTIP
UNL
U24A
NFLR
U9C
U21B
U21A
U8B
NINTLK
TIP
NUNL
LOAD CONTROL
U5A
U5C
U14A
U51A
RELAY DRIVER
FROM OUTPUT OF U8C
NSTAC
SINGLE SHOT (0.75 SEC)
STAC
U3D
NRAC
U20D
U9A
U15B
U9B
U15C
REWIND CONTROL
U6B
U6E
NONLINE
U11A
NSRST
U15A
+18V
Q15
Q16
U7B
U47A
U30B
NINTLK
IRWC
U6D
NBOT
SRO
U11B
U4C
U4D
ARM UP-STOP
TO ARM ACTUATOR MOTOR
U10D
U6F
ISLT
U40B
SLT
W17
ISLTO
U10B
U10C
U10A
BOTDP
RW3
ARM DOWN-STOP
U4A
U4F
NSTAC
NONLINE
BOT
RWD N.C.
U22A
U23B
AOS
U16D
ISFC
U20A
U28A
ISRC
U20B
U28B
U20E
+18V, AC
NTIP
U16A
NUNL ENABLE REWIND RAMP GENERATOR
RAC
U16E
U16F
NRAC
CLR
C65
C64
C63
R254

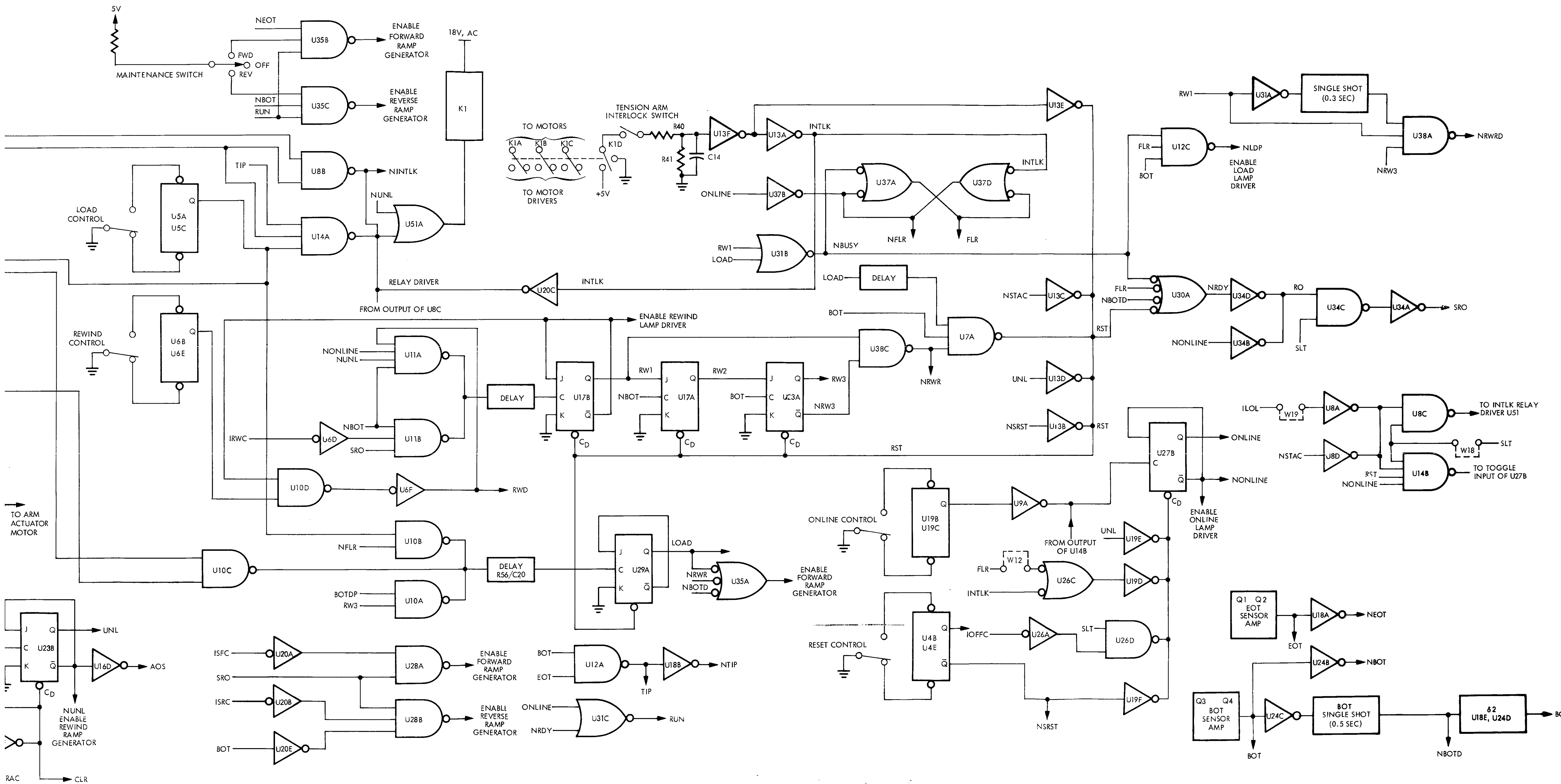


Figure 4-24. Tape Control System Block Diagram

380M

SECTION V
PRINTED CIRCUIT BOARDS THEORY OF OPERATION

5.1 INTRODUCTION

This section contains the theory of operation of the printed circuit board assemblies (PCBAs) used in the Model T8X40A and T8X60A Tape Transports. The schematics and assembly drawings for the PCBAs are at the end of Section VII.

5.2 DATA E19 AND E17 PCBAS (T8X40A)

The following is a description of the Data E19 and E17 PCBAs. The Data E19 is designed to operate with 9-track transports; the Data E17 is designed to operate with 7-track transports. Refer to Schematic 101710 and Assembly 101711 for the Data E19 and to Schematic 101715 and Assembly 101716 for the Data E17.

Each PCBA measures 406.4 by 220.7 mm (16 by 8.69 inches) and has edge connectors at each end along one edge. Figures 5-1 and 5-2 illustrate the placement of each connector and test point for the Data E19 and E17 PCBAs, respectively. J102 and J103 are interface connectors slotted to mate with keys in the mating plugs. Three additional connectors are used: J8 for power and control signals from the Tape Control PCBA, and J1 and J2 for write and read head cables.

5.2.1 CIRCUIT DESCRIPTION

The PCBA operation is described with reference to circuit 100, which is identical to circuits 200—900. All interface signals relevant to writing data (7 or 9 WRITE DATA signals [IWD0—7 or IWD0—9], WRITE DATA STROBE [IWDS], and WRITE AMPLIFIER RESET [IWARS]) enter via J102 and are terminated by a resistor combination and an IC inverter.

Referring to circuit 100, the WRITE DATA PARITY (IWDP) line is terminated by resistors R101, R102, and inverter U36-A. Inverters U36-A and U36-B perform a low-true AND function between IWDP and the IWDS pulse received by U36-D, boosted by power gate U35-A, and bused to all channels. Thus, a true signal on the IWDP line at IWDS time results in a positive-going pulse being applied directly to the J input of the write waveform generator flip-flop U28-A and via inverter U36-C and OR gate U27-A to the K input of U28-A. Since the clock input level is high at this time, the *master* section of U28-A is toggled.

The IWDS pulse also toggles clock control flip-flop U28-B which initiates the Write Deskewing operation. The Q output goes high, switching off clamp transistor Q2 for the clock oscillator Q3, Q4. This is an emitter-coupled multivibrator which generates 100-nanosecond negative pulses at the base of Q4 of a width determined by resistor R19 and capacitor C6; the frequency is determined by R17 and R18 and C6.

The pulses are applied to 5-bit shift registers U24 and U25, which generate 10 negative-going edges which occur sequentially on 10 output pins. Outputs T1 through T9 are applied to the relevant write waveform generator flip-flops causing the *slave* section of the flip-flop to toggle on the negative-going edge. The tenth output (C) resets U28-B via U27-B and U27-C. The $\overline{Q}$ output of U28-B goes high, clamping the shift register. Also, the Q output goes low, clamping the oscillator.

The outputs of the write waveform generator flip-flop drives write amplifier transistors Q101 and Q102, whose emitters are taken to approximately +5v when the WRT PWR line J8-4 is high. The transistor connected to the low (approximately 0v) output of the flip-flop will conduct and current will flow in the associated half of the head winding whose center tap is connected to approximately −5v through Q12. This output is driven into saturation

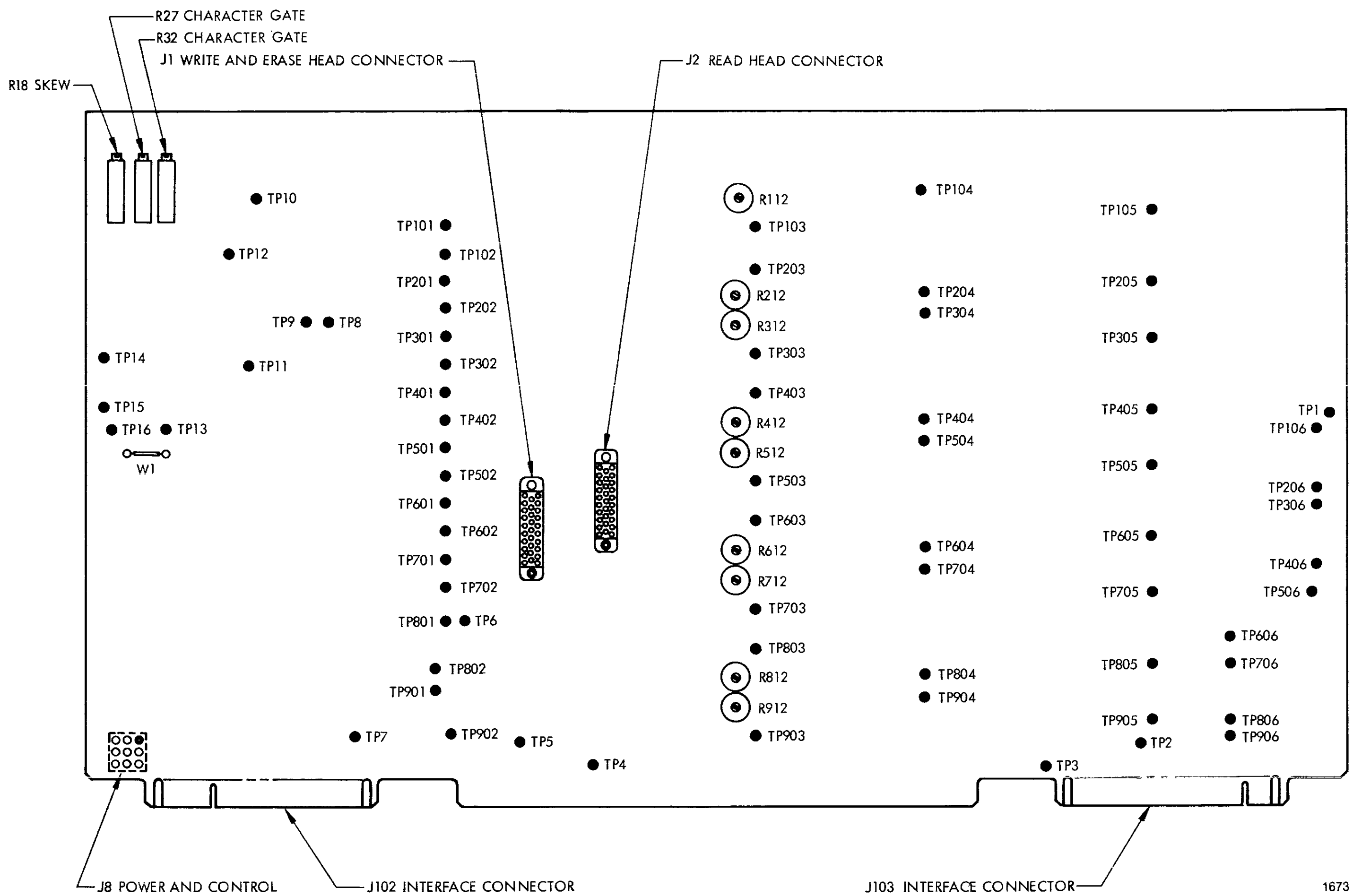


Figure 5-1. Data E19 PCBA, Test Point and Connector Placement

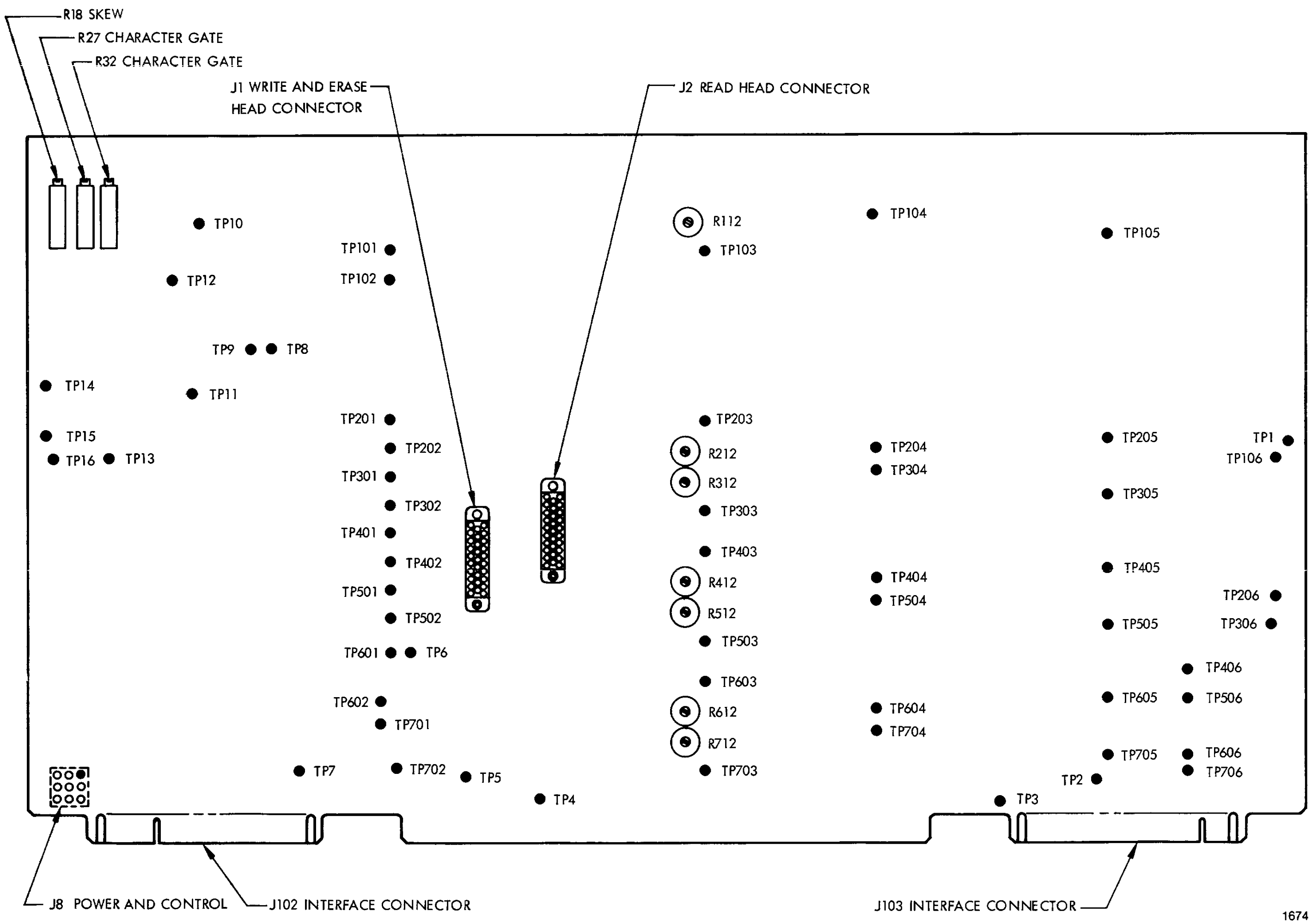


Figure 5-2. Data E17 PCBA, Test Point and Connector Placement

by Q11 when J8-4 is high and the NWRT line J8-9 is low. When the WRT PWR line is low (approximately 0v) or the NWRT line is high, writing is inhibited because the write amplifier transistors cannot be turned on, and Q11 cannot drive Q12 into saturation. Similarly, the erase current supplied by transistor Q1 is inhibited when the WRT PWR line is low, or the NWRT line is high. In operation, the write current is defined by resistors R105 and R106, while R107 is the associated damping resistor.

The write waveform generator flip-flops are primed for writing by J8-9. This signal is inverted by power gate U26-B and bused to the S_D inputs of the write waveform generator flip-flops. The signal is also connected via a R-C delay to OR gate U27-D and power gate U26-A. The output of U26-A is bused to the C_D inputs of all the write waveform generator flip-flops. Thus, when the NWRT line is high, the ability to write is removed because both the Q and $\overline{Q}$ outputs of the write waveform generator flip-flops are at +5v. When the NWRT level is lowered to allow writing, the R-C network delays the removal of the C_D input with respect to the S_D input, leaving the flip-flops in the reset state.

The head windings are so phased that the reset flip-flops cause current to flow in the standard *erase* direction. The MOTION level received at J8-6 prevents write current from flowing unless tape is in motion.

The IWARS pulse received by inverter U36-E is used to reset all the write waveform generator flip-flops required to write the LRCC at the end of the record. The pulse is applied to the K inputs of all write waveform generator flip-flops via inverter OR gates U27-A, U30-D, etc., resetting the *master* section of all flip-flops.

The leading edge of the IWARS pulse is differentiated by capacitor C4 and resistors R12 and R13 and sets clock flip-flop U28-B. This initiates a Write Deskewing sequence that results in toggling of the write waveform generator flip-flops and the writing of the LRCC in a deskewed manner.

During reading, signals from the read head (at a nominal level of 48 millivolts) are routed to connector J2 to the read amplifier, which is one-half of a dual operational amplifier IC (U19-B). The amplifier output is maintained close to 0v in the absence of an input signal by the feedback path of resistors R110 and R113, which determine a fairly low dc gain. The low frequency cutoff is determined by capacitors C101 and C102. The operating gain of the amplifier is defined by resistor network R111, R114, and R112. R112 is a variable resistor used in the initial setup to set the output peak-to-peak amplitude.

The read amplifier output is applied to a unity gain inverting amplifier using transistors Q103, Q104, and Q105. The positive-going halves of the two phases of the read signal are added by means of diodes CR101, CR102, and transistors Q106 and Q107. The exact voltage at which CR101 and CR102 conduct is controlled by the threshold level at TP12 to which R120 is connected. This level is controlled by the NWRT line. When NWRT is low, indicating a Write operation, a voltage close to +2v is obtained at TP12 which results in a clip level of close to 45 percent of the read amplitude. When NWRT is high indicating a Read operation, a voltage close to 0v is obtained at TP12 which results in a clip level of close to 20 percent of the read amplitude.

The double emitter-follower stage Q106, Q107 is used to drive the input of the peak detector which is essentially a feedback differentiator circuit that used one-half of a dual operational amplifier (U14-B). The amplifier is prevented from saturating by feedback diodes CR103, CR104, CR105, and CR106. The amplifier is biased to negative output in the absence of an input signal by resistor R123. At this point, a positive-going transition from −1v to +1v corresponds to a peak of the read waveform. The output of the peak detector operational amplifier is passed to Q108, which converts the signal to standard logic levels. At this point, a negative-going edge corresponds to the peak of the read waveform.

Resistor R128 and the corresponding resistors of the other eight circuits are connected to TP2. Examination of the output at TP2 with an oscilloscope while reading an all ones tape allows a good estimate of the condition of the tape path. Skew is indicated by a progression of steps on the negative-going edge, and skew magnitude by the ratio of the fall time to the character time (see Paragraph 6.6.13). The output of Q108 is differentiated by capacitor C110 and resistor R129 and applied to the clock input of Read Staticiser flip-flop U4-A, setting it.

The $\overline{Q}$ output of U4-A, together with those of the other eight Read Staticiser flip-flops, are ORed by gate U2-B. The first flip-flop to be set causes a positive-going transition at TP9, which switches off clamp transistor Q8. This initiates run-down circuit Q7, Q8, Q9, and Q10. The voltage at the cathode of CR2 decays toward $-5v$ from $+4.5v$ with a time constant (R31 + R32) C10.

At approximately 0v, Q9 starts to cut off. This action is regenerative due to the positive feedback via capacitor C11 and resistor R36, resulting in a negative-going transition at the collector of Q10 (TP10). This transition is differentiated, and subsequently shaped in single-shot U1-B, U2-A, U40, and associated components, to form a 1 microsecond IRDS pulse which is routed to the interface via power gate U3-B.

In addition, the negative transition is delayed via U1-D, U1-F, resistor R41, capacitor C14, and inverter U1-A, and routed via OR gate U3-A and power gate U5-B to the reset inputs of the Read Staticiser flip-flops. This causes the output of U2-B to go negative, turning on Q8, therefore, reapplying the clamp to the run-down circuit. The delay is such that the data lines reset a minimum of 0.5 microsecond after the trailing edge of the IRDS. The Read Staticisers are reset whenever the MOTION signal J8-6 is low; i.e., tape is not in motion.

Data E17 is the 7-channel version. It is essentially the same as the Data E19 except for configuration; circuits 200 and 300 are omitted from both the write and read sections of the PCBA and the deskewing connections from the shift register to the write waveform generator flip-flops are different to accommodate the different track layout format (see Figures 4-8 and 4-9).

5.3 DATA D1 PCBA (T8X60A)

The following is a description of the Data D1 PCBA. Refer to Schematic 101720 and Assembly 101721.

The PCBA measures 406.4 by 220.7 mm (16 by 8.69 inches) and has edge connectors at each end along one edge. Figure 5-3 illustrates the placement of each connector and test point. J102 and J103 are the interface connectors and are slotted to mate with keys in the mating plugs. Two additional connectors are used: J8 for the power and control signals from the Tape Control PCBA; and J1 for the write and read head cable. The Data D1 is used with both 7- and 9-track models. Jumper W1 is used with 9-track models and omitted with 7-track models.

5.3.1 CIRCUIT DESCRIPTION

The PCBA operation is described with reference to circuit 100 which is identical to circuits 200—900. All interface signals relevant to writing data (7 or 9 WRITE DATA signals [IWD0, etc.], WRITE DATA STROBE, [IWDS], and WRITE AMPLIFIER RESET [IWARS]), enter via J102 and are terminated by a resistor combination and an IC inverter.

Referring to circuit 100, the WRITE DATA PARITY (IWDP) data line is terminated by resistors R101, R102, and inverter U32-C. The inverter output is connected to the J and K inputs of write flip-flop U24-A so that a true interface signal results in the toggling of the flip-flop when the IWDS pulse is received by U31-A, which is bused to all clock inputs.

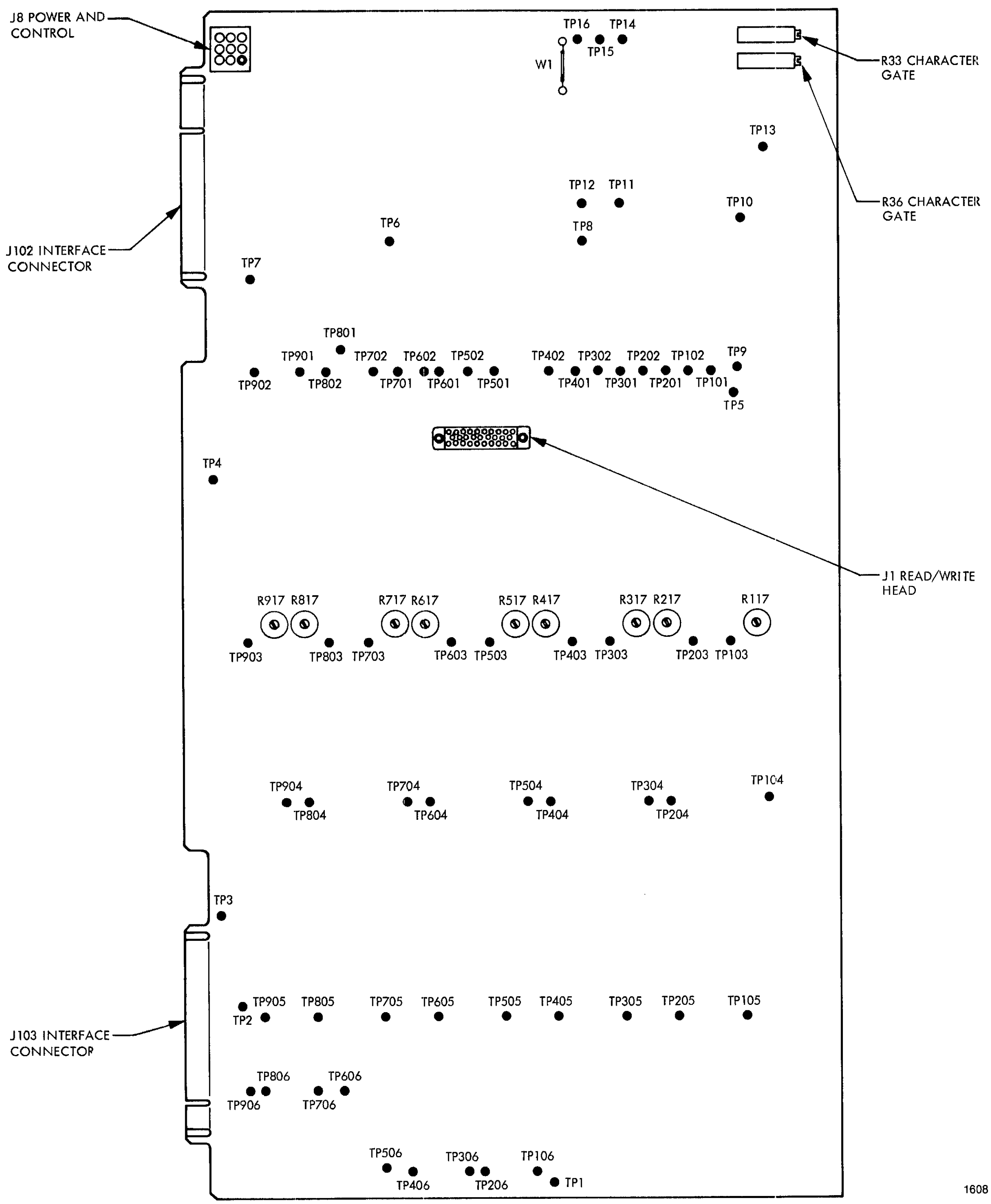


Figure 5-3. Data D1 PCBA, Test Point and Connector Placement

The output of the write flip-flop drives write amplifier transistors Q101 and Q102, whose emitters are taken to +5v when the WRT POWER line (J8-4) is high. This allows current to flow in the transistor whose flip-flop output is low. When the WRT POWER level is low (approximately 0v), writing is inhibited because the write amplifier transistors cannot be turned on. In the same way, the erase current supplied by Q1 is inhibited when WRT POWER is low.

The write flip-flops are primed for writing by the NWRT line J8-9. This signal is inverted by power gate U30-B and bused to all set inputs of the write flip-flops. This signal is also connected through an R-C delay to a pair of inverting stages U30-A and U31-B and bused to all reset inputs of the write flip-flops. Thus, when the NWRT level is high, the ability to write is removed because both true and false outputs of the flip-flops are raised to +5v. When the NWRT level is lowered to allow writing, the R-C network delays the removal of the reset input with respect to the set input, leaving the flip-flops in the reset state.

The head windings are phased so that the reset flip-flops cause current to flow in the standard *erase* direction. Raising the WRT POWER also turns on erase driver Q1. Q2 conducts whenever NWRT is low and WRT POWER is high, causing Q3 to conduct. Thus, transistor Q3 acts as a switch to provide −5v to the center taps of all head windings.

The MOTION level received at J8-6 prevents write current from flowing unless tape is in motion.

The IWARS signal is used to write the LRCC at the end of a record. The leading edge of the IWARS pulse resets all the write flip-flops causing the head currents to be switched in those tracks where a 1 is required in the LRCC. The write current is defined by R107 and R108 and the damping resistor across the head which is the sum of R109 and R110.

During reading, transistors Q101 and Q102 are held nonconducting and, since Q1, Q2, and Q3 are cut off, the effect of the write circuits is removed; therefore the head windings are left loaded by the read amplifier input resistors R109 and R110. The signals, at this point during read, are so low that CR101 and CR102 do not conduct.

The read amplifier is one half of a dual operational amplifier (U19-B). The amplifier output is maintained close to 0v by the feedback path of R116 and R113, which produces a fairly low dc gain. The low frequency cut-off is determined by capacitors C102 and C103. Diodes CR103 and CR104 shunting C102 and C103 are used to prevent large voltages from building up during a write operation that might prevent recovery of the amplifier during the available time prior to a subsequent read operation.

The operating gain of the amplifier is defined by resistor network R114, R115, and R117. R117 is a variable resistor used in the initial setup to set the output peak-to-peak amplitude to 12v.

The read amplifier output is applied to a unity gain inverting amplifier, using transistors Q103, Q104, and Q105. The positive-going halves of the two phases of the read signal are added by means of diodes CR105 and CR106, and transistors Q106 and Q107. The exact voltage at which CR105 and CR106 conduct is controlled by the level at TP10, to which R123 is connected. This level is controlled by the IRTH interface line of J102. When IRTH is high (false), a voltage close to 0v is obtained at TP10, which results in a clip level of close to 20 percent of the read amplitude. When IRTH is low (true), a voltage close to +2v is obtained at TP10, which results in a clip level close to 50 percent of the read amplitude. The double emitter-follower stage Q106, Q107 is used to drive the input of the peak detector.

The peak detector is essentially a feedback differentiator circuit which uses one-half of a dual operational amplifier U14-B. The amplifier is prevented from saturating by feedback diodes CR107, CR108, CR109, and CR110. The amplifier is biased to a negative output in the absence of an input signal by resistor R126. At this point, a positive-going transition from – 1v to + 1v corresponds to a peak of the read waveform. The output of the peak detector operational amplifier is passed to Q108, which converts the signal to standard logic levels. At this point, a negative-going edge corresponds to the peak of the read waveform. Resistor R131 and the corresponding resistors of the other 8 circuits are connected to TP2. Examination of the output at TP2 (with an oscilloscope) while reading an all-ones tape, allows a good estimate of the condition of the tape path. Skew is indicated by a progression of steps on the negative-going edge and the magntiude of skew by the ratio of fall time to the character time. The output of Q108 is differentiated by capacitor C110 and resistor R132 and applied to the clock input of Read Staticiser flip-flop U4-A, setting it.

The $\overline{Q}$ output of U4-A, together with those of the other 8 Read Staticiser flip-flops, are ORed by gate U2-B. The first flip-flop to be set causes a positive-going transition at TP11, which switches off clamp resistor Q7. This initiates run-down circuit Q6, Q7, Q8, and Q9.

With the transport operating in the Low Density mode, transistor Q6 is switched on by the NHID signal at J8-5. The conduction of Q6 places the + 5v at the cathode of CF1. This effectively reverse-biases CR1, removing R32 and R33 from the run-down circuit.

Switching off clamp transistor Q7 removes the + 4.5v from the junction of R34 and R35. This allows the positive voltage on the cathode of CR2 to decay toward – 5v with a time constant (R35 + R36) C28.

At approximately 0v, Q8 starts to cut off and this action is regenerative due to the positive feedback via capacitor C29 and resistor R40, resulting in a negative-going transition at the collector of Q9 (TP13). This transition is shaped by the single-shot circuit consisting of U2-A, U1-B, and capacitor C31 to form a 2-microsecond IRDS pulse which is routed to the interface via power gate U3-B.

In addition, the negative transition is delayed via U1-F, resistor R46, capacitor C32, and inverter U1-A and applied to the reset inputs of the Read Staticiser flip-flops via OR gate U3-A and power gate U5-B. This causes the output of U2-B to go negative, turning on Q7, therefore, reapplying the clamp to the run-down circuit. The delay is such that the data lines reset a minimum of 0.5 second after the trailing edge of the IRDS.

The Read Staticisers are reset whenever the MOTION signal J8-6 is false; i.e., tape is not in motion.

When the transport is operated in the High Density mode, transistor Q6 is cut off by the positive-going NHID signal at J8-5. Switching off Q6 removes the + 5v at the cathode of CR1. This effectively places R32 and R33 in parallel with R35 and R36.

Switching off clamp transistor Q7 allows the positive voltage at the cathode of CR2 to decay toward – 5v with a time constant determined by C28 and the parallel combination of R32, R33, and R34, R35.

Circuit action continues in the manner previously described under the Low Density mode.

The 7-channel version of the Data D1 is obtained by omitting circuits 200 and 300 from both the write and read sections of the circuit board.

Jumper W2 is used in the 9-track transport to hold Q4 cut off, thus allowing only one packing density, 32 c/mm (800 cpi).

5.4 TAPE CONTROL J PCBA

The following is a description of the Tape Control J PCBA (refer to Schematic 102333 and Assembly 102334).

The Tape Control J PCBA measures 406.4 by 266.7 mm (16 by 10.5 inches) and contains the tape control system, reel servo amplifiers, capstan servo amplifier, regulators, EOT/BOT amplifier, overwrite system, and necessary signals and switch electronics. Figure 5-4 illustrates the placement of test points and connectors.

The power transistors associated with the circuits on this board are mounted on an external heatsink, illustrated in Figure 5-5, which is part of the power supply and is attached to the transport rear deck. Electrical connection between the Tape Control PCBA and the transistors is accomplished via jumper cables.

Connectors, located with respect to their associated circuitry, are used to connect all deck-mounted assemblies to the PCBA, e.g., power supply, motors, tension arm sensors, photosensors, write lockout assembly, tension arm limit switch, EOT/BOT sensors, switch/indicators, as well as the interface lines and the Data PCBA.

5.4.1 CIRCUIT DESCRIPTION

The Tape Control PCBA consists of seven functionally distinct sections which are described in the following paragraphs.

(1) Tape control system
(2) Reel servo amplifiers
(3) Capstan servo amplifier
(4) Regulated power supply
(5) EOT/BOT amplifier
(6) Overwrite system
(7) Status and control signals.

5.4.1.1 Tape Control System Circuit Description

A description of the logic sequences employed in the Tape Control System is detailed in Paragraph 4.3.5. The following paragraphs explain the operation of the Forward, Reverse, and Rewind ramp generators.

The Forward and Reverse ramp generator converts the digital signals to analog levels with controlled transition times, which are the inputs to the capstan servo. The ISFC, or ISRC, is fed via transistors Q19, or Q20, to the operational amplifier circuits (U48,U49) whose output levels are determined by the +5v and −5v lines, and the ratio of R82 to R74, R277 and R79, respectively. The circuit rise and fall times are determined by the +5v and −5v lines and R87, R88, R89, R90, and C24. Tape speed is a function of the current entering the capstan servo circuit; therefore, the proper current for the selected speed is provided by a voltage divider R94, R95, R96, and R97 and one of the series resistors R98, R99 at the output of U49.

Field Effect Transistor (FET) Q22 is used as a switching device to select one of the two specified speeds on dual speed models. Q21 selects the appropriate ramp times for the two speeds. Bias for the gates of Q21 and Q22 is provided by a polarity reversing network consisting of Q23 and Q24 which is controlled by the HIGH SPEED signal from the speed control circuit at the base of transistor Q23.

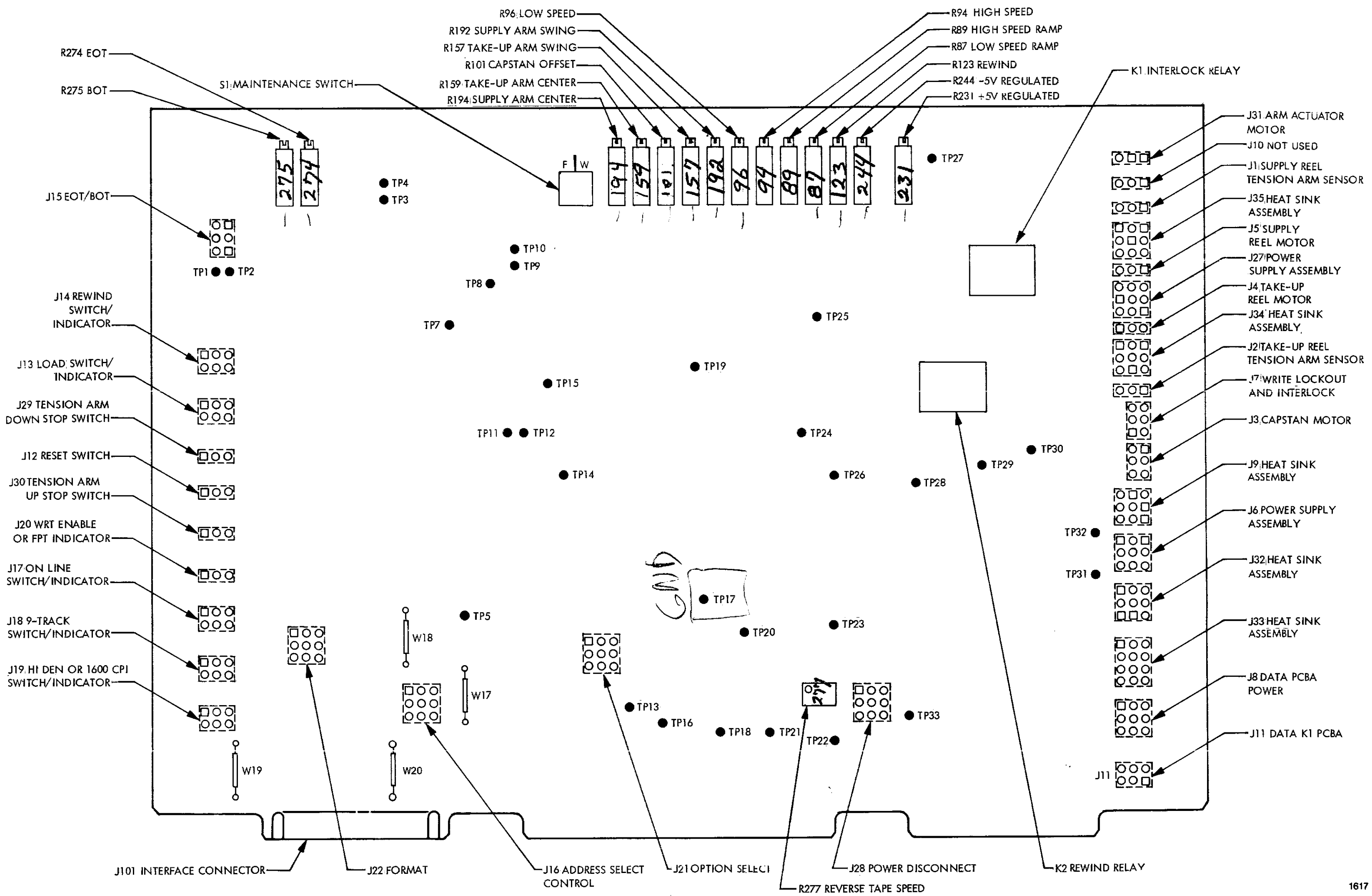
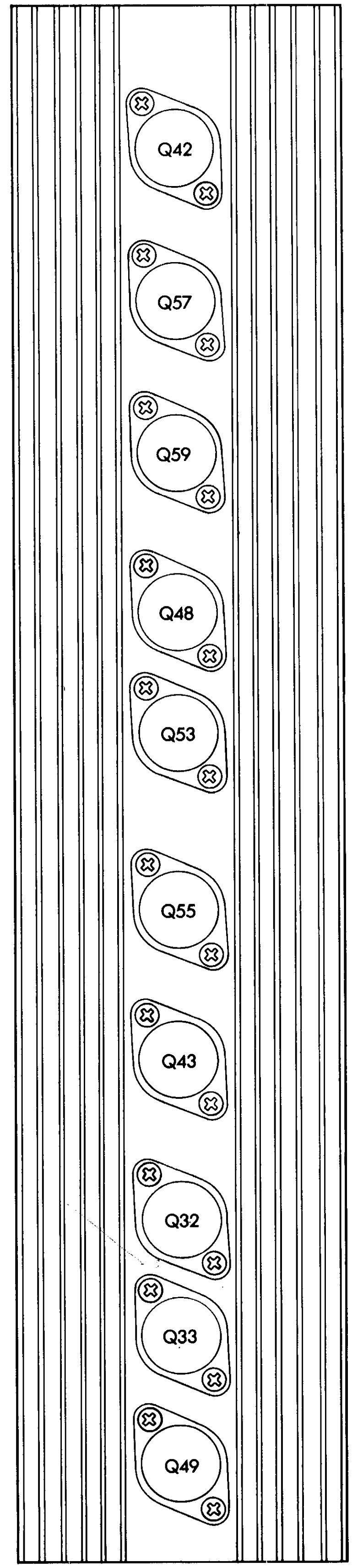


Figure 5-4. Tape Control J PCBA, Test Point and Connector Placement



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NOTE: REFER TO DRAWING 102333 LOCATED IN SECTION VII FOR CIRCUIT IDENTIFICATION OF THESE COMPONENTS.

