EK-TUA81-UG-002

TU81/TA81 Tape Subsystem

User's Guide

digital™

EK-TUA81-UG-CN1

TECHNICAL DOCUMENTATION CHANGE NOTICE

TU81/TA81 TAPE SUBSYSTEM
USER'S GUIDE
ADDENDUM
EK-TUA81-UG-002

digital equipment corporation • maynard, massachusetts

Refer to the following instructions for incorporating new and revised information into the TU81/TA81 Tape Subsystem User's Guide.

Page 5-21 M8739 Module Address Selection

Insert the following paragraphs at the end of the SYSGEN procedure.

Installing Additional UNIBUS Adapters (M8739)

The M8739 module is factory configured to 772150(8). This address is for a primary MSCP tape/disk used on a system.

For the first TU81 in a system, the M8739 module must be set to address 774500(8), as shown in Figure 5-16. To install additional M8739 modules, you must select an address for each module from the floating device address range. This range includes addresses from 760010(8) through 763776(8).

The module's vector is set by software.

To configure a module for installation in a VAX system, use the SYSGEN procedure on page 5-21 to determine the module's address.

To configure a module for installation in a PDP-11 system, follow these guidelines to determine the module's address.

Choosing an address from the floating address range is a process of finding a value called "nnn," and adding that value to a base address of 760000. Since the smallest nnn value that can be used is 010, the range of addresses begins at 760010.

To determine an nnn value, and then produce an address from the floating address range (760010 through 763776), list all modules to be installed in the system that need floating addresses.

Look for these modules on the following ranking chart. The size column lists a number of words (in decimal), and the modulus column lists a number of bytes (in octal). Also, the modulus column must be used as a number that the nnn value of the address is divisible by -- that is, nnn can be divided by the modulus value and the result is a whole number. The examples following the table show how the modulus is used.

Rank	Device	Size	Octal Modulus
1	DJ11	4	10
2	DH11	8	20
3	DQ11	4	10
4	DU11,DUV11	4	10
5	DUP11	4	10
6	LK11A	4	10
7	DMC11/DMR11	4	10
8	DZ11/DZV11, DZS11, DZ32	4	10
9	KMC11	4	10
10	LPP11	4	10
11	VMV21	4	10
12	VMV31	8	20
13	DWR70	4	10
14	RL11, RLV11	4	10
15	LPA11-K	8	20
16	KW11-C	4	10
17	Reserved	4	10
18	RX11/RX211, RXV11/RXV21	4	10
19	DR11-W	4	10
20	DR11-B	4	10
21	DMP11	4	10
22	DPV11	4	10
23	ISB11	4	10
24	DMV11	8	20
25	DEUNA	4	10
26	UDA50, RQDX1, RUC25, RUX50	2	4
27	DMF32	16	40
28	KMS11	6	20
29	VS100	8	20
30	TU81	2	4
31	KMV11	8	20
32	DHV11, DHU11	8	20
33	DMZ32, CPI (asynch)	16	40
34	CPI32 (synch)	16	40

For example, the first floating CSR address is 760010 and the first device in the chart is the DJ11. If you have a DJ11, its CSR address is 760010. If you don't have a DJ11, address 760010 must be left blank, that is, cannot be assigned to any device.

If you have a DJ11, assign it the address of 760010. The size column in the chart indicates that the module's size is 4 words (8 bytes). This requires addresses 760010 through 760016. The next available address is then 760020.

If you have a second DJ11, assign it address 760020. There are two reasons for this assignment.

1. Since the first DJ11 is assigned address 760010 and its size requires 4 words, it uses addresses 760010 through 760016 (4 word locations). That makes the next available address 760020.

2. The DJ11, according to the chart, has a modulus of 10. The rule states that the nnn value of the address to be used must be divisible by the modulus. For address 760020, the nnn value is 020 -- this number is divisible by 10 and results in a whole number (2).

If you don't have a second DJ11, address 760020 can not be assigned to any device. This address must be left vacant to let the system know that there is not a second DJ11 occupying a location in the floating address range. Since 760020 must be left vacant, 760022 is the next available address in the floating address range. The vacancy of 760020 indicates that there are no more DJ11s.

Note that the next available address (760022) has nothing to do with how many addresses a second DJ11 require IF one is present. Only one address needs to be left vacant to indicate that there is no second DJ11 installed. As already stated, the vacant address must be 760020.

NOTE

This is the key to assigning addresses from the floating range. Just as a response from an address identifies to the system what kind of device is present, a vacant address identifies what kind of device is not present. "Gaps" (unused addresses) must be left to tell the system which devices are NOT present.

The next device on the list is the DH11, which is listed with a modulus of 20. The next available address (that we left off with earlier in our example) is 760022. The nnn field of 022 cannot be used for the DH11, since 22 cannot be divided by 20. In fact, the next nnn field that can be used is 040. So, to install a DH11 into this system, its address would be set to 760040. Since the size listed for the DH11 is 8 (words), the DH11 uses addresses 760040 through 760056, making the next available address 760060.

If you do not install a DH11 into this system, address 760040 has to stay vacant. This makes 760042 the next available address.

Another example - one that applies to the TU81.

Suppose you have three options that require floating addresses: one DZ11 and two TU81 subsystems.

Determine the list of addresses that would be vacant, and the addresses these modules would use. See if your answer agrees with the following list (vacant addresses are listed with the corresponding "missing module" that they represent).

760010 Vacant (DJ11)
760020 Vacant (DH11)*
760030 Vacant (DQ11)
760040 Vacant (DU11,DUV11)
760050 Vacant (DUP11)
760060 Vacant (LK11A)
760070 Vacant (DMC11/DMR11)
760100 Setting for the DZ11 module
760110 Vacant (no additional DZ11)
760120 Vacant (KMC11)
760130 Vacant (LPP11)
760140 Vacant (VMV21)
760160 Vacant (VMV31)*
760170 Vacant (DWR70)
760200 Vacant (RL11)
760220 Vacant (LPA11-K)*
760230 Vacant (KW11-C)
760240 Vacant (Reserved)
760250 Vacant (RX11)
760260 Vacant (DR11-W)
760270 Vacant (DR11-B)
760300 Vacant (DMP11)
760310 Vacant (DPV11)
760320 Vacant (ISB11)
760340 Vacant (DMV11)*
760350 Vacant (DEUNA)
760354 Vacant (UDA50)*
760400 Vacant (DMF32)*
760420 Vacant (KMS11)*
760440 Vacant (VS100)*
760444 Setting for a TU81 subsystem*
760450 Setting for another TU81 subsystem*

---

* Indicates addresses for devices where the modulus is NOT 10. Don't forget that the nnn value of the address that you select must be divisible by that device's modulus to produce a whole number.

Since these addresses include all the devices to be added for our example, all remaining addresses in the floating range are vacant.

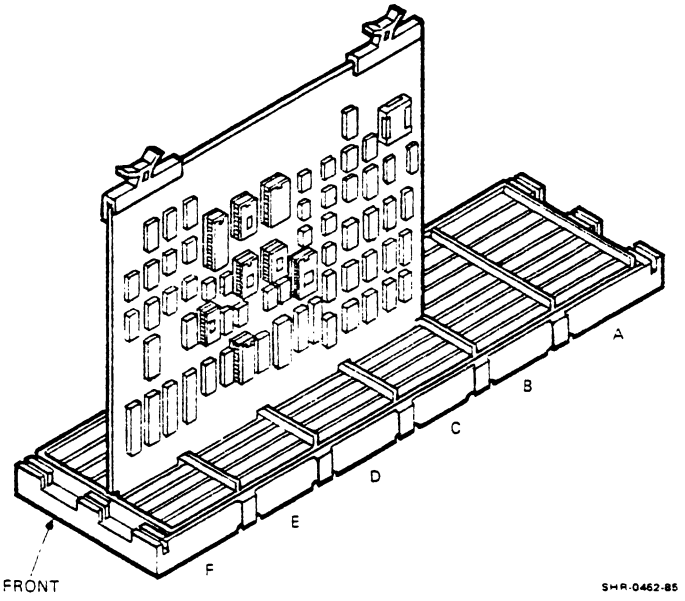
Page 5-23 M8739 Module Installation

Replace step 9 with the following.

9. Carefully insert the M8739 module into the SPC slot, as shown in the SPC Module Installation figure.

WARNING

Make sure that the module is installed in backplane connector rows C, D, E, and F. Installing the module in any other connector rows will damage the module.



SPC Module Installation

Delete the note under PDP-11-Based Diagnostics and insert the following paragraphs.

PDP-11 XXDP+ Diagnostics -- CZTU2, CZTU1

CZTU2 is the TU81 Front End Functional Diagnostic. This diagnostic is the first host level diagnostic run, since it tests the basic functionality of the TU81 subsystem.

CZTU2 tests up to four TU81 subsystems. To run a full pass of the program, a scratch tape must be mounted on the transport and an operator must be present to perform manual intervention.

The first pass of the program is a quick verify. For a single unit under test, the first pass takes about 20 minutes. All following passes run multiple iterations of each test listed. These passes each take about 24 minutes for a single unit under test.

CZTU2

Test 001: Existence Verification
Test 002: Initialization
Test 003: Initialization
Test 004: SA Register Wrap
Test 005: Vector and BR Level
Test 006: Purge and Poll
Test 007: Small Ring
Test 008: Maximum Ring Buffer
Test 009: Get DUST Status
Test 010: Functional Fault Detection (Internal Drive Test 1)
Test 011: Tension Fault Isolation (Internal Drive Test 2)
Test 012: Velocity Fault Isolation (Internal Drive Test 3)
Test 013: Select A Drive Resident (Internal Drive Tests 1 -- 99)

CZTU1 is the TU81 Data Reliability Test. This diagnostic tests the performance quality of the TU81 subsystem.

CZTU1 tests up to four TU81 subsystems. A scratch tape must be mounted on the transport to run this test. Each pass takes about 1 hour and 10 minutes for each unit under test.

CZTU1

Test 001: Basic Function
Test 002: Quick Verify Read/Write
Test 003: Complex Read/Write
Test 004: Write Interchange Tape
Test 005: Read Unknown Tape
Test 006: Start/Stop Write/Read
Test 007: Conversation

CXTUCA -- TU81 DEC/X11 Module

This module streams the drive in both read and write modes. Each pass begins where the previous pass left off. In effect, the entire reel of tape is written and read.

CXTUCA tests a single TU81 subsystem.

CONTENTS

CHAPTER 2 OPERATING INSTRUCTIONS

CHAPTER 3 CUSTOMER DIAGNOSTICS

CHAPTER 4 CARE AND PREVENTIVE MAINTENANCE

CHAPTER 5 INSTALLATION

APPENDIX A TUR8X ADD-ON INSTALLATION

FIGURES

TABLES

INTRODUCTION

The TU81/TA81 Tape Subsystem User's Guide provides information on installing, testing, maintaining, and operating the TU81 and TA81 magnetic tape subsystems.

The guide is divided into five chapters.

Chapter 1 gives a general description of the subsystems. It provides a functional and physical description of the transport, an overview of the system and interface, and a list of basic specifications.

Chapter 2 describes all operator controls and indicators. It gives instructions for routine, fault-free transport operation. It also provides fault codes and corrective action you can take in case of transport failure.

Chapter 3 provides troubleshooting information and customer diagnostics (tests, fault codes, and corrective actions).

Chapter 4 provides complete care and preventive maintenance (PM) information, customer responsibilities, magnetic tape care, customer PM procedures, and accessories and supplies. Also listed are Digital Repair Service programs and telephone numbers.

Chapter 5 provides complete unpacking and installation information, including power and signal cabling and acceptance test procedures.

Appendix A describes the procedure for installing an optional disk drive into the TU81/TA81 Tape Subsystem cabinet.

CHAPTER 1
SUBSYSTEM DESCRIPTION

GENERAL

The TU81 and TA81 are low-cost, data storage systems. These systems are dual-speed, 9-track, magnetic tape subsystems. They feature microprocessor-controlled electronic control systems and tape streaming techniques for high data transfer rates, data reliability, and maintainability.

The TU81 and TA81 subsystems are similar in design, operation, and function. Their main difference is in the data communication interface, that is, the way the tape transport connects to and communicates with the host computer.

Both tape subsystems have the same standalone tape transport, but have different I/O controller modules, interface buses, and external system interface modules. Briefly, these tape subsystems can be described as follows.

- The TU81 consists of the tape transport and the UNIBUS interface. The TU81 connects directly to the host computer through the low-end storage interconnect (LESI) bus and UNIBUS adapter. It uses tape mass storage control protocol (TMSCP) to communicate with Digital Equipment Corporation's various computers.

- The TA81 consists of the tape transport and the standard tape interface (STI) interconnect bus. The TA81 is used with and controlled by a HSC mass storage I/O controller. The HSC enables multiple processors to access a common pool of disks and tapes. The TA81 has a dual communication port that allows at least two HSC controllers to share the transport through static dual porting.

LEGAL NOTICE

TMSCP and STI protocols and documentation are the proprietary information of Digital Equipment Corporation. UNIBUS/Q-BUS/BI-BUS port drivers and documentation for MSCP/TMSCP products are also proprietary information of Digital Equipment Corporation.

RELATED DOCUMENTS

The documents in Table 1-1 apply to the TU81 and TA81. They are available through Digital's local sales and service office or the Accessories and Supplies Group. Refer to the ordering information in Chapter 4 for details.

Also, use the manuals and handbooks of the appropriate PDP-11 and VAX computer systems and processors, the HSC50, and the RA60, RA80, and RA81 disk drives.

Table 1-1 Related Documents

Title	Number	Description
TU81/TA81 Tape Subsystem User Guide	EK-TUA81-UG	Contains the functional and system overview with installation, operation, and user maintenance information.
TU81/TA81 Tape Subsystem Technical Manual	EK-TUA81-TM	Contains the system functional description, interface and communication protocol overview, theory of operation, installation and acceptance test procedures, test and maintenance information, including ASCII test terminal and port description and use.
TU81/TA81 Pathfinder	EK-TUA81-SV	Provides test documentation (troubleshooting procedures, diagnostic tests, fault and subfault codes) for use by trained service personnel.
TU81/TA81 Illustrated Parts Breakdown	EK-TUA81-IP	Provides a list and illustrations of TU81/TA81 assemblies and replaceable parts.
TU81 Magnetic Tape Subsystem Pocket Service Guide	EK-ØTU81-PS	Provides a quick reference to installation, maintenance, and repair procedures for trained service personnel.
TA81 Magnetic Tape Subsystem Maintenance Guide	AA-Z786A-TC	As a part of the HSC5Ø Service Manual, gives a quick reference to installation, maintenance, and repair procedures for trained service personnel.
874 Power Controller IPB	EK-ØØ874-IP	Provides an illustrated parts breakdown of the 874 power controller.

UNIT VARIATIONS

The TU81 and TA81 subsystems are available in the following models.

TU81-CA (120 V, 60 Hz)	TA81-CA (120 V, 60 Hz)
TU81-CB (240 V, 50 Hz)	TA81-CB (240 V, 50 Hz)

TAPE TRANSPORT

The tape transport for the TU81 and TA81 is horizontally mounted. It is a fully integrated tape storage system. The transport is packaged with its formatter, interface controller, and 874 power controller in the standard cabinet, a 40-inch high H9643. The transport writes and reads data in two formats. One format uses phase-encoded (PE), 9-track, 1600 bits/inch data recording, which is compatible with standards of the American National Standards Institute (ANSI). The other uses group-coded recording (GCR) and 9-track, 6250 bits/inch data recording. GCR is a coding method that uses nonreturn-to-zero, inverted (NRZI) recording, but provides a much higher recording density and transfer rate. The transport operates in either the conventional start/stop or streaming modes. The mode is automatically selected by the transport's adaptive speed control system.

The transport has three speed modes.

Low speed, start/stop	63.5 cm/s (25 in/s)
Low speed, streaming	63.5 cm/s (25 in/s)
High speed, streaming	190.5 cm/s (75 in/s)

Instantaneous data transfer rates are from 40 Kbytes/s to 469 Kbytes/s depending on the speed mode and density.

> **NOTE**
>
> The TU81 or TA81 cabinet can hold an optional disk drive under the tape transport at the bottom of the cabinet. Refer to Appendix A for disk drive installation information.

The transport does not have a capstan, tension arms, or vacuum columns in its tape drive mechanism. Instead, it uses a microprocessor-controlled servo that directly controls the reel motors to maintain constant tape speed and tension.

Basic Features

The transport has the following basic features.

- Tape path is short.
- Tape path has no capstan and no moving parts.
- Tape contacts only the tape cleaner and magnetic head.
- Transport has air bearings and a solid-state, tape tension sensor.
- Microprocessors control all major operating functions.
- Built-in, power-on diagnostics are automatically initiated at power-on.
- Resident diagnostics can be manually initiated from the front panel.
- Transport has resident adaptive speed control.
- Transport has no mechanical adjustments.
- Transport requires no scheduled preventive maintenance.
- Transport has a long-life, magnetic head.
- Transport has "on-the-fly," 1-track (PE mode) or 2-track (GCR mode) error correction.

Special Features

The transport features an ASCII* diagnostic port. This port allows qualified Field Service personnel to conduct complex TU81/TA81 troubleshooting and testing with any RS232C-compatible terminal. A special, hand-held terminal is available for this purpose.

The TA81 has two, special switches/indicators on the control panel: PORT A and PORT B (one for each interface channel). They control the TA81-to-HSC data interchange.

Figure 1-1 shows the TU81 and TA81 subsystems.

* American Standard Code for Information Interchange.

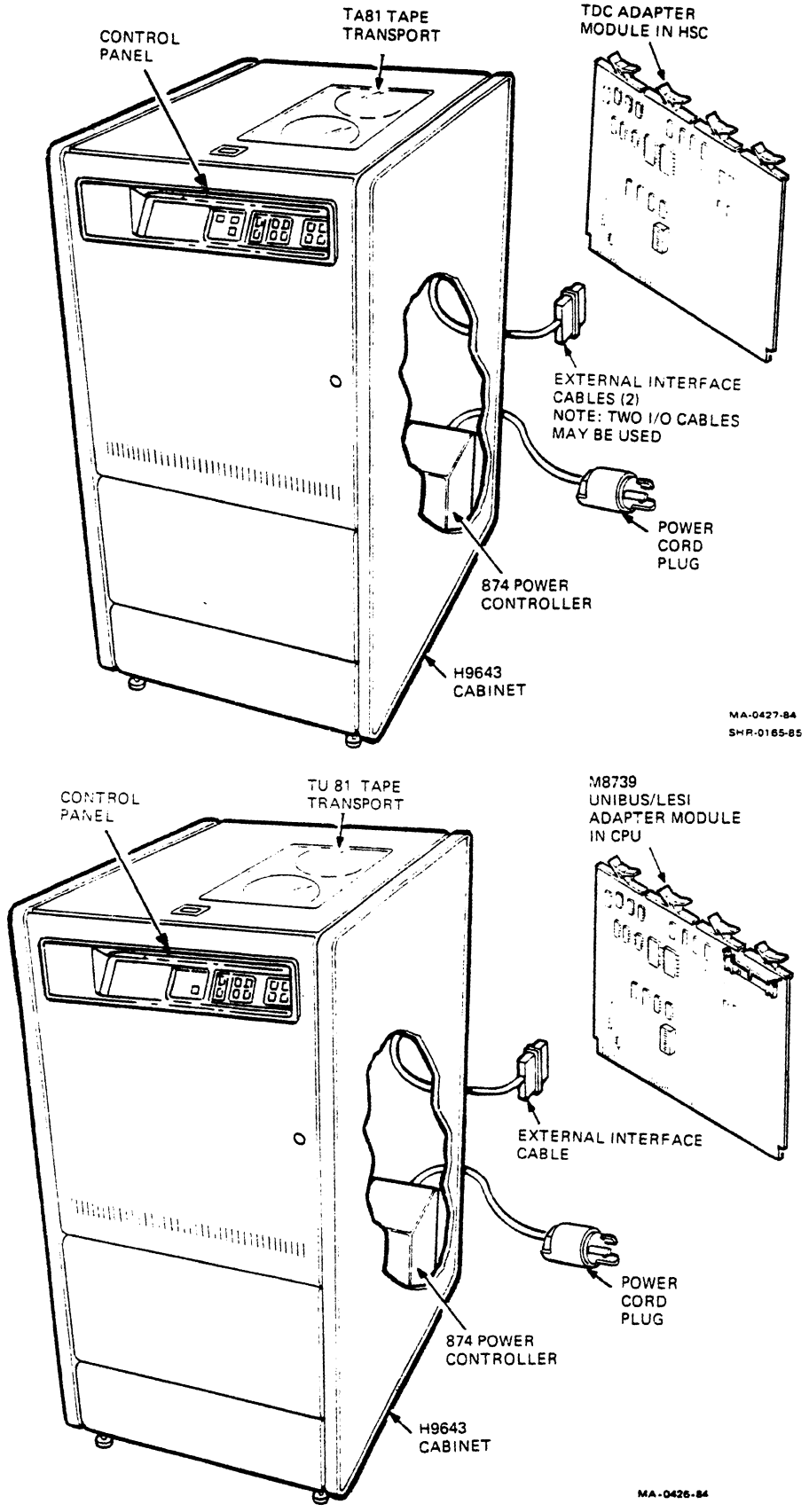


Figure 1-1 TU81 and TA81 Tape Subsystems

TAPE MEDIA REQUIREMENTS

All of Digital's tape transport products are designed and manufactured for high performance and reliability. The considerations given to produce such products must include the tape media used on them.

The TU81 and TA81 are designed to meet the format and recording requirements for 1/2-inch wide, 9-track, magnetic tape as set in ANSI standard X3.54-1976. This design requires that the magnetic tapes used on this tape transport strictly adhere to ANSI standard X3.40-1981. This standard defines the minimum physical and magnetic requirements for 1/2-inch wide magnetic tape. In addition to meeting ANSI requirements, all tapes recommended by Digital must conform to Digital's own magnetic tape specifications. This specification is used to evaluate and qualify magnetic tapes for Digital's use and sale to its customers.

Digital is constantly evaluating tape media in an ongoing effort to ensure a high-quality product. To date, no backcoated magnetic tapes meet Digital's specification. Backcoating can cause tape slippage, load failures, and false end-of-tape (EOT) and beginning-of-tape (BOT) sensing. It also requires frequent transport cleaning because it leaves a residue on the transport. As a result of these problems, backcoated magnetic tapes are not recommended for use on the TU81 and TA81 tape transport.

For the best performance and maximum reliability of the TU81 and TA81 tape transport, use only those magnetic tapes that meet ANSI requirements and Digital's specification.

NOTE

To get ANSI standards, call (212) 354-3300 or write to the following address.

American National Standards Institute
1430 Broadway Street New York, New York
10018

SUBSYSTEM OVERVIEW AND SPECIFICATIONS

Figure 1-2 shows general block diagrams of the TU81 and TA81 subsystems. A TU81 subsystem consists of one tape transport, one resident interface controller module, one interface adapter module, and an interface cabling set. A TA81 subsystem includes the tape transport and interface cabling.

The following list gives the basic operating specifications for the TU81 and TA81 subsystems.

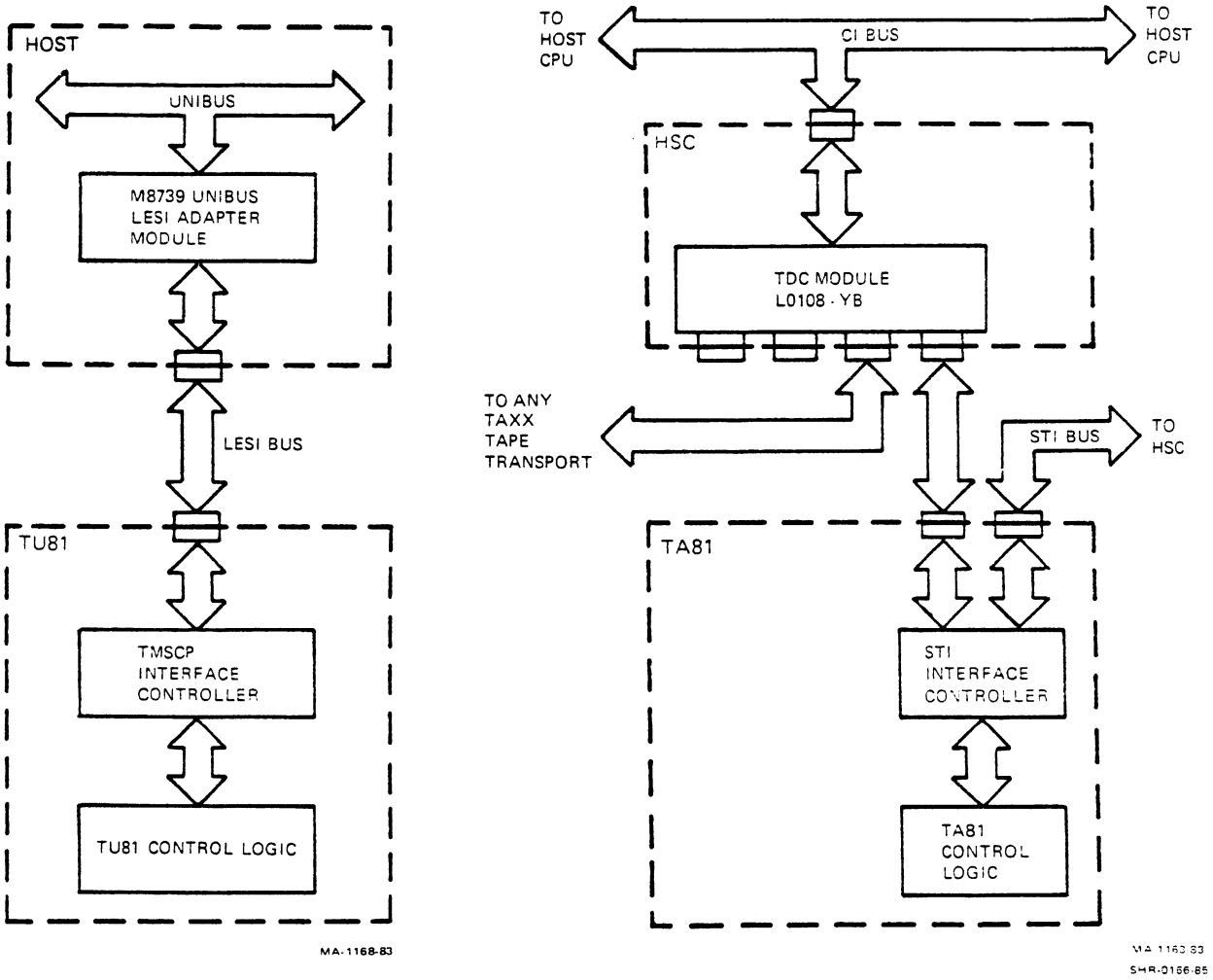


Figure 1-2 TU81 and TA81 Subsystem Block Diagrams

Functional Characteristics

Tape speed (nominal)	
Low speed, start/stop mode	25 in/s
Low speed, streaming mode	25 in/s
High speed, streaming mode	75 in/s
Data format/recording	
PE mode	9-track, phase-encoded recording, 1600 bits/inch
GCR mode	9-track, group-coded recording, 6250 bits/inch
Tape capacity (typical)	
PE mode	40 Mbytes
GCR mode	140 Mbytes
Data transfer rate	
PE low speed mode	40 Kbytes/s
PE high speed mode	120 Kbytes/s
GCR low speed mode	156 Kbytes/s
GCR high speed mode	469 Kbytes/s
Rewind time (nominal)	2.5 minutes
Rewind speed (nominal)	192 in/s
Load/unload time (maximum)	15 seconds

Physical Characteristics

Electronics	Solid-state
Tape width	12.65 mm (0.5 in)
Tape thickness	38.1 micron (1.5 mil)
Tape tension	2.23 N (8 oz and 5 oz)
Reel diameter	26.7 cm* (10.5 in)
Reel capacity	732 m* (2400 ft)
Transport dimensions	105.7 cm (H) X 54.6 cm (W) X 76.2 cm (D) or 41.6 in (H) X 21.5 in (W) X 30 in (D)
Transport weight (in cabinet)	139 kg (295 lbs)

* Smaller tape reels are also allowed.

Operational Characteristics

Power requirements

Voltage	93 to 128 Vac, 120 Vac nominal, 60 Hz, single phase 187 to 256 Vac, 220 or 240 Vac nominal, 50 Hz, single phase
Current	Average input current 3.0 A rms at 75 in/s
Power consumption	300 VA, standby and loaded 550 VA, start/stop (maximum)
Power controller	Model 874F, 50 Hz, 240 V, 12 A Model 874D, 60 Hz, 120 V, 24 A
Power cord (for 120 V, 60 Hz)	3-wire, number 12 AWG, 14-ft long; plug NEMA L5-30P, Hubbel 2611
Operating temperature†	10°C (50°F) to 40°C (104°F)‡
Storage temperature	-10°C (14°F) to 50°C (122°F)
Relative humidity	20% to 80% (10% to 90% in storage)
Altitude	Up to 3048 m (10,000 ft) or 688 millibar (9.98 psi)
Heat dissipation (average)	1100 Btu/Hr
Acoustical noise	51 dB for open office environment

† Restricted by the operating temperature of the media.
‡ Operating temperature is further limited by the temperature limitations of the media (refer to Chapter 4 for media limitations).

M8739 UNIBUS Adapter

Module type	Quad-height PC card
Power	+5 V at 4 A maximum

Data Reliability

Recoverable write error	1 in 10^8 bits (PE) 1 in 10^8 bits (GCR)
Recoverable read-forward error	1 in 10^9 bits (PE and GCR)
Unrecoverable read error	1 in 10^{10} bits (PE) 1 in 10^{11} bits (GCR)
Unrecoverable write error	Not allowed

PERFORMANCE EVALUATION

The TU81 and TA81 tape transports use PE and GCR recording and streaming techniques for an inexpensive way to back up high-speed transfer, high-capacity disk storage. The GCR recording method with 6520 bits/in data density gives fast serial access to large amounts of data.

GCR recording has several advantages over other techniques such as NRZI or PE.

- Faster data transfer rates
- More data storage per tape reel
- "On-the-fly" error correction per data block (record)

Tape Formats

Three major recording formats are used with 1/2-inch, 9-track, magnetic tape. They are NRZI, PE, and GCR. Figure 1-3 shows the relationship between these formats.

In NRZI mode, a 1 is represented by a flux change. This flux change can be either positive or negative. The maximum number of flux changes that can be on tape is 800 flux changes per inch. In Figure 1-3, NRZI format shows the data string 101010000111. The NRZI format is normally written at either 200, 556, or 800 bits/inch, which is relatively low density for high-capacity disk backup.

In PE mode, a 1 is written on tape by generating a negative transition in the center of a bit cell. A 0 is written by generating a positive transition in the center of a bit cell. In PE mode, the tape is written at 1600 to 3200 flux changes per inch. Any time sequential 1s are recorded (11111), there are 3200 flux changes per inch. The same is true for a record of sequential 0s (00000). If the data pattern written is alternate 1s and 0s (101010), the tape is written at 1600 bits/inch.

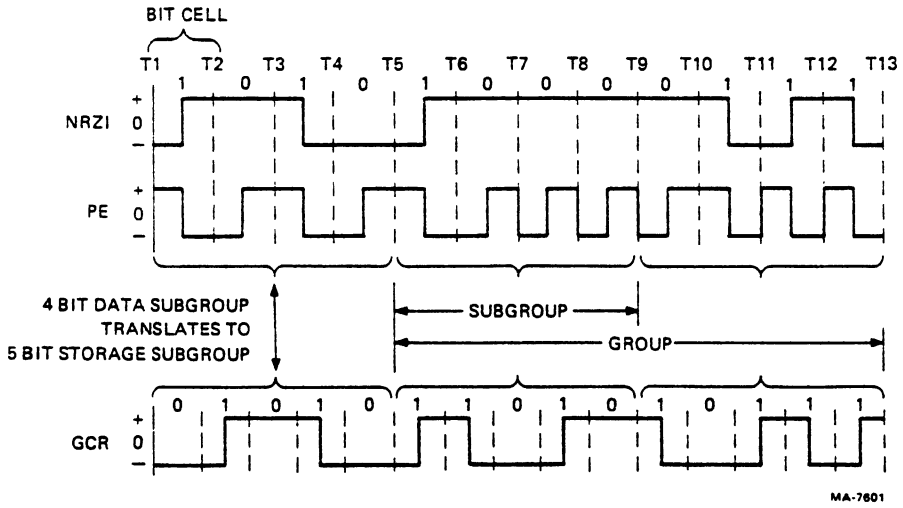


Figure 1-3 Tape Recording Formats

GCR mode is a version of NRZI recording that increases the effective transfer rate up to 6250 bits/inch. This is accomplished by writing at 9042 flux changes per inch with special four-to-five translation and addition of characters to a GCR record. The transport's hardware automatically makes this translation when operating in GCR mode.

