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TU77
Magnetic Tape Transport
User's Guide

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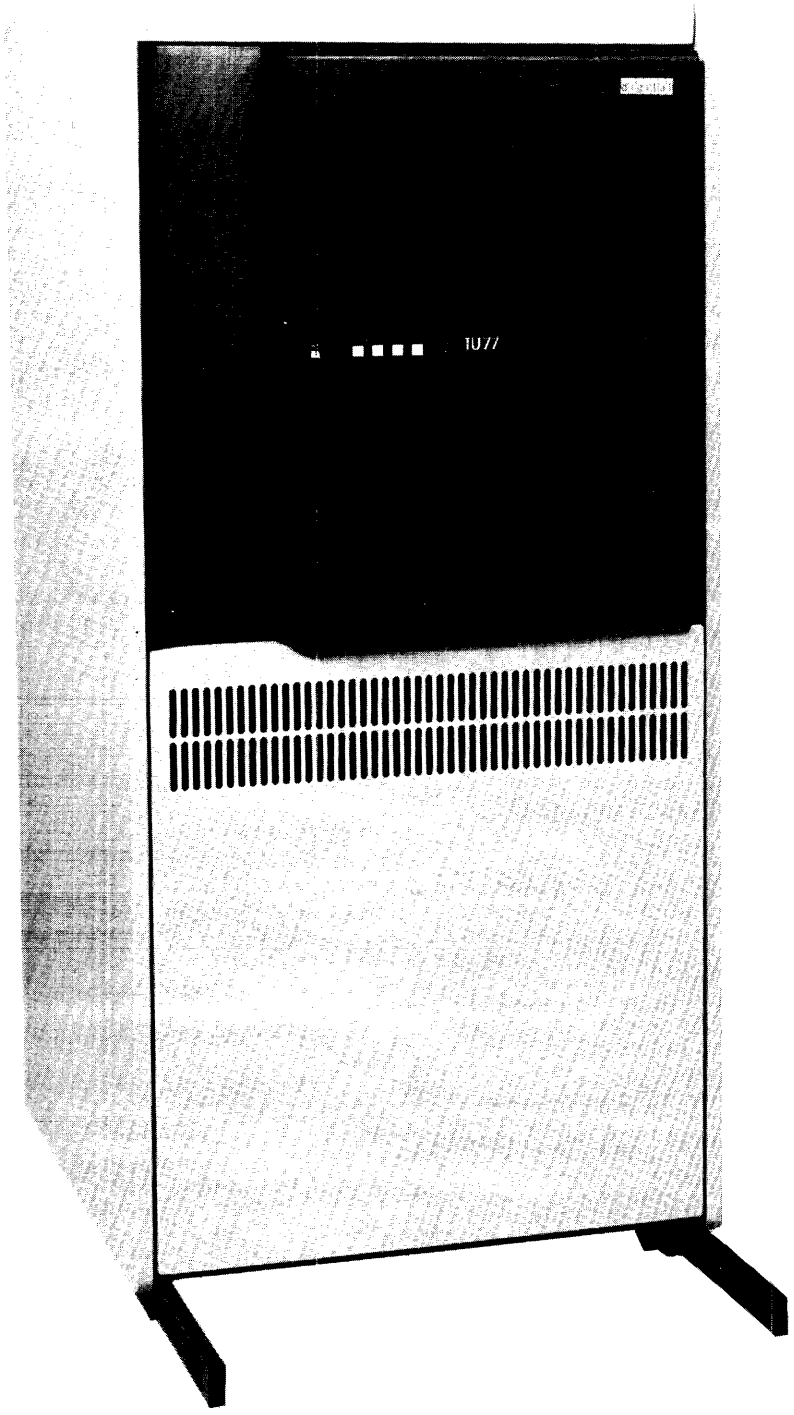
CONTENTS

CONTENTS (Cont)

FIGURES

FIGURES (Cont)

TABLES



Frontispiece – TU77 Tape Transport

CHAPTER 1
GENERAL DESCRIPTION

1.1 INTRODUCTION

The TU77 is a magnetic tape transport that records and reads data in 9-track non-return-to-zero (NRZI) or phase-encoded (PE) format. Bit density is 800 bits per inch (BPI) for the NRZI format and 1600 BPI for the PE format. The transport can read data in the forward or reverse direction. The read/write tape speed for both the forward and reverse directions is 125 inches per second (IPS). The nominal rewind time for a 731.5 m (2400 ft) reel is 65 seconds.

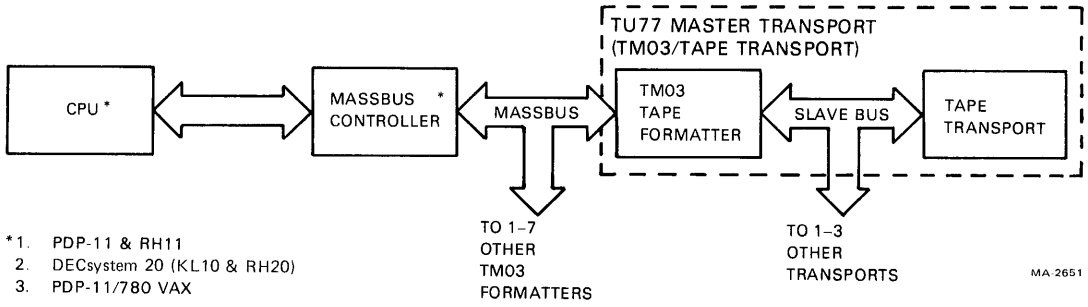


Figure 1-1 Basic System Configuration

The TU77 transport interfaces with the system processor via the Massbus, a Massbus controller and a TM03 tape formatter. Up to four TU77s may be driven from one TM03 formatter. Figure 1-1 illustrates the basic system configuration for a TU77. The TM03 tape formatter and its associated power supply (H740-DA) are housed in the TU77 cabinet (H9500* corporate cabinet). Those TU77s containing a TM03 are designated as "master units". TU77s without the TM03 are the "slave units".

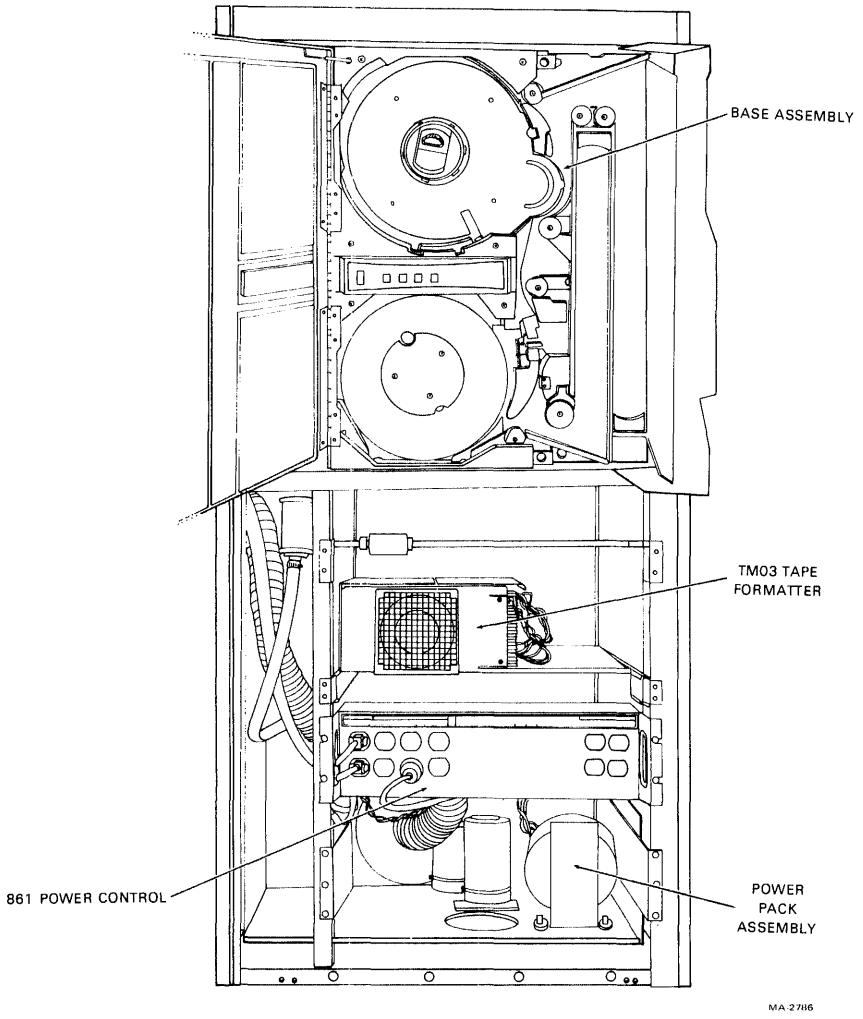
1.2 PHYSICAL DESCRIPTION

Figure 1-2 illustrates the locations of the major subassemblies of the TU77. These are:

TM03 tape formatter (master TU77 only)
H740-DA power supply (master TU77 only)
861 power control
TU77 transport, consisting of:

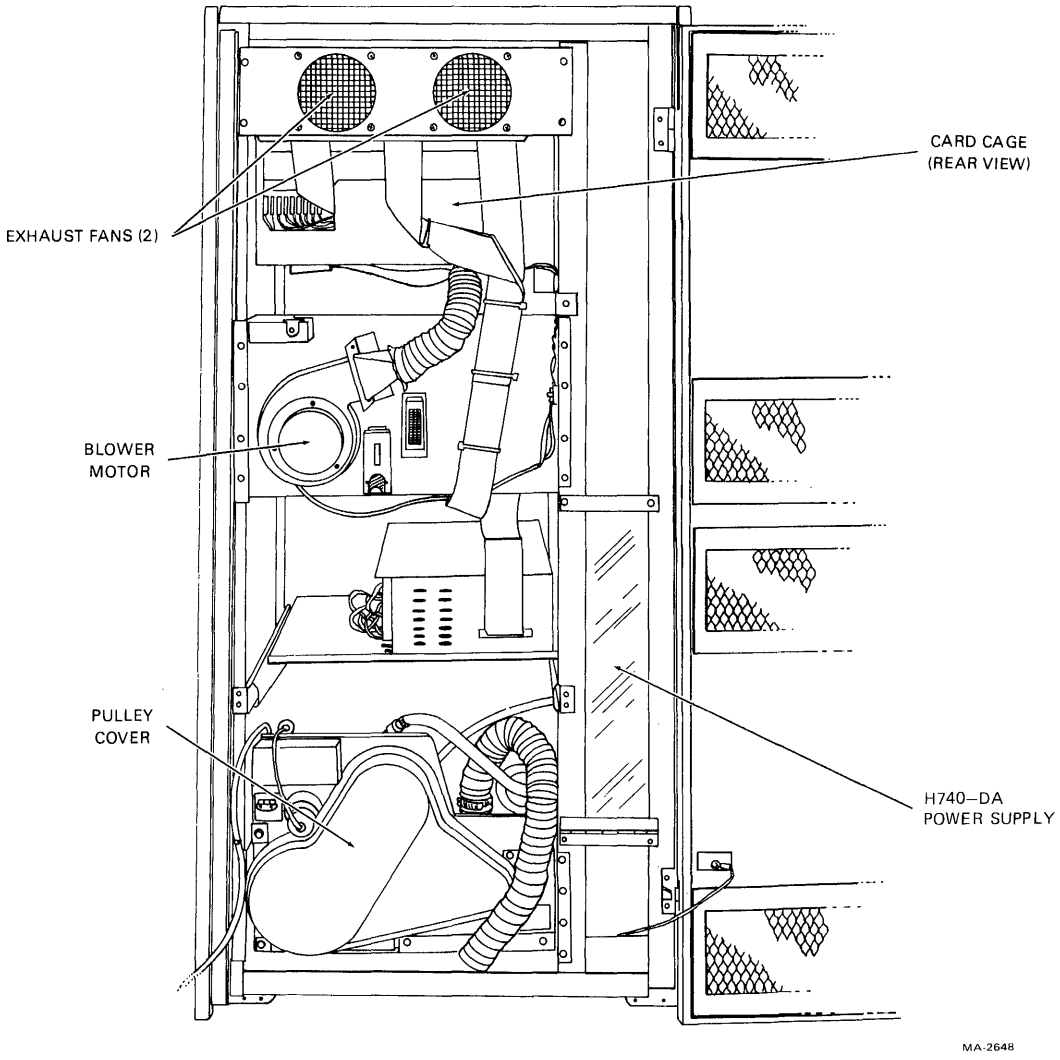
- Base assembly
- Card Cage Area
- Power Pack Assembly

*The specific model of the H9500 cabinet series used for the TU77 is H9602KA, however, the cabinet is referred to as the H9500 in this manual.



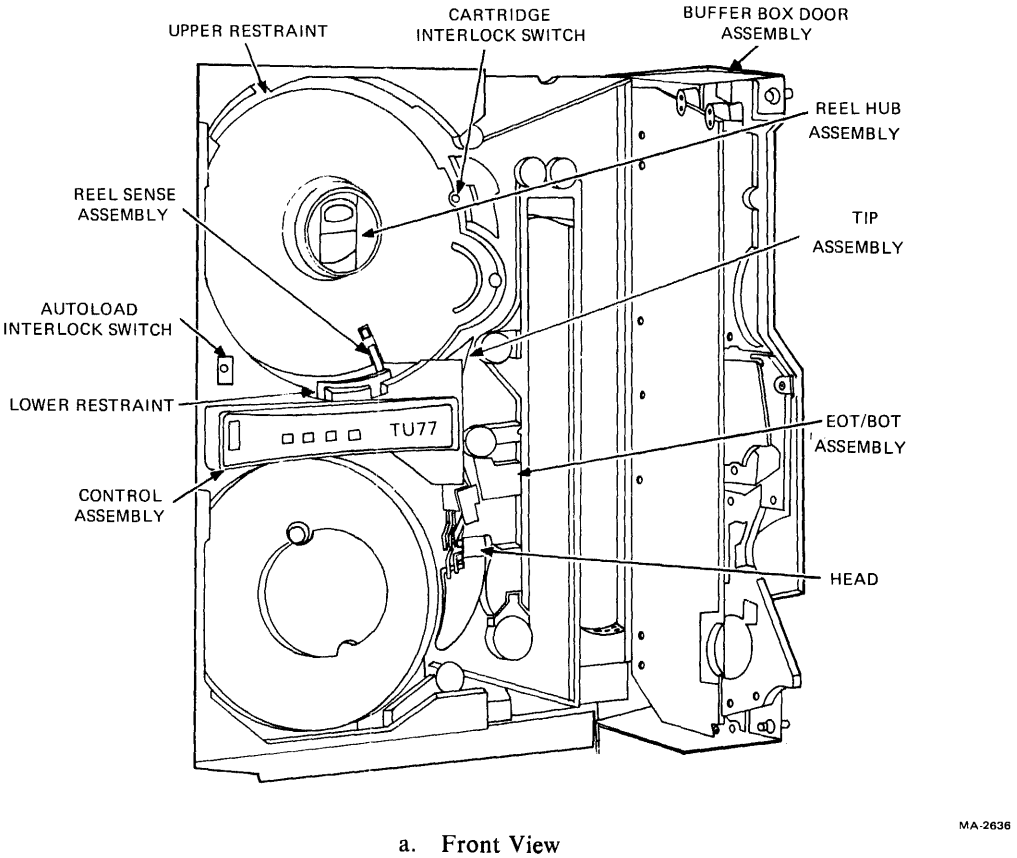
a. Front View

Figure 1-2 TU77 Master Tape Transport



b. Rear View

Figure 1-2 TU77 Master Tape Transport

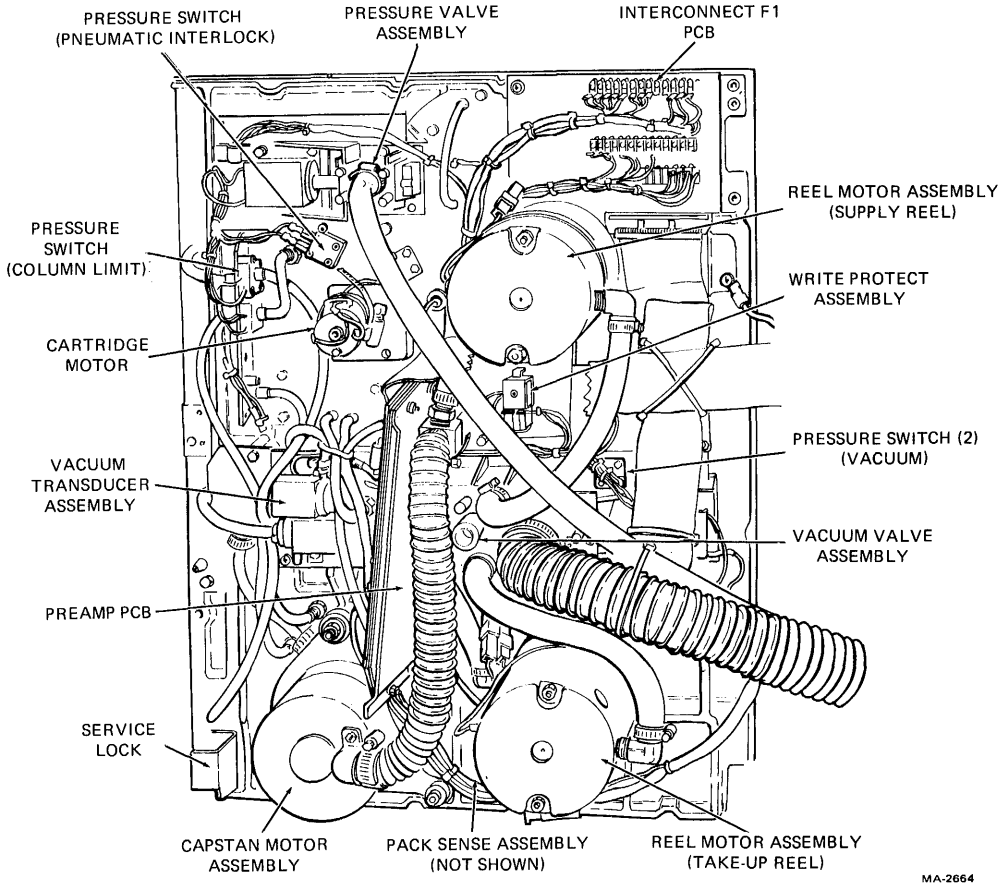


a. Front View

Figure 1-3 Base Assembly

Figure 1-3 is a front and rear view of the base assembly identifying components within the assembly. These are:

Control assembly (P.N. 29-23214)
Reel sense assembly (P.N. 29-23216)
Autoload interlock switch (P.N. 29-23297)
Reel hub assembly (P.N. 29-22776)
Buffer box door assembly (P.N. 29-23215)
Tape in path (TIP) assembly (P.N. 29-23243)
EOT/BOT assembly (P.N. 29-23242)
Head (P.N. 29-23233)
Cartridge interlock switch (P.N. 29-16280)
Upper restraint (P.N. 29-23225)
Lower restraint (P.N. 29-23224)



b. Rear View

Figure 1-3 Base Assembly

Cartridge motor (P.N. 29-23280)
Pressure switch (Pneumatic interlock) (P.N. 29-23240)
Pressure valve assembly (P.N. 29-23249)
Interconnect F1 printed circuit board (PCB) (P.N. 29-23213)
Reel motor assemblies (2) (P.N. 29-23236)
Write protect assembly (P.N. 29-23235)
Vacuum valve assembly (P.N. 29-23248)
Pressure switches (vacuum) (2) (P.N. 29-23238, 29-23239)
Pack sense assembly (P.N. 29-23217)
Capstan motor assembly (P.N. 29-23234)
Service lock
Preamp printed circuit board (PCB) (P.N. 29-23232)
Vacuum transducer assembly (P.N. 29-23246)
Pressure switch (column limit) (P.N. 29-23238)

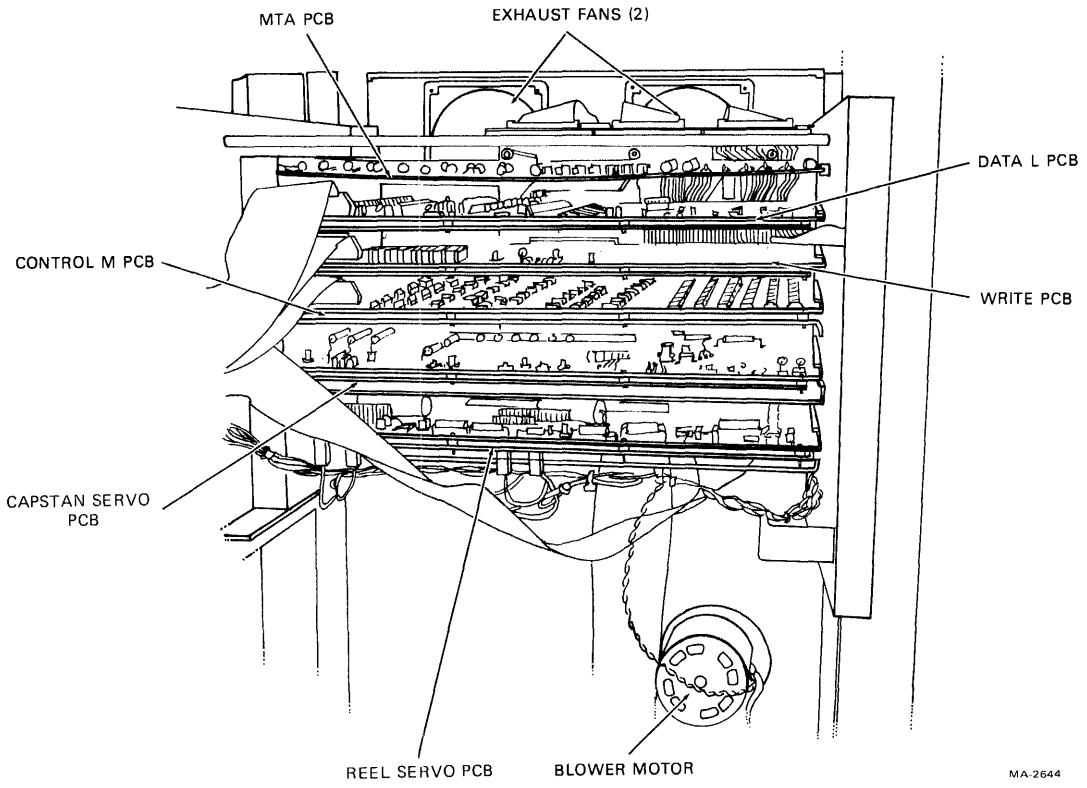


Figure 1-4 Card Cage Area

Figure 1-4 illustrates the card cage area containing the following items:

Magtape adapter (MTA) M8940 PCB (P.N. M8940)
Data L PCB (P.N. 29-23227)
Write PCB (P.N. 29-23226)
Control M PCB (P.N. 29-23229)
Capstan/regulator PCB (P.N. 29-23230)
Reel servo PCB (P.N. 29-23231)
Blower motor (P.N. 70-14569)
Exhaust fans (2) (P.N. 12-10930)
Interconnect D1 PCB (interconnecting backplane not shown in Figure 1-4) (P.N. 29-23211)

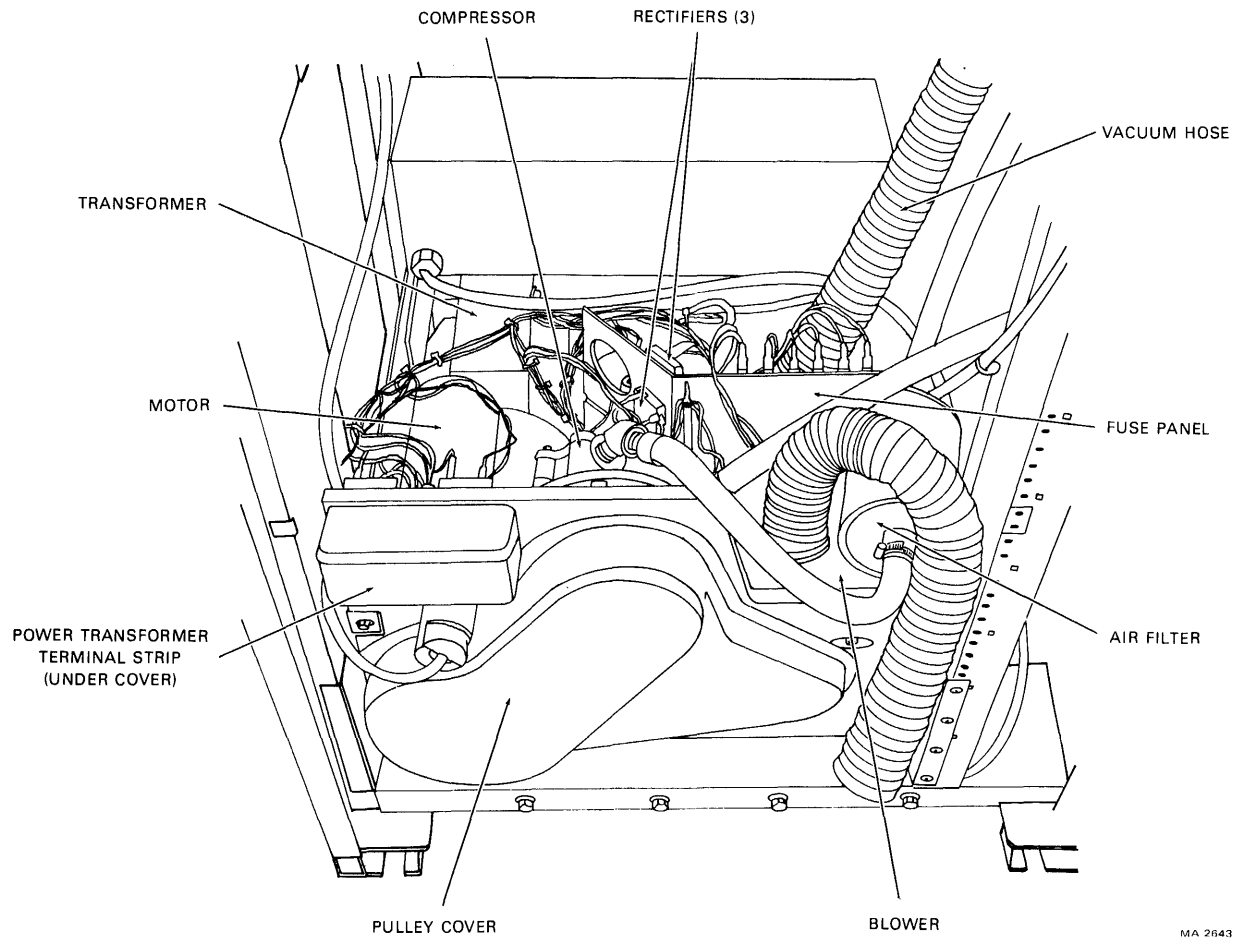


Figure 1-5 Power Pack Assembly; Rear View

Figure 1-5 illustrates the power pack assembly containing the following items:

Rectifiers (3) (Part Numbers 29-23311, 29-23312)
Vacuum hose
Fuse panel
Air filter (P.N. 29-23259)
Blower (P.N. 29-23253)
Pulley cover
Power transformer terminal strip
Compressor (P.N. 29-23257)
Motor (P.N. 29-23254)
Transformer (P.N. 29-23258)

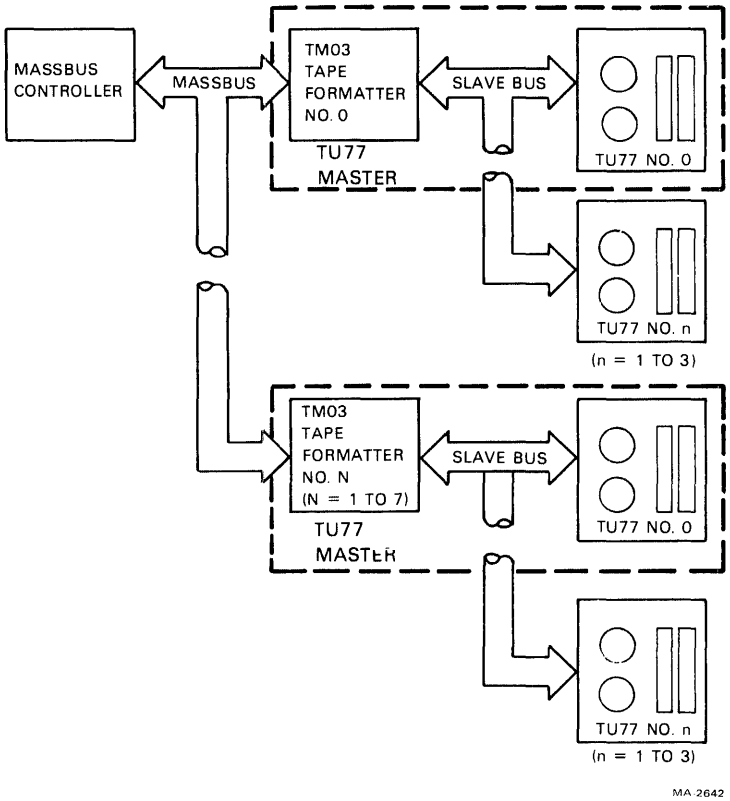


Figure 1-6 Possible TU77 Configurations

1.3 FUNCTIONAL DESCRIPTION

Figure 1-6 illustrates the various TU77 configurations that are possible from the Massbus. The TM03 tape formatter interfaces up to four TU77 transports to the Massbus. Additional TM03s may be added, up to a maximum of eight, with each formatter interfacing up to four additional TU77s. Thus the maximum configuration interfacing a Massbus controller consists of eight TM03 formatters and 32 TU77 transports.

The TM03 tape formatter is housed in the TU77 cabinet. Those TU77 cabinets containing a TM03 (and its associated H740-DA power supply) are designated as master transports while those without the TM03 and H740-DA are designated as slave transports. The basic transport within a TU77 master is identical to a TU77 slave transport.

Figure 1-7 is a functional block diagram of a master TU77 tape transport. During a write operation the TM03 accepts write data from the Massbus and formats it into 8-bit data characters for the TU77 transport. Massbus data is in PDP-10 compatible, PDP-10 core dump, PDP-11 normal or PDP-15 normal format. The TM03 disassembles the Massbus data under control of the CPU which specifies the format of the data. During a read operation, 8-bit characters received from the transport are

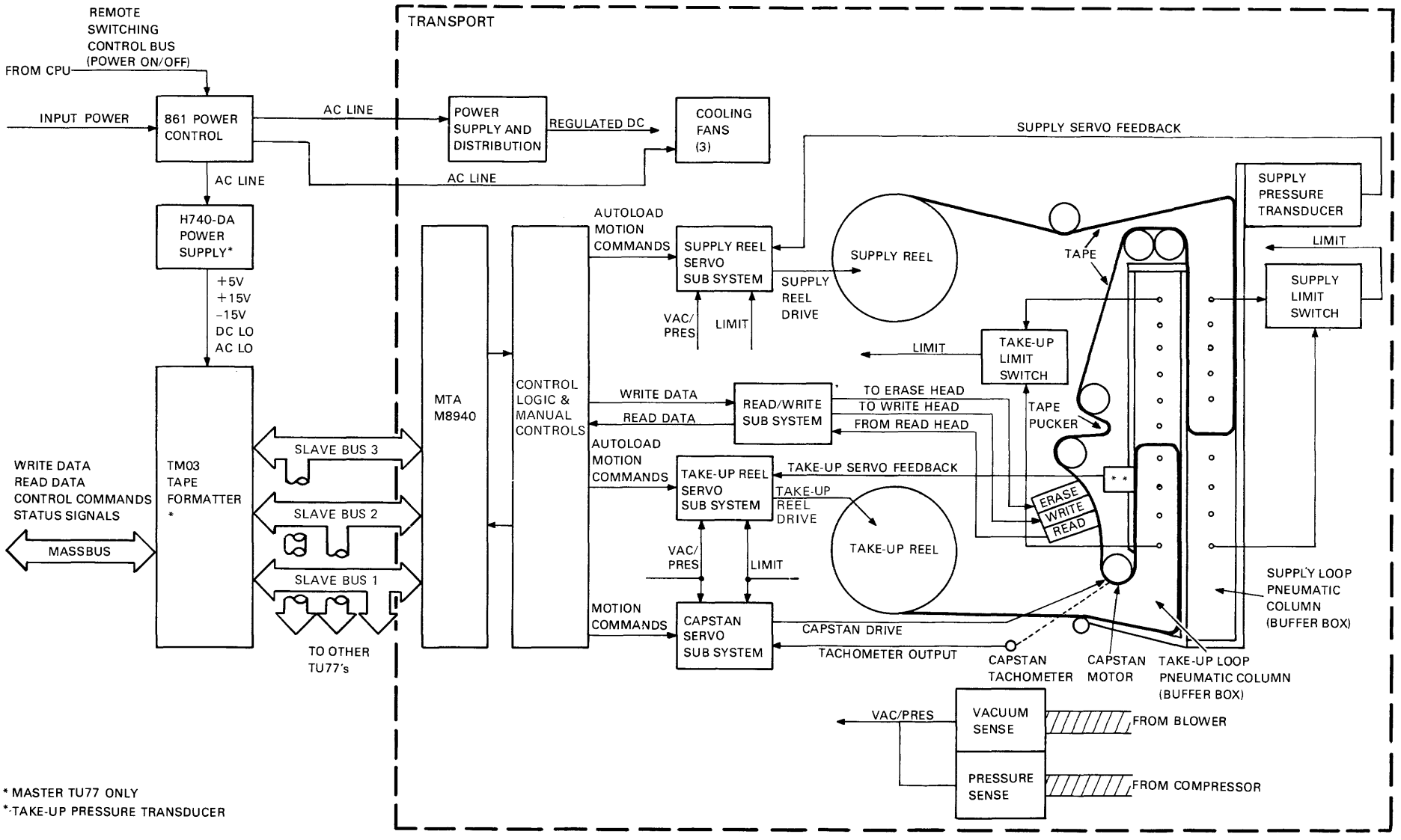


Figure 1-7 Master TU77 Functional Block Diagram

formatted into data words and placed on the Massbus. The TM03 reassembles the data characters into the Massbus format specified by the CPU. The TM03 writes and reads data in either 800 BPI NRZI or 1600 BPI PE formats.