S/B		IS
2N6051	Q42	2N6051 MOT
2N3771	Q57	2N3055 MOT
2N3771	Q59	2N3055
2N6051	Q48	2N6051
2N3771	Q53	2N3055
2N3771	Q55	2N3055
2N6058	Q43	2N6058
2N3771	Q32	2N3771 -TRW
2N3771	Q33	2N3771
2N6058	Q49	2N6058

Figure 5-5. Heatsink Assembly

The NRWRD command activates the Rewind ramp generator which includes transistors Q25, Q26. The rewind speed is determined by the −5v line which saturates transistor Q26 when a rewind to BOT is in progress. Rewind from BOT (unloading of tape) is accomplished in the same manner except that Q27 is saturated by NUNL going low, thus decreasing the available driving voltage to the capstan drive amplifier.

The rise and fall times of the Rewind ramp are determined by resistors R118 and R119 in conjunction with capacitors C30 and C31.

5.4.1.2 Reel Servo Amplifiers Circuit Description

Two dc linear amplifiers drive the supply and takeup reel motors (refer to Schematic 102333). Relay K1 connects these amplifiers to the motors. When K1 is deenergized, contacts 5 and 11 connect the two reel motors to ground (supply side directly, takeup side via a resistor). This provides a dynamic braking effect when interlock is lost due to power failure, tape breaking or reaching the end of the tape leader.

Referring to the takeup reel amplifier circuit, the input (C36, C37, R158, R162) and feedback (C39, C40, R166, R167) circuits of the operational amplifier stage U50 provide lead-lag phase compensation. The dc gain of the amplifier is given by the ratio R166/(R158 + R162). Current limiting is provided by amplifying the voltage developed by the motor current across R183 and applying it in proper phase to the input of U50. Diodes CR34 and CR35 ensure that current limiting is not initiated at low levels. The offset voltage from the output of U44 provides for the 142.24 mm (5.6-inch) swing of the takeup tension arm; the swing is adjusted by potentiometer R157. The offset voltage from potentiometer R159 adjusts the arm center position. Takeup reel power transistors Q42 and Q43 are located on the large vertical heatsink as shown in Figure 5-5.

The supply reel amplifier circuit is identical to the takeup reel circuit in all respects except for the offset voltage which provides for the 142.24 mm (5.6-inch) swing of the supply tention arm. This voltage comes from the output of U43 and furnishes the necessary phase reversals for the supply reel servo. Supply reel power transistors Q48 and Q49 are located on the large vertical heatsink as shown in Figure 5-5.

In the Rewind mode NRWRD (U38A) goes low and activates Rewind relay driver U51. Relay K2 is energized and connects the return leads of the takeup and supply reel motors to +18v and −18v, respectively; it also connects the negative and positive inputs of the respective amplifiers to the −18v and +18v. This action allows the amplifiers to supply sufficient output voltage to enable the reel servos to follow tape speeds of 5.08 m/s (200 ips). Also, offset voltages being zero, the tension arms move only 6.35 mm (0.25 inch).

After the BOT tab is detected, NRWRD goes high at the trailing edge of the BOT pulse; it deactivates K2 relay driver U51 and triggers single-shot U31, Q9, and associated circuitry. Transistors Q50, Q51, Q41, and Q42 turn on for the duration of the on-state condition of the single-shot. This raises the reel servo amplifier current limits and provides for the large deceleration required to bring the reels to a rapid halt.

In the Rewind-at-BOT mode (unloading of tape), AOS high (U16D) introduces 50.8 mm (2-inch) offsets in the tension arms, as the reels continue to rotate and the tape is completely rewound on the supply reel. When tension is lost, the arms move down a distance and impact on the stops. The ULOS offsets are then necessary to reduce the reel motor speed.

Diodes CR36, CR37, CR42, and CR43 prevent the contacts of relay K1 from arcing when they are opened; diodes CR38, CR39, CR44, and CR45 protect the contacts of relay K2.

5.4.1.3 Capstan Servo Amplifier Circuit Description

Relay K1 connects the capstan servo amplifier to the capstan motor (refer to Schematic 102333). The amplifier uses operational amplifier U54 as the input stage and discrete transistors Q32 and Q33 (located on vertical heatsink as shown in Figure 5-5) to drive the high currents in the motor. The overall dc gain of the amplifier is determined by the sum of R103 and R109 divided by the sum of R106 and R112 for high speed motor-tachometers. When the low speed motor-tachometer is employed, the overall gain of the amplifier is determined by the sum of R103 and R109 divided by the sum of R106 and R111. Diodes CR26 and CR27 prevent the contacts of relay K1 from arcing when they are opened. Potentiometer R101 adjusts the initial output offset of the operational amplifier to 0.

5.4.1.4 Regulated Power Supply Circuit Description

Transistors Q55, Q59, Q53, and Q57 (located on vertical heatsink as shown in Figure 5-5) provide regulated +5v, −5v, +10v, and −10v, respectively. The regulators are driven by the unregulated +18v and −18v from the power supply module (J6). Potentiometers R231 and R244 adjust the +5v and −5v levels. Zener diodes VR2 and VR5 provide the reference voltage for the positive and negative regulators, respectively. The currents to these diodes come from the regulated +10v and −10v lines via R229 and R241. This technique provides improved ripple characteristics for the regulators. CR46, CR47, CR52, and CR53 improve the temperature stability of the supplies. Jumpers W1, W2, W3, and W4 isolate the regulators from the remainder of the PCBA.

A *crowbar* over-voltage protection is provided and uses zener diode VR3 to detect an increase in the +5v level to 8v, in which case SCR1 fires. Firing SCR1 causes the +18v fuse on the power supply module to blow, removing the +18v supply. A similar protection is provided by VR6 and SCR2 for the −5v level.

5.4.1.5 EOT/BOT Amplifier Circuit Description

The EOT and BOT amplifiers utilize identical circuits, therefore, only the operation of the EOT amplifier will be detailed.

The EOT phototransistor is connected via J15 to the Tape Control PCBA. Network C1, R2, R3 in the emitter lead of the EOT phototransistor filters any spurious signals. R1 provides dc feedback between the base and emitter to reduce the current gain variation of the phototransistor. When the EOT tab reaches the EOT/BOT sensor assembly, the light reflected from the tab hits the base of the phototransistor, turning it on. The emitter voltage rises causing Q1 to turn on and Q3 to cut off. Thus, the EOT level goes high. Resistor R5 provides positive feedback, thus enabling the stability of the section.

5.4.1.6 Overwrite System Circuit Description

The logic operation of the overwrite circuit is described in Paragraph 4.3.4.3 for T8X40A and 4.3.4.5 for T8X60A. The write power enable portion of the overwrite circuit is basically an R-C ramp utilizing a Darlington-pair transistor circuit (Q12,Q13). Write power is applied to the circuit from contacts 15 and 16 of K1 via the Write Lockout switch.

NOTE

A write enable ring must be installed on the supply reel to complete the Write Power Interlock circuit.

When an Overwrite operation is initiated, voltage at the output of power gate U42B drops sharply to 0v and the +5v charge on capacitor C19 discharges toward 0v. (The R-C time of discharge is determined by the values of C19, R50.) Transistor Q12 conducts and causes transistor Q13 to conduct. The rate of conduction is determined by the discharge time of C19. The voltage at the collector of Q13 rises toward +5v as determined by the current flow through R53 and Q13. The output voltage is supplied via J8 pin 4 to the Write logic on the Data PCBA.

Termination of a Write or Overwrite operation causes the voltage at pin 8 of power gate U42B to rise sharply to +5v. Conduction of transistors Q12 and Q13 decrease toward cutoff at a rate determined by (R49 + R50), Q19. The output voltage at the collector of Q13 ramps from +5v to 0v as Q13 cuts off.

5.4.1.7 Status and Control Signals Circuit Description

The following paragraphs describe the generation techniques of the various status and control signals which were not explained in the preceding functional subsystems description of the Tape Control PCBA.

The low-true interface ISFC is received via J101 (pin C), inverted by U20A, and passed to NAND gate U28A. ISFC is gated at U28A with the Selected, Ready, and On-line (SRO) signal (U34A) and applied to the Forward ramp generator.

The output of U28A is also passed through NOR gate U28B. The output of U28B is the MOTION signal. Additionally, MOTION is delayed, inverted, differentiated, and applied to the base of transistor Q6. The negative-going signal on the base of Q6 causes the transistor to cut off, generating the positive-going GO pulse at the collector of transistor Q6. This pulse samples the status of the ISWS (J101-K) line. If ISWS is low, indicating that the Write mode is required, the Write/Read flip-flop U41B is set and NWRT goes low. If IOVW is high, then U41A is reset and U42B-8 goes low. In this case, WRT PWR at J8 pin 4 is high if Q12 and Q13 are provided with +5v to their emitters via the WLO switch.

Reverse commands are generated in the same manner as described for ISFC. The low-true ISRC is received via J101 (pin E) and operates in the same manner as the ISFC, with the exception that the inverted (high-true) ISRC is ANDed with the inverted BOTA 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 ISRC or the reverse command from the Maintenance switch is NORed by U28C to provide the REVERSE control signal for the Data PCBA.

The BOT single-shot consists of components pertinent to Q5. 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 C3 and C4 in conjunction with resistors R15 and R16. The single-shot pulse (NBOTD) is inverted and the trailing edge is differentiated by capacitor C5 in conjunction with resistors R18 and R19 and applied to inverter U24D. In this manner a narrow pulse (BOTDP) is generated whose width is determined by capacitor C5 and resistors R10 and R19.

Read Only transports employ the 9 TRACK switch/indicator to select the 7-track or 9-track head. The switch is not included in the Read/Write transports although the hardware is included on the PCBA. Table 5-1 illustrates the jumper placement for selection of either 7-or 9-track heads.

Read Only transports employ the 9 TRACK switch/indicator to select the 7-track or 9-track head. The switch is not included in the Read/Write transports although the hardware is included on the PCBA. Table 5-1 illustrates the jumper placement for selection of either 7-or 9-track heads.

NRZI models which are equipped to operate in the high density mode only, and all PE models, utilize jumper W10. Jumper W7 is omitted in these transports, thereby forcing the input of inverter U1B low through jumper W10. The output of U1B is, therefore, permanently high. Since the output of U1B is coupled to the input of inverter U1C, the output of U1C (NHID) is forced low. Note that the switch contacts are disabled. In PE transports, the front panel is supplied with a 1600 CPI switch/indicator instead of the HI DEN (high density) switch/indicator which is permanently illuminated since the low output of U1C continuously enables the transistor of the lamp driver circuit.

Table 5-1
Jumper Connections, FORMAT

Transport Configuration	P22 (101897)	Jumpers Used					
		W5	W7	W8	W9	W10	W11
9 TRACK, PE, ROT	-01				X	X	
9 TRACK, PE/NRZI, ROT	-02		X		X		
7/9 TRACK, PE/NRZI, ROT	-03		X	X			
9 TRACK, NRZI, ROT	-04				X		
7 TRACK, NRZI, ROT/7 TRACK NRZI, READ AND WRITE, HI-DENSITY LOCAL	-05		X				
7/9 TRACK, NRZI, ROT	-06		X	X			X
7 TRACK, NRZI, READ AND WRITE, HI-DENSITY REMOTE	-07	X					
9 TRACK, PE, READ AND WRITE	Not Used						
9 TRACK, NRZI, READ AND WRITE	Not Used						
9 TRACK, PE/NRZI, READ AND WRITE (HI-DEN LOCAL)	-02		X		X		
9 TRACK, PE/NRZI, READ AND WRITE (HI-DEN REMOTE)	-08	X			X		
7/9 TRACK PE/NRZI, ROT HI-DENSITY REMOTE	-09	X		X			

In NRZI transports equipped to operate in only the low density mode, jumpers W5, W7, and W10 are omitted. The input of inverter U1B is, therefore, permanently high. Since the low output of U1B is directly coupled to the input of inverter U1C, the output of U1C is permanently high. The HI DEN switch contacts are permanently disabled and the lamp is extinguished.

NRZI transports configured to operate in the dual density mode have jumper W7 only installed. The data density and associated indicator are controlled by the HI DEN switch. When high density is selected, the input of U1B is connected to 0v via the contacts of switch. This causes NHID to be low and the transport is conditioned to operate in the high density mode. When the HI DEN switch is deactivated, NHID is high and the transport is conditioned to operate in the low density mode.

When jumper W11 is not used and the transport is in high density and 9-track mode (jumper W9 is used or jumper W8 is used and 9 TRACK switch is depressed), then HIGH SPEED (U3A-3) goes low. Otherwise, HIGH SPEED is high.

The interface DATA DENSITY SELECT (IDDS) operation provides for the external selection of the packing density on dual density transports. Jumper W5 provides the electrical connection to U1B necessary for this feature.

In 9-track transports the High Density mode of operation is automatically selected by installing a jumper to 0v on the Data PCBA which forces J8-5 (NHID) continuously low.

Certain options may be included on the transport to facilitate additional On-line and interface output capabilities. Table 5-2 illustrates the possible combinations of jumpers W12, W13, and W14.

Jumper W12 determines the On-line capabilities of the transport. Transports are normally equipped with jumper W12 which protects the transport from being placed on-line before FLR (First Load or Rewind) goes true. When jumper W12 is omitted, the transport can be placed on-line any time after the interlock has been completed, provided that OFF-LINE COMMAND (IOFFC) is false.

Jumper W13 determines the relationship between the ISLT command and the SLTA command. SLT is generated by the inversion of ISLT through gate U40B. All interface inputs except IDDS are disabled when ISLT is low (false). SLTA is controlled by the output of U40B when jumper W13 is installed, or SLTA is permanently high (true) through R67 when jumper W13 is omitted. Interface outputs (IONLINE, IEOT, IRDY, ILDP, IRWD, IDDI, and IFPT) are gated with SLTA and are disabled when SLTA is low.

The presence of jumper W14 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 W13 is installed) can go true. Transports are normally equipped with jumper W14.

If a reel of tape with a write enable ring is mounted on the supply reel hub, the Write Lockout switch closes, Q10 turns on, and the Write Lockout solenoid energizes. The solenoid in turn keeps the Write Lockout switch closed by retracting the write enable ring probe. In this case, +5v reaches the emitter of Q10 through interlock relay K1 and WRT PWR goes high when the Write mode or Overwrite mode is selected.

In addition, if jumper W16 is used, the write enable lamp drive circuit is activated and the WRT EN (write enable) indicator is lit. On the other hand, if jumper W15 is used, the WRT EN indicator is extinguished unless the write enable ring is removed from the reel of tape.

Table 5-2
Jumper Connections, OPTIONS

Options Available				P21	Jumpers Used				
On Line At	Output Interface Line Enabled By	Input and Output Interface Lines Enabled By	WRT EN/FPT Indicator	P/N 102344	W12	W13	W14	W15	W16
Middle of Tape	SLTA	SELECT	WRT EN	-01					X
			FPT	-02				X	
		SELECT AND ON LINE	WRT EN	-03			X		X
			FPT	-04			X	X	
	SELECT	SELECT	WRT EN	-05		X			X
			FPT	-06		X		X	
		SELECT AND ON LINE	WRT EN	-07		X	X		X
			FPT	-08		X	X	X	
Beginning Of Tape	SLTA	SELECT	WRT EN	-09	X				X
			FPT	-10	X			X	
		SELECT AND ON LINE	WRT EN	-11	X		X		X
			FPT	-12	X		X	X	
	SELECT	SELECT	WRT EN	-13	X	X			X
			FPT	-14	X	X		X	
		SELECT AND ON LINE	WRT EN	-15	X	X	X		X
			FPT	-16	X	X	X	X	

SECTION VI
MAINTENANCE AND TROUBLESHOOTING

6.1 INTRODUCTION

This section provides information necessary to perform electrical and mechanical adjustments, parts replacement, and troubleshooting of Model T8X40A and Model T8X60A Tape Transports. Sections IV and V contain the theory of operation of components and circuits for reference.

6.2 FUSE IDENTIFICATION

Three fuses are located at the rear of the transport and are identified in Table 6-1.

6.3 SCHEDULED MAINTENANCE

The tape transport is designed to operate with a minimum of maintenance and adjustments. Part replacement 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 service the transport is given in Paragraph 6.7.

6.3.1 MAINTENANCE PHILOSOPHY

The objective of any maintenance program is to provide maximum machine readiness with a minimum of downtime. To provide this type of reliability, it is necessary to perform preventive maintenance at specific intervals; a preventive maintenance schedule is given in Table 6-2. In general, it is not necessary to alter any adjustment on equipment that is performing in a satisfactory manner.

6.3.2 GENERAL MAINTENANCE

Perform a visual inspection of the equipment for loose electrical connections, dirt, cracks, binding, excessive wear, and loose hardware while conducting any maintenance function. Cleanness is essential for proper operation. Minute particles of dirt trapped between the head and the tape can cause data errors.

6.3.3 CLEANING THE TRANSPORT

The transport requires cleaning in these major areas: head and associated guides, roller guides, tape cleaner, and capstan. To clean the head and guides, use a lint-free cloth or cotton swab moistened in 91 percent isopropyl alcohol. Wipe the head carefully to remove all accumulated oxide and dirt.

CAUTION

DO NOT USE ROUGH OR ABRASIVE CLOTHS TO CLEAN THE HEAD AND HEAD GUIDES. USE ONLY 91 PERCENT ISOPROPYL ALCOHOL. 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 91 percent isopropyl alcohol to remove accumulated oxide and dirt. To clean the roller guides, use a lint-free cloth or

Table 6-1
Fuse Identification

	Location	Function	Type
F1	Power Supply Module	Line Fuse	5 Amp 3AG, SB, 125v and below or 3 Amp, 3AG, SB, 190v and above
F2		+ 18v	10 Amp, 3AG, FB
F3		− 18v	8 Amp, 3AG, FB

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Table 6-2
Preventive Maintenance Schedule

Maintenance Operation	Frequency (hours)	Quantity to Maintain	Time Required (minutes)	Manual Paragraph Reference
Clean Head, Head Guides, Roller Guides, and Capstan	8 (or start of operating day)	—	5	6.3.2
Check Skew, Tape Tracking, and Speed	500	—	15	6.6.13 or 6.6.14, 6.6.7, 6.5.6
Check Head Wear	2,500	1	3	6.6.15
Replace Reel Motors and Capstan Motor	10,000	3	30	6.6.18
Replace Tension Arm Springs	10,000	2	15	6.6.20
Clean Tape Cleaner	80	1	5	6.6.25

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cotton swab moistened in isopropyl alcohol. Wipe the guide surfaces carefully to remove all accumulated oxide and dirt.

CAUTION

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

The tape cleaner must be removed from the transport for proper cleaning. Paragraph 6.6.25 details the procedure for removal, cleaning, and reinstallation of the tape cleaner.

6.3.4 DOOR SAFETY SWITCH

The optional Door Safety switch is an interlock that prevents tape motion when the door is open. To override the interlock, a Pertec Switch Retractor Tool, Part No. 617-0010, is used to pull the switch plunger to its outermost position. Tape can then be moved by either the Maintenance switch, front panel controls, or interface control. Refer to Paragraph 3.4.11.

6.4 PART REPLACEMENT ADJUSTMENTS

Table 6-3 and Table 6-4 define the adjustments necessary when a part is replaced for the T8X40A and T8X60A transports, respectively. The details are given in Paragraph 6.5 and Paragraph 6.6.

6.5 ELECTRICAL ADJUSTMENTS

In addition to the tools listed in Paragraph 6.7, the following equipment (or equivalent) is required.

(1) Oscilloscope, Tektronix Model 465B (vertical and horizontal sensitivity specified to ±2 percent accuracy).

(2) Digital Multimeter, Fluke Model 8030A-01 (±0.1 percent accuracy).

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

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

(5) Exerciser, Hand-Held, Pertec Model TE-T03 (Part No. 897280-01).

6.5.1 ADJUSTMENT PHILOSOPHY

Acceptable limits are defined in each adjustment procedure, taking into consideration the assumed accuracy of the test equipment specified in Paragraph 6.5. Adjustment procedures detailed in this section should be performed at room temperature (15.50° to 26.7°C or 60° to 80°F).

When the measured value of any parameter is within the specified acceptable limits, NO ADJUSTMENTS should be made. Should the measured value fall outside the specified acceptable limits, adjustment should be made in accordance with the relevant procedure.

NOTE

Some adjustments may require corresponding adjustments in other parameters. Ensure these are made as specified in the individual procedures. The +5v and −5v regulator voltages must be checked prior to any electrical adjustments.

Table 6-3
Part Replacement Adjustments, Model T8X40A

Part Replaced	Auxiliary Adjustments	Time Required (minutes)	Manual Paragraph Reference
Capstan	Capstan Height, Read Skew, Tape Path	10	6.6.10, 6.6.13, 6.6.7
Capstan Motor	*Capstan Servo Offset, Tape Speed, Ramp Timing and Rewind Speed on Tape Control PCBA, Read Skew, Tape Path	35	6.5.4, 6.5.6, 6.5.5, 6.5.7, 6.6.13, 6.6.7
Control Switch	None	2	—
Data PCBA	Read Character Gate, Read Amplifier Gain, Write Deskew	20	6.5.9, 6.5.8, 6.6.13
Head	Write Deskew, Read Skew, Read Amplifier Gain, Flux Gate	30	6.6.13, 6.5.8, 6.6.17
Tension Arm Interlock Switch	Switch Adjustment	10	6.6.2
Photosensor	EOT/BOT Amplifier	10	6.5.3
Power Supply Assembly	None	20	—
Reel Hub Assembly	Reel Hub Assembly Height, Write Lockout Plunger	10	6.6.21, 6.6.24
Takeup Reel Hub Assembly	Takeup Hub Height Check	10	6.6.22, 6.6.10.5
Reel Motor Assembly	Belt Tension, Tension Arm Position Sensor	10	6.6.19, 6.6.6
Reel Motor Drive Belt	Belt Tension	5	6.6.19
Roller Guide Assembly	Read Skew, Tape Path	25	6.6.13, 6.6.7
Tape Control PCBA	*Ramp Timing, Tape Speed, Rewind Speed, Capstan Servo Offset, Tension Arm Position Sensor	40	6.5.5, 6.5.6, 6.5.7, 6.5.4, 6.6.6
Tape-In-Path Sensor	EOT/BOT Amplifier	10	6.5.3
Tension Arm Position Sensor	Tension Arm Position Sensor	20	6.6.6
Tension Arm Spring	Tape Tension throughout Arm Travel	30	6.6.20
Write Lockout Assembly	Plunger Height	10	6.6.24
Arm Retracted Limit Switch	Gear Motor Limit Switch	10	6.6.4
Arm Extended Limit Switch	Load Limit Switch	10	6.6.3

*The +5v and −5v regulators must be checked before attempting any electrical measurements or adjustments.

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Table 6-4
Part Replacement Adjustments, Model T8X60A

Part Replaced	Auxiliary Adjustments	Time Required (minutes)	Manual Paragraph Reference
Capstan	Capstan Height, Read Skew, Tape Path	10	6.6.10, 6.6.14, 6.6.7
Capstan Motor	*Capstan Servo Offset, Tape Speed, Ramp Timing and Rewind Speed on Tape Control PCBA, Read Skew, Tape Path	35	6.5.4, 6.5.6, 6.5.5, 6.5.7, 6.6.14, 6.6.7
Control Switch	None	2	—
Data PCBA	Read Character Gate, Read Amplifier Gain, Write Deskew	20	6.5.9, 6.5.8, 6.6.14
Head	Read Skew, Read Amplifier Gain	30	6.6.14, 6.5.8
Tension Arm Interlock Switch	Switch Adjustment	10	6.6.2
Photosensor	EOT/BOT Amplifier	10	6.5.3
Power Supply Assembly	None	20	—
Reel Hub Assembly	Reel Hub Assembly Height, Write Lockout Plunger	10	6.6.21, 6.6.24
Takeup Reel Hub Assembly	Takeup Hub Height Check	10	6.6.22, 6.6.10.5
Reel Motor Assembly	Belt Tension, Tension Arm Position Sensor	10	6.6.19, 6.6.6
Reel Motor Drive Belt	Belt Tension	5	6.6.19
Roller Guide Assembly	Read Skew, Tape Path	25	6.6.14, 6.6.7
Tape Control PCBA	*Ramp Timing, Tape Speed, Rewind Speed, Capstan Servo Offset, Tension Arm Position Sensor	40	6.5.5, 6.5.6, 6.5.7, 6.5.4, 6.6.6
Tape-In-Path Sensor	EOT/BOT Amplifier	10	6.5.3
Tension Arm Position Sensor	Tension Arm Position Sensor	20	6.6.6
Tension Arm Spring	Tape Tension throughout Arm Travel	30	6.6.20
Write Lockout Assembly	Plunger Height	10	6.6.24
Arm Retracted Limit Switch	Gear Motor Limit Switch	10	6.6.4
Arm Extended Limit Switch	Load Limit Switch	10	6.6.3

*The +5v and −5v regulators must be checked before attempting any electrical measurements or adjustments.

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

CAUTION

POWER SHOULD BE REMOVED FROM THE TRANSPORT WHEN REAR ACCESS IS REQUIRED, EXCEPT IN CASES OF ELECTRICAL TESTING AND ADJUSTMENTS.

6.5.2 +5V AND −5V REGULATORS

The +5v and −5v regulators are located on the Tape Control PCBA and are adjusted by means of variable resistors R231 and R244. The numerical value of the voltage difference, disregarding polarity, between the +5v and −5v lines must be less than 0.07v since tape speed is dependent upon these voltages. Refer to Figure 5-4 to locate test points and adjustments.

6.5.2.1 Test Configuration

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

(2) Apply power to the transport.

(3) Depress and release the LOAD control twice to establish interlock and tension the tape, and tape will advance to the Load Point.

6.5.2.2 Test Procedure

(1) Using a digital voltmeter, measure and note the voltage difference between TP23 (+5v) and TP17 (0v) on the Tape Control PCBA.

(2) Measure and note the voltage difference between TP22 (−5v) and TP17 (0v) on the Tape Control PCBA.

(3) Acceptable Limits

- ☐ +5v Regulator
  - +4.95v minimum
  - +5.05v maximum
- ☐ −5v Regulator
  - −4.95v minimum
  - −5.05v 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.

6.5.2.3 Adjustment Procedure

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

(1) Adjust variable resistor R231 on the Tape Control PCBA to +5v as observed at TP23 (using TP17 as the 0v reference).

(2) Adjust variable resistor R244 on the Tape Control PCBA to −5v as observed at TP22 (using TP17 as the 0v reference).

(3) (Verify that the voltage difference between TP23 and TP22 on the Tape Control PCBA falls within the acceptable limits and the absolute difference between the +5v and −5v lines is less than 0.7v.

6.5.2.4 Related Adjustments

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

(1) EOT/BOT Amplifier (Paragraph 6.5.3).

(2) Capstan Servo Offset (Paragraph 6.5.4).

(3) Ramp Timing (Paragraph 6.5.5).

(4) Tape Speed (Paragraph 6.5.6).

(5) Rewind Speed (Paragraph 6.5.7).

(6) Read Amplifier Gain (Paragraph 6.5.8).

6.5.3 EOT/BOT AMPLIFIER

The EOT/BOT Amplifier is located on the Tape Control PCBA. Before performing the following procedure, examine the PCBA and determine the value of resistors R2 and R9. See Figure 5-6 to locate test points and adjustments.

NOTE

The +5v and −5v regulator voltages must be checked and adjusted prior to adjusting the EOT/BOT Amplifier.

6.5.3.1 Test Procedure

(1) Apply power to the transport.

(2) With the head cover installed and no tape in path, measure and note the voltage across resistor R2 (EOT).

(3) Measure and note the voltage across resistor R9 (BOT).

(4) Acceptable Limits

- Resistor value 3300 ohms: ⩾0.5v
- Resistor value 10k ohms: ⩾1.5v

(5) Place tape in the tape path (between the sensor and reflector) and measure and note the voltage across resistor R2 (EOT). Ensure that reflective tab is not under the sensor.

(6) Measure and note the voltage across R9 (BOT).

(7) Acceptable Limits

- Resistor value 3300 ohms: <0.2v
- Resistor value 10k ohms: <0.6v

NOTE

If the voltage is 0.6v (nominal) with 3300 ohm resistor or 1.5v (nominal) with 10k ohm resistor with no tape in path, and greater than 0.2v with 3300 ohm resistor or 0.6v with 10k ohm resistor with no tape in path, the sensor is defective.

6.5.3.2 Adjustment Procedure

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

(1) Apply power to the transport.

(2) If resistor value of R2 and R9 is 3300 ohms, perform Steps (3), (4), and (7). If resistor value of R2 and R9 is 10k ohms, perform Steps (5), (6), and (7).

(3) With no tape in path, adjust R274 (EOT) until the voltage across R2 is 0.6v.

(4) With no tape in path, adjust R275 (BOT) until the voltage across R9 is 0.6v.

(5) With tape in path (off tab), adjust R274 (EOT) until the voltage across R2 is 0.55v.

(6) With tape in path (off tab), adjust R275 (BOT) until the voltage across R9 is 0.55v.

(7) Verify Steps (2)—(7) of the test procedure in Paragraph 6.5.3.1.

6.5.3.3 Related Adjustments

- None

6.5.4 CAPSTAN SERVO OFFSET

The Capstan Servo Offset potentiometer, R101, is located on the Tape Control PCBA, and should be checked and adjusted prior to adjusting tape speed. Refer to Figure 5-4 to locate test points and adjustments.

NOTE

The +5v and −5v regulators must be checked and adjusted prior to adjusting Capstan Servo Offset.

6.5.4.1 Test Configuration

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

(2) Apply power to the transport.

(3) Depress and release the LOAD control twice to establish interlocks and tension the tape, and to advance tape to the Load Point.

6.5.4.2 Test Procedure

(1) Using a digital voltmeter, measure and note the voltage between TP32 and TP17 on the Tape Control PCBA. Measured voltage is the output of the capstan motor amplifier.

(2) Acceptable Limits

- −0.20v minimum
- +0.20v maximum

6.5.4.3 Adjustment Procedure

When the acceptable limits are exceeded, perform the following adjustment.

(1) Establish the test configuration described in Paragraph 6.5.4.1.

(2) Using a digital voltmeter, measure the voltage between TP32 and TP17 on the Tape Control PCBA.

(3) Adjust variable resistor R101 to obtain 0v, nominal.

6.5.4.4 Related Adjustments

After adjustments are made to the Capstan Servo Offset, check and adjust the following:

(1) Tape Speed (Paragraph 6.5.6)

(2) Read Amplifier Gain (Paragraph 6.5.8)

(3) Capstan Servo Offset Paragraph 6.5.4)

(4) Rewind Speed (Paragraph 6.5.7)

6.5.5 RAMP TIMING

The four 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 chosen to ensure that the correct Start/Stop distance is obtained. Refer to Figure 5-4 to locate test points and adjustments.

NOTE

The +5v and −5v regulator voltages must be checked and adjusted prior to adjusting Ramp Timing.

6.5.5.1 Test Configuration

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

(2) Apply power to the transport.

(3) Depress and release the LOAD control twice to establish interlock and tension the tape, and to advance tape to the Load Point.

6.5.5.2 Test Procedure

(1) Connect the oscilloscope signal probe to TP20 on the Tape Control PCBA.

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

(3) Connect the transport ISLT0 line to ground at J101 pin J and place the transport On-line.

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

NOTE

Alternatively, the customer's computer or the Pertec Hand Held Tape Exerciser, Model TE-T03 (Part No. 897280-01) may be used to provide the 5 Hz square wave.

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

(6) Adjust oscilloscope vertical output control to display 0 to 100 percent of the ramp waveform over four large divisions of the oscilloscope graticule.

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

(8) Nominal values for ramp times are: 90 percent of actual speed

- ☐ 1.143 m/s (45 ips) transports
  - 6.5 milliseconds

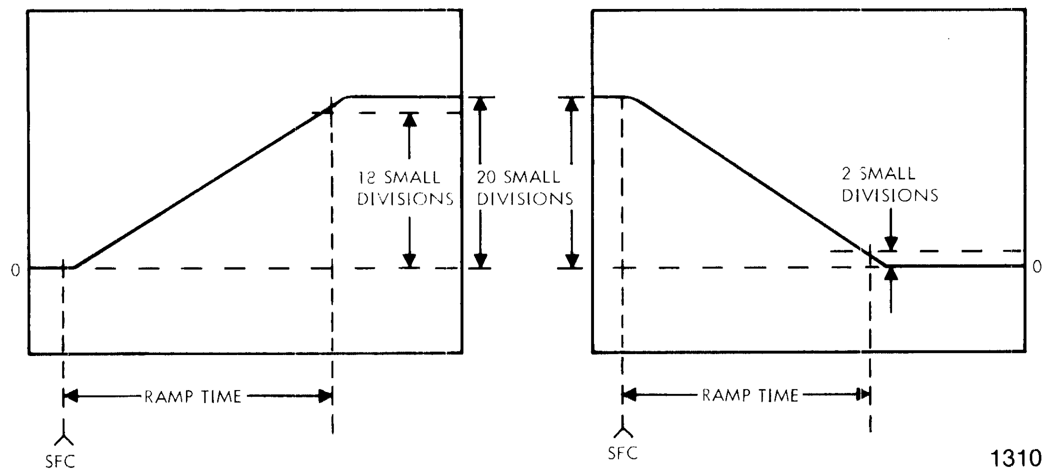

Figure 6-1. Ramp Levels and Timing

- ☐ 0.953 m/s (37.5 ips) transports
  - 8.0 milliseconds
- ☐ 0.635 m/s (25 ips) transports
  - 11.5 milliseconds
- ☐ 0.476 m/s (18.75 ips) transports
  - 15.5 milliseconds
- ☐ 0.317 m/s (12.5 ips) transports
  - 26.0 milliseconds

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

(10) With the oscilloscope adjusted as specified in Step (6), observe that the reverse ramp timing is within the limits specified in Step (8).

NOTE

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

6.5.5.3 Adjustment Procedure

(1) Establish test configuration described in Paragraph 6.5.5.1.

(2) Perform test procedure described in Paragraph 6.5.5.2, Steps (1) through (6).

(3) Adjust variable resistor R87 on Tape Control PCBA to obtain ramp adjustment tim specified in Paragraph 6.5.5.2, Step (8)

NOTE

Specified time results in oscilloscope display illustrated in Figure 6-1. Ramp adjustment time intersects 90 percent of ramp amplitude when accelerating and 10 percent 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 the oscilloscope display of reverse ramp. The time should be as specified in Paragraph 6.5.5.2, Step (8).

6.5.5.4 Related Adjustments

- None.

6.5.6 TAPE SPEED

The synchronous forward and reverse speeds are independently adjustable. Reverse speed is dependent upon forward speed, therefore, forward speed must be adjusted first.

NOTE

The +5v and −5v regulator voltages must be checked and adjusted prior to adjusting tape speed.

Two methods of tape speed adjustments are given. Paragraphs 6.5.6.1—6.5.6.3 describe the skew tape method; Paragraphs 6.5.6.4—6.5.6.9 describe the strobe disk method.

CAUTION

MASTER SKEW TAPES REQUIRE CAREFUL HANDLING. AVOID EXERTING EXCESSIVE TENSION ON MASTER SKEW TAPES. NEVER REWIND A MASTER SKEW TAPE.

6.5.6.1 Test Configuration — Skew Tape Method

(1) Load a master skew tape on the transport.

(2) Apply power to the transport.

(3) Depress and release the LOAD control twice to establish interlocks and tension tape, and to advance tape to the Load Point.

(4) Connect counter probe to TP101 on the Data PCBA. Set counter controls as required to monitor signal frequency over a one-second interval. (See Figure 5-1, 5-2 or 5-3 for Test Point Locations.)

6.5.6.2 Test Procedure — Skew Tape Method

(1) Set the Maintenance switch on the Tape Control PCBA so that tape moves forward.

(2) Adjust the sample interval of the counter timer to monitor the signal frequency over a one-second interval.

(3) Acceptable Limits

☐ 1.143 m/s (45 ips) transports

- 17820 Hz minimum
- 18540 Hz maximum

☐ 0.953 m/s (37.5 ips) transports

- 14850 Hz minimum
- 15150 Hz maximum

- ☐ 0.635 m/s (25 ips) transports
  - 9900 Hz minimum
  - 10100 Hz maximum
- ☐ 0.476 m/s (18.75 ips) transports
  - 7425 Hz minimum
  - 7575 Hz maximum
- ☐ 0.317 m/s (12.5 ips) transports
  - 4950 Hz minimum
  - 5050 Hz maximum

(4) Set the Maintenance switch on the Tape Control PCBA so that tape moves in reverse.

(5) With the counter set as specified in Step (2), monitor the signal frequency.

(6) Acceptable Limits

- ☐ 1.143 m/s (45 ips) transports
  - 17460 Hz minimum
  - 18540 Hz maximum
- ☐ 0.953 m/s (37.5 ips) transports
  - 14550 Hz minimum
  - 15450 Hz maximum
- ☐ 0.635 m/s (25 ips) transports
  - 9700 Hz minimum
  - 10300 Hz maximum
- ☐ 0.476 m/s (18.75 ips) transports
  - 7275 Hz minimum
  - 7725 Hz maximum
- ☐ 0.317 m/s (12.5 ips) transports
  - 4850 Hz minimum
  - 5150 Hz maximum

6.5.6.3 Adjustment Procedure — Skew Tape Method

When the forward or reverse tape speed exceeds the specified limits, perform the following adjustment procedure.

(1) Establish the test configuration described in Paragraph 6.5.6.1.

(2) Perform the test procedure described in Paragraph 6.5.6.2, Steps (1) and (2).

(3) Set the Maintenance switch on the Tape Control PCBA so that tape moves forward (or reverse when adjusting for reverse tape speeds).

(4) Adjust the variable resistor R96 (or R277 for reverse) on the Tape Control PCBA for the following counter timer values.

- ☐ 1.143 m/s (45 ips) transports
  - 18000 Hz
- ☐ 0.953 m/s (37.5 ips) transports
  - 15000 Hz

- ☐ 0.635 m/s (25 ips) transports
  - 10000 Hz
- ☐ 0.476 m/s (18.75 ips) transports
  - 7500 Hz
- ☐ 0.317 m/s (12.5 ips) transports
  - 5000 Hz

(5) Monitor the counter timer to ensure that the forward and reverse speeds are within the limits established in Paragraph 6.5.6.2. Repeat Steps (2)—(6) as required.

6.5.6.4 Tape Speed — Strobe Disk Adjustment

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, appears stationary. Table 6-4 lists the disks, synchronous tape speeds, and light source frequencies.

Some strobe disks have two or more 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, 0.317/0.635 m/s (12.5/25 ips). The outer ring is used when the fluorescent light source is 60 Hz; the inner ring is used when it is 50 Hz.

(2) Part No. 101744-03, 0.476/0.953 m/s (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 0.476 or 0.953 m/s (18.75 or 37.5 ips) from a 60 Hz light source. The middle ring is used at a tape speed of 0.953 m/s (37.5 ips) from a 50 Hz light source. The inner ring is used at a tape speed of 0.476 m/s (18.75 ips) from a 50 Hz light source.

(3) Part No. 101744-05, 0.572/1.143 m/s (22.5/45 ips). The outer ring is used at a speed of 1.143 m/s (45 ips) from a 60 Hz light source. The middle ring is used at a tape speed of 0.572 m/s (22.5 ips) from a 60 Hz light source. The inner ring is used at a tape speed of 0.572 m/s (22.5 ips) from a 50 Hz light source.

(4) Part No. 101744-08, 0.635 m/s (25 ips). The outer ring is used when the light source is 60 Hz. The inner ring is used when the light source is 50 Hz.

NOTE

Strobe disks are available from Pertec for non-standard transport speeds.

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 coarse speed adjustments (e.g., when replacing a Tape Control PCBA), refer to the test and adjustment procedures described in Paragraphs 6.5.6.1 through 6.5.6.3.

6.5.6.5 Test Configuration — Strobe Disk Method

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

(2) Apply power to the transport.

(3) Depress and release LOAD control twice to establish interlocks and tension the tape, and to advance tape to the Load Point.

(4) Illuminate the strobe disk located on the front of the capstan using a 60 Hz fluorescent light source.

Table 6-5
Strobe Disks

Pertec Part No.	Tape Speed	Light Source Frequency (Hz)
101744-02	0.317/0.635 m/s (12.5/25 ips)	60/50
101744-03	0.476/0.953 m/s (18.75/37.5 ips)	60/50
101744-05	0.572/1.143 m/s (22.5/45 ips)	60/50
101744-08	0.635 m/s (25 ips)	60/50

6.5.6.6 Test Procedure — Strobe Disk Method

(1) Establish the test configuration described in Paragraph 6.5.6.5.

(2) Set Maintenance switch on the Tape Control PCBA so that tape moves forward.

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

6.5.6.7 Adjustment Procedure — Strobe Disk Method

(1) Establish the test configuration described in Paragraph 6.5.6.5.

(2) Set the Maintenance switch on the Tape Control PCBA so that tape moves forward (or in reverse when adjusting reverse tape speeds).