In GCR mode, no more than two 0s can be recorded in succession, on a given track. This is done by translating 4-bit data groups into 5-bit storage groups. Refer to Figure 1-3 and note how data 1010 is transferred to 01010. Every time a 1 is represented, a flux change occurs in the center of bit cell. When a 0 is written, no flux change occurs.

Figure 1-4 shows how data is written on tape in GCR mode. Every 4 bits on all nine tracks are grouped together, forming a data subgroup. Two data subgroups make a data group. After every 4 bits on each nine tracks are translated into 5 bits, they can be grouped in a storage subgroup. This new 5-bit storage subgroup is what is actually written on tape. Two storage subgroups form a storage group.

Table 1-2 shows the translation codes for bit combination encoding and decoding. During GCR recording, each 4-bit group is sequentially translated (encoded) to the corresponding 5-bit combination. The transport records this combination by using the NRZI technique. When the transport reads the tape, the opposite occurs. It decodes the 5-bit combination into the original 4-bit code.

GCR recording provides high data recording density and transfer rates, and is efficient for disk backup.

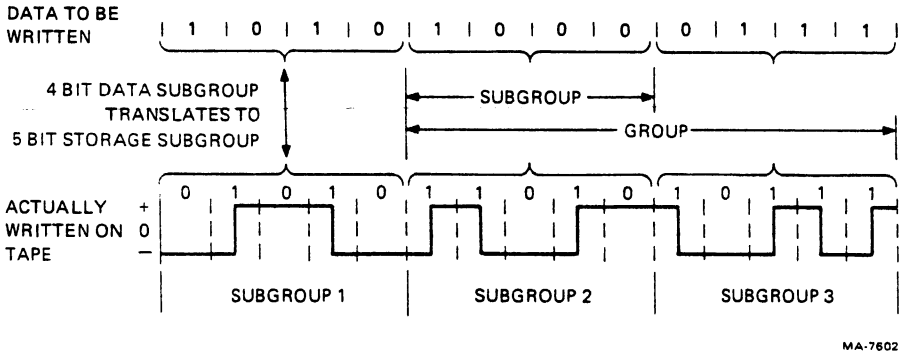


Figure 1-4 GCR Representation of Data Written on Tape

Table 1-2 Translation Record Codes

4-Bit Data Value (Data Subgroup)	5-Bit Recording Value (Storage Subgroup)
0000	11001
0001	11011
0010	10010
0011	10011
0100	11101
0101	10101
0110	10110
0111	10111
1000	11010
1001	01001
1010	01010
1011	01011
1100	11110
1101	01101
1110	01110
1111	01111

Speed Modes and Speed Selection

The TU81 and TA81 transport operates at one of three speeds automatically selected to optimize data throughput.

25 in/s start/stop
25 in/s streaming
75 in/s streaming

In the 25 in/s start/stop speed, the transport can stop and start within an ANSI-minimum interblock gap (IBG) of 0.6 inches (PE mode) or 0.3 inches (GCR mode) when reading. However, if the transport stops when writing at this speed, it writes a gap of 0.7 inches. A stop or a start in this mode takes 20 milliseconds (nominal), and is similar to the stopping and starting of a "conventional" (nonstreaming) transport.

In the 25 in/s or 75 in/s streaming speeds, the transport always writes ANSI-minimum gaps of 0.3 inches, but is operating as a "streaming" tape transport. When streaming, it cannot start and stop in the IBG, as conventional transports can. When a streaming transport does have to stop, it:

- Slowly coasts forward to a stop,
- Backs up over a section of tape previously processed,

- Waits for the next command, and
- Accelerates, taking a running start so when it finds the original IBG, it is at full speed.

This cycle is called repositioning. Approximately 0.2 seconds at 25 in/s and 0.6 seconds at 75 in/s are required to complete an entire repositioning cycle. If the central processing unit (CPU) cannot supply data to, or accept data from, a streaming transport at a rate that keeps the transport constantly in motion (streaming), the transport repositions when it runs out of commands to execute. In this instance, thrashing can occur. Thrashing is when extremely long reposition times overwhelm the time spent processing data. This results in poor data throughput.

The TU81 and TA81 transport has a microprocessor-based adaptive speed control system that is designed to eliminate thrashing. This feature automatically changes the tape speed from 75 in/s streaming to 25 in/s streaming if excessive repositioning is sensed. Conversely, if the transport has been successfully streaming at 25 in/s for a determined time, the adaptive speed control changes the speed to 75 in/s. A similar algorithm controls speed changing from 25 in/s start/stop to 25 in/s streaming, and vice versa.

If the adaptive speed control system changes tape speed from 25 in/s to 75 in/s, and vice versa, too often within a determined time, the transport stops trying to operate at 75 in/s. The transport tries 75 in/s again after the algorithm is reset by the occurrence of the rewind, initialize commands, or after encountering a tape mark (read or write).

Adaptive speed control is not user programmable. It matches the CPU data rate to the tape speed mode of the transport for the best performance.

TU81 Expected Performance

During VMS (disk) backup, TU81 performance varies depending on the CPU model, the load on the system, and the allocated buffer space. Performance also depends on whether the cyclic redundancy check (CRC) is turned on or off. Disk speed and insufficient internal memory also have some effect.

For best performance, build a large data buffer in the main memory (for example, set BUFFER=5). Also, see "Performance Hints" in this chapter.

When running disk backup without a heavy system load, you can expect the following results.

VAX-11/780 — In PE and/or GCR modes, the TU81 generally runs at 25 in/s with some repositioning.

VAX-11/750 — In PE mode, the TU81 generally runs at 75 in/s with some repositioning.

In GCR mode, the TU81 generally runs at 25 in/s streaming. It can run at 75 in/s (with repositioning) if you turn off CRC, use high-speed disks (RA or some MASSBUS disks), and provide 2 Mbytes or more of main memory.

VAX-11/730 — In PE mode, the TU81 generally runs at 25 in/s streaming. Using fast disks and large main memory (2 Mbytes or more) can increase the likelihood of getting 75 in/s performance.

In GCR mode, the TU81 always runs at 25 in/s start/stop. It can run at 25 in/s streaming with system "tuning" (fast disks, large memory) as in PE mode.

NOTE

If data throughput is not sufficient to maintain the streaming capabilities of the transport, then the TU81 always defaults to the 25 in/s start/stop mode in PE and GCR mode.

Performance Hints

The frequency of drive repositioning depends entirely on how fast the CPU can process data, relative to the tape speed of the transport while it is streaming.

One way to increase the likelihood of tape streaming under VMS Backup is to turn off the CRC. This can substantially improve data speed in GCR mode. In PE mode, turning off CRC is not recommended because it creates unacceptable risks in data integrity.

Another way to increase the probability of tape streaming (at 25 and 75 in/s) is to build a large data buffer in the main memory that can deliver or accept data at tape-streaming rates. This makes sure that a known, large amount of data is processed (the data in the buffer) before a potential reposition cycle. The total percentage of time the transport is doing useful work increases, relative to the time spent repositioning. The adaptive speed control system is more likely to maintain a higher performance speed selection.

A buffer allocated by the application's program should have the capacity of at least 32 Kbytes (for example, eight 4-Kbyte records) for better overall performance. Furthermore, use a ring buffer type. That is, reading and writing into the buffer should occur at the same time to prevent or delay an empty buffer condition.

Of course, if the potential data rate to or from the host CPU is greater than the tape streaming rate, then the tape streams and no buffering is necessary. However, if the potential rate drops below the streaming rate, the buffer reduces the frequency of repositioning and the opportunity for high-speed streaming increases. Figure 1-5 shows how data buffering enhances performance.

In several cases, Digital's operating systems have the capability of buffering I/O channels. Wherever possible, select operating system features of this type to enhance opportunities for high-speed streaming also.

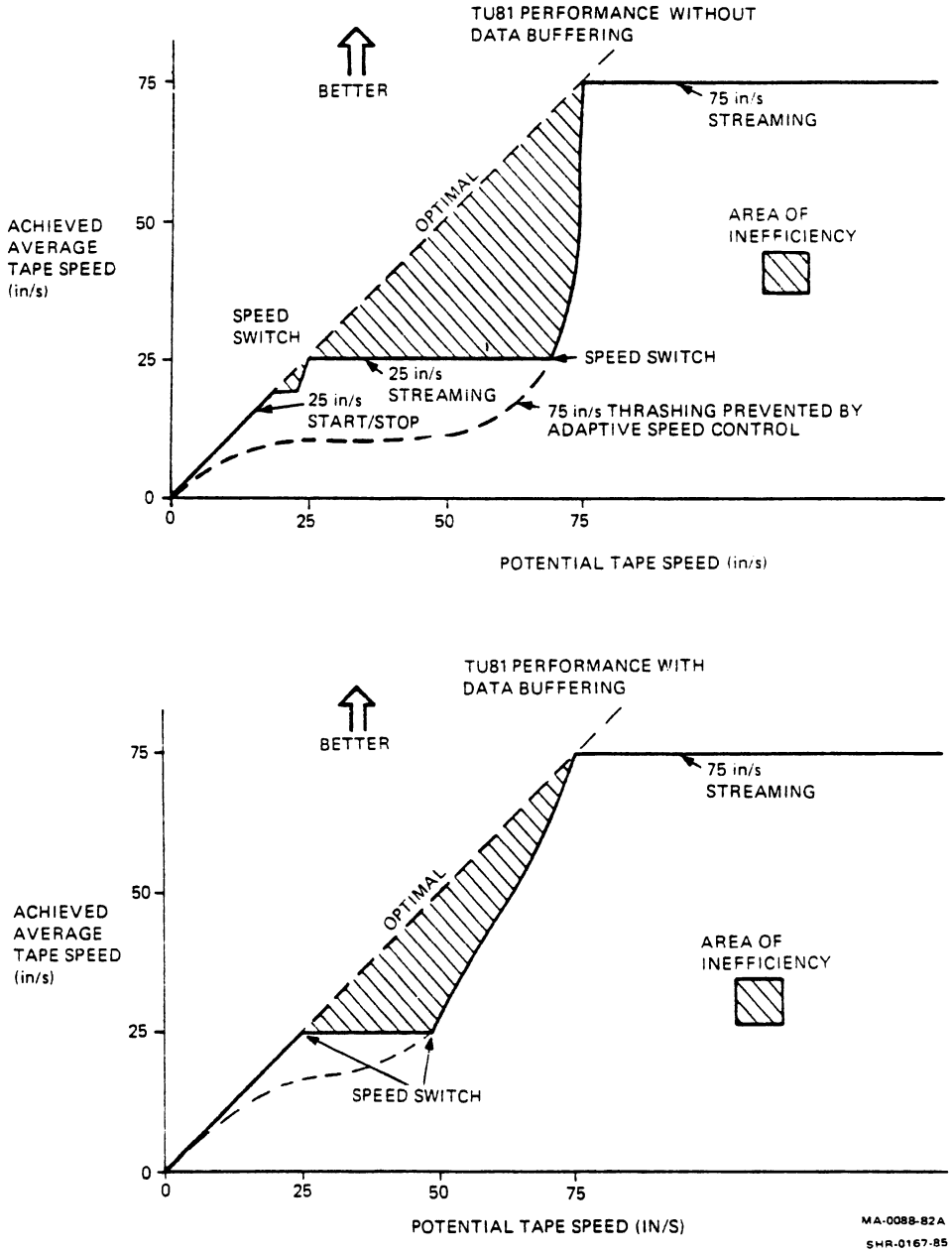


Figure 1-5 Adaptive Speed Control and Buffering

FUNCTIONAL DESCRIPTION

The TU81 and TA81 consist of the transport control system, the interface, power supply, and the tape transport unit (Figure 1-6).

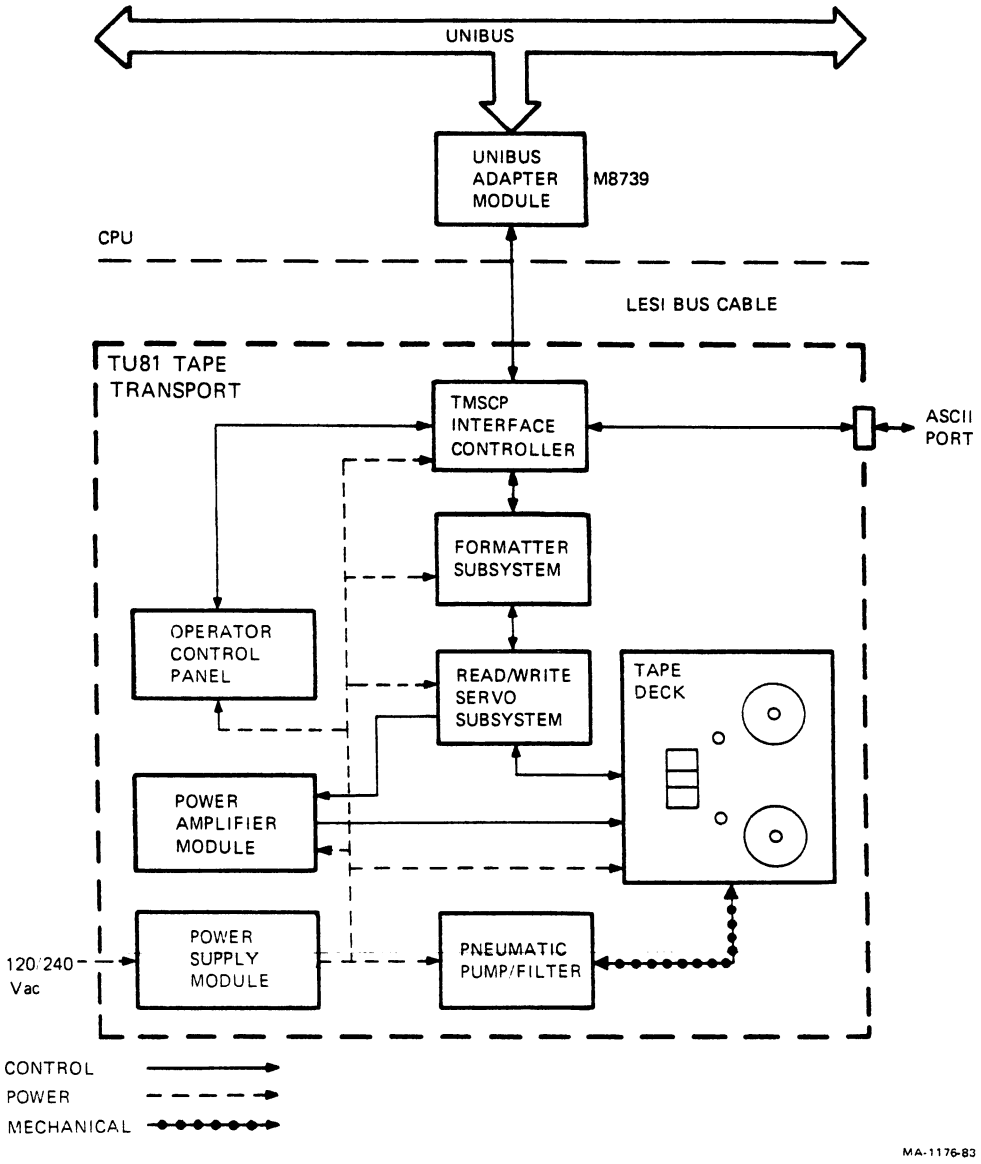


Figure 1-6 TU81 and TA81 Transport Functional Block Diagrams (Part 1)

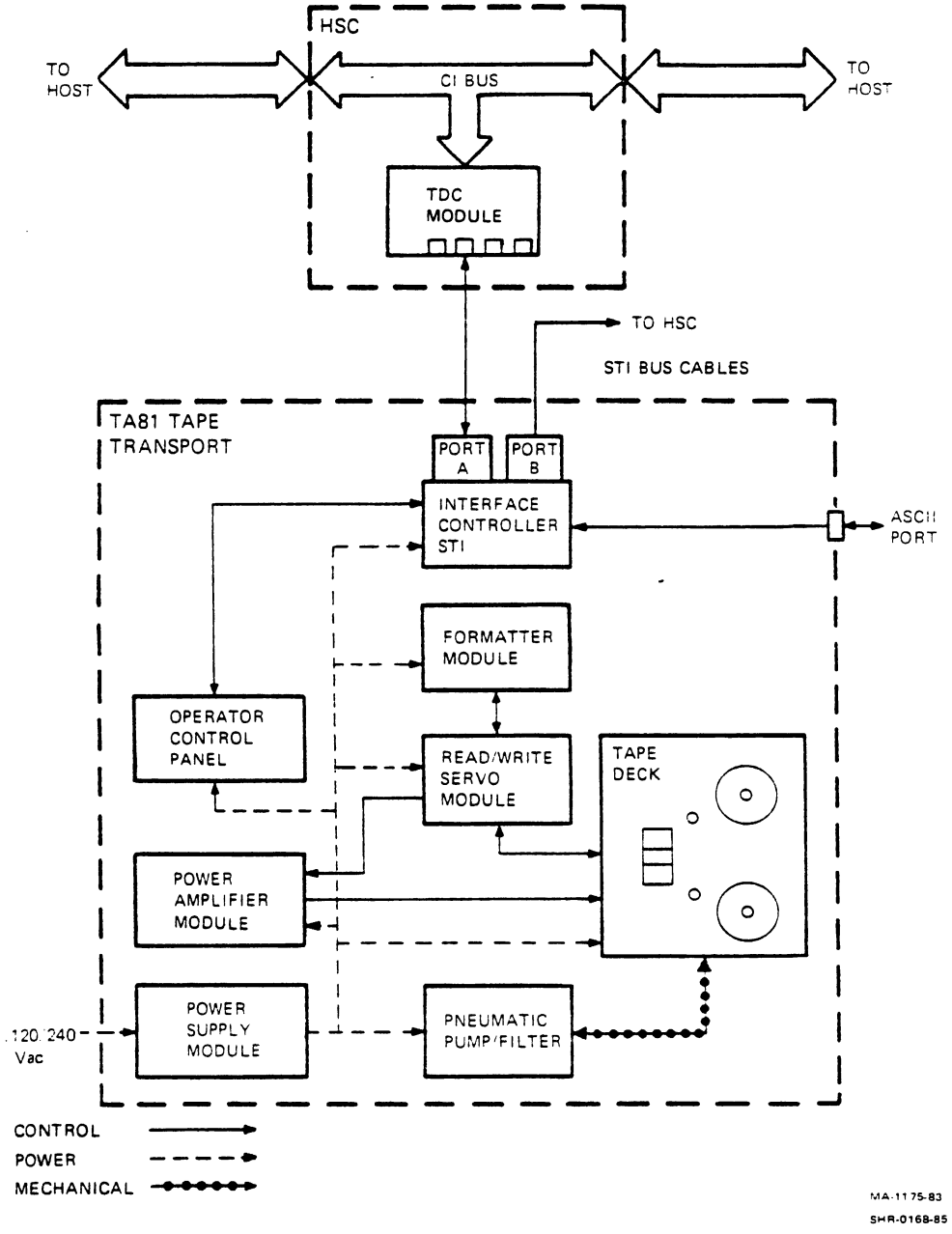


Figure 1-6 TU81 and TA81 Transport Functional Block Diagrams (Part 2)

Transport Control System
This part consists of two logic/control subsystems and a power amplifier module. All logic modules are functionally partitioned and controlled by the on-board microprocessors.

First is the formatter subsystem. It uses two logic printed circuit (PC) cards to control the transport's operation, and to convert received I/O commands into the transport's motion and data transfer operations. The formatter converts data received from the host computer via the interface controller to GCR or PE format and passes it to the read/write head for recording on tape. Data read from tape is "on-the-fly" error corrected, converted into data bits, and passed via the interface to the host computer. The formatter also stores and monitors the built-in diagnostic routines.

Second is the read/write/servo subsystem. It includes three logic PC cards and controls the electromechanical functions of the transport (reel motors, tension sensors, magnetic head).

The power amplifier module receives low voltage analog control signals from the read/write/servo subsystem and outputs higher voltages to the reel motors.

Interface System
This part consists of the resident (transport-mounted) interface controller or "personality" module, the interface bus, and a communication interface adapter module installed in an appropriate host computer or controller. The TU81 and TA81 have different interfaces.

TU81 Interface -- The TU81 tape transport is directly interfaced to the host CPU. The interface consists of a transport-mounted TMSCP interface controller module, LESI bus to the CPU, and the UNIBUS/LESI adapter module plugged into a small peripheral controller (SPC) slot in the host I/O backplane.

The UNIBUS/LESI adapter module (M8739) is the standard quad-size PC card that provides physical interface with the CPU's I/O. It supervises several I/O functions and works with the resident TMSCP I/O controller in command and data transfers. The physical LESI interconnect between the CPU and the TU81 consists of three serially connected 50-conductor cables.

The first cable is the external, round shielded cable, which is 20 feet long. The second one is the internal ribbon cable in the CPU (from the M8739 to the bulkhead). The third cable is in the TU81 (from the TMSCP controller). For I/O cabling, refer to Figures 5-11 and 5-12.

The TU81 uses the asynchronous TMSCP data communication protocol to transmit data. This enables the TU81 to communicate with Digital's various computer systems.

The TMSCP resident interface module is a complete on-board interface controller that establishes data interface between the LESI bus and the PE/GCR formatter. This module mounts in the same logic cage as the formatter. The microprocessor-based controller fetches and translates host-originated command messages into PE/GCR formatter commands. It monitors and encodes formatter and drive status data into the status messages, and transmits them to the host. It also supervises bidirectional data transfers between the host CPU and the TU81.

TA81 Interface -- The TA81 tape transport connects to the host system only through the HSC I/O controller. The TA81 communicates with the HSC by means of the standard tape interface (STI). The STI consists of the transport-mounted STI controller module with two I/O ports, one or two STI cables, and the HSC-mounted tape data channel (TDC) module (L0108-YB). Data transfers on the STI bus are performed according to STI protocol (see the legal notice at the beginning of this chapter). A dual communication port allows connection of up to two HSC controllers; each HSC controller allows the TA81 to be accessed by one of several host systems. For maximum availability, connect one TA81 to two HSC controllers.

NOTE

The STI controller and TDC module function like the corresponding TU81 modules (see above) except for the different communication bus and protocol (STI versus TMSCP).

The transport logic and interface modules are compactly mounted in two metal cages under the tape deck.

Power Supply
This part is vertically mounted in the rear of the tape deck. It provides all required ac/dc voltages. The switched 120 or 240 volts to the power supply come from the 874 power controller at the bottom of the transport cabinet.

The 874 power controller is connected to the CPU or HSC by the power switching line, which enables the CPU (or HSC) to control ac power remotely (on/off) to the on-line transport.

PHYSICAL DESCRIPTION

The TU81 and TA81 are manual load, reel-to-reel tape transports with the following major assemblies.

- Tape deck with a read/write/erase magnetic head, servo reel motors, air bearings, and solid-state tension sensors
- Two electronic logic cages
- Control panel
- ASCII port panel
- Pneumatic pump/air filter
- Power supply and cooling fan

Tape Deck

The following paragraphs briefly describe the deck components and their functions (Figures 1-7 and 1-8).

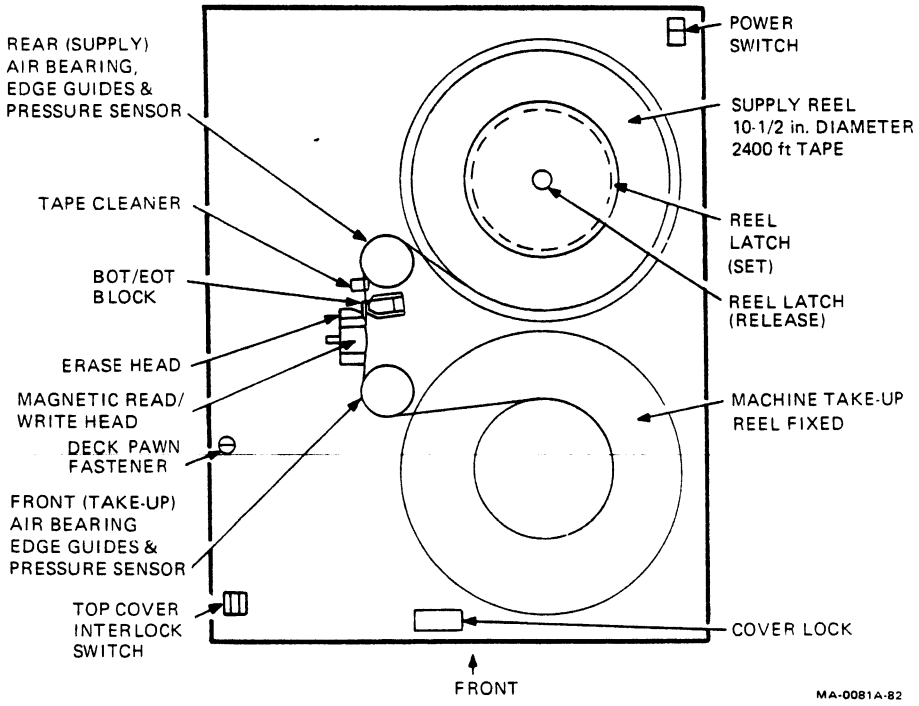


Figure 1-7 Tape Deck Components

Reel Motors and Hubs -- The reel servo motors are mounted under the tape deck and are covered by an acoustic, cooling, and electrical cover. The servo motors drive the supply and take-up reels. The supply (rear) hub has a manual, mechanical latch. The latch secures the reel to the hub face by pressing the periphery of the hub face while the reel is positioned against the bottom flange of the hub. To release the reel, press the center button on the hub face.

The supply reel motor works with the supply and take-up air bearings to control tape tension across the recording surface of the magnetic head.

The take-up (front) reel is permanently mounted on the take-up motor shaft. The take-up motor/reel speed is controlled to maintain constant tape speed across the read/write head.

Power Amplifier Module -- This module is also mounted under the tape deck within the motor acoustic cover.

Air Bearings -- Two air bearing/tension sensor assemblies guide the tape across the magnetic head on an air cushion and measure air pressure reflection. The pressure signal is processed by the control system that maintains constant tape speed and air pressure with an appropriate change in reel motor speed.

Magnetic Head Assembly -- This assembly consists of a read/write head and an erase head.

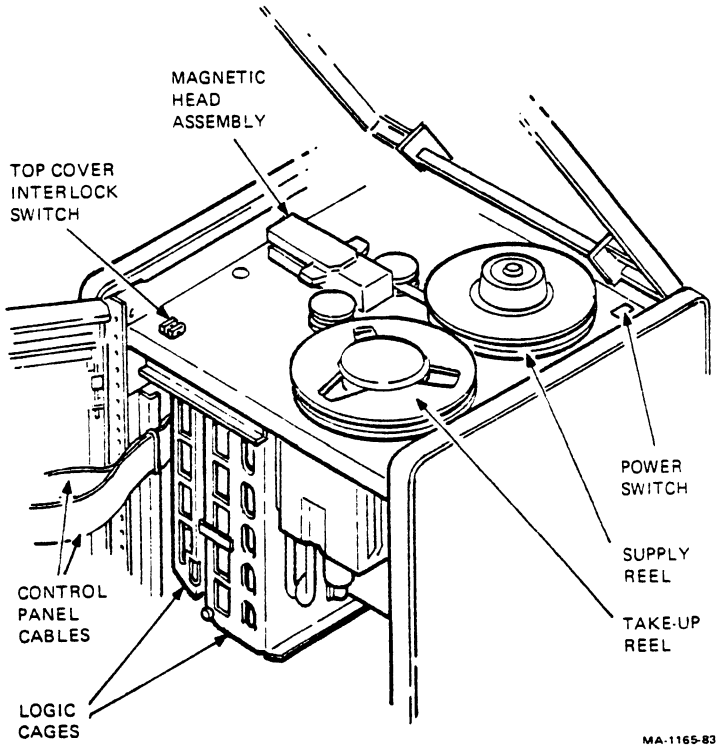


Figure 1-8 Major Transport Assemblies

The dual-gap read/write head unit is designed to do the read/write functions in a 9-track format. The dual-gap head allows a write-to-tape operation, read-only operation, or read-after-write operation. A full-width erase head erases the tape during a write operation while the tape moves forward before passing over the write head.

Tape Cleaner -- This cleaner consists of two blades and a vacuum port to strip unwanted particles off the tape surface. One blade cleans tape in the forward direction and the second cleans tape in reverse. The vacuum system directs the stripped particles through a screen and into an air filter.

BOT/EOT Assembly -- This assembly is adjacent to the magnetic head assembly. Beginning-of-tape (BOT) and end-of-tape (EOT) markers are detected optically. Photosensors detect light reflected from BOT and EOT markers on tape. An absence-of-tape (AOT) condition is detected when either one of the BOT and EOT photosensors detects a reflective marker normally blocked by the presence of a tape.

File Protect Sensor -- This sensor consists of a reflective ring around the supply hub and an adjacent photosensor that are used to detect the presence or absence of the write-enable ring on the supply reel.

Power Switch -- The main power switch (circuit breaker) is at the rear, right corner of the tape deck. In the off position (0 side pressed), input ac voltage is removed from the transport power supply. In the on position (1 side pressed), the transport is powered on.

Cover Interlock -- The interlock switch/cover latch is a safety device that allows reel motor motion only when the top cover is closed and latched.

Electronic Logic Cages
These two metal cages, vertically mounted under the tape deck, are the mounting and security enclosures for the logic modules.

- One cage holds the formatter (two PC cards) and interface controller (one PC card) modules. The external I/O cable(s) plug into the connectors on the cage's mounting plate.

- The other cage holds the read/write/servo subsystem (three PC cards).

The logic modules can move along the slots in the cages allowing easy access for testing, removal, and replacement.

Pneumatic Pump/Air Filter

The pump and air filter, together with the plenums, are a pressure/vacuum system. This system provides specified air pressure/vacuum at the air bearings and the tape cleaner. The pneumatic system turns on and operates continuously when the tape is loaded.

Power Supply and Cooling Fan

The power supply is mounted at the rear of the tape deck. The power supply provides ac/dc voltages when the transport is powered on. A fan cools the power supply and provides air circulation for the logic modules.

Control Panel

The control panel is in the upper-right corner of the cabinet's front panel. The control panel has operational and diagnostic membrane-type switches, functional indicators, connectors, and a 3-digit, light-emitting diode (LED) display. (Chapter 2 details control panel functions.)

ASCII Port Test Panel

This panel is on the control panel in the upper part of the cabinet's front door (Figures 2-1, 2-2, and 2-3). The ASCII test panel has an I/O (signal) connector for the RS232-compatible terminal (including Digital's hand-held test terminal), power outlet, and fuse. Field Service personnel can use this port and the ASCII terminal for conducting special diagnostic routines.

For more information on the ASCII port, refer to the technical manual and the service and maintenance guides for the TU81 and TA81 subsystems (Table 1-1).

CHAPTER 2
OPERATING INSTRUCTIONS

GENERAL

This chapter explains the control panel and provides instructions for installing the tape reel, loading tape, and placing the drive on-line to a host computer.

CONTROL PANEL

Figures 2-1 and 2-2 show the control panels of the TU81 and TA81 tape transports. The control panels in both transports are almost identical, except for the two additional communication switches A and B on the TA81.

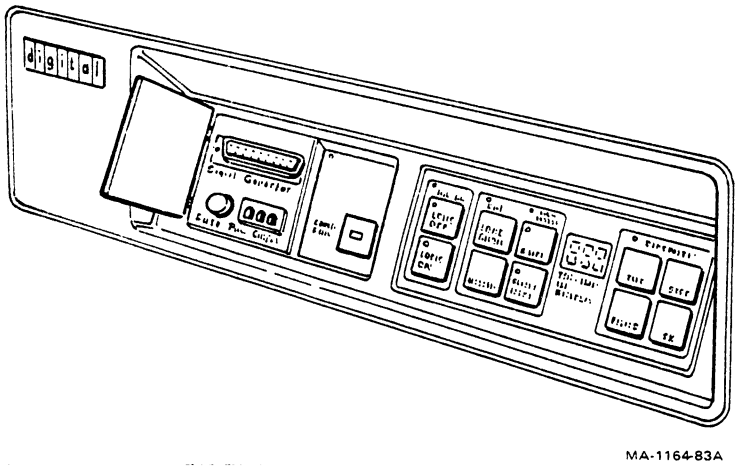


Figure 2-1 TU81 Control Panel

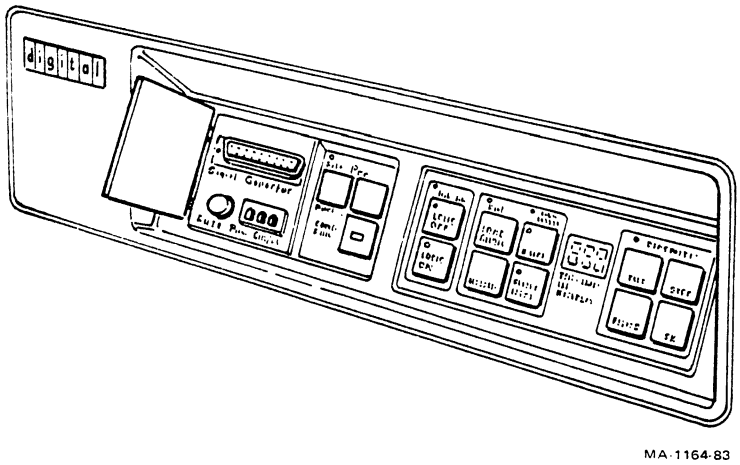


Figure 2-2 TA81 Control Panel

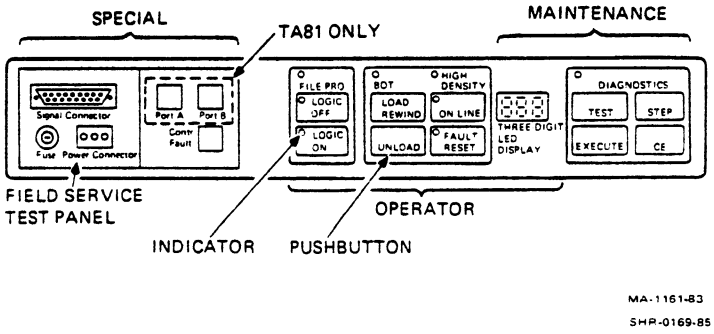


Figure 2-3 Control Panel Functions

All panel switches are pushbuttons. Switch functions, and the conditions required for enabling the functions, are given in the following paragraphs. Figure 2-3 gives a general view of the TU81 and TA81 control panel.