During a write operation, the TM03 generates a parity bit for each 8-bit data character, written on tape. The parity bit is added to the data character, thereby providing 9-bit tape characters to the transport. Error detection is accomplished by parity checks and, during NRZI operation, cyclic redundancy checks (CRC) and longitudinal redundancy checks (LRC). Error detection occurs for both read and write operations. During a write operation a read-after-write function is performed where the data just written on tape is read by the TM03 and undergoes error checking. During read operations, the TM03 can perform error correction of single-track errors in both NRZI and PE. PE single-track correction occurs automatically while NRZI single-track error correction is under software control and must be implemented by the program.

The TM03 also controls and monitors tape transport operation. It receives operational commands from the CPU, and then selects the desired transport and issues functional and motion commands. It monitors transport operation and provides error and status information to the CPU.

The H740-DA power supply supplies regulated ±15 V and +5 Vdc operating voltage for the TM03. Power-fail signals AC LO and DC LO are also supplied to the TM03.

The 861 power control provides ac power to the transport cabinet. It provides filtering for the ac input power which is supplied to switched outlets when the remote power on/off line is enabled from the system processor via the remote switching control bus. There is no power on/off control on the TU77 control panel. Transport power is turned on and off at the system processor. The switched ac is supplied to the H740-DA power supply (master TU77 only), the three cabinet cooling fans and the transport power pack.

The basic TU77 transport contains seven functional areas as shown in Figure 1-7. These are:

Capstan servo subsystem
Reel servo subsystem (2)
Pneumatic subsystem
Read/write subsystem
Control logic and manual controls
MTA interface
Power supply and distribution

The capstan servo subsystem controls the speed and direction of tape movement past the read/write heads. The subsystem is a velocity servo that receives command signals from the control logic specifying forward, reverse or rewind motion. The capstan motor responds with the appropriate velocity. The capstan tachometer generates a feedback signal proportional to speed. The feedback signal is summed with the basic command signal to maintain the correct capstan velocity at all times.

The reel servo subsystems control the speed of the tape reels as required to maintain optimum tension on the tape between the supply and the take-up reels. The supply reel and take-up reel servos are similar but separate subsystems. The path followed by the tape in either direction between the supply reel and take-up reel contains two tape loops in the buffer box (supply loop and take-up loop). Each

loop is separately formed and maintained by a vacuum in conjunction with automatically controlled reel motor speeds. In effect, the reel servos function to feed tape into and remove tape from the buffer box at the rate required to maintain the correct loops.

Servo operation is initiated by signals developed within the pneumatic subsystem. The subsystem senses that the tape loop position has changed as a result of forward or reverse tape motion. Air is drawn from the closed ends of the two buffer boxes creating a vacuum causing the tape loop to form in each box. The differential between the positive pressure inside the loop and the relatively negative pressure at the closed end of the buffer box (outside the loop), maintains the proper tension on the tape during the tape loaded state.

A separate chamber is located behind each buffer box and is connected to its respective box by a series of holes. The spacing and arrangement of these holes is such that, if the loop becomes larger, more of the holes will be exposed to the positive pressure inside the loop, and fewer will be exposed to the lower pressure area outside the loop. This will cause the pressure in the chamber to rise. Conversely, if the loop becomes smaller, the pressure in the chamber will decrease.

Pressure transducers are connected to the supply and take-up chambers. The pressure variations are interpreted by the pressure transducers to provide the supply and take-up servo feedback signals. The pressure sensitive feedback signals are fed back to the reel servos to adjust the velocity of the reel motors for the proper loop in the two buffer boxes. The uppermost and lowermost holes in each buffer column are limit ports. The limit ports connect to supply and take-up limit switches which feed back to both the take-up and supply servos. Should the tape cross a limit port in either the supply or take-up columns, a disabling signal is coupled back to the servos, stopping both reel motors before tape damage occurs.

A pneumatic interlock exists which shuts down the capstan servo and the reel servos if a pneumatic failure is detected. The pneumatic subsystem contains a blower to create the vacuum for the tape columns, and a compressor to generate pressure for the tape path bearings. Vacuum and pressure are monitored by sensing devices. If either is lost, the sensing device sends a VAC/PRES signal to the three servo subsystems, stopping the servo motors and preventing tape damage.

The read/write subsystem processes and transfers data to and from the magnetic tape. The read function processes data picked up from the tape by the read heads and translates the information from the recorded NRZI or PE format to digital data acceptable to the external controlling circuits. The function includes the read after write capability that permits the formatter to verify the execution of a write command while writing is in progress. The write function prepares incoming data for recording in NRZI or PE format and writes the information on the tape in the selected format.

The control logic and manual control circuit interfaces other TU77 subsystems. The control logic transfers the read/write data to and from the read/write subsystem, and the operational commands to the capstan servo. During the autoload sequence the logic circuits control the steps of the sequence by issuing the appropriate commands to the reel servos. Timing of the autoload sequence steps, and other operational sequences (such as rewind), is controlled and monitored by the control logic. Commands

generated by the manual controls are processed by the control logic and applied to the appropriate subsystem. Transport status (e.g., transport selected, on line, EOT, BOT, etc.) is sensed by the control logic, which modifies the signals to the read/write subsystem and to the servo subsystems accordingly. The logic illuminates the appropriate control panel indicators to indicate transport status. Transport status is sent to the TM03 tape formatter via the MTA interface module.

The control and read/write signals are coupled from the slave bus to the transport via the magnetic tape adapter (MTA) interface module M8940. The M8940 adapts the signals on the slave bus to the format required by the transport and vice versa. This includes signal gating, latching and timing. The M8940 also has a test mode capability for troubleshooting and maintenance.

The power supply function includes ac rectification, filtering, dc regulation, and distribution of power as required to the various subsystems.

1.4 APPLICABLE DOCUMENTS

Table 1-1 lists documents applicable to the TU77 tape transport.

Table 1-1 Applicable Documents

Title	Document Number	Description
TM03 Magnetic Tape Formatter User's Manual	EK-TM03-OP	Description, programming and installation information of the TM03.
TM03 Magnetic Tape Formatter Maintenance Manual	EK-TM03-TM	Theory of operation, programming information, installation and maintenance of the TM03.
H740-D Power Supply Maintenance Manual	DEC-11-H740A-A-D	Theory and maintenance of H740-DA power supply.
861-A,B,C Power Controller	DEC-00-H861A-A-A	Theory and maintenance of 861 power control.
TU77 Magnetic Tape Transport Technical Manual; Volume 1	EK-1TU77-TM	Schematics and logic prints of TU77.
TU77 Magnetic Tape Transport Technical Manual; Volume 2	EK-2TU77-TM	Description, installation, operation, theory and maintenance of TU77.
TU77 Magnetic Tape Transport IPB	EK-TU77-IP	Exploded views and parts lists of TU77

1.5 MECHANICAL AND ELECTRICAL SPECIFICATIONS

Table 1-2 details the mechanical and electrical specifications of the transport.

Table 1-2 Mechanical and Electrical Specifications

Item	Specification
Tape (computer grade)	
Width	12.6492 ± 0.0508 mm (0.498 ± 0.002 in)
Thickness	0.0381 mm (1.5 mil)
Tape tension	2.224 ± 0.139 Newtons (8.0 oz nominal)
Reel diameter (Autoload)	266.7 mm (10.5 in) maximum (Note 1) and easy load cartridge #1 and #2*
Recording modes	1600 BPI PE 800 BPI NRZI
Magnetic head	Dual stack (with erase head)
Tape speed	3.2 m/s (125 ips)
Instantaneous speed variation	±3 percent
Long term speed variation	±1 percent
Rewind time for 731.5 m (2400 ft)	65 seconds nominal with 80 seconds maximum
Tape cleaner	Dual-blade type connected to vacuum supply
Interchannel displacement	
Read	3.81 μm (150 μin) maximum (Note 2)
Write NRZI	5.72 μm (225 μin) maximum (Note 3)
Write PE	11.43 μm (450 μin) maximum
Start time	3.0 ± 0.3 ms
Stop time	3.0 ± 0.3 ms
Start distance	4.216 ± 0.508 mm (0.166 ± 0.02 in)
Stop distance	4.953 ± 0.508 mm (0.195 ± 0.02 in)
Beginning of tape (BOT) and end of tape (EOT) Detectors (Note 4)	Photoelectric
Tape creepage	None
Pneumatic interlock	Tape motion disabled when vacuum is lost in vacuum column
Load time	No greater than 10 seconds without a retry, and 20 seconds with a retry for 10-1/2 inch reels
Unload time	Less than 7 seconds for 10-1/2 inch reels
Write gap to read gap distance	0.381 ± 0.013 cm (0.150 ± 0.005 in)
Weight	288 kg (640 lbs) (Master unit)
Cabinet dimensions	
Height	152.4 cm (60.0 in)
Width	67.3 cm (26.5 in)
Depth (from face of front door to rear of cabinet)	81.9 cm (32.3 in)

*Easy Load #1 and #2 are Registered Trademarks of IBM.

Table 1-2 Mechanical and Electrical Specifications (Cont)

Item	Specification
Operating temperature (Electronics)	4.44° to 44.0° C (40° to 112° F) (Note 5)
Non-operating temperature	-45.55° to 71.11°C (-50° to 160° F)
Operating altitude	0 to 2134 m (0 to 7000 ft) (Note 6)
Non-operating altitude	15,240 m (50,000 ft) maximum
Power	
Volts ac	200, 210, 220, 230, 240, 250 (Note 7)
Frequency	50 ± 1 or 60 ± 1 Hz
Kilovolt amp (KVA)	
Standby (Loaded)	1.3 KVA maximum (Note 8)
Start/stop	2.1 KVA maximum (Note 8)
Electronics	All silicon

NOTES

1. 177.8 mm (7 in) and 216.0 mm (8.5 in) reels may be used but cannot be autoloaded.
2. The maximum displacement between any two bits of a character when reading a master tape using the read section of the read-after-write head.
3. The maximum displacement between any two bits of a character on a tape written with all ones using the write section of the read-after-write head.
4. Approximate distance from detection area to write head gap is 35.6 mm (1.40 in).
5. For data transfer, the operating temperature is dictated by the nature of the tape material.
6. Operation above 1220 m (4000 ft) requires installation of high altitude pulley and pulley belts in TU77 power pack.
7. Line variations must be within ±10 percent.
8. Slave unit only. Add 625 W for master units.

CHAPTER 2
INSTALLATION

2.1 SITE PLANNING AND CONSIDERATIONS

2.1.1 Space Requirements

Figure 2-1 illustrates the space and service clearances required for the TU77 cabinet. Adequate space must be provided to slide the TM03 out of the cabinet for servicing and to open the front and rear doors on the TU77 Tape Transport.

2.1.2 Power Requirements

The TU77 Tape Transport can be operated from 200–250 Vac, 50/60 Hz with proper connections on the power chassis. Line voltage should be maintained to within ±10 percent of the nominal value and the frequency should not vary more than ±2 Hz.

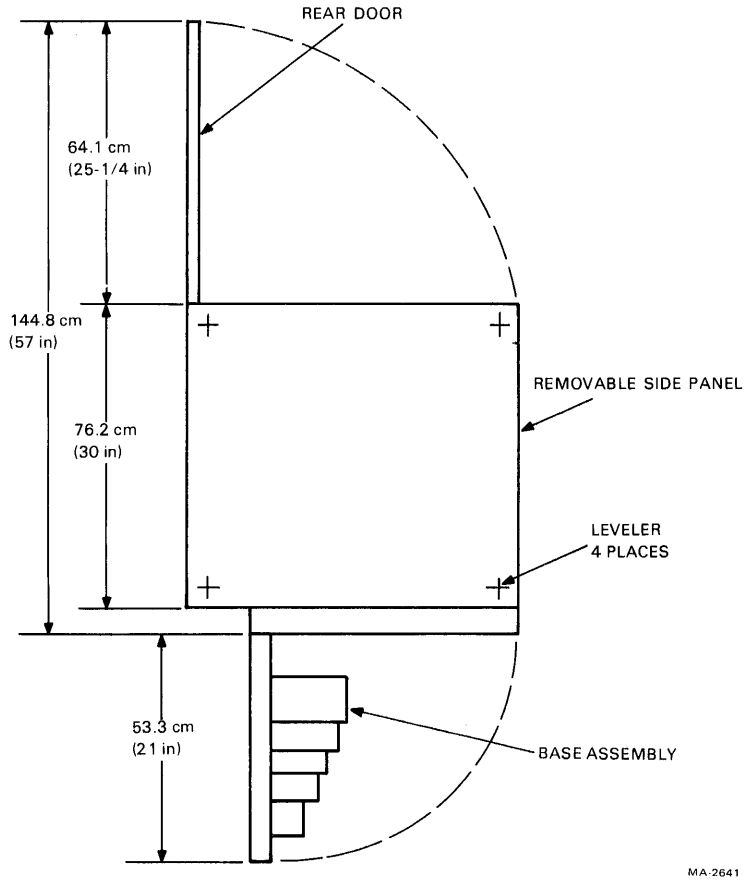


Figure 2-1 Space and Service Clearance, Top View

2.1.3 Environmental Requirements

The TU77 transport should be located in an area free of excessive dust and dirt or corrosive fumes and vapors. To ensure proper cooling, the bottom of the cabinet and the air vents in the front panel and rear door of the cabinet must not be obstructed. The operating environment should have cool, well-filtered, humidified air; a temperature range of 15° to 27° C (59° to 80° F); and relative humidity of 40 to 60 percent.

2.2 UNPACKING AND INSPECTION

2.2.1 Unpacking

The TU77 H9500 cabinet comes packed in an extra strong corrugated cardboard container* that measures approximately 76 cm (30 in) wide, 89 cm (35 in) long and 147 cm (58 in) high. The cabinet is shipped on its casters which raises the shipping carton about 7 cm (2-3/4 in) off the floor. The casters are a shock-isolating type, thus eliminating the need for shipping skids. Caster locks are supplied with each cabinet (Figure 2-2). These locks function to facilitate cabinet movement by preventing two of the four casters from swiveling. They also assist in providing cabinet stability by restricting the direction of cabinet movement. These caster locks are mounted with hardware and may be removed when it becomes necessary to allow omni-directional movement during installation. In any case, the locks are to be removed when the cabinet has been installed at its final destination. The locks are to be stored with the cabinet and may be used again if the cabinet has to be moved.

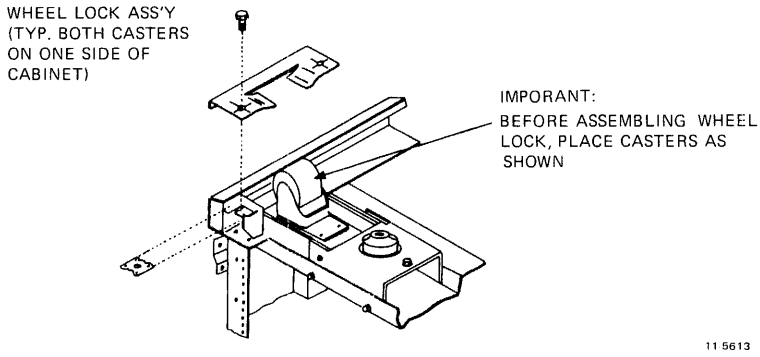


Figure 2-2 Caster Lock Assembly

To unpack the TU77 from its shipping container, proceed as follows:

1. Cut the plastic bands around the container.
2. Cut the tape on the top and sides of the container.
3. Remove and dispose of the container. (The container is not reuseable.)

2.2.2 Inspection

After unpacking the TU77 transport, inspect it and report any damage to the responsible shipper and the local DIGITAL sales office. Inspect as follows:

1. Inspect all switches, indicators and panels for damage.

2. Open TU77 front door. Depress the upper and lower release buttons and open the buffer box door. Check that the buffer box door is tightly secured to the cabinet. Inspect for foreign material, loose or damaged components, and for glass damage.

* Units shipped outside the continental United States have an additional wooden container around the cardboard carton. The side panels of the container are bolted together.

3. Check the transport for any foreign material that may have lodged in the take-up reel or other moving parts.

4. Rotate the supply hub and take-up reel. Check for binding and physical damage.

5. Rotate the capstan. Check for binding and physical damage.

CAUTION

The capstan is fragile. Do not touch the capstan rubber surface and do not apply pressure to the capstan which might cause it to deform.

6. Check tape path for any sharp edges.

7. Close the buffer box door by pressing the two release buttons using moderate pressure. (The buttons will not catch if pressed too hard.)

8. Close the TU77 front door.

2.3 SINGLE TRANSPORT INSTALLATION

2.3.1 Mechanical Installation

After the shipping container has been removed and visual inspection has been performed, roll the transport cabinet into position and proceed as follows.

1. An array of vertical slots constitute venting in the cabinet front panel. A quick-release latch is located approximately 2.54 cm (1 in) behind each end of this array. Insert a thin-bladed tool, such as a small steel rule, into one of the end slots and push on the latch while simultaneously pulling forward to release one corner of the front panel. In the same manner, while continuing to pull forward, release the latch at the other end of the array to free the front panel. Remove the front panel and set it aside. Do not disconnect the ground strap from the panel.