(3) Adjust variable resistor R96 (or R277 for reverse) on the Tape Control PCBA until the strobe disk image appears stationary.

6.5.6.8 Tape Speed Adjustment — Reverse

The reverse speed adjustment is made by adjusting R277 on the Tape Control PCBA. Refer to Paragraph 6.5.6.

6.5.6.9 Related Adjustments — Skew Tape or Strobe Disk Method

(1) Read Amplifier Gain (Paragraph 6.5.8)

(2) Tension Arm Position Sensor (Paragraph 6.6.6)

6.5.7 REWIND SPEED

The rewind speed should be between the following limits.

- 4.572 m/s (180 ips) minimum
- 5.588 m/s (220 ips) maximum

NOTE

The +5v and −5v regulator voltages must be checked and adjusted prior to adjusting the tape speed.

6.5.7.1 Test Configuration

(1) Load an all 1s 32 c/mm (800 cpi) 9-track tape on the transport.

(2) Apply power to the transport.

(3) Depress and release the LOAD control twice to establish interlock and tension the tape, and to advance tape to the Load Point.

(4) Connect a counter timer to TP101 on the Data PCBA. (See Figure 5-1, 5-2, or 5-3 for test point location.)

(5) Adjust the sample interval of the counter timer to monitor the signal frequency over a one-second interval.

6.5.7.2 Test Procedure

(1) With the full all 1s tape on the takeup reel, depress and release REWD control.

(2) Monitor the frequency output.

(3) Acceptable Limits

- 72,000 Hz minimum
- 88,000 Hz maximum

6.5.7.3 Adjustment Procedure

(1) Establish the test configuration described in Paragraph 6.5.7.1.

(2) Perform the test procedure described in Paragraph 6.5.7.2.

(3) Adjust variable resistor R123 on the Tape Control PCBA to obtain a counter timer value of 80,000 Hz. This corresponds to 5.50 m/s (200 ips) rewind speed.

6.5.7.4 Related Adjustments

- None.

6.5.8 READ AMPLIFIER GAIN

The gain of each of the read amplifiers located on the Data PCBA is independently adjustable. To locate test points and adjustments, refer to Figure 5-1 for the T8X40A, 9-track, or Figure 5-2 for the T8X40A, 7-track, or Figure 5-3 for the T8X60A.

NOTE

The Tape Speed must be checked and adjusted prior to adjusting the Read Amplifier Gain.

Read amplifier gain may be determined by reading an all-1s tape which was recorded on the transport. Paragraph 6.5.8.5 details a method for generating an all-1s tape. A quality tape, such as 3M 777, should be used for this purpose.

6.5.8.1 Test Configuration

(1) Clean the head assembly and tape path as described in Paragraph 6.3.2.

(2) Load a pre-recorded all-1s tape.

(3) Apply power to the transport.

(4) Depress and release the LOAD control twice to establish interlock and tension the tape, and to advance tape to the Load Point.

6.5.8.2 Test Procedure

(1) Set Maintenance switch on the Tape Control PCBA so that tape moves forward.

(2) Using the oscilloscope signal probe, measure and record the peak-to-peak amplitude of the read amplifier waveforms viewed as follows.

NOTE

Oscilloscope vertical sensitivity should be set to display 2v per division.

- ☐ TP103—TP903 on the Data E19 PCBA
- ☐ TP103—TP703 on the Data E17 PCBA
- ☐ TP103—TP903 on the Data D1 PCBA

NOTE

For 7-track versions, circuits 200 and 300 are omitted; therefore, TP203 and TP303 are not functional.

(3) Acceptable limits (peak-to-peak using an all-1s tape)

- ☐ Model T8X40A
  - 9.20v minimum
  - 11.50v maximum
- ☐ Model T8X60A
  - 9.50v minimum
  - 13.50v maximum

6.5.8.3 Adjustment Procedure

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

(1) Establish the test configuration described in Paragraph 6.5.8.1.

(2) Set Maintenance switch on the Tape Control PCBA so that tape moves forward.

(3) View the peak-to-peak amplitude of the read amplifier waveforms. Use the oscilloscope signal probe. Adjust the appropriate potentiometers in accordance with the following.

- ☐ Data E19 PCBA. Adjust potentiometers R112—R912 to 10.5v peak-to-peak. View outputs of read amplifiers at TP103—TP903.
- ☐ Data E17 PCBA. Adjust potentiometers R112—R712 to 10.5v peak-to-peak. View outputs of read amplifiers at TP103—TP703.
- ☐ Data D1 PCBA. Adjust potentiometers R117—R917 to 12.0v peak-to-peak. View outputs of read amplifiers at TP103—TP903.

NOTE

For 7-track versions of the Data D1 PCBA, circuits 200 and 300 are omitted; TP203 and TP303 are not functional.

6.5.8.4 Related Adjustments

- None.

6.5.8.5 Generation of All-1s Tape

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. The read amplifier output should be adjusted as detailed in Paragraph 6.5.8.3. A read amplifier gain adjusted too high will result in amplifier saturation; gain set too low will increase the susceptibility to data errors due to dropouts. It is important that a good quality tape be used when generating an all-1s tape.

An all-1s tape may be generated as follows.

(1) Ensure that the head assembly and tape path are clean.

(2) Load a good quality work tape with a write enable ring in place, on the transport.

(3) Depress the LOAD switch twice to bring the transport to Load Point.

(4) Apply a ground to interface line ISWS (J101 pin K).

(5) Apply a ground to interface line ISLT (J101 pin J).

(6) Apply a ground to interface line ISFC (J101 pin C).

(7) Apply a ground to interface lines IWDP—IWD7 (J102 pins L, M, N, P, R, S, T, U, and V).

(8) Apply negative-going pulses (+3v to 0v) of 2 microseconds duration at the specified transfer rate to the interface line IWDS (J102 pin A).

(9) Maintain the transport in this record mode for approximately 3 minutes.

(10) Remove the signal source from the interface line IWDS and ISLT.

(11) Remove the ground from the interface line ISWS and ISFC.

(12) Depress and release REWD control; tape will rewind to the Load Point and stop.

6.5.9 READ CHARACTER GATE ADJUSTMENT

The duration of the read character gate is adjusted by means of variable resistors located on the Data PCBA. Nominally, the duration of the character gate is one-half of the character time. To locate test points and adjustments, refer to Figure 5-1 for the T8X40A, 9-track, or Figure 5-2 for the T8X40A, 7-track, or Figure 5-3 for the T8X60A.

Note that only one density, 32 c/mm (800 cpi) is relevant to the 9-track Data D1 and E19 PCBAs. Dual density operation can be selected on the 7-track Data D1 and E17 PCBAs through use of the HI DEN manual control, or remotely through use of the optional IDDS interface line.

There are three combinations of two densities available for 7-track; 32/22, 32/8 and 22/8 c/mm (800/556, 800/200, and 556/200 cpi). The particular combination in any transport will depend upon the version of the circuit board.

NOTE

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

6.5.9.1 Test Configuration

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

NOTE

An all-1s tape recorded at low density should be used. Refer to Paragraph 6.5.8.5 for generating an all-1s tape.

(2) Apply power to the transport.

(3) Depress and release the LOAD control twice to establish interlock and tension tape, and to advance tape to the Load Point.

6.5.9.2 Test Procedure

(1) Set the Maintenance switch on the Tape Control PCBA to move tape forward.

(2) Using the oscilloscope signal probe, measure and note the duration of the waveform observed at TP11 on the Data D1 or TP9 on the Data E17 or E19 PCBAs.

NOTE

The oscilloscope should be set to trigger on the positive-going edge of the observed waveform.

(3) Calculate the ideal character gate duration using the following formula.

$$t \text{ (microsecond)} = \frac{10^6}{2\,DV} = \text{one-half character time}$$

where

D = density in cpi (recorded tape)

V = tape speed in ips

(4) Acceptable limits (given for 0.635 m/s (25 ips) only; for other speeds, see Step (3) and calculate the limits based on ± 5 percent of nominal).

- ☐ 32 c/mm (800 cpi) 9-track Data E19 or D1 PCBAs.
  - 23.8 microseconds minimum
  - 26.2 microseconds maximum
- ☐ 22 c/mm (556 cpi) 7-track Data E17 or D1 PCBAs.
  - 27.8 microseconds minimum
  - 34.2 microseconds maximum
- ☐ 8 c/mm (200 cpi) 7-track Data E17 or D1 PCBAs.
  - 95.0 microseconds minimum
  - 105.0 microseconds maximum

6.5.9.3 Adjustment Procedure (7-Track Transports)

When the acceptable limits are exceeded, perform the following adjustment.

(1) Establish test configuration described in Paragraph 6.5.9.1.

(2) Set the Maintenance switch on the Tape Control PCBA so tape moves forward.

(3) Select the lower of the two packing densities (HI DEN control extinguished) on transports equipped for dual-density operation.

(4) Connect the oscilloscope signal probe to TP11 on the Data D1 or TP9 on the Data E17 PCBA.

(5) Connect the oscilloscope reference probe to TP3 on the Data E17 or Data D1 PCBA.

(6) Adjust potentiometer R32 on the Data E17 or R36 on the Data D1 PCBA to display a character gate waveform according to speed and density as follows (given for 0.635 m/s (25 ips) only; see Paragraph 6.5.9.2 for calculating other speeds).

- ☐ 22 c/mm (556 cpi)
  - 31.0 microseconds
- ☐ 8 c/mm (200 cpi)
  - 100.0 microseconds

(7) Select the higher of the two densities (HI DEN illuminated) on versions equipped for dual density operation.

(8) Adjust potentiometer R27 on the Data E17 or R33 on the Data D1 PCBA to display a character gate waveform according to speed as follows (given for 0.635 m/s (25 ips) only; see Paragraph 6.5.9.2 for calculating other speeds).

- ☐ 32 c/mm (800 cpi)
  - 25 microseconds

NOTE

The foregoing adjustments must be made in the order specified.

6.5.9.4 Adjustment Procedure (9-Track Transports)

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

(1) Establish test configuration described in Paragraph 6.5.9.1.

(2) Set the Maintenance switch on the Tape Control PCBA so tape moves forward.

(3) Connect the oscilloscope signal probe to TP11 on the Data D1 or TP9 on the Data E19 PCBA.

(4) Connect the oscilloscope reference probe to TP3 on the Data E19 or Data D1 PCBA.

(5) Adjust potentiometers R27 and R32 on the Data E19, or R33 and R36 on the Data D1 PCBA to display the positive-going portion of the character gate waveform as follows (given for 0.635 m/s (25 ips) only; for other speeds, see Paragraph 6.5.9.2).

- ☐ 32 c/mm (800 cpi)
  - 25.0 microseconds

6.5.9.5 Related Adjustments

- None.

6.6 MECHANICAL ADJUSTMENT

6.6.1 TENSION ARM LIMIT SWITCHES

There are three limit switches used in the transport; these are the tension arm interlock switch, the load limit switch, and the gear motor limit switch.

When adjusting these switches it will be necessary to move the tension arms up or down. The arms can be moved into the operating region only by applying power to the transport. Preliminary preparation of the transport is accomplished as follows.

CAUTION

NEVER EXERT PRESSURE ON TENSION ARM ROLLER ATTEMPTING TO MOVE TENSION ARM INTO OPERATING REGION. DAMAGE TO ARM RETRACTOR ASSEMBLY OR ROLLER GUIDE SHAFT MAY RESULT.

(1) Remove both tape reels.

(2) Block the light path to the Tape In Path (TIP) reflector.

(3) Depress and release the LOAD control.

(4) Remove power from the transport when the arms have reached the end of their operating range.

6.6.2 TENSION ARM INTERLOCK SWITCH

6.6.2.1 Test Procedure

The tension arm interlock switch is located on the supply tension arm bearing housing and is actuated by the cam interlock on the tension arm shaft. Proper adjustment of the arm interlock is checked as follows.

(1) Prepare the transport as described in Paragraph 6.6.1.

(2) Disconnect connector P5 (supply reel motor) and connector P4 (takeup reel motor) from the Tape Control PCBA.

(3) Manually rotate the supply arm from its retracted position through its complete range to a position where the supply arm contacts the upper stop. Observe the following conditions.

- At rest, with the switch arm roller in contact with the low point of the cam, the switch contacts are open.
- When the center line of the supply arm is 3.81 mm (0.15-inch) past the first mark on the tape deck (visible through the arm slot), the switch arm roller should be contacting the high point of the cam. At this point, the switch contacts should close.
- When the supply arm approaches within 3.81 mm (0.15-inch) of the third mark (uppermost) on the tape deck (visible through the arm slot), the switch arm roller should still be in contact with the high point of the cam. At this point, the switch contacts should be closed.

NOTE

The operating range of the interlock switch is between the first and third marks on the tape deck (while the switch arm is in contact with the high point of the cam).

6.6.2.2 Adjustment Procedure

If the test procedure performed in Paragraph 6.6.2.1 indicates that an adjustment is required, proceed as follows.

(1) Loosen the cam retaining setscrew located in the hub of the cam.

(2) Reposition the cam on its shaft until the switch arm is in contact with the low point of the cam and the switch contacts are open.

(3) Torque the cam retaining setscrew to 1.69 newton-metres (15 inch-pounds).

CAUTION

SETSCREW MUST BE TORQUED TO 1.69 NEWTON-METRES (15 INCH-POUNDS) TO PREVENT ROTATION OF CAM WHEN SUPPLY TENSION ARM CONTACTS EITHER UPPER OR LOWER STOP.

(4) If the adjustment in Step (2) cannot be made, loosen the two switch mounting screws and reposition the switch to a location where the requirements of Paragraph 6.6.6.1 Step (3) can be met.

6.6.2.3 Replacement Procedure

Replacement of the interlock switch is accomplished as follows.

(1) Remove power from the transport.

(2) Remove two mounting screws which secure limit switch to mounting plate.

(3) Remove switch and connectors; note switch terminals and color coding of wires.

(4) Install a new switch. Ensure the requirements of Paragraph 6.6.2.1 can be met.

(5) Connect wiring to new switch observing proper connections noted in Step (3).

6.6.3 LOAD LIMIT SWITCH

The load limit switch is mounted on the tape deck and is accessible from the front. The load limit switch is actuated by the supply tension arm and is used to turn off the arm gear motor when the supply arm reaches the load position.

6.6.3.1 Adjustment Procedure

The load limit switch should be adjusted so the normally open switch contacts are closed when the supply arm is in the maximum extended load position. Adjustment of the switch is made by loosening the switch mounting screws and sliding the switch mounting bracket to the desired position and then retightening the screws.

6.6.3.2 Replacement Procedure

Replacement of the load limit switch is accomplished as follows.

(1) Remove power from the transport.

(2) Remove the load limit switch connector from the cable harness.

(3) Disconnect the leads and remove the switch assembly from the deck.

(4) Place the new switch near the center of the adjustment region.

(5) Connect the leads to the new switch.

(6) Check that the normally open switch contacts are closed when the arms are at the maximum extended load position. Readjust if necessary.

(7) Connect the cable harness.

6.6.4 GEAR MOTOR LIMIT SWITCH

The gear motor limit switch is attached to the gear motor mounting plate and is used to indicate to the relevant logic that the arm retractor has completed a full cycle. Refer to Figure 6-2 in conjunction with the following adjustment procedure.

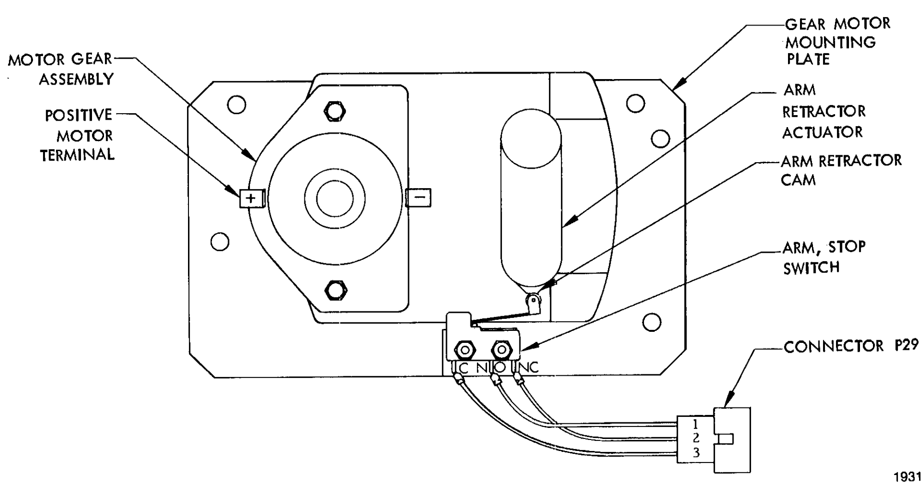

Figure 6-2. Gear Motor Limit Switch Assembly, Rear View

6.6.4.1 Adjustment Procedure

The gear motor limit switch should be adjusted so that when the gear motor is cycling, the normally open switch contacts are closed when the switch roller is approximately at the center of the arm retractor cam. Adjustments are made by loosening the switch mounting screws and rotating the switch. Two holes in the rear of the mounting plate provide access to the screws.

CAUTION

DO NOT ATTEMPT TO REMOVE OR INSTALL GEAR MOTOR ASSEMBLY WITH TENSION ARMS IN ANY POSITION OTHER THAN FULLY RETRACTED. DAMAGE TO GEAR TRAIN OR TENSION ARMS COULD RESULT.

6.6.4.2 Replacement Procedure

Replacement of the gear motor limit switch is accomplished as follows.

(1) Remove both tape reels and retract both tension arms.

(2) Remove power from the transport.

(3) Disconnect connector P29 from the cable harness.

(4) Remove the leads from the limit switch, noting terminal and wire colors; remove the old switch.

(5) Install the new switch and connect the leads to the switch.

(6) If adjustment is required, loosen and rotate the switch until the contact closes.

(7) Reconnect P29 to the cable harness.

6.6.5 GEAR MOTOR ASSEMBLY

The gear motor assembly (Pertec Part No. 500-0002) is replaced as a complete assembly. The arm retractor actuator and the limit switch cable assembly need not be replaced unless damaged. Removal and replacement procedures are as follows (refer to Figure 6-2 for identification of parts).

6.6.5.1 Removal of Gear Motor Assembly

(1) Remove both tape reels and retract tension arms.

(2) Remove power from the transport.

(3) Disconnect connector P29 from the cable harness.

(4) Remove the spring-loaded wire linkage cables from the arm retractor actuator to each driver arm pulley.

(5) Disconnect the wires to the motor terminals; note polarity and color coding.

(6) Remove the four mounting screws securing the gear motor assembly to the mounting plate; remove the entire assembly.

(7) Remove the arm retractor actuator from the output shaft.

6.6.5.2 Replacement of Gear Motor Assembly

Replacement of the gear motor assembly is made as follows. When the new assembly is received, the flat on the output shaft of the gear motor may not be in the desired operating position relative to the retractor assembly.

CAUTION

DO NOT ATTEMPT TO ROTATE THE OUTPUT SHAFT BY HAND AS DAMAGE TO THE GEAR TRAIN MAY RESULT.

(1) Install the arm retractor actuator on the gear motor output shaft. Tighten the setscrew in the arm retractor to the flat on the output shaft; torque to 1.13 newton-metres (10 inch-pounds). (Disregard the position of the arm retractor relative to the switch actuating arm.)

(2) Install the gear motor assembly to the mounting plate.

(3) Connect the negative wire to the negative terminal of the motor.

NOTE

Do not connect the positive (red) wire at this time.

(4) Connect arm limit switch connector P29 to the cable harness connector.

(5) Insert a nonreflective card between the photosensor and the reflector.

(6) Apply power to the transport.

(7) Depress and release the LOAD control.

(8) Momentarily connect the positive (red) wire to the motor. The arm actuator roller will rotate to the center of the cam lobe and the motor will stop. (The position of the arm actuator is illustrated in Figure 6.2.)

(9) If the gear motor limit switch fails to stop the gear motor, loosen the mounting screws and position the switch to a point that, when the switch actuating arm is depressed by the retractor actuator cam, power to the motor is removed.

(10) Tighten the switch mounting screws.

(11) Connect the positive (red) wire to the positive motor terminal. Allow the retractor actuator to again rotate until the switch roller is actuated by the cam lobe on the arm retractor actuator. At this position, power should be removed from the motor.

(12) Remove power from the transport.

6.6.5.3 Return Transport to Operational Status

(1) Reinstall the spring-loaded wire linkage cables to each tension arm pulley.

(2) Remove the nonreflective card from between the photosensor and reflector.

(3) Install the tape reels on the transport.

(4) Thread the tape along the tape path and onto the takeup reel.

(5) Apply power to the transport.

(6) Depress and release LOAD control once. Observe that each tension arm is positioned at a point about three-quarters through its range.

(7) Depress and release LOAD control again. Observe forward tape motion until BOT tab is reached.

(8) Depress and release LOAD control once more. There should be no movement of tape or tension arms.

(9) Make an overall inspection of the transport for foreign material; ensure that the cable harness routing does not interfere with moving parts.

6.6.6 TENSION ARM POSITION SENSOR

There are two tension arm position sensors; one on the takeup arm, and the second on the supply arm. The sensor outputs are connected to the reel servo amplifier inputs on the Tape Control PCBA. Refer to Figure 5-5 to locate test points and adjustments.

NOTE

Ensure that +5v and −5v Regulators, Ramp Timing, and Tape Speeds are correct per Paragraphs 6.5.2, 6.5.5, and 6.5.6, before adjusting the tension arm position sensors.

6.6.6.1 Preliminary Adjustment

Tension arm position sensors are initially adjusted as follows.

(1) Remove both tape reels. Position both tension arms in their operating region as described in Paragraph 6.6.1.

(2) Remove power from the tranport.

(3) Loosen the No. 10-32 self-locking nut securing the optical shutter. Ensure that there is sufficient friction to prevent the setting from changing when the screw is tightened.

(4) Apply power to the transport. Establish an environment which ensures that the tension sensors are shielded from high ambient light. Failure to do so might result in a shift in the arm operating region when the unit is rack-mounted.

(5) To place the shutters in the correct position, rotate each shutter with the tension arm placed over the center mark on the surface of the tape deck until +0.6v is read at TP19 for the supply reel or TP24 for the takeup reel. Tighten the 10-32 self-locking nut to 2.26 newton-metres (20 in-lbs). Do not disturb the shutter setting.

(6) Remove power from the transport.

(7) Load tape on transport.

(8) Perform electrical adjustments detailed in Paragraphs 6.6.6.2 and 6.6.6.3.

6.6.6.2 Takeup Arm Adjustment

When the preliminary adjustments are completed, proceed as follows.

(1) Ensure that the takeup reel is nearly empty.

(2) Alternately toggle the Maintenance switch on the Tape Control PCBA to shuttle tape back and forth.

(3) If Step (2) causes loss of tape tension because the takeup arm exceeds its operating range, retension tape by depressing LOAD. Adjust potentiometer R157 on the Tape Control PCBA 5 turns CCW so as to reduce the total arm movement. Repeat this step as required.

(4) Adjust potentiometer R157 on the Tape Control PCBA until the outside edge of the takeup arm is in line with the outside marks on the surface of the tape deck.

NOTE

The actual arc of movement may not coincide with that specified because the shutter may not be perfectly centered at this point in the procedure.

(5) Adjust R159 on the Tape Control PCBA so that the arc of the arm movement is equidistant between the marks on both of the center marks.

NOTE

The arm position in Forward and Reverse motion should remain within the limits of the two outside marks on the tape deck.

6.6.6.3 Supply Arm Adjustment

When the preliminary adjustments are completed, proceed as follows.

(1) Ensure that the supply reel is nearly empty.

(2) Alternately toggle the Maintenance switch on the Tape Control PCBA to shuttle tape back and forth.

(3) If Step (2) causes loss of tape tension because the supply arm exceeds its operating range, retension tape by depressing the LOAD control. Adjust potentiometer R192 on the Tape Control PCBA 5 turns CCW to reduce the total supply arm movement; repeat this step as required.

(4) Adjust potentiometer R192 on the Tape Control PCBA until the outside edge of the supply arm is in line with the outside marks on the surface of the tape deck.

NOTE

The actual arc of movement may not coincide with that specified because the shutter may not be perfectly centered at this point in the procedure.

(5) Adjust R194 on the Tape Control PCBA so the arc movement is within the limits of the center mark.

NOTE

The arm position during Forward and Reverse motion should remain within the limits of the two outside marks on the tape deck.

6.6.6.4 Tension Arm Sensor Replacement

The tension arm optical sensors are replaced as follows.

(1) Rewind tape and remove the tape reel from the transport.

(2) Retract and position the tension arms in their operating regions as described in Paragraph 6.6.1.

(3) Remove power from the transport.

(4) Remove the harness connector at the arm sensor.

(5) Loosen the 10-32 self-locking nut which secures the optical shutter to the tension arm shaft.

(6) Rotate the shutter to clear the right-hand countersunk screw which retains the arm sensor PCBAs to the standoffs.

(7) Remove the right-hand screw. Manually rotate the tension arm to gain access to the left-hand screw.

(8) Remove the left-hand mounting screw and remove the sensor assembly.

(9) Mount the replacement assembly in the above (reverse) order. Torque the 10-32 self-locking nut on the tension arm shaft to 2.26 newton-metres (20 inch-pounds).

NOTE

The F6 mark is visible when the supply arm shutter is correctly installed.

(10) Partially tighten the shutter in place.

(11) Plug the harness connector into the arm sensor connector.

(12) Perform the relevant adjustment procedures in Paragraphs 6.6.6.1, 6.6.6.2, and 6.6.6.3.

6.6.7 TAPE PATH ALIGNMENT

Paragraphs 6.6.8 through 6.6.12 detail the procedures for tape path alignment of the T8000A series transports.

6.6.8 UNIVERSAL TAPE PATH ALIGNMENT TOOL

The Pertec Universal Tape Alignment Tool (Part No. 102382-01) is used for alignment of the supply and takeup guide rollers to the head guides. This tool is used to establish tension arm guide roller parallelism and tape reel positioning. The alignment tool is a 2-piece tool referred to in this manual as *U-frame* and *crossbar*.

Since this tool can be used on all Pertec tape transports, not all hole combinations or tool positions are used on any one transport. Only those holes required to accomplish tape path alignment on this model transport will be shown on the supporting figures.

CAUTION

THE PERTEC ALIGNMENT TOOL IS A PRECISION INSTRUMENT. CARE MUST BE TAKEN TO AVOID DAMAGE TO ALL CONTACTING SURFACES. STORE THE TOOL IN THE PROTECTIVE CONTAINER.

6.6.9 TAPE PATH ALIGNMENT — TAKEUP

Refer to Figure 6-3 in conjunction with the following takeup alignment procedures.

6.6.9.1 Transport Preparation

(1) With tape loaded and the transport operationally ready, perform an unload operation (refer to Paragraph 3.3.2).

NOTE

Tension arms are now properly positioned for removal of the overlay.

(2) Remove the head covers which enclose the head, tape guides, and tape cleaner by firmly grasping each cover and pulling out and away from the transport.

(3) Remove the supply reel from the supply hub.

(4) Remove the takeup reel from the takeup hub by loosening the two Phillips-head screws on the face plate of the hub.

(5) Remove the overlay as follows.

- Disconnect the power source from the transport.
- Remove the door stop screws from the deck casting.
- Remove the eight 4-40 flathead screws.
- Free the switch housing from the tape deck by removing the four mounting screws; access is made from the rear of the deck.
- From the rear of the tape deck, extend the slack in the cable harness through the access hole so that the switch housing is free of the tape deck.
- Rotate the switch housing to a position where the overlay can pass over the switch housing; remove the overlay.
- Return the switch housing to its operating position and secure in place. Ensure that green wire from the power switch is grounded to the tape deck.

NOTE

Check that wiring to all switches is in place and is securely connected before applying power to the transport.

- Reinstall the supply and takeup reels. Torque the Phillips-head screws on the takeup hub to 0.226 newton-metres (2 inch-pounds) after the reel is firmly seated on the hub.

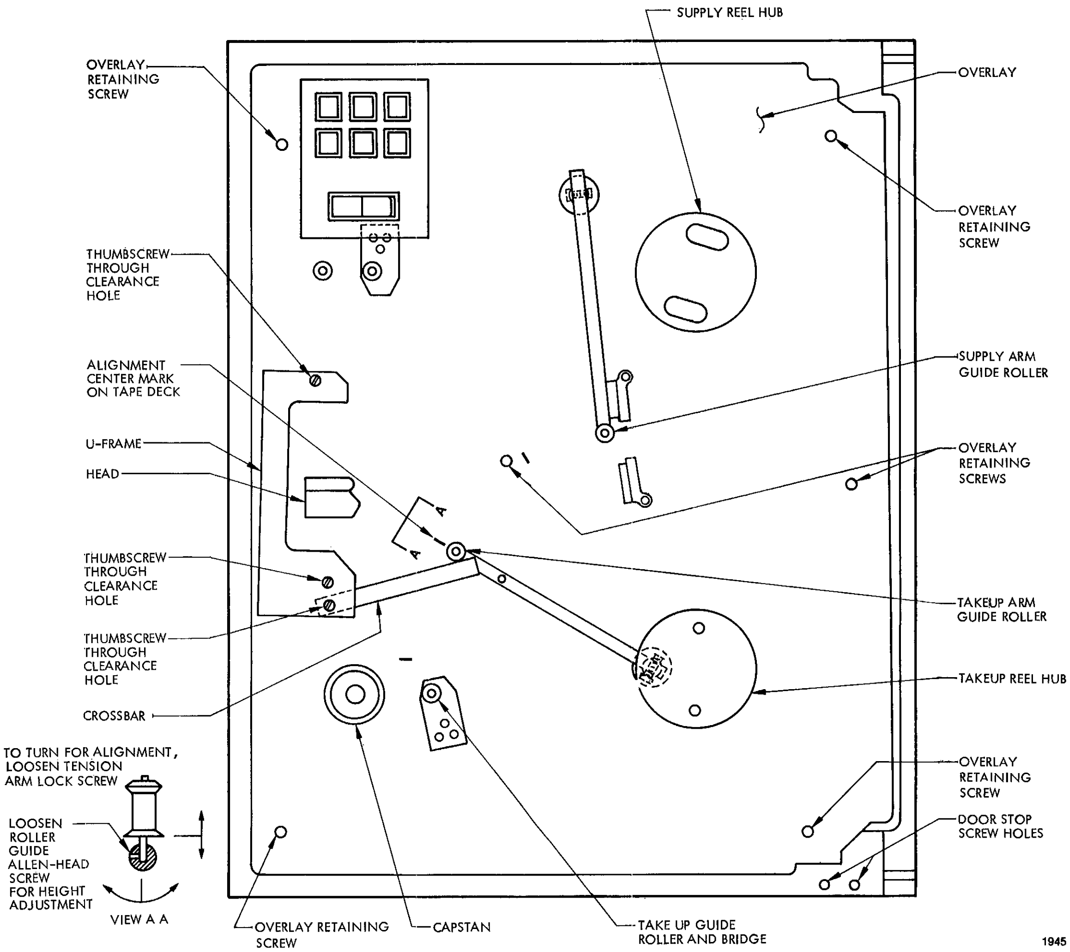

Figure 6-3. Takeup Tape Path Alignment

(6) Insert a card with a nonreflective surface between the reflecting surface and sensing elements of the photosensor.

(7) Apply power to the transport.

(8) Depress and release the LOAD control; the tension arms will move into their operating positions and stop.

(9) Remove power from the transport.

(10) Remove the head guide caps; prevent loosening of the guide post retaining screws (from the rear of the transport) by engaging and holding an Allen wrench in the socket heads.

(11) Install the U-frame to the head guides using the thumbscrews.

- Pass the thumbscrew through the U-frame clearance hole and thread into the upper head guide.
- Pass the thumbscrew through the U-frame clearance hole and thread into the lower head guide.

CAUTION

ENSURE THAT MAGNETIC HEAD CABLE IS NOT DAMAGED BY EDGE OF U-FRAME DURING INSTALLATION.

6.6.10 TAKEUP ARM GUIDE ROLLER

6.6.10.1 Takeup Arm Guide Roller Height Check

(1) Install the crossbar to the U-frame by passing a thumbscrew through the U-frame clearance hole and threading it into the crossbar hole.

(2) Swing the takeup arm away from its stop to the center mark on the deck.

(3) Position the crossbar so contact is made between the bottom of the guide roller and the upper surface of the crossbar. Tighten the thumbscrew finger tight.

(4) Determine that the crossbar contacts the center of the tape traction area of the guide roller. If the crossbar is not centered, a guide roller height adjustment is required.

(5) Return the takeup arm to its rest position.

6.6.10.2 Takeup Arm Guide Roller Height Adjustment

If the takeup arm guide roller height check indicates that an adjustment is required, proceed as follows.

(1) Swing the takeup arm away from its stop to the center mark on the tape deck.

(2) Position the crossbar so contact is made between the bottom of the guide roller and the upper surface of the crossbar. Tighten the thumbscrew finger tight.

(3) With the crossbar in place, loosen the takeup arm guide roller Allen-head screw located near the end of the tension arm (refer to Figure 6-3, view A-A).

(4) Center the tape traction area of the guide roller on the crossbar when the guide roller is positioned at the center mark on the deck.

(5) When the correct height is established, tighten the takeup Allen-head screw.

6.6.10.3 Takeup Arm Guide Roller Parallelism Check

(1) Swing the takeup arm away from its stop to the center mark on the deck.

(2) Position the crossbar so contact is made between tape traction area of the guide roller and upper surface of the crossbar. Tighten thumbscrew finger tight.

(3) Sight along the upper surface of the crossbar that is now in contact with the tape traction area of the guide roller. Observe an equal contact between the tape traction area of the guide roller and the upper surface of the crossbar.

(4) If a light path is observed between the two surfaces, an adjustment is required.

6.6.10.4 Takeup Arm Guide Roller Parallelism Adjustment

If the takeup arm guide roller parallelism check indicates that an adjustment is required, proceed as follows.

(1) Insert an Allen wrench in the Allen-head screw on the takeup arm hub to prevent the screw from turning. Loosen the nut using an 11/32 wrench.

(2) Swing the takeup arm until contact is made between the upper surface of the crossbar and the tape traction area of the guide roller. Tighten the thumbscrew finger tight.

(3) Sight along the upper surface of the crossbar that is now in contact with the tape traction area of the guide roller.

(4) Rotate the tension arm by inserting a small diameter rod into the hole in the takeup arm near the guide roller until the face of the guide roller and the contacting surface of the crossbar are parallel.

(5) Test by sighting between the two surfaces. Observe a minimum amount of light between the parallel surfaces.

(6) Torque the nut on the tension arm Allen-head screw to 2.26 newton-metres (20 inch-pounds), nominal.

(7) Recheck parallelism of the guide roller.

6.6.10.5 Takeup Hub Height Check

(1) Install an empty takeup reel on the takeup hub. Torque the two Phillips-head screws on the face of the hub to 0.226 newton-metres (2 inch-pounds).

(2) Position the crossbar between the flanges of the takeup reel. Locate the crossbar so the upper surface is in the same plane as the center line of the hub. Tighten the thumbscrew finger tight.

(3) Rotate the takeup reel and determine that the reel flanges are parallel to the crossbar.

(4) While rotating the reel, observe an equal clearance between the crossbar and the reel flanges. If the clearances are not equal, ensure that the reel flanges are not warped or distorted; also determine that the takeup reel is fully seated on the hub.

(5) If one edge of the crossbar is closed to one reel flange, the height of the hub must be adjusted.

6.6.10.6 Takeup Hub Height Adjustment

From the rear of the transport, locate the takeup reel bearing assembly which encloses the takeup reel hub bearings. Note that there is an access hole provided between the front and rear hub bearings. Through this hole observe the collar which secures the hub shaft in place. Rotate the shaft until an Allen-head setscrew appears. This setscrew is used to clamp the collar to the shaft which, in turn, establishes the height of the hub.

To adjust the takeup hub height, proceed as follows.

(1) Loosen the Allen-head screw located on the collar.

(2) With the crossbar in place between the flanges on the reel, adjust the hub so the reel flanges are equally spaced on either side of the crossbar.

(3) Tighten the Allen-head screw on the shaft collar.

(4) Recheck the clearance between reel flanges and the crossbar to ensure the clearances are equal.

(5) Loosen the thumbscrew to allow the crossbar to clear the reel flanges and remove the tape reel.

6.6.10.7 Capstan Height Check and Adjustment

(1) Reposition the crossbar between the capstan and the takeup bridge guide roller; align, and thread the thumbscrew into the U-frame clearance hole and the crossbar hole.

(2) Position the crossbar so that the lower surface contacts the tape transporting area of the capstan. Tighten the thumbscrew.

(3) Observe an equal display of tape traction area on each side of the crossbar.

(4) If the capstan does not run true, replace the capstan.

(5) If the capstan requires centering to the left or right side of the crossbar, loosen the setscrew in the capstan hub and adjust the height to conform to the requirements of Step (3).

6.6.10.8 Takeup Bridge Roller Height Check

(1) Loosen the crossbar thumbscrew.

(2) Swing the crossbar upward so that the upper surface contacts the tape transporting area of the takeup bridge roller. Tighten the thumbscrew finger tight.

(3) Determine that the crossbar contacts the center of the tape traction area of the roller. If the roller is not centered on the crossbar, a height adjustment is required.

6.6.10.9 Takeup Bridge Roller Height Adjustment

When a height adjustment is required, proceed as follows.

(1) Loosen the thumbscrew and free the crossbar from the roller.

(2) From the rear of the transport, gain access through the deck to the Phillips-head screw which secures the roller standoff to the bridge. Loosen the screw and remove the standoff. Retain all original shims.

(3) Utilizing shims, reinstall and adjust the standoff to the bridge until the tape traction area of the roller is centered on the crossbar when the crossbar is contacting the tape transporting area of the roller.

NOTE

Tighten the standoff screw each time shims are removed or added.

6.6.10.10 Takeup Bridge Roller Parallelism Check and Replacement

(1) With the crossbar positioned where the upper surface contacts the tape transporting area of the takeup bridge roller, tighten the thumbscrew finger tight.

(2) Sight along the crossbar in contact with the roller. Observe an equal contact between the two surfaces.

(3) If a light path is observed, replace the bridge roller assembly.

NOTE

If replacement of the bridge roller assembly is made, repeat the height check in Paragraph 6.6.10.8.

6.6.10.11 Return Transport to Operational Status.

(1) Remove the crossbar and U-frame from the transport and store in the protective case while not in use.

(2) Replace the caps on the head guides.

(3) Install a reel of tape on the supply hub and thread tape along the tape path and onto the takeup reel.

(4) Apply power to the transport; tape is now tensioned with the tension arms in the operating position.

(5) Perform an unload operation (refer to Paragraph 3.3.2).

NOTE

The tension arms are now properly positioned for installation of the overlay.

(6) Remove the supply and takeup reels from the transport.

(7) Replace the overlay.

- Remove power from the transport.
- From the rear of the tape deck, remove mounting screws to free switch housing.

- From the rear of the tape deck, extend the slack in the cable harness through the access hole so the switch housing is free of the deck.
- Rotate the switch housing to a position where the overlay can be passed over it.
- Press the overlay firmly against the tape deck.

NOTE

Check that wiring to all switches is in place and securely connected before applying power to the transport.

(8) Install the supply and takeup reels. After the takeup reel is firmly seated on the hub, torque the Phillips-head screws on the takeup hub face plate to 0.226 newton-metres (2 inch-pounds).

(9) Remove the protective covering from the recording surface of the head.

(10) Perform a general inspection of the transport for the presence of foreign material and for the condition of belts, wiring, and all connections.

(11) Replace the head covers.

6.6.11 TAPE PATH ALIGHMENT — SUPPLY

Refer to Figure 6-4 in conjunction with the following supply alignment procedures.

6.6.11.1 Transport Preparation

(1) With tape loaded and the transport operationally ready, perform an unload operation (refer to Paragraph 3.3.2).

NOTE

Tension arms are properly positioned to remove overlay.

(2) Remove the head covers which enclose the head, tape guides, and tape cleaner by firmly grasping each cover and pulling out and away from the transport.

CAUTION

PROTECT HEAD RECORDING SURFACE BY TAPING A PAD OF SOFT NONABRASIVE MATERIAL OVER HEAD.

(3) Remove the supply reel from the supply hub.

(4) Remove the takeup reel from the takeup hub by loosening the two Phillips-head screws on the face plate of the hub.

(5) Remove the overlay as follows.

- Disconnect the power source from the transport.
- Remove the door stop screws from the deck casting.
- Remove the six 4-40 flathead screws.
- Free the switch housing from the tape deck by removing the four mounting screws; access is made from the rear of the tape deck.
- From the rear of the tape deck, extend the slack in the cable harness through the access hole so the switch housing is free of the tape deck.
- Rotate the switch housing to a position where the overlay can pass over the switch housing; remove the overlay.
- Return the switch housing to its operating position and secure in place. Ensure that the green wire from the power switch is grounded to the tape deck.

NOTE

Check that wiring to all switches is in place and is securely connected before applying power to the transport.