The central part of the control panel (OPERATOR) contains operator-oriented switches and indicators. The 3-digit display shows the unit number during normal operation. If an error occurs, either during on-line operation or an off-line diagnostic routine, the display indicates the 3-character error code (for example, E31). While running the off-line resident diagnostic, the display shows the number of the test in progress.

The right part of the panel (MAINTENANCE) contains the switches and indicators for running the resident diagnostic test routines.

The left part of the control panel (SPECIAL) provides special-purpose switches, connectors, and indicators. These are the fault/controller switch/indicator, the ASCII test panel (used by Field Service), and the communication channel selection switches for port A and port B (only TA81).

Operator Controls

Table 2-1 describes the operator controls on the TU81 and TA81.

Diagnostic Controls

Table 2-2 describes the diagnostic controls on the TU81 and TA81.

Special Controls

Table 2-3 describes the special-purpose controls on the TU81 and TA81.

Table 2-1 Operator Controls

Switch/Indicator	Function
LOGIC OFF	Indicator -- When on, LOGIC OFF indicates a power fault, meaning a failure is in the transport's power supply.
LOGIC ON	Indicator -- When on, LOGIC ON indicates a normal power-on condition with all dc voltages applied to the transport's control system and circuits.
	NOTE The LOGIC OFF and LOGIC ON buttons are not operational.
FILE PRO	Indicator -- When on, FILE PRO indicates the absence of a write-enable ring in the supply reel and write operation is inhibited. Otherwise, write operations are allowed.
BOT	Indicator -- When on, BOT indicates the tape is loaded and positioned at the BOT marker.
LOAD/REWIND	Switch -- If the transport is powered on and tape is threaded, pressing this switch loads the tape. If tape is already loaded, pressing the switch rewinds the tape to BOT.
UNLOAD	Switch -- If tape is loaded at BOT, pressing this switch causes tape to unload from the take-up reel and tape path onto the supply reel. If tape is loaded beyond BOT, it rewinds to BOT. If tape is threaded, but not loaded, pressing the switch causes the transport to unload tape slowly onto the supply reel.
ON-LINE	Switch -- If tape is loaded, pressing this switch causes the transport to become available to the host system. Press the RESET switch to take the transport off-line. Indicator -- When on, ON-LINE indicates that the transport is available for on-line operation. All switches except RESET are inhibited.
HIGH DENSITY	Indicator -- When on, HIGH DENSITY indicates that the transport is selected by the host system for GCR operation.

Table 2-1 Operator Controls (Cont)

Switch/Indicator	Function
FAULT/RESET	Indicator -- When on, FAULT indicates that the transport is in fault or diagnostic status. The 3-digit display may contain a fault or diagnostic code. Switch -- When pressed, RESET places the transport off-line, stops tape motion and clears error status. The switch can stop a load or rewind operation. it also turns off the fault indicator and clears a diagnostic test condition.

Table 2-2 Diagnostic Controls

Switch/Indicator	Function
DIAGNOSTIC	Indicator -- When on, DIAGNOSTIC indicates that the transport is in the diagnostic/test mode. The indicator remains on until the RESET switch is pressed.
TEST	Switch -- If the transport is not on-line and/or has tape threaded, but not loaded, pressing this switch places the transport in the diagnostic/test mode.
STEP	Switch -- If the transport is in the diagnostic/test mode (and the test number is displayed), pressing this switch allows the diagnostic/test sequence numbers in the 3-digit display to increment to a required digit.
EXECUTE	Switch -- If the transport is in the diagnostic/test mode (and the test number is displayed), pressing this switch initiates the internal diagnostic test shown on the 3-digit display.
CE	Switch -- If the transport is in the diagnostic/test mode, this switch helps to recall and run Field Service diagnostics.

Table 2-3 Special Controls

Switch/Indicator	Function
CONTR FAULT (TU81 Subsystem)	Indicator -- When on, it indicates the TMSCP interface controller fault condition until cleared by the TU81 or host computer.
	Switch -- With the CONTR FAULT indicator on, pressing this switch causes the transport to attempt to clear the fault condition. If the fault is corrected (through either the transport or the host computer), the CONTR FAULT indicator goes off and the transport is available to the host again.
CONTR FAULT (TA81 Subsystem)	Indicator -- When on, it indicates the STI controller fault condition until cleared by the transport or HSC.
	Switch -- With the CONTR FAULT indicator on, the STI controller remains in the same connection state relative to HSC. Pressing this switch for the first time stops transport transmission to the HSC. Pressing it a second time causes the STI controller to attempt to clear the fault condition. If this attempt is successful, the CONTR FAULT indicator goes off and the transport is available to the HSC again. If the STI controller is unable to clear the fault condition, the CONTR FAULT indicator remains on, and the transport becomes unavailable to the HSC for system generated diagnostics and failure correction.
	NOTE When the interface controller fails (CONTR FAULT is on), the 3-digit display shows no error code. The display continues to show the unit number.
PORT A PORT B	TA81 Only -- Pressing either of these switches selects the corresponding interface channel to the I/O controller (and the host computer). The indicator shows the active (selected) port.
	CAUTION Complete dual-port functionality is not presently supported under VMS. If, however, both ports are cabled, only one port switch should be enabled at one

Port Switch Operation

Through two I/O ports, the TA81 connects to the HSC controllers, which control the mass storage subsystems of several computer systems. The I/O port becomes operational when the transport is on-line and the I/O channel is selected through the corresponding port switch. If this switch is disabled with the transport on-line, the transport cannot be disconnected from I/O port until ON-LINE is also disabled.

ASCII Port Test Panel

This panel contains the connectors for an ASCII terminal that runs a wide spectrum of general and unique diagnostic tests. For more information on this ASCII port, refer to the technical manual and the service and maintenance guides for the TU81 and TA81 subsystems (Table 1-1).

OPERATOR'S HINTS

The following list provides information to help you operate the TU81 and TA81.

- When the LOGIC ON indicator is on, all control panel switches and indicators are functional, except the LOGIC OFF indicator.
- The ON-LINE switch can be pressed while tape is loading. The transport goes on-line immediately when loaded.
- When the FAULT/RESET indicator is on, the control panel is not operable, except for RESET switch. To turn the indicator off, press the RESET switch.
- Tape unloads at low speed. If the take-up reel has a lot of tape and you wish to unload it quicker, press LOAD REWIND first and then press UNLOAD.
- The HIGH DENSITY indicator comes on when GCR information is being processed.

OPERATING PROCEDURE

The operating procedure includes preparing and loading the tape reel, powering on the transport, placing it on-line to the host computer, and checking its operational status. If a fault code appears in the 3-digit display during loading or routine operation, refer to "Corrective Action" in this chapter.

Inserting the Write-Enable Ring

Before mounting the reel of tape onto the supply hub, determine whether the tape will be recording (write operation). If so, place a write-enable ring into the bottom, recessed part of the reel (Figure 2-4).

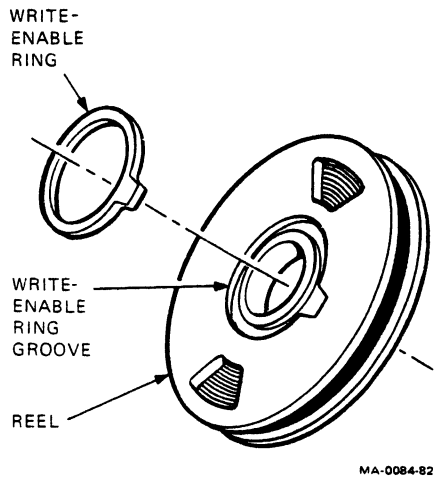


Figure 2-4 Write-Enable Ring

When the reel is prepared, proceed as follows.

Threading and Loading the Tape
Perform this procedure to thread tape and then load it.

1. Pull the cover latch toward the front and lift the top access door. Make sure the power switch is in the on (1) position.

   NOTE
   Keep the circuit breaker on the 874 power controller in the on position all the time.

   The power switch can also be in the on position all the time to allow the CPU to control the transport remotely, provided the power controller is in remote mode.

2. If all dc voltages are present, the LOGIC ON and FILE PRO indicators must be on.

   NOTE
   If the power supply fails at power-on (or later), the LOGIC OFF indicator goes on, and the display may show a fault code.

   Refer to Chapter 3 for information on the power-on health check.

3. Press the inner button on the face of the supply reel hub.

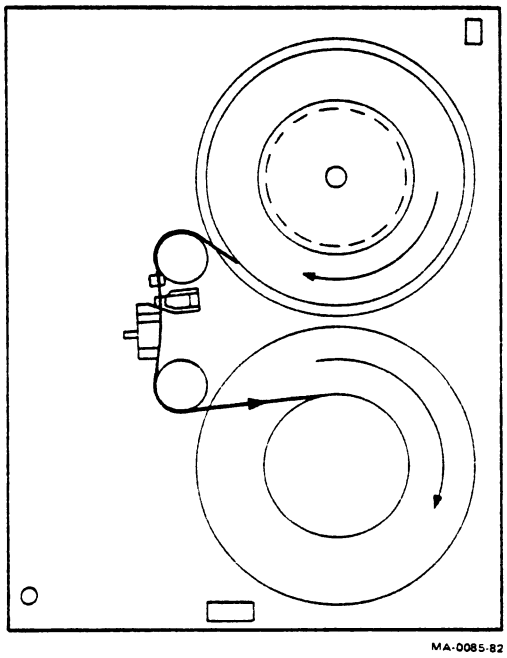


Figure 2-5 Tape Path

4. Mount the supply reel onto the hub so the reel is seated on the bottom flange. Secure the reel by pressing the periphery of the hub face to latch the reel.

5. Thread magnetic tape through the tape path as shown in Figure 2-5.

6. Wrap the tape leader (a length of tape before the BOT marker) onto the take-up reel for several turns.

CAUTION

Make sure the tape is positioned correctly over all tape path components, otherwise tape may be damaged.

7. Close and latch the top cover.

8. Press the LOAD/REWIND switch. In 1 second, air pressure builds at the air bearings and the tape starts moving forward. This motion stops when the transport detects the BOT marker on the tape. If you overthreaded the tape and positioned the BOT marker after the sensor, the tape moves forward for about 40 feet. Then the transport reverses the tape until the transport detects the BOT marker. At this moment, tape motion stops and the BOT indicator comes on.

NOTE

If LOAD fails and the tape does not move to BOT, check for the BOT marker on the tape. If there is no BOT marker, attach one by following the instructions in Chapter 4.

9. Press the ON-LINE switch to make the transport available to the host computer. You can press the switch while loading is in progress. When the tape is completely loaded, the transport indicates on-line status by turning on the ON-LINE indicator. (If the transport is ready for a write operation, the FILE PRO indicator goes off.) Now the transport is ready for use.

10. For the TA81 only, press either or both of the interface channel selection buttons (PORT A or PORT B) to select the appropriate host interface channels.

Unloading the Tape

The following procedures are for unloading tape manually or in on-line mode.

Manual Mode -- Perform this procedure to unload tape manually.

1. Press the RESET switch to place the transport off-line.

2. Press the UNLOAD switch. Tape reverses (rewind), gently winding onto the supply tape reel until it clears the take-up reel and the tape path.

NOTE

If loaded beyond the BOT marker, the tape rewinds to BOT.

3. Open the top cover and press the center button of the supply reel hub. The hub unlatches. Remove the supply reel.

4. Close the top cover to prevent dust accumulation on the tape deck components.

On-Line Mode -- When the transport is on-line to the host CPU, unloading can be done under CPU control. To remove the reel, perform steps 3 and 4 above.

Pump Shutdown
If the transport does not receive a new command from the CPU within 1 minute, the transport automatically shuts down its pressure pump (compressor) and removes power from the reel motors. Tape position continues to be monitored by the transport microprocessor and if motion of the take-up reel is detected, power is re-applied to the take-up reel to renull its position.

If the transport enters the shutdown mode, execution of the first command received from the CPU is delayed by about 1 second.

CORRECTIVE ACTION
When you power on the transport (set the power switch to the on position), it performs the power-on health check. This check validates all dc voltages applied and tests the control panel indicators.

If a power failure is detected at this time (or any other time during use), the LOGIC OFF indicator goes on and a fault code may be indicated in the display.

Press the RESET button and turn off the power. Then turn the power on again to repeat the power-on health check. If this action does not help to eliminate the malfunction, report the problem and the displayed fault code (if indicated) to service personnel.

CAUTION
Do not try to locate and correct the malfunction yourself.

A fault can occur during a load or read/write operation. If the host computer cannot correct the fault and the transport takes itself off-line, the 3-digit display shows the fault code. See Table 2-4 for a list of fault codes and corresponding corrective actions.

You can check the transport's operating condition with the built-in, basic diagnostic test Ø1 (see Chapter 3). You can use this test to check the basic operating functions of the transport, or to verify a malfunction when a fault code indicates transport failure.

Refer to Chapter 3 for test information. Table 2-4 lists the fault codes and corrective actions.

Table 2-4 Corrective Actions

Fault Code	Action
E01 to 09	Clean the magnetic head and tape path. Follow the instructions in Chapter 4.
E10	Make sure the cover door is securely closed.
E11	Thread the tape.
E12	Latch the supply reel hub.
E13	Thread the tape correctly as shown on the tape threading diagram.
E14	Check for a BOT marker on the tape. Attach a BOT marker by following the instructions in Chapter 4.
E15	This fault code indicates that the RESET switch was pressed inadvertently. Reinitiate the test.
E16	Install the write-enable ring in the supply tape reel if not present.
E17	Check for a EOT marker on the tape. Attach a EOT marker by following the instructions in Chapter 4.
E18	The tape was loaded when the test was initiated. Thread the tape, but do not press the LOAD switch.
E20 to 29	Mount a tape of known good quality.
All others	Try to run diagnostic test 01 (see Chapter 3) and then report a fault code to Field Service.

CHAPTER 3
CUSTOMER DIAGNOSTICS

GENERAL

Built-in operator diagnostics allow you to test transport performance. Run the diagnostics to check the transport after a long idle period, or to troubleshoot a fault.

OPERATOR TROUBLESHOOTING

If the transport fails, you can make a few minor checks to isolate an easily correctable malfunction before calling Field Service.

1. Make sure the tape has a BOT marker.

2. For a write operation, make sure the tape reel has the write-enable ring installed.

3. Make sure the tape path is clean.

4. Make sure the power switch is on (1).

5. In case of power failure, make sure the power controller circuit breaker is on.

6. Make sure the top cover door is closed and latched.

If the host computer reports data (read/write) errors, use "first aid." Clean the tape path as described in Chapter 4.

NOTE

During cleaning, take the time to inspect the tape path components for defects (damaged tape cleaner blades, loose air bearings, cracked or misaligned reel flanges causing contact with tape edges). Cleaning and inspecting components takes only minutes, but goes a long way toward maintaining the reliability of the transport and minimizing downtime.

If cleaning does not solve the problem, then replace the reel of tape with a tape of "known-good quality," used only for testing. If the fault persists after these procedures, then report the fault to Field Service.

Error Reporting
When the transport is on-line, you may notice an abnormal condition through a message on the system's monitor screen or the printer. The host system should retain or log the message so Field Service can determine not only the type of fault, but also all the circumstances under which the fault occurred.

OPERATOR DIAGNOSTIC PROCEDURE
The operator diagnostics include the power-on health check and one user-oriented, selectable test (Ø1), which runs for about 1Ø minutes with a 24ØØ-foot tape reel.

Faults found during the tests stop the test and display a numerical fault code on the 3-digit display. Log any fault code and give it to Field Service when you report the problem.

Power-On Health Check
The transport automatically performs the power-on health check when the power switch (circuit breaker) in the far, right corner of the tape deck is set on (1).

This built-in diagnostic checks dc power distribution (availability of all required dc voltages on the electronic modules' inputs) and normal operation of the control panel indicators.

If the check is successful, all indicators momentarily go on and off. Then the LOGIC ON and FILE PRO indicators light, indicating normal stand-by operating condition. The 3-digit display shows the unit number.

NOTE
The LOGIC ON and LOGIC OFF indicators are dc power lights. LOGIC ON shows normal power status; LOGIC OFF shows power failure.

If a power failure is detected at power-on, a fault code may appear on the 3-digit display, the LOGIC OFF and FAULT/RESET indicators come on, and the LOGIC ON indicator goes off.

NOTE
If the fault code is not listed in Table 2-4, call Field Service.

Diagnostic Test Ø1
This test examines the operating characteristics of the transport and points to the external (operator) or internal (hardware) causes of the failure.

The following are some external causes of failure that can be corrected by the operator.

Dirt in the tape path
Worn, damaged, or incorrectly written tape
Incorrectly threaded tape
No write-enable ring when one is required
Unlocked top cover
Tape that does not conform to Digital's specifications

Internal causes are hardware (mechanical and electronic) problems that require intervention from Field Service.

CAUTION

Test Ø1 reads and writes on tape. Therefore, remove any mounted tape to save the data on it. Replace it with a tape of known-good quality reserved for this purpose.

To eliminate the possibility of false displays due to a display panel failure, the first portion of diagnostic test Ø1 is an exercise of the display panel indicators. The numerical display increments from ØØØ through 999. Concurrent with the numerical display, the following indicators are on: FILE PRO, LOGIC ON, ON-LINE, RESET and DIAGNOSTICS, HIGH DENSITY.

Pretest conditions are as follows.

NOTE

Make sure the 874 power controller's circuit breaker is on.

1. Make sure the power switch is in the on (1) position. If a fault occurs at power-on, do not attempt further testing. Report the fault code to Field Service.

2. Thread the tape through the tape path and onto the take-up reel, but DO NOT LOAD.

3. Close and latch the top cover.

Use the following procedure to perform test Ø1.

1. Disable the Port switches (TA81 only).

2. Press the RESET switch.

3. Press the TEST switch on the diagnostic portion of the control panel.

   a. The DIAGNOSTICS indicator goes on.

   b. The display indicates Ø1.

4. Press the EXECUTE switch.

   a. Test Ø1 starts with the display panel incrementing from ØØØ, 111, 222 through 999. Make sure all segments of the numerical display are functioning.

   b. Make sure all indicators except LOGIC OFF, BOT, and FAULT/RESET are on.

   c. Test Ø1 continues with various tape motion and read/write exercises for about 1Ø minutes (with 24ØØ feet of tape).

If the test runs to completion, the transport performs a rewind and unload operation and the 3-digit display indicates ØØ, with the FAULT/RESET indicator on. Press the RESET switch to get out of the diagnostic mode.

Perform the following procedure if the test is not successful.

1. The diagnostic program halts and a numerical fault code appears on the display, with the FAULT/RESET indicator on. Record this number.

2. Refer to Table 2-4 for corrective action.

> NOTE
> Run test Ø1 again after performing any corrective action. If the test is successful, return the transport to normal operation. If the fault is not resolved, proceed with step 3.

3. If the corrective action did not correct the fault, report the number recorded in step 1, or any other fault code, to Field Service.

> NOTE
> Press the RESET switch to get out of diagnostic mode or to clear the fault condition and repeat the test.

UNIT NUMBER

The unit number is a unit address feature. It gives each transport a unique code (from Ø to 255) that the host computer recognizes. This number is especially useful in a multidrive configuration because it allows you to re-address a peripheral device from one transport to another in case of emergency (transport failure, connection breakdown).

The unit number is a 3-digit code that you enter from the transport's control panel with procedure Ø4. This code is stored in the transport's nonvolatile memory (that retains stored data in case of any power fluctuations or failure) until you enter new unit numbers. The transport's display indicates the unit number when the transport is powered on and when it is in its normal on-line, off-line, or tape-unloaded status. A fault code or test number replaces the unit number only during a fault condition or a diagnostic test (run from the control panel).

To enter the unit number, use procedure Ø4 as shown in the following example.

Example

To enter unit number '2Ø1,' proceed as follows.

Procedure	Indication
Press TEST once.	DIAGNOSTICS lights with a display of Ø1.
Press STEP three times.	Ø4
Press EXECUTE.	ØØØ
Press STEP twice.	ØØ2
Press TEST twice.	2ØØ
Press STEP once.	2Ø1

To store that unit number in the transport's memory, proceed as follows.

Procedure	Indication
Press EXECUTE once.	ØØ
Press RESET once to return the transport to the operating condition.	2Ø1

CHAPTER 4
CARE AND PREVENTIVE MAINTENANCE

MAGNETIC TAPE BASICS

Magnetic tape is a narrow ribbon of a stable polyester with a thin coating of needle-like particles of magnetic iron oxide bound to it. These particles are uniformly dispersed in the coating and can be permanently magnetized in such a way that information can be coded onto the tape. Unless accidentally or intentionally altered, data is there to stay.

For many years people have relied on magnetic tape for processing data and for storing current and historical information. Recent advances in tape technology have made it possible for manufacturers to develop a product that is strong and resilient, more resistent to solvents, and more stable in varying temperatures and humidities than ever before.

Magnetic tape is sold in standard lengths (for example, 600 ft, 1200 ft, and 2400 ft) around a rigid plastic hub. Plastic flanges extend from the hub on both sides to protect the edges of the wound tape.

Data can be written on tape in a variety of densities, usually described in bits per inch, or BPI. Until recently the most common density was 200 BPI. Now 1600 BPI is the industry standard and there is a move toward packing bits even more densely. With the introduction of 6250 BPI into the marketplace, tape sensitivity becomes a very important issue. This sensitivity, combined with the fact that tapes are often run at speeds approaching 250 inches per second, proves that an error-free tape can be rendered worthless with only a little mishandling.

This chapter outlines good tape handling and storing procedures so that you can optimize tape reliability. Because most problems encountered with tape are physical rather than operational, careful handling of magnetic tape can make a difference. Good procedures are a matter of common sense more than technical expertise.

MAGNETIC TAPE CARE

Although magnetic tape is not fragile in the usual sense of the word, adverse environmental conditions, exposure to contaminants, and careless physical handling can cause serious damage. Figure 4-1 shows types of tape damage that can occur. Proper storage and handling can insure a greater likelihood of top quality data retrieval and prevent tape damage.

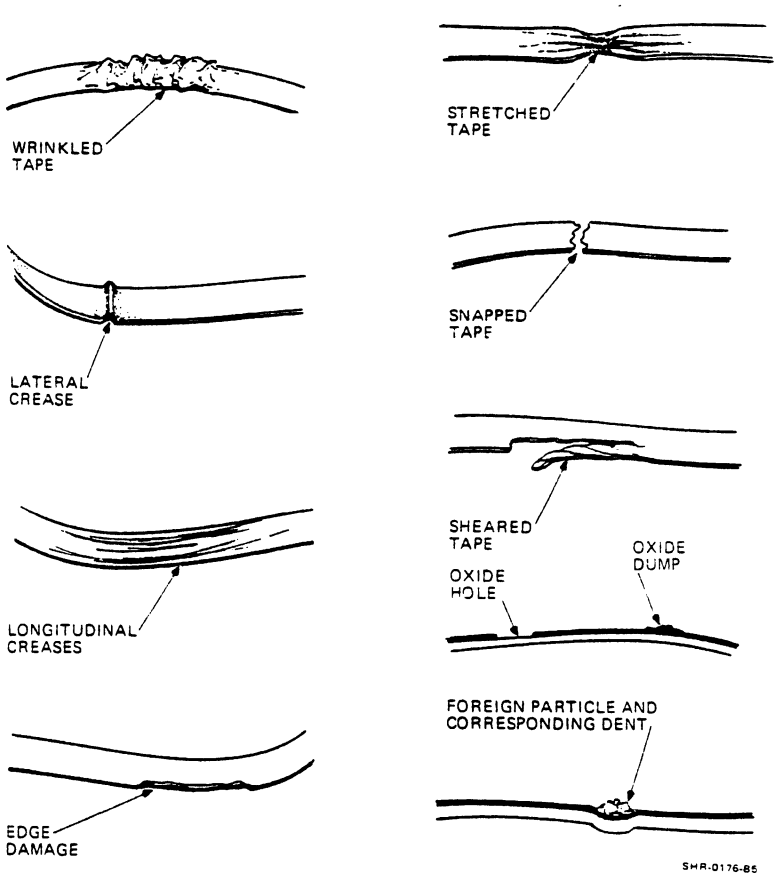


Figure 4-1 Tape Damage

Tape Storage
Follow these precautions when storing magnetic tape.

1. When storing reels of tape, use one of the following protective covers to protect the tape from contamination and physical abuse.

   - Canisters -- These rigid containers completely enclose a tape, protecting it from dirt as well as physical shocks. Keep empty canisters tightly closed to guard against dust and dirt.

   - Tape collars or "seals" -- These flexible plastic collars stabilize the tape reel's flanges at their outside circumference, sealing the tape inside.

   - Tape cartridges -- These include a collar that never has to be removed; it is designed to be used on tape systems with auto-load options.

2. Do not store magnetic tape near electric motors or any other magnetic sources that can erase data.

3. Do not place magnetic tape near printers or other devices that produce paper dust.

4. Do not place magnetic tape where it can be affected by hot air.

5. Do not smoke near the transport or storage area. Tobacco smoke and ash are especially damaging to tapes.

6. Store tapes in an environment where the temperature and humidity are in the ranges listed below. A good rule of thumb is to keep room temperature around 20oC (70oF) and the relative humidity at about 40 percent.

   Storage Environment

   Temperature Range: $5^{o}C$ to $32^{o}C$ ($40^{o}F$ to $90^{o}F$)

   Relative Humidity Range: 20% to 80%

Magnetic Tape Handling
Follow these precautions when handling magnetic tape.

1. Always handle tape reels by the hub hole. Since the hub is the strongest part of a reel of tape, you should grasp the reel with your fingers through the center of the hub and your thumb on the outside circumference of the reel. (See Figure 4-2.)

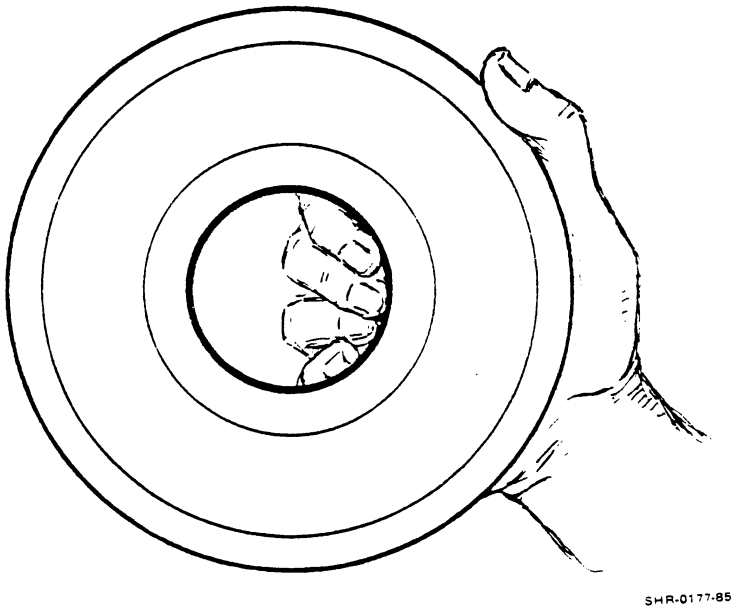
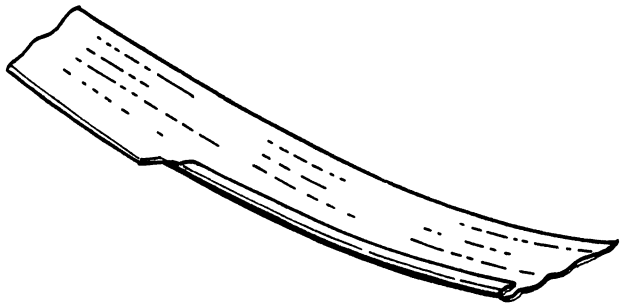


Figure 4-2 Correct Tape Handling

2. Never handle a tape by the reel flanges, since it could damage the tape edges as shown in Figure 4-3. This type of damage ruins the tape's outer recording areas.

3. Do not expose magnetic tape to dust or dirt. Most tape read errors are caused by dust or dirt on the read/write head.

4. Never touch the portion of tape between the BOT and EOT markers. Oil from fingers attracts dust and dirt.



SHR-0178-85

Figure 4-3 Tape Edge Damage

5. Never use a contaminated reel of tape. This spreads dirt to the clean tape reels and can adversely affect transport reliability. Figure 4-4 shows the relative size of tape, tape head, and typical contaminants.

6. When mounting a tape on a drive, press on the hub, not on the flanges. Be sure that the reel is evenly and securely seated so that the tape tracks smoothly in the tape path.

7. Do not expose magnetic tape to excessive heat. The operating environment should as nearly as possible approach clean room conditions. Keep the environment in the temperature and humidity ranges listed below. A good rule of thumb is to keep room temperature around 70°F and the relative humidity at about 40 percent.

Operating Environment

Temperature Range: 15°C to 32°C (60°F to 90°F)
Relative Humidity Range: 20% to 80%

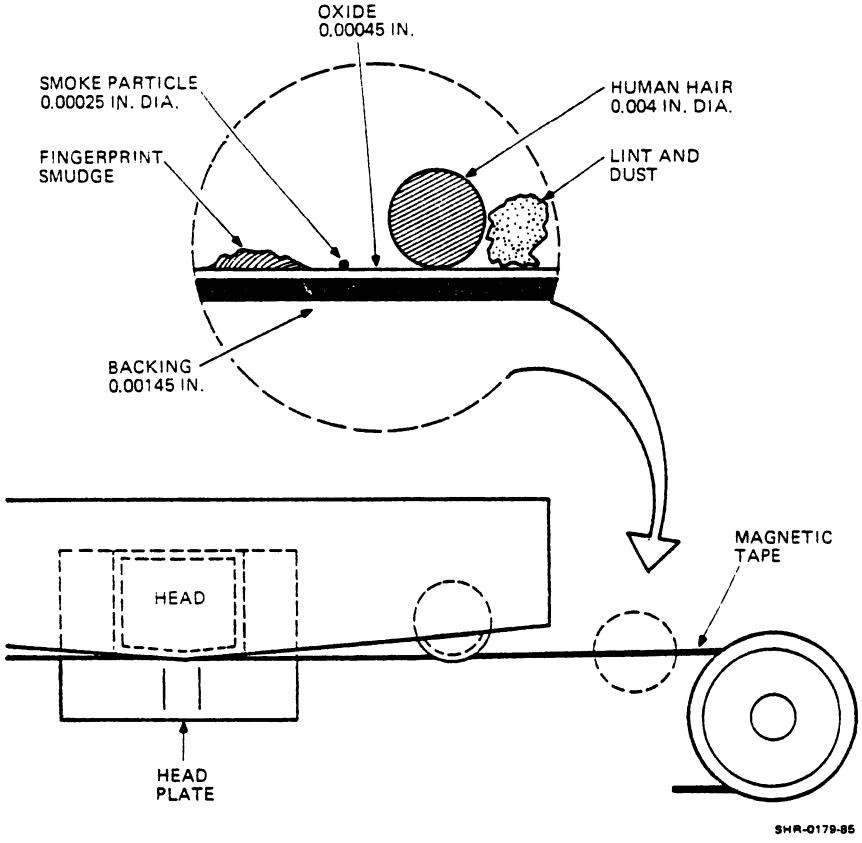


Figure 4-4 Relative Size of Tape Contaminants

8. If possible, increase the air pressure in the computer room to prevent infiltration of dust from other areas, as shown in Figure 4-5. Also, if you use a vacuum cleaner when cleaning, be sure to have it exhaust outside the area.

9. When you bring a tape that has been in transit or in storage into your work area, give it 24 hours to acclimate itself to the new environment, especially if it has been exposed to extremes in temperature and/or humidity.