2. Remove the two leveler pads and four leveler feet that are wrapped in blister wrap and taped to the inside of the front panel.

3. Raise the interlock rods on each side of the cabinet. Remove the two stabilizer arms from the stabilizer sleeve assemblies (Figure 2-3).

4. Screw the leveler pads into the stabilizer arms.

5. Raise the interlock rods. Reinsert the stabilizer arms into the stabilizer sleeve assemblies.

6. Install the leveler feet in the lower corners of the cabinet frame (Figure 2-3).

7. Using a 1.43 cm (9/16 in) wrench, lower the leveling feet until they make contact with the floor stabilizing the cabinet.

8. Using a level, adjust the feet until the cabinet is level.

9. Extend the two stabilizer arms and lower the leveler pads until they just touch the floor yet can easily slide along the floor. Do not place any weight on the leveler pads.

10. Insert an opening tool (Figure 2-4) into the rear door, and turn one-quarter turn in a counter-clockwise direction and open the door.

11. Remove the locking pins from the rear of the TM03 shelf slide assembly (Figure 2-5).

12. Open the transport front door. Using a screwdriver, release the service lock located in the lower right corner of the base assembly. Swing the base assembly open.

NOTE

The base assembly will not swing open unless the stabilizer arms are extended (step 9).

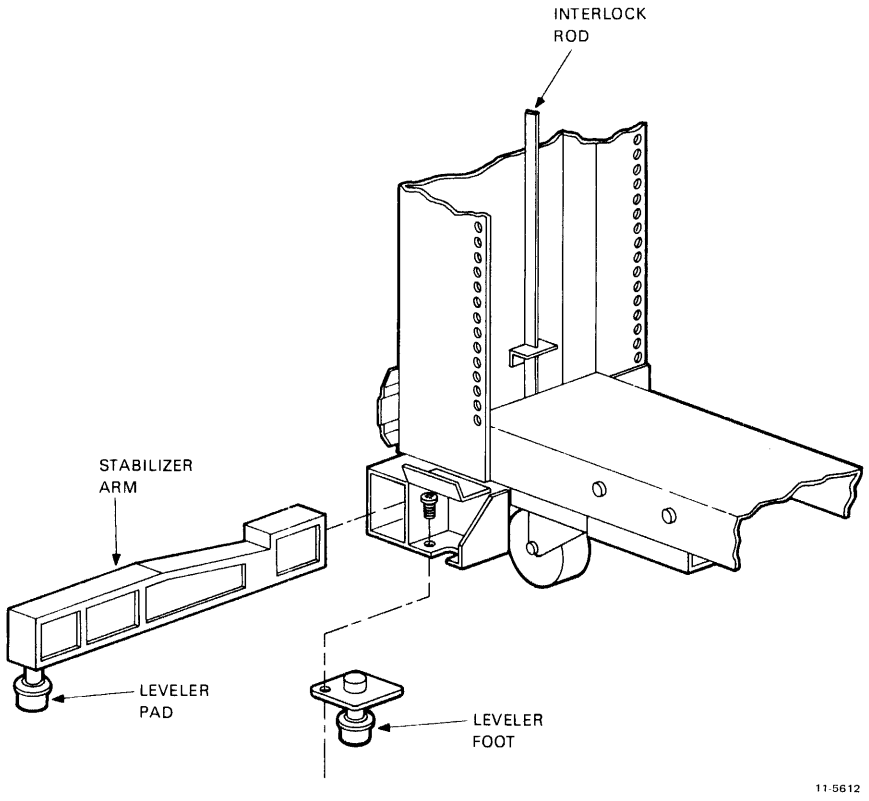


Figure 2-3 Location of Stabilizer Arm and Leveler Feet

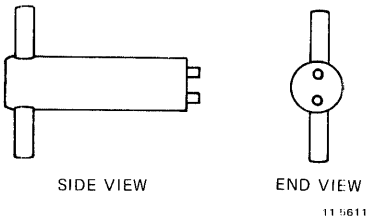


Figure 2-4 Rear Door Opening Tool

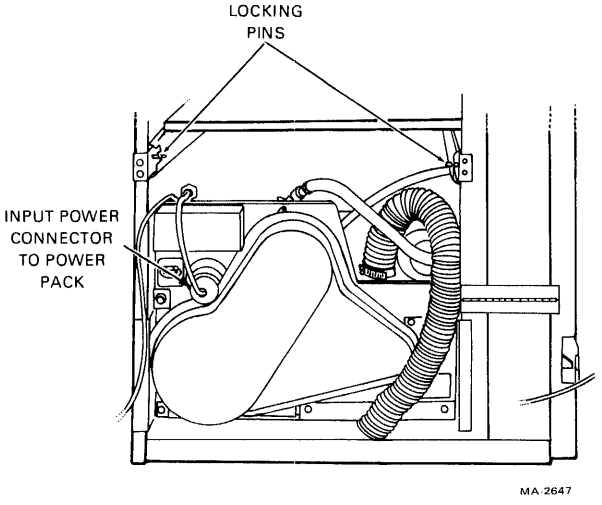


Figure 2-5 Location of TM03 Shelf Locking Pins and Power Pack Connector

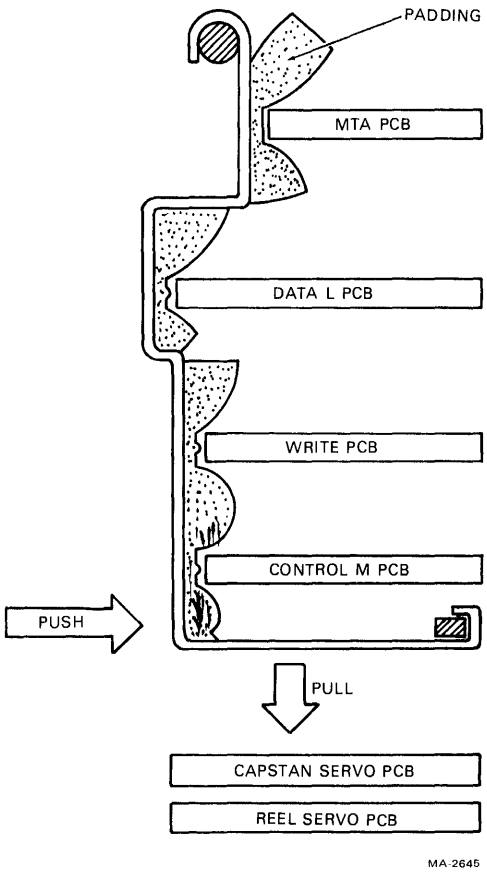


Figure 2-6 PCB Shipping Bracket

13. Remove the PCB shipping bracket by pushing in on the lower front and pulling down from underneath (Figure 2-6).

14. Check seating of PCBs in their sockets.

2.3.2 Power and Cabling

1. Check TU77 internal cabling as follows:

   a. Power cable from 861 switched outlet to transport power pack (Figure 2-5)

   b. Power cable from 861 switched outlet to cabinet blowers

   c. Power cable from 861 switched outlet to H740-DA power supply

   d. H740-DA power cabling to TM03*

   e. TM03 cabling to Massbus connector panel*

   f. TM03 cabling to the three connectors on the M8940 MTA board.*

2. Check that the power on/off circuit breaker on the 861 is on and the remote/local switch is set to REMOTE ON (Figure 2-7).

*See *TM03 User's Manual* or *TM03 Technical Manual* for TM03 cabling. The TM03 manuals are listed in Table 1-1.

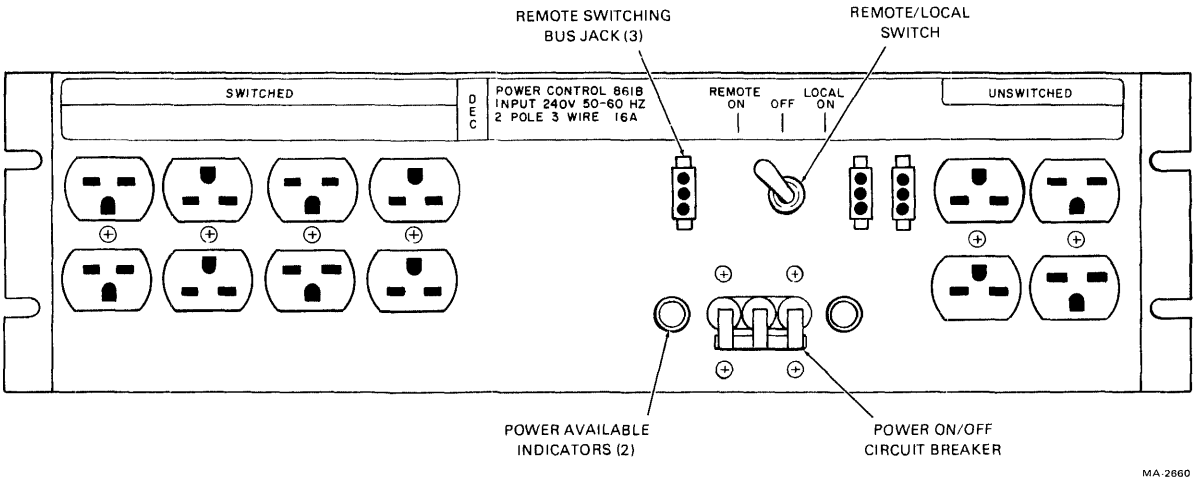


Figure 2-7 861B Power Control Panel

3. Check fuses on power pack fuse panel (Figure 1-5). To see fuses, it is necessary to fully extend the TM03 shelf. The fuses can be seen from the front of the cabinet. A closer view can be obtained from the rear of the cabinet by looking over and down onto the fuse panel.

4. Remove the cover from the power transformer terminal strip (Figure 2-8). (The ac input plug on the power pack must also be removed.) Check that the blue, brown and white/red wires are connected to the lower terminals as shown in Table 2-1. The terminals are numbered 1 through 9 from left to right.

Table 2-1 Primary Power Connections

Input Voltage	Blue Wire	Brown Wire and White/Red Wire
198 - 205	TB1-4	TB1-7
206 - 215	TB1-3	TB1-7
216 - 225	TB1-4	TB1-8
226 - 235	TB1-3	TB1-8
236 - 245	TB1-4	TB1-9
246 - 255	TB1-3	TB1-9

Replace the cover and connect the power pack connector.

5. Check that the circuit breaker on the rear of the power pack is in the on (up) position.

6. Remove the pulley cover from the rear of the transport power pack (Figure 2-8) and check that the ac motor pulley is the proper one for the source frequency and altitude as shown in Table 2-2. The variation of the vendor part number is stamped on the pulley. Spin the ac motor pulley by hand and check that the blower and compressor belts are tight and track properly. Replace the pulley cover.

7. Connect the BC06S round Massbus cable to the "in" connector on the rear of the TU77 (Figure 2-9).

8. Connect a Massbus terminator into the "out" receptacle.

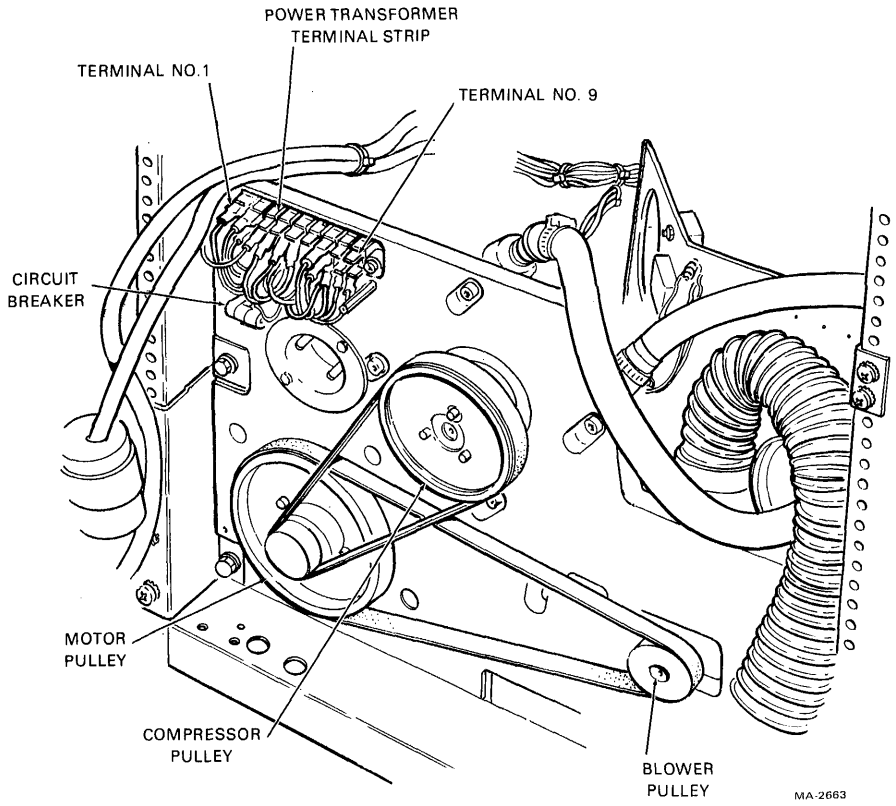


Figure 2-8 Rear of Power Pack with Pulley Cover Removed

Table 2-2 AC Motor Pulley Part Numbers

Frequency	Altitude*	DEC Part Number	Vendor Part Number
60 Hz	Low	29-23299	108478-01
60 Hz	High	29-23300	108478-02
50 Hz	Low	29-23301	108478-03
50 Hz	High	29-23302	108478-04

*Low = Under 1,220 M (4,000 ft), High = Over 1,220 M (4,000 ft)

9. Connect the remote switching control bus from the CPU to one of the three jacks on the 861, next to the remote/local switch.

10. Replace the front panel. Close the rear door.

11. Check that system power is off at the CPU and connect the ac power cable from the 861 to the power source.

12. Perform the acceptance tests (Paragraph 2.5).

2.4 MULTI-TRANSPORT INSTALLATION

2.4.1 Mechanical Installation

When an installation contains more than one transport, only the master transport is shipped with the side panels. During installation, one of the side panels is removed, and the master and slave transport(s) are bolted together. The removed side panel is then mounted onto the end slave transport.

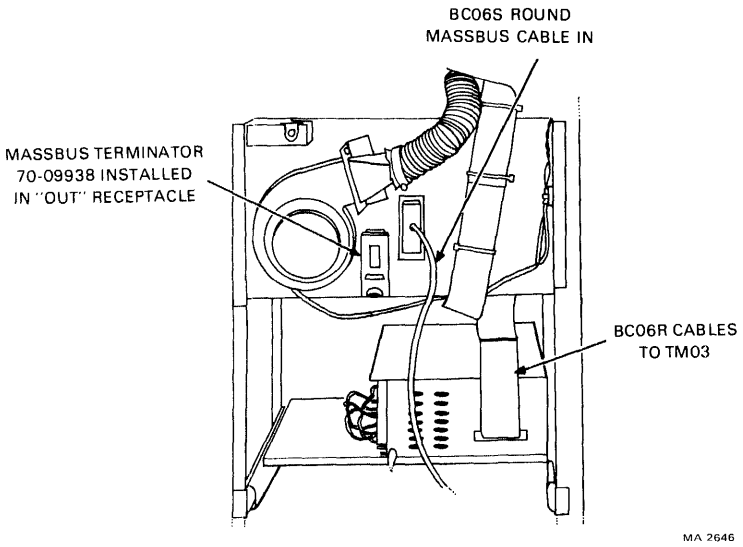


Figure 2-9 Massbus Connection to TU77 Master Transport

After the shipping containers have been removed and the transports have been visually inspected, roll the transport cabinets into their approximate position. Place the master transport next to the CPU. Proceed as follows for each cabinet unless otherwise specified.

1. An array of vertical slots constitute venting in the cabinet front panel. A quick-release latch is located approximately 2.54 cm (1 in) behind each end of this array. Insert a thin-bladed tool, such as a small steel rule, into one of the end slots and push on the latch while simultaneously pulling forward to release one corner of the front panel. In the same manner, while continuing to pull forward, release the remaining latch at the other end of the array to free the front panel. Remove the front panel and set it aside. Do not disconnect the ground strap from the front panel.
2. Two leveler pads and four leveler feet are blister wrapped and taped to the inside of the front panel. Remove the leveler pads and feet.
3. Raise the interlock rods on each side of the cabinet and remove the two stabilizer arms from the stabilizer sleeve assemblies (Figure 2-3).
4. Screw the leveler pads into the stabilizer arms.
5. Raise the interlock rods and reinsert the stabilizer arms into the stabilizer sleeve assemblies.
6. Install the leveler feet in the lower corners of the cabinet frame (Figure 2-3).
7. Extend the two stabilizer arms from each cabinet and lower the leveler pads until they just touch the floor. Do not place any weight on the leveler pads. (The pads will be readjusted later.)
8. Open the master transport front door. Using a screwdriver, release the service lock located in the lower right corner of the base assembly. Swing the base assembly open.

NOTE

The base assembly will not swing open unless the stabilizer arms are extended (step 7).