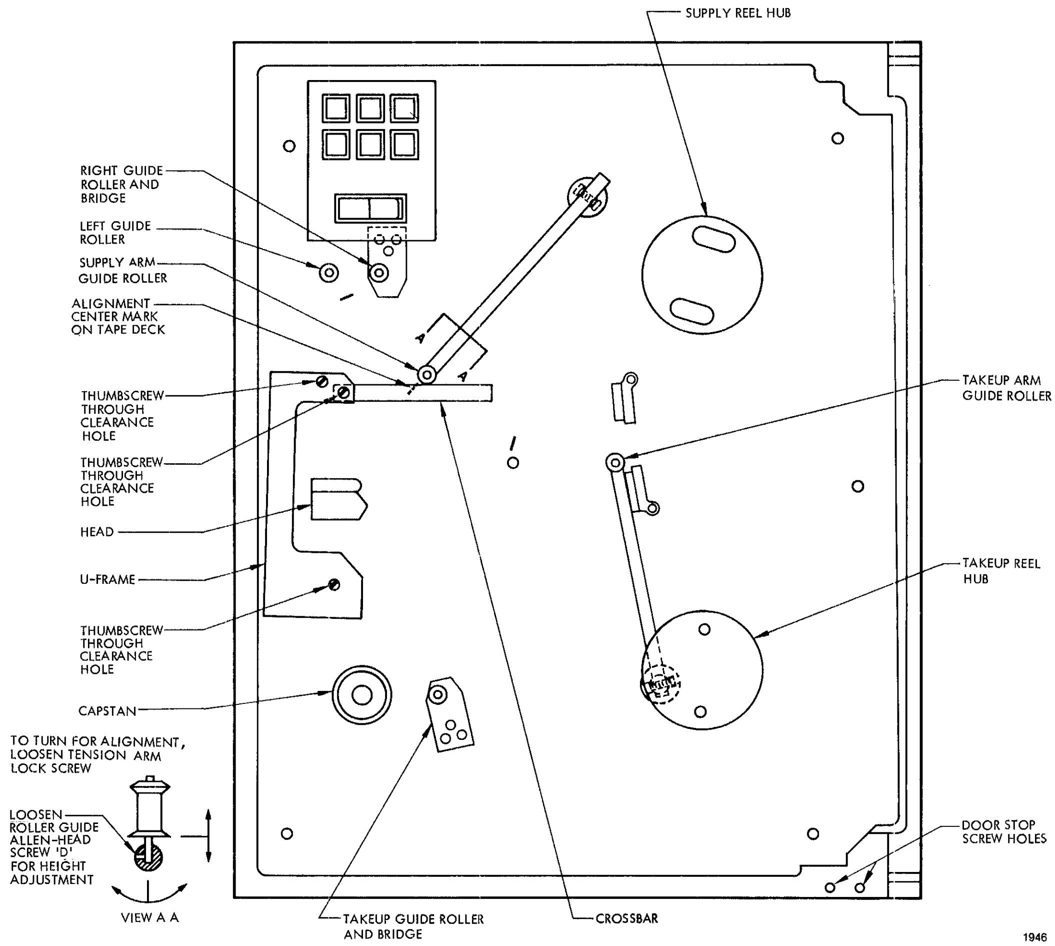

Figure 6-4. Supply Tape Path Alignment

- Reinstall the supply and takeup reels. Torque the Phillips-head screws on the hub to 0.226 newton-metres (2 inch-pounds) after the reel is firmly seated.
- Reconnect the transport to the power source.

(6) Insert a card with a nonreflective surface between the reflecting surface and sensing elements of the photosensor.

(7) Apply power to the transport.

(8) Depress and release the LOAD control; the tension arms will move into their operating positions and stop.

(9) Remove power from the transport.

(10) Remove the caps from the head guide. Prevent loosening of the guide post retaining screws (from the rear of the transport) by engaging and holding an Allen wrench in the socket heads.

(11) Install the U-frame to the head guide using thumbscrews.

- Pass the thumbscrews through the U-frame clearance holes and thread into the upper head guide.
- Pass a thumbscrew through the U-frame clearance hole and thread into the lower head guide.

CAUTION

ENSURE THAT MAGNETIC HEAD CABLE IS NOT DAMAGED BY EDGE OF U-FRAME DURING INSTALLATION.

6.6.12 SUPPLY ARM GUIDE ROLLER

6.6.12.1 Supply Arm Guide Roller Height Check

(1) Install the crossbar to the U-frame by passing a thumbscrew through the U-frame clearance hole and threading it into the crossbar hole.

(2) Swing the supply arm away from its stop to the center mark on the deck.

(3) Position the crossbar so contact is made between the bottom of the guide roller and the upper surface of the crossbar. Tighten the thumbscrew finger tight.

(4) The crossbar should contact the center of the tape traction area of the guide roller. If the crossbar is not centered, a guide roller height adjustment is required.

(5) Return the supply arm to its rest position.

6.6.12.2 Supply Arm Guide Roller Height Adjustment

If the supply arm guide roller height check indicates that an adjustment is required, proceed as follows.

(1) Swing the supply arm away from its stop to the center mark on the tape deck.

(2) Position the crossbar so contact is made between the bottom of the guide roller and the upper surface of the crossbar. Tighten the thumbscrew finger tight.

(3) With the crossbar in place, loosen the supply arm guide roller Allen-head screw located near the end of the tension arm (refer to Figure 6-4, view A-A).

(4) Center the tape traction area of the guide roller on the crossbar when the guide roller is positioned at the center mark on the deck.

(5) When the correct height is established, tighten the supply Allen-head screw.

6.6.12.3 Supply Arm Guide Roller Parallelism Check

(1) Swing the supply arm away from its stop to the center mark on the deck.

(2) Position the crossbar so contact is made between tape traction area of the guide roller and upper surface of the crossbar. Tighten thumbscrew finger tight.

(3) Sight along the upper surface of the crossbar that is now in contact with the tape traction area of the guide roller. Observe an equal contact between the tape traction area of the guide roller and the upper surface of the crossbar.

(4) If a light path is observed between the two surfaces, an adjustment is required.

6.6.12.4 Supply Arm Guide Roller Parallelism Adjustment

If the supply arm guide roller parallelism check indicates that an adjustment is required, proceed as follows.

(1) Insert an Allen wrench in the Allen-head screw on the supply arm hub to prevent the screw from turning. Loosen the nut using an 11/32 wrench.

(2) Swing the supply arm until contact is made between the upper surface of the crossbar and the tape traction area of the guide roller. Tighten the thumbscrew finger tight.

(3) Sight along the upper surface of the crossbar that is now in contact with the tape traction area of the guide roller.

(4) Rotate the tension arm by inserting a small diameter rod into the hole in the supply arm near the guide roller until the face of the guide roller and the contacting surface of the crossbar are parallel.

(5) Test by sighting between the two surfaces. Observe a minimum amount of light between the parallel surfaces.

(6) Torque the nut on the tension arm Allen-head screw to 2.26 newton-metres (20 inch-pounds), nominal.

(7) Recheck parallelism of the guide roller.

6.6.12.5 Supply Hub Height Check

(1) Install an empty supply reel on the supply hub. Lock the reel in place.

(2) Position the crossbar between the flanges of the supply reel. Locate the crossbar so the upper surface is in the same plane as the center line of the hub. Tighten the thumbscrew finger tight.

(3) Rotate the supply reel and determine that the reel flanges are parallel to the crossbar.

(4) While rotating the reel, observe an equal clearance between the crossbar and the reel flanges. If the clearances are not equal, ensure that the reel flanges are not warped or distorted; also determine that the supply reel is fully seated on the hub.

(5) If one edge of the crossbar is closer to one reel flange, the height of the hub must be adjusted.

6.6.12.6 Supply Hub Height Adjustment

From the rear of the transport, locate the supply reel bearing assembly which encloses the supply reel hub bearings. Note that there is an access hole provided between the front and rear hub bearings. Through this hole observe the collar which secures the hub shaft in place. Rotate the shaft until an Allen-head setscrew appears. This setscrew is used to clamp the collar to the shaft which, in turn, establishes the height of the hub.

To adjust the supply hub height, proceed as follows.

(1) Loosen the Allen-head screw located on the collar.

(2) With the crossbar in place between the flanges on the reel, adjust the hub so the reel flanges are equally spaced on either side of the crossbar.

(3) Tighten the Allen-head screw on the shaft collar.

(4) Recheck the clearance between reel flanges and the crossbar to ensure the clearances are equal.

(5) Loosen the thumbscrew to allow the crossbar to clear the reel flanges and remove the tape reel.

6.6.12.7 Supply Bridge Roller Height Check

(1) Relocate the crossbar. Pass the thumbscrew through the clearance hole and thread it into the crossbar hole.

(2) Swing the crossbar upward so that the upper surface contacts the tape transporting area of the supply bridge roller. Tighten the thumbscrew finger tight.

(3) The crossbar should contact the center of the tape traction area of the roller. If the roller is not centered on the crossbar, a height adjustment is required.

6.6.12.8 Supply Bridge Roller Height Adjustment

When a height adjustment is required, proceed as follows.

(1) Loosen the thumbscrew and free the crossbar from the roller.

(2) From the rear of the transport, gain access through the deck to the Phillips-head screw which secures the bridge to the roller standoff. Loosen the screw and remove the standoff. Retain all original shims.

(3) Utilizing shims, reinstall and adjust the standoff to the bridge until the tape traction area of the roller is centered on the crossbar when the crossbar is contacting the tape transporting area of the roller.

NOTE

Tighten the standoff screw each time shims are removed or added.

6.6.12.9 Supply Bridge Roller Parallelism Check and Replacement

(1) With the crossbar positioned where the upper surface contacts the tape transporting area of the supply bridge roller, tighten the thumbscrew finger tight.

(2) Sight along the crossbar in contact with the roller. Observe an equal contact between the two surfaces.

(3) If a light path is observed, replace the bridge roller assembly.

NOTE

If replacement of the bridge roller assembly is made, repeat the height check in Paragraph 6.6.12.7.

6.6.12.10 Supply Guide Roller Height Check

(1) Reposition the crossbar so the right side contacts the tape transporting area of the supply guide roller. Pass the thumbscrew through the clearance hole and thread it into the crossbar hole.

(2) Swing the crossbar upward so that the upper surface contacts the tape transporting area of the roller. Tighten the thumbscrew finger tight.

(3) Determine that the crossbar contacts the center of the tape traction area of the roller. If the roller is not centered on the crossbar, a height adjustment is required.

6.6.12.11 Supply Guide Roller Height Adjustment

(1) Loosen the thumbscrew and free the crossbar from the roller.

(2) From the rear of the transport, gain access through the deck to the Phillips-head screw which secures the roller standoff to the deck. Loosen the screw and remove the standoff. Retain all original shims.

(3) Utilizing shims, reinstall and adjust the standoff to the deck until the tape traction area of the roller is centered on the crossbar when the crossbar is contacting the tape transporting area of the roller. Tighten the roller guide Allen-head screw in the bushing.

6.6.12.12 Supply Guide Roller Parallelism Check and Replacement

(1) With the right side of the crossbar contacting the tape transporting area of the supply guide roller, tighten the thumbscrew finger tight.

(2) Sight along the crossbar in contact with the roller. Observe an equal contact between the two surfaces.

(3) If a light path is observed, replace the roller assembly.

NOTE

If replacement of the guide roller assembly is made, repeat the height check in Paragraph 6.6.12.10.

6.6.12.13 Return Transport to Operational Status.

(1) Remove the crossbar and U-frame from the transport and store in the protective case while not in use.

(2) Replace the caps on the head guides.

(3) Install a reel of tape on the supply hub and thread tape along the tape path and onto the takeup reel.

(4) Apply power to the transport; tape is now tensioned with the tension arms in the operating position.

(5) Perform an unload operation (refer to Paragraph 3.3.2).

NOTE

The tension arms are now properly positioned for installation of the overlay.

(6) Remove the supply and takeup reels from the transport.

(7) Replace the overlay.

- Remove power from the transport.
- From the rear of the tape deck, remove mounting screws to free switch housing.
- From the rear of the tape deck, extend the slack in the cable harness through the access hole so the switch housing is free of the deck.
- Rotate the switch housing to a position where the overlay can be passed over it.
- Press the overlay firmly against the tape deck.

NOTE

Check that wiring to all switches is in place and securely connected before applying power to the transport.

- Install the four mounting screws on the switch housing. Ensure that the green ground wire from the power switch is grounded to the tape deck.

(8) Install the supply and takeup reels. After the supply reel is firmly seated on the hub, torque the Phillips-head screws on the supply hub face plate to 0.226 newton-metres (2 inch-pounds).

(9) Remove the protective covering from the recording surface of the head.

(10) Perform a general inspection of the transport for the presence of foreign material and for the condition of belts, wiring, and all connections.

(11) Replace the head covers.

6.6.13 SKEW MEASUREMENT AND ADJUSTMENT (MODEL T8X40A)

Dynamic and static skew can be measured and adjusted by using one of the 800-cpi master skew tapes listed below and an oscilloscope.

Pertec No.	Reel Size
516-0002	177.8 mm (7 inch)
516-0003	216.0 mm (8.5 inch)
516-0004	266.7 mm (10.5 inch)

NOTE

The tape path alignment procedures detailed in Paragraphs 6.6.7—6.6.12 should be performed before checking skew.

6.6.13.1 Read Skew Measurement

CAUTION

MASTER SKEW TAPES REQUIRE CAREFUL HANDLING. AVOID EXERTING EXCESSIVE TENSION ON MASTER SKEW TAPES. NEVER REWIND A MASTER SKEW TAPE.

An indication of total system read skew may be obtained by observing the algebraic sum of the peak detectors at TP2 on the Data PCBA. Figure 6-5 illustrates correctly adjusted skew. This method of determining the system read skew is accomplished as follows.

(1) Set the vertical sensitivity on the oscilloscope to 1.0v/cm.

(2) Set the oscilloscope to trigger on Channel 1 negative slope, alternate mode.

(3) Load an 800-cpi master tape on the transport, bring to BOT, and activate the Maintenance switch so that tape moves forward.

(4) Observe oscilloscope waveform and adjust the horizontal time/division fixed and variable controls to display one complete cycle.

NOTE

With an 800 cpi tape, each cycle represents 1250 μinches. The scope graticule is divided into 10 major divisions, each of which is divided into 5 divisions; therefore, 1250 μinches ÷ 50 divisions = 25 μinches/division.

(5) Observe and note the fall time of the waveform viewed at TP2. This measurement should be taken between the 95- and 5-percent points of the waveform.

(6) Acceptable limits: maximum displacement between any two bits of a character is less than 150 μinches, i.e., less than 6 small divisions of the oscilloscope graticule.

6.6.13.2 Read Skew Adjustment

To reduce skew to within acceptable limits, the following procedure is performed.

(1) Perform skew measurement procedure described in Paragraph 6.6.13.1, Steps (1)—(5).

(2) While observing the waveform at TP2 on the Data PCBA with tape moving forward, 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.

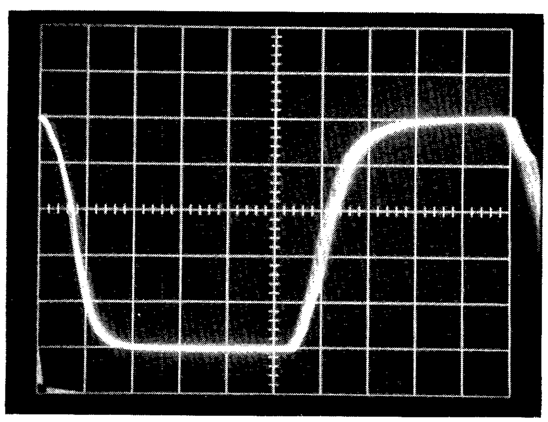

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Figure 6-5. Skew Waveform (Typical)

(3) Observe the waveform and determine which movement (left or right guide) improves the display. If moving the tape off the left guide improved the display, the right guide should be shimmed.

NOTE

The shims are burr-free, etched, one-half thousandths of an inch thick berrylium copper.

(4) Observe and note the fall time of the waveform observed at TP2.

(5) Place the Maintenance switch on the Tape Control PCBA in the stop position.

(6) 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 (500 μinches thick) is $500 \div 12 = 42$ μinches. The number of shims used must satisfy the following.

- Skew must be reduced to a minimum consistent with the maximum number of shims allowable.
- The maximum number of shims used must not exceed four.

Therefore, if, for example, the measured skew is 250 μinches, four shims will yield a correction of 168 μinches (i.e., $4 \times (500 \div 12) = 168$ μinches). This satisfies the requirements listed above.

(7) Remove the head 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.

(8) Insert the required number of shims and replace the head guides.

NOTE

Shim only one head guide.

(9) Recheck skew measurement as described in Paragraph 6.6.13.1.

6.6.13.3 Write Skew Measurement

Measurement of write skew is accomplished by writing and simultaneously reading an all-1s tape.

NOTE

Read Skew must be checked and adjusted before adjusting Write Skew.

(1) Set the oscilloscope vertical sensitivity to 1.0v/cm and horizontal range to 5 μsec/cm.

(2) Set the oscilloscope to trigger on Channel 1, negative slope, alternate mode.

(3) Ensure that the head assembly and tape path are clean.

(4) Load a good quality work tape with a write enable ring in place on the transport and bring to Load Point.

(5) Place the transport On-line.

(6) Apply a ground to interface line ISWS (J101 pin K) on the Tape Control PCBA.

(7) Apply a ground to the interface line ISLT (J101 pin J) on the Tape Control PCBA.

(8) Apply a ground to interface lines IWDP and IWD0—IWD7 (J102 pins L, M, N, P, R, S, T, U, and V) of the Data PCBA.

(9) Activate the Maintenance switch so that tape moves forward.

(10) Apply negative-going pulses (+3v to 0v) of 2 μsec duration at the specified transfer rate to the interface line IWDS (J102 pin A) on the Data PCBA.

NOTE

Transfer Rate = D × V
where D = Density in cpi
V = Speed in ips
i.e., 20Kc transfer rate = 800 cpi × 25 ips.

(11) Connect the oscilloscope signal probe to TP2 on the Data PCBA and adjust the horizontal time/division variable control to display one complete cycle over ten major divisions.

NOTE

With an 800 cpi tape, each cycle represents 1250 μinches. The scope graticule is divided into 10 major divisions, each of which is divided into 5 divisions; therefore, 1250 μinches ÷ 50 divisions = 25 μinches/division.

(12) Observe and note the fall time of the waveform viewed at TP2.

NOTE

This value includes the effect of gap scatter of the read head. Tape will actually be recorded with less than 175 μinches of skew.

(13) Acceptable limits: the maximum displacement between any two bits of a character when writing and simultaneously reading an all-1s tape, is less than 225 μinches (i.e., less than nine small divisions of the oscilloscope graticule).

6.6.13.4 Write Skew Adjustment

To reduce write skew to within acceptable limits, perform the following procedure.

(1) Perform the write skew measurement procedure in Paragraph 6.6.13.3.

(2) While observing the waveform viewed at TP2 on the Data PCBA, adjust R18 to reduce skew to less than 9 small divisions of the oscilloscope graticule which represents 225 μinches.

6.6.14 SKEW MEASUREMENT AND ADJUSTMENT (MODEL T8X60A)

Dynamic and static skew can be measured and adjusted by using one of the 800-cpi master skew tapes listed below and an oscilloscope.

Pertec No.	Reel Size
516-0002	177.8 mm (7 inch)
516-0003	216.0 mm (8.5 inch)
516-0004	266.7 mm (10.5 inch)

NOTE

The tape path alignment procedures in Paragraphs 6.6.7—6.6.12 should be performed before checking skew.

6.6.14.1 Skew Measurement

An indication of skew may be obtained by observing the algebraic sum of the peak detectors at TP2 on the Data PCBA. Figure 6-6 illustrates an example of correctly adjusted skew. This method of determining the system skew is as follows.

(1) Set the vertical sensitivity on the oscilloscope to 1.0v/cm.

(2) Set the oscilloscope to trigger on Channel 1 negative slope, alternate mode.

(3) Ensure that the head assembly and tape path are clean.

(4) Load an 800-cpi master tape on the transport, bring to BOT, and activate the Maintenance switch so that tape moves forward.

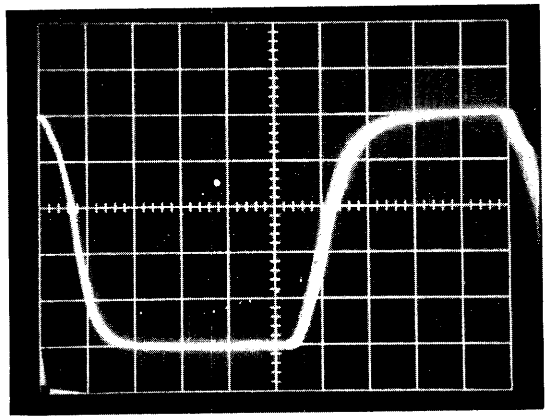
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Figure 6-6. Skew Waveform (Typical)

(5) Observe oscilloscope waveform and adjust the horizontal time/division fixed and variable controls to display one complete cycle.

NOTE

With an 800 cpi tape, each cycle represents 1250 μinches. The scope graticule is divided into 10 major divisions, each of which is divided into 5 divisions; therefore, 1250 μinches ÷ 50 divisions = 25 μinches/division.

(6) Observe the fall time of the waveform viewed at TP2. This measurement should be taken between the 95- and 5-percent points of the waveform.

(7) Acceptable limits: maximum displacement between any two bits of a character is 150 μinches (i.e., less than 6 small divisions of oscilloscope graticule).

6.6.14.2 Skew Adjustment

To reduce skew to within acceptable limits, perform the following procedure.

(1) Perform skew measurement procedure described in Paragraph 6.6.14.1.

(2) While observing the waveform at TP2 on the Data PCBA with tape moving forward, 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 (upper or lower guide) improves the display. If moving the tape off the upper guide improved the display, the lower guide should be shimmed.

NOTE

The shims are burr-free, etched, one-half thousandths of an inch thick berrylium copper.

(4) Observe and note the fall time of the waveform observed at TP2.

(5) Position the Maintenance switch to the stop position; tape motion will cease.

(6) 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 (500 μinches thick) is 500 ÷ 12 = 42 μinches. The number of shims used must satisfy the following.

- Skew must be reduced to a minimum consistent with the maximum number of shims allowable.
- The maximum number of shims used must not exceed four.

Therefore, if, for example, the measured skew is 250 μinches, four shims will yield a correction of 168 μinches (i.e., 4 × (500 ÷ 12) = 168 μinches). This satisfies the requirements listed above.

(7) Move the Maintenance switch to the stop position.

(8) Remove the head 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.

(9) Insert the required number of shims and replace the head guides.

NOTE

Shim only one head guide.

(10) Recheck skew measurement as described in Paragraph 6.6.14.1.

6.6.15 HEAD REPLACEMENT

The head may require replacement because of internal faults, faulty cabling, or wear. Internal faults can be verified by reading a master tape; wear can be verified by measuring the depth of the wear pattern on the head crown. On heads having *guttering* (grooves cut on the crown on either side of the tape path), the head should be replaced when the guttering is worn down to a depth in excess of 0.254 mm (0.010 inch). In those heads showing guttering, the head wear should be measured with a brass shim that is 0.254 mm (0.010 inch) thick. The shim width should be less than the minimum tape width (12.598 mm or 0.496 inch). The shim is placed in the worn area of the head crown with one side butted against the outer worn edge. When the upper surface of the shim is below the unworn surface of the head crown, the head should be replaced.

When a head is installed, it is adjusted to 12 degrees for a dual-stack head, or 9 degrees for a single-stack head. These angles are in respect to the tape path when the tape is at operating tension.

Positioning the head can easily be accomplished if a cardboard or plastic template with the appropriate angle is constructed as shown in Figure 6-7.

6.6.15.1 Head Removal

Removal of the head is accomplished as follows.

(1) Remove the head covers.

(2) Disconnect the head connectors from the Data PCBA.

(3) Remove the two screws that attach the head to the deck.

(4) Ease the head cables through the deck.

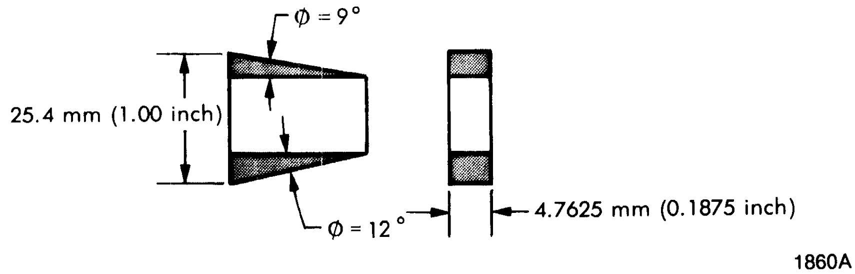


Figure 6-7. Head Alignment Template

6.6.15.2 Head Replacement

(1) 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 may result.

(2) Route the head connectors and cables through the deck.

(3) Install the head using the two screws removed in Step (3) of Paragraph 6.6.15.1; do not fully tighten the screws.

NOTE

Two sets of screw holes are provided for mounting the head. The set nearest the capstan is for dual-stack (T8X40A); the other set is for single-stack (T8X60A).

(4) Load an all-1s tape on the transport.

(5) Bring tape to Load Point by depressing and releasing the LOAD control twice.

(6) Position the crown of the head so contact is made with the tape that is now under operating tension.

NOTE

Ensure the full width of the tape is in contact with the magnetic head laminations.

(7) Place the template (Figure 6-7) in the position shown in Figure 6-8 or 6-9 for single- or dual-stack transports, respectively.

NOTE

It will be necessary to remove the photosensor, tape-in-path reflector, and tape cleaner when a head is aligned.

(8) Rotate the head until the narrow surface of the template is in full contact with tape.

(9) Tighten the head screws sufficiently to maintain head-to-tape alignment.

(10) Recheck the head-to-tape alignment and remove the template.

(11) Torque the headscrews to 0.45 newton-metres (4 inch-pounds).

(12) Replace the photosensor, the tape-in-path reflector, and the tape cleaner.

(13) Replace the head connectors.

- For dual-stack transports, plug the write head connector into J1 and the read head connector into J2 on the Data PCBA.

NOTE

The read head is the one farthest from the erase head and nearest the takeup reel.

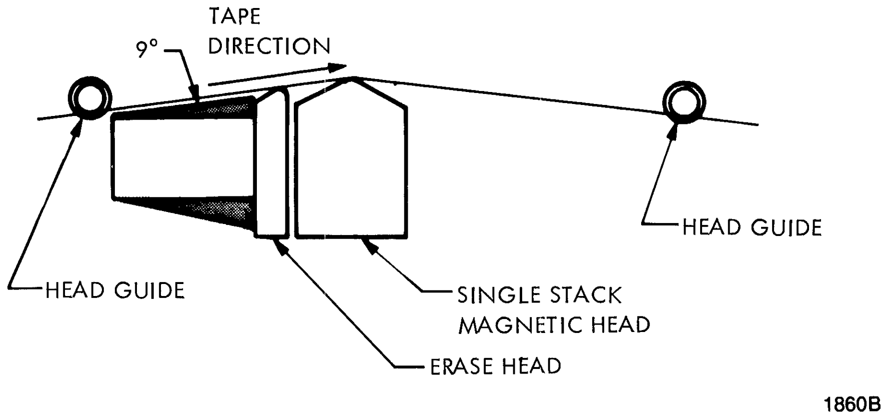


Figure 6-8. Single-Stack (9-Degree) Head-to-Tape Positioning

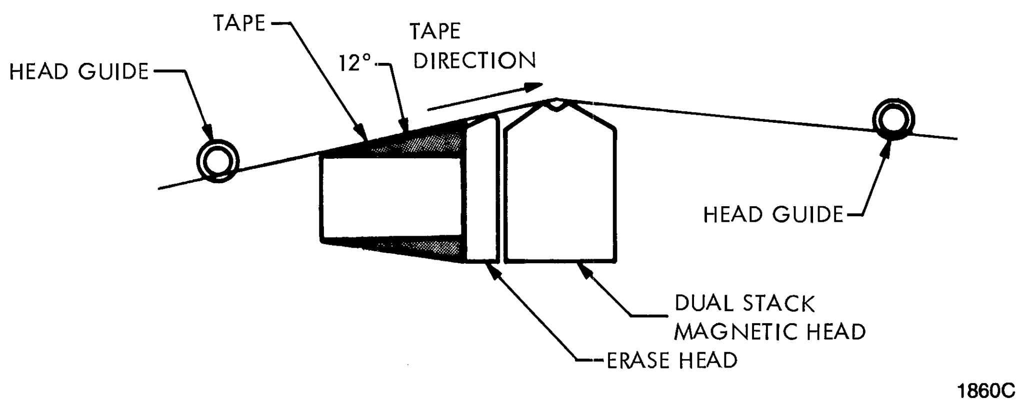


Figure 6-9. Dual-Stack (12-Degree) Head-to-Tape Positioning

- For single-stack transports, plug the head connector into J1 on the Data PCBA.

6.6.15.3 Head Operation Test

(1) Set the all-1s tape in motion and set all read amplifier gains as described in Paragraph 6.5.8.

(2) Operate the transport in a shuttling mode, i.e., forward, then reverse, by actuating the Forward-Reverse switch on the Tape Control PCBA; observe the oscilloscope signal amplitude at the output of the read amplifiers. While operating in the shuttling mode, physically adjust the head assembly until the observed amplitude difference between forward and reverse operation is at a minimum.

(3) Check the read skew, write skew, and flux gate (T8X40A only), as described in Paragraphs 6.6.13 or 6.6.14 and 6.6.17, respectively. Output waveforms should approach that shown in Figure 6-5.

(4) Torque the head screws to 0.45 newton-metres (4 inch-pounds).

(5) Rewind tape to the supply reel and remove the reel.

(6) Replace the head covers.

6.6.16 BOT/EOT SENSOR ASSEMBLY REPLACEMENT

Removal and replacement of the BOT/EOT sensor is accomplished as follows.

(1) Remove the head covers.

(2) From the rear of the transport, disconnect the wiring harness plug from the photosensor cable.

(3) Remove the screw that retains the sensor assembly.

(4) Remove the pins from the plug by using a Molex extractor tool; remove the cable through the hole in the deck.

(5) Insert the new photosensor cable through the deck.

(6) Replace the connector pins, using the Molex tool, as follows.

- Brown wire — pin 1
- Red wire — pin 2
- Orange wire — pin 3
- Yellow wire — pin 4
- Green wire — pin 5
- Blue wire — pin 6

(7) Measure the output of the BOT and EOT amplifiers as described in Paragraph 6.5.3.

6.6.17 FLUX GATE ADJUSTMENT (MODEL T8X40A ONLY)

Crosstalk can be checked and, if necessary, reduced to within acceptable limits by mechanically positioning the flux gate. The check and adjustment procedure is accomplished as follows.

(1) Load a reel of tape with a write enable ring installed on the transport. Do not pass tape over the capstan.

(2) Apply power to the transport.

(3) Bring the transport to the Load Point by placing a white card between the tape and photosensor assembly and depressing the LOAD control.

(4) Place the transport on-line.

(5) Apply a ground to interface line ISWS (J101 pin K) on the Tape Control PCBA.

(6) Apply a ground to interface line ISLT (J101 pin J) on the Tape Control PCBA.

(7) Apply a ground to interface line ISFC (J101 pin C) on the Tape Control PCBA.

(8) Apply a ground to interface lines IWDP and IWD0—IWD7 (J102 pins L, M, N, P, S, T, U, and V) on the Data PCBA.

(9) Apply negative-going (+5v to 0v) pulses of 2 microseconds duration to the interface line (J102 pin A) on the Data PCBA.

(10) Obsserve the oscilloscope waveforms at TP103—TP903 on the 9-track Data E19 PCBA, or TP103 and TP403—TP903 on the 7-track Data E17 or D1 PCBAs.

(11) Observe that the waveforms viewed in Step (10) are approximately sinusoidal with no pronounced peaks. The maximum allowable crosstalk is 1.0v peak-to-peak.

NOTE

If the waveforms observed fall within the limit specified in Step (11), no adjustment should be attempted.

(12) Place a white card approximately 0.127 mm (0.005-inch) thick (e.g., business card) between the flux gate and the magnetic head; press the flux gate assembly lightly against the head. Adjust the spacing screw on the base of the flux gate until a gap width of 0.127 mm (0.005-inch) minimum is established.

(13) Figure 6-10 shows the correct relationship between the magnetic head and flux gate.

NOTE

It may be necessary to move 6-10 shows the correct relationship between the magnetic head and flux gate.

NOTE

It may be necessary to move or rotate the assembly slightly to achieve the best compromise between all tracks.

(14) Tighten the flux gate assembly screws and repeat Steps (1) through (7).

CAUTION

ENSURE CLEARANCE BETWEEN FLUX GATE AND MAGNETIC HEAD IS 0.127 mm (0.005 INCH) MINIMUM TO AVOID DAMAGE TO HEAD OR TAPE.

6.6.18 CAPSTAN MOTOR REPLACEMENT

Removal and replacement of the capstan motor is accomplished as follows.

(1) Disconnect the motor leads: if the motor has terminals, disconnect the leads at the motor and tachometer terminals; if not, disconnect the motor connector from the main cable assembly.

(2) Remove the capstan from the old motor.

(3) Remove the overlay; refer to Paragraph 6.6.9.1, Steps (1)—(5).

(4) Remove the screws holding the capstan motor to the deck. Note the presence of any shims as they maU be reused to maintain the angulave the screws holding the capstan motor to the deck. Note the presence of any shims as they may be reused to maintain the angularity of the motor shaft to the tape path.

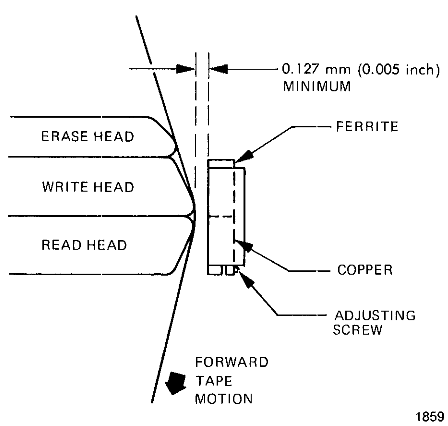


Figure 6-10. Flux Gate Adjustment

(5) Mount the replacement motor. Alternately tighten the three retaining screws and torque to 1.8 newton-metres (16 inch-pounds).

NOTE

The mounting surface must be free of all foreign substances to ensure the perpendicularity of the capstan to the tape path.

(6) Reinstall the motor leads and/or harness connector.

NOTE

To ensure effective filtering, the RFI filter must be firmly secured by the tie wrap or clamp to the frame of the motor.

(7) Reinstall the overlay; refer to Paragraph 6.6.10.11, Steps (7)—(11).

(8) Load takeup and supply reels with a work tape installed on the transport.

(9) Adjust the back edge of the capstan to 6.35 mm (0.25-inch) above the surface of the overlay.

(10) Establish capstan position on the motor shaft by moving tape first in reverse and then forward. Observe the tape tracking around the periphery of the capstan. If tape skewing or capstan walk are observed, raise or lower the capstan on the shaft or adjust the shims on the motor mounting surfaces so that capstan walk is less than 0.127 mm (0.005-inch).

(11) Adjust the tape speed (Paragraph 6.5.6) and rewind speed (Paragraph 6.5.7).

(12) Perform a check of the read system skew (Paragraph 6.6.13 or 6.6.14).

6.6.19 REEL MOTOR 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 may result. The belts must not have excessive tension as this will overload the motors and reel shaft bearings.

The belt tension is adjusted as follows.

(1) Loosen three screws that fasten the motor mounting plate to the deck standoffs.

NOTE

The slots in the motor mounting plate allow rotation of the motor to adjust belt tension.

(2) Adjust the motor mounting so the belt is snug. Note the last belt tooth that is completely seated in a slot on the large pulley (refer to Figure 6-11).

(3) Count two to three teeth from the last engaged tooth. Hold the large pulley so 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 pulley.

CAUTION

DO NOT APPLY EXCESSIVE FORCE ON THE TOOTHED BELT.

(4) Adjust the motor assembly so 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).

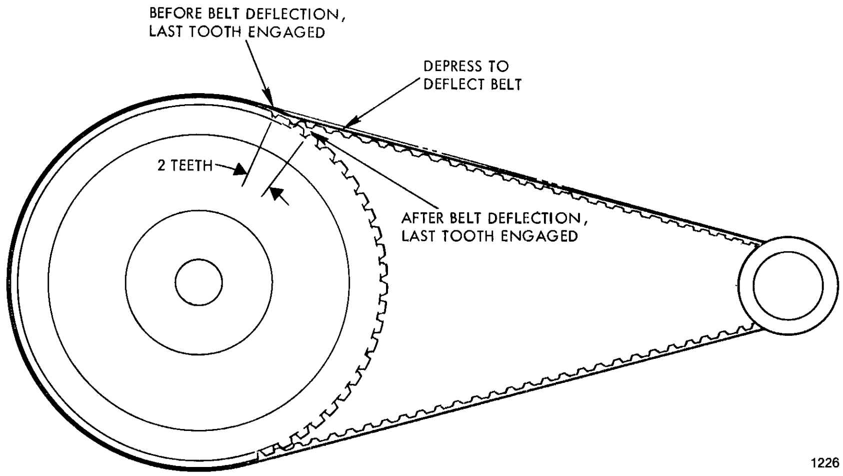


Figure 6-11. Reel Servo Belt Tension Adjustment

6.6.20 TAPE TENSION

Tape tension is controlled by individual springs connected to the tape deck and the tension arms.

NOTE

When performing a tension check, it is not necessary to remove the overlay. If an adjustment is required, the overlay must be removed (refer to Paragraph 6.6.9.1).

6.6.20.1 Supply Tape Tension Check

When checking tape tension, it is necessary to move the tension arm through its operating range. The tension arm can be moved into the operating region only by applying power and bringing the transport to the load condition. Refer to Figure 6-12 in conjunction with the following procedure.

CAUTION

NEVER EXERT PRESSURE ON A TENSION ARM ROLLER WHEN ATTEMPTING TO MOVE A TENSION ARM INTO THE OPERATING REGION. DAMAGE TO THE ARM RETRACTOR OR THE ROLLER GUIDE SHAFT MAY RESULT.

(1) Remove both tape reels.

(2) Block the light path to the Tape In Path (TIP) reflector.

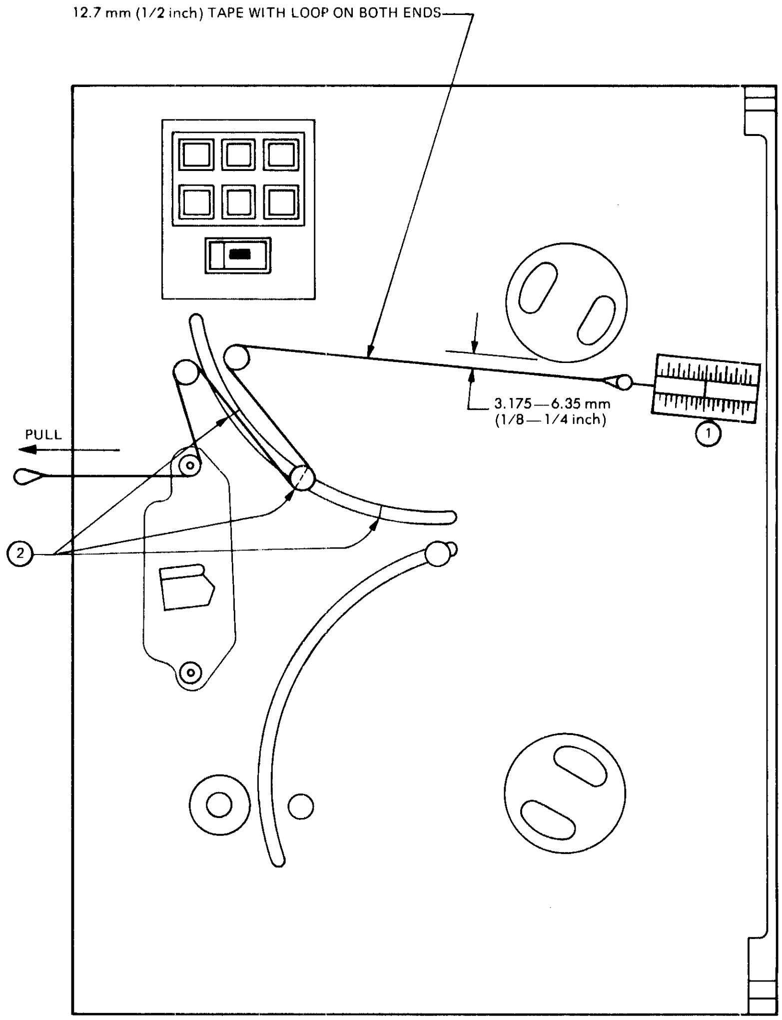
(3) Depress and release the LOAD control.

(4) When the arms have reached the end of their operating range, remove power from the transport.