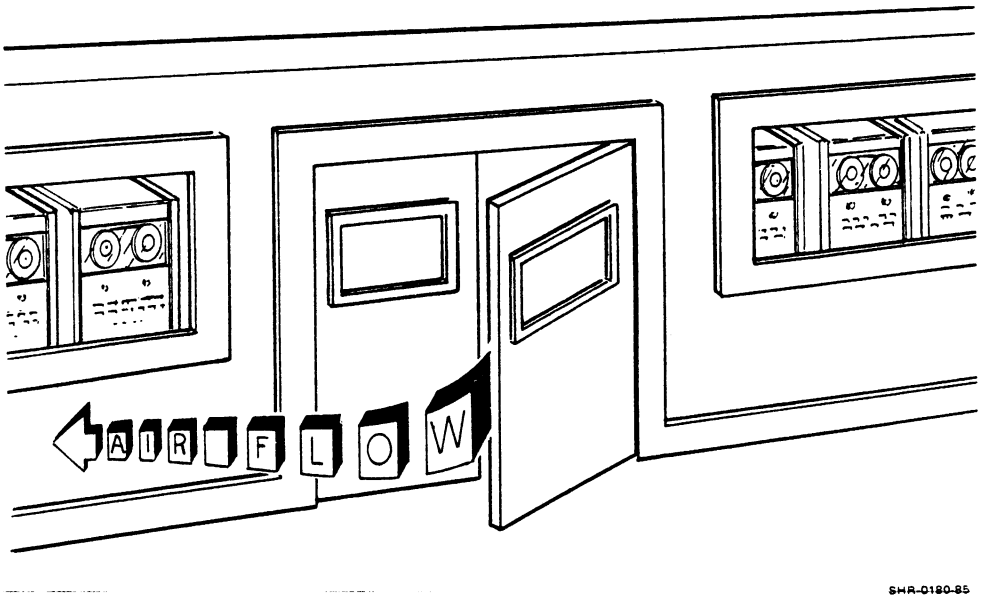


Figure 4-5 Operating Environment (Positive Room Pressure)

CUSTOMER RESPONSIBILITIES

Digital's tape transports are highly reliable, precision instruments that provide years of trouble-free performance when correctly maintained. A program of routine inspection and maintenance is essential for optimum performance and reliability. The following information will help you care for the equipment.

You are responsible for the following steps in caring for the TU81 and TA81 tape subsystems.

1. Obtain operating supplies, including magnetic tape and cleaning supplies.

2. Keep the exterior of the system and the surrounding area clean.

3. Make sure the ac power plugs are securely plugged in each time the equipment is used.

4. Perform the specific operations for equipment care described in this chapter at the suggested periods, or more often if usage and environment warrant.

Also, Digital recommends that you take these steps.

1. Maintain the required logs and report files consistently and accurately.

2. Make the necessary documentation available in a location convenient to the system.

CUSTOMER MAINTENANCE

To guarantee trouble-free operation, keep a preventive maintenance (PM) schedule. Preventive maintenance consists of cleaning only a few items, but the cleanliness of these items is essential to correct transport operation. The frequency of maintenance varies with the environment and the amount of use the transport receives. Therefore, a rigid schedule for all machines is difficult to define. Digital recommends daily cleaning for transports in constant operation in ordinary environments. Modify this schedule if experience shows other periods are more suitable.

Before any cleaning, remove the supply reel and store it correctly. When cleaning, be gentle, but thorough.

CAUTION

Do not use acetone, lacquer thinner, rubbing alcohol, or trichlorethylene to clean the tape path.

Magnetic Tape Transport Cleaning Kit

Digital has carefully assembled a magnetic tape transport cleaning kit (TUCØ1) to provide cleaning materials that do not harm tape equipment or leave residue to interfere with data reliability. Follow the hints in the following paragraphs to get the best results from the kit.

The cleaning fluid in this kit is one of the best cleaners available. Unscrew the top and punch a small hole in the metal seal covering the pour spout.

WARNING

When using DECmagtape cleaning fluid, avoid excessive skin contact and contact with the eyes. Do not swallow it. Use the cleaning fluid only in a well ventilated area.

CAUTION

When cleaning the tape equipment, never dip a dirty cleaning swab or wipe into the can. Instead pour a little onto the swab or wipe. Use the smallest amount of cleaning fluid necessary. Do not soak the swab or wipe in the cleaning fluid.

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

Use the cleaning materials from the kit to clean tape heads, tape guides, tape cleaner, and any part of the drive where residue could contact the tape. To clean other parts of the drive, such as the exterior tape deck surface and doors, use any reasonably clean, lint-free material with or without cleaning fluid.

CAUTION

To clean exterior surfaces, use only soap and water.

If you encounter any unusually stubborn dirt that resists the cleaner, try a mild soap and water solution. After using soap, be sure to wash the area thoroughly with cleaning fluid to remove soapy residue.

Reflective Tape Markers

Every reel of magnetic tape must have a BOT and EOT reflective marker so the transport can recognize starting and stopping areas. Tapes are always supplied with reflective markers on them. However, if the markers detach for any reason or if a tape leader is shortened because of tape damage, then install a marker at the position shown in Figure 4-6.

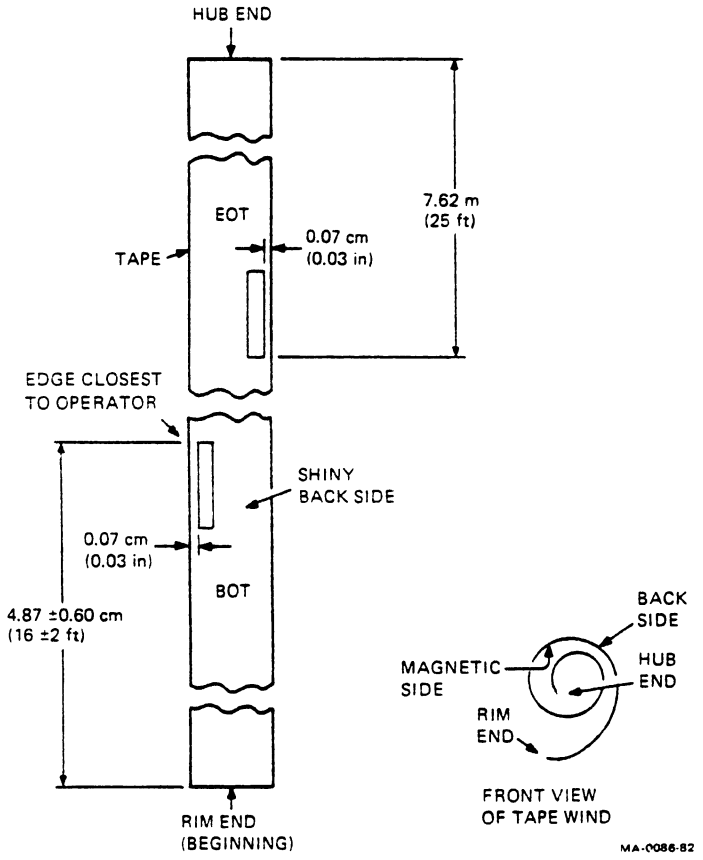


Figure 4-6 Reflective Tape Markers

Cleaning the Transport

All transport components that need regular cleaning are on the tape deck. These components include the magnetic head assembly, EOT/BOT sensor, tape cleaner, and air bearings. Also, you should regularly examine and clean (as required) the top of the tape deck, reel hubs, and top cover door.

To reach the magnetic head components (Figure 4-7), pull up the 2-part dust cover for the head assembly from the tape deck.

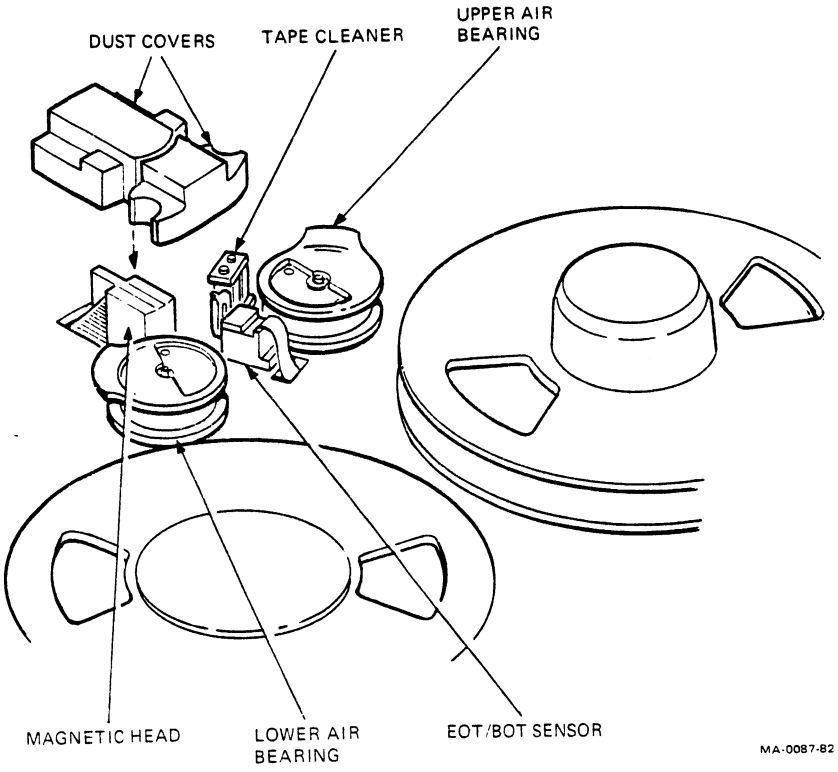


Figure 4-7 Magnetic Head/Tape Path Components

Magnetic Heads -- Use the following procedure to clean the magnetic heads.

1. Clean the magnetic head working surface with a soft, lint-free wipe moistened with the cleaning fluid.

> NOTE
> Wipe the head surface in the same direction that the tape travels during data recording (forward motion).

2. Clean the area next to the head of any dirt that can be transported with the tape.

Air Bearings -- Use the following procedure to clean the air bearings.

1. Clean both air bearings with a swab moistened with the cleaning fluid.

2. Make sure the foil area, guide springs, and both tape guides are clear of any oxide and dirt buildup. If available, use a small mirror to inspect the inner edge of the guides.

Top Cover, Tape Deck, and Head Assembly Dust Covers -- To prevent the transfer of dirt to the tape components, do not allow dust or dirt to accumulate on the inside of the dust cover. Clean the inside cover surface with a clean, lint-free wipe and any cleaning fluid that is safe for plastic, painted surfaces.

Inspection of Tapes and Equipment

In addition to following a regular preventive maintenance schedule on the equipment, it is a good idea to visually inspect the equipment frequently. For instance, check the tape transport after running a tape to be certain that no debris has collected there. Clean it often, since contaminants that have collected on the tape head or guides can easily contaminate a new tape. Check empty reels for defects such as cracks or rough spots since these can damage the edges of the tape that is wound on them; warped uneven reels can cause uneven winding and edge damage as shown in Figure 4-8.

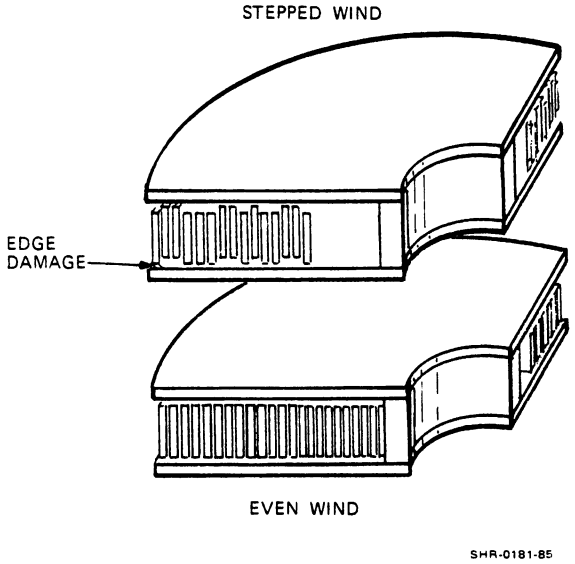


Figure 4-8 Uneven (Stepped) and Even Wind

LONG TERM STORAGE

Data is often backed up on tape and stored to keep it safe in case primary disks or tapes fail, are lost, or are destroyed. When properly maintained, there is no reason that tapes cannot remain viable for many years.

Tapes that remain in vaults for long periods of time are subject to certain problems. For example, temporary tape errors tend to become permanent errors with time. Compression on tape layers can eventually distort the shape of reels of tape hanging from tape collars, causing them to become egg shaped rather than round. Variations in warehouse conditions may cause a condition called cinching. Cinching occurs with the slight expansion and contraction of the tape, alternately loosening and binding the tape and ultimately adversely affecting the way the tape is wound, as shown in Figure 4-9.

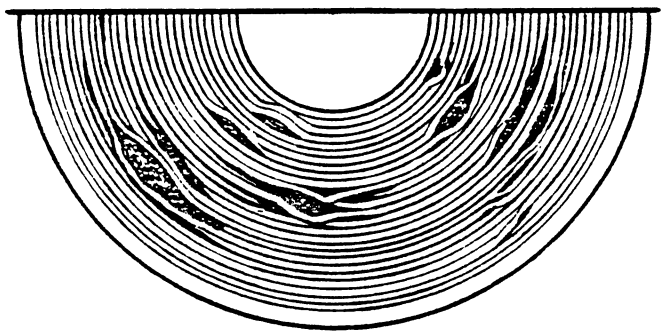


Figure 4-9 Cinching

To prevent these problems, exercise the tapes regularly. For example, unwind and rewind each tape on an annual or semi-annual schedule. This can remove errors and redistribute the stresses that build up. Another approach is to randomly sample and read a percentage of the tape library on a regular basis. This can detect problem areas and alert you to the need to recopy or reconstruct data.

SHIPPING MAGNETIC TAPES

When packing magnetic tape for shipment, take precautions to protect it from being damaged in transit. Carefully secure the ends of the tapes using both the hold-down sponge and a vinyl strip for added safety. Use containers that can withstand dropping and other rough handling. Consider using materials that provide protection from water damage in case your shipment is exposed to moisture.

Bulk packing material used between individual reels and between the reels and the container serves serveral purposes. It separates the reels from one another, evenly distributes stress from impact, and provides some protection to the tapes in the event that the shipment is exposed to a magnetic field. Three inch spacing is considered adequate protection.

ACCESSORIES AND SUPPLIES

To use the TU81 and TA81 tape subsystems efficiently, you should have the following accessories and supplies.

Magnetic tape cleaning kit (TUC01)
Magnetic tapes
BOT/EOT marker tape (PN 90-09177-00)

Ordering

Forward purchase orders for supplies, accessories, or documentation to the following address.

Digital Equipment Corporation
Accessories and Supplies Group
PO Box CS2008
Nashua, New Hampshire 03061

Contact your local sales office or call DECdirect catalog sales toll-free at (800) 258-1710 from 8:30 a.m. to 6:00 p.m. Eastern Standard Time (U.S. customers only). Customers from New Hampshire, Alaska, and Hawaii should dial (603) 884-6660. Terms and conditions include net 30 days and FOB Digital plant. Freight charges will be prepaid by Digital and added to the invoice. The minimum order is $35.00. The minimum does not apply when full payment is submitted with an order. Checks and money orders should be made out to Digital Equipment Corporation.

DIGITAL REPAIR SERVICE

Digital Field Service offers a range of flexible service plans.

On-Site Service offers the convenience of service at your site and insurance against unplanned repair bills. For a small monthly fee, you receive personal service from our Service Specialists. Within a few hours, the specialist is dispatched to your site with equipment and parts to give you fast and dependable maintenance.

Basic Service offers full coverage from 8 a.m. to 5 p.m., Monday through Friday. Options are available to extend your coverage to 12-, 16-, or 24-hour days, and to Saturdays, Sundays, and holidays.

DECservice offers a premium, on-site service that guarantees extra-fast response and nonstop, remedial maintenance. We don't leave until the problem is solved, which makes this service contract ideal for those who need uninterrupted operations.

Under Basic Service and DECservice, all parts, materials, and labor are covered in full.

Carry-In Service offers fast, personalized response, and the ability to plan your maintenance costs for a smaller monthly fee than On-Site Service. When you bring your unit to one of 160 Digital Servicenters worldwide, factory-trained personnel repair your unit within two days (usually 24 hours). This service is available on selected terminals and systems. Contact your local Digital Field Service office to see if this service is available for your unit.

Digital Servicenters are open during normal business hours, Monday through Friday.

DECmailer offers expert repair at a per use charge. This service is for users who have the technical resources to troubleshoot, identify, and isolate the module causing the problem. Mail the faulty module to our Customer Returns Center where the module is repaired and mailed back to you within five days.

Per Call Service offers a maintenance program on a noncontractual, time-and-materials-cost basis. This service is available with either On-Site or Carry-In Service. It is appropriate for customers who have the expertise to perform first-line maintenance, but may occasionally need in-depth support from Field Service.

Per Call Service is also offered as a supplementary program for Basic Service customers who need maintenance beyond their contracted coverage hours. There is no materials charge in this case.

On-Site Per Call Service is provided on a best effort basis, with a normal response time of two to three days. It is available 24 hours a day, seven days a week.

Carry-In Per Call Service is available during normal business hours, with a two to three day turnaround.

For more information on these Digital service plans, prices, and special rates for volume customers, call one of the following numbers for the location of the Digital Field Service office nearest you.

Digital's International Field Service Information Numbers

U.S.A.	1-(800)-554-3333
Canada	(800)-267-5251
United Kingdom	(734) 868711
Belgium	(02) 2425095
West Germany	(089) 95910
Italy	(02) 617961
Japan	(03)-989-7161
France	(6) 0778292
Denmark	(2) 889666
Spain	(1) 7331900
Finland	(0) 423511
Holland	(30) 640293
Switzerland	(01) 829911
Sweden	(8) 7338000
Norway	(2) 160290
Austria	(222) 6776410
Ireland	(1) 308433
Portugal	(1) 725402
Australia	(02) 4125555

CHAPTER 5
INSTALLATION

GENERAL

This chapter describes how to prepare a site for the TU81 and TA81 transport. It also describes how to unpack and install the transport. The last section in this chapter provides information on acceptance testing.

SITE PLANNING

Before installing a TU81 and TA81 tape subsystem, prepare a site according to the following requirements.

Space Requirements

Figure 5-1 shows the transport dimensions and the space and service clearances required for the cabinet (model H9643). Leave enough space to open the front, rear, and top doors.

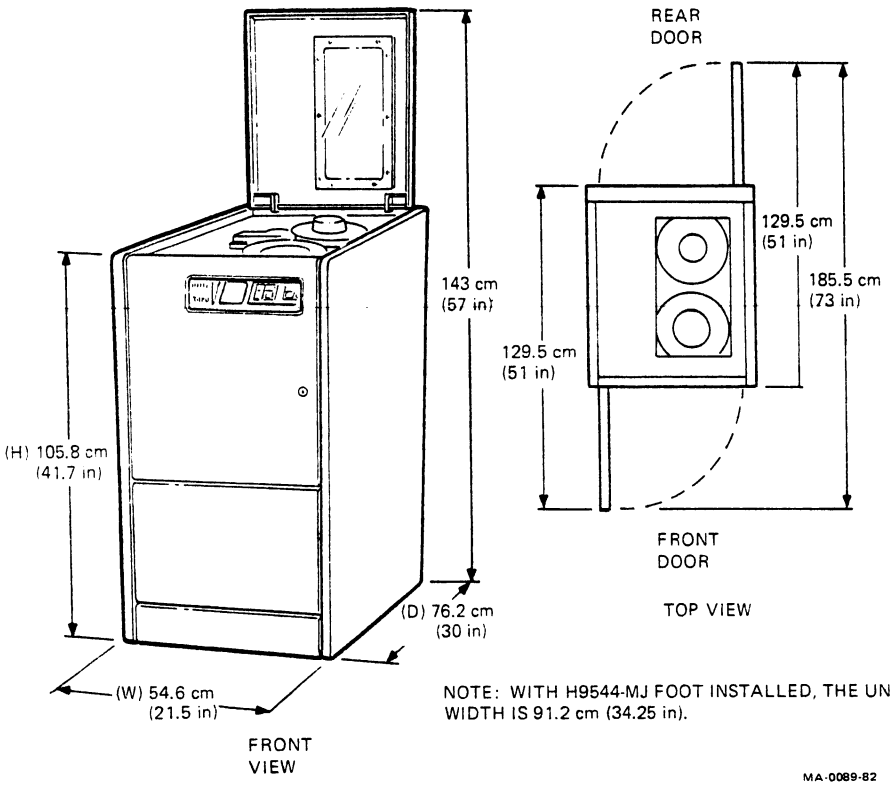


Figure 5-1 Space Requirements

Power Requirements
The transport can be operated within 93 to 128 Vac, 60 Hz (120 Vac nominal) or 187 to 256 Vac, 50 Hz (220 or 240 Vac nominal). Frequency should not vary more than ±3 Hz.

The appropriate power plugs are provided with the transport. (See the specifications in Chapter 1 for the plug's NEMA numbers.)

In the TU81 subsystem, the M8739 adapter module is installed in the CPU. This module typically draws 4 A at +5 Vdc. No other voltage is required. Power for the module comes from the host CPU through dedicated pins on the CPU backplane.

In the TA81 subsystem, the TDC module is installed in the backplane of the HSC controller.

Environmental Requirements and Limits
The transport should be in an area free from excessive dust, dirt, corrosive fumes, and vapors. The bottom of cabinet and air vents on the doors must not be obstructed. The operating environment requirements are listed in the specifications in Chapter 1.

Tools Required
To install the transport, you need the following tools.

- 5/32 inch allen wrench
- 3/4 inch combination box and open-end wrench
- 7/16 inch, open-end wrench
- 9/16 inch, open-end wrench
- 5/16 inch nut driver
- Number 2 phillips screwdriver

UNPACKING AND INSPECTION
This section describes how to unpack the transport and inspect it for damage before installation.

Floor Loading and Routing
The transport is shipped in a cardboard container and is mounted on a wooden skid. The shipping weight is 154 kg (340 lb). Check the route the transport will travel to the installation site to guarantee problem-free delivery. The transport's net weight is 139 kg (295 lb).

Unpacking

Figure 5-2 shows the unpacking procedure. Refer to the numbered instructions in Figure 5-2.

To unpack the transport, proceed as follows.

1. Cut and remove the shipping straps around the cardboard container (1).
2. Lift and remove the top container cover (2).
3. Carefully lift and remove the two ramps from the top of the cabinet. Set them aside for future use.

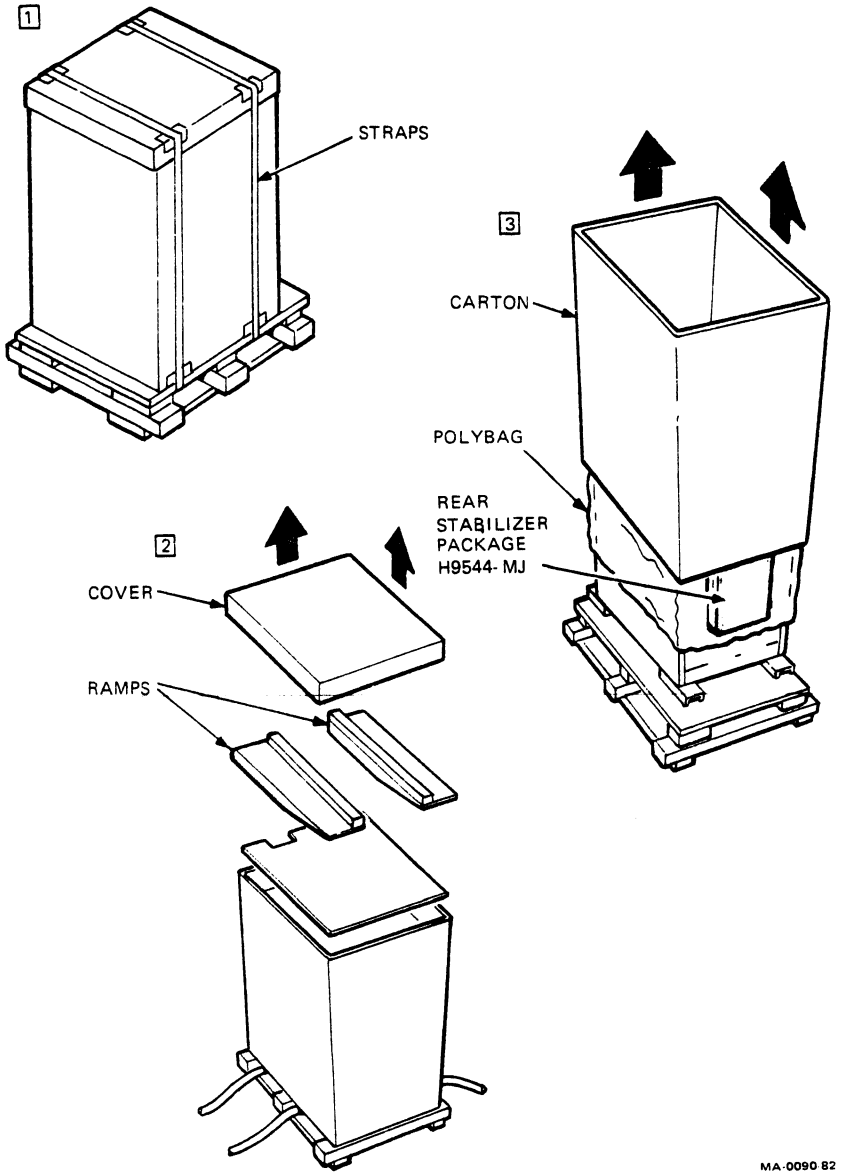


Figure 5-2 Unpacking the Transport

4. Lift and remove the protective carton (3).

5. Remove the top pad and polybag (3).

6. Remove the rear stabilizer package (H9544-MJ) from the rear of the transport cabinet.

> NOTE
> This package may not be supplied with the transport. Refer to step 10 in "Mechanical Installation" for more details.

7. Securely attach the two ramps to the skid deck. Use Figure 5-3 as a guide. Engage the ramps in the groove by matching the arrows.

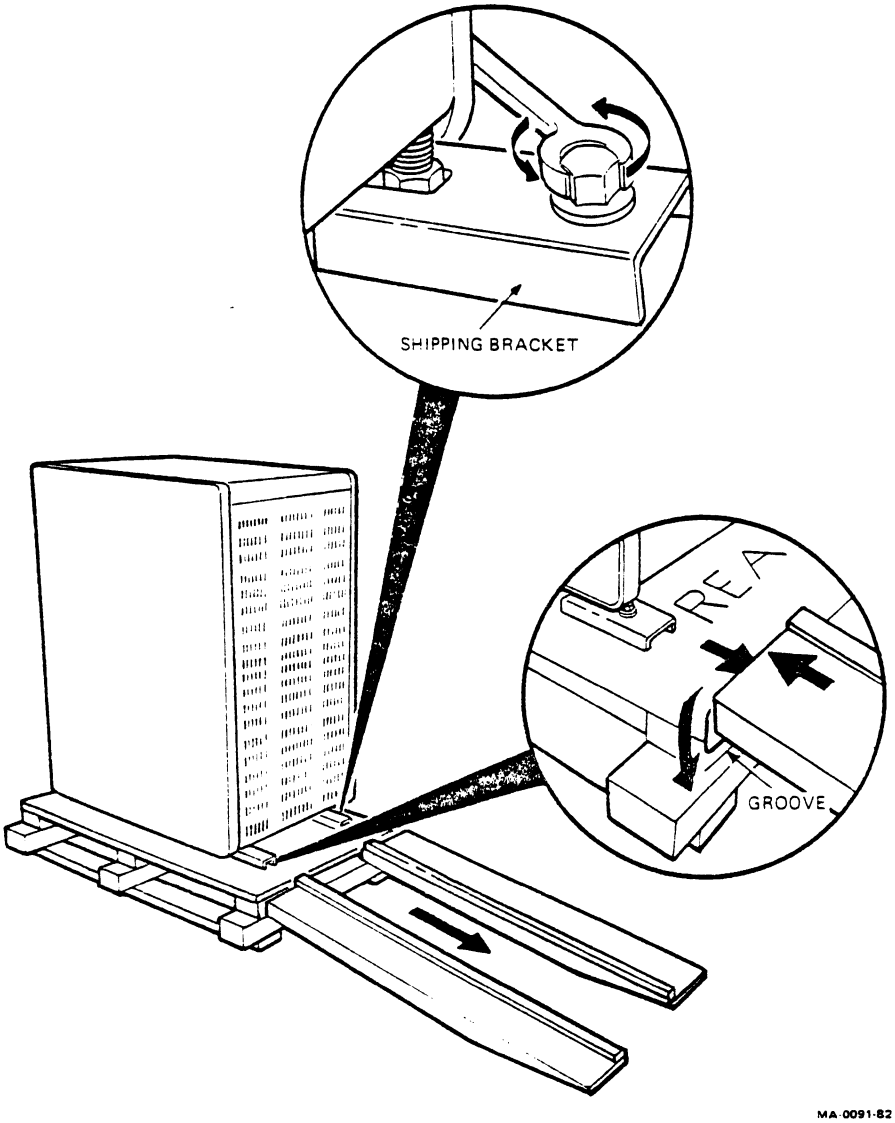


Figure 5-3 Removing the Transport from the Shipping Pallet with Ramps

8. Use a 9/16 inch wrench to unbolt and remove the four shipping bolts and the red shipping brackets (Figure 5-3).

NOTE
The process of deskidding, or taking the cabinet off the pallet (skid), is next. TAKE EXTREME CARE!

CAUTION
The cabinet can be rolled only when the leveler feet are raised.

9. Roll the transport toward the ramp-attached side of the skid by pushing gently on the front side of the cabinet.

10. Gently slide the cabinet backward on the ramps. Hold the transport firmly to prevent it from tipping. Let it roll off the skid, down the ramps, and onto the floor.

11. Remove the wooden ramps. Store the skid, ramps, and carton for future use.

Inspection
After removing the transport from its container, inspect it and report any damage to the responsible shipper and the local Digital sales office.

Inspect the transport as follows.

1. Inspect all panels, doors, door latches, and the control panel for any obvious damage.

2. Using a 5/32 inch allen wrench, open the front and rear doors. Inspect the cabinet for any foreign material and loose or damaged components or cables.

3. Pull the top cover latch and lift the top cover. Inspect the tape deck for broken glass, damaged magnetic head components, and damaged reels.

4. Check for any foreign materials that may have lodged in the tape reels. Rotate the supply and take-up reels.

5. Check the tape path for any sharp edges. Close the top cover and the front and rear doors.

OPERATION PREPARATIONS

Place the transport not further than 7 m (20 ft) from the host CPU. Leave adequate space (Figure 5-1) for air circulation and servicing.

Prepare for operation as follows.

Mechanical Installation

Use the following procedure to install the hardware.

1. Roll the transport to its correct location.

NOTE
The transport should be in front of any disk drive installed on the UNIBUS.

2. Open the rear door and remove the cardboard box with the TU81 accessory kit (TU81K-AC).

3. Remove the two screws holding the rear shipping bracket to the frame stabilizing bar (Figure 5-4).

4. Turn the rear shipping bracket around to its normal (transport operating) position and reinstall the two mounting screws.

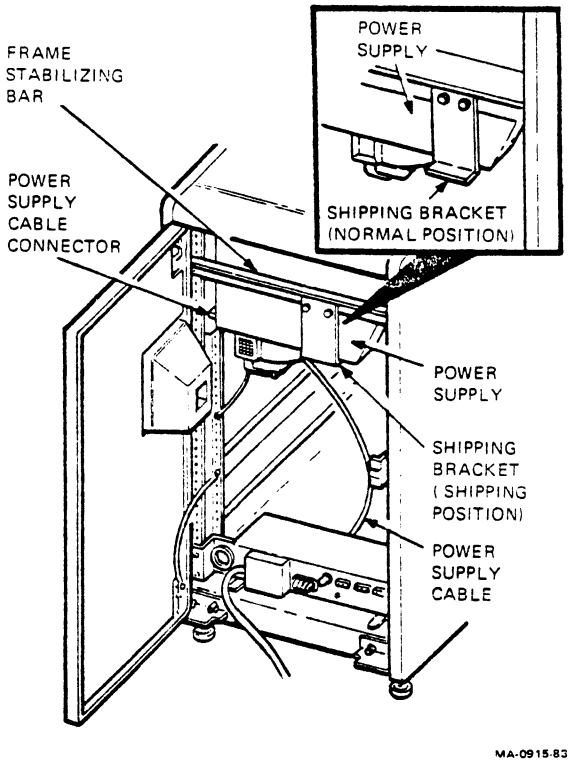


Figure 5-4 Rear Shipping Bracket

5. Open the front door and remove the horizontal shipping bar (Figure 5-5).

NOTE

The transport has two more shipping brackets that keep the logic PC boards in the logic cage secure during shipping. These brackets can stay intact until you need to replace any of the logic PC boards. Then, remove these brackets as described in the maintenance chapter of your service manual.

Return all shipping brackets to their original (shipping) positions before any reshipment.

Mechanical installation varies with the cabinet configuration (with or without a disk drive).