9. Locate the fastener attached to the underside of the master transport top cover (Figure 2-10). Release the top cover by turning the fastener one-quarter turn in a counter-clockwise direction. When it is released, the fastener hangs by a wire from the top cover. Pull the top cover forward approximately 1.27 cm (0.5 in) and lift off. Rest the cover on top of the cabinet leaving the ground wire connected.

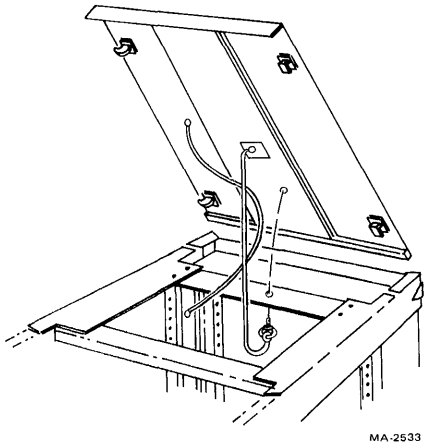


Figure 2-10 Top Cover Fastener

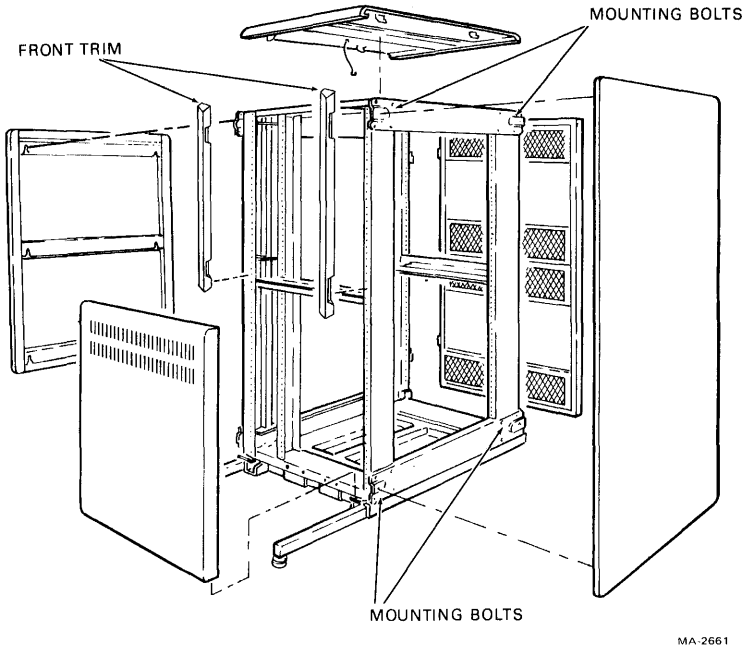


Figure 2-11 Corporate Cabinet with Side Panels and Top Cover Removed

10. Remove the end panel furthest from the CPU by grasping it by both sides and lifting it off the four mounting bolts. If the side panel will not lift off, it may be necessary to loosen the mounting bolts. Remove the front panel trim to gain access to the upper front mounting bolt. To remove the trim, lift up and out (Figure 2-11).

11. Disconnect the side-panel ground strap from the cabinet frame and set the panel aside.

12. Remove the four exposed mounting bolts from the master transport.

13. Push the cabinets together so they are in adjoining positions with the mounting-bolt plates side by side.

14. Using a 1.43 cm (9/16 in) wrench, lower the leveling feet of the highest cabinet until they make contact with the floor giving the cabinet a firm base.

15. Using a level, adjust the feet until the cabinet is level.

16. Level and adjust the adjoining cabinet(s) so that the bolting (middle) holes on the four corner bolting plates are aligned.

17. After aligning the bolting holes of adjoining cabinets, insert 1/4 in bolts into the holes and secure them with kepnuts. Bolting the cabinets in this manner provides good horizontal alignment.

18. After all the cabinets have been bolted together, readjust the leveler pads on the stabilizer arms until each pad touches, yet easily slides along the floor. Do not place any weight on the leveler pads.

19. Install the four mounting bolts taken from the master cabinet, into the mounting-bolt plates of the end slave transport. Remove front-panel trim if necessary.

20. Open the base assembly of the end slave transport. Release the top cover fastener, remove the cover and rest it on top of the cabinet, off to one side. Do not disconnect the cover ground strap.

21. Set the side panel taken from the master transport, next to the slave transport. Connect the panel ground strap to the cabinet frame and mount the panel onto the side of the slave transport.

22. Replace the top cover and secure the cover fastener.

23. Unlock the rear door of the master transport using the opening tool provided for that purpose (Figure 2-4). Insert the tool and turn one-quarter turn in a counter-clockwise direction.

24. Remove the locking pins from the rear of the TM03 shelf slide assembly of the master TU77 cabinet (Figure 2-5).

25. Open the base assembly of each transport and remove the PCB shipping bracket by pushing in on the lower front and pulling down from underneath (Figure 2-6). Check seating of PCBs in their sockets.

2.4.2 Power and Cabling

Perform the following steps for each of the TU77 cabinets unless otherwise specified.

1. Check TU77 internal cabling as follows:

   a. Power cable from 861 switched outlet to transport power pack (Figure 2-5)

   b. Power cable from 861 switched outlet to cabinet blowers

   c. Power cable from 861 switched outlet to H740-DA power supply*

   d. H740-DA power cabling to TM03*

   e. TM03 cabling to Massbus connector panel*

   f. TM03 cabling to the three connectors on the M8940 MTA board*.

2. Check that the power on/off circuit breaker on the 861 is on and the remote/local switch is set to REMOTE ON (Figure 2-7).

3. Check fuses on power pack fuse panel (Figure 1-5). The fuses can be seen from the front of the cabinet. (On the master transport it is necessary to fully extend the TM03 shelf to see the fuse panel.) A closer view can be obtained from the rear of the cabinet by looking over and down onto the fuse panel.

4. Remove the cover from the power transformer terminal strip (Figure 2-8). (The ac input plug on the power pack must also be removed.) Check that the blue, brown and white/red wires are connected to the lower terminals as shown in Table 2-1. The terminals are numbered 1 through 9 from left to right. Replace the cover and connect the power pack connector.

*Master TU77 only. See *TM03 User's Manual* or *TM03 Technical Manual* for TM03 cabling. The TM03 manuals are listed in Table 1-1.

5. Check that the circuit breaker on the rear of the power pack is in the on (up) position.

6. Remove the pulley cover from the rear of the transport power pack (Figure 2-8) and check that the ac motor pulley is the proper one for the source frequency and altitude as shown in Table 2-2. The variation of the vendor part number is stamped on the pulley. Spin the ac motor pulley by hand and check that the blower and compressor belts are tight and track properly. Replace the pulley cover.

7. Connect the BC06S round Massbus cable to the in connector on the rear of the master TU77 (Figure 2-9).

8. If the system has only one master TU77, connect a Massbus terminator into the out receptacle of the master unit. If the system contains another master TU77, connect them together in daisy chain fashion by connecting another BC06S Massbus cable from the out receptacle of the first TU77 master to the in receptacle of the second. If there are more master units in the system, connect them onto the daisy chain in a similar manner. Install a Massbus terminator into the out receptacle of the last master unit on the chain.

9. Daisy chain the slave TU77s interfaced to a particular TM03 by connecting three slave bus cables from the M8940 MTA board in the master unit to the M8940 MTA board in the first slave unit and so on up to a maximum of three slave units (four transports to one TM03 tape formatter). If the system contains more than three slave units, a second TU77 master unit is required. The slave bus cabling is illustrated in Figure 2-12. The orientation of the slave bus to the MTA boards is colored stripes on the left with the smooth side up for the in cables, and colored stripes on the left with the ribbed side up for the out cables (Figure 2-13).

10. All M8940 MTA boards have five resistive dual in-line package (DIP) pack terminators (P.N. 13-11003-01) for terminating the slave bus. Remove the terminators from all except the last M8940 board of each slave bus chain. The location of the terminators are shown in Figures 2-12 and 2-13.

11. Daisy chain the remote switching control bus by connecting the bus from the CPU to one of the three jacks next to the remote/local switch on the 861 in the master TU77. Connect the bus from one of the two remaining jacks to the 861 in the next TU77. Continue the daisy chain until all the TU77s are connected to the remote switching control bus.

12. Check that system power is off at the CPU and connect the ac power cable from each 861 to a power source.

13. Install cabinet front panels, and close and secure all base assemblies.

14. Perform the acceptance tests (Paragraph 2.5).

2.5 ACCEPTANCE TESTING

This section lists and describes all the tests required for acceptance testing of the TU77 transport and the TM03 tape formatter. If the acceptance tests are performed satisfactorily, then the TM03 and the TU77 have been installed and are operating properly.

Acceptance testing is divided into two categories: a turn-on and loading checkout, and the system diagnostics. The turn-on and loading checkout checks basic functions of the transport only. The diagnostics treat the TM03 and the transport as a subsystem. Instructions on how to run these diagnostics and interpret the results are given in this section.

If unfamiliar with interlocks and other conditions affecting autoload/manual load selection, refer to Paragraph 3.2.2.

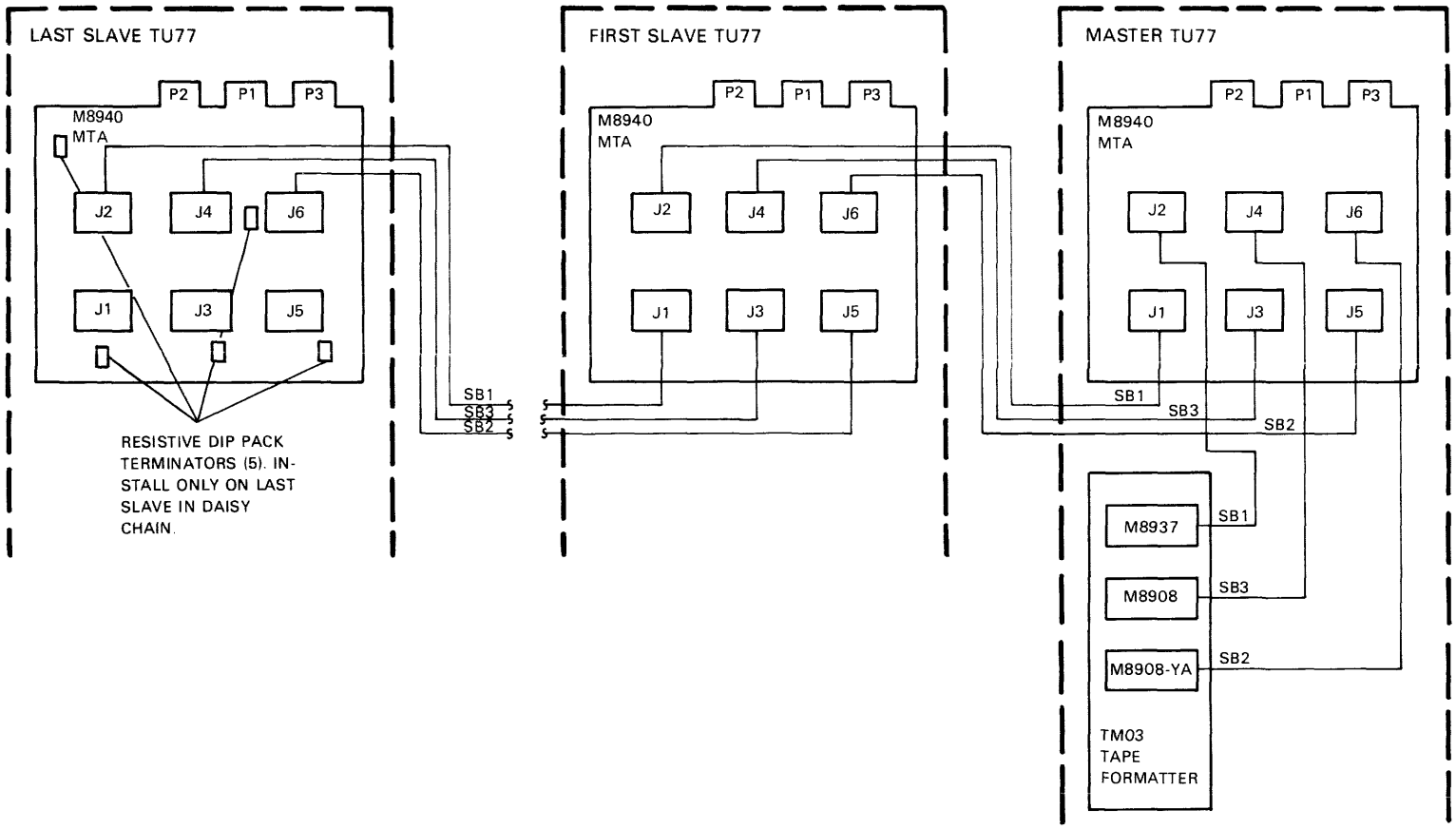


Figure 2-12 Slave Bus Cabling of TU77 Daisy Chain

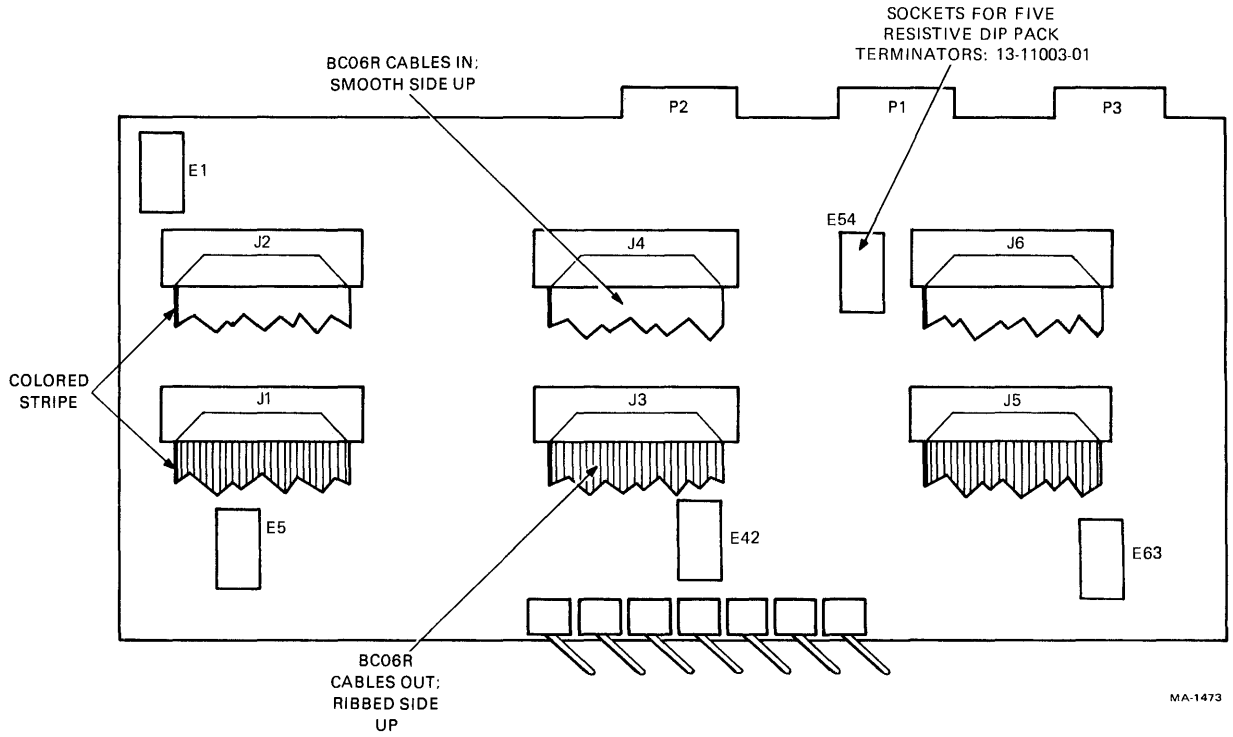


Figure 2-13 Cable Orientation on M8940 MTA Module

2.5.1 Turn-On and Loading Checkout

The turn-on and loading checkout consists of loading the transport under various conditions and checking that the proper responses are obtained. The checkout utilizes flowcharts to show the proper sequence of events for each of the loading operations. Actions listed inside a flowchart box occur at about the same time while actions listed in separate boxes occur in sequence. The flowcharts include minor troubleshooting to aid in locating simple problems caused by bad tape or improper loading procedures. Perform the following operations in order.