(5) Prepare a 152.4 mm (6-inch) length of 12.7 mm (0.5-inch) magnetic recording tape with loops at each end.

(6) Thread tape about the guide rollers and supply arm roller, as shown in Figure 6-12.

(7) Hold a calibrated 5-newton (16-ounce) force gauge in the position shown in Figure 6-12. Maintain the tape to supply reel hub distance as shown.



NOTES:
1. SECURE INDICATOR TO OVERLAY
2. OPERATING RANGE BETWEEN THREE POINTS MARKED ON DECK CASTING

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Figure 6-12. Supply Tape Tension Adjustment

(8) With an even pull on the tape, exert enough force to bring the supply arm guide roller to the first operating mark on the tape deck. Verify that the force gauge indicates 2 newtons (7.5 ounces).

(9) Continue to pull on the tape until the supply arm reaches the end operating mark on the tape deck. Verify that the force gauge indicates 2.64 newtons (9.5 ounces).

(10) If the tape tension required in Steps (8) and (9) cannot be met, perform the following adjustment.

6.6.20.2 Supply Tape Tension Adjustment

To adjust the tape tension, the overlay must be removed and the location of the spring adjusting bracket changed.

(1) Remove the overlay; refer to Paragraph 6.6.9.1, Steps (1) through (5).

(2) With the tape positioned as described in Paragraph 6.6.20.1, bring the supply arm roller from the rest position to the first operating mark on the tape deck. Holding the supply arm roller in this position, slightly loosen the anchor bracket screws and adjust the tape pull to 2 newtons (7.5 ounces) and tighten the anchor bracket screws.

(3) Further extend the pull on the tape until the end operation mark is reached. Verify that the force gauge indicates 2.64 newtons (9.5 ounces).

(4) Repeat Steps (2) and (3) as required.

(5) Apply a slight amount of Bendix brake lubricant or Lubriplate to each end of the spring and clevis pin.

(6) Remove the tape loop and force gauge.

(7) Replace the overlay and return the transport to operating condition; refer to Paragraph 6.6.10.11, Steps (7)—(11).

6.6.20.3 Takeup Tape Tension Check

When checking tape tension, it is necessary to move the tension arm through its operating range. The tension arm can be moved into the operating region only by applying power and bringing the transport to the load condition. Refer to Figure 6-13 in conjunction with the following procedure.

CAUTION

NEVER EXERT PRESSURE ON A TENSION ARM ROLLER WHEN ATTEMPTING TO MOVE A TENSION ARM INTO THE OPERATING REGION. DAMAGE TO THE ARM RETRACTOR OR THE ROLLER GUIDE SHAFT MAY RESULT.

(1) Remove both tape reels.

(2) Block the light path to the Tape In Path (TIP) reflector.

(3) Depress and release the LOAD control.

(4) When the arms have reached the end of their operating range, remove power from the transport.

(5) Prepare a 152.4 mm (6-inch) length of 12.7 mm (0.5-inch) magnetic recording tape with loops at each end.

(6) Thread tape about the guide rollers and takeup arm roller, as shown in Figure 6-13.

(7) Hold a calibrated 5-newton (16-ounce) force gauge in the position shown in Figure 6-13. Maintain the tape to takeup reel hub distance as shown.

(8) With an even pull on the tape, exert enough force to bring the takeup arm guide roller to the first operating mark on the tape deck. Verify that the force gauge indicates 2 newtons (7.5 ounces).

(9) Continue to pull on the tape until the takeup arm reaches the end operating mark on the tape deck. Verify that the force gauge indicates 2.64 newtons (9.5 ounces).

(10) If the tape tension required in Steps (8) and (9) cannot be met, perform the following adjustment.

6.6.20.4 Takeup Tape Tension Adjustment

To adjust the tape tension, the overlay must be removed and the location of the spring adjusting bracket changed.

(1) Remove the overlay; refer to Paragraph 6.6.9.1, Steps (1) through (5).

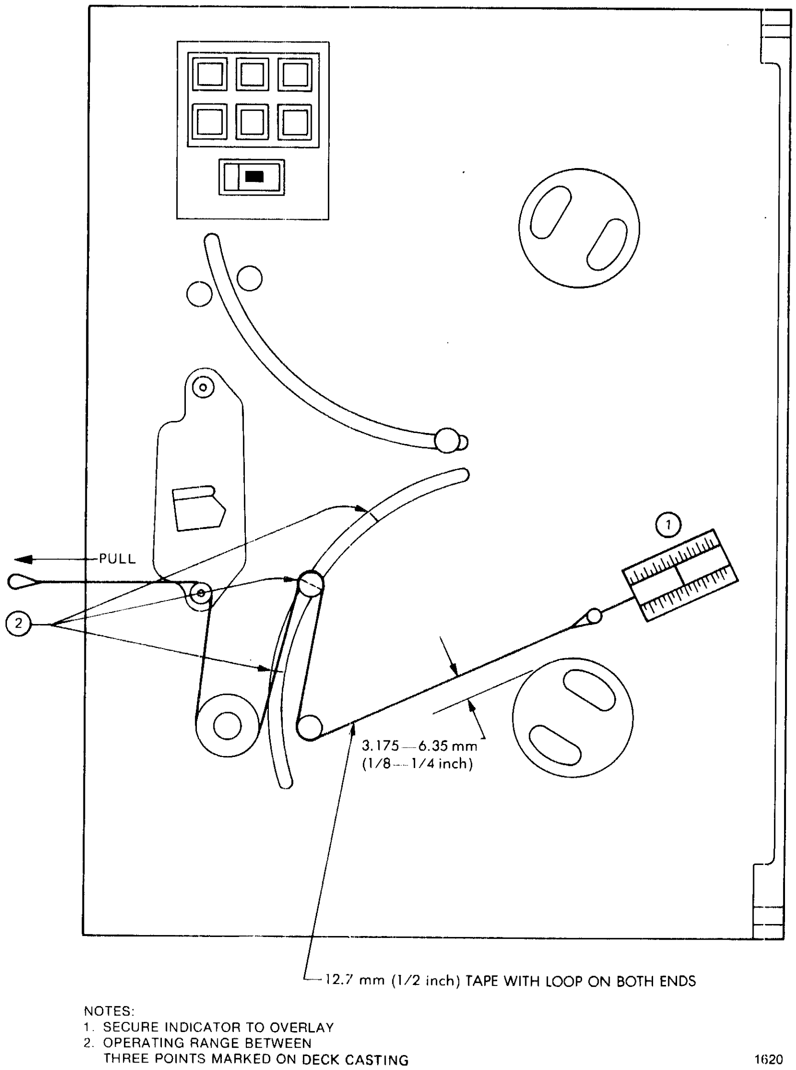

Figure 6-13. Takeup Tape Tension Adjustment

(2) With the tape positioned as described in Paragraph 6.6.20.3, bring the takeup arm roller from the rest position to the first operating mark on the tape deck. Holding the takeup arm roller in this position, slightly loosen the anchor bracket screws and adjust the tape pull to 2 newtons (7.5 ounces) and tighten the anchor bracket screws.

(3) Further extend the pull on the tape until the end operating mark is reached. Verify that the force gauge indicates 2.64 newtons (9.5 ounces).

(4) Repeat Steps (2) and (3) as required.

(5) Apply a slight amount of Bendix brake lubricant or Lubriplate to each end of the spring and clevis pin.

(6) Remove the tape loop and force gauge.

(7) Replace the overlay and return the transport to operating condition; refer to Paragraph 6.6.10.11, Steps (7)—(11).

6.6.21 SUPPLY REEL HUB REPLACEMENT

Removal and replacement of the supply reel hub assembly is accomplished as follows.

(1) From the rear of the transport, loosen the two setscrews which hold the belt-driven gear pulley on the shaft.

(2) Slide the gear pulley off the shaft; the toothed belt will disengage from the gear pulley.

(3) Loosen the setscrew on the shaft collar.

(4) Rotate the hub and align the setscrew with the access hole.

(5) From the front of the transport, withdraw the hub.

(6) Install the replacement hub assembly. Ensure the line-up of each setscrew to the flat surface on the shaft.

(7) Proper hub height must be ensured; refer to Paragraphs 6.6.12.5 and 6.6.12.6 for check and adjustment procedures.

(8) Proper write lockout plunger height must be ensured; refer to Paragraph 6.6.24.

6.6.22 TAKEUP REEL HUB REPLACEMENT

Removal and replacement of the takeup reel hub assembly is accomplished as follows.

(1) Remove the takeup reel by loosening the two Phillips-head screws on the face plate of the hub.

(2) From the rear of the transport, loosen the two setscrews which hold the belt-driven gear pulley on the shaft.

(3) Slide the gear pulley off the shaft; the toothed belt will disengage from the gear pulley.

(4) Loosen the setscrew on the shaft collar.

(5) Rotate the hub and align the setscrew with the access hole.

(6) From the front of the transport, withdraw the hub.

(7) Install the replacement hub assembly. Ensure the line-up of each setscrew to the flat surface on the shaft.

(8) Proper hub height must be ensured; refer to Paragraphs 6.6.10.5 and 6.6.10.6 for check and adjustment procedures.

6.6.23 SUPPLY REEL HUB EXPANSION RING ADJUSTMENT

Adjustment of the hub expansion ring is required when a supply reel hub is replaced, or when reel slippage is noted. Adjustment of the ring is accomplished as follows.

(1) Place the quick-release latch in the unload position.

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

(3) Lock the quick-release latch by depressing the indented portion of the hub.

(4) Using a suitable force gauge, exert pressure at the center of the indented latch. If the force required to release the latch is less than 26.7 newtons (6 pounds), the expansion ring should be adjusted.

(5) Insert an Allen wrench into the adjustment hole in the center of the hub and turn one-quarter turn clockwise.

(6) Repeat Steps (4) and (5) until the force required to release the latch is 26.7 newtons (6 pounds).

6.6.24 WRITE LOCKOUT ASSEMBLY

When the supply reel hub assembly or the write lockout assembly are replaced, the write lockout plunger may require adjustment. The plunger height should be adjusted so that when the plunger is fully retracted, the plunger end is just flush with the back side of the reel hub flange. Adjustment may be accomplished by removing the write lockout assembly, loosening the safety nut and rotating the plunger adjusting screw to the desired position. The safety nut is then tightened.

6.6.25 TAPE CLEANER CLEANING AND REPLACEMENT

6.6.25.1 Removal of Tape Cleaner

(1) Remove the head covers to gain access to the tape cleaner.

(2) Remove the Allen-head screws securing the tape cleaner to the deck.

6.6.25.2 Cleaning the Tape Cleaner

(1) Remove the two machine screws securing the perforated mesh to the tape cleaner mounting post.

(2) Gently push the perforated mesh forward and away from the body of the tape cleaner.

(3) Clean the cavity of the tape cleaner with a cotton swab moistened with 91 percent isopropyl alcohol. Clean the perforated mesh.

(4) Inspect the perforated mesh for excessive wear or rough areas that could cause tape damage. Ensure that all holes in the mesh are free of contamination.

(5) Replace the mesh on the body of the tape cleaner and ensure that it is fully seated. Replace the two machine screws.

(6) Perform the installation and alignment procedures in the following paragraphs.

6.6.25.3 Installation of Tape Cleaner

(1) Ensure all surface areas on the tape cleaner and deck casting are free of contamination.

(2) Insert the captive tape cleaner dowel pin into the pin hole. Replace the retaining screws and secure the tape cleaner to the deck.

6.6.26 TAPE-IN-PATH (TIP) REFLECTOR ADJUSTMENT

Note that the TIP reflector adjustment is to be performed after the head and the tape cleaner are aligned, and the EOT/BOT photosensor has been removed. Refer to Figure 6-14 in conjunction with the following procedure.

(1) Install the TIP reflector in place; do not tighten the retaining screws.

(2) Position the TIP adjustment tool so that the step side contacts, and is parallel to, both the head and the tape cleaner.

(3) With the adjustment tool held in place, slide the TIP reflector along the slots until the reflecting surface touches the step portion of the tool. Tighten the retaining screws.

(4) Remove the TIP adjustment tool and install the EOT/BOT photosensor assembly as described in Paragraph 6.6.16.

(5) Check the EOT/BOT amplifier as described in Paragraph 6.5.3.

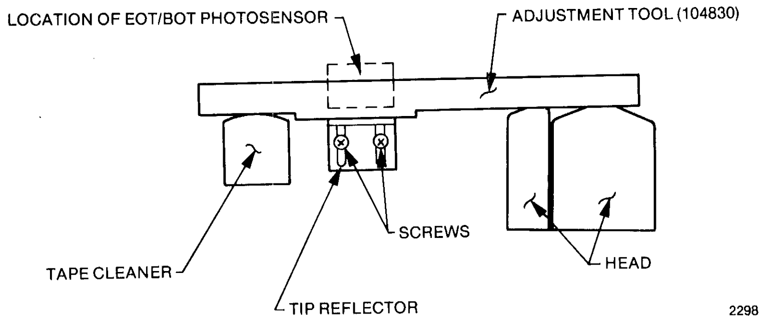

Figure 6-14. Tape-in-Path (TIP) Reflector Adjustment

6.7 MAINTENANCE TOOLS

The following is a list of tools required to maintain the tape transport. All tools, except items (17) and (18) may be obtained from a local source.

(1) Hex socket key set 0.050 through 5/32 sizes.
(2) Splined drive socket key for a 4-40 setscrew.
(3) Long-nose pliers.
(4) Phillips screwdriver set.
(5) Standard blade screwdriver set.
(6) Open-end wrenches, sizes 3/16, 1/4, 5/16, and 3/8.
(7) Soldering aid.
(8) Soldering iron.
(9) Five newton (one-pound) force gauge.
(10) Forty-five newton (ten-pound) force gauge.
(11) Lint-free cloth.
(12) Cotton swabs.
(13) 91 percent isopropyl alcohol.
(14) Torque wrench, 0—5 newton-metres (0—35 inch-pounds).
(15) Molex pin extractor (Mfg. Part No. HT2285).
(16) Loctite Sealant, Grade C.
(17) Universal Tape Path Alignment Tool, Pertec Part No. 102382-01.
(18) TIP Reflector Adjustment Tool, Pertec Part No. 104830.

6.8 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 6-6
System Troubleshooting

Symptom	Probable Cause	Remedy	Reference
Tape does not tension and the capstan shaft rotates freely when the LOAD control is depressed for the first time after the arms have moved down.	Interlock relay K1 does not close.	Check relay operation; replace if necessary.	Paragraph 5.4
	LOAD control is not operative.	Check control operation; replace if necessary.	Paragraph 5.4
	Relay driver defective.	Check collector voltage of U51 with LOAD control depressed. It should be less than +1v. If greater, isolate defective relay driver component and replace.	Paragraph 5.4
After the tension arms have moved down, tape is tensioned when the LOAD control is depressed, but tension is lost when control is released.	Relay latching contacts 7 and 13 do not mate.	Check that voltage at TP8 goes to +5v when LOAD control is depressed.	Paragraph 5.4
	Interlock switch is not operative.	Adjust as described in Paragraph 6.6.2; replace limit switch assembly if necessary.	Paragraph 6.6.2
Arms do not retract to load the tape.	Motor driver amplifier faulty.	Check transistors Q15—Q16 on Tape Control PCBA.	Paragraph 5.4
Actuator motors fail to deactivate.	Extended limit switch malfunction.	Check that cable harness is properly connected. Check arm extended switch adjustment, replace if necessary.	Paragraph 6.6.4
Arms travel downward but tape does not tension. Actuator motor does not deactivate.	Arm retract limit switch malfunction.	Check that limit switch is properly connected. Adjust or replace if necessary.	Paragraph 6.6.5
Tension arms fail to move to extended position when power is applied to transport and tape path is open.	Actuator motor or TIP circuit defective.	Check actuator motor operation; check TIP reflector and related circuits.	Paragraph 6.6.5, 6.6.6, 4.3.5.1
Tape unwinds or tension arm hits stop when the LOAD control is depressed for the first time.	Tape is improperly threaded.	Rethread tape (see Figure 3-1).	Paragraph 3.3
	+5v or −5v is missing from tension arm sensor.	Check tension arm sensor lamps. Isolate problem if lamp is extinguished.	Figure 7-3, item 4
	Fault in reel servo amplifier.	Check that movement of reels responds to tension arm position without tape on the transport.	Paragraph 5.4.1.2
Tape *runs away* or rewinds when the LOAD control is depressed for the second time.	Fault on Tape Control PCBA or capstan motor assembly.	Replace or repair Tape Control PCBA or capstan motor assembly.	Paragraph 5.4, 6.6.18

Table 6-6
System Troubleshooting (Continued)

Symptom	Probable Cause	Remedy	Reference
Tension arms hit interlock switches at rewind.	Relay K2 does not latch.	Check relay for faulty contacts. Check U51.	Paragraph 5.4.1.2
At rewind after BOT, the arms do not move down 2 and 2½ inches.	AOS and ULOS signals missing.	Check output of U16D and U16C on Tape Control PCBA.	Paragraph 5.4
Tape runs past the BOT marker.	BOT tab dirty or tarnished.	Replace tab.	—
	Photosensor inoperative.	Replace photosensor.	Paragraph 6.6.16
	Photosensor or amplifier defective.	Check for appropriate voltage levels in sensor systems with tab not over photosensor. Check appropriate voltage levels in sensor systems when tab is over photosensor.	Paragraph 6.5.3
	Logic fault (Load flip-flop does not reset).	Replace or repair Tape Control PCBA.	Paragraph 5.4
Transport does not move in response to SYNCHRONOUS FORWARD or REVERSE COMMANDS.	Interface cable fault or receiver fault.	Check levels at outputs and inputs of receivers on Tape Control PCBA. Replace or repair cable or Tape Control PCBA.	Paragraph 5.4
	Transport is not Ready.	Replace or repair Tape Control PCBA.	Paragraph 5.4
	Fault in ramp generator or capstan servo amplifier.	Check TP20 on Tape Control PCBA. Replace or repair Tape Control PCBA.	Paragraph 5.4
Transport responds to SYNCHRONOUS FORWARD COMMAND, but tape is not written.	Write current is not enabled.	Check presence of write enable ring on supply reel, WRT EN indicator should be lit. Check TP18 on Tape Control PCBA (should be +5v for writing). Replace Write Lockout Assy if faulty. Check that WRT PWR leve is +5v on Data PCBA.	Paragraph 5.2 or 5.3, 5.4
	Write status or MOTION signal to Data PCBA is not correct.	Check receiver on Tape Control PCBA and on Data PCBA for Write status.	
		Check Data PCBA for MOTION signal. Replace or repair Data or Tape Control PCBA if faulty.	
	WRITE DATA or WRITE DATA STROBE is not received correctly on Data PCBA from interface.	Check for correct levels on Data PCBA. Replace or repair Data PCBA or interface cable if faulty.	Paragraph 5.2 or 5.3
	Head not plugged in correctly.	Check J1 and J2 on Data PCBA.	

Table 6-6

System Troubleshooting (Continued)

Symptom	Probable Cause	Remedy	Reference
Data incorrectly written.	Incorrect data format.	Use correct format.	IBM Form A22-6589-3 (729 or 727 Series) IBM Form A22-6866-3 (2400 Series)
	Write deskew circuit faulty.	Check TP10 on Data E7/E9 or TP8 on E17/E19 for sequence of 10 pulses for each IWDS. Replace Data PCBA if necessary.	Paragraph 5.2 or 5.3
	Fault on one track due to failure in write circuits.	Check receiver and write amplifier on Data PCBA. Replace or repair Data PCBA if faulty.	Paragraph 5.2 or 5.3
	Intermittent WRT PWR, WRITE, MOTION, or IWARS signal.	Examine signals; replace or repair Tape Control PCBA or Write Lockout Assembly.	Paragraph 5.4
Correct tape cannot be read.	Interface cable or transmitter fault.	Replace or repair interface cable or Data PCBA.	Paragraph 5.2 or 5.3
	Head is not plugged in.	Check J1 and J2 on Data PCBA.	—
	Tape tracking on skew is badly adjusted.	Readjust according to procedures in Section VI.	Paragraph 6.6.13 or 6.6.14
	Head, guides, and tape cleaner need cleaning.	Clean head, guides and tape cleaner.	Paragraph 6.3.2, 6.6.25
	Read amplifier gains are incorrectly adjusted.	Check and adjust amplifier gains.	Paragraph 6.5.8
	Faulty write amplifier causes current to be passed through head while reading.	Check write amplifier output test points and replace or repair Data PCBA if faulty.	Paragraph 5.2 or 5.3
	Component fault in read channel.	Check test points on Data PCBA. Replace or repair Data PCBA.	Paragraph 5.2 or 5.3
	Envelope detector delays not correct.	Check TP106—TP906 on Data PCBA for correct on and off times. Replace or repair Data PCBA.	Paragraph 5.2 or 5.3
	Threshold level incorrect.	Check level at TP6 on Data PCBA. Replace or Repair PCBA.	Paragraph 6.5.9

SECTION VII
PARTS LISTS, LOGIC LEVELS AND WAVEFORMS, AND SCHEMATICS

7.1 INTRODUCTION

This section includes illustrated parts lists, logic level and waveform definitions, and schematic and assembly drawings.

7.2 ILLUSTRATED PARTS BREAKDOWN (IPB)

Figures 7-1 through 7-5, used in conjunction with Tables 7-1 through 7-5, respectively, provide identification by Pertec part number of the mechanical and electrical components of the T8000A and FT8000A Series Tape Transports.

When part numbers for a particular part differ due to a change in transport configuration, descriptions and part numbers for all configurations are listed.

7.3 RECOMMENDED SPARE PARTS

Table 7-6 provides a list of the recommended subassembly spare parts for the T8000A and FT8000A Series Tape Transports. The Customer should always furnish the model number and the serial number of the transport when ordering parts.

An additional recommended spare parts list containing the part number, description, current price for component parts, subassembly parts, and special tools, is also available. This list can be obtained by providing the unit part number from the ID label on the transport to Pertec Spares Administration, P.O. Box 2198, Chatsworth, CA 91311.

7.4 PART NUMBER CROSS REFERENCE

Table 7-7 provides a cross reference to the manufacturer's part number from typical Pertec part numbers.

7.5 LOGIC LEVELS AND WAVEFORMS

The transport control and interface logic uses the DTL800 series of logic elements. Logic levels are: +5.0v — logical true; +0.4v — logical false.

All basic waveform names are chosen to correspond to the logical true condition, e.g., SET WRITE STATUS (ISWS) enables the write circuits when it is logically true (+5.0v), 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 photosensor head, or +5.0v 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 voltage divider between +5.0v and 0v.

All interface waveforms are low-true. Their logic levels are: +3.0v — logical false; +0.4v — logical true. For example, ISFC (SYNCHRONOUS FORWARD COMMAND) will be +0.4v when the transport is driven in the forward direction, or +3.0v otherwise.

The Glossary contains the waveforms mnemonics referred to in this manual.

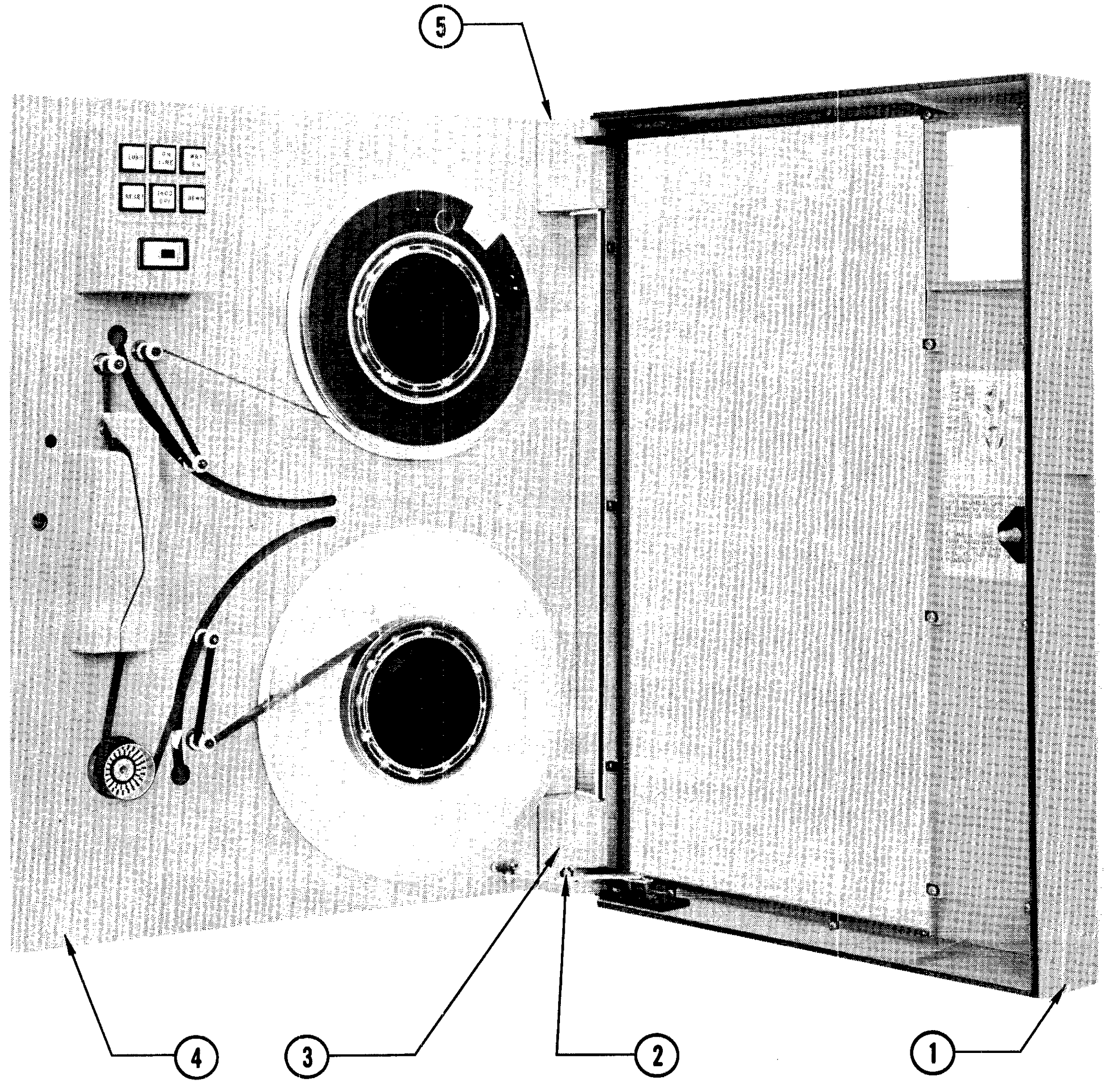

Figure 7-1. T8000A and FT8000A Series, Photo Parts Index (Front View)

Table 7-1
T8000A and FT8000A Series, Photo Parts List

Figure and Index No.	Part No.	Description
Figure 7-1		
1	103357-01	Door Assembly, Complete
	103336-01	Door Frame
	103356-01	Door Insert (large)
	103356-02	Door Insert (small)
	103836-02	Glass Retainer (15 required)
	600-2606	Screw (15 required)
	103369-01	Latch Bracket
	602-0605	Screw (2 required)
	605-0600	Washer (2 required)
	606-0600	Washer (2 required)
	615-0005	Ball Stud
	101125-01	Hex Spacer
	103966-01	Tape Path Label
	103342-01	Lower Hinge
	103342-02	Upper Hinge
	601-0611	Screw (2 per hinge)
	606-0600	Washer (2 per hinge)
	604-2600	Nut (2 per hinge)
2	101777-01	Door Stop Assembly
	608-0608	Screw (2 required)
3	104796-06	Door Hinge Block (bottom)
	608-1012	Screw (2 required)
	608-1016	Screw (1 required)
4	101761-01	Overlay
	103387-02	Screw (6 required)
5	104796-05	Door Hinge Block (top)
	608-1012	Screw (2 required)
	608-1016	Screw (1 required)
Not Shown	103535-01	Accent Panel — White with Pertec Logo
	103535-02	Accent Panel — White with no Logo
	103535-03	Accent Panel — Clear with Pertec Logo
	103535-04	Accent Panel — Clear with no Logo

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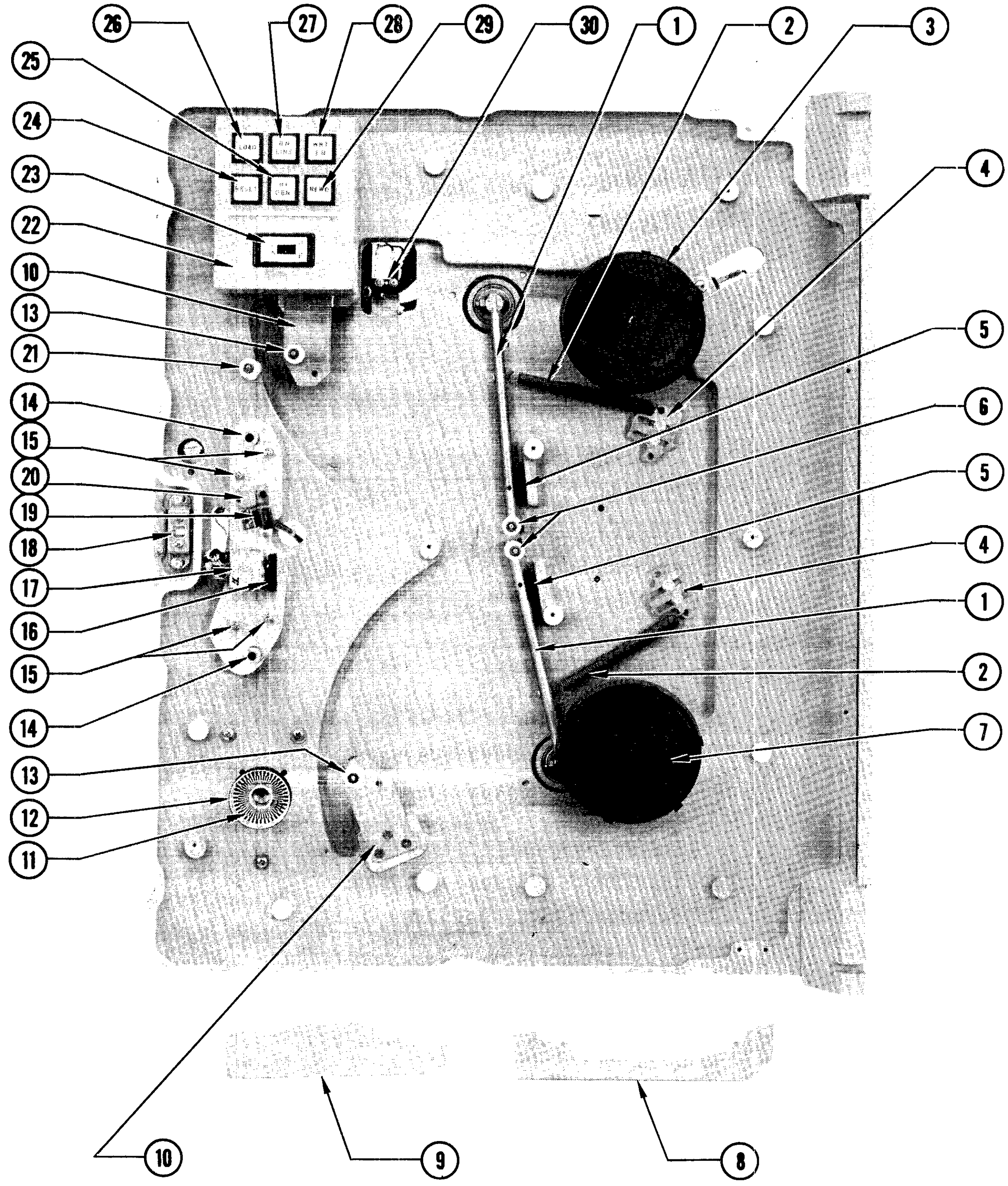

Figure 7-2. T8000A and FT8000A Series, Photo Parts Index (Door and Overlay Removed)

Table 7-2
T8000A and FT8000A Series Photo Parts List

Figure and Index No.	Part No.	Description
Figure 7-2		
1	103347-01	Tension Arm
	602-0812	Screw
	604-2800	Hex Nut
2	103544-01	Tension Arm Spring
	615-0070	Clevis Pin
	669-0038	Shrink Sleeving
3	102261-02	Reel Hub Assembly
	109502-01	Friction Ring and Expansion Ring Kit
4	103384-01	Spring Anchor Bracket
	608-1606	Screw
5	667-0017	Neoprene Cushion
6	100808-03	Tension Arm Roller Guide Assembly with shaft (white)
	100808-06	Tension Arm Roller Guide Assembly with Shaft (black)
	602-0406	Screw
7	103343-02	Fixed Takeup Hub Assembly
	109502-01	Friction Ring and Expansion Ring Kit
8	103938-01	Front Head Cover Plate
9	103939-01	Rear Head Cover Plate
10	103351-01	Guide Bridge Plate
	601-0610	Screw (3 required)
11	101744-*	Strobe Disk
12	103352-01	Capstan ≤0.635 m/s (25 ips)
	603-1603	Screw
	103353-01	Capstan >0.635 m/s (25 ips)
	603-1603	Screw
13	101026-02	Fixed Roller Guide (white)
	101026-05	Fixed Roller Guides (black)
	601-0806	Screw
14	100810-01	Head Guide Assembly (matched pair)
	602-0414	Screw
	605-0400	Washer
	606-0400	Washer
15	615-0460	Stud (midget banana plug)
16	102581-01	Flux Gate (dual stack transport only)
	602-0212	Screw
	605-4201	Washer
	606-0200	Washer
17	526-*	Magnetic Head
	602-0414	Screw (2 required)
	612-0005	Washer (2 required)
	605-0400	Washer (2 required)

Figure and Index No.	Part No.	Description
18	103542-01	Door Latch Assembly
	608-1608	Screw (2 required)
19	102320-01	Photosensor (EOT/BOT)
	608-1608	Screw (2 required)
	103813-01	EOT/BOT Reflector
	600-0416	Screw (2 required)
	604-2400	Nut (2 required)
20	103805-90	Tape Cleaner Assembly
	602-0405	Screw (2 required)
	605-0400	Washer (2 required)
	100761-01	Tape Cleaner Blade
	600-0403	Screw
21	101026-03	Fixed Roller Guide Assembly (white)
	101026-06	Fixed Roller Guide Assembly (black)
	600-0826	Screw
	605-0800	Washer
22	102280-01	Switch Housing
	102280-02	Switch Housing with Select Switch (option)
	102363-02	Select Switch Assembly (option)
	608-1616	Screw (2 required)
	109620-01	Switch Housing with Door Safety Switch (option)
	108396-01	Housing, Switch
	108397-01	Bracket, Switch
	601-0405	Screw (2 required)
23	506-1817	ON/OFF Switch with Clip
24	102357-23	RESET Switch Assembly
25	102357-20	HI DEN Switch Assembly (NRZI)
	102357-21	1600 CPI Switch Assembly (PE)
26	102357-16	LOAD Switch Assembly
27	102357-17	ON-LINE Switch Assembly
28	102357-19	WRT EN Switch Assembly
	102357-22	FPT Switch Assembly
	102357-24	9-TRACK Switch Assembly
29	102357-18	REWD Switch Assembly
	659-0730	Lamp for above Switches
30	103552-03	Arm-Stop Switch Assembly
	506-6361	Microswitch
Not Shown	100298-01	Head Guide Shims
	516-0100	Takeup Reel
	103338-01	Rack Mounting Hinge (male)
	103338-02	Deck Mounting Hinge (female)
	110186-04	Door Safety Switch (Ref. PIB T8069B)

*Refer to Table 7-6 for specific part numbers.

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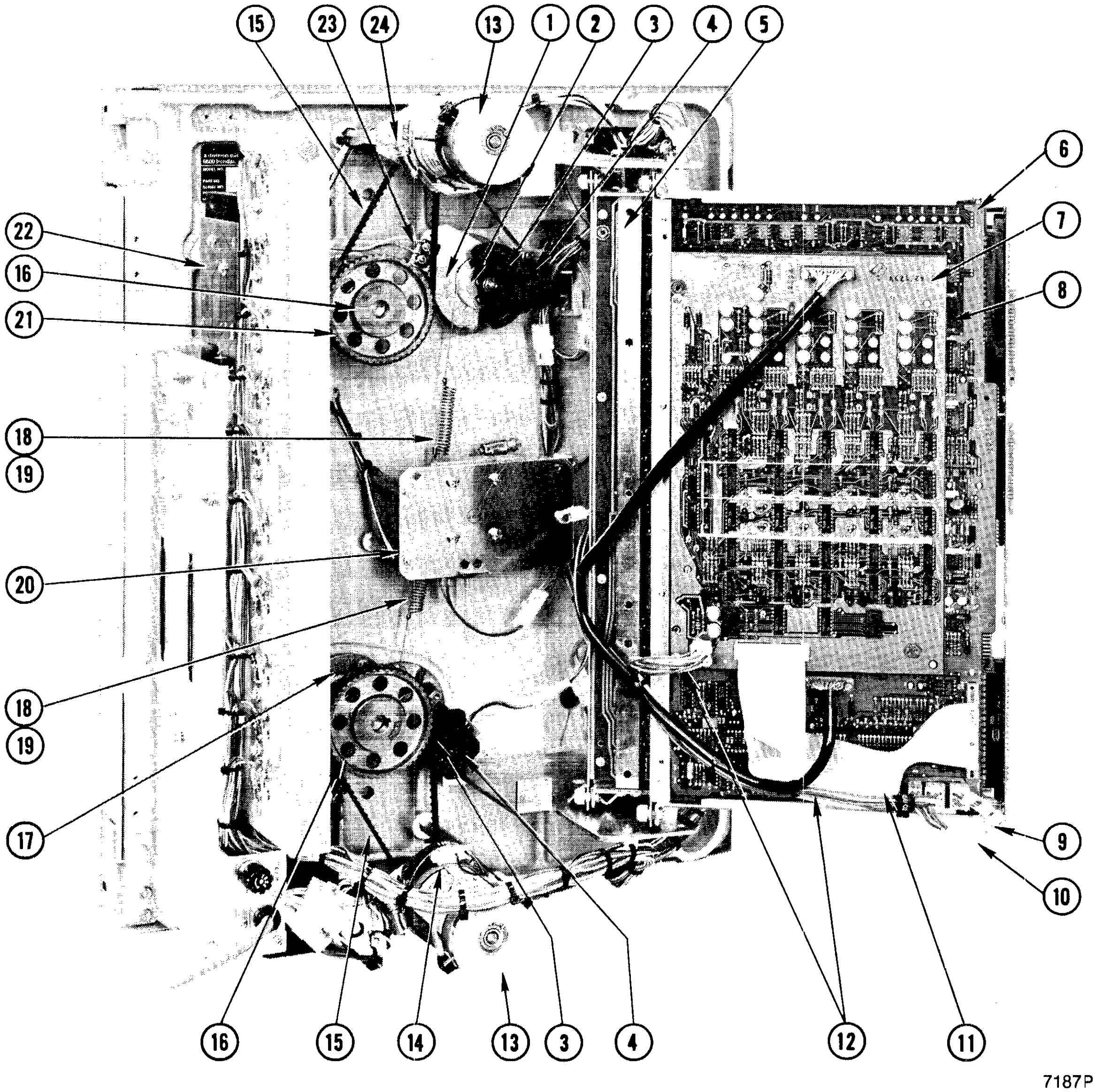

Figure 7-3. T8000A and FT8000A Series, Photo Parts Index (Rear View, PCBAs Extended)

Table 7-3
T8000A and FT8000A Series Photo Parts List

Figure & Index No.	Part No.	Description
Figure 7-3		
1	103547-01 602-0414	Cam, Interlock Screw
2	102297-01 602-0414 604-0400	Pulley, Arm Retract Screw Hex Nut
3	100925-01 606-0001 612-0021 615-1032	Shutter Flat Washer Lock Washer Lock Nut
4	100858-05 601-0604	Tension Arm Sensor Assembly Screw (2 required)
5	103375-01 103375-02	Complete Card Cage Assembly Complete Card Cage Assembly (FT8 Only)
6	107605-*	Microformatter PCBA (FT8 Only)
7	**	PE/NRZI Write PCBA (8640-98 Only)
8	**	Data PCBA
9	101077-03	Cable Board Interconnect (Data E17, E19, D J1 to Tape Control J J8) (Data F, G, D1, K1, J8 to Tape Control J J8)
10	101915-03	Cable Board Interconnect (Data K1 J11 to Tape Control J J11) (Data K2 J6 to Tape Control J J11)
11	696-0034	Cable
12	102368-02	Cable Board Interconnect (Data K2 J7 to PE/NRZI Write 2 J3)
13	102410-02 600-2606 606-0600	Reel Motor Assembly Screw (4 required) Washer (4 required)
14	102245-01 615-0114	RFI Filter Assembly Clamp, Adjustable
15	610-0020	Timing Belt, 80 Tooth
16	102595-01 615-3404	Pulley, 48 Tooth Key
17	103350-01 608-1008	Reel Drive Assembly, Takeup Screw (3 required)
18	102305-01	Arm Retract Linkage (Cable)
19	102373-01	Retract Linkage Spring
20	102258-01 506-6360	Retractor Assembly (Gear Motor) Microswitch
21	100179-02 608-1008	Reel Drive Assembly, Supply Screw (3 required)
22	107615-*	Power Supply II PCBA (FT8 Only) (Part of Power Supply Assembly)
23	103541-01 506-6361 601-0606	Limit Switch Assembly Microswitch Screw (2 required)
24	102332-01	Reel Motor Mounting Plate
Not Shown	101070-01 101077-04	Card Alignment Block (T8 Only) Cable Board Interconnect (PE/NRZI Write J26 to Tape Control J J8) (Data K2 J5 to Tape Control J J8)
	102368-01	Cable Board Interconnect (PE/NRZI Write J25 to Data K1 J8)
Not Shown	107653-02	Cable Board Interconnect (Power Supply II J2 to Interconnect E J5)

*Order as indicated on PCBA, Component Side.
**Refer to Spare Parts List, Table 7-6, for specific part number.