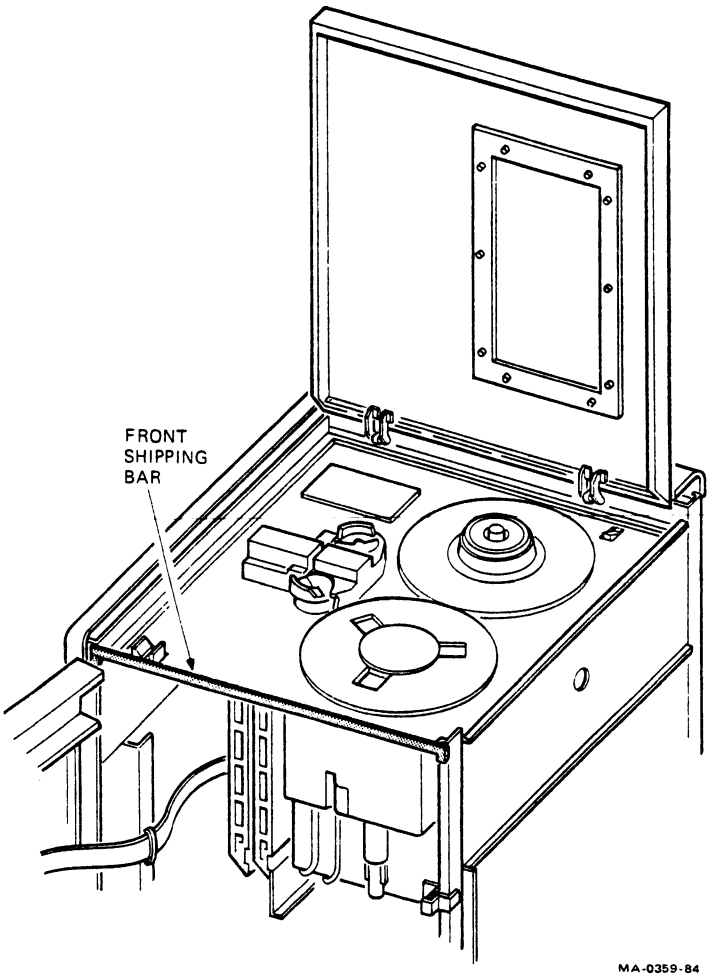


Figure 5-5 Removing the Front Shipping Bar

If a disk drive is in the cabinet, proceed with step 6. If not, skip to step 8.

6. Install the extension stabilizer (PN H9544-HC) (Figure 5-6).

   a. Unwrap the stabilizer and mounting hardware.

   b. Slide the stabilizer in place from the rear of the cabinet.

   c. Fasten the tether cable to the stabilizer with the supplied hex screw.

   d. Thread on the stabilizer's leveling foot.

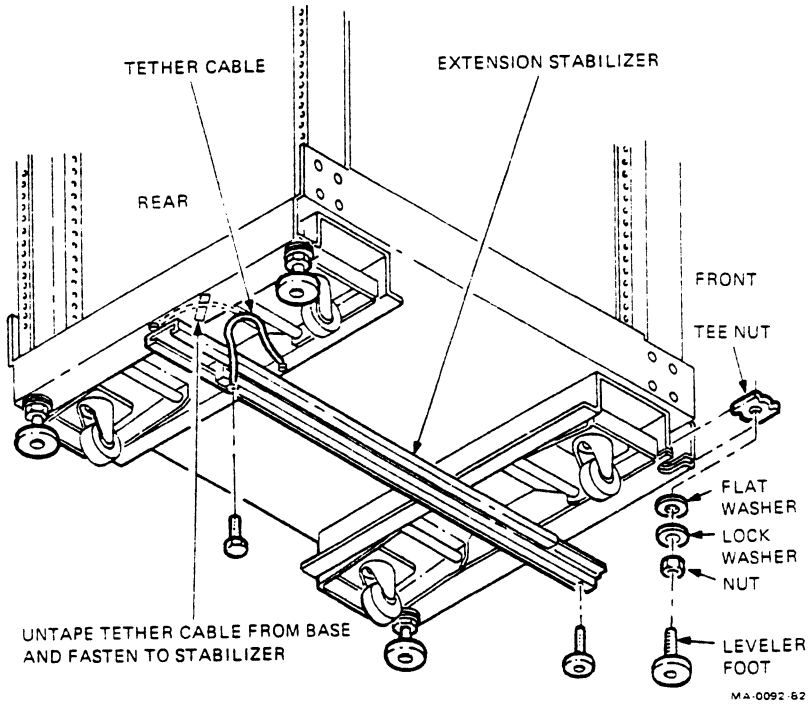


Figure 5-6 Cabinet Leveler Feet Assembly and Extension Stabilizer

7. Lower the four leveler feet as shown in Figure 5-7.

   a. Lower the leveler foot to contact the floor.

   b. Using a 3/4 inch, open-end wrench, turn the top nut up to the top and tighten it.

   c. Repeat for the remaining feet to stabilize the transport.

   d. Continue with "Electrical Connection."

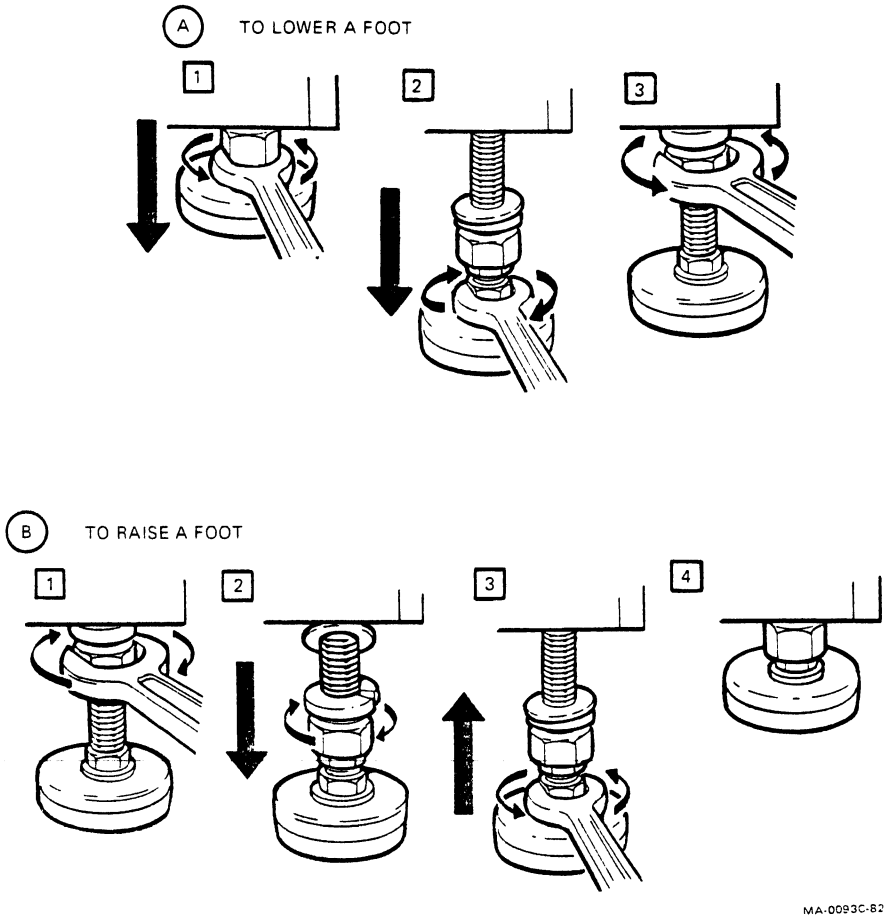


Figure 5-7 Leveler Feet Adjustments

If a disk drive is not in the cabinet, proceed with step 8.

8. Remove the two end (side) panels and the rear door as shown in Figure 5-8.

   a. Pull up the spring pins and remove the rear door (Figure 5-8A). Remove the ground strap using a 5/16 inch nut driver.

   b. Remove the door hinge brackets in the rear, bottom left and right corners of the cabinet with a 7/16 inch, open-end wrench (Figure 5-8B).

   c. Remove the end panels by lifting them up and away from the unit.

   d. Remove the ground straps from the side (end) panels with a 5/16 inch nut driver.

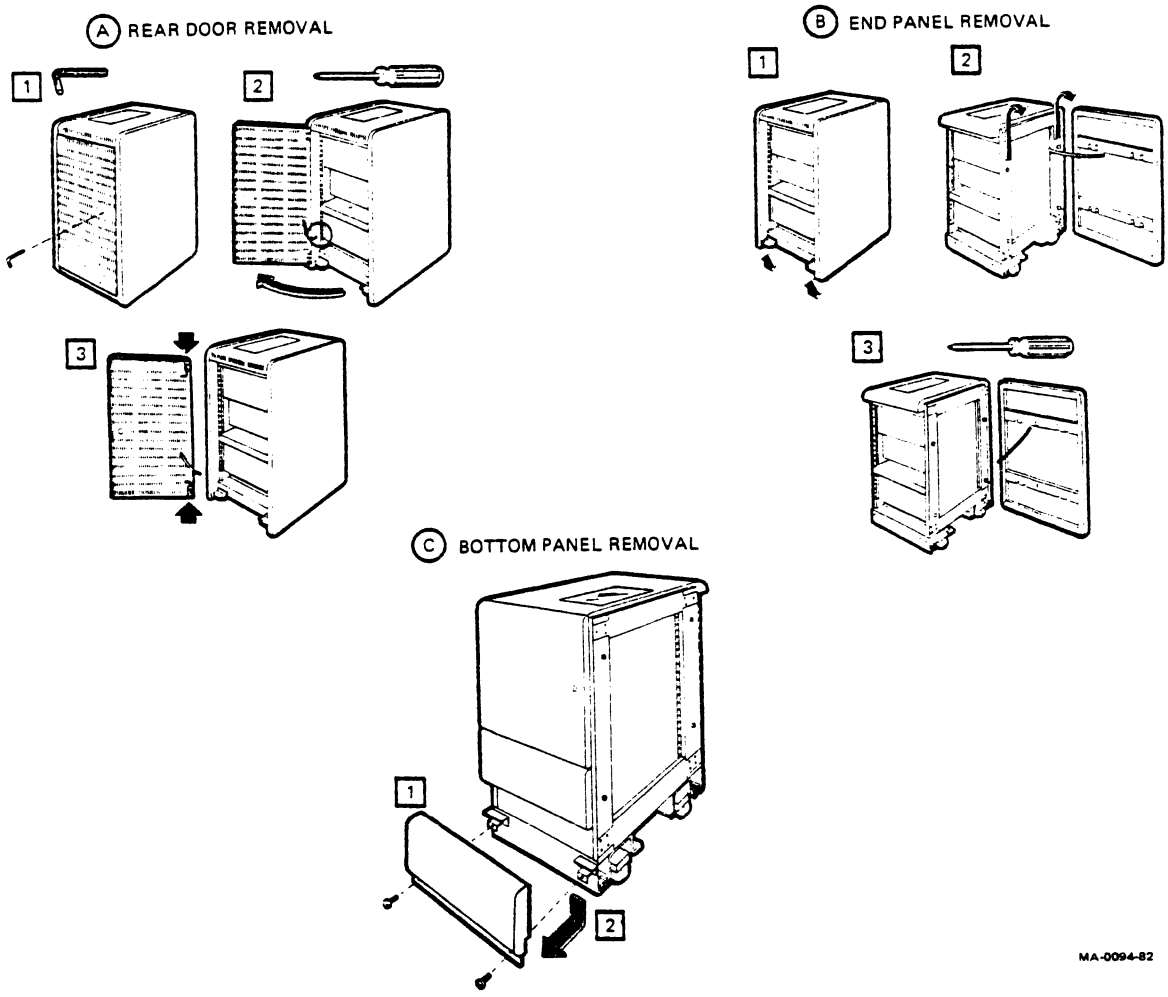


Figure 5-8 Cabinet Assembly

9. Remove the two rear leveler feet (Figures 5-6 and 5-7).

   a. Using a 3/4 inch, open-end wrench, loosen and lower the top nut on a foot.

   b. Place a 9/16 inch, open-end wrench on the bottom nut on a foot and turn the nut upward.

   c. Back the foot off the floor, then pull it outward to remove.

10. Unpack and install the rear stabilizer (PN H9544-MJ) (Figure 5-9).

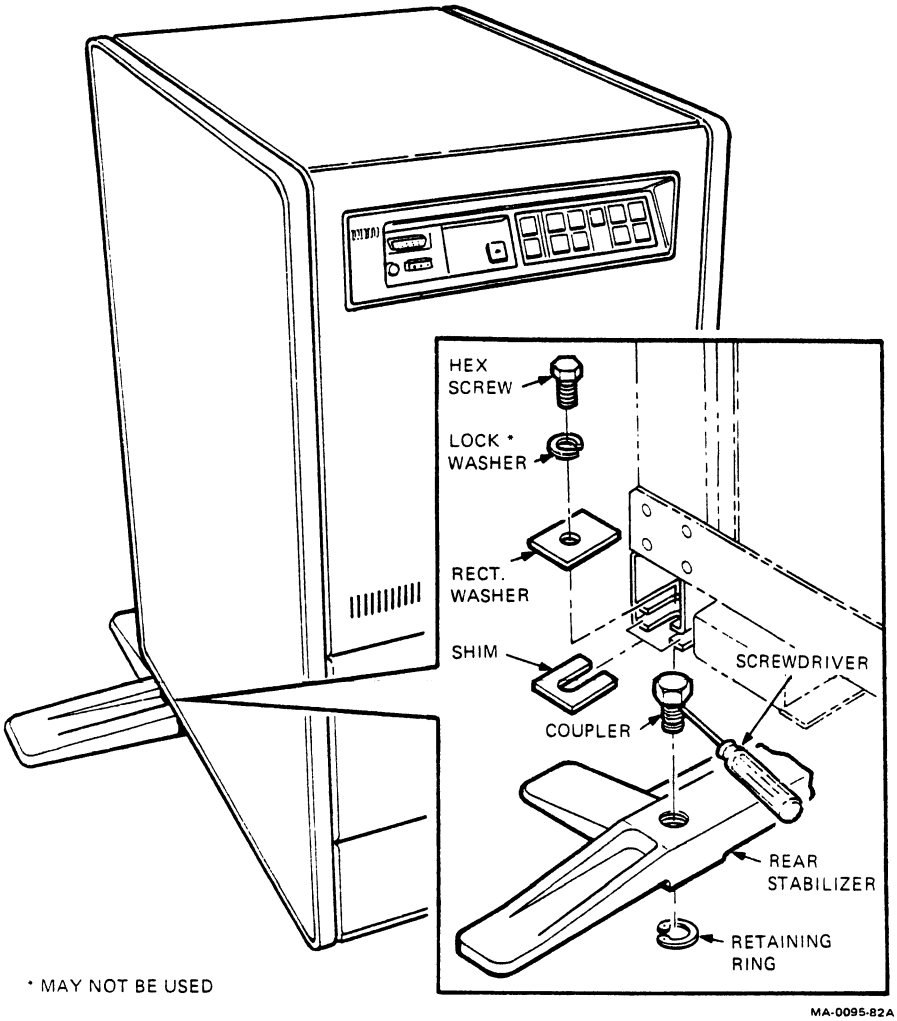


Figure 5-9 Rear Stabilizer Installation

NOTE

If you haven't received the H9544-MJ stabilizer with your transport, your transport may be equipped with the side stabilizers as shown in Figure 5-10. If so, skip this step completely.

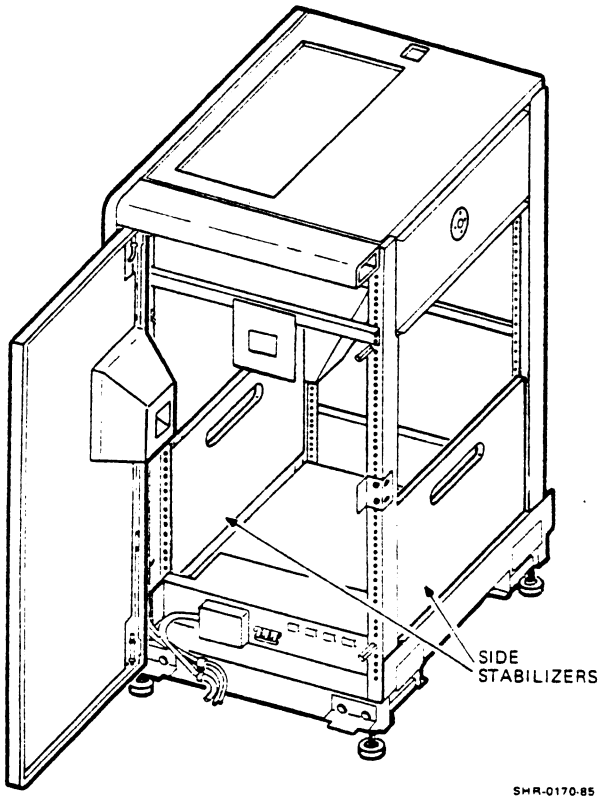


Figure 5-10 Side Stabilizers

a. Install two couplers in the stabilizer base.

b. Slide the stabilizer under the rear bottom of the cabinet so the couplers are directly under the mounting slots.

c. Install the rectangular washers, retaining washers, and hex screws. Do not tighten the screws yet.

d. Level the cabinet by adjusting the couplers. Use a screwdriver inserted into a hole in the coupler to jack it up.

NOTE

To raise the cabinet, turn the coupler counterclockwise. To lower the cabinet, turn the coupler clockwise.

e. Slide the shim(s) in place in the mounting slots.

f. Tighten the hex screw(s) with a 3/4 inch box wrench and number 2 phillips screwdriver.

11. Adjust the leveler feet to stabilize the cabinet (Figure 5-7). Use the 3/4-inch and 9/16-inch, open-end wrenches.

12. Replace the end panels and the rear door on the cabinet, and re-attach the ground straps.

NOTE

If you need to move the transport to another location within the room, raise the leveler feet. Release the nuts on the feet with the 3/4 inch and 9/16 inch, open-end wrenches (Figure 5-7). Then pull each foot up to the top.

Electrical Connection

Use the following procedure to connect the transport to power.

NOTE

Check the transport's data (ID) plate for power specifications. Make sure the local line voltage and frequency are compatible with the specifications.

1. Make sure the power ON/OFF circuit breaker on the 874 power controller is in OFF position and the REMOTE/LOCAL switch is set to the REMOTE position (Figure 5-11).

2. Connect the remote power switching cable from the 874 power controller (any of the four connectors) to the CPU (or HSC) power controller. Turn the system's circuit breaker off.

NOTE

The TA81 is connected to and remotely controlled by a HSC mass storage controller.

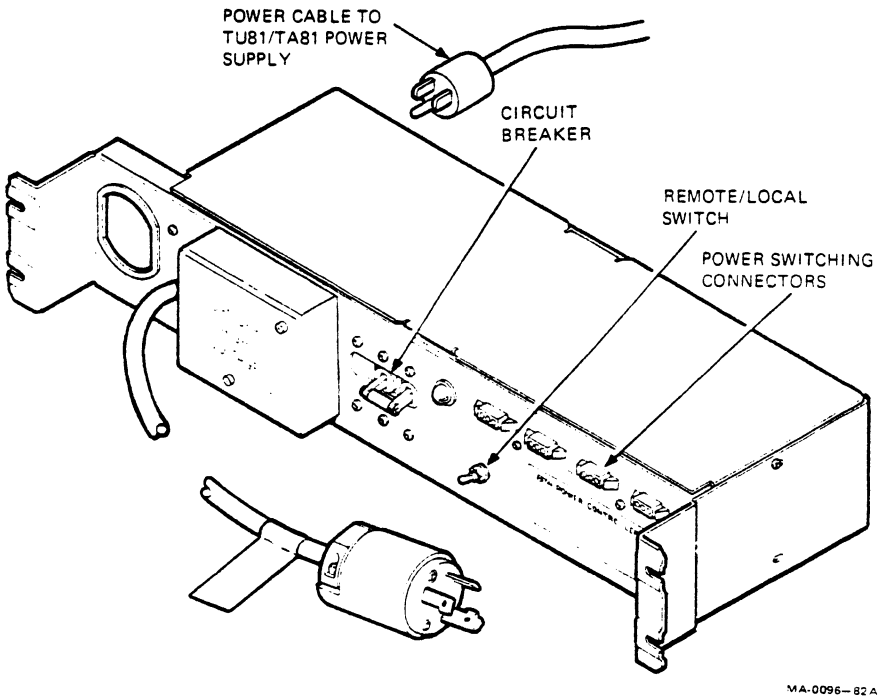


Figure 5-11 874 Power Controller

3. Make sure the power cable from the transport's power supply is plugged into the ac connector on the power controller.

4. Plug the power cord into a local power outlet. Set the circuit breaker on the 874 power controller to ON.

NOTE

Refer to the power specifications in Chapter 1.

5. Open the transport's top cover and set the power switch on (1).

6. Turn the CPU power on. The LOGIC ON indicator on the control panel should go on.

NOTE

When installed, the transport should be in the remote, power-on mode controlled by the CPU (or HSC).

7. Turn the CPU power off.

   a. Now, for a TU81, install the M8739 UNIBUS adapter and interface the transport with the CPU.

   b. For a TA81, connect the transport to one (or two) HSCs.

Grounding
The transport is grounded via a grounding line in the power cord. No other grounding is required.

TU81-TO-HOST INTERFACING
This section provides information on how to install, cable, and check the interface for TU81.

The TU81 communicates with the host computer via the UNIBUS/LESI interface, which consists of the LESI I/O cables and the M8739 LESI module. The M8739 is a standard, quad-height PC card. It plugs into a small peripheral controller (SPC) slot on the host computer backplane. The module contains a switch pack and jumper for setting the desired I/O address. Interrupt vector is not hardware settable. The vector is software selectable from the host computer at SYSGEN time.

The M8739 connects to the TU81 by a set of I/O cables. Figures 5-12 through 5-14 show the interface cable interconnections.

NOTE

Check for the CPU kit (TU81K-CP). If it is shipped with the transport, the M8739 has to be installed in the CPU. Call for the authorized Field Service representative to do this installation.

Refer to the installation procedure under "Add-On Configuration" in this chapter.

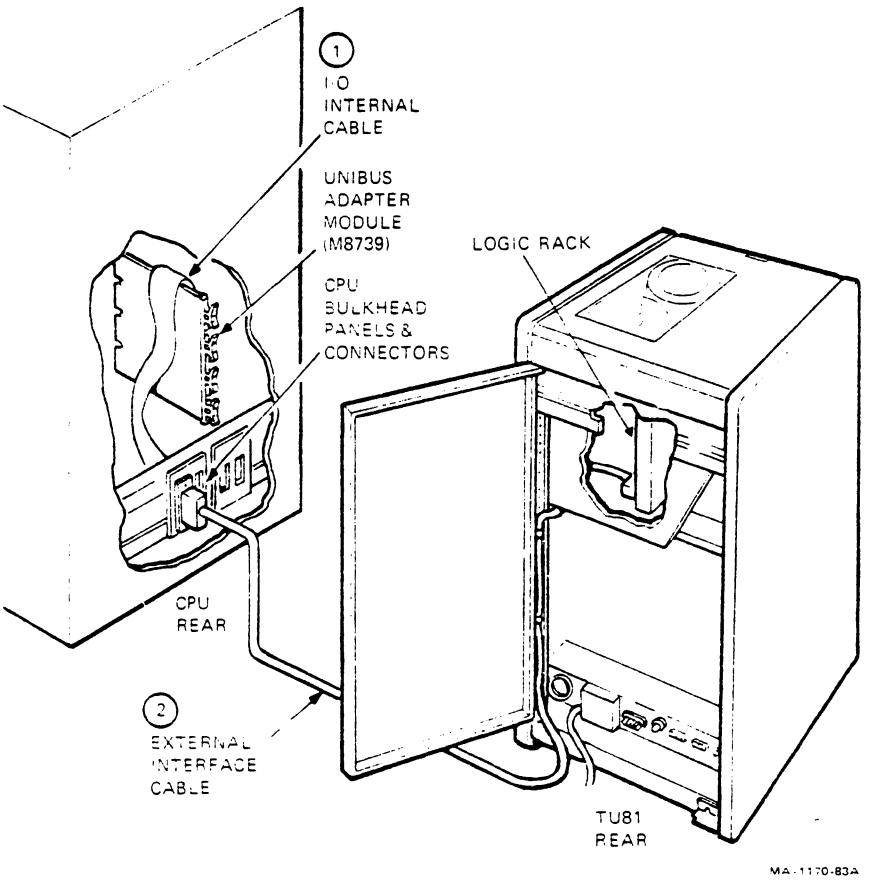


Figure 5-12 Interface Cabling

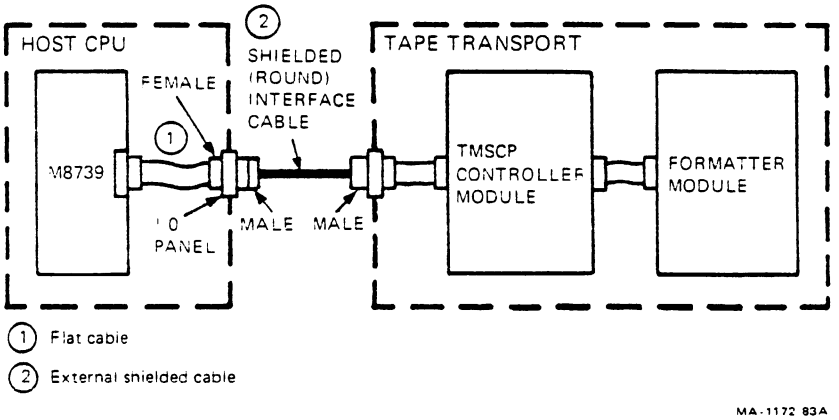


Figure 5-13 Cabling Connections

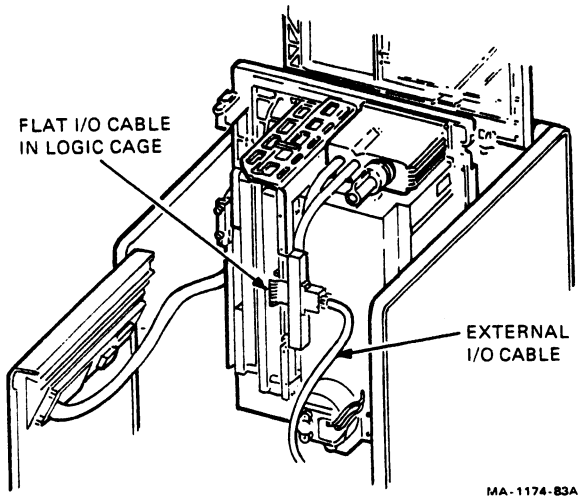


Figure 5-14 Tape Deck Access and Internal Cabling

Turnkey Configuration
If the TU81 is purchased (and supplied) as a part of the complete system, the M8739 module and CPU internal ribbon cable should already be installed. If so, all you need to do is connect the TU81 and CPU with the external I/O cable supplied with the transport.

TU81-to-Host External Cabling
Use the following procedure to cable the TU81 to the host computer.

NOTE
External cabling is a user-oriented procedure that does not require special training.

1. On the TU81, open the rear door and unroll the external I/O cable (PN BC17Y-20). The TU81 is shipped with this cable plugged in and secured in the socket on the logic cage panel (Figure 5-13). The flexible ribbon cable connects the external I/O cable to the TMSCP interface controller module inside the logic cage.

NOTE
Check for loose connections, lost mounting screws, and dangling cables or wires.

2. Insert and secure the other plug of the external I/O cable (PN BC17Y-20) into the available slot on the CPU I/O bulkhead as shown on Figures 5-12 and 5-19.

3. Now continue with the TU81 acceptance diagnostic tests.

Add-On Configuration

If the TU81 is an add-on to the host system, the M8739 module must be installed in the CPU with the CPU TU81 kit (TU81K-CP) and the TU81 accessory kit (TU81K-AC).

> **NOTE**
>
> **The following procedures must be performed by a trained Field Service representative.**

M8739 Preparation and Installation -- The following procedure describes how to install the M8739.

1. Remove the M8739 module, the ribbon cable, the CPU's bulkhead connector panels, and the mounting hardware from the TU81K-CP shipping container. Unwrap and examine them for damage.

2. On the M8739 module, select the correct UNIBUS address with a single, 10-position DIP switchpack (location E44) and jumper W2 (location E68). Figures 15A and 15B show the two versions of the M8739 module used with the TU81. Refer to Figures 5-15 and 5-16, and Table 5-1 for address settings.

   > NOTES
   >
   > If this is the first TU81 on the host CPU, just check the DIP switchpack and the jumper because the module is factory-set for the basic (one drive) configuration.
   >
   > The typical UNIBUS address and vector for a single TU81 subsystem configuration are specified in Table 5-1.
   >
   > When more than one (up to four) TU81 is installed with the host system, select the UNIBUS addresses for the second, third, and fourth TU81 with SYSGEN>CONFIG. SYSGEN>CONFIG shows the available CSR addresses. Refer to the example in Table 5-1.

3. Use the address setting diagram (Figure 5-16) to set the UNIBUS address. Figure 5-16 shows the diagram for the starting address 774500 in the basic configuration.

4. Set the switches on the 10-position, DIP switchpack according to the diagram. Address bits 12 through 3 are specified via the DIP switch. Address bits 17 through 13 are hardwired to be 1s. Address bit 2 is set by the W2 jumper. Address bits 1 and 0 are ignored.