2.5.1.1 Power On – Follow the instructions and check for the events specified in Figure 2-14.

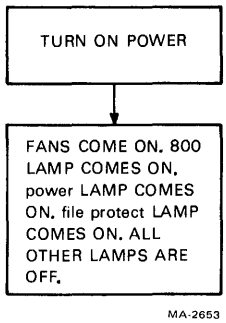


Figure 2-14 Power On

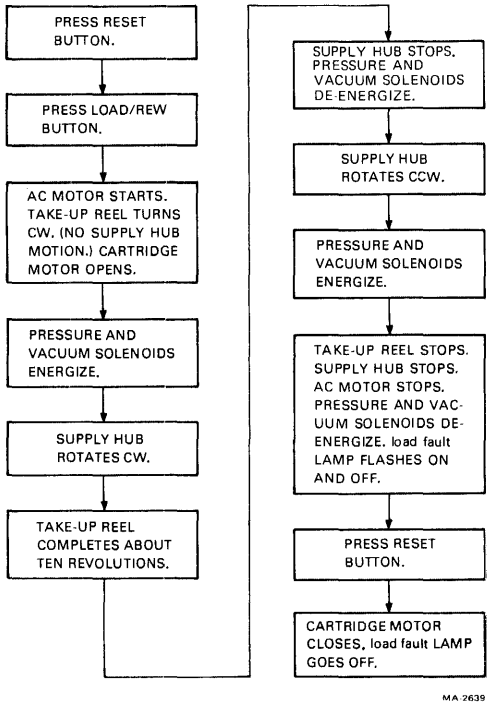


Figure 2-15 Load Sequence Without Tape

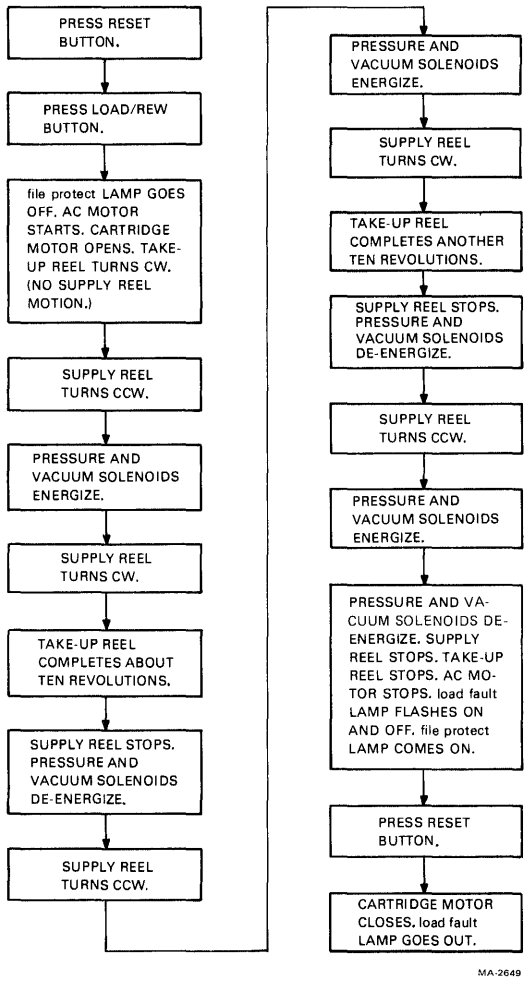


Figure 2-16 Inhibited Autoload Sequence

2.5.1.2 Load Sequence Without Tape – With no tape reel mounted on the supply hub, follow the instructions and check for the events specified in Figure 2-15.

2.5.1.3 Inhibited Autoload Sequence – Install a write-enable ring on a large 267 mm (10-1/2 in) reel of tape. Tape the leader to prevent magnetic tape from coming off the reel. Mount the reel onto the supply hub. Close the transport front door so the interlock can enable the autoload sequence. If it is desired to leave the door open, override the interlock by pulling it out. Follow the instructions and check for the events specified in Figure 2-16.

2.5.1.4 Autoload Sequence – Remove the tape from the leader allowing the magnetic tape to come off the supply reel. Check that the leader has no creases or rips. If necessary, cut the end of the tape with the tape crimper (P.N. 47-00038). Leave the write-enable ring installed. If a wraparound cartridge is not used, close the transport front door so the interlock can enable the autoload sequence. If it is desired to leave the door open, override the interlock by pulling it out. Follow the instructions and check for the events specified in Figure 2-17.

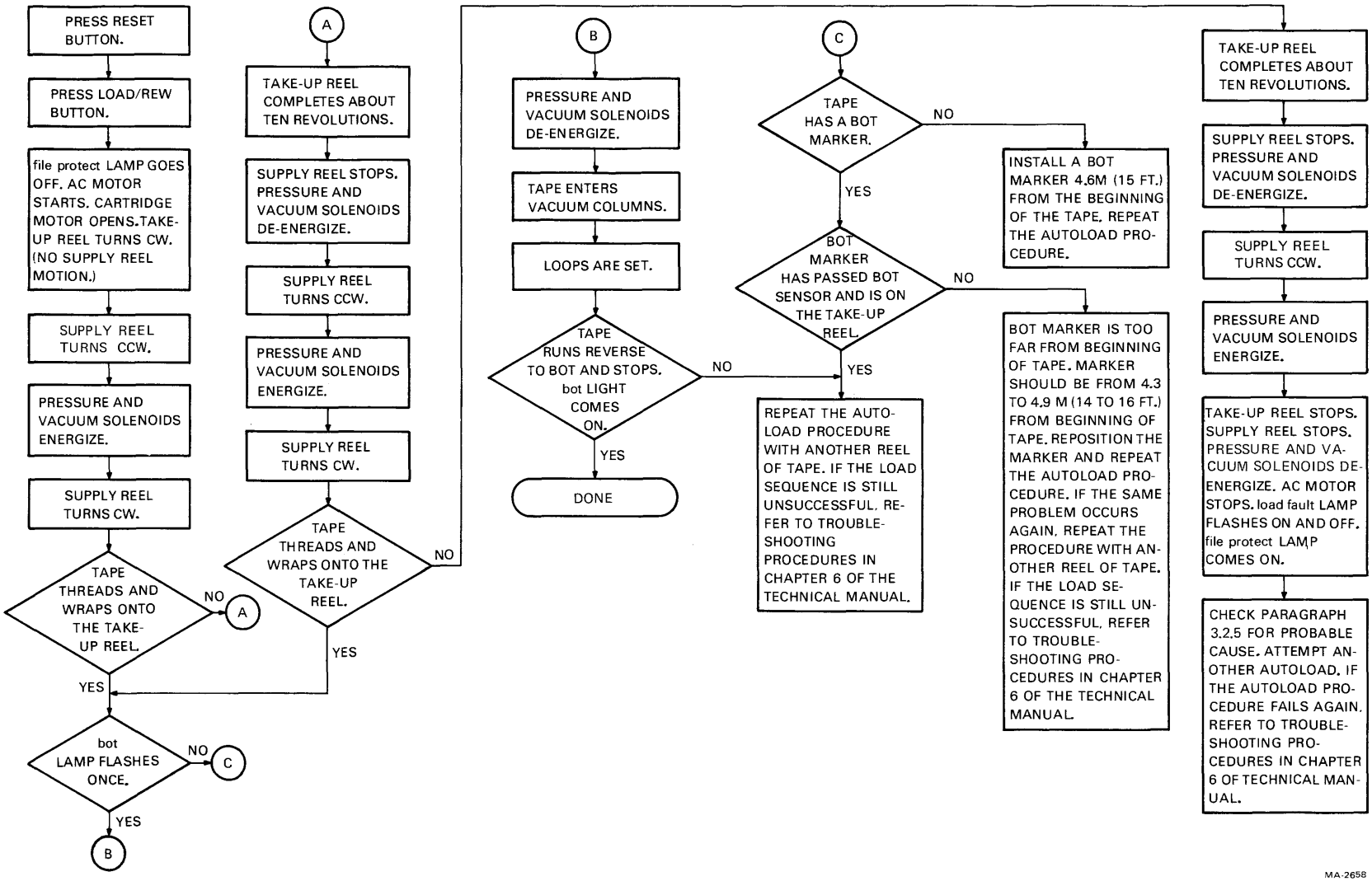


Figure 2-17 Autoload Sequence

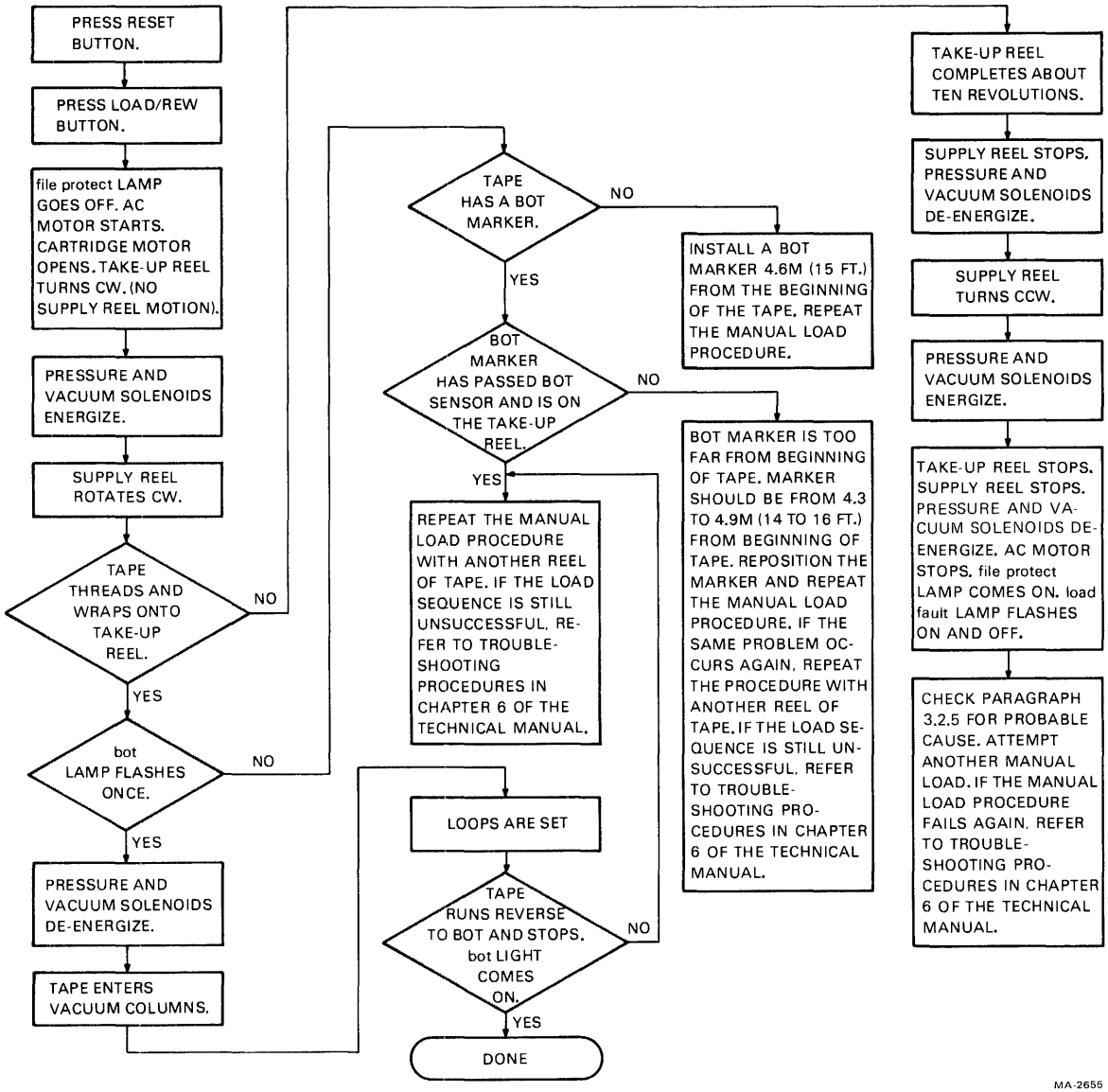


Figure 2-18 Manual Load Sequence

2.5.1.5 Manual Load Sequence – Install a write-enable ring on a 216 or 178 mm (8-1/2 or 7 in) reel of tape and mount the reel onto the supply hub. Check that the leader has no creases or rips. If necessary, cut the end of the tape with the tape crimper. Insert 8 to 10 cm (3 to 4 in) of tape into the threadblock column. Follow the instructions and check for the events specified in Figure 2-18.

2.5.1.6 Unload Sequence – Follow the instructions and check for the events specified in Figure 2-19.

2.5.1.7 Manual Load Repeatability

1. Mount a 216 or 178 mm (8-1/2 or 7 in) reel of tape onto the supply hub.
2. Check that the leader has no creases or rips. If necessary, cut the end of the tape with the tape crimper.
3. Insert 8 to 10 cm (3 to 4 in) of tape into the threadblock column.

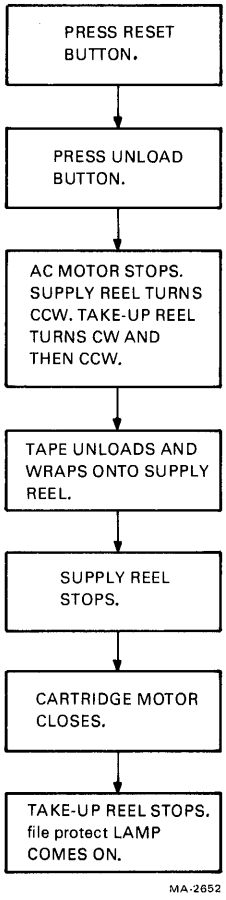


Figure 2-19 Unload Sequence

4. Initiate a manual load by pressing and releasing the LOAD/REW button.

5. If the tape loaded successfully, press the UNLOAD button to unload the tape.

6. Repeat steps 3, 4 and 5 to attempt eight manual loads. If a failure occurs within the eight tries, continue manual loading up to twenty tries. There should be no more than three failures among the twenty successive tries.

7. After completing the manual load repeatability test, check the tape for damage caused by the tape transport. The tape should not show damage that would cause a load failure or data errors.

2.5.1.8 Autoload Repeatability

1. Mount a large 267 mm (10-1/2 in) reel of tape onto the supply hub.

2. Check that the leader has no creases or rips. If necessary, cut the end of the tape with the tape crimper.

3. Close the transport door.

4. Initiate an autoload by pressing and releasing the LOAD/REW button.

5. If the tape loaded successfully, press the UNLOAD button to unload the tape.

6. If the autoload fails, the tape will automatically try to load a second time. If the second attempt fails, the load fault lamp will flash on and off. This is counted as one failure.

7. Repeat steps 4, 5 and 6 to attempt nine autoloads. If a failure occurs within the nine tries, continue autoloading up to twenty tries. There should be no more than two failures among the twenty successive tries.

8. After completing the autoload repeatability test, check the tape for damage caused by the tape transport. The tape should not show damage that would cause a load failure or data errors.

2.5.2 TM03/TU77 Diagnostics

Install a write-enable ring on a large 267 mm (10-1/2 in) reel of tape. Mount the reel onto the supply hub. Close the transport front door to close the autoload interlock or pull out the interlock switch to override. Press the LOAD/REW button to load the tape. Press the ON LINE button and check that the on-line light is on.

Table 2-3 lists the TM03/TU77 diagnostics for PDP-11, DECsystem 20, and PDP-11/780 VAX system. Run the following diagnostics that apply to the system used. Use the instructions in the diagnostic documentation and check for the results specified in Paragraphs 2.5.2.1 through 2.5.2.5

Table 2-3 TM03/TU77 Diagnostics Used for Acceptance Testing*

Title	Number PDP-11	Number DECsystem 20	Number PDP-11/780 VAX	Description
Control Logic Test 1	MAINDEC 11-DZTEA †	-	-	Test TM03 logic. Includes control and data logic in maintenance modes wrap 0 through 3. Indicates probable faulty area.
Control Logic Test 2	MAINDEC 11-DZTEB †	-	-	Tests TM03 logic. Includes control and data logic in maintenance mode wrap 4. Indicates probable faulty area.
Basic Function Test	MAINDEC 11-DZTEC †	MAINDEC 10-DFTUE ‡	-	Tests the subsystem command functions (read, write, space, etc.)
Drive Function Timer	MAINDEC 11-DZTEE †	-	ZZ-ESMAB	Tests for proper tape motion timing (speed, acceleration, deceleration) and data transfer rate.
Data Reliability	MAINDEC 11-DZTED †	MAINDEC 10-DFTUK †	ZZ-ESMAA	Tests TM03 and TU77 circuitry by writing and reading user-determined or predetermined data patterns and recording modes. Provides error information to the user via the console.

* Additional TM03/TU77 diagnostics are available for maintenance
† Revision B (Rev 2) or higher
‡ Revision F (Rev 6) or higher

2.5.2.1 Control Logic Test No. 1 – Run control logic test no. 1 for two passes. No errors are allowed. Run the test again with manual intervention.

2.5.2.2 Control Logic Test No. 2 – Run control logic test no. 2 for two passes. No errors are allowed.

2.5.2.3 Basic Function Test – Run the PDP-11 basic function test for two passes. No errors are allowed. Run the DECsystem 20 basic function test B1 and B2 for one pass each. No errors are allowed.

2.5.2.4 Drive Function Timer – Run the PDP-11 or VAX-11 /780 drive function timer diagnostics for two passes. No out-of-range errors are allowed.

2.5.2.5 Data Reliability

NOTE

In using the data reliability diagnostic on the PDP-11, DECsystem 20, and PDP-11/780 VAX, do not count errors caused by bad tape.