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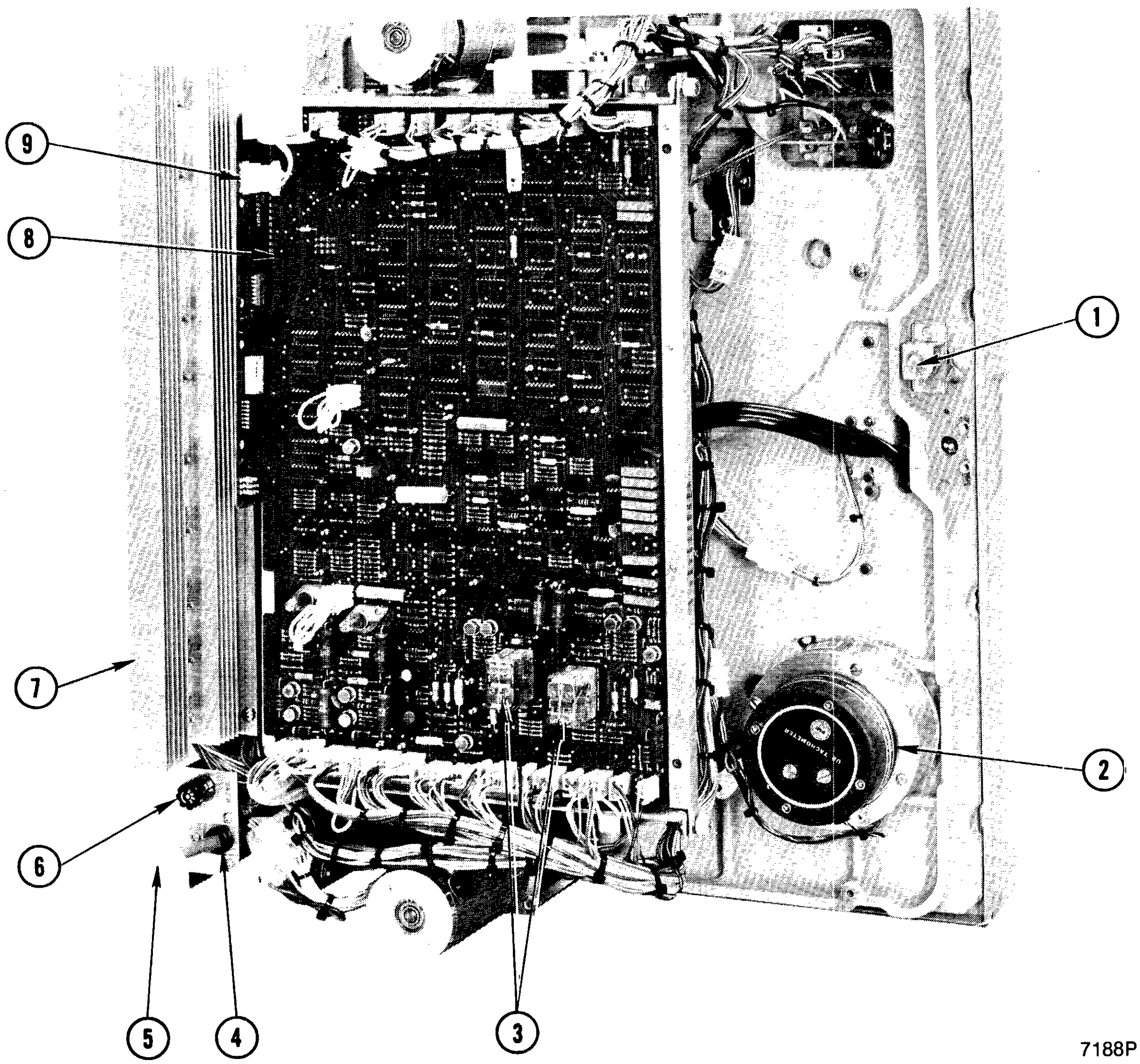

Figure 7-4. T8000A and FT8000A Series, Photo Parts Index (Rear View)

Table 7-4
T8000A and FT8000A Series Photo Parts List

Figure and Index No.	Part No.	Description
Figure 7-4		
1	615-4410	Adjustable Pawl Fastener
	608-1608	Screw (2 required)
2	102386-11	Capstan Motor Assembly >0.635 m/s (25 ips)
	600-0818	Screw (3 required)
	605-0800	Washer (3 required)
	606-0800	Washer (3 required)
	102413-11	Capstan Motor Assembly ≤0.635 m/s (25 ips)
	602-0612	Screw (3 required)
	605-0600	Washer (3 required)
	606-0600	Washer (3 required)
3	502-1244	Relay
4	660-0022	Bushing, Strain Relief
5	104770-01	Power Cord Assembly, 95-125V, 50/60 Hz
	104770-02	Power Cord Assembly, 190-250V, 50 Hz
	104770-03	Power Cord Assembly, 190-250V, 60 Hz
6	663-3550	Fuse, 95-125V, 5A
	663-3530	Fuse, 190-250V, 3A
7	102316-01	Heatsink Assembly
	600-2006	Screw (3 required)
	604-2000	Nut (3 required)
8	102334-**	Tape Control J PCBA
9	107611-**	Interconnect E PCBA (FT8 Only)
Not Shown	102245-01	RFI Filter Assembly
	615-0114	Adjustable Clamp

*Not required with 48V Converter
**Order as indicated on PCBA, Component Side

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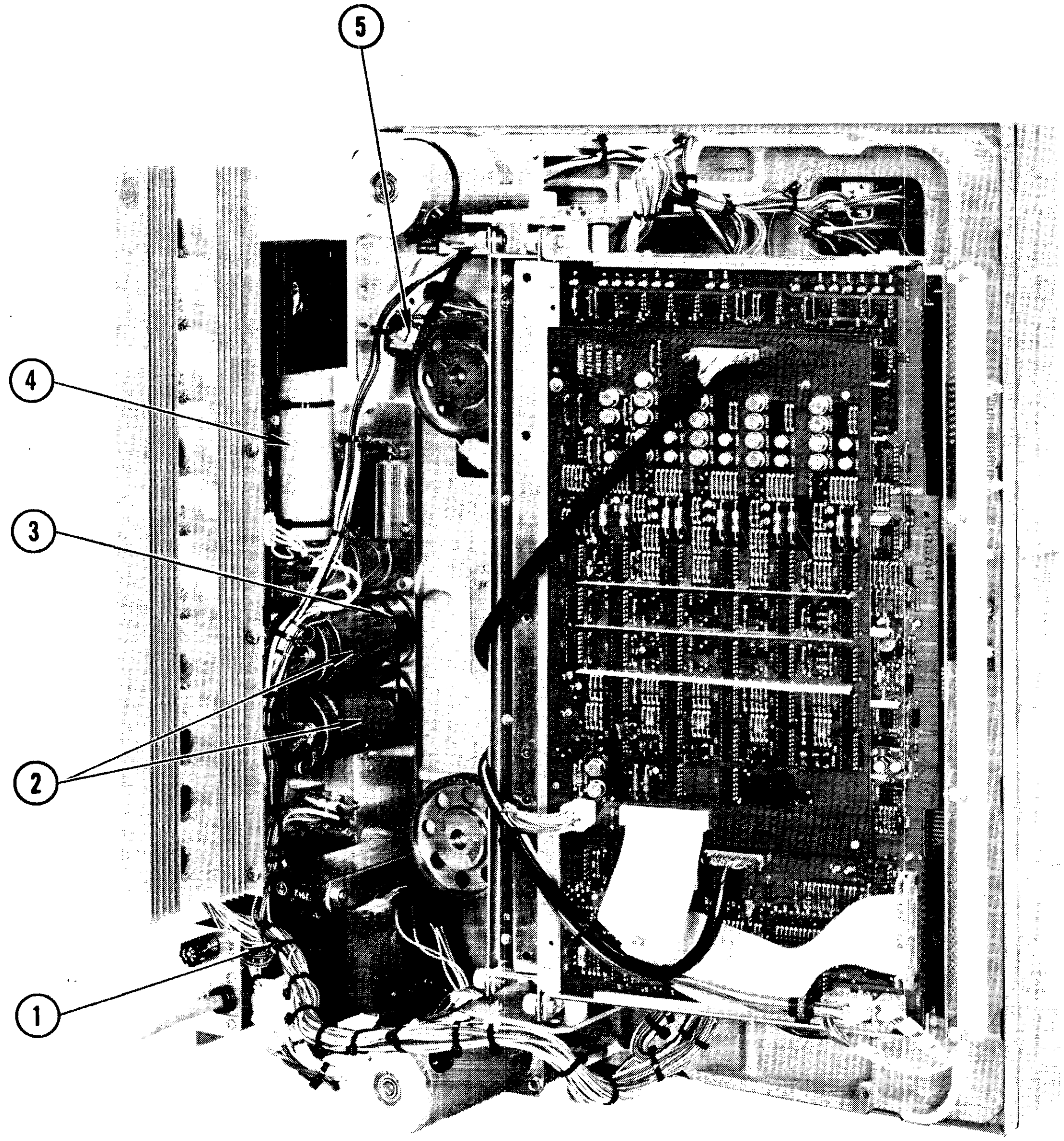

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Figure 7-5. T8000A and FT8000A Series, Photo Parts Index (Rear View)

Table 7-5
T8000A and FT8000A Photo Parts List

Figure and Index No.	Part No.	Description
Figure 7-5		
1	103345-01	Power Supply Assembly (T8)
	103345-03	Power Supply Assembly (FT8)
	or	
	104700-*	48V Converter Assembly
2	134-2492	Capacitor
3	661-0013	Tie Wrap
4	107615-**	Power Supply II PCBA
	—or—	
	110188-**	48V Power Supply II
5	100817-02	Write Lockout Assembly
	506-6360	Microswitch
Not Shown	102262-01***	Capacitor Pack Assembly (T8 Only)

*Refer to drawing 104700 for specific part number.
**Order as indicated on PCBA, Component Side
***Not required with 48V Converter

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Table 7-6
Recommended Spare Parts List

	Description	Part No.
1.	Data D1 PCBA (T8X60A)	101721-*
	Data F PCBA (8640A)	101346-*
	Data G PCBA (T8660A)	101376-*
	Data K1 PCBA (8640A-98)	102326-*
	Data K2 PCBA (8640A-98)	104721-*
	Data E17 PCBA (8X40A) (7-Track) (T8000 Only)	101716-*
	Data E19 PCBA (8X40A) (9-Track)	101711-*
2.	PE/NRZI Write PCBA (8640A-98)	102308-*
	PE/NRZI Write 2 PCBA (8640A-98)	104726-*
3.	Tape Control J PCBA	102334-*
4.	Interconnect E PCBA (FT8000 Only)	107611-*
5.	Microformatter PCBA (FT8X40A-9XDF) (FT8X40A-9XF)	107605-*
6.	Tape Cleaner Assembly	103805-90
	Tape Cleaner Blade	100761-01
7.	Photosensor Assembly	102320-01
8.	Tension Arm Sensor Assembly	100858-05
9.	Tension Arm Roller Guide Assembly (white)	100808-03
	Tension Arm Roller Guide Assembly (black)	100808-06
10.	Fixed Roller Guide Assembly (white)	101026-02
	Fixed Roller Guide Assembly (black)	101026-05
11.	Fixed Roller Guide Assembly (white)	101026-03
	Fixed Roller Guide Assembly (black)	101026-06
12.	Reel Motor Assembly	102410-02
13.	Capstan Motor Assembly >0.635 m/s (25 ips)	102386-11
	Capstan Motor Assembly ⩽0.635 m/s (25 ips)	102413-11
14.	ON/OFF Switch	506-1817
15	LOAD Switch Assembly	102357-16
	ON LINE Switch Assembly	102357-17
	REWD Switch Assembly	102357-18
	WRT EN Switch Assembly	102357-19
	HI DEN Switch Assembly	102357-20
	1600 CPI Switch Assembly	102357-21
	FPT Switch Assembly	102357-22
	RESET Switch Assembly	102357-23
	9 TRACK Switch Assembly	102357-24
16.	Lamp for above switches	659-0730
17.	Head, 7-Track (T8X40A) All Speeds	510-6187
	Head, 9-Track (8X40A) All Speeds	510-6189
	Head, 9-Track (8640A) All Speeds	510-6269
	Head, 9-Track (8640A-98) All Speeds	510-6269
	Head, 7-Track (T8X60A) All Speeds	510-5187
	Head, 9-Track (T8X60A) All Speeds	510-5189
	Head, 9-Track (T8660A), 0.317 m/s (12.5 ips)	510-5169
	Head, 9-Track (T8660A), 0.476 m/s (18.75 ips)	510-5269
	Head, 9-Track (T8660A), 0.635—1.143 m/s (25—45 ips)	510-5369
18.	Head Guide Shim	100298-01
19.	Strobe Disk, 0.317/0.635 m/s (12.5/25 ips)	101744-02
	Strobe Disk, 0.476/0.953 m/s (18.75/37.5 ips)	101744-03
	Strobe Disk, 0.508/1.016 m/s (20/40 ips)	101744-04
	Strobe Disk, 0.572/1.143 m/s (22.5/45 ips)	101744-05
	Strobe Disk, 0.762 m/s (30 ips)	101744-07
	Strobe Disk, 0.635 m/s (25 ips)	101744-08
20.	Plug Assembly (FT8640A-9XXF) 0.317 m/s (12.5 ips)	107609-01
	Plug Assembly (FT8640A-9XXF) 0.476 m/s (18.75 ips)	107609-02
	Plug Assembly (FT8640A-9XXF) 0.572 m/s (22.5 ips)	107609-03
	Plug Assembly (FT8640A-9XXF) 0.635 m/s (25 ips)	107609-04
	Plug Assembly (FT8640A-9XXF) 0.953 m/s (37.5 ips)	107609-05
	Plug Assembly (FT8640A-9XXF) 1.143 m/s (45 ips)	107609-06

*Order as indicated on PCBA, Component Side.

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Table 7-7
T8000/FT8000 Series
Part Number Cross Reference

Manufacturer Part No./Description	Manufacturer	Pertec Part No.
Resistors, Carbon Film, Carbon Composition	(Comply with MIL-R-11)	
5.6 ohms ±5%, ½w		101-0565
7.5 ohms ±5%, ¼w		100-0755
10 ohms ±5%, ¼w		100-1005
12 ohms ±5%, ¼w		100-1205
22 ohms ±5%, ¼w		100-2205
27 ohms ±5%, ¼w		101-2705
39 ohms ±5%, ¼w		100-3905
47 ohms ±5%, ½w		101-4705
56 ohms ±5%, ¼w		100-5605
68 ohms ±5%, ¼w		100-6805
68 ohms ±5%, ½w		101-6805
68 ohms ±5%, 1w		102-6805
82 ohms ±5%, ½w		101-8205
100 ohms ±5%, ¼w		100-1015
100 ohms ±5%, ½w		101-1015
100 ohms ±5%, 1w		102-1015
100 ohms ±5%, 2w		103-1015
120 ohms ±5%, ¼w		100-1215
120 ohms ±5%, ½w		101-1215
150 ohms ±5%, ¼w		100-1515
150 ohms ±5%, 1w		102-1515
180 ohms ±5%, ¼w		100-1815
180 ohms ±5%, 1w		102-1815
220 ohms ±5%, ¼w		100-2215
220 ohms ±5%, ½w		101-2215
220 ohms ±5%, 1w		102-2215
270 ohms ±5%, ¼w		100-2715
270 ohms ±5%, ½w		101-2715
330 ohms ±5%, ¼w		100-3315
330 ohms ±5%, ½w		101-3315
330 ohms ±5%, 1w		102-3315
390 ohms ±5%, ¼w		100-3915
390 ohms ±5%, ½w		101-3915
470 ohms ±5%, ¼w		100-4715
470 ohms ±5%, ½w		101-4715
560 ohms ±5%, ¼w		100-5615
560 ohms ±5%, ½w		101-5615
680 ohms ±5%, ¼w		100-6815
820 ohms ±5%, ¼w		100-8215
820 ohms ±5%, ½w		101-8215
1k ohms ±5%, ¼w		100-1025
1.2k ohms ±5%, ¼w		100-1225
1.5k ohms ±5%, ¼w		100-1525
1.5k ohms ±5%, ½w		101-1525
1.8k ohms ±5%, ¼w		100-1825
2.2k ohms ±5%, ¼w		100-2225
2.7k ohms ±5%, ¼w		100-2725
3.3k ohms ±5%, ¼w		100-3325
3.9k ohms ±5%, ¼w		100-3925
4.7k ohms ±5%, ¼w		100-4725
5.6k ohms ±5%, ¼w		100-5625
6.8k ohms ±5%, ¼w		100-6825
8.2k ohms ±5%, ¼w		100-8225
10k ohms ±5%, ¼w		100-1035
12k ohms ±5%, ¼w		100-1235
15k ohms ±5%, ¼w		100-1535
18k ohms ±5%, ¼w		100-1835
22k ohms ±5%, ¼w		100-2235
27k ohms ±5%, ¼w		100-2735
33k ohms ±5%, ¼w		100-3335
39k ohms ±5%, ¼w		100-3935
47k ohms ±5%, ¼w		100-4735
56k ohms ±5%, ¼w		100-5635
68k ohms ±5%, ¼w		100-6835
82k ohms ±5%, ¼w		100-8235
100k ohms ±5%, ¼w		100-1045

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Table 7-7
T8000/FT8000 Series
Part Number Cross Reference (Continued)

Manufacturer Part No./Description	Manufacturer	Pertec Part No.
Dipped Mica Capacitors (Cont.)		
150 pf ±5%, 500wvdc		130-1515
200 pf ±5%, 500wvdc		130-2015
220 pf ±5%, 500wvdc		130-2215
330 pf ±5%, 500wvdc		130-3315
470 pf ±5%, 500wvdc		130-4715
560 pf ±5%, 300wvdc		130-5615
750 pf ±5%, 300wvdc		130-7515
Film Capacitors		
0.001 μfd ±10%, 100wvdc, 630 series	TRW	131-1020
0.0015 μfd ±10%, 100wvdc, 630 series	TRW	131-1520
0.0022 μfd ±10%, 100wvdc, 630 series	TRW	131-2220
0.0033 μfd ±10%, 100wvdc, 630 series	TRW	131-3320
0.0047 μfd ±10%, 100wvdc, 630 series	TRW	131-4720
0.0068 μfd ±10%, 100wvdc, 630 series	TRW	131-6820
0.01 μfd ±10%, 100wvdc, Type PT-420	Paktron	131-1030
0.015 μfd ±10%, 100wvdc, 630 series	TRW	131-1530
0.022 μfd ±10%, 100wvdc, Type PT-485	Paktron	131-2230
0.033 μfd ±10%, 100wvdc, 630 series	TRW	131-3330
0.047 μfd ±10%, 100wvdc, Type PT-605	Paktron	131-4730
0.22 μfd ±10%, 100wvdc, 192P22492	Sprague	131-2240
0.33 μfd ±10%, 100wvdc, 334K01PT605	Paktron	131-3340
Solid Tantalum Capacitors		
2.2 μfd ±20%, 20wvdc, TAC225M020P03	Mallory	139-2244
2.7 μfd ±20%, 35wvdc, TIM275M035POW	Mallory	132-2752
10 μfd ±20%, 10wvdc, TIM106M010POW	Mallory	132-1062
12 μfd ±20%, 10wvdc, TIM126K010POW	Mallory	132-1262
22 μfd ±20%, 6wvdc, TIM226M006POW	Mallory	132-2262
Ceramic Capacitors		
0.001 μfd ±20%, 1000wvdc, DD-102	Centralab	135-1002
0.47 μfd ±20%, 100wvdc, 300-100-601-474M	Center Engineering	135-4742
0.47 μfd +80% −20%, 100wvdc, 8128-M102-651-4742	Erie	135-4741
Transistors		
TIP41C, NPN, TO-220AB	Texas Instruments	200-0041
2N3053, NPN, Medium Power, TO-5	RCA	200-3053
2N3771, NPN, Power, TO-3	RCA	200-3771
2N4037, PNP, Medium Power, TO-5	RCA	200-4037
2N4123, NPN, Switching, TO-92	Motorola	200-4123
2N4124, NPN, Switching, TO-92	Motorola	200-4124
2N4125, PNP, Switching, TO-92	Motorola	200-4125
2N5321, NPN, High Power, TO-5	RCA	200-5321
2N5323, PNP, High Power, TO-5	RCA	200-5323
2N6051, PNP, Power Darlington, TO-3	Motorola	200-6051
2N6058, NPN, Power Darlington, TO-3	Motorola	200-6058
Silicon Controlled Rectifier		
2N3228, 5A, 120v, TO-66	RCA	201-3228
Field Effect Transistors		
2N4393, N-Channel, Switching, TO-18	National	204-4394
2N4860, N-Channel, Switching, 0.1A, 30v, TO-92	Motorola	204-0074
Diodes		
1N4002, Rectifier, 1A, 100vdc, DO-41	Motorola	300-4002
1N4446, Switching, 75PIV, DO-35	Texas Instruments	300-4446
Zener Diodes		
1N4730A, 3.9vdc ±5%, 1w	Texas Instruments	330-0395
1N4732A, 4.7vdc ±5%, 1w	Texas Instruments	330-0475
1N4740-1%, 10vdc ±1%, 1w	ITT	330-1005
1N5223B, 2.7vdc ±5%, 500mw	ITT	331-0275

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Table 7-7
T8000/FT8000 Series
Part Number Cross Reference (Continued)

Manufacturer Part No./Description	Manufacturer	Pertec Part No.
Operational Amplifiers		
LM318N, Op Amp, Single, High Speed	National	400-0318
LM339N, Quad Volt Comp	National	400-0339
MC1437L, Dual Op Amp	Motorola	400-1437
Relays		
R10 E3725-2, 4PDT, 185 ohms, 12vdc coil, contacts rating 7A @28vdc	Potter & Brumfield	502-1243
Inductors		
1537-76, 100 μH ±5%, @ 2.5 MHz	Delevan	515-1015
Integrated Circuit		
SN15836N, Inverter, Hex	Texas Instruments	700-8360
SN15844N, Gate Power NAND, M-75	Texas Instruments	700-8440
SN15846N, Gate NAND, M-75	Texas Instruments	700-8460
SN158093, Flipflop Dual J-K	Texas Instruments	700-8530
SN158097N, Flipflop Dual J-K	Texas Instruments	700-8520
SN74504, Inverter Hex	Texas Instruments	700-4040
SN7400N, Positive NAND	Texas Instruments	700-7400
SN7402N, Digital Positive-NOR	Texas Instruments	700-7402
SN7404N, Hex, Single Input Inverter	Texas Instruments	700-7404
SN7410N, Gate Positive NAND	Texas Instruments	700-7410
SN74107N, Flipflop, J-K	Texas Instruments	700-4107
SN74123N, Multivibrator	Texas Instruments	700-4123
SN7416N, Inverter Buffer	Texas Instruments	700-7416
SN74221N, Multivibrator Dual	Texas Instruments	700-4221
SN7430N, Positive NAND	Texas Instruments	700-7430
SN7433N, Buffer Gate NOR	Texas Instruments	700-7433
SN7438N, Positive NAND, Digital	Texas Instruments	700-7438
SN7474N, Flipflop, D-Type	Texas Instruments	700-7474
SN7476, Flipflop J-K Dual	Texas Instruments	700-7476
SN7486N, Exclusive-OR, Quad	Texas Instruments	700-7486
SN7496, Register Shift, Five-bit	Texas Instruments	700-7496
SN75107AN, Receiver, Shift, Five-bit	Texas Instruments	700-5107
SN75451BP, Driver Dual, AND/OR Invert	Texas Instruments	700-7545
SN75452P, Positive NAND	Texas Instruments	700-5452
SN74LS00N, Positive NAND	Texas Instruments	710-7400
SN74LS02N, Gate Positive NOR	Texas Instruments	710-7402
SN74LS04N, Inverter Hex	Texas Instruments	710-7404
SN74LS08N, Gate Positive AND	Texas Instruments	710-7408
SN74LS10N, Gate Positive NAND	Texas Instruments	710-7410
SN74LS11N, Gate Positive AND	Texas Instruments	710-7411
SN74LS14N, Inverter Hex	Texas Instruments	710-7414
SN74LS27N, Gate Positive NOR	Texas Instruments	710-7427
SN74LS30N, Gate Positive NAND	Texas Instruments	710-7430
SN74LS32N, Gate Positive OR	Texas Instruments	710-7432
SN74LS74N, Flipflop, D-Type	Texas Instruments	710-7474
SN74LS76N, Flipflop, J-K	Texas Instruments	710-7476
SN74LS86N, Gate Exclusive-OR	Texas Instruments	710-7486
SN74LS95N, Register, Right Shift	Texas Instruments	710-7495
SN74LS96N, Register, Shift	Texas Instruments	710-7496
SN74LS151, Digital Selector	Texas Instruments	710-4151
SN74LS153, Digital Selector	Texas Instruments	710-4153
SN74LS161N, Synchronous Counter	Motorola	710-4161
SN74LS163PC, Synchronous Counter	Fairchild	710-4163
SN74LS164N, Synchronous Register	Motorola	710-4164
SN74LS174N, Flipflop, D-Type	Texas Instruments	710-4174
SN74LS175N, Flipflop, D-Type	Texas Instruments	710-4175
SN74LS280N, Parity Generator/Checker	Texas Instruments	710-4280

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Table 7-7
T8000/FT8000 Series
Part Number Cross Reference (Continued)

Manufacturer Part No./Description	Manufacturer	Pertec Part No.
Resistors, Carbon Film, Carbon Composition (Cont.)		
120k ohms ±5%, ¼w		100-1245
150k ohms ±5%, ¼w		100-1545
180k ohms ±5%, ¼w		100-1845
220k ohms ±5%, ¼w		100-2245
330k ohms ±5%, ¼w		100-3345
390k ohms ±5%, ¼w		100-3945
470k ohms ±5%, ¼w		100-4745
820k ohms ±5%, ¼w		100-8245
1.0m ohms ±5%, ¼w		100-1055
1.5m ohms ±5%, ¼w		100-1555
5.6m ohms ±5%, ¼w		100-5655
10m ohms ±5%, ¼w		100-1065
Resistors, Metal Film		
178 ohms ±1%, 1/8w		107-1780
287 ohms ±1%, ¼w		104-2870
422 ohms ±1%, 1/8w		107-4220
422 ohms ±1%, ¼w		104-4220
511 ohms ±1%, ¼w		104-5110
562 ohms ±1%, ¼w		104-5620
619 ohms ±1%, 1/8w		107-6190
619 ohms ±1%, ¼w		104-6190
681 ohms ±1%, ¼w		104-6810
825 ohms ±1%, ¼w		104-8250
909 ohms ±1%, ¼w		104-9090
1k ohms ±1%, 1/8w		107-1001
1k ohms ±1%, ¼w		104-1001
1.1k ohms ±1%, ¼w		104-1101
1.21k ohms ±1%, 1/8w		107-1211
1.62k ohms ±1%, ¼w		104-1621
1.78k ohms ±1%, 1/8w		107-1781
1.96k ohms ±1%, 1/8w		107-1961
1.96k ohms ±1%, ¼w		104-1961
2.15k ohms ±1%, 1/8w		107-2151
2.15k ohms ±1%, ¼w		104-2151
2.37k ohms ±1%, 1/8w		107-2371
2.37k ohms ±1%, ¼w		104-2371
2.61k ohms ±1%, ¼w		104-2611
2.87k ohms ±1%, ¼w		104-2871
3.16k ohms ±1%, 1/8w		107-3161
3.16k ohms ±1%, ¼w		104-3161
3.48k ohms ±1%, ¼w		104-3481
3.83k ohms ±1%, ¼w		104-3831
4.22k ohms ±1%, ¼w		104-4221
4.64k ohms ±1%, 1/8w		107-4641
4.64k ohms ±1%, ¼w		104-4641
5.11k ohms ±1%, 1/8w		107-5111
5.11k ohms ±1%, ¼w		104-5111
5.62k ohms ±1%, ¼w		104-5621
6.19k ohms ±1%, ¼w		104-6191
6.81k ohms ±1%, ¼w		104-6811
7.5k ohms ±1%, ¼w		104-7501
9.09k ohms ±1%, 1/8w		107-9091
9.09k ohms ±1%, ¼w		104-9091
10k ohms ±1%, 1/8w		107-1002
10k ohms ±1%, ¼w		104-1002
11k ohms ±1%, ¼w		104-1102
13.3k ohms ±1%, ¼w		104-1332
17.8k ohms ±1%, ¼w		104-1782
19.6k ohms ±1%, ¼w		104-1962
21.5k ohms ±1%, 1/8w		107-2152
2.15k ohms ±1%, ¼w		104-2152
23.7k ohms ±1%, 1/8w		107-2372
23.7k ohms ±1%, ¼w		104-2372
26.1k ohms ±1%, 1/8w		107-2612
26.1k ohms ±1%, ¼w		104-2612
28.7k ohms ±1%, 1/8w		107-2872

Table 7-7
T8000/FT8000 Series
Part Number Cross Reference (Continued)

Manufacturer Part No./Description	Manufacturer	Pertec Part No.
Metal Film Resistors (Cont.)		
31.6k ohms ±1%, 1/8w		107-3162
31.6k ohms ±1%, ¼w		104-3162
34.8k ohms ±1%, 1/8w		107-3482
34.8k ohms ±1%, ¼w		104-3482
38.3k ohms ±1%, 1/8w		107-3832
38.3k ohms ±1%, ¼w		104-3832
46.4k ohms ±1%, ¼w		104-4642
56.2k ohms ±1%, 1/8w		107-5622
61.9k ohms ±1%, ¼w		104-6192
68.1k ohms ±1%, ¼w		104-6812
75k ohms ±1%, 1/8w		107-7502
75k ohms ±1%, ½w		104-7502
82.5k ohms ±1%, 1/8w		107-8252
82.5k ohms ±1%, ¼w		104-8252
90.9k ohms ±1%, ¼w		104-9092
100k ohms ±1%, ¼w		104-1003
110k ohms ±1%, 1/8w		107-1103
110k ohms ±1%, ¼w		104-1103
121k ohms ±1%, ¼w		104-1213
133k ohms ±1%, ¼w		104-1333
147k ohms ±1%, 1/8w		107-1473
162k ohms ±1%, 1/8w		107-1623
178k ohms ±1%, ¼w		104-1783
196k ohms ±1%, ¼w		104-1963
215k ohms ±1%, ¼w		104-2153
348k ohms ±1%, ¼w		104-3483
383k ohms ±1%, ¼w		104-3833
422k ohms ±1%, ¼w		104-4223
681k ohms ±1%, ¼w		104-6813
Resistors, Wirewound		
0.10 ohms ±3%, 5w		109-0003
0.20 ohms ±3%, 5w		109-0002
0.5 ohms ±3%, 1w		113-0053
5 ohms ±3%, 5w		109-0009
Variable Resistors		
100 ohms ±10%, ½w, 66W-100	Beckman	124-1010
500 ohms ±10%, ¾w, 79PR500	Beckman	121-5010
1k ohms ±10%, ¾w, 79PR1K	Beckman	121-1020
1k ohms ±20%, ½w, 3329P-1-102	Bourns	123-1020
2k ohms ±10%, ¾w, 79PR2K	Beckman	121-2020
5k ohms ±10%, ½w, 66W-5K	Beckman	124-5020
5k ohms ±10%, ¾w, 79PR5K	Beckman	121-5020
5k ohms ±20%, ½w, 3329P-1-502	Bourns	123-5020
10k ohms ±10%, ¾w, 79PR10K	Beckman	121-1030
10k ohms ±20%, ½w, 3329P-1-1-103	Bourns	123-1030
20k ohms ±10%, ½w, 66W-20K	Beckman	124-1030
20k ohms ±10%, ¾w, 79PR20K	Beckman	121-2030
50k ohms ±10%, ½w, 66W-50K	Beckman	124-5030
50k ohms ±10%, ¾w, 79PR50K	Beckman	121-5030
100k ohms ±10%, ¾w, 79PR100K	Beckman	121-1040
Dipped Mica Capacitors	(Comply with MIL-C-5)	
5 pf ±5%, 500wvdc		130-0505
10 pf ±5%, 500wvdc		130-1005
15 pf ±5%, 500wvdc		130-1505
22 pf ±5%, 500wvdc		130-2205
33 pf ±5%, 500wvdc		130-3305
39 pf ±5%, 500wvdc		130-3905
47 pf ±5%, 500wvdc		130-4705
56 pf ±5%, 500wvdc		130-5605
68 pf ±5%, 500wvdc		130-6805
75 pf ±5%, 500wvdc		130-7505
100 pf ±5%, 500wvdc		130-1015
130 pf ±5%, 500wvdc		130-1315

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APPENDIX A

GLOSSARY — T5000, T6000, T7000, T8000 AND T9000 TAPE TRANSPORTS

Symbol	Description
AOS	Arm Offset (T5000 and T8000 Transports)
B1B	Buffer 1 Busy
BCD	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
BOV*	Buffer Overflow
BPI	Bits Per Inch
BUSY	Transport Busy
CBY	Command Busy
CCG*	Check Character Gate
CCS	Check Character Strobe
CER*	Correctable Error
CHARDET*	Character Detect
CLRNZDATA*	Clear NRZI Data
CMP1,2	Clamp Waveform 1,2
COPY*	Copy
COS	Capstan Offset Adjustment
CPI	Characters Per Inch
CRC0—CRC7	Cyclic Redundancy Check, Ch 0—7
CRCC	Cyclic Redundancy Check Character
CRCP	Cyclic Redundancy Check Parity
CT0—CT7	Center Tap 0—7
CTP	Center Tap Parity
CT4	Count 4
CT8	Count 8
CUR	Clean-up Ramp
CURLIM	Reel Servo Current Limit
c/mm	Characters Per Millimetre
D8CT	Disables 8 Count
DBOT	Delayed Beginning of Tape
DBY	Data Busy
DCLM	Delay Current Limit Motors
DD1	Data Density Indicator
DDS	Data Density Select
DDSX	Data Density Select External
DEN*	Density
DGATE*	Data Gate
DI*	Data In
DMC	Disable Manual Controls
DROPDET*	Drop Detected
DUN	Done and Unload
EAO	Encoder Amplifier Output
ECC	Error Check Character (Group Coded Recording)
ECD	Echo Check Disable
ECE	Echo Check Error
ECLK	Envelope Clock
ECO0—ECO7	Echo Check Output, Ch 0—7
ECOP	Echo Check Output Parity
ECR	Echo Check Reset
ECRC	Enable CRC
EDIT*	Edit

Symbol	Description
EEC	Enable Echo Check
EEP	Enable Encoder Pulse
EF	Erase Winding Finish
EFM	Enable File Mark
ENV*	Envelope Detected
EOT*	End of Tape
EOTI	End of Tape Input
EOTO	End of Tape Output
EPNP	Encoder Pulse Narrow Powerful
EPS	Erase Power Start
EPW	Encoder Pulse Wide
ERASE*	Erase
ES	Erase Winding Start
EWPC	Enable Write Power Control
EWRS	Enable Write/Read Status
FAD*	Formatter Address
FBY*	Formatter Busy
FEN*	Formatter Enable
FER*	Formatter Error
FGC	File Gap Command
FGL	File Gap Lamp
FGR	File Gap Ramp
FLR	First Load or Rewind
FM	File Mark
FMK*	File Mark
FMKNZ*	File Mark NRZI
FMKPE*	File Mark PE
FPT	File Protect
FRPI	Flux Reversals Per Inch
fr/mm	Flux Reversals Per Millimetre
FWD	Forward
GIP	Gap In Process
GO	Pulse that occurs at the beginning of MOTION
GO1*	GO
GRS	General Reset
HER*	Hard Error
HERNZ*	Hard Error NRZI
HID	High Density
HIS	High Speed Adjustment
HSR	High Speed Ramp Adjustment
IBG	Inter-Block Gap (same as IRG)
ID*	Identification
IDGATE	Identification Gate
ILKS	Interlock Switch, Supply (Vacuum Column Transports)
ILKT	Interlock Switch, Takeup (Vacuum Column Transports)
INTLK	Transport Interlock Signal
INTLK SW	Interlock Switch (Tension Arm Transports)
IRG	Inter-Record Gap (same as IBG)
IRGC	Inter-Record Gap Command
K1-ON	Relay K1 On
K2 ENERG	Relay K2 Energize
LD	Lamp Driver

NOTES:
1. *Microformatter Only
2. Symbols are often prefixed with I (Interface signal) or N (low active signal) when used in text and tables.