5. Plug the ribbon I/O cable (PN 70-19923) into edge connector J1 on the M8739 module (Figure 5-15).

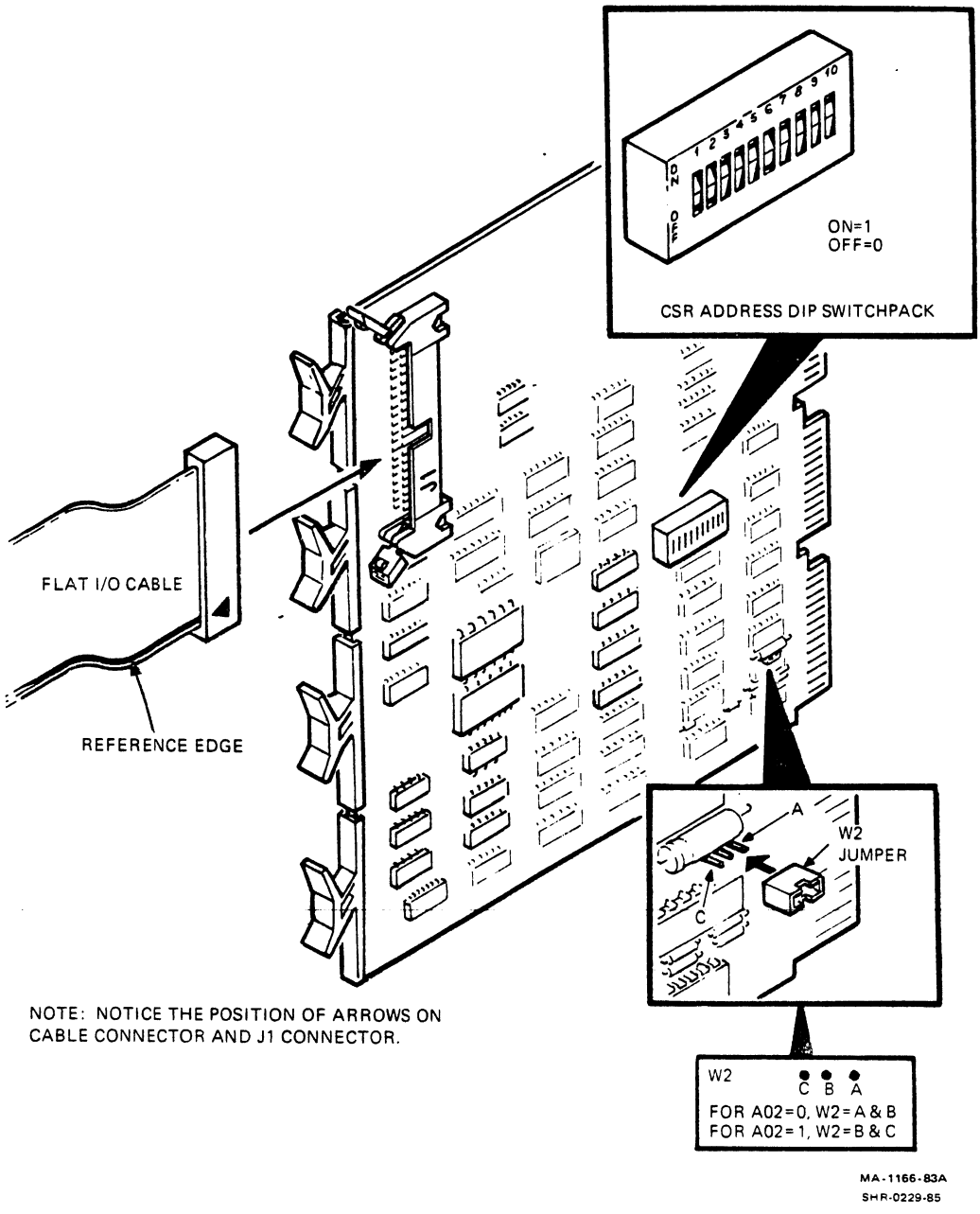


Figure 5-15A M8739 Module (Style A)

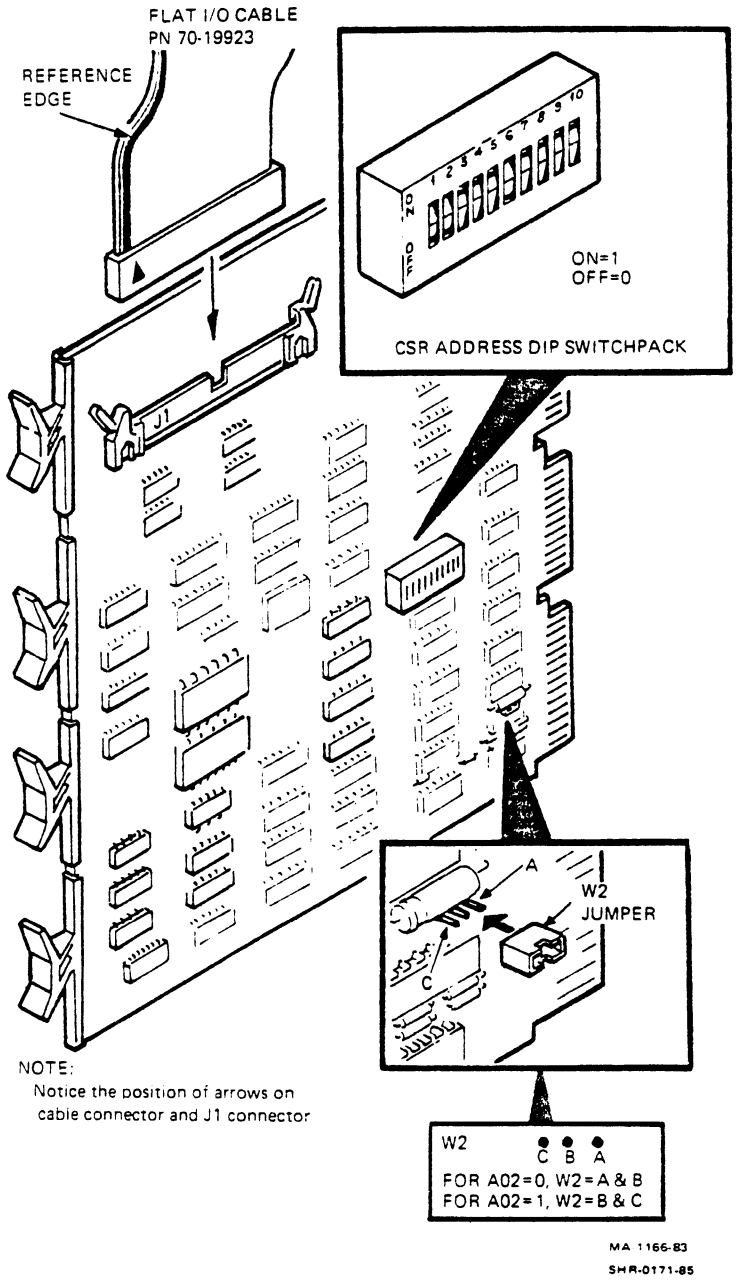


Figure 5-15B M8739 Module (Style B)

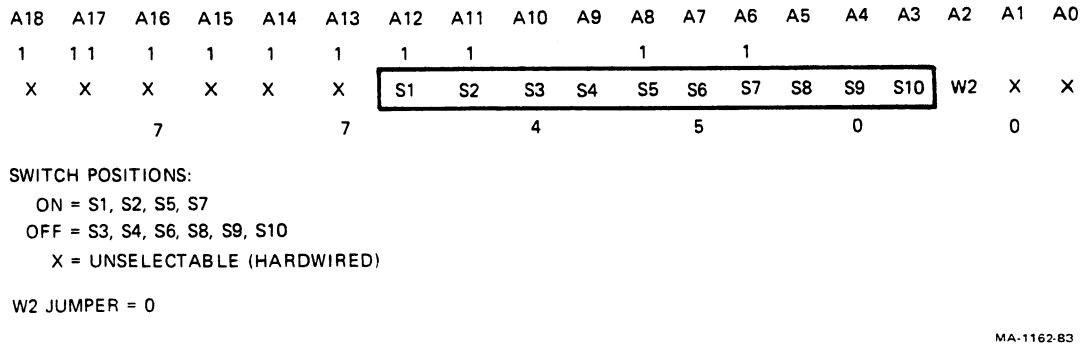


Figure 5-16 Address Selection Scheme

Table 5-1 Address Settings

Transport	Unit Number	Address	Vector	Configuration
1	0	1745008	2608	1 (unit 0)
		F94016	B016	
2 to 4		CSR range 7600008 to 7777748	Vector range 3008 to 7008	2 to 4 (units 1÷3)

Example -- Use the following SYSGEN procedure to find the available CSR addresses and vectors. Then set in the CSR address on the UNIBUS DIP switchpack (Figures 5-15 and 5-16).

```
$ MCR SYSGEN
SYSGEN> CONFIG
DEVICE> RK 611
DEVICE> DZ11
DEVICE> TU81, 3
DEVICE> ^Z

DEVICE: RK611    NAME: DMA   CSR: 777400   VECTOR: 210
DEVICE: TU81     NAME: PTA   CSR: 774500   VECTOR: 260
DEVICE: DZ11     NAME: TTA   CSR: 760100   VECTOR: 300
DEVICE: TU81     NAME: PTB   CSR: 760444   VECTOR: 310
DEVICE: TU81     NAME: PTC   CSR: 760450   VECTOR: 314
SYSGEN> ^Z
$
```

6. Turn off the power to the CPU.

7. On the CPU backplane, remove the G727 bus grant card from the desired SPC slot (Figure 5-17). A bus grant (continuity) card must be in connector D of any unused SPC slot. Otherwise, bus grant continuity will be lost.

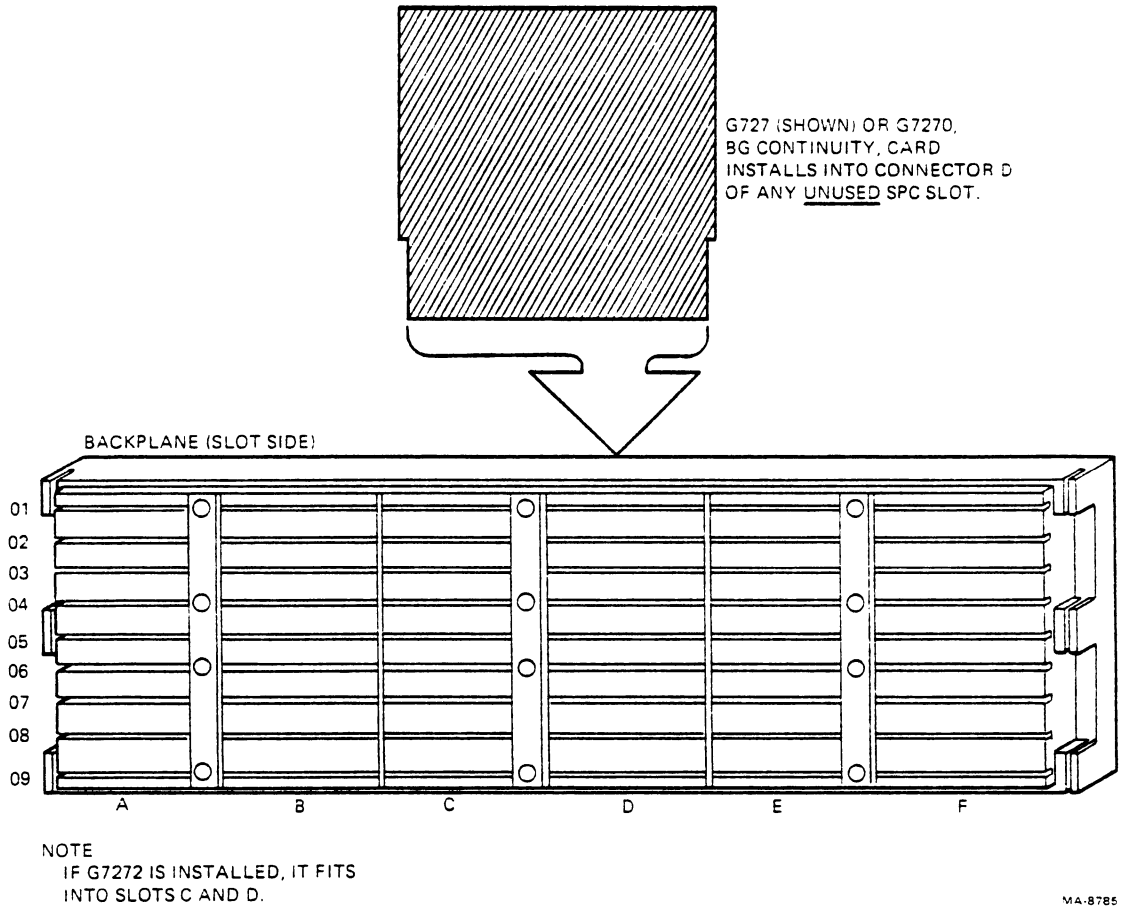


Figure 5-17 UNIBUS Grant Continuity Card

8. Also in the same SPC slot, remove the nonprocessor grant (NPG) jumper (CA1 to CB1) on the pin side of the backplane (Figure 5-18).

9. Carefully insert the M8739 module into the SPC slot.

NOTE

Examine the CPU for compliance with the FCC installation specifications. The CPU should have the I/O bulkhead connector frame. If this frame is not installed, refer to "Installing the I/O Bulkhead Frame."

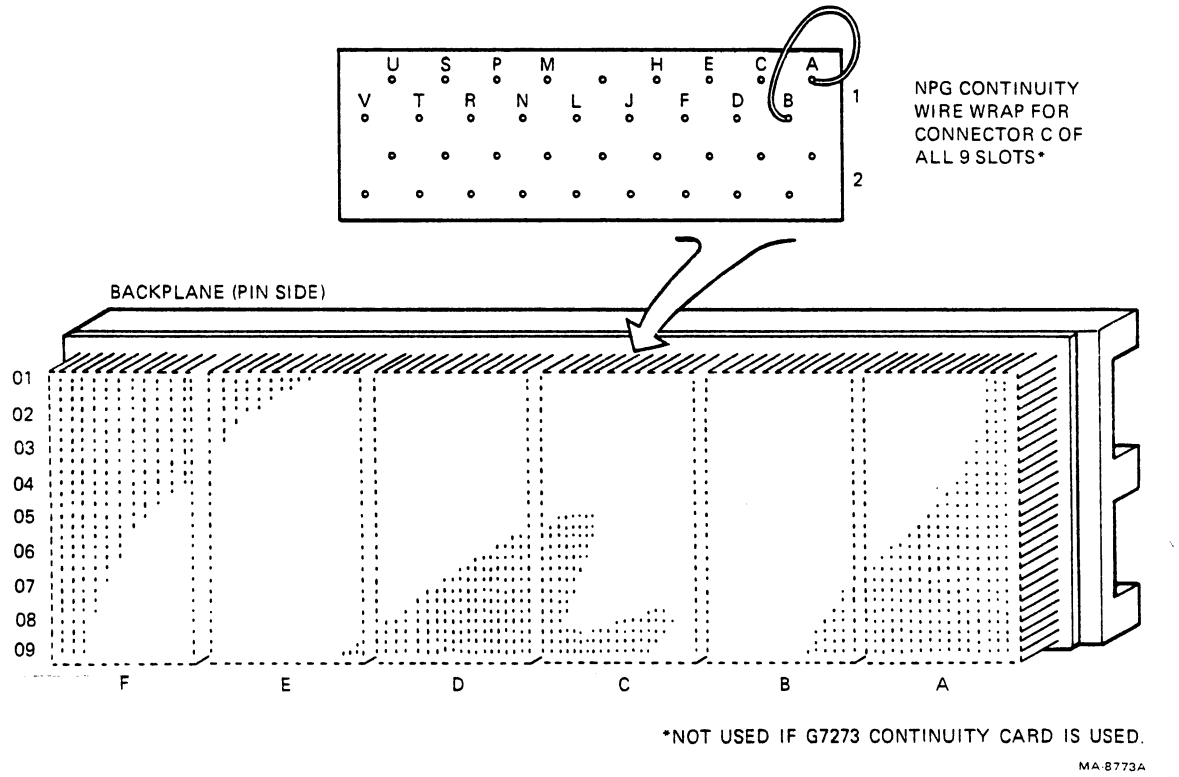


Figure 5-18 UNIBUS NPG Jumper

10. Install and secure the I/O panel (PN 74-26407-13) on the CPU's bulkhead frame at the bottom of the CPU cabinet (Figures 5-12 and 5-19).

11. Route the ribbon I/O cable from the M8739 through the CPU cabinet down to the I/O frame and insert the cable connector (female) into the I/O panel slot. Secure this connector in its position with the two 4/40 hex standoffs (PN 74-26407-13) provided.

NOTE

Do not chafe the ribbon I/O cable against other PC cards and chassis parts.

12. Insert the free plug of the external I/O cable from the TU81 into this I/O slot, connecting both I/O cables. Secure the connection with two screws (Figure 5-19).

13. Power on the CPU and proceed with system initialization and TU81 acceptance testing.

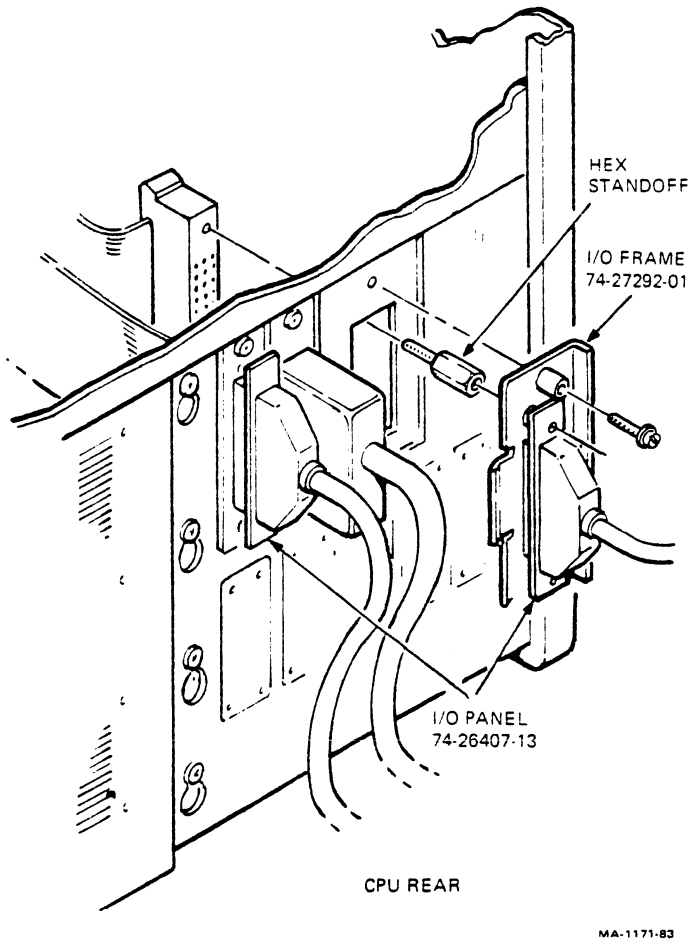


Figure 5-19 Installing the I/O Cables on the CPU Bulkhead

Installing the I/O Bulkhead Frame -- The following procedure describes how to install the I/O bulkhead frame on the CPU for FCC compliance.

1. Mount the I/O panel (PN 74-26407-13) on the I/O frame (PN 74-27292-01) and secure it with two screws (Figure 5-19).

2. Install the I/O frame (with the I/O panel) on the CPU rack. Find the best location on the CPU rack to accommodate internal and external cables.

   NOTE
   The best recommended location for the I/O frame is at the rear bottom of the CPU cabinet.

3. Continue with the M8739 installation as described in steps 9 through 13 above.

TA81-TO-HSC INTERFACING

This section provides information on how to install, cable, and check the interface for TA81.

The TA81 communicates with a host through an HSC mass storage server. A Tape Data Channel module in the HSC connects it through an STI bus to the TA81's STI module.

The cable connections required between the HSC and TA81 are shown in Figures 5-20 through 5-22.

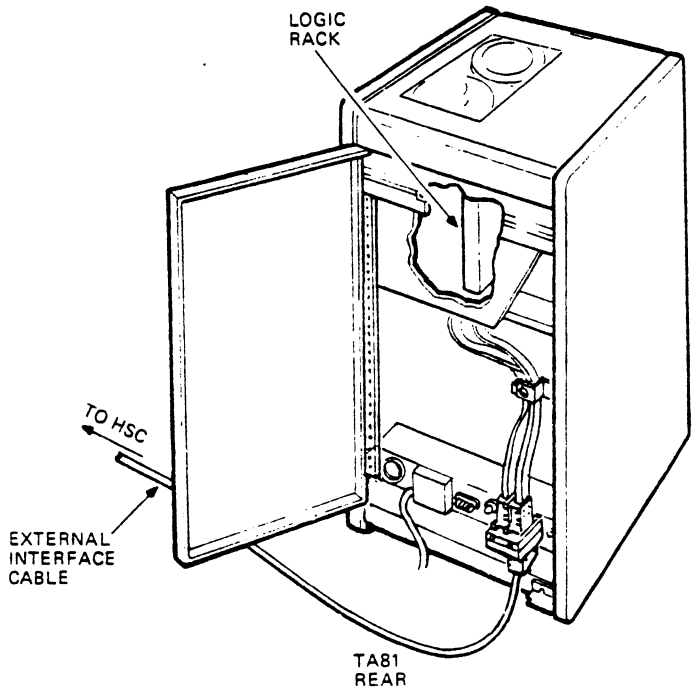


Figure 5-20 · TA81 Interface Cabling

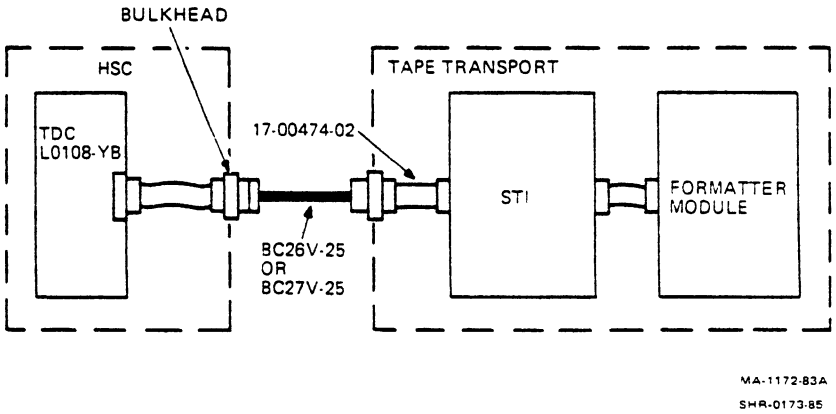


Figure 5-21 TA81 Cabling Connections

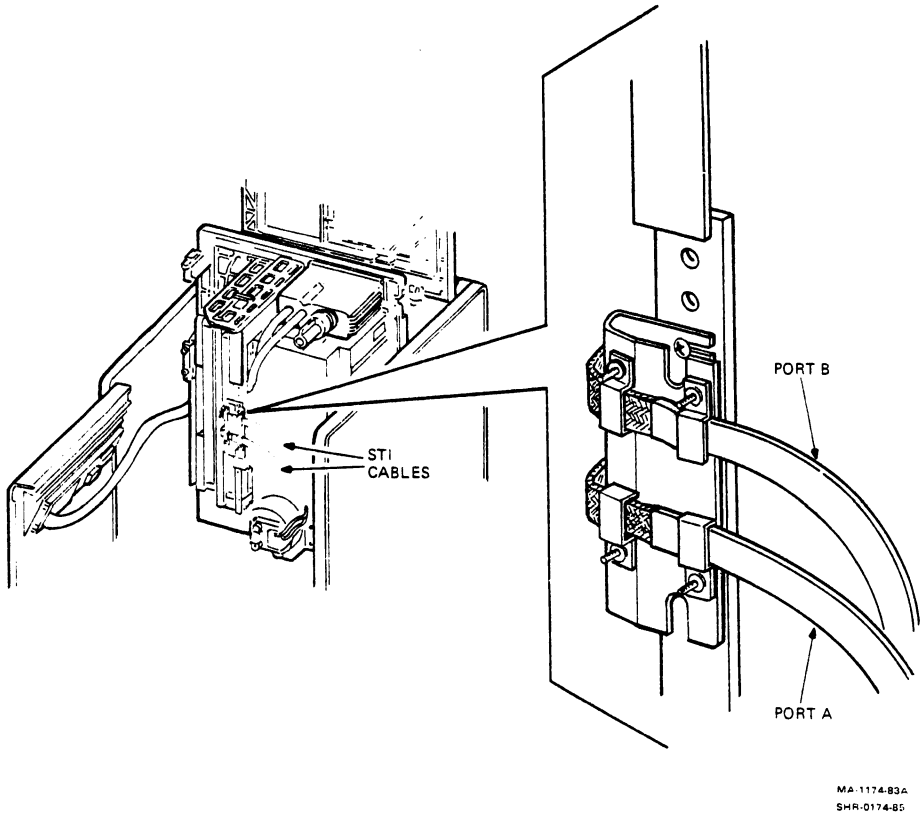


Figure 5-22 TA81 Tape Deck Access and Internal Cabling

TA81-TO-HSC External Cabling

Use the following procedure to cable the TA81 to the HSC mass storage server.

NOTE

External cabling is a user-oriented procedure that does not require special training.

1. On the TA81, open the rear door. Connect the flat STI bus cable (PN BC26V-25 or BC27V-25) from the HSC to the proper port connector in the TA81 (Figures 5-20 and 5-21). A cable (PN 17-00474-02) connects each STI bus cable to the STI interface controller module inside the logic cage.

NOTE

Check for loose connections, lost mounting screws, and dangling cables or wires.

2. Make sure that the other plug of the STI bus cable (PN BC26V-25 or BC27V-25) is securely connected to an STI connector on the HSC bulkhead.

3. Connect the remote switching control bus from the HSC to one of the front jacks on the 874-E/872-E power controller. (When both STI ports are used, connect a bus from both HSCs to the 874-E/872-E.)

4. Close the rear door of the TA81.

5. Make sure system power is off at the HSC(s). Connect the ac power cable from the 874-E/872-E to the power source.

6. Now continue with the TA81 acceptance diagnostic tests.

TU81 ACCEPTANCE DIAGNOSTICS

This section describes all the tests necessary to check and accept the TU81 subsystem.

TU81 acceptance testing includes the following resident and host diagnostics.

Resident Diagnostics

The power-on health check automatically runs when the power switch is turned on. See Chapter 3 for a description of this check.

M8739 Status Checking

On system power-on with an add-on TU81, the host computer automatically configures the transport into the system. If the M8739 fails at that time (or anytime afterward), the host computer cannot access the TU81.

If the M8739 fails during normal on-line operation, the host computer cannot continue to access the TU81. An error message is entered in the system error log.

NOTE

Use the SHOW DEVICE command to check the status of TU81, TMSCP module, and I/O connections.

VAX-Based Diagnostics

The following diagnostics are executed by the host VAX computer.

NOTE

Refer to the diagnostic documentation of the installed Digital computer for information on how to run and interpret the host diagnostics.

VAX Front-End Standalone Diagnostic, Tests 1 through 10 -- This diagnostic (EVMBB) checks the subsystem in all basic modes of operation, and tests the TU81 logic, interface bus, and I/O silo. It can run with the transport off-line only.

The front-end diagnostic consists of three test sections: default, manual, and fault. For acceptance testing purposes, use only the default and manual sections. Each section contains several tests that check various modules and functions of the TU81 subsystem.

The default tests do not need magnetic tape in their exercises. The manual tests require operator intervention to mount and remove magnetic tape when requested by the diagnostic at the console terminal.

VAX Data Reliability On-Line Diagnostic, Tests 1 through 3 -- This diagnostic (EVMBA) provides a complete tape subsystem checkout. It tests the TU81 while it is on-line without bringing the system down. This diagnostic consists of five tests.

NOTE
This diagnostic does not run in Standalone mode.

Test 1, acceptance test
Test 2, qualification test
Test 3, multidrive test
Test 4, read interchange test
Test 5, conversation mode test

Basic Operating Instructions -- Follow these instructions when running VAX-based diagnostics.

1. Load the diagnostic supervisor (ENSAA, ECSAA, or ESSAA) for the appropriate computer system.

   NOTE
   Use ENSAA on VAX-11/730, ECSAA on VAX-11/750, and ESSAA on VAX-11/780.

2. Attach and select the devices to be loaded in one of two ways.

   NOTE
   DS is the prompt from the diagnostic supervisor. Do not type DS.

   Load the diagnostic in the beginning (before the devices are attached) only if the supervisor revision does not support TU81.

   Operator responses are underlined throughout the procedure.

a. In prompt mode, type:

```
DS> Load EVMBA
DS> Attach (UNIBUS)
Device Type? DWXXX*
Device Link? HUB DWO 3 4
DS> Attach (LESI/TU81)
Device Type? TU81
Device Link? DWO
Device Name? MUAO
CSR? 774500
Vector? 260
BR? 5
```

b. In explicit mode, type:

```
DS> Load EVMBA
DS> Attach DWXXX HUB DWO 3 4 (This is UNIBUS.)
DS> Attach TU81 DWO MUAO 774500 260 5 (This is
LESI/TU81.)
```

NOTE

For control flags, refer to the VAX diagnostic listings.

* XXX can be 780, 750, or 730.

Acceptance Test Example -- This procedure is for the TU81 and VAX-11/780. You can use any other VAX CPU instead.

NOTE

Before starting any acceptance test, power to the CPU and TU81 must be off.

1. Plug the TU81 into the local power outlet. Power on the CPU.

2. Power on the TU81 by setting the ON/OFF power switch on the tape deck to the ON position. This step activates the built-in, power-on health check to verify normal dc power distribution and normal operation of all control panel indicators. (See "Power-On Health Check" in Chapter 3.) The check is successful when the LOGIC ON and FILE PRO indicators light and a unit number (201, for example) appears on the 3-digit display on control panel (with all other indicators off).

NOTE

If a fault code appears on the 3-digit display, or if the LOGIC OFF indicator lights, or if you find any other failure, contact a Field Service representative.

3. Log in on the system.

4. Check the devices' status and connections with the SHOW DEVICE command.

```
$ SHOW DEV PT (Checks the I/O modules.)
$ SHOW DEV MU (Checks the TU81 status.)
```

5. Run the EVMBB diagnostic. Load EVMBB by booting a load media device.

```
>>>B/10 DXXX*
(DXXX = BOOT DEVICE)

DIAGNOSTIC SUPERVISOR, ZZ-ESSAA
DS> LOAD EVMBB
DS> ATTACH DWXXX HUB DWO 3 4
DS> ATTACH TU81 DWO MUAO 774500 260 5
DS> SELECT MUAO

To start the default section (tests 1 to 9), type:

DS>START
```

* XXX can be 780, 750, or 730.

Complete the section with no fatal errors. To continue with the manual section (test 10), type:

```
DS>RUN EVMBB/SEC:MANUAL
```

The diagnostic gives you the following instructions.

```
MOUNT A SCRATCH TAPE LOADED, ON-LINE, AND WRITE ENABLED
Is the tape ready? Y
```

The test starts. Test 10, the functional fault detection test, runs for about 10 minutes with different tape motions and read/write operations. When the unit number appears on the 3-digit display, the test is successful.

6. Continue with the EVMBA diagnostic.

```
$ RUN ECSAA

DIAGNOSTIC SUPERVISOR, ZZ -- ECSAA

DS> LOAD EVMBA
DS> ATTACH DWXXX HUB DWO 3 4
DS> ATTACH TU81 DWO MUAO 774500 260 5
DS> SELECT MUAO
DS> START/SEC=DEFAULT
```

PDP-11-Based Diagnostics

The following diagnostics are executed by the host PDP-11 computer.

NOTE

Individual PDP-11 diagnostics to be used to test the TU81 will be described in the next revision of this document.

Basic Operating Instructions -- Follow these instructions when running PDP-11-based diagnostics.

1. Load XXDP+ monitor.

   a. Enter date.

2. Answer hard core questions.

   a. 50 Hz? Y or N
   b. LSI? Y or N

   This is XXDP+. Type H or H/L for details (Help File).

   [Receive XXDP+ prompt (dot)]

   .

3. Enter R (space) program name.

   The program may be TUFDD0 (for example)

   The operator entry should look like this:

   [.R TUFD??]

4. Receive DR> prompt.

5. Enter the appropriate command.

   For example,

   DR>STA to start the test.

6. Change HW(L)? "Y" or "N" - to run the diagnostic, the answer must be "Y".

7. Change SW(L)? "Y" or "N".

NOTE

Refer to the Diagnostic Listing for specific progam problems and instructions.

No hard errors are allowed.

Hardware Parameters - The following are the TU81 base address and vector assignments.

Unibus Address = 774500

Unibus Vector = 260

Example of commands: STA/TES:2/FLA:IDU:LOE

Example meaning: Start Test 2, inhibit dropping unit, and loop on error.

Software Parameters - Refer to Diagnostic Listings.

TA81 ACCEPTANCE DIAGNOSTICS

This section describes all the tests necessary to check and accept the TA81 subsystem.

TA81 acceptance testing includes the following resident and host diagnostics.

Resident Diagnostics

The power-on health check automatically runs when the power switch is turned on. See Chapter 3 for a description of this check.

Subsystem Level Diagnostics
Two subsystem level diagnostics, ILTAPE and ILEXER, verify proper TA81 operation.

To run these diagnostics, mount and load a write-enabled 267 mm (10.5 in) tape reel. Place the transport on-line and make sure the on-line indicator lights. Depending on the STI port being driven, set the PORT SELECT A or B button on the TA81 control panel to the enable (in) position.

The paragraphs that follow briefly describe these two diagnostics.

In-Line Tape Diagnostic (ILTAPE) -- ILTAPE is capable of running all the drive-resident formatter microdiagnostics from the HSC. A canned sequence, test 01, tests the TA81 transport functions. A second canned sequence, test 05, is available to verify the streaming function.

In-Line Exerciser (ILEXER) -- This diagnostic exercises from 1 to 10 units in any combination of disk and tape drives connected to an HSC. Logic is tested by writing and reading predetermined data patterns and recording modes.

ILTAPE and ILEXER are run from the HSC ASCII port. Refer to the appropriate HSC user documentation for more information.

Perform the following procedure to test the TA81.

1. Run ILTAPE Formatter canned sequences 1 and 5 for one pass. No errors are allowed. (When both STI ports are used, also run ILTAPE through the second port for one pass.)

2. Run ILEXER. Use the GCR worst case data pattern (22) for 15 minutes. Table 5-2 lists the acceptable error criteria. (When both STI ports are used, also run ILEXER through the second port for 15 minutes.)

Table 5-2 Maximum Error Number

Error Type Designation	Description	Allowed Number (Per pass of 2400 ft reel)
Hard	Nonrecoverable	0
Media	Tape media	20
Double Trkerr	Double-track correction (read)	1
Double Trkrev	Double-track correction (read reverse)	*
Single Trkerr	Single-track correction (read)	5
Single Trkrev	Single-track correction (read reverse)	*
Other Err A	Other (read)	10
Other Err B	Status	*
Other Err C	Other (write)	10

* Indicates designations not used by TA81. Headings appear on the error report, but these designations always report 0 errors.

NOTES:

1. Other (read) -- Successful operation without error correction, but with interesting occurrence (AMTIE or PHTIE flag).

   Other (write) -- Write retry succeeded in same physical location that previous write retry failed.

2. If the TA81 does not meet these specifications, additional run time is necessary to determine the validity of errors.

Booting the HSC -- Follow these instructions when running HSC-based diagnostics.

1. Boot the HSC by pressing the INIT button on the HSC. The following message is displayed:

   INIPIO-I Booting...

   The boot process takes about two minutes. When it is complete, the following message appears.

   HSC50 Version XXXX Date Time System n

2. Type Control Y. The following prompt appears.

   HSC50>

Running ILTAPE Example (Test 01) -- In response to the HSC prompt shown above, enter the command to run ILTAPE, then answer the user dialog questions as shown.

```
HSC50>R ILTAPE
ILTAPE>D>hh:mm Execution Starting
DRIVE UNIT NUMBER (U) [ ]?Tnnn (nnn=unit number assigned)
EXECUTE FORMATTER DIAGNOSTICS (YN) [N]?N
EXECUTE TEST OF TAPE TRANSPORTATION (YN) [N]?Y
IS SCRATCH MEDIA MOUNTED (YN) [N]?Y
FUNCTIONAL TEST SEQUENCE NUMBER (D) [1]?1
SELECT DENSITY (1-800, 2-1600, 3-6250) [3]?3
DATA PATTERN (D) [3]?3
ITERATIONS (D) [1]?1
```

One pass of ILTAPE test 01 runs.