PDP-11 System Using 11-DZTED*

1. Run the data reliability test for one pass in NRZI mode with the following parameters:

   Density = 3
   Parity = 0
   Format = 14
   Record count = 1
   Character count = 20
   Pattern number = 1
   Tape mark = 1
   Interchange read = 0
   Single pass = 1
   CRC correction = 0
   Stalls
   Read = 1
   Write = 1
   Turnaround = 1

   Before typing the last CR, set the console switches to 000720. Then type CR to run the test. The following errors are allowed:

   0 hard errors (read and write)
   2 soft write errors
   2 soft read errors

2. Run the data reliability test for one pass in PE mode with the following parameters.

   Density = 4
   Parity = 0
   Format = 14
   Record count = 1
   Character count = 20
   Pattern number = 1
   Tape mark = 1
   Interchange read = 0
   Single pass = 1
   Stalls
   Read = 1
   Write = 1
   Turnaround = 1

*Revision B or higher.

Before typing the last CR, set the console switches to 000720. Then type CR to run the test. The following errors are allowed:

0 hard errors (read and write)
4 soft write errors
2 soft read errors

DECsystem 20 Using 10-DFTUK*

1. Run NRZI test R8 for one pass. The following errors are allowed:

   0 hard errors (read and write)
   3 soft write errors
   1 soft read errors

2. Run PE test R1 for one pass. The following errors are allowed:

   0 hard errors (read and write)
   3 soft write error
   1 soft read error

3. Set left-hand switches to 400010. Run the NRZI IW test for one pass with the following parameters entered on the terminal.

   Density = 800
   Close skew window = CR
   Data compare mask = CR
   SYSERR recording = N
   Fast mode Y or N = Y
   Verify tapes = N

   The following errors are allowed:

   0 hard write errors
   1 soft write error

   Run the NRZI IR test for one pass. The following errors are allowed:

   0 read errors (hard or soft)

4. With the left-hand switches still set to 400010, run the PE IW test for one pass with the following parameters entered on the terminal:

   Density = CR or 1600
   Close skew window = CR
   Data compare mask = CR
   SYSERR recording = N
   Fast mode Y or N = Y
   Verify tapes = N

   The following errors are allowed:

   0 hard write errors
   1 soft write error

   Run the PE IR test for one pass. The following errors are allowed:

   0 read errors (hard or soft)

*Revision B or higher.

PDP-11/780 VAX System using ZZ-ESMAA

1. Run the data reliability test for one pass in NRZI mode. Supply the requested information. The following errors are allowed:

   0 hard errors (read and write)
   2 soft write errors
   2 soft read errors

2. Run the data reliability test for one pass in PE mode. Supply the requested information. The following errors are allowed:

   0 hard errors (read and write)
   4 soft write errors
   2 soft read errors

CHAPTER 3
OPERATION

3.1 CONTROLS AND INDICATORS

The TU77 operational controls and indicators are located on the transport control panel. The controls and indicators are illustrated in Figure 3-1 and listed in Tables 3-1 and 3-2.

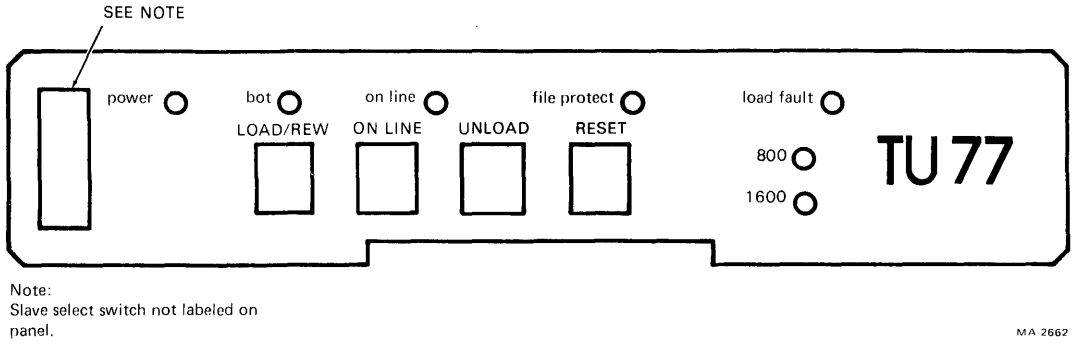


Figure 3-1 TU77 Control Panel

Table 3-1 TU77 Controls

Control	Function
Slave Select Switch (unlabeled)	Selects the address (slave number 0 to 3) of the tape transport.
LOAD/REW	Pressing and releasing the LOAD/REW button will initiate one of three sequences: 1. With no tape in path, a load sequence is initiated. 2. With tape in path but not tensioned, a mid-reel load sequence will be initiated. In a mid-reel load sequence the tape will load and run in the reverse direction to BOT. 3. With tape in path and tensioned, and the transport off-line, the tape rewinds to BOT. If the tape is already at BOT or if the transport is on-line, no action occurs.
ON LINE	Pressing and releasing the ON-LINE button will change the transport from off-line to on-line. Pressing and releasing the button again will change the transport from on-line to off-line.
UNLOAD	If the TU77 is off-line, pressing and releasing the UNLOAD button causes the tape to rewind and unload. If the tape is already at BOT, it will unload. If the TU77 is on-line, the UNLOAD button has no effect.
RESET	Pressing and releasing the RESET button terminates all functions and clears a load fault.

Table 3-2 TU77 Indicators

Indicator	Function
power	Indicates presence of dc and secondary ac power.
bot	Indicates tape is at BOT.
on line	Indicates the TU77 is on-line. The transport will revert to the off-line mode if any of the following occur. 1. ON LINE button is pressed. 2. An external rewind unload command is received. 3. Vacuum column interlock is broken. 4. AC power is lost. 5. RESET button is pressed.
file protect	Indicates that a reel of tape without a write-enable ring has been loaded onto the transport.
load fault	Lamp flashes when a load fault has occurred; i.e., 1. When the autoload sequence has failed to load a tape from a 267 mm (10-1/2 in) reel after two trys. 2. When a load sequence has failed to load tape from a 216 or 178 mm (8-1/2 or 7 in) reels.
800	Indicates the tape transport is set to read or write at 800 BPI (NRZI mode).
1600	Indicates the tape transport is set to read or write at 1600 BPI (PE mode).

3.2 OPERATING PROCEDURES

3.2.1 Power On-Off

Power is applied to the TU77 when the system CPU is turned on. The 861 power control is remotely enabled from the CPU and applies ac power from the power source to the TU77 cabinet.

3.2.2 Autoload/Manual Load Selection

Figure 3-2 illustrates various conditions and interlock settings that affect the selection of an autoload or manual load procedure.

When a 216 or 178 mm (8-1/2 or 7 in) reel is being loaded, the manual procedure must be used. If a 267 mm (10-1/2 in) reel is used, and the reel is in a cartridge, the cartridge will engage the cartridge interlock which bypasses the autoload interlock and causes the autoload procedure to be used.

A prerequisite for an autoload sequence is that a full reel of tape be used. The minimum quantity of tape to accomplish automatic loading is such that the outer turn of tape is between 1.59 and 0.64 cm (5/8 and 1/4 in) from the outer edge of the reel as shown in Figure 3-3. Large 267 mm (10-1/2 in) reels not containing sufficient tape to accomplish automatic loading must follow the manual load procedure.

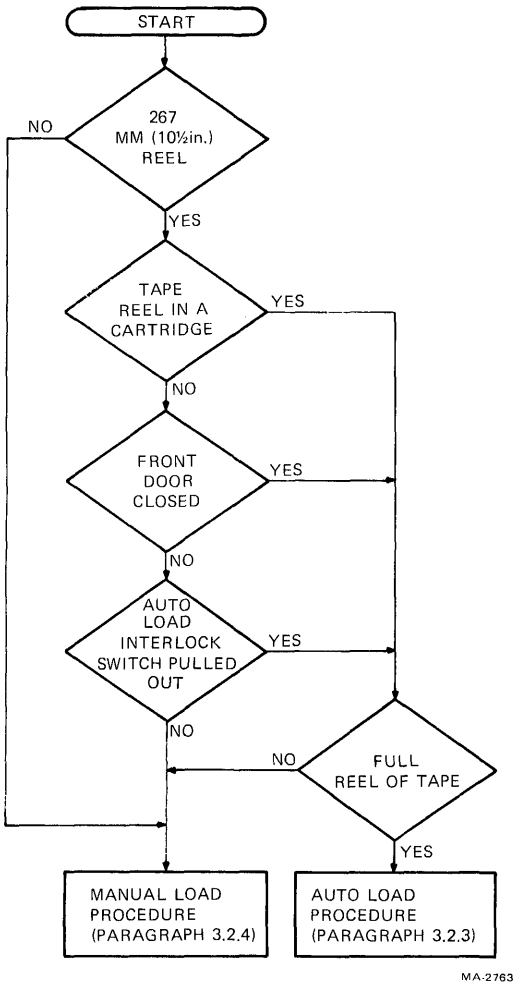


Figure 3-2 Autoload / Manual Load Selection

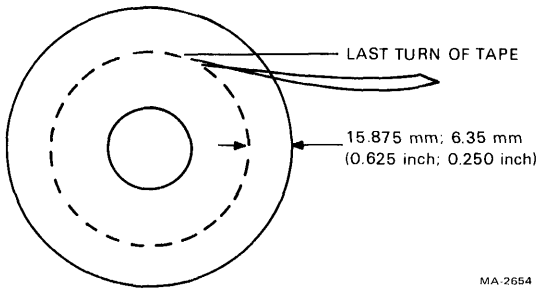


Figure 3-3 Tape Content Limit

When a tape cartridge is not used, the autoload procedure is followed if the transport front door is closed. When the front door is open, the autoload procedure will still be used if the autoload interlock is pulled out. Otherwise, the manual procedure must be followed.

3.2.3 Autoload

1. Check the tape path for cleanliness. (Refer to Paragraph 4.3.4 for cleaning procedure.)

2. Check that the tape reel is a large 267 mm (10-1/2 in) reel and that it has a full reel of tape.

3. Check that end of tape has a clean edge and is not bent, torn or frayed. If necessary, trim the end with the tape crimper (P.N. 47-00038).

NOTE

Do not crimp the tape unnecessarily. Each crimping shortens the tape leader and could eventually lead to failures in the autoload sequence.

4. Check that static charge is not causing end of tape to stick to reel. End of tape must be free of reel to accomplish autoload.

5. If a write operation is to be performed, install a write-enable ring onto the rear flange of the tape reel.

6. Place the supply reel in position on the upper hub, rotate until it slips easily into place, and press the reel-retaining actuator. The reel should be positioned in such a way that the tape will unwind if the reel is turned clockwise.

NOTE

The supply reel may be contained in an easy-load* wraparound cartridge. It is not necessary to remove or open the cartridge. The cartridge will be opened automatically during the autoload sequence.

*Registered trademark, IBM, Inc.

7. Carefully close the buffer door making sure the door is closed securely.

8. Close the transport front door.

NOTE

If a wraparound cartridge is not used, the transpart front door must be shut to close the autoload interlock and enable the autoload sequence. If it is desired to leave the door open, override the interlock by pulling the switch out.

9. Check that power is applied to the tape transport (power light on).

10. Follow the instructions and check for the events specified in Figure 3-4. If the tape fails to load properly, the figure contains some operator troubleshooting hints that can be tried before maintenance personnel are called. Refer to Figure 3-5 to identify tape path components.

3.2.4 Manual Load

1. Check the tape path for cleanliness. (Refer to Paragraph 4.3.4 for cleaning procedure.)

2. If a write operation is to be performed, install a write-enable ring onto the rear flange of the tape reel.

3. Place the supply reel in position on the upper hub, rotate until it slips easily into place, and press the reel-retaining actuator. The reel should be positioned in such a way that the tape will unwind if the reel is turned clockwise.

4. Manually place the tape leader between thread block no. 1 and air bearing no. 1 (Figure 3-5).

NOTE

Ensure that there is no tape slack or sag between the supply reel and thread block no. 1.

5. Carefully close the buffer door making sure the door is closed securely.

6. If a 216 or 178 mm (8-1/2 or 7 in) reel is being loaded, close the transport front door. If a 267 mm (10-1/2 in) reel is being loaded, leave the transport door open.†

7. Check that power is applied to the tape transport (power light is on).

8. Follow the instructions and check for the events specified in Figure 3-6. If the tape fails to load properly, the figure contains some operator troubleshooting hints that can be tried before maintenance personnel are called. Refer to Figure 3-5 to identify tape path components.

†This disables the autoload sequence that would normally occur with a 267 mm reel.

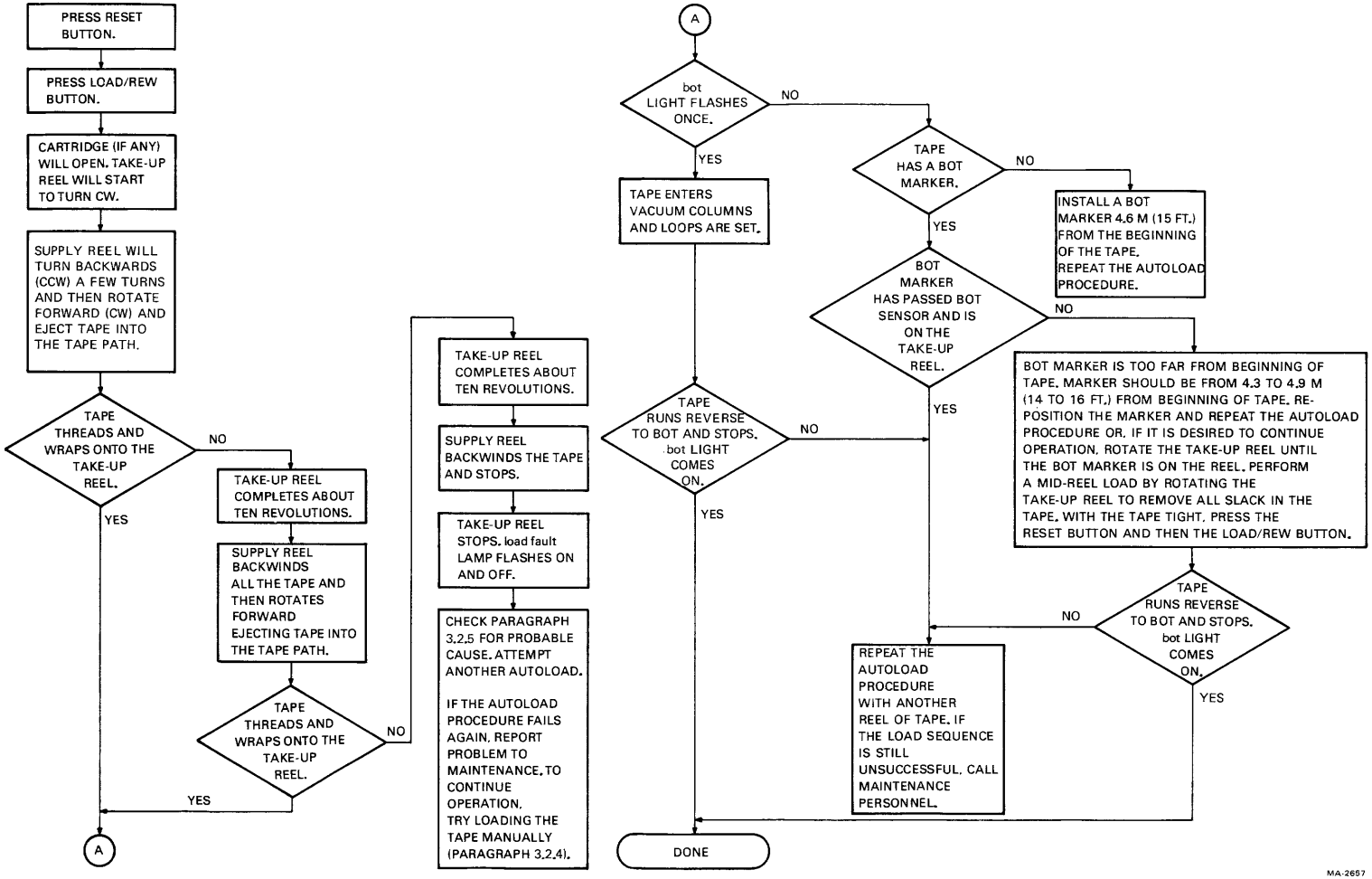


Figure 3-4 Autoload Sequence with Operator Troubleshooting

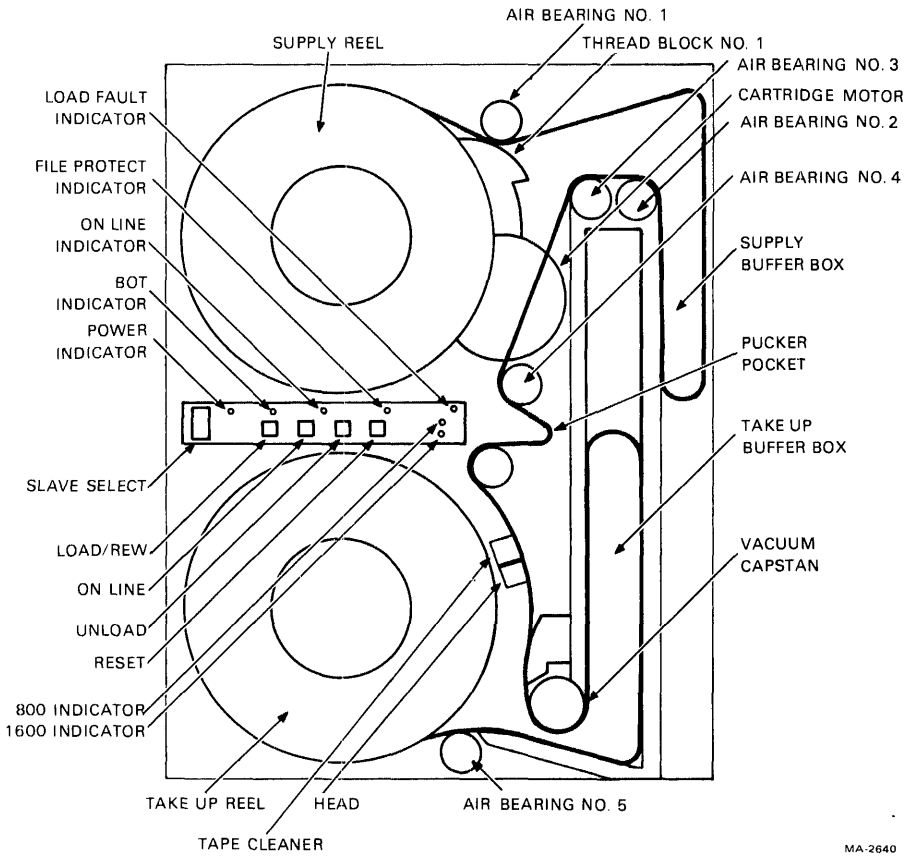


Figure 3-5 Tape Path and Controls

3.2.5 Probable Causes of Load Failure

1. Check that the buffer door is closed and sealed properly.

2. Check for ripped, creased, or damaged tape leader. This is especially critical if an autoload failure has occurred. If necessary crimp the end of the tape with a tape crimper.