APPENDIX A

GLOSSARY — T5000, T6000, T7000, T8000 AND T9000 TAPE TRANSPORTS (Continued)

Symbol	Description
LDCRC*	Load Cyclic Redundancy Check
LDFAIL	Load Fail
LDLOOP	Load Loop
LDP	Load Point
LDWRTDATA*	Load Write Data
LFC	Load Forward Command
LFR	Load Forward Ramp
LKS	Interlock Switches, Supply
LKT	Interlock Switches, Takeup
LOAD	Load Forward
LOAD SW	Load Switch Signal, Low True
LOCK	Interlock Off pulse
LOCKA	Interlock A
LOCKB	Interlock B
LOCKTIME	Locktime pulse
LOL*	Load On Line
LOS	Low Speed Adjustment
LRCC	Longitudinal Redundancy Check Character
LSR	Low Speed Ramp Adjustment (T8000 and T5000 Transports)
LWD*	Last Word
m	Metric system abbreviation for metre equal to 39.37 inches.
mm	Metric system abbreviation for millimetre equal to 0.001 metre or 0.03937 inch.
MOT	Tape Motion. Goes true for internal tape motion of any kind, i.e. forward, reverse, manual, rewind (T9000 transports).
MOTION	Tape Motion in response to interface commands.
MRY	Master Reset
MTA	Multiple Transport Adapter
N	Metric system unit of force; abbreviation for newton; equal to the force that produces an acceleration of one metre per second on a mass of one kilogram. Conversion from the U.S. system is as follows: pounds × 4.448 = N ounces × 0.278 = N
N·m	Metric system measurement of torque; abbreviation for newton-metre. Conversion from the U.S. system is as follows: foot-pounds × 1.3558 = N·m inch-pounds × 0.11298 = N·m
NRZ*	Non-Return to Zero
NRZI	Non-Return to Zero Inverted
OFC*	Off Line Command
OFFC	Off Line Input Command
OFL*	Off Line
OLUNL	Off Line Unload
ONEDET*	Ones Detected
ONLD	On Line Delay
ONLINE	On Line Status Signal
OOLL	On Line/Off Line Lamp
ORD	ORed Data
OVW	Overwrite
PARC*	Parity Correcting
PE	Phase Encoded
PICKK1	Pick K-1 Relay
POSTJUMP*	Postamble Jump
POSTEST*	Postamble Test

Symbol	Description
PR*	Parity
PRESET*	Preset
PS SIGNAL	Power Supply Ready Signal
PSEN*	Power Supply Enable
PSO0—PSO7	Peak Sensor Output, Ch 0—7
PSOP	Peak Sensor Output Parity
PSP	Peak Sensor Parity
RAC	Reset AC
RACT	Read Amplifier Center Tap
RAP1, RAP2	Read Amplifier Parity, Output 1, Output2
RCLK*	Read Clock
RD0—RD7	Read Data, Ch 0—7
RDI	Relay Driver Input
RDNZ*	Read NRZI Data
RDP	Read Data Parity
RDS	Read Data Strobe
RDY	Ready
REN*	Read Enable
RENDNZ*	Read End NRZI
RENDPE*	Read End PE
REV	Reverse
REW*	Rewind
REW RAMP A	Rewind Ramp Output A
REW RAMP B	Rewind Ramp Output B
REWRI	Rewind Ramp Initiate
RF0—RF7	Read Finish 0—7
RFP	Read Finish Parity
RGATENZ*	Read Gate NRZI
RGATEPE*	Read Gate PE
RGC	Inter-Record Gap Command
RGR	Inter-Record Gap Ramp
RMP	Capstan Ramp Adjustment (Vacuum Column Transports)
RO	Ready and On Line
ROT	Read Only Transport
RROS	Rewind Reel Offset
RRS	Remote Reset
RS1	Rewind Step 1
RSC*	Read Strobe Counter
RSP	Read Start Parity
RST	Reset
RSTR*	Read Strobe
RSTRNZ*	Read Strobe NRZI
RSTRPE*	Read Strobe PE
RTH1	Read Threshold 1
RTH2	Read Threshold 2
RTN1	Front Panel Switches Ground Return 1
RWC	Rewind Command
RWD	Rewinding
RWD REL DRVR	Rewind Relay Driver
RWL	Rewind Lamp
RWU	Rewind Unit
RWR	Rewind Ramp
RW1	Rewind Sequence 1. Active during entire rewind sequence.
RW2	Rewind Sequence 2. Active upon first detecting BOT.
RW3	Rewind Sequence 3. Active upon passing over BOT tab detected in RW2.
RYC	Ready Command

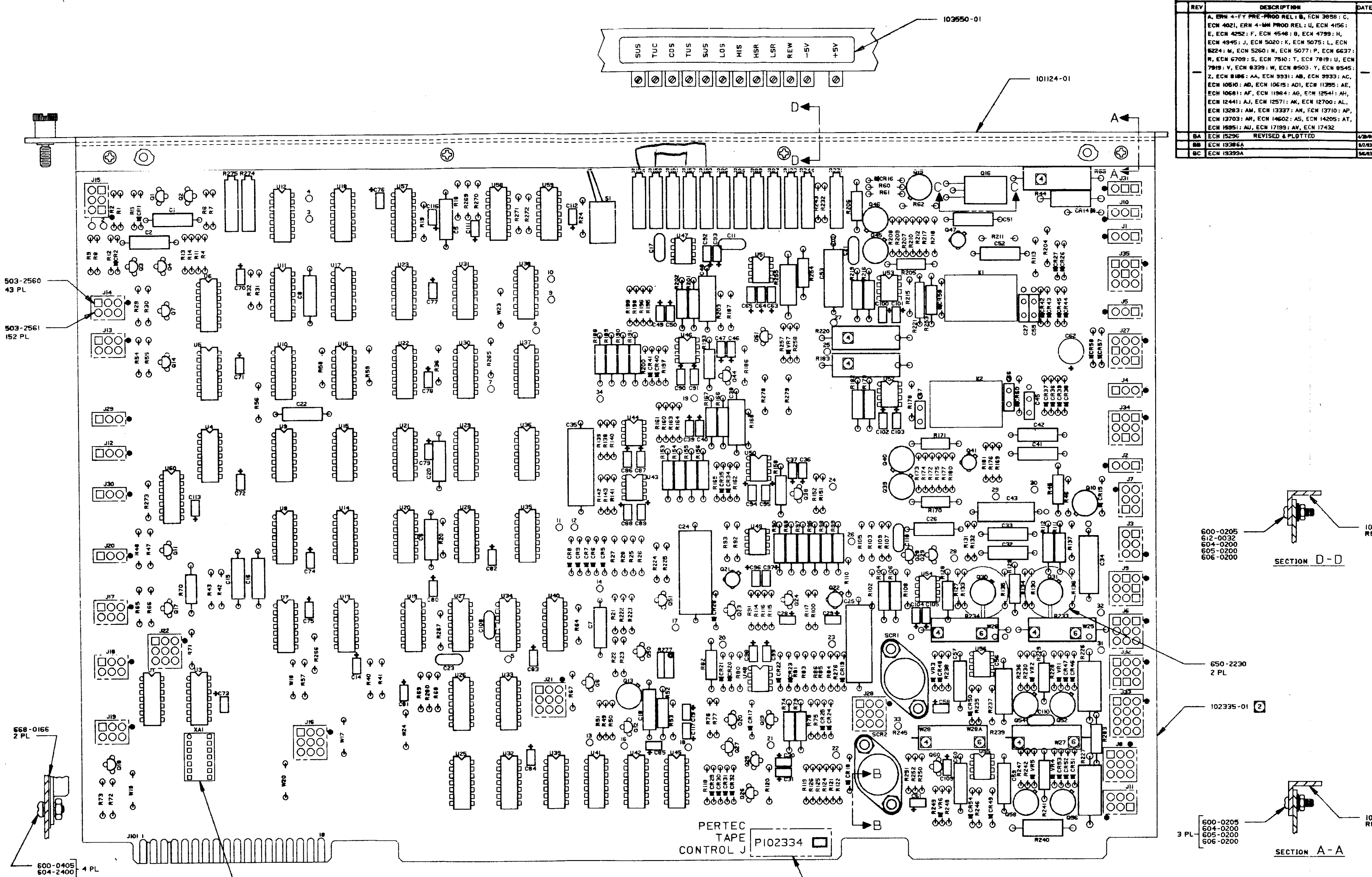
APPENDIX A

GLOSSARY — T5000, T6000, T7000, T8000 AND T9000 TAPE TRANSPORTS (Continued)

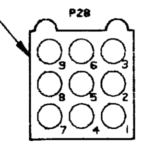
Symbol	Description
SBY	Start Busy Delay
SEEKLP	Seek Load Point
SFC	Synchronous Forward Command
SFCD	Synchronous Forward Command Delayed
SFL1—SFL4	Step Forward Level 1—4
SGL*	Single
SHLCLK*	Shift Left Clock
SHRCLK*	Shift Right Clock
SKLP	Seek Load Point
SKTO	Seek Time Out
SLT0—SLT3	Select Transport 0—3
SPC*	Space Command
SPD*	Speed
SRC	Synchronous Reverse Command
SRO/SRO1	Selected, Ready and On-Line
SRST	Switch Reset
STAC	Stop Tension Arm Cocking (T8000 Transport)
SUC	Supply Arm Centering Adjustment (T5000 and T8000 Transport)
SUP	Supply Position Adjustment (T9000 Transports)
SUP F 90% SW	Supply Forward 90% Switch (T9000 Transports)
SUP F/R 110% SW	Supply Forward/Reverse Switch (T9000 Transports)
SUS	Supply Swing Adjustment (Tension Arm Transports except T7000) Supply Speed Adjustment (Vacuum Column Transports)
SWS	Set Write Status
TAD	Turnaround Delay
TAD0,1*	Transport Address
TBY	Turnaround Busy
TENCNT	Tension Control
THR*	Read Threshold
TIP	Tape In Path
TNA	Tension Amplifier
TNT	Tape Not Tensioned (Vacuum Column Transports)
TRR	Transport Ready
TU F 90% SW	Takeup Forward 90% Switch (T9000 Transports)
TU F/R 110% SW	Takeup Forward/Reverse 110% Switch (T9000 Transports)

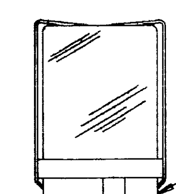
Symbol	Description
TU R 90% SW	Takeup Reverse 90% Switch (T9000 Transports)
TUC	Takeup Arm Centering Adjustment (T5000 and T8000 Transports)
TUP	Takeup Position Adjustment (Vacuum Column Transports)
TUS	Takeup Swing Adjustment (T5000, T6000 and T8000 Transports) Takeup Speed Adjustment (Vacuum Column Transports)
ULOS	Unload Offset
UNL	Unload
VPA	Vacuum Pump Actuator
WARS	Write Amplifier Reset
WCLK*	Write Clock
WCN*	Write Control
WCRC	Write CRC
WD*	Write Data
WDO	Write Data Output
WD0—WD7	Write Data, Ch 0—7
WDP	Write Data Parity
WDS	Write Data Strobe
WDSN	Write Data Strobe Narrow
WDSW	Write Data Strobe Wide
WF0—WF7	Write Finish, Ch 0—7
WFM	Write File Mark
WFP	Write Finish Parity
WLO	Write Lockout
W/RF0—W/RF7	Write/Read Head Winding Finish, Ch 0—7
W/RFP	Write/Read Head Winding Finish Parity
WRS	Write/Read Status
W/RS0—W/RS7	Write/Read Head Winding Start, Ch 0—7
W/RSP	Write/Read Head Winding Start Parity
WRT*	Write
WRT EN	Write Enable
WRT PWR	Write Power
WS0—WS7	Write Start, Ch 0—7
WSC	Write Step Command
WSP	Write Start Parity
WSTR*	Write Strobe
9 TRK	Nine Track Format

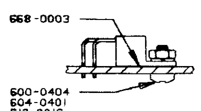
	REV	DESCRIPTION	DATE	DR	CHK	APPR
	—	A, ERN 4-FY PRE-PROD REL: B, ECN 3858: C, ECN 4021, ERN 4-MN PROD REL: D, ECN 4156: E, ECN 4252: F, ECN 4548: G, ECN 4799: H, ECN 4945: J, ECN 5020: K, ECN 5075: L, ECN 5224: M, ECN 5260: N, ECN 5077: P, ECN 6637: R, ECN 6709: S, ECN 7510: T, ECN 7819: U, ECN 7919: V, ECN 8339: W, ECN 8503: Y, ECN 8545: Z, ECN 8186: AA, ECN 9931: AB, ECN 9933: AC, ECN 10610: AD, ECN 10615: AD1, ECN 11355: AE, ECN 10681: AF, ECN 11984: AG, ECN 12541: AH, ECN 12441: AJ, ECN 12571: AK, ECN 12700: AL, ECN 13283: AM, ECN 13337: AN, ECN 13710: AP, ECN 13703: AR, ECN 14602: AS, ECN 14205: AT, ECN 15951: AU, ECN 17199: AV, ECN 17432	—	—	—	—
	BA	ECN 15296 REVISED & PLOTTED	4/30/81	CADD		
	BB	ECN 19386A	9/2/83	SCF		
	BC	ECN 19399A	9/6/83	SCF		

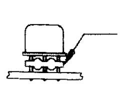


P28 WIRING CHART			
REF	JUMPER WIRE P/N 101914	FROM	TO
W1	-01	6	8
W2	-01	2	7
W3	-01	4	9
W4	-02	1	3(MALE)









SPEC: 102337
SCHEMATIC: 102333
REFERENCE DRAWINGS:

PART NO. 102334- REV

6 FOR PART USAGE SEE 102333,VERSION TABLE II.

5 TERMINATING RESISTOR PACK A1 IS SPECIFIED AT TOP ASSY. IT IS NOT REQD FOR MTA APPLICATION.

4 MAINTAIN MINIMUM AIR GAP OF .125 MIN TO .250 MAX BETWEEN COMPONENT BODY AND BOARD.

3 IDENTIFY ASSEMBLY WITH PART NUMBER AND REVISION ON COMPONENT SIDE.

2 THIS ASSEMBLY SHALL BE MADE FROM PROCESS BOARD 102335-01 REV Y AND SUBSEQUENT.

1. ASSEMBLE PER STANDARD MANUFACTURING METHODS.

NOTES: UNLESS OTHERWISE SPECIFIED

TOP ASSY	T8000
NEXT ASSY	1ST USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
.XX ±
.XXX ±
ANGULAR ± 1/2°
BREAK ALL SHARP CORNERS APPROX. .010
FINISH:

SIGNATURES	DATE
DR. CADD	
CHK J B REEVES	6/6/72
DES	
ENGR D BLANDINO	6/7/72
PROJ. ENGR B ALAIMO	6/12/72

MAT'L: SEE LM

PERTEC
A DIVISION OF PERTEC COMPUTER CORPORATION

TITLE
PCBA,
TAPE CONTROL J

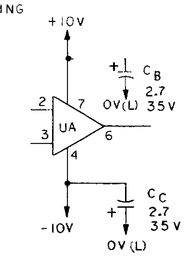
SIZE E | 32097 | DWG NO. 102334 | REV BC

SCALE 2/1 | DO NOT SCALE DRAWING | SHEET 1

CADD

OPERATIONAL AMPLIFIER DECOUPLING TABULATION CHART

UA	CB	CC
U43	C89	C88
U44	C87	C86
U46	C91	C90
U48	C99	C98
U49	C97	C96
U50	C95	C94
U52	C103	C102
U53	C101	C100
U54	C105	C104



POWER CONNECTION AND DECOUPLING USED ON UA

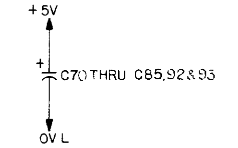
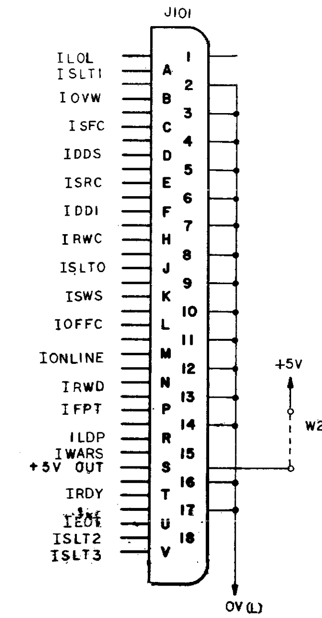
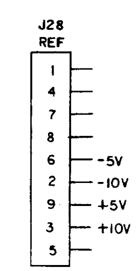
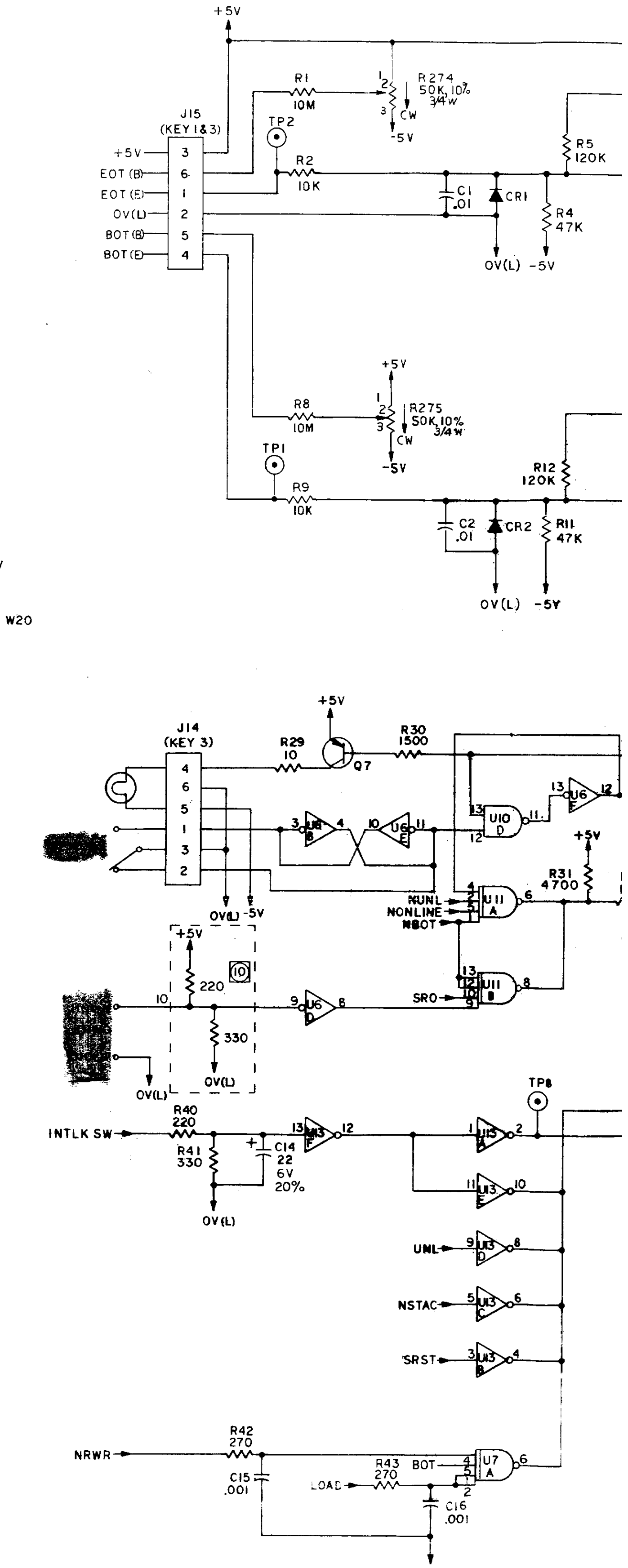


TABLE IV (9)

REFERENCE DESIGNATIONS		
LAST USED		DELETED
[illegible]		C3,4,9,10,12,13,106,107,114,115,44,54,119,120,68,69
CR66		CR3,4,10,11,12,13,33,61,62,63,64,65,66
Q62		Q5,8,9,34 THRU 37,62
R2[illegible]		R15,16,17,33,34,35,37,38,39,144 THRU 150,3,10, 256,259,260,261,262,263,264,268
SCR2		
TP34		TP6, 15
U60		U2,24
W28		W21,22
VR7		
K2		
A1		
S1		







23 REMOVED

(22) FOR PART NO. SEE TABLE III.

(21) FOR PART NO. OF COMPONENTS NOT AFFECTED BY VERSION NO. SEE TABLE I.

(20) COMPONENTS LOCATED ON HEAT SINK ASSY 102316.

(19) PIN 7 IS +10V, PIN 4 IS -10V. FOR DECOUPLING SEE DETAIL ON SHEET 1.

18. REMOVED

17. REMOVED

16. REMOVED

15. REMOVED

(14) NOT USED ON VERSION-01 THRU -32.

(13) SEE TOP ASSEMBLY FOR APPROPRIATE VERSION.

12. ON ALL DIGITAL I.C.'S: PIN 14 IS +5V, PIN 7 IS OV(L). ONE DECOUPLING CAPACITOR USED FOR EVERY THREE I.C.'S.

(11) JUMPER WIRES ARE PART OF JUMPER PLUG ASSEMBLY P21 AND P22, SEE APPROPRIATE VERSION FOR CORRESPONDING INTERCONNECTIONS.

(10) TERMINATING RESISTOR PACK A1 IS SPECIFIED AT TOP ASSY.

(9) FOR LAST USED AND DELETED REF DESIGNATIONS SEE TABLE IV.

8. ⬡ INDICATES TRANSISTORS REQUIRING TOP HAT HEAT SINK.

7. ALL ZENER DIODES ARE 1N4736A.

6. ALL DIODE ARE 1N4446.

5. ALL PNP TRANSISTORS ARE 2N4125.

4. ALL NPN TRANSISTORS ARE 2N4123.

3. ALL CAPACITOR VALUES ARE IN MICROFARADS, 10%, 100V.

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

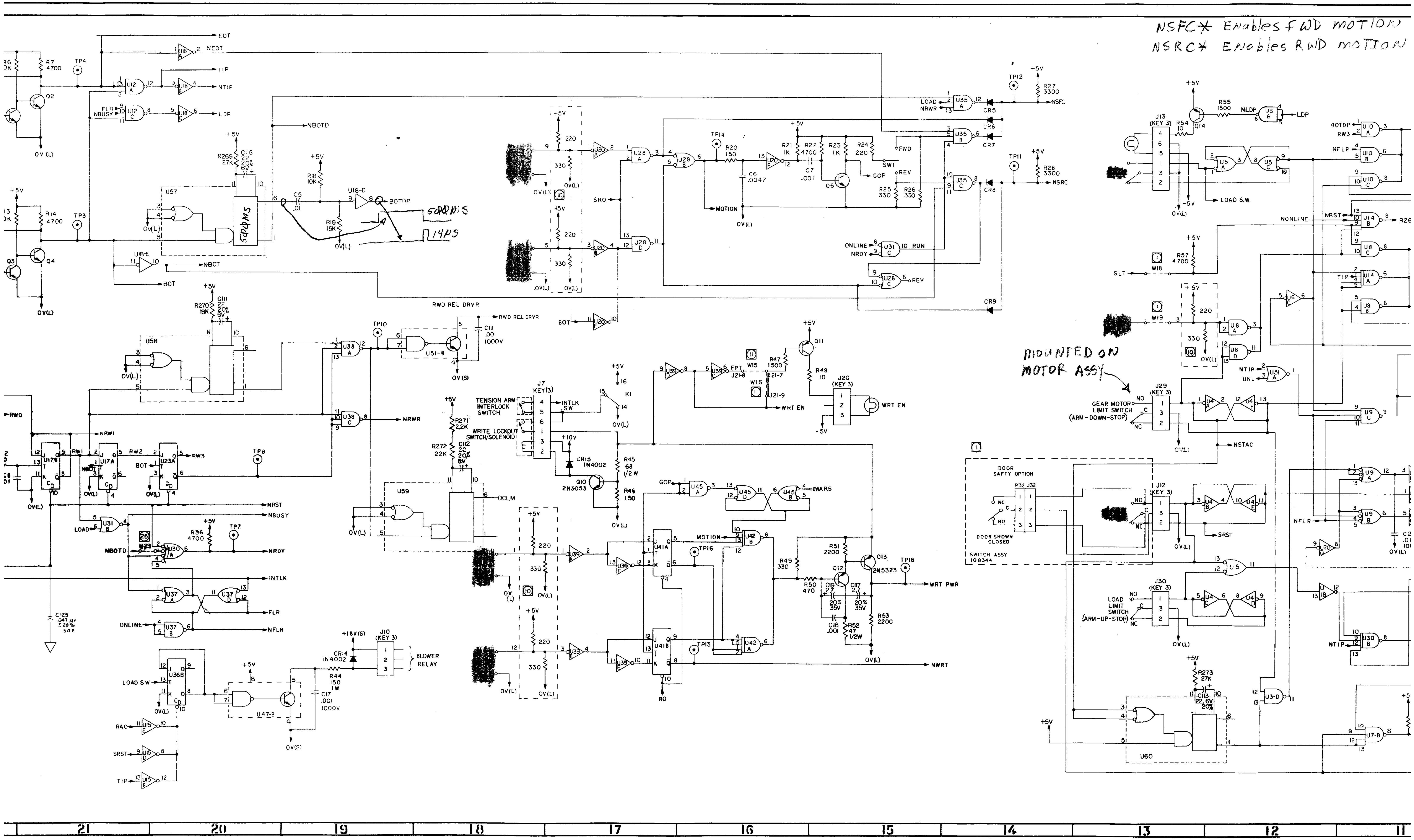
(1) FOR VALUE, PART NO. AND USAGE OF COMPONENTS AFFECTED BY VERSION NO. SEE TABLE II.

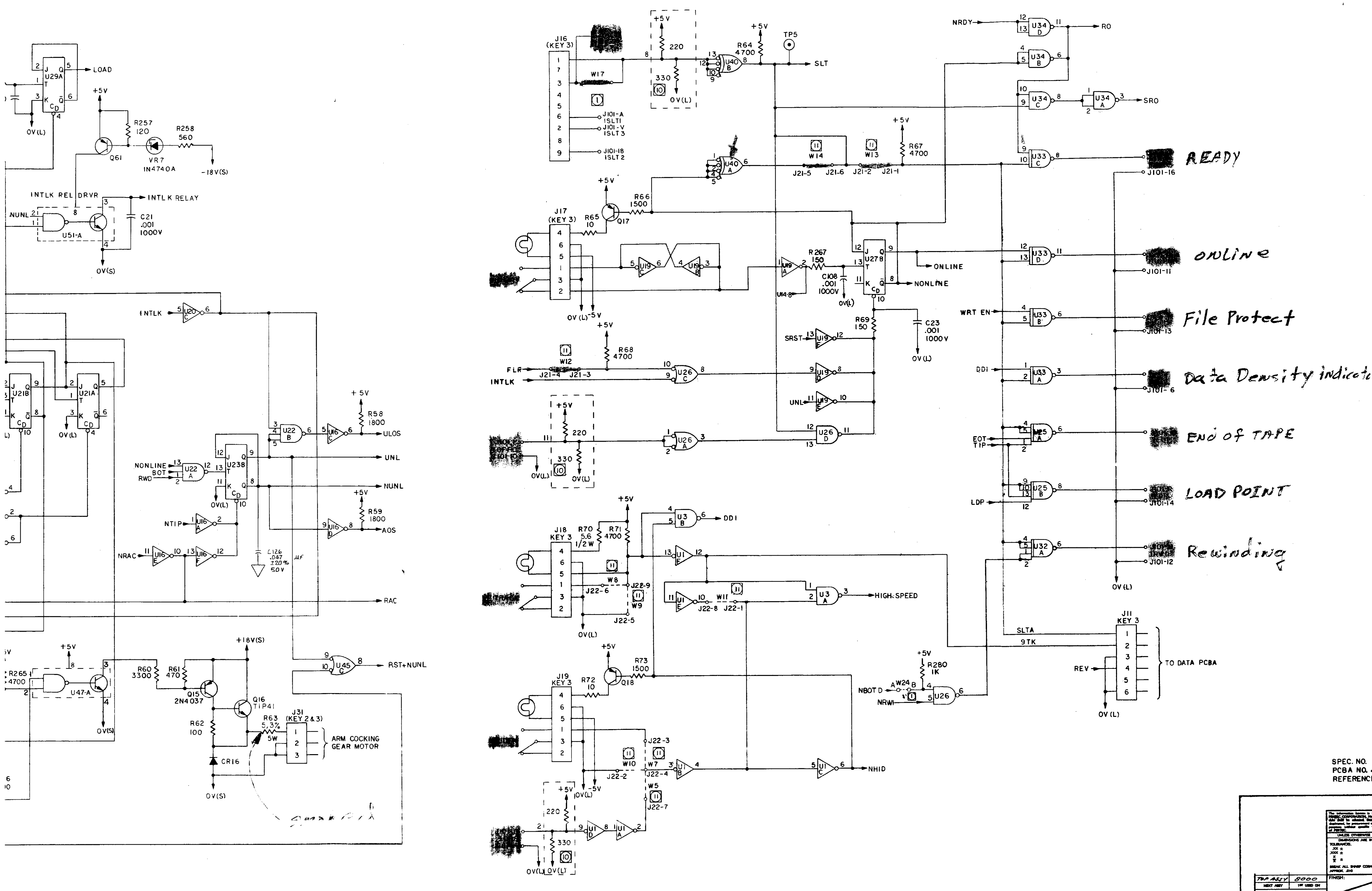
NOTES: UNLESS OTHERWISE SPECIFIED:

(25) CUSTOMER CONTROLLED OPTION - REMOVAL OF W23 ELIMINATES DELAYED READY SIGNAL AFTER REWIND AND AFTER REVERSE COMMAND ONTO BOT.

(24) FOR 37.5 IPS AND 45 IPS VERSIONS USING ELECTROCRAFT MOTORS THESE COMPONENTS ARE INSTALLED IN THE MOTOR HARNESS.

28 | 27 | 26 | 25 | 24 | 23 | 22


NSFC* Enables FWD MOTION
NSRC* Enables RWD MOTION
MOUNTED ON MOTOR ASSY
EOT
NEOT
TIP
NTIP
LDP
NBOTD
BOTDP
NBOT
BOT
RWD REL DRVR
NRWR
NRST
NBUSY
NRDY
INTLK
FLR
NFLR
DCLM
TENSION ARM INTERLOCK SWITCH
WRITE LOCKOUT SWITCH/SOLENOID
WRT EN
WRT PWR
NWRT
MOTION
RUN
REV
GOP
NSFC
NSRC
LOAD S.W.
NSTAC
SRST
GEAR MOTOR LIMIT SWITCH (ARM-DOWN-STOP)
LOAD LIMIT SWITCH (ARM-UP-STOP)
DOOR SAFTY OPTION
DOOR SHOWN CLOSED
SWITCH ASSY 108344
BLOWER RELAY
21
20
19
18
17
16
15
14
13
12
11



REV	DESCRIPTION	DATE	DR	CHK	APPD
A	ERN 4-F-Y PRE PRODUCTION RELEASE	[illegible]	[illegible]	[illegible]	[illegible]
F	ECN 3858	[illegible]	[illegible]	[illegible]	[illegible]
C	ECN 3931	[illegible]	RAS	[illegible]	[illegible]
D	ECN 3957	[illegible]	RAS	[illegible]	[illegible]
E	ECN 4027A	7/31/72	T.B	[illegible]	[illegible]
	ERN 4-MN PROD. RELEASE	[illegible]	[illegible]	[illegible]	[illegible]
F	ECN 4044A	8/28/72	TB	[illegible]	DB
G	ECN 4222 REVISED & REDRAWN	[illegible]	TB	[illegible]	[illegible]
H	ECN 4253	[illegible]	T.B	[illegible]	[illegible]
J	ECN 4455	[illegible]	[illegible]	[illegible]	DB
K	ECN 4548	[illegible]	[illegible]	[illegible]	DB
L	ECN 4625	1/4/73	J.M	[illegible]	DB
M	ECN 4799A	1/10/73	[illegible]	[illegible]	DB
N	ECN 4877B	[illegible]	[illegible]	[illegible]	DB
P	ECN 4945	[illegible]	[illegible]	[illegible]	DB
R	ECN 5020	[illegible]	[illegible]	[illegible]	DB
S	ECN 5075	[illegible]	C.W.	[illegible]	DB
T	ECN 5224	5/21/73	[illegible]	[illegible]	KW
U	ECN 5260	6-4-73	CW.	[illegible]	KW
V	ECN 5250 A	[illegible]	[illegible]	[illegible]	KW
W	ECN 5397	8/1/73	[illegible]	[illegible]	KW
Y	ECN 5077A	10/3/73	[illegible]	[illegible]	KW
Z	ECN 6190	[illegible]	[illegible]	[illegible]	KW
Z1	ECN 6430	[illegible]	[illegible]	[illegible]	[illegible]
AA	ECN 6637A	[illegible]	[illegible]	[illegible]	[illegible]
AB	ECN 6709	[illegible]	[illegible]	[illegible]	[illegible]
AC	ECN 7059	[illegible]	[illegible]	[illegible]	[illegible]
AD	ECN 7075	[illegible]	[illegible]	[illegible]	[illegible]
AE	ECN 7170	3/12/75	CJ	[illegible]	[illegible]
AF	ECN 7510	[illegible]	[illegible]	[illegible]	[illegible]
AG	ECN 7680	[illegible]	GJR	[illegible]	[illegible]
AH	ECN 7787	9/10/75	GJR	[illegible]	[illegible]
AJ	ECN 7819	[illegible]	[illegible]	[illegible]	[illegible]
AK	ECN 7835A	[illegible]	MM	[illegible]	[illegible]
AL	ECN 8115	[illegible]	FPP	[illegible]	[illegible]
AL1	ECN 8149	[illegible]	RAS	[illegible]	[illegible]
AM	ECN 8339	[illegible]	[illegible]	RK	[illegible]
AN	ECN 8311	[illegible]	AK	[illegible]	[illegible]
AP	ECN 8342	[illegible]	[illegible]	[illegible]	[illegible]
AR	ECN 8503	[illegible]	RJ	[illegible]	[illegible]
AS	ECN 8545A	[illegible]	RJ	[illegible]	[illegible]
AT	ECN 8186	[illegible]	RJ	[illegible]	[illegible]
AU	ECN 8803	[illegible]	SK	[illegible]	[illegible]
AV	ECN 9754	[illegible]	[illegible]	[illegible]	[illegible]
AW	ECN 9931A	[illegible]	J.S	[illegible]	[illegible]
AY	ECN 9935	[illegible]	[illegible]	[illegible]	[illegible]
AZ	ECN 10503	[illegible]	[illegible]	[illegible]	[illegible]
BA	ECN 10510	[illegible]	[illegible]	[illegible]	[illegible]
BB	ECN 10615	[illegible]	J.S.	[illegible]	[illegible]
BC	ECN 11079	[illegible]	[illegible]	[illegible]	[illegible]
BD	ECN 11222	[illegible]	JS	[illegible]	[illegible]
BE	ECN 10681	[illegible]	HM	[illegible]	[illegible]
BF	ECN 11984	[illegible]	HM	[illegible]	[illegible]
BG	ECN 12200	[illegible]	HM	[illegible]	[illegible]
BG1	ECN 12283	[illegible]	HM	[illegible]	[illegible]
BH	ECN 12541	[illegible]	[illegible]	[illegible]	[illegible]
BJ	ECN 12441	[illegible]	L.R	[illegible]	[illegible]
BK	ECN 12922A	[illegible]	L.R	88	[illegible]
BL	ECN 13283A	[illegible]	MP	[illegible]	[illegible]
BM	ECN 13337A	[illegible]	[illegible]	[illegible]	[illegible]
BN	ECN 13454	[illegible]	[illegible]	[illegible]	[illegible]
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BS	ECN 14182	[illegible]	[illegible]	[illegible]	[illegible]
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BV	ECN 14205A	[illegible]	L.S.	[illegible]	[illegible]
BW	ECN 13129	[illegible]	C.B.	[illegible]	[illegible]
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BZ	ECN 17056	[illegible]	PRO	[illegible]	[illegible]
CA	ECN 17199A	[illegible]	[illegible]	[illegible]	KG
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CD	ECN 18089	[illegible]	SRC	[illegible]	[illegible]
CE	ECN 18149A	[illegible]	A.S	[illegible]	[illegible]
CF	ECN 18662	[illegible]	A.S	[illegible]	[illegible]
CG	ECN 18742	[illegible]	A.S.	[illegible]	[illegible]
CH	ECN 15296	[illegible]	A.S.	[illegible]	[illegible]
CJ	ECN 19386	[illegible]	[illegible]	[illegible]	[illegible]
CK	ECN 19399A	[illegible]	[illegible]	[illegible]	[illegible]

SPEC. NO. 102337
PCBA NO. 102334
REFERENCE DRAWINGS:

PERTEC PERIPHERAL EQUIPMENT

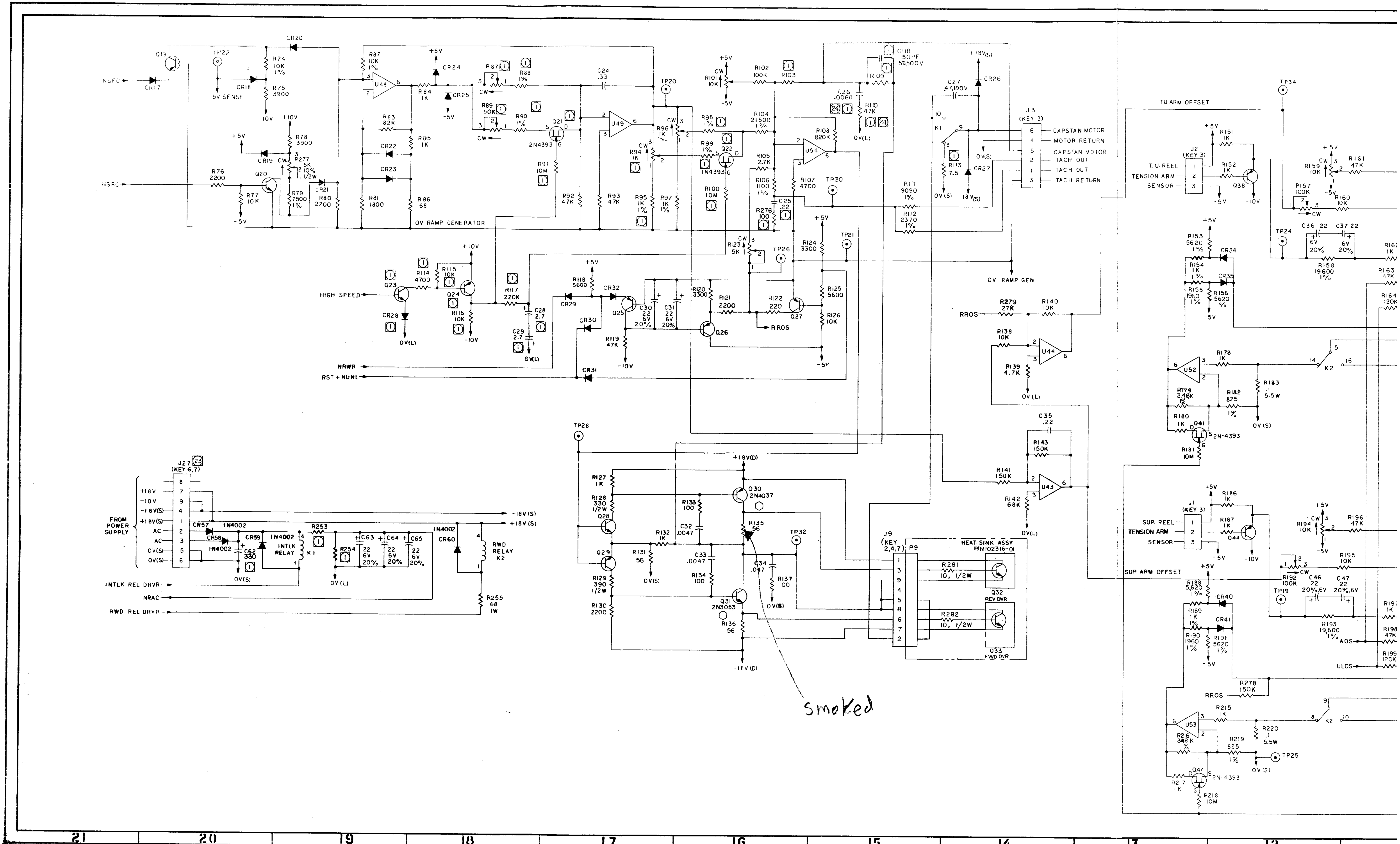
TITLE: SCHEMATIC
TAPE CONTROL J

TOP ASSY 8000 — NEXT ASSY — APPLICATION

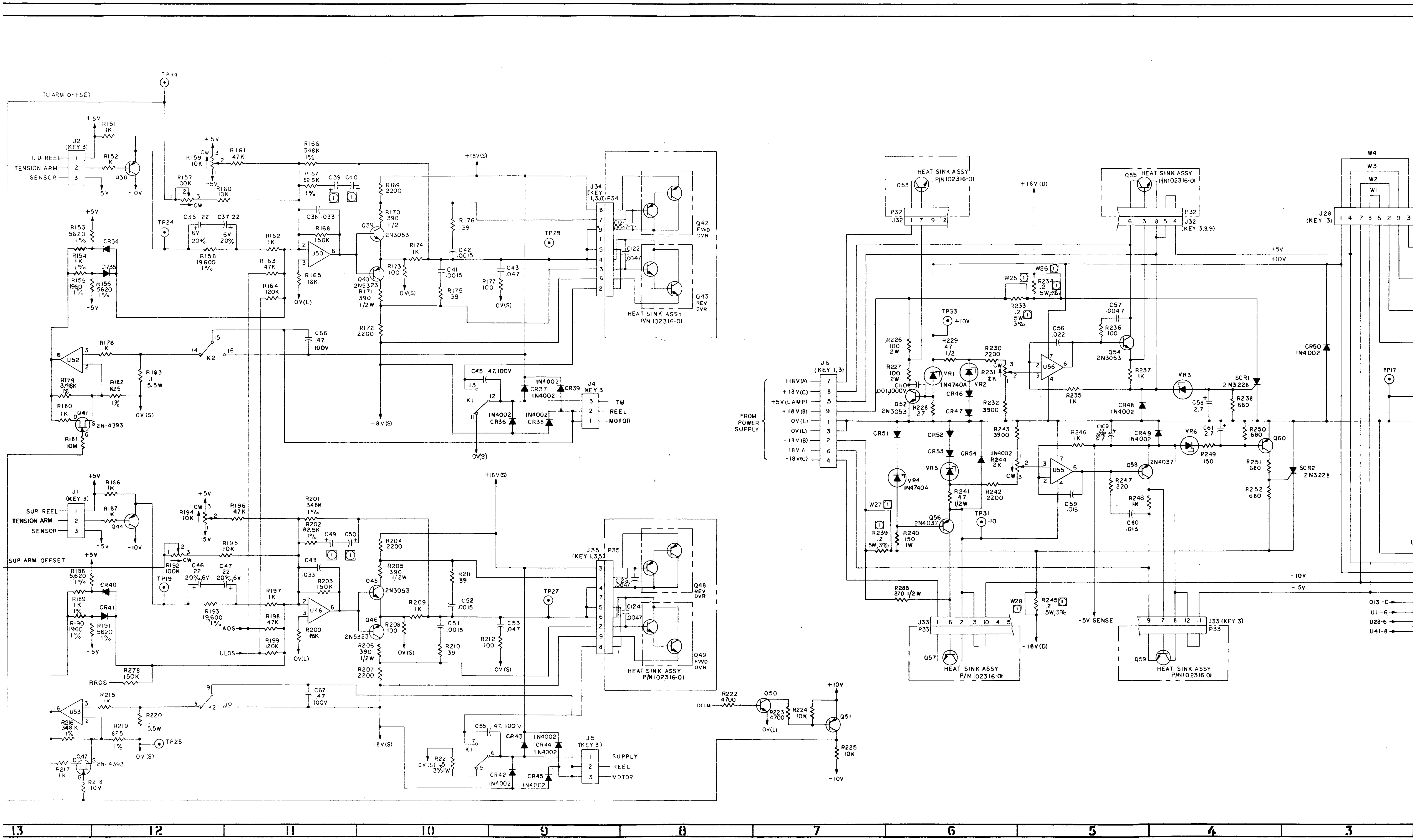
SIZE J — DWG NO. 102333

SCALE NONE — DO NOT SCALE DWG

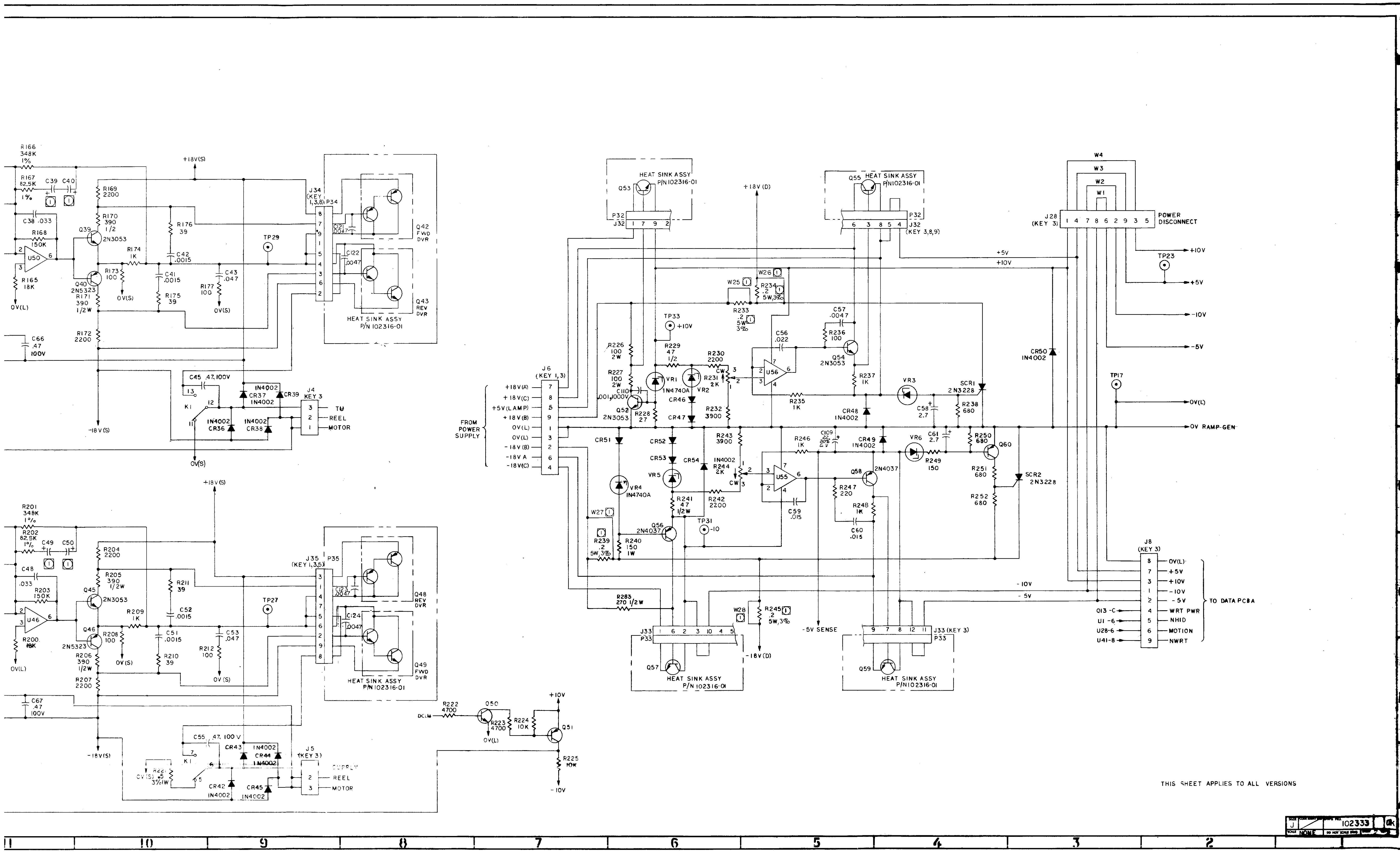
10 9 8 7 6 5 4 3 2



NSFC
NSRC
TP22
5V SENSE
CR17
CR18
CR19
CR20
CR21
R74 10K 1%
R75 3900
R76 2200
R77 10K
R78 3900
R277 5K 10% 1/2W
R79 7500 1%
R80 2200
R81 1800
R82 10K 1%
R83 82K
R84 1K
R85 1K
R86 68
R87
R88 1%
R89 50K
R90 1%
R91 10M
R92 47K
R93 47K
R94 1K
R95 1K 1%
R96 1K
R97 1K 1%
U48
U49
CR22
CR23
CR24
CR25
Q19
Q20
Q21
2N4393
C24 .33
TP20
0V RAMP GENERATOR
R98 1%
R99 1%
Q22
1N4393
R100 10M
R101 10K
R102 100K
R103
R104 21500 1%
R105 2.7K
R106 1100 1%
R107 4700
R108 820K
R109
R110 47K
R276 100
C25 .22
C26 .0068
C118 150PF 5%,500V
U54
TP30
R111 9090 1%
R112 2370 1%
C27 47,100V
CR26
CR27
R113 7.5
K1
J3 (KEY 3)
CAPSTAN MOTOR
MOTOR RETURN
CAPSTAN MOTOR
TACH OUT
TACH OUT
TACH RETURN
0V RAMP GEN
HIGH SPEED
Q23
Q24
CR28
R114 4700
R115 10K
R116 10K
R117 220K
C28 2.7
C29 2.7
R118 5600
CR29
CR30
CR31
CR32
Q25
C30 22 6V 20%
C31 22 6V 20%
R119 47K
R120 3300
R121 2200
R122 220
R123 5K
R124 3300
R125 5600
R126 10K
Q26
Q27
TP26
TP21
RROS
NRWR
RST + NUNL
RROS
R279 27K
R140 10K
R138 10K
R139 4.7K
U44
C35 .22
R143 150K
R141 150K
R142 68K
U43
TP28
+18V(D)
R127 1K
R128 330 1/2W
R129 390 1/2W
R130 2200
R131 56
R132 1K
R133 100
R134 100
C32 .0047
C33 .0047
C34 .047
R135 56
R136 56
R137 100
Q28
Q29
Q30 2N4037
Q31 2N3053
TP32
-18V (D)
J9 (KEY 2,4,7) P9
HEAT SINK ASSY P/N102316-01
R281 10, 1/2W
R282 10, 1/2W
Q32 REV DVR
Q33 FWD DVR
Smoked
J27 (KEY 6,7)
FROM POWER SUPPLY
+18V
-18V
-18V(S)
+18V(S)
AC
AC
0V(S)
0V(S)
-18V (S)
+18V (S)
CR57
CR58
1N4002
CR59
C62 330
INTLK RELAY
R253
R254
C63 22 6V 20%
C64 22 6V 20%
C65 22 6V 20%
CR60
RWD RELAY K2
R255 68 1W
INTLK REL DRVR
NRAC
RWD REL DRVR
TU ARM OFFSET
TP34
J2 (KEY 3)
T. U. REEL
TENSION ARM
SENSOR
R151 1K
R152 1K
Q38
R159 10K
R161 47K
R157 100K
R160 10K
TP24
C36 22 6V 20%
C37 22 6V 20%
R158 19600 1%
R153 5620 1%
R154 1K 1%
R155 1960 1%
R156 5620 1%
CR34
CR35
U52
R178 1K
R179 3.48K 1%
R180 1K
R181 10M
R182 825 1%
R183 .1 5.5W
Q41 2N-4393
J1 (KEY 3)
SUP. REEL
TENSION ARM
SENSOR
R186 1K
R187 1K
Q44
R194 10K
R196 47K
R195 10K
R192 100K
SUP ARM OFFSET
TP19
C46 22 20% 6V
C47 22 20% 6V
R193 19600 1%
R188 5,620 1%
R189 1K 1%
R190 1960 1%
R191 5620 1%
CR40
CR41
AOS
ULOS
R278 150K
U53
R215 1K
R216 348K 1%
R219 825 1%
R220 .1 5.5W
TP25
Q47 2N-4393
R217 1K
R218 10M
21
20
19
18
17
16
15
14
13
12



TU ARM OFFSET
TP34
T. U. REEL
TENSION ARM
SENSOR
J2 (KEY 3)
+5V
R151 1K
R152 1K
Q38
-5V
-10V
R157 100K
R159 10K
R160 10K
R161 47K
R166 348K 1%
R167 82.5K 1%
C39
C40
C38 .033
R168 150K
R169 2200
R170 390 1/2
Q39 2N3053
Q40 2N5323
R171 390 1/2W
R172 2200
R174 1K
R173 100
R175 39
R176 39
C41 .0015
C42 .0015
C43 .047
R177 100
+18V(S)
-18V(S)
OV(S)
OV(L)
U50
TP24
TP29
C36 22 6V 20%
C37 22 6V 20%
R153 5620 1%
R154 1K 1%
R155 1960 1%
R156 5620 1%
R158 19600 1%
R162 1K
R163 47K
R164 120K
R165 18K
CR34
CR35
J34 (KEY 1,3,8) P34
C121 .0047
C122 .0047
Q42 FWD DVR
Q43 REV DVR
HEAT SINK ASSY P/N 102316-01
U52
R178 1K
R179 3.48K 1%
R180 1K
R181 10M
Q41 2N-4393
R182 825 1%
R183 .1 5.5W
K2
C66 .47 100V
C45 .47, 100V
K1
CR36 IN4002
CR37 IN4002
CR38 IN4002
CR39
J4 KEY 3
TU REEL MOTOR
SUP. REEL
TENSION ARM
SENSOR
J1 (KEY 3)
R186 1K
R187 1K
Q44
SUP ARM OFFSET
R188 5,620 1%
R189 1K 1%
R190 1960 1%
R191 5620 1%
CR40
CR41
R192 100K
R194 10K
R195 10K
R196 47K
R201 348K 1%
R202 82.5K 1%
C49
C50
C48 .033
R203 150K
C46 22 20% 6V
C47 22 20% 6V
TP19
R193 19,600 1%
R197 1K
R198 47K
R199 120K
R200 18K
AOS
ULOS
U46
R204 2200
R205 390 1/2W
Q45 2N3053
Q46 2N5323
R206 390 1/2W
R207 2200
R208 100
R209 1K
R210 39
R211 39
C51 .0015
C52 .0015
C53 .047
R212 100
TP27
J35 (KEY 1,3,5) P35
C123 .0047
C124 .0047
Q48 REV DVR
Q49 FWD DVR
HEAT SINK ASSY P/N 102316-01
R278 150K
RROS
U53
R215 1K
R216 348K 1%
R217 1K
R218 10M
Q47 2N-4393
R219 825 1%
R220 .1 5.5W
TP25
C67 .47 100V
C55 .47, 100V
R221 .5 3% 1W
CR42 IN4002
CR43
CR44 IN4002
CR45 IN4002
J5 (KEY 3)
SUPPLY REEL MOTOR
DCLM
R222 4700
Q50
R223 4700
R224 10K
Q51
R225 10K
+10V
-10V
HEAT SINK ASSY P/N 102316-01
Q53
P32 J32
Q55
J32 (KEY 3,8,9)
+18V (D)
W4 W3 W2 W1
J28 (KEY 3)
+5V
+10V
W25
W26
R233 .2 5W 3%
R234 .2 5W 3%
TP33 +10V
C57 .0047
C56 .022
R236 100
Q54 2N3053
R226 100 2W
R227 100 2W
R229 47 1/2
R230 2200
R231 2K
VR1 IN4740A
VR2
C110 .001, 1000V
Q52 2N3053
R228 27
CR46
CR47
R232 3900
U56
R235 1K
R237 1K
VR3
C58 2.7
SCR1 2N3228
R238 680
CR48 IN4002
CR50 IN4002
TP17
J6 (KEY 1,3)
+18V(A)
+18V(C)
+5V(LAMP)
+18V(B)
OV(L)
OV(L)
-18V(B)
-18V A
-18V(C)
FROM POWER SUPPLY
CR51
CR52
CR53
CR54 IN4002
R243 3900
R244 2K
R246 1K
C109 .22 20% 2V
CR49 IN4002
VR6
C61 2.7
R250 680
Q60
VR4 IN4740A
VR5
R241 47 1/2W
R242 2200
U55
Q58 2N4037
R247 220
R248 1K
R249 150
R251 680
R252 680
SCR2 2N3228
C59 .015
C60 .015
W27
TP31 -10
Q56 2N4037
R239 .2 5W 3%
R240 150 1W
-10V
-5V
R283 270 1/2W
W28
R245 .2 5W 3%
-5V SENSE
J33 P33
J33 (KEY 3) P33
Q57
Q59
HEAT SINK ASSY P/N 102316-01
-18V (D)
Q13 -C
U1 -6
U28-6
U41-8
13 12 11 10 9 8 7 6 5 4 3



HEAT SINK ASSY P/N 102316-01
FROM POWER SUPPLY
POWER DISCONNECT
TO DATA PCBA
-5V SENSE
0V RAMP GEN
THIS SHEET APPLIES TO ALL VERSIONS
102333

TABLE II (1)

	LOAD AND ON-LINE: LOCAL (OMIT W18 AND W19 P/N 100 0005)				REMOTE (USE W18 AND W19 PIN 100-0005)			
WITH ADDRESS SELECT AND MTA	USE W17 100-0005		(hatched)		USE W17 100-0005		(hatched)	
WITH ADDRESS SELECT AND WITHOUT MTA	(hatched)		OMIT W17 100-0005		(hatched)		OMIT W17 100-0005	
WITHOUT ADDRESS SELECT, MTA OR, WITHOUT MTA	USE W17 100-0005		(hatched)		USF W17 100-0005		(hatched)	
WITH POWER OFF DELAY/48V	(hatched)	USE C62 1343360	(hatched)	USE C62 1343360	(hatched)	USE C62 1343360	(hatched)	USE C62 1343360
WITHOUT POWER OFF DELAY	OMIT C62 1343360	(hatched)	OMIT C62 1343360	(hatched)	OMIT C62 1343360	(hatched)	OMIT C62 1343360	(hatched)

DOOR SAFETY SWITCH FEATURE	SPECIAL FEATURES	SPEED IPS	ASSY 102334 DASH NO.							
WITHOUT		12.5	-01	-02	-03		-05	-06	-07	-08
↑		18.75	-09	-10	-11		-13	-14	-15	-16
		25	-17	-18	-19		-21	-22	-23	-24
		37.5	-25	-26	-27		-29	-30	-31	-32
↓		45	-33	-34	-35		-37	-38	-39	-40
WITHOUT		45/22.5	-57	-58	-59					
WITH		12.5	-04							
↑		18.75	-12							
		25	-20				-41			
		37.5	-28							
↓		45	-36				-42			
WITH		45/22.5								
WITHOUT	RWD DELAY AT BOT	25	-65							
WITH	RWD DELAY AT BOT	25	-43							

DOOR SAFETY / SPEED IPS	C26 131-6820 USAGE	C39, 40 49, 50 132-2752 USAGE	R113 100-0755 USAGE	R110 100-4735 USAGE	R87 VALUE	R87 PART NO.	R88 VALUE	R88 PART NO.	R98 VALUE	R98 PART NO.
WITHOUT 12.5	OMIT	USE	OMIT	OMIT	50K	121-5030	75K	104-7502	61.9K	104-6192
18.75	↑	↑	OMIT	↑	50K	121-5030	34.8K	104-3482	31.6K	104-3162
25		↓	OMIT		20K	121-2030	34.8K	104-3482	19.6K	104-1962
37.5	↓	USE	USE	↓	20K	121-2030	21.5K	104-2152	5.62K	104-5621
45	OMIT	USE	USE	OMIT	10K	121-1030	19.6K	104-1962	1.1K	104-1101
WITHOUT 45/22.5	OMIT	USE	USE	OMIT	20K	121-2030	34.8K	104-3482	19.6K	104-1962
WITH 12.5	↑	↑	OMIT	↑	50K	121-5030	75K	104-7502	61.9K	104-6192
18.75			OMIT		50K	121-5030	34.8K	104-3482	31.6K	104-3162
25			OMIT		20K	121-2030	34.8K	104-3482	19.6K	104-1962
37.5	↓	↓	USE	↓	20K	121-2030	21.5K	104-2152	5.62K	104-5621
45	OMIT	USE	USE	OMIT	10K	121-1030	19.6K	104-1962	1.1K	104-1101
WITH 45/22.5	OMIT	USE	USE	OMIT	20K	121-2030	34.8K	104-3482	19.6K	104-1962
WITHOUT RWD DELAY AT BOT 25	OMIT	USE	OMIT	OMIT	20K	121-2030	34.8K	104-3482	19.6K	104-1962
WITH RWD DELAY AT BOT 25	OMIT.	USE	OMIT	OMIT	20K	121-2030	34.8K	104-3482	19.6K	104-1962

DOOR SAFETY / SPEED IPS	R99 VALUE	R99 PART NO.	R109 VALUE	R109 PART NO.	C25 131-2240 USAGE	R276 100-1015 USAGE	W24 100-0005 USFAGE	R90 VALUE	R90 PART NO.	R103 VALUE	R103 PART NO	R89, ,91,94,95, 100,114 THRU 117 C28,29 Q21,22,23,24 CR28 USAGE (22)	C118 130-1515 USAGE
WITHOUT 12.5		OMIT	470K	100-4745	OMIT	OMIT	OMIT	—	OMIT	470K	100-4745	OMIT	USE
18.75		↑	470K	100-4745	OMIT	OMIT	↑	—	↑	470K	100-4745	↑	USE
25			470K	100-4745	OMIT	OMIT		—		470K	100-4745		USE
37.5		↓	330K	100-3345	USE	USE		—	↓	330K	100-3345	↓	OMIT
45		OMIT	330K	100-3345	USE	USE		—	OMIT	330K	100-3345	OMIT	OMIT
WITHOUT 45/22.5	1.1K	104-1101	330K	100-3345	USE	USE		34.8K	104-3482	330K	100-3345	USE	OMIT
WITH 12.5		OMIT	470K	100-4745	OMIT	OMIT		—	OMIT	470K	100-4745	OMIT	USE
18.75		↑	470K	100-4745	OMIT	OMIT		—	↑	470K	100-4745	↑	USE
25			470K	100-4745	OMIT	OMIT		—		470K	100-4745		USE
37.5		↓	330K	100-3345	USE	USE	↓	—	↓	330K	100-3345	↓	OMIT
45		OMIT	330K	100-3345	USE	USE	OMIT	—	OMIT	330K	100-3345	OMIT	OMIT
WITH 45/22.5	1.1K	104-1101	330K	100-3345	USE	USE	OMIT	34.8K	104-3482	330K	100-3345	USE	OMIT
WITHOUT RWD DELAY AT BOT 25		OMIT	470K	100-4745	OMIT	OMIT	USE		OMIT	470K	100-4745	OMIT	USE
WITH RWD DELAY AT BOT 25		OMIT	470K	100-4745	OMIT	OMIT	USE		OMIT	470K	100-4745	OMIT	USE

R253	101-1025	1K	USE	OMIT	USE	OMIT	USE	OMIT	USE	OMIT
	101-2225	2.2K	OMIT	USE	OMIT	USE	OMIT	USE	OMIT	USE
R254	101-3915	390	USE	OMIT	USE	OMIT	USE	OMIT	USE	OMIT
	101-8215	820	OMIT	USE	OMIT	USE	OMIT	USE	OMIT	USE

(11)

TRANSPORT CONFIGURATION	P22 101897	JUMPERS USED W5	W7	W8	W9	W10	W11
9 TRACK, PE, ROT	-01				X	X	
9 TRACK, PE/NRZI, ROT	-02		X		X		
7/9 TRACK, PE/NRZI, ROT	-03		X	X			
9 TRACK, NRZI, ROT	-04				X		
7 TRACK, NRZI, ROT/7 TRACK, NRZI, READ AND WRITE, HI-DENSITY LOCAL	-05		X				
7/9 TRACK, NRZI, ROT	-06		X	X			X
7 TRACK, NRZI, READ AND WRITE, HI-DENSITY REMOTE	-07	X					
9 TRACK PE, READ AND WRITE	NOT USED						
9 TRACK, NRZI, READ AND WRITE	NOT USED						
9 TRACK PE/NRZI, READ AND WRITE (HI-DEN LOCAL)	-02		X		X		
9 TRACK, PE/NRZI, READ AND WRITE (HI DEN REMOTE)	-08	X			X		

OPTIONS AVAILABLE: ON LINE AT	UNIT SELECTED	STATUS LINE	WRT EN/FPT INDICATOR	P21 102344	JUMPERS USED (11) W12	W13	W14	W15	W16
ON LINE AT THE BEGINNING OF TAPE (OLBT)	SOL SELECT AND ON LINE	SLTA	WRT EN	-11	X		X		X
			FPT	-12	X		X	X	
		SOL	WRT EN	-15	X	X	X		X
			FPT	-16	X	X	X	X	
	SLT SELECT OFF LINE/ON LINE	SLTA	WRT EN	-09	X				X
			FPT	-10	X			X	
		SLT	WRT EN	-13	X	X			X
			FPT	-14	X	X		X	
ON LINE AT THE MIDDLE OF TAPE (OLMT)	SOL SELECT AND ON LINE	SLTA	WRT EN	-03			X		X
			FPT	-04			X	X	
		SOL	WRT EN	-07		X	X		X
			FPT	-08		X	X	X	
	SLT SELECT OFF LINE/ON LINE	SLTA	WRT EN	-01					X
			FPT	-02				X	
		SLT	WRT EN	-05		X			X
			FPT	-06		X		X	

TABLE II (1)

LOAD AND ON-LINE: LOCAL				LOAD AND ON-LINE: REMOTE				C26 131-6820	C39, 40 49, 50 132-2752	R113 100-0755	R110 100-4735	R87 VALUE	R87 PART NO.	R88 VALUE	R88 PART NO.	R98 VALUE	R98 PART NO.	R99 VALUE	R99 PART NO.	R109 VALUE	R109 PART NO.	C25 131-2240	R276 100-1015	W24 100 0005	R90 VALUE	R90 PART NO.	R103 VALUE	R103 PART NO	R89, 91,94,95, 100,114 THRU 117 C28,29 Q21,22,23,24 CR28 USAGE (22)	C116 130-1515	R233 234 239 245 109-0002	W25,26 27,28A 102334-96 / W28 100-0005
OMIT W18 AND W19 P/N 100 0005				USE W18 AND W19 PIN 100-0005																												
USE W17 100-0005	OMIT W17 100-0005			USE W17 100-0005	OMIT W17 100-0005																											
USE W17 100-0005 / USE CR2 1343360	USE CR2 1343360 / OMIT CR2 1343360			USE W17 100-0005 / OMIT CR2 1343360	USE CR2 1343360	USE CR2 1343360																										
ASSY 102334 DASH NO.								USAGE														USAGE							USAGE (22)	USAGE	USAGE	USAGE
-01	-02	-03		-05	-06	-07	-08	OMIT	USE	OMIT	OMIT	50K	121-5030	75K	104-7502	61.9K	104-6192		OMIT	470K	100-4745	OMIT	OMIT	OMIT	—	OMIT	470K	100-4745	OMIT	USE	USE	OMIT
-09	-10	-11		-13	-14	-15	-16			OMIT		50K	121-5030	34.8K	104-3482	31.6K	104-3162			470K	100-4745	OMIT	OMIT		—		470K	100-4745		USE	USE	OMIT
-17	-18	-19		-21	-22	-23	-24			OMIT		20K	121-2030	34.8K	104-3482	19.6K	104-1962			470K	100-4745	OMIT	OMIT		—		470K	100-4745		USE	USE	OMIT
-25	-26	-27		-29	-30	-31	-32		USE	USE		20K	121-2030	21.5K	104-2152	5.62K	104-5621			330K	100-3345	USE	USE		—		330K	100-3345		OMIT	USE	OMIT
-33	-34	-35		-37	-38	-39	-40	OMIT	USE	USE	OMIT	10K	121-1030	19.6K	104-1962	1.1K	104-1101		OMIT	330K	100-3345	USE	USE		—	OMIT	330K	100-3345	OMIT	OMIT	OMIT	USE
-57	-58	-59						OMIT	USE	USE	OMIT	20K	121-2030	34.8K	104-3482	19.6K	104-1962	1.1K	104-1101	330K	100-3345	USE	USE		34.8K	104-3482	330K	100-3345	USE	OMIT	OMIT	USE
-04										OMIT		50K	121-5030	75K	104-7502	61.9K	104-6192		OMIT	470K	100-4745	OMIT	OMIT		—	OMIT	470K	100-4745	OMIT	USE	USE	OMIT
-12										OMIT		50K	121-5030	34.8K	104-3482	31.6K	104-3162			470K	100-4745	OMIT	OMIT		—		470K	100-4745		USE	USE	OMIT
-20				-41						OMIT		20K	121-2030	34.8K	104-3482	19.6K	104-1962			470K	100-4745	OMIT	OMIT		—		470K	100-4745		USE	USE	OMIT
-28										USE		20K	121-2030	21.5K	104-2152	5.62K	104-5621			330K	100-3345	USE	USE		—		330K	100-3345		OMIT	USE	OMIT
-36				-42				OMIT	USE	USE	OMIT	10K	121-1030	19.6K	104-1962	1.1K	104-1101		OMIT	330K	100-3345	USE	USE	OMIT	—	OMIT	330K	100-3345	OMIT	OMIT	OMIT	USE
								OMIT	USE	USE	OMIT	20K	121-2030	34.8K	104-3482	19.6K	104-1962	1.1K	104-1101	330K	100-3345	USE	USE	OMIT	34.8K	104-3482	330K	100-3345	USE	OMIT	OMIT	USE
-65								OMIT	USE	OMIT	OMIT	20K	121-2030	34.8K	104-3482	19.6K	104-1962		OMIT	470K	100-4745	OMIT	OMIT	USE		OMIT	470K	100-4745	OMIT	USE	USE	OMIT
-43								OMIT.	USE	OMIT	OMIT	20K	121-2030	34.8K	104-3482	19.6K	104-1962		OMIT	470K	100-4745	OMIT	OMIT	USE		OMIT	470K	100-4745	OMIT	USE	USE	OMIT
USE	OMIT	USE	OMIT	USE	OMIT	USE	OMIT																									
OMIT	USE	OMIT	USE	OMIT	USE	OMIT	USE																									
USE	OMIT	USE	OMIT	USE	OMIT	USE	OMIT																									
OMIT	USE	OMIT	USE	OMIT	USE	OMIT	USE																									

TABLE III (22)

PART NO.	REF DESIGNATION
100-1035	R115, 116
100-1065	R91, 100
100-2245	R117
100-4725	R114
104-1001	R95
121-1020	R94
121-5030	R89
132-2752	C28, 29
200-4123	Q23
200-4125	Q24
204-4393	Q21, 22
300-4446	CR28

TABLE I (21)

PART NO.	REF DESIGNATION
100-0005	W20, 23
-1005	R29,48,54,65,72
-1015	R62,133,134,137,173,177, 208,212,236
-1025	R21, 23, 84, 85, 127, 132, ,151, 152, 162,174, 178, 180, 186, 187, 197, 209, 215, 217, 235, 246,280, 237, 248
-1035	R 2, 9, 6, 13, 18, 77, 126, 138 140, 160, 195, 224, 225
-1045	R102,
-1065	R181, 218, 1, 8
-1245	R5, 12, 164, 199
-1515	R20,32,46,56,69,249,267
-1525	R30, 47, 55, 66, 73
-1535	R19,
-1545	R141, 143, 168, 203, 278
-1825	R58, 59, 81
-1835	R165, 200, 270
-2215	R24, 40, 122, 247
-2225	R51, 53, 76, 80, 121, 130, 169, 172, 204, 207, 271, 230, 242
-2705	R228
-2715	R42, 43
-2725	R105
-3315	R25, 26, 41, 49
-3325	R27, 28, 60, 120, 124
-3905	R175, 176, 210, 211
-3925	R75, 78, 232, 243
-4715	R61, 50
-4725	R7, 14, 22, 31, 36, 64, 67, 68, 71, 107, 139, 222, 223, 265, 266, 57
-4735	R4, 11, 92, 93, 163, 198, 161, 196, 119,
-5605	R131, 135, 136
-5625	R125, R118
-5615	R258
-6805	R86
-6815	R238, 250, 251, 252
-6835	R142
-8245	R108
-8235	R83
-2235	R272
100-2735	R269, 273, 279
100-1215	R257
101-0565	R70
-3315	R128
-3915	R129, 170, 171, 205, 206
-4705	R229, 241, 52
101-6805	R45
101-2715	R283
102-1515	R44, 240
102-6805	R255
104-7501	R79
103-1015	R226, 227

TABLE I (CONT) (21)

PART NO.	REF DESIGNATION
104-1001	R97, 154, 189
-1002	R74, 82
1101	R106
8252	R167, 202
-1961	R155, 190
-1962	R158, 193
-2152	R104
-2371	R112
-3483	R166, 201
-5621	R153, 156, 188, 191
-8250	R182, 219
104-9091	R111
104-3481	R179, 216
113-0053	R221
109-0003	R183, 220
109-0009	R63
121-1020	R96,
-1030	R101, 159, 194
-1040	R157, 192
121-5020	R123
121-5030	R274, 275
121-2020	R231, 244
124-5020	R277
131-1020	C7, 8, 15, 16, 18, 20
-1030	C1, 2, 5, 22
-1520	C41, 42, 51, 52
-1530	C60, 59
-2230	C56
-2240	C35
-3340	C24
-4720	C6, 32, 33, 57
131-4730	C34, 43, 53
131-3330	C38, 48
132-2262	14, 30, 31, 3[illegible] 37, 46, 47, 63, 64, 65 C111 THRU 113, 116, 109
132-2752	C19, 58, 61, 70 THRU 105, 11[illegible]
135-1002	C11, 17, 21, 23, 108, 110
135-4741	C27, 45, 55, 66, 67
135-4731	C125, 126
200-3053	Q10, 31, 39, 45, 52, 54
-4037	Q15, 30, 56, 58
-4123	Q1 THRU 4, 6, 20, 28, 50
-4125	Q7, 11, 12, 14, 17, 18, 19, 25, 26, 27, 29, 38, 44, 51, 60, 61
-0041	Q16
200-5323	Q13, 40, 46
201-3228	SCR1, 2
204-4393	Q41, 47
300-4002	CR14, 15, 36 THRU 39, 42 THRU 45, 48 THRU 50, 54, 57 THRU 60
330-0685	VR2, 3, 5, 6
330-1005	VR1, 4, 7
300-4446	CR1, 2, 5 THRU 9 16 THRU 27, 29 THRU 32, 34, 35 40, 41, 4[illegible] 47, 51, 52, 53

(11)

N	P22 101897	JUMPERS USED W5	W7	W8	W9	W10	W11
	-01				X	X	
	-02		X		X		
	-03		X	X			
	-04				X		
	-05		X				
	-06		X	X			X
	-07	X					
E	NOT USED						
	NOT USED						
)	-02		X		X		
	-08	X			X		

OPTIONS AVAILABLE: ON LINE AT	UNIT SELECTED	STATUS LINE	WRT EN/FPT INDICATOR	P21 102344	JUMPERS USED (11) W12	W13	W14	W15	W16
ON LINE AT THE BEGINNING OF TAPE (OLBT)	SOL SELECT AND ON LINE	SLTA	WRT EN	-11	X		X		X
			FPT	-12	X		X	X	
		SOL	WRT EN	-15	X	X	X		X
			FPT	-16	X	X	X	X	
	SLT SELECT OFF LINE/ON LINE	SLTA	WRT EN	-09	X				X
			FPT	-10	X			X	
		SLT	WRT EN	-13	X	X			X
			FPT	-14	X	X		X	
ON LINE AT THE MIDDLE OF TAPE (OLMT)	SOL SELECT AND ON LINE	SLTA	WRT EN	-03			X		X
			FPT	-04			X	X	
		SOL	WRT EN	-07		X	X		X
			FPT	-08		X	X	X	
	SLT SELECT OFF LINE/ON LINE	SLTA	WRT EN	-01					X
			FPT	-02				X	
		SLT	WRT EN	-05		X			X
			FPT	-06		X		X	

18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8

TABLE III (22)

REF DESIGNATION
R115, 116
R91, 100
R117
R114
R95
R94
R89
C28, 29
Q23
Q24
Q21, 22
CR28

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PART NO.	REF DESIGNATION
100-0005	W20, 23
-1005	R29,48,54,65,72
-1015	R62,133,134,137,173,177, 208,212,236
-1025	R21, 23, 84, 85, 127, 132, 151, 152, 162, 174, 178, 180, 186, 187, 197, 209, 215, 217, 235, 246, 280, 237, 248
-1035	R 2, 9, 6, 13, 18, 77, 126, 138 140, 160, 195, 224, 225
-1045	R102,
-1065	R181, 218, 1, 8
-1245	R5, 12, 164, 199
-1515	R20,32,46,56,69,249,267
-1525	R30, 47, 55, 66, 73
-1535	R19,
-1545	R141, 143, 168, 203, 278
-1825	R58, 59, 81
-1835	R165, 200, 270
-2215	R24, 40, 122, 247
-2225	R51, 53, 76, 80, 121, 130, 169, 172, 204, 207, 271, 230, 242
-2705	R228
-2715	R42, 43
-2725	R105
-3315	R25, 26, 41, 49
-3325	R27, 28, 60, 120, 124
-3905	R175, 176, 210, 211
-3925	R75, 78, 232, 243
-4715	R61, 50
-4725	R7, 14, 22, 31, 36, 64, 67, 68, 71, 107, 139, 222, 223, 265, 266, 57
-4735	R4, 11, 92, 93, 163, 198, 161, 196, 119,
-5605	R131, 135, 136
-5625	R125, R118
-5615	R258
-6805	R86
-6815	R238, 250, 251, 252
-6835	R142
-8245	R108
-8235	R83
-2235	R272
100-2735	R269, 273, 279
100-1215	R257
101-0565	R70
-3315	R128
-3915	R129, 170, 171, 205, 206
-4705	R229, 241, 52
101-6805	R45
101-2715	R283
102-1515	R44, 240
102-6805	R255
104-7501	R79
103-1015	R226, 227

TABLE I (CONT) (21)

PART NO.	REF DESIGNATION
104-1001	R97, 154, 189
-1002	R74, 82
1101	R106
8252	R167, 202
-1961	R155, 190
-1962	R158, 193
-2152	R104
-2371	R112
-3483	R166, 201
-5621	R153, 156, 188, 191
-8250	R182, 219
104-9091	R111
104-3481	R179, 216
113-0053	R221
109-0003	R183, 220
109-0009	R63
121-1020	R96,
-1030	R101, 159, 194
-1040	R157, 192
121-5020	R123
121-5030	R274, 275
121-2020	R231, 244
124-5020	R277
131-1020	C7, 8, 15, 16, 18, 20
-1030	C1, 2, 5, 22
-1520	C41, 42, 51, 52
-1530	C60, 59
-2230	C56
-2240	C35
-3340	C24
-4720	C6, 32, 33, 57
131-4730	C34, 43, 53
131-3330	C38, 48
132-2262	14, 30, 31, 36, 37, 46, 47, 63, 64, 65 C111 THRU 113, 116, 109
132-2752	C19, 58, 61, 70 THRU 105, 117
135-1002	C11, 17, 21, 23, 108, 110
135-4741	C27, 45, 55, 66, 67
135-4731	C125, 126
200-3053	Q10, 31, 39, 45, 52, 54
-4037	Q15, 30, 56, 58
-4123	Q1 THRU 4, 6, 20, 28, 50
-4125	Q7, 11, 12, 14, 17, 18, 19, 25, 26, 27, 29, 38, 44, 51, 60, 61
-0041	Q16
200-5323	Q13, 40, 46
201-3228	SCR 1, 2
204-4393	Q41, 47
300-4002	CR14, 15, 36 THRU 39, 42 THRU 45, 48 THRU 50, 54, 57 THRU 60
330-0685	VR 2, 3, 5, 6
330-1005	VR 1, 4, 7
300-4446	CR1, 2, 5 THRU 9 16 THRU 27, 29 THRU 32, 34, 3540, 41, 46, 47, 51, 52, 53

TABLE I (CONT) (21)

	PART NO.	REF DESIGNATION
	400-2741	U43, 44, 46, 48, 49, 50 52 THRU 56
	700-7402	31
	-7410	U9, 12, 22, 35, 38
	-7438	U33
	-7545	U47, 51
	-8360	U1, 4, 6, 13, 15, 16, 18, 19, 20, 39,
	-8440	U7, 11, 14, 25, 30, 32, 40, 42,
	-8460	U3, 8, 10, 26, 28, 34, 37, 45, 5
	700-8530	U17, 21, 23, 27, 29, 36, 41
	700-4121	U57, 58, 59, 60
	502-1243	K1, 2
	514-0003	S1
(20)	101-1005	R281, 282
(20)	131-4720	C121, 122, 123, 124
(20)		
(20)	200-3771	Q32, 33, 53, 55, 57, 59
(20)	200-6051	Q42, 48
(20)	200-6058	Q43, 49
(10)	120-0001	A1

SIGNAL MNEMONICS SCHEMATICALLY UNCONNECTED

	ORIGIN											
SIGNAL	COMPONENT	SHEET	ZONE	COMPONENT	SHEET	ZONE	COMPONENT	SHEET	ZONE	COMPONENT	SHEET	ZONE
AOS	U16-8	1	C9	R198	2	C11						
ULOS	U16-6	1	D9	R199	2	C11						
BOT	Q4-C	1	F21	U7-5	1	B22	U20-11	1	E17	U22-1	1	D10
				U23-1	1	D20						
BOTDP	U18-8	1	G19	U10-1	1	G11						
NBOT	U18-10	1	F21	U11-1	1	D22	U17-1	1	D21			
NBOTD	U57-1	1	G19	W23	1	C20	W24-A	1	C6			
DDI	U3-6	1	D6	U33-1	1	E4						
EOT	Q2-C	1	H21	U25-1	1	D4						
FLR	U37-3	1	C20	U12-9	1	G20	U21-4	1	E7			
NFLR	U37-6	1	C20	U9-5	1	C11	U10-4	1	G11			
GOP	Q6-C	1	G15	U45-1	1	D16						
HIGH SPEED	U3-3	1	C6	Q23-B	2	E19						
INTLK	U13-2	1	C22	U20-5	1	E10	U26-9	1	E7			
INTLK REL	U51-3	1	G10	K1-1	2	C19						
INTLK SW	J7-4	1	E18	R40	1	C23						
LDP	U18-6	1	G20	U25-12	1	D4	U5-4	1	G12			
LOAD	U29-5	1	G10	U31-6	1	D21	U35-2	1	H14	R43	1	A23
LOAD SW	J13-1	1	G13	U36-13	1	B20						
MOTION	U28-6	1	G16	U42-9	1	C16	J8-6	2	C2			
NBUSY	U31-4	1	C21	U12-10	1	G20						
DCLM	U59-6	1	D18	R222	2	B8						
NHID	U1-6	1	B6	J8-5	2	C2						
NRDY	U30-6	1	C20	U31-9	1	F13	U34-12	1	H4			
NRWR	U38-8	1	D19	U35-13	1	H14	R42	1	A23	CR29-C	2	F17
SRST	J12-2	1	D13	U13-3	1	B22	U15-9	1	A21	U19-13	1	E6
ONLINE	U27-9	1	F5	U31-8	1	F15	U37-4	1	C20			
NONLINE	U27-8	1	F5	U11-5	1	D22	U14-10	1	G11	U22-13	1	D10
NRAC	R253	2	D19	U16-11	1	C10						
RAC	U16-10	1	C10	U15-11	1	A21						
REV	U28 8	1	F15	J11-4	1	B4						
RO	U34-11	1	H4	U41-10	1	B17						
SRO	U34-3	1	G4	U28-2	1	G17	U11-10	1	D22			
NRST	U7-6	1	A22	U14-13	1	G11						
RWD	U6-12	1	E22	U22-2	1	D10						
RWD REL	U51-5	1	E18	R255	2	C18						
NRWI	U17-8	1	D21	U26-5	1	C5						
RW3	U23-5	1	D20	U10-2	1	G11						
NSFC	CR5-A	1	H14	CR17-A	2	H21						
NSRC	CR8-A	1	G14	R76	2	G20						
SLT	U40-8	1	H6	W18	1	F13						
NSTAC	J29-1	1	E13	U13-5	1	B22						
TIP	U12-12	1	H21	U14-1	1	F11	U15-13	1	A21	U25-2	1	D4
NTIP	U18-4	1	H20	U16-1	1	D10	U30-12	1	B11	U31-3	1	E12
UNL	U23-9	1	D9	U13-9	1	B22	U19-11	1	D6	U31-3	1	E12
NUNL	U23-8	1	D9	U11-2	1	D22				U51-2	1	F11
RST+NUNL	CR31-C	2	E17	U45-8	1	B8						
IWARS	U45-4	1	D16	J101-15	1	F24						
WRT EN	U39-8	1	E17	U33-4	1	E4						
WRT PWR	Q13-C	1	C15	J8-4	2	C2						
-5V SENSE	R246	2	E5	CR18-A	2	H20						
NWRT	U41-8	1	B17	J8-9	2	C2						
RROS	R121	2	E16	R279	2	14F	R278	2	12B			

SIZE | DWG NO. 102333 | REV C
SCALE NONE | DO NOT SCALE DWG | SHEET 3 OF 3