Running ILTAPE Example (Test 05) -- Responses to the HSC prompt and user dialog questions are the same as those to run test 01 until the following questions.

```
FUNCTIONAL TEST SEQUENCE NUMBER (D) [1]?5
SELECT DENSITY (1-800, 2-1600, 3-6250) [3]?3
ILTAPE>D>FIXED SPEEDS AVAILABLE:
ILTAPE>D>                (1) 025 IPS
ILTAPE>D>                (2) 075 IPS
SELECT FIXED SPEED (D) [0 = AUTOMATIC]?0
DATA PATTERN NUMBER (D) [3]?3
ITERATIONS (D) [1]?1
```

One pass of ILTAPE test 05 runs.

APPENDIX A
TUR8X ADD-ON INSTALLATION

INTRODUCTION

This appendix explains how to install an RA80 or RA81 Disk Drive into a TU80 or TU81/TA81 Tape Drive cabinet.

The term disk drive refers to the RA80 or RA81. The term tape drive or cabinet refers to the TU80 or TU81/TA81 Tape Drive cabinet.

REQUIRED TOOLS AND SUPPLIES

You will need the following items to perform the TUR8X installation.

5/32 inch allen wrench
5/16 inch nut driver
Number 2 phillips screwdriver, medium length
3/8 inch nut driver
Adjustable wrench
Flat-blade screwdriver
One pair of diagonal cutters

Parts List (Hardware Kit)

You will find the following hardware in the disk drive carton (Figure A-1). The hardware listed reflects only what you need to merge the RA80 or RA81 Disk Drive with the TU80 or TU81/TA81 Tape Drive cabinet. For a more complete parts list, refer to the RA80, RA81, TU80, and TU81/TA81 Illustrated Parts Breakdowns (IPBs) and the TUR80 -- D/E Tape Disk Subsystem Parts List (K-PL-TUR80-0-DBP).

Digital PN	Description	Quantity
12-13686-00	Chassis slide set	1*
12-13686-01	Mounting rail set	1
74-19261-00	Chassis slide bracket	4*
74-28330-00	Electrostatic discharge bracket	2*
74-25167-01	Spacer, slide mount	2*
74-25168-01	Bar, nut	4*
90-09700-00	10-32 X 0.31 PPH sem screws	12*
H9544-HC	Extension stabilizer	1
36-13390-00	Warning label, Rev B	1
70-19692-01	Plug assembly (RA8X)	1
70-18340-01	I/O bulkhead drive module	1
90-06022-01	Number 6-32 X 3/8 inch PPH screw	1
90-06659-00	Number 6 flat washer	1
90-07032-00	Cable tie	6
90-07083-00	3/8 inch cable clamp	1
90-07867-00	Cable tie push mount	1
90-07801-00	Split washer	1
90-09718-02	Grommet	1
EK-ORA80-UG	RA80 User Guide	1
EK-ORA81-UG	RA81 User Guide	1
90-10174-01	8-32 X 0.31 sem screws	12

* Part of RA80/RA81 Mounting Hardware Kit.

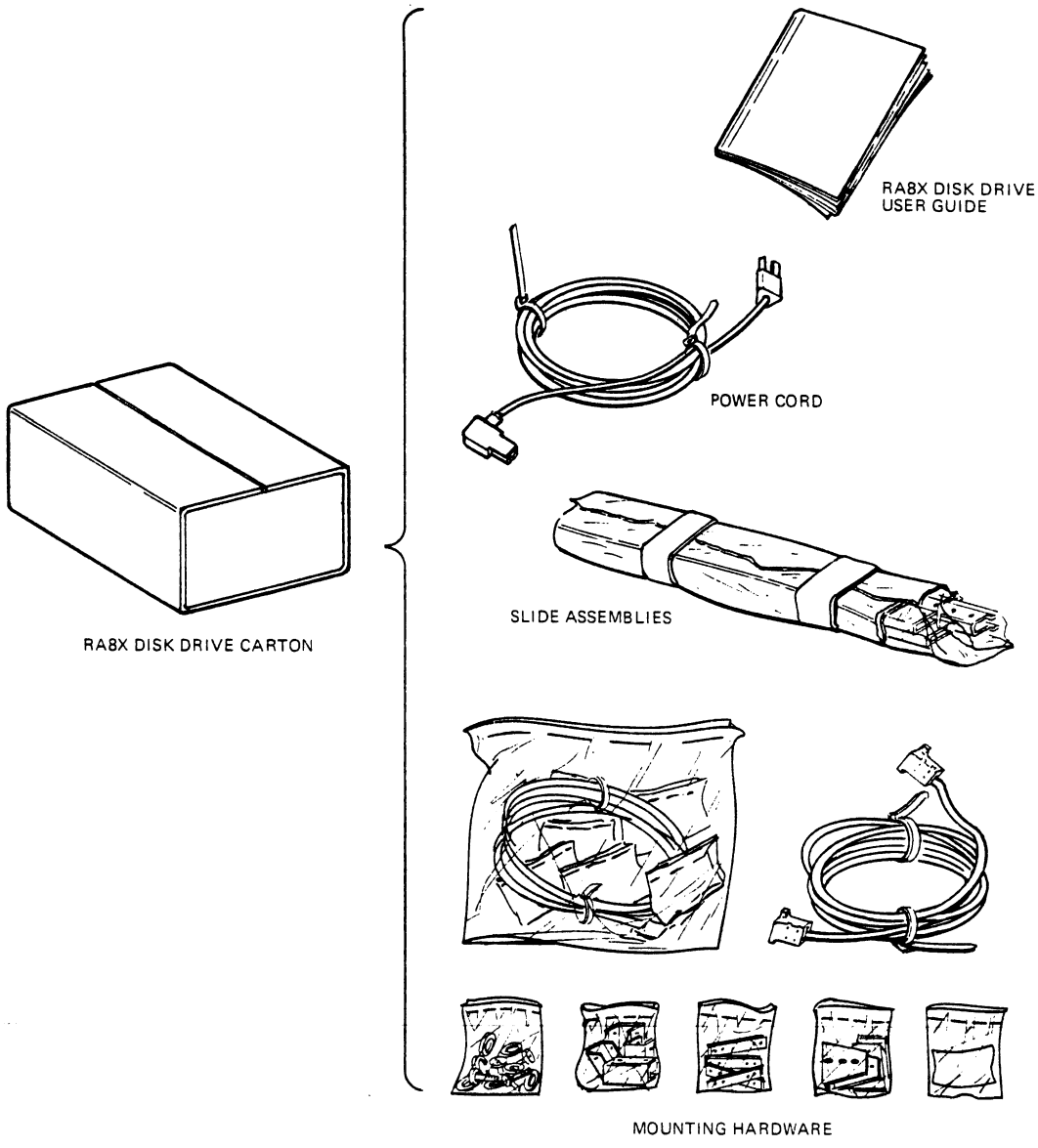


Figure A-1 Carton Contents

IF PARTS ARE MISSING
If you determine that parts are missing from the disk drive carton, call your local Digital representative (phone numbers are listed in Chapter 4 of this book) or your carrier immediately. Do not continue.

IF YOU NEED HELP
Contact your local Digital representative if you have problems during the installation procedure. The Digital Field Service office numbers are in Chapter 4 of this book.

BEFORE YOU BEGIN
Place both the TU80/81 cabinet and the RA80/81 Disk drive near each other. Make sure that the area you are working in is large enough for you to perform the procedure comfortably. A utility table nearby for holding tools and parts may be useful.

It's a good idea to locate the TU80 or TU81 cabinet near its final location.

GOAL

The goal of this procedure is to successfully merge an RA80 or RA81 Disk Drive into a TU80, TU81, or TA81 Tape Drive cabinet. At the beginning of this procedure, the tape drive will look like Figure A-2.

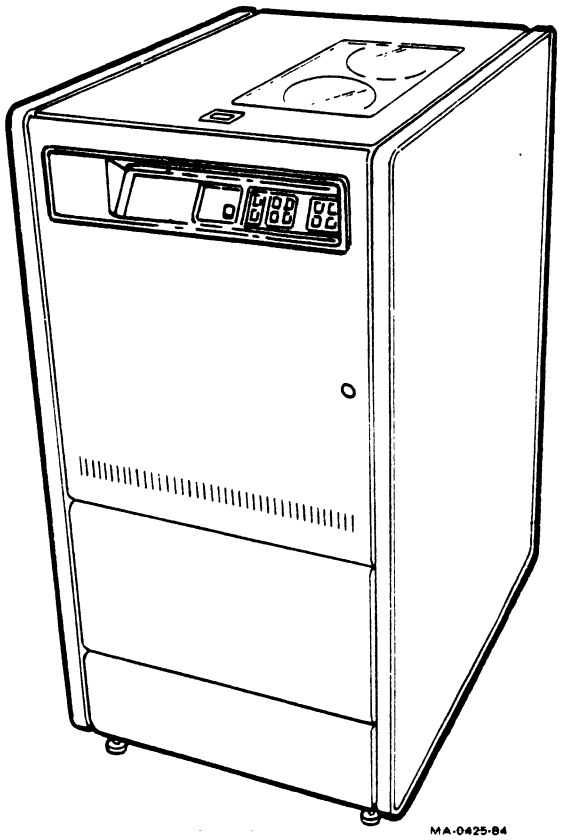


Figure A-2 Tape Drive Before Merge Procedure

Figure A-3 shows a completed TUR8X (merged disk drive/tape drive).

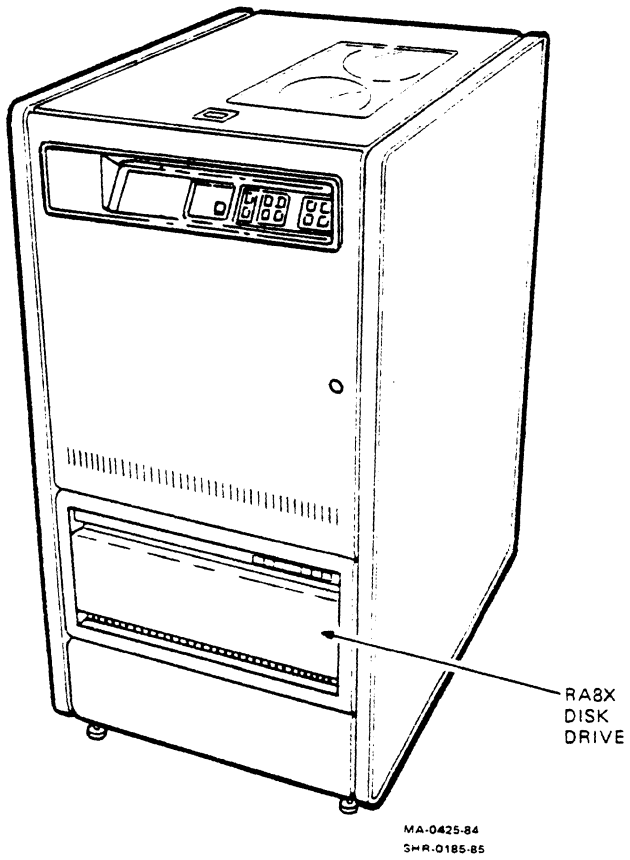


Figure A-3 TUR8X-merge Complete

UNPACKING AND SET UP

Following is the set up procedure for installing the disk drive into the tape drive cabinet.

1. Unpack the tape drive and remove it from its shipping skid. Follow the instructions in the TU80 User Guide (EK-OTU80-UG) or TU81/TA81 Tape Subsystem User Guide (EK-TUA81-UG).

   CAUTION

   If you are performing this procedure on a previously installed TU80 or TU81/TA81 tape drive, make sure its power cord is disconnected from the wall socket.

2. Cut the shipping bands to unpack the disk drive. Remove the top of the carton.

3. Remove the disk drive mounting hardware kit from the box and put it aside. You'll need it beginning in step 1 of the Assembly section.

4. Use a 5/32 inch allen wrench to open the back door of the TU80/81 cabinet. Use a 5/16 inch nut driver to remove the ground wire from the door (Figure A-4). Once you've disconnected the ground wire, screw the ground screw and washer back into the ground stud on the door, so it won't get lost.

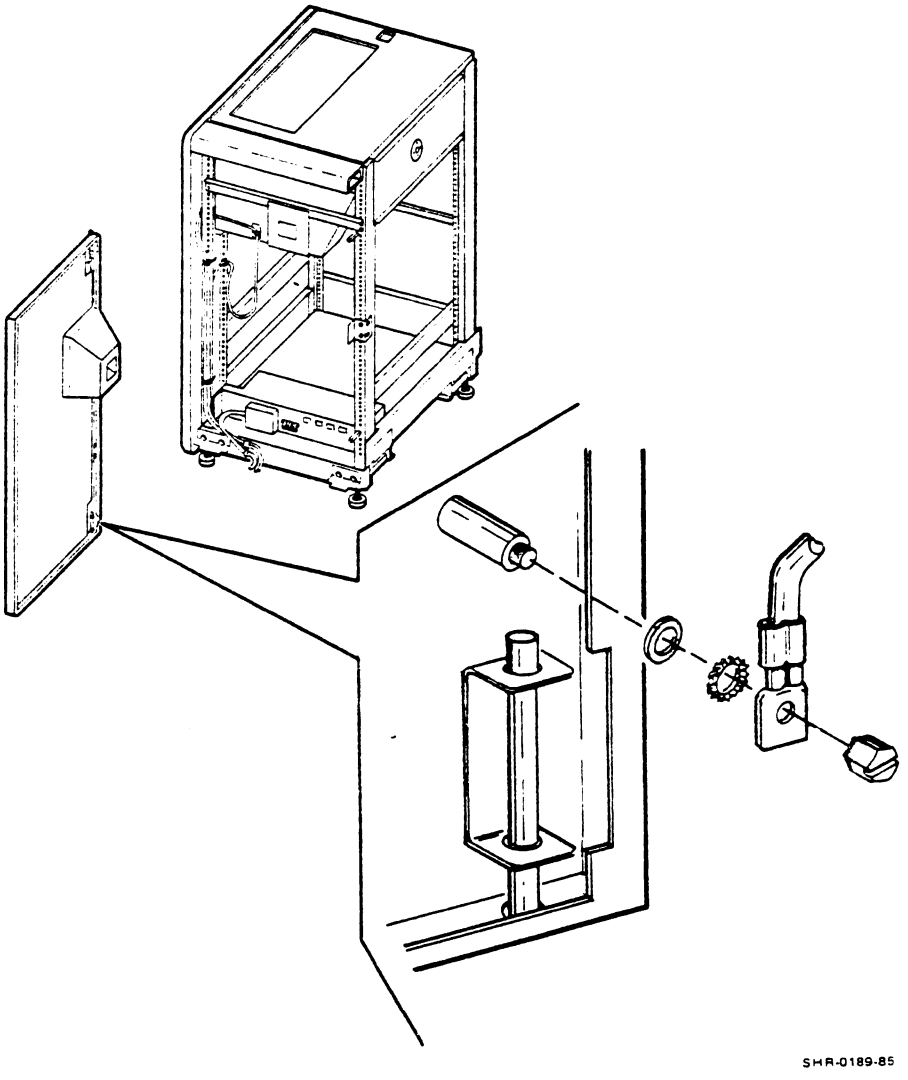


Figure A-4 Removing Ground Stud from Rear Door

5. Remove the rear door by pulling down on the spring-loaded pivot pin and pulling the door up and out (Figure A-5). Place the door well out of your way. You won't need it again until the last step in the merge procedure.

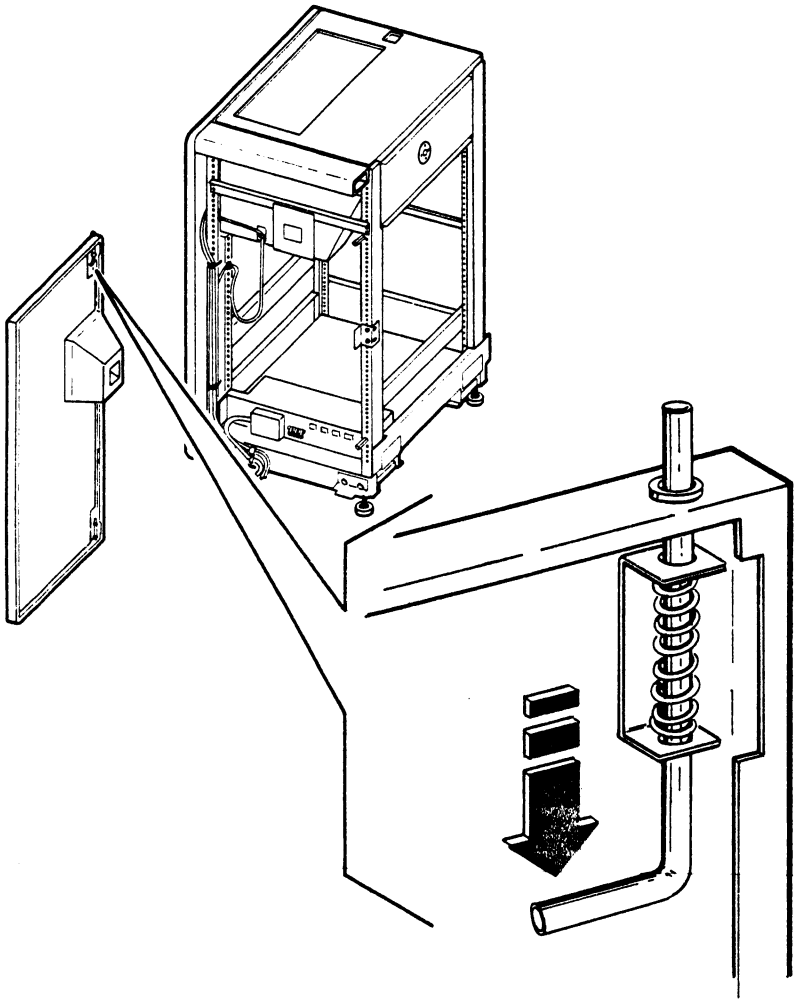


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Figure A-5 Releasing Pivot Pin to Remove Rear Door

6. Remove all boxed hardware from the tape drive cabinet. Follow the instructions in the beginning of this book for installation information regarding the packed hardware. If the tape drive is not new, this hardware has already been installed, so skip this step.

7. Open the front door of the tape drive cabinet. Remove the 10-1/2 inch front bezel (Figure A-6). Use a 3/8 inch wrench or a small adjustable wrench to remove the four hex nuts that hold the bezel in place. Access to the hex nuts is from inside the cabinet.

8. Unpack the disk drive hardware kit, which contains the chassis slide mechanism. The slide mechanism is wrapped in bubble wrapping and is in the disk drive's box. There are also several small bags of screws, nuts, and bolts. Make sure these bags are present.

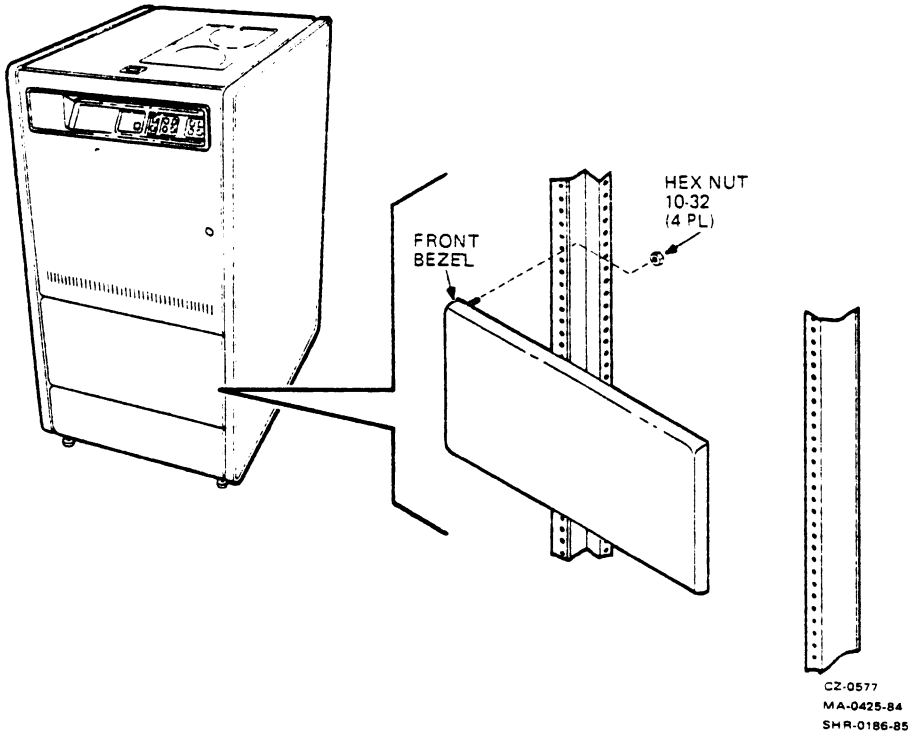

Figure A-6 Removing Front Bezel

ASSEMBLY

1. Attach the chassis slide brackets to the ends of the two chassis slides using four 8-32 X 0.31 sem screws (Figure A-7). Each chassis slide and chassis slide bracket is marked with left and right designations. For example, the left chassis slide is marked 12-13686-00 Rev J-L. The sem screws are in one of the bags packed inside the disk drive's box.

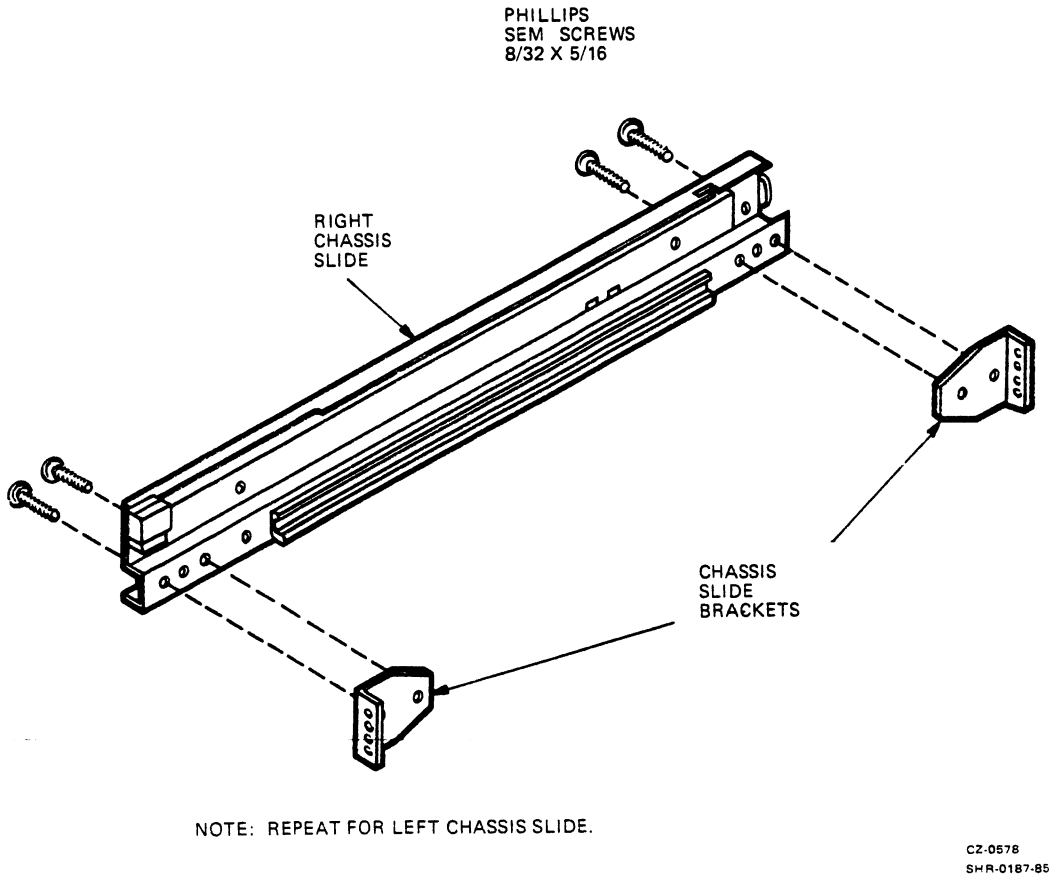

Figure A-7 Mounting the Chassis Slide Brackets to the Right-Side Chassis Slide

2. Mount the chassis slides to the front and rear vertical frame uprights on the tape drive cabinet as shown. Use mounting holes 9 and 13 counting up from the bottom of the uprights. Use four 10-32 X 1/2 inch phillips sem screws for each chassis slide (two screws for the front and two for the back) (Figures A-8 and A-9).

NOTE

Take care that the chassis slide marked L is attached to the left vertical upright (viewed from the front), and the slide marked R is attached to the right vertical upright.

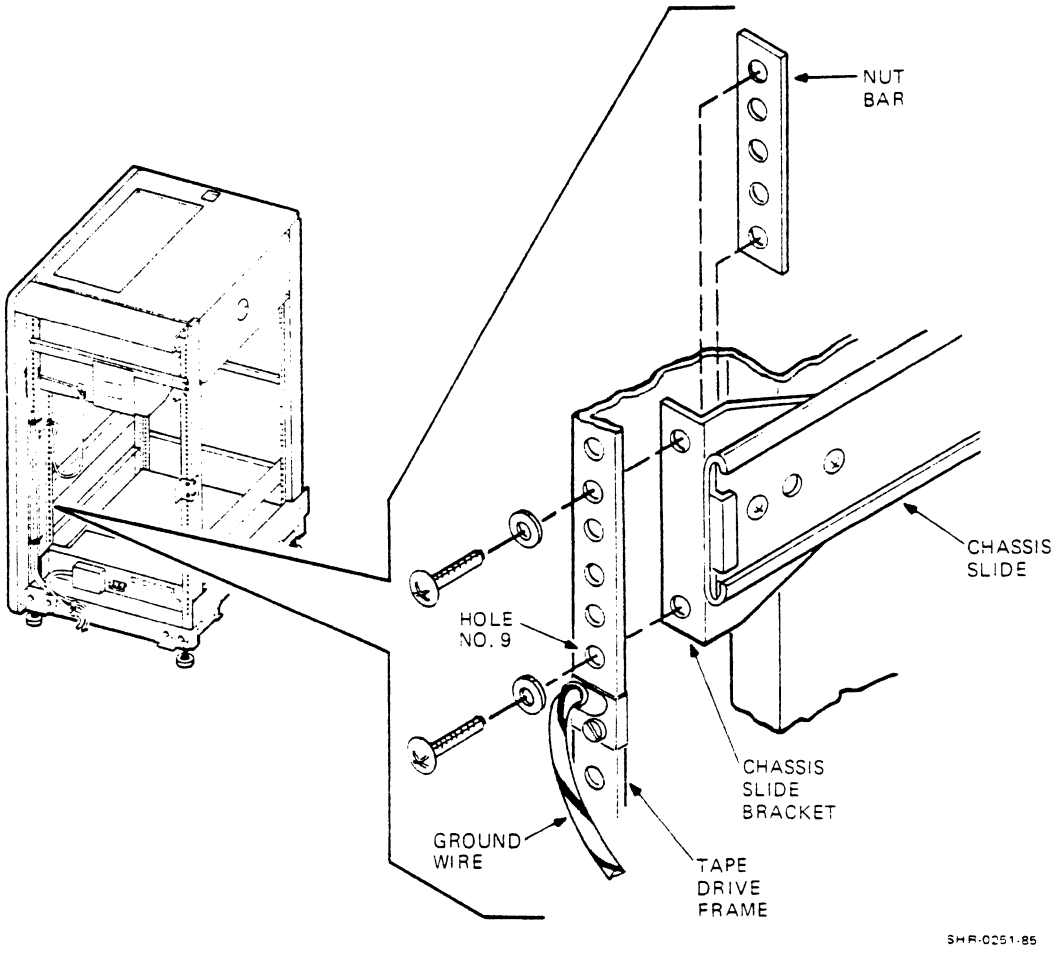

Figure A-8 Mounting the chassis Slides to the Tape Drive's Rails (Left Side)

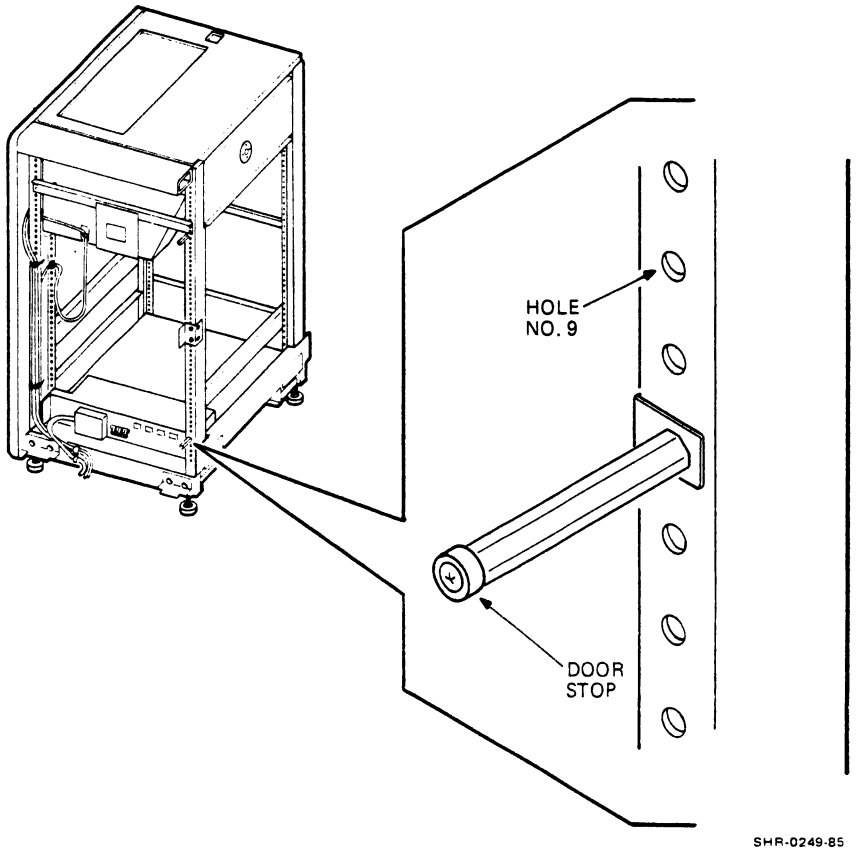

Figure A-9 Hole Locator (Right Side)

3. Mount the electrostatic discharge brackets on the left and right rear vertical uprights, using holes 10 and 12, counting up from the bottom (Figure A-10). Use two 10-32 X 1/2 inch sem screws to mount each bracket.