3. Check that the write-enable ring is inserted in the tape reel if a write operation is to be performed. (File protect indicator should be out.)

4. Check that the transport front door is open and the autoload interlock switch is not pulled out if a manual load is being performed with a 267 mm (10-1/2 in) reel of tape.

5. If an autoload is being performed, check that:

   a. A large 267 mm (10-1/2 in) reel of tape is on the supply hub

   b. The supply reel has a wraparound cartridge. If not, check that the transport door is closed, or if the door is open, that the interlock switch is pulled out

   c. The supply reel has a full reel of tape. The tape must be between 0.64 and 1.59 cm (1/4 and 5/8 in) from the outer edge of the reel.

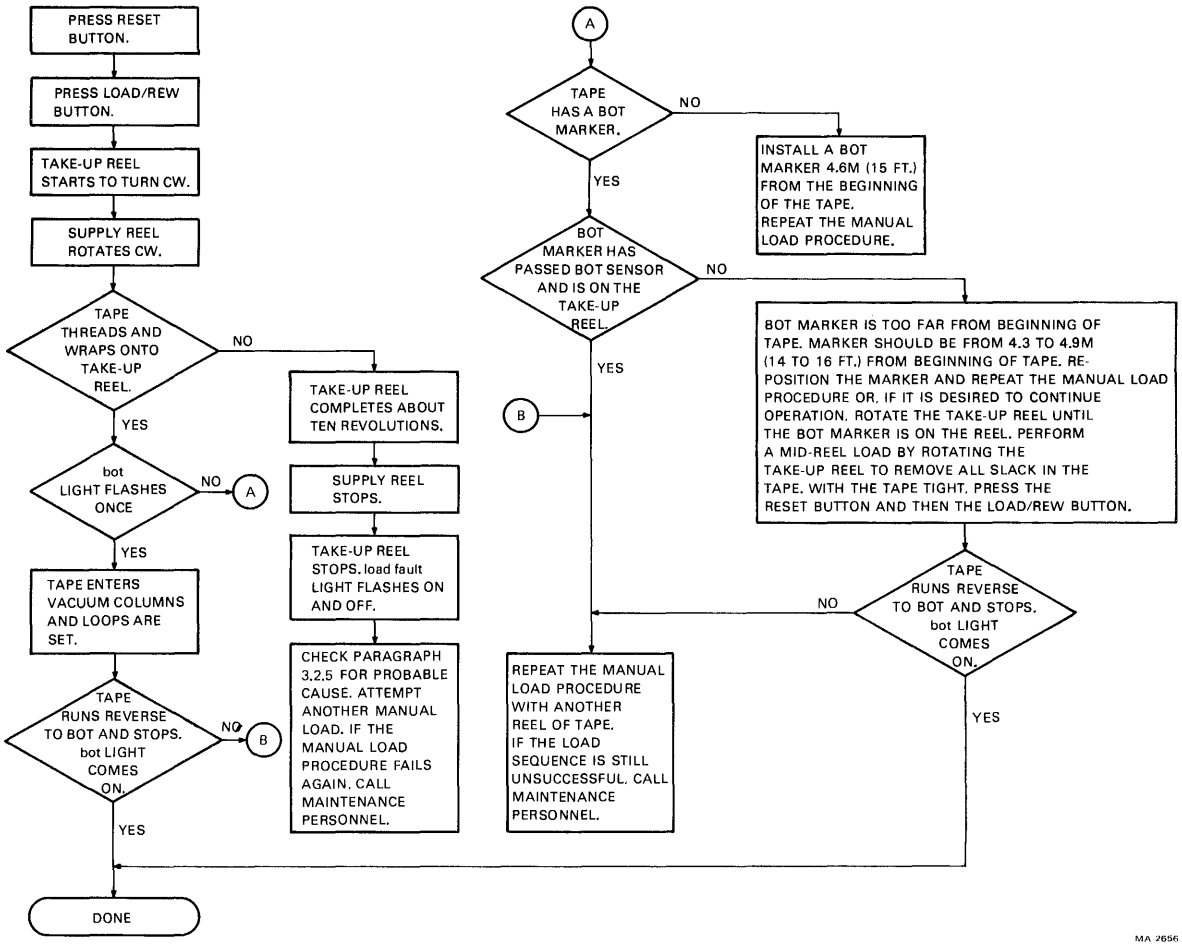


Figure 3-6 Manual Load Sequence with Operator Troubleshooting

3.2.6 Mid-Reel Load

A mid-reel load is usually required after a power failure or a lost interlock.

1. Rotate the take-up reel to remove all slack in the tape.

CAUTION

Do not attempt mid-reel load until all slack is manually removed from the tape between the reels.

2. Press the RESET button.

3. Press the LOAD/REW button.

The transport loads tape and starts a reverse operation to BOT. To stop the transport, press the RESET button. Any other command may now be given.

3.2.7 Unload

1. Press the RESET button to terminate any on-going operation and place the transport off-line.

2. Press the UNLOAD button. If the tape is at BOT, it will backwind onto the supply reel. If the tape is at mid-reel, it will rewind to BOT and then unload (backwind onto the supply reel).

3.2.8 Rewind

Pressing the LOAD/REW button, with tape tensioned and the transport off-line, the tape rewinds to BOT. When the button is pressed with the tape at BOT, no action occurs.

3.2.9 On-Line/Off-Line

Pressing the ON LINE button places the transport on-line and illuminates the on-line light. While on-line, the transport can accept external commands provided it is selected and ready. If the ON LINE button is pressed again, the transport will go off-line and the on-line light will go out. Also, the transport automatically reverts to the off-line mode if any of the following occur:

- An external rewind unload command is received
- Vacuum column interlock is broken
- AC power is lost
- RESET button is pressed.

CHAPTER 4
CUSTOMER CARE AND PREVENTIVE MAINTENANCE

4.1 CUSTOMER RESPONSIBILITIES

The customer is directly responsible for:

1. Obtaining operating supplies, including magnetic tape and cleaning supplies.
2. Supplying accessories, including cabinetry, tables, and chairs.
3. Maintaining the required logs and report files consistently and accurately.
4. Making the necessary documentation available in a location convenient to the system.
5. Keeping the exterior of the system and the surrounding area clean.
6. Ensuring that ac plugs are securely plugged in each time equipment is used.
7. Performing specific equipment care operations described in Paragraph 4.2 and 4.3 at the suggested frequencies or more often if usage and environment warrant.

4.2 CARE OF MAGNETIC TAPE

1. Do not expose magnetic tape to excessive heat or dust. Most tape read errors are caused by dust or dirt on the read head; it is imperative that the tape be kept clean.
2. Always store tape reels inside containers when not in use; keep the empty containers tightly closed to keep out dust and dirt.
3. Never touch the portion of tape between the BOT and EOT markers; oil from fingers attracts dust and dirt.
4. Never use a contaminated reel of tape; this will spread dirt to clean tape reels and could have an adverse affect on tape transport reliability.
5. Always handle tape reels by the hub hole; squeezing the reel flanges could lead to tape edge damage in winding or unwinding tapes.
6. Do not smoke near the tape transport or storage area; tobacco smoke and ash are especially damaging to tapes.
7. Do not place magnetic tape near any lineprinter or other device that produces paper dust.
8. Do not place magnetic tape on top of the tape transport, or in any other location where it might be affected by hot air.
9. Do not store magnetic tape in the vicinity of electric motors.

4.3 CUSTOMER PREVENTIVE MAINTENANCE OF TU77 TAPE TRANSPORT

4.3.1 General

Digital Equipment Corporation tape transports are highly reliable precision instruments that will provide years of trouble-free performance when properly maintained. A planned program of routine inspection and maintenance is essential for optimum performance and reliability. The following information will assist the customer in caring for his equipment and ensure the highest level of performance and reliability.

4.3.2 Preventive Maintenance

To ensure trouble-free operation, a preventive maintenance schedule should be kept. Preventive maintenance consists of cleaning only a few items, but the cleanliness of these items is very important to proper tape transport operation. The frequency of performance will vary somewhat with the environment and degree of use of the transport. Therefore, a rigid schedule applying to all machines is difficult to define. Daily cleaning is recommended for units in constant operation in ordinary environments. This schedule should be modified if experience shows other periods are more suitable. Paragraph 4.3.4 contains the cleaning instructions.

Before performing any cleaning operation, remove the file reel and store it properly. All items in the tape path should be cleaned on a daily basis. In cleaning, it is important to be thorough yet gentle and to avoid certain dangerous practices. It should be remembered that some tape cleaners are strong cleaning agents and should not come in contact with painted surfaces or plastic.

CAUTION

Do not use acetone or lacquer thinner, rubbing alcohol, or excessive cleaner. Be extremely careful not to allow the cleaner to penetrate ball bearings and motors.

4.3.3 Magnetic Tape Transport Cleaning Kit

A magnetic tape transport cleaning kit (TUC01) has been carefully configured to provide cleaning materials that will not harm tape equipment and will not leave any residue behind to interfere with data reliability. The hints contained in the following few paragraphs will ensure that the very best results possible will be obtained from the kit.

The Freon TF113™ cleaning fluid in this kit is one of the safest and best degreasing agents available. It will not adversely affect any part of DIGITAL's tape equipment. To ready the can of fluid for service, unscrew the top and punch a small hole in the metal seal covering the pour spout.

WARNING

TF113 is a non-restricted, non-hazardous substance. However, when using TF113, avoid excessive skin contact, do not allow TF113 to come in contact with the eyes, and do not swallow it. Use TF113 only in a well-ventilated area.

When cleaning tape equipment, never dip a contaminated cleaning swab or wipe into the can. To transfer fluid onto the swab, pour a little into the screw cap and dip the swab into the cap. Discard the remaining fluid when the cleaning operation is complete.

Always keep the can of fluid tightly closed when not in use because Freon TF113 evaporates rapidly when exposed to air.

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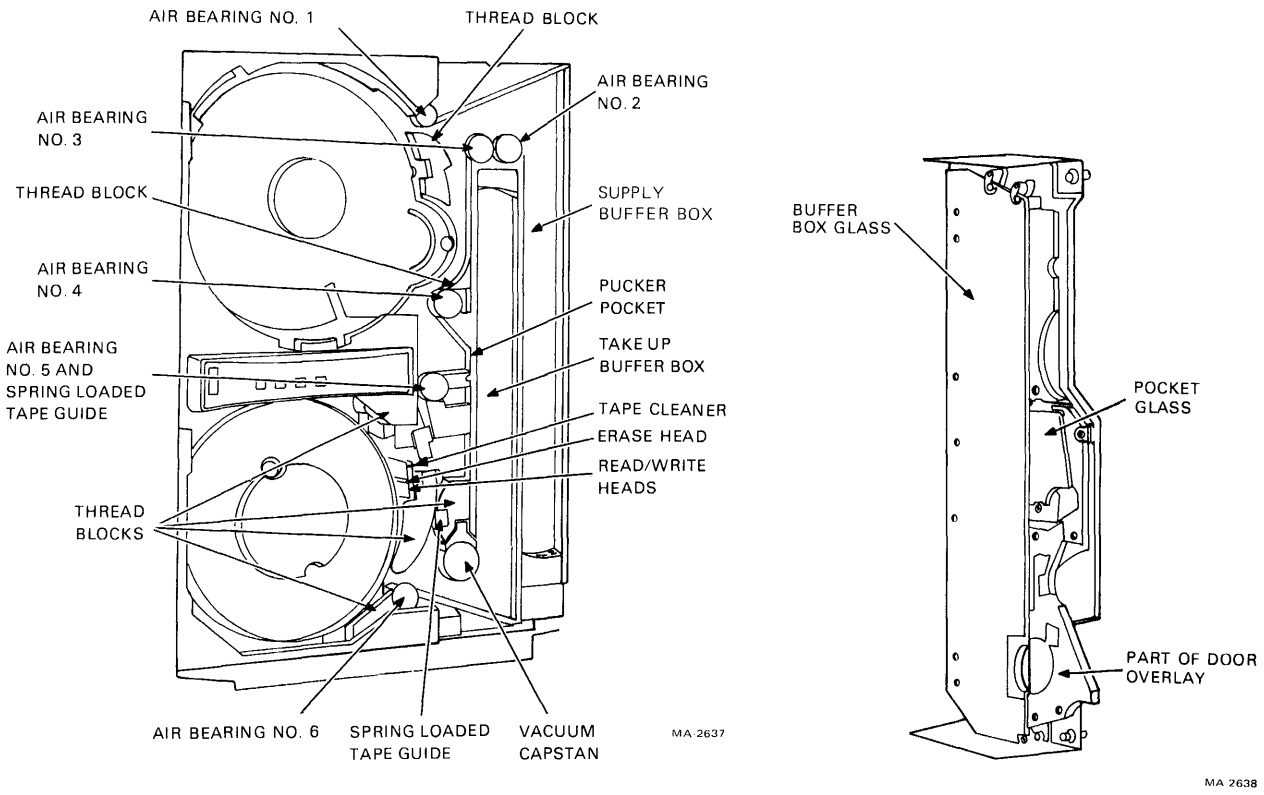

a. Tape Path Items

b. Buffer Box Door

Figure 4-1 Transport Items for Daily Cleaning

Use the cleaning materials contained in the kit to clean tape heads, air bearings, tape guide blocks, the tape cleaner, capstan, reel hubs and any part of the transport where a dirty residue could ultimately come in contact with tape. To clean other parts of the transport, such as the exterior surfaces of doors, use any reasonably clean, lint-free material with or without cleaning fluid.

NOTE

For an unusually stubborn dirt deposit that appears to resist TF113, try a mild soap and water solution to dislodge it. After using soap, be sure to wash down the affected area thoroughly with TF113 to remove soapy residues.

4.3.4 Cleaning the TU77 Tape Transport

1. Dismount the tape from the unit.

2. Clean the following components of the transport using a foam-tipped swab soaked in cleaning fluid (Figure 4-1).

   Read/write head
   Erase head
   Tape cleaner
   Air bearings (6)
   Spring-loaded ceramic tape guides (2)
   Thread blocks (6)
   Capstan
   Buffer boxes (2)
   Pucker pocket
   Buffer box glass, pocket glass, door overlay.

NOTE

Perform all cleaning using foam-tipped swabs. Do not touch any part of the tape path as oil from fingers attracts dust and dirt. Also excessive physical pressure on the capstan could affect capstan alignment.

3. When cleaning the thread blocks, be sure to clean the air guide ports. Every thread block has air guide ports except the metal block containing the spring-loaded tape guide.

4. When cleaning the spring-loaded ceramic guides, be sure that the washer is pressed firmly against the tape guide surface and not "hung up" on its shaft.

5. When cleaning the inner surface of the vacuum door, use a lint-free wipe and cleaning fluid. Pass another lint-free wipe over the head using a polishing action to remove any remaining deposits.

APPENDIX A
GLOSSARY

BOT	Beginning of Tape
BPI	Bits per Inch
CPU	Central Processor Unit
CRC	Cyclic Redundancy Check
DIP	Dual In-Line Package
EOT	End of Tape
IPS	Inches per Second
IRWU	Interface Rewind Unload
LRC	Longitudinal Redundancy Check
MTA	Magnetic Tape Adapter
NRZI	Non Return to Zero Inverted
PCB	Printed Circuit Board
PE	Phase Encoded
REW	Rewind
SB	Slave Bus
TIP	Tape in Path
WLO	Write Lockout

TU77 MAGNETIC TAPE TRANSPORT
USER'S GUIDE
EK-TU77-UG-001

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