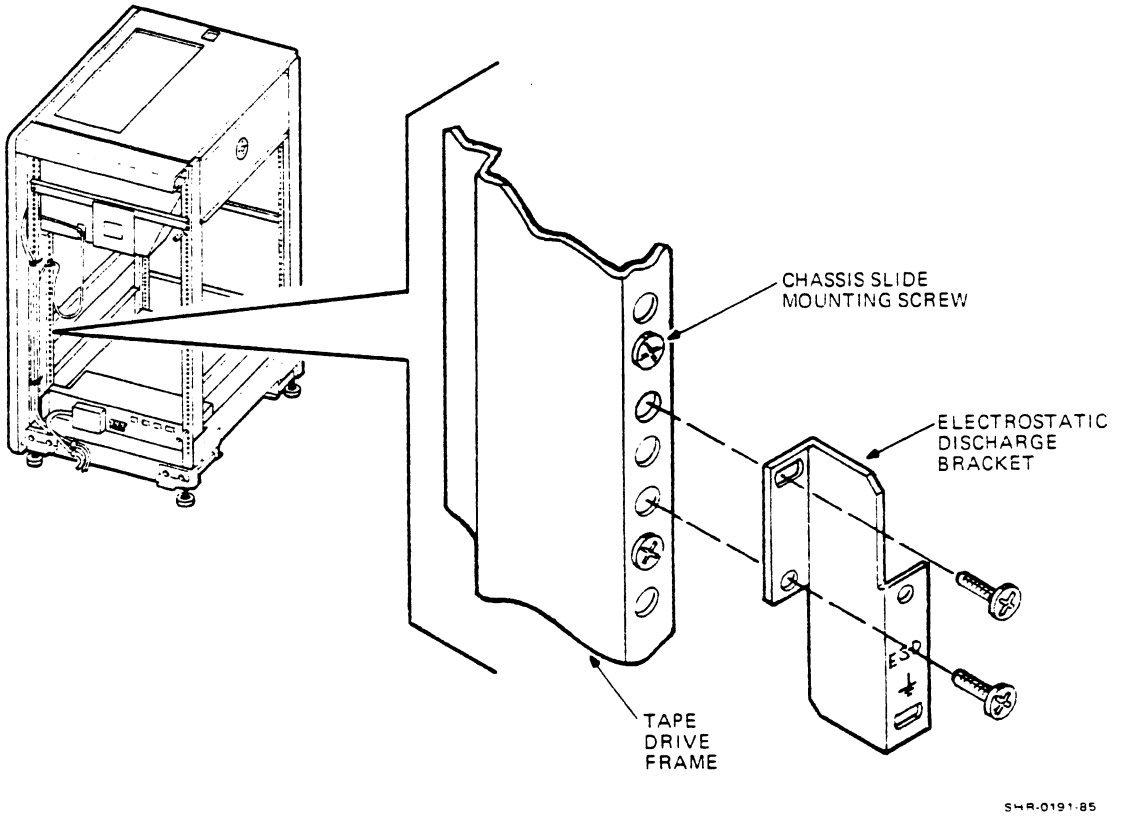

Figure A-10 Mounting the Left Electrostatic Discharge Bracket

4. Extend the chassis slides forward until they lock (Figure A-11).

5. Position the disk drive, still on the pallet, so that its rear is facing the front of the TU80/81 cabinet.

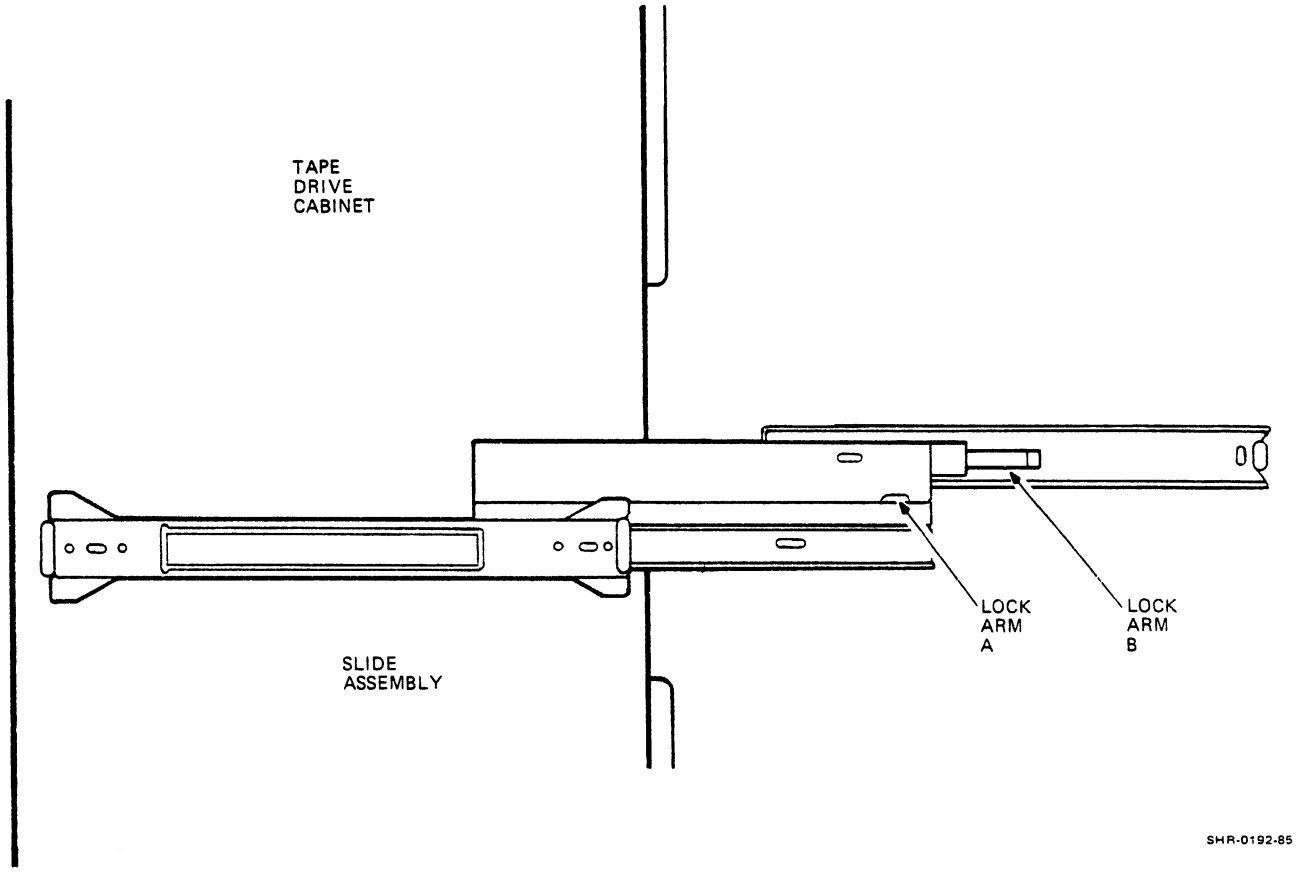

Figure A-11 Extended, Locked Chassis Slides

6. Push the cabinet up as closely as possible **while making sure the extended chassis tracks are lining up with and engaging the disk mounting rails.** The disk mounting rails are premounted on either side of the disk drive.

7. Push the disk drive forward slightly to make sure that the cabinet chassis slides are properly engaged with the rails on the side of the disk drive.

CAUTION

Make sure the disk drive is still fully supported by the shipping pallet.

8. Secure the drive to the chassis slides using four number 8-32 X 0.31 phillips sem screws (Figure A-12). If the rails on the disk drive and chassis slides you installed are engaged correctly, the holes on the chassis slides should line up with the holes on the disk drive's rails.

CAUTION
Make sure the disk drive is still fully supported by its shipping pallet.

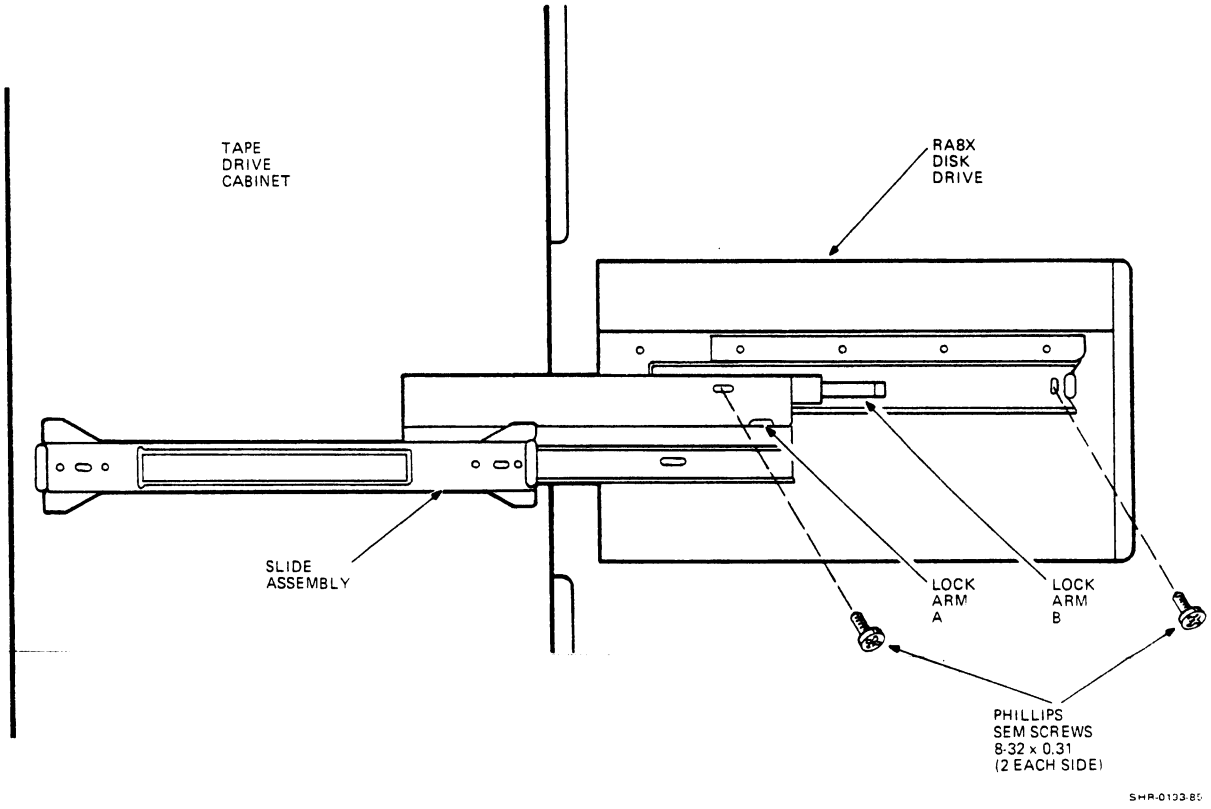

Figure A-12 Securing the Disk Drive to the Chassis Slides

9. Lower the front two feet under the tape drive cabinet (which raises the cabinet and, therefore, the disk drive) until the disk drive is about 1/2 inch above its remaining packing material and shipping skid. See instructions in the TU80 or TU81 User Guide information on raising and lowering the feet on the tape drive cabinet.

CAUTION

Do not perform this step unless step 8 immediately above is complete.

10. Break off the extra foam padding from the base of the disk.

11. Remove the power cord from the back of the disk drive.

12. Remove the shipping pallet and other excess packing material from the disk drive.

CAUTION

Make sure that cables and wires are clear of the chassis slides and rails, and that they are not pinched, scraped, or crushed by the rear of the disk drive.

13. Release lock arms B and A, in that order. The lock arms are on the disk drive's rails (see Figure A-12). Slide the disk drive forward into the tape drive cabinet until it stops.

NOTE

If the disk drive doesn't slide smoothly into the cabinet, you may have to adjust the height of the disk drive in the cabinet. Find the small filler panel directly below the disk unit, on the cabinet. Loosen its two mounting screws (it's not necessary to remove them) (Figure A-13). The mounting screws are on the bottom of the filler panel. Press the panel as far down as it will go. Re-tighten the screws.

Now make sure that the disk drive can smoothly slide back into the cabinet.

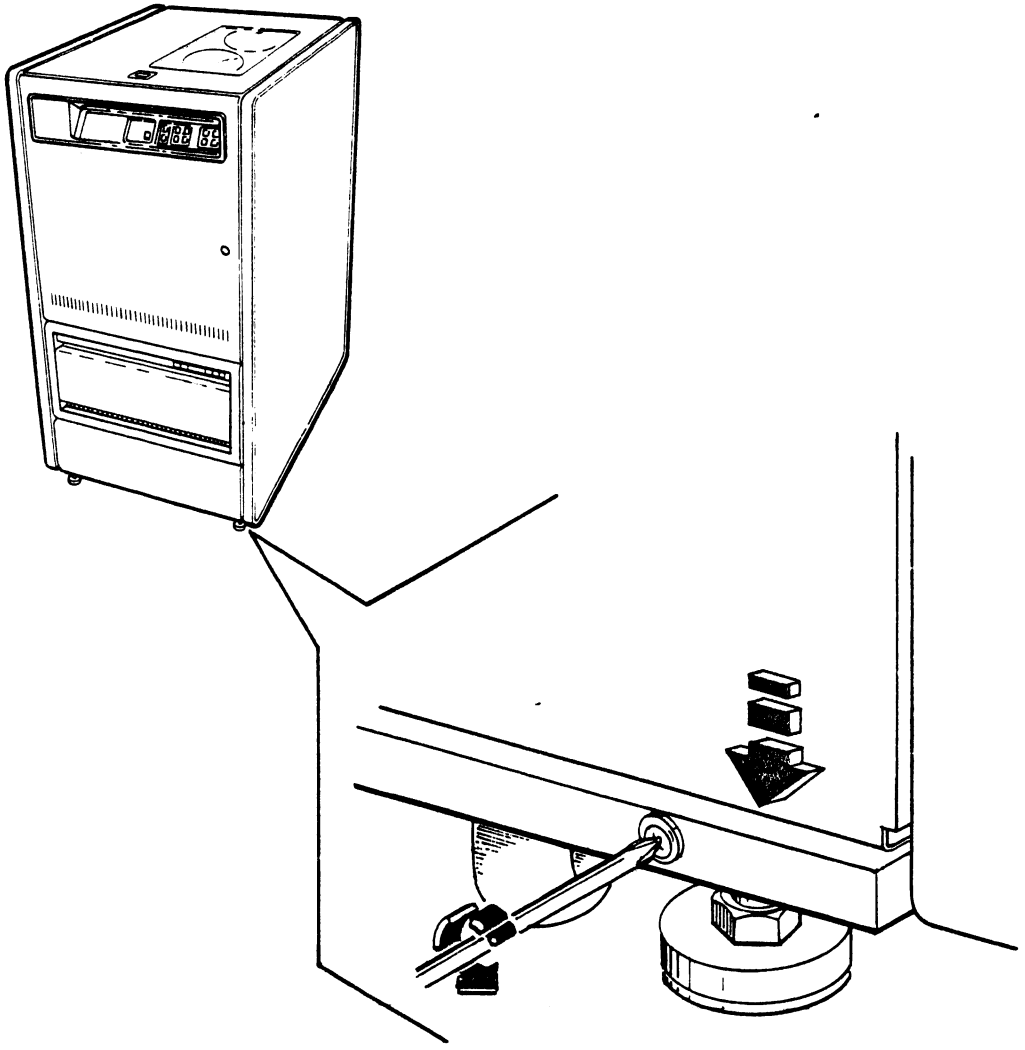

Figure A-13 Adjusting the Filler Panel

CABLING

1. Secure the disk drive power cord to the rear of the disk drive as shown in Figures A-14 and A-15. Use the existing phillips screw, along with one 3/8 inch cable clamp and one number 6 flat washer. See the TUR80-D/E Unit Assembly Drawing.

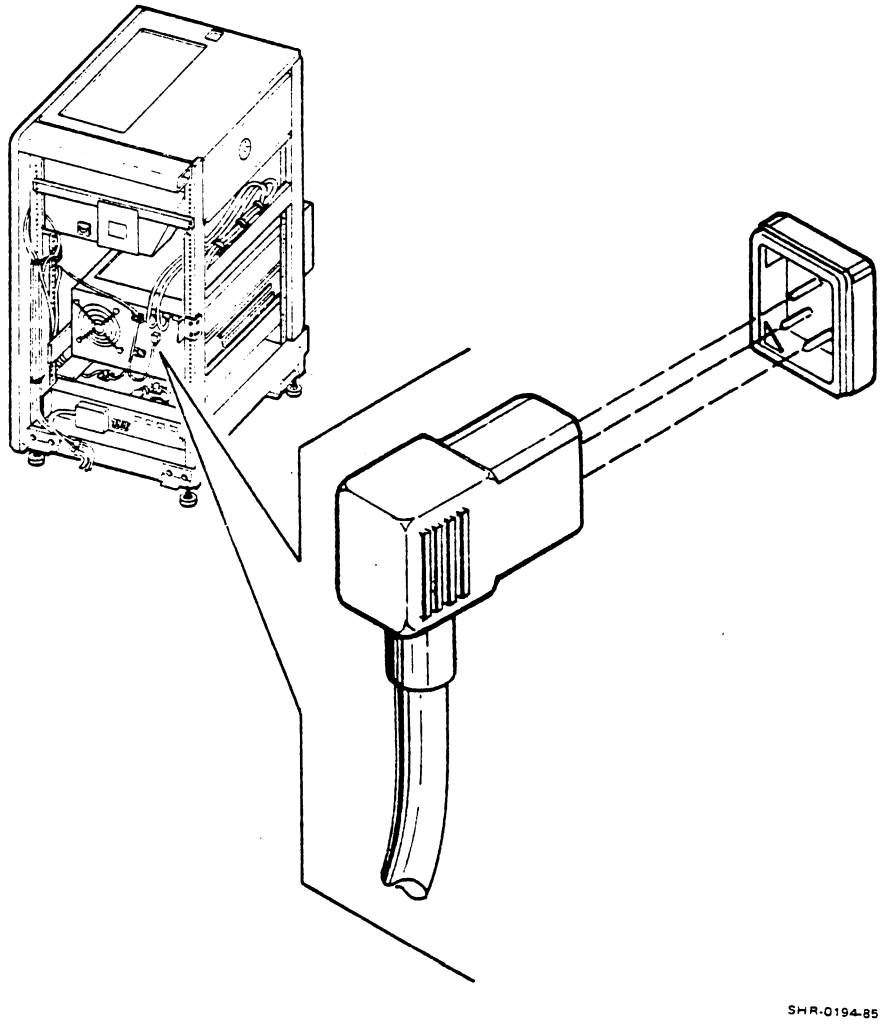

Figure A-14 Plugging in the Disk Drive's Power Cord

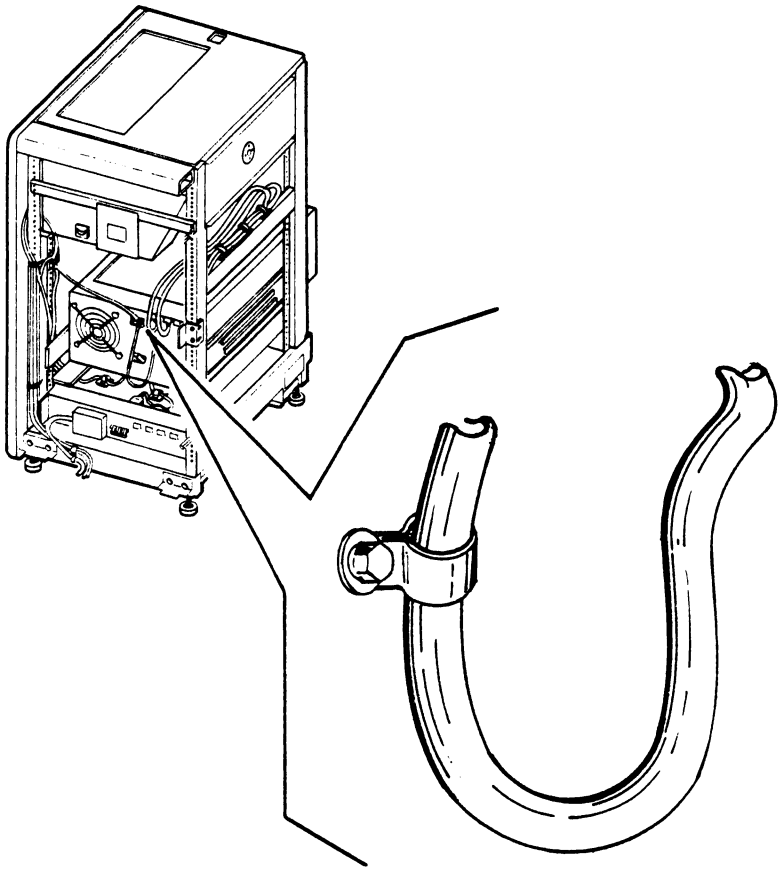

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Figure A-15 Routing the Disk Drive's Power Cord

2. There are three adhesive-backed tie wraps that you must cut. The first is on the tape drive's power supply, the second and third on the inside channel of the left rear rail (viewed from the rear). The tie wraps hold the tape drive's power cord.

   Begin dressing the disk drive's power cord by cutting the uppermost tie wrap on the inside channel of the rear rail (hole number 10 counting from the top). Use the cable tie provided to secure the tape drive's power cord with the disk drive's power cord to this common point (hole 10).

   Next, cut the adhesive-backed tie wrap on the tape drive's power supply and let the tape drive's power cord fall along the rail.

   Third, cut the remaining adhesive-backed tie wrap on the inside channel of the rear rail. Secure the disk drive's power cord with the tape drive's power cord to this common point with a new cable tie.

   Run the power cords behind the previously installed chassis slide on the left rear (seen from the rear).

   NOTE

   Be sure to dress the tape drive's power cord exactly as you found it. Leave a very small amount of slack in the disk drive's power cord.

3. Coil the RA80/81 power cord through the three cable clips on the bottom of the frame assembly. Plug the power cord into the connector labeled J6 on the power controller. You'll have to look in the front of the cabinet to find connector J6 on the power controller.

4. Mount the I/O bulkhead drive module to the I/O bulkhead bracket (Figure A-16).

5. With the disk still fully extended, secure the two disk SDI cables to the cable mounting bracket on the disk drive using one cable tie.

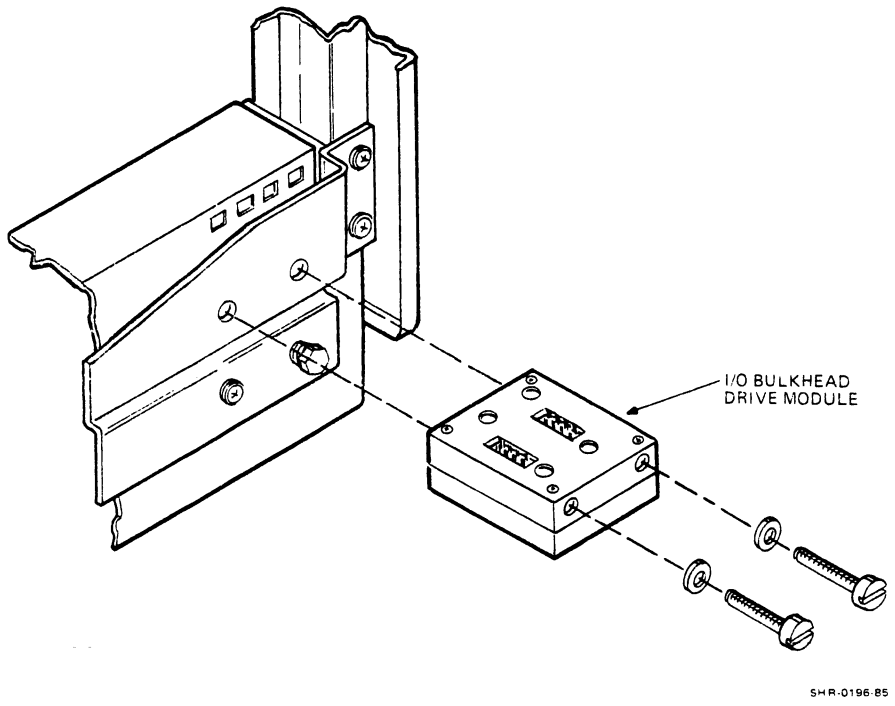

Figure A-16 Mounting the I/O Bulkhead Module

6. Run the two cables across the inside of the rail, behind the rear door lock bracket, and down to the I/O bulkhead mounting bracket (Figure A-17). Connect the SDI cables to the top of the I/O bulkhead drive module. Connect the external SDI cables to the bottom of the I/O bulkhead drive module. The external SDI cables connect to a host system (Figure A-18).

NOTE

This cable must be dressed with the disk drive fully extended on the chassis slides. Now move the disk in and out to make sure that there are no "hangups" involving the cables.

7. When you've fully routed the disk's cables, move the disk in and out several times, slowly, to make sure that none of the cables on the disk drive are pinched or cut. This step requires two people. One person should slide the disk drive forward and back, while the other checks the cables.

NOTE

All cables are important, but pay particular attention to the disk power cord.

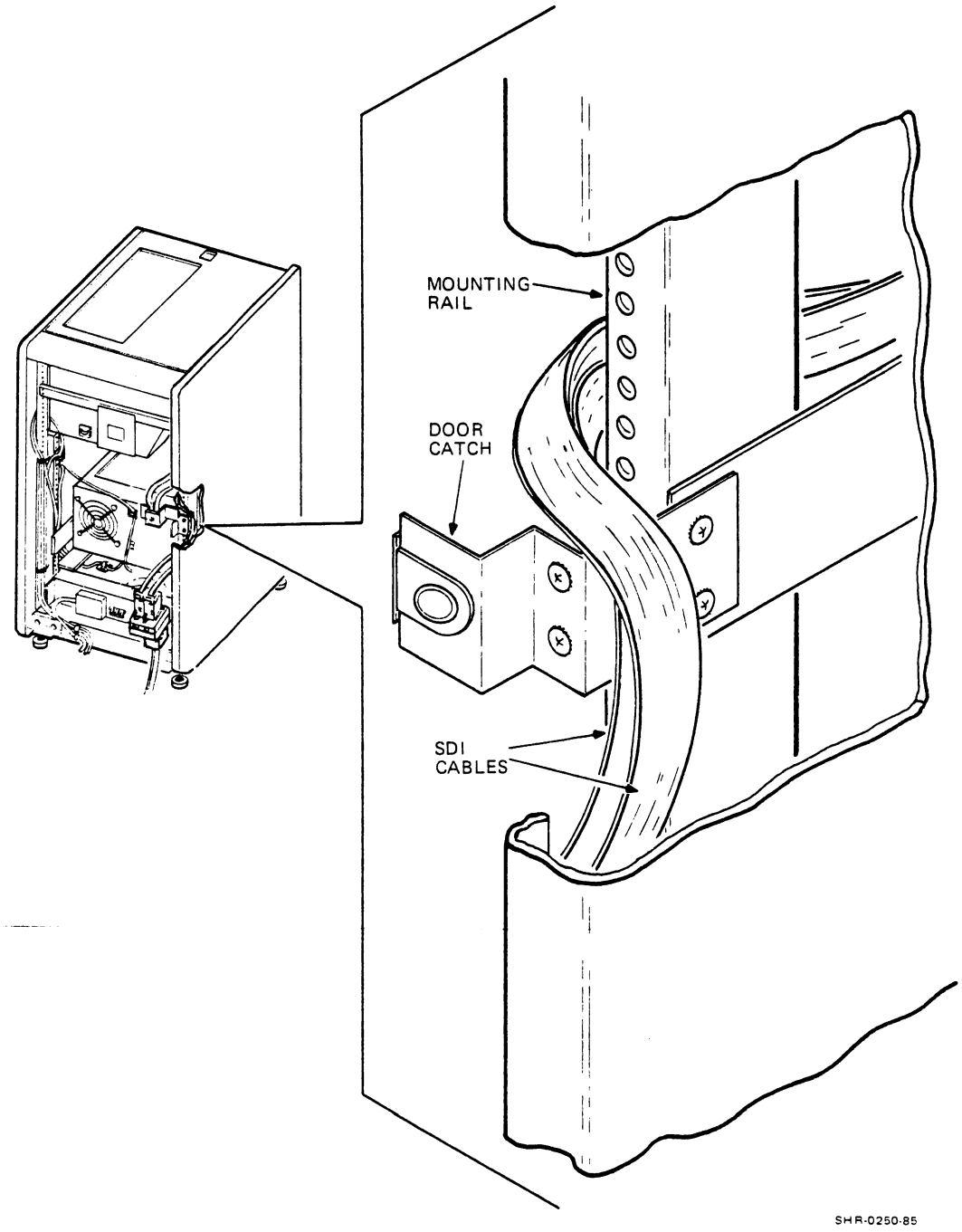

Figure A-17 Routing the SDI Cables

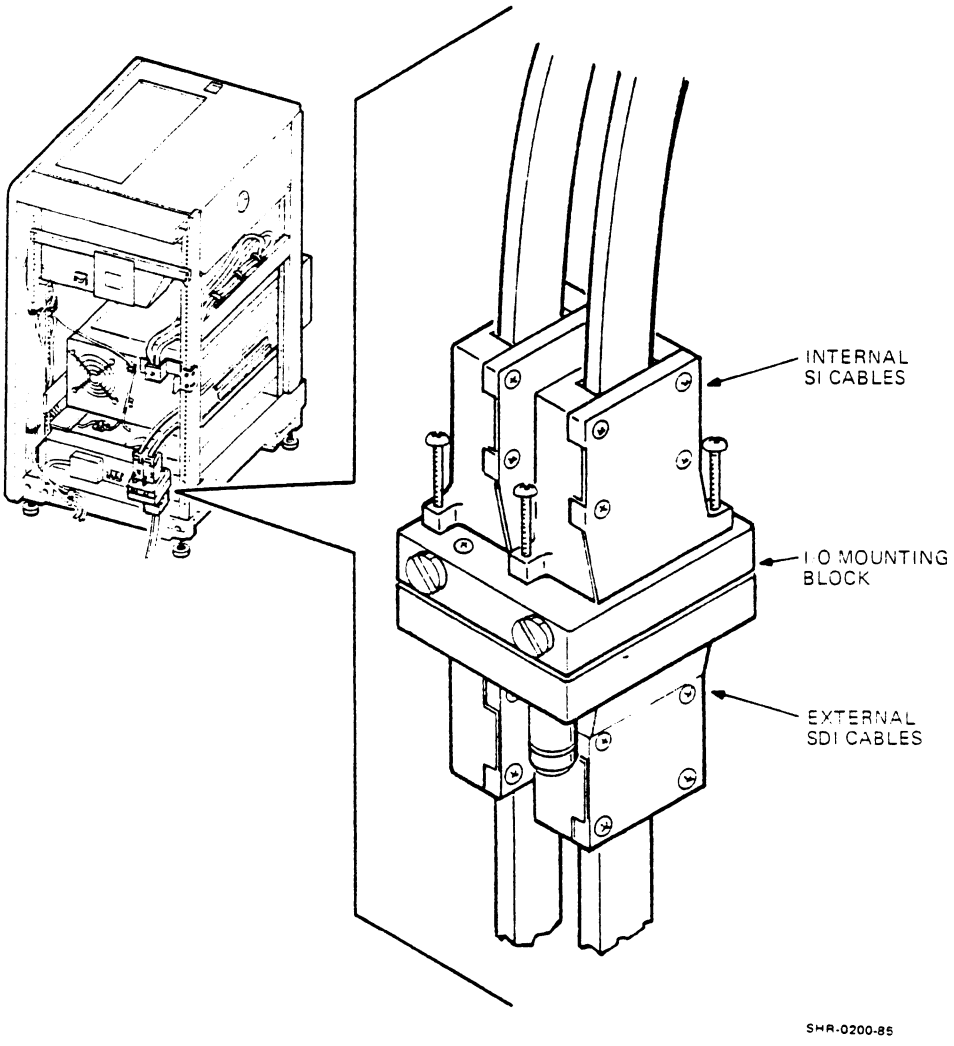

Figure A-18 SDI Cable Connections

8. Secure the electrostatic discharge cable bracket (Figure A-19). Remove the bottom left (seen from the rear) power supply screw on the disk drive, attach the bracket as shown, then replace the screw with the bracket in place. Repeat for the right side.

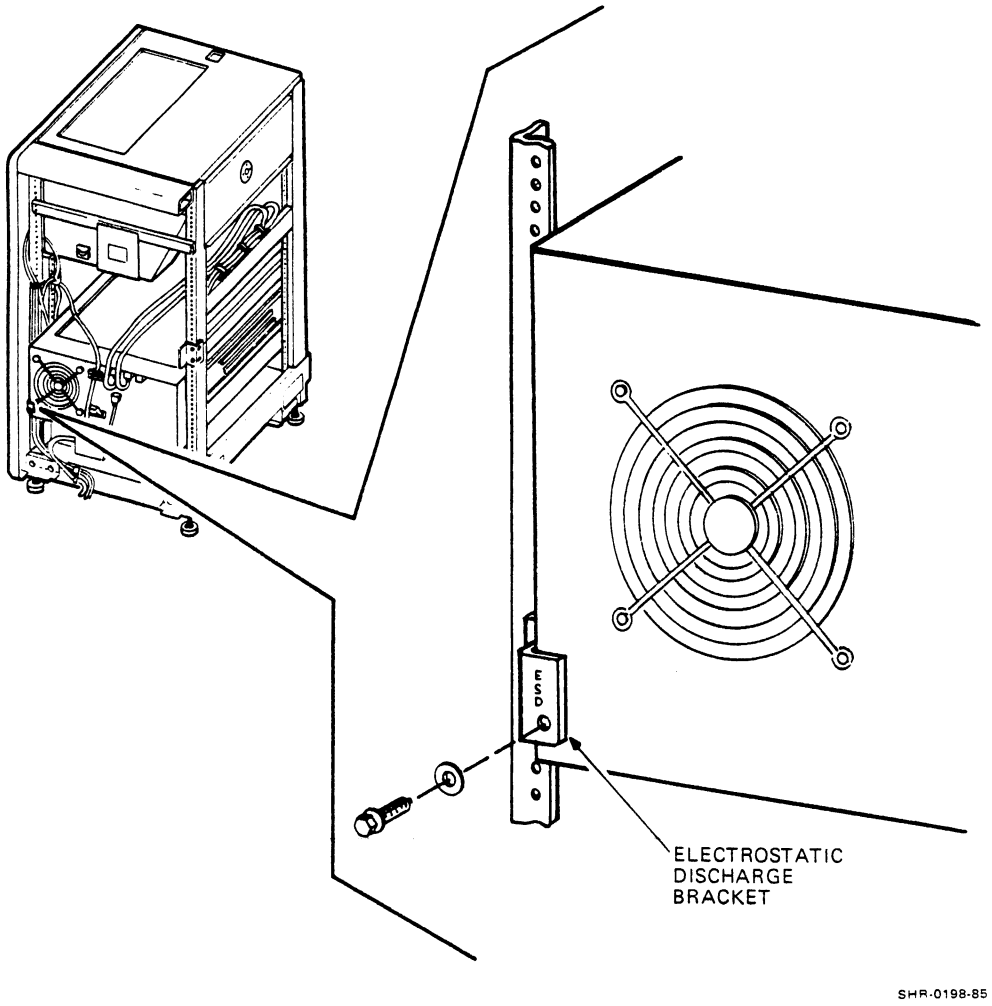

Figure A-19 Securing the Disk Drive with the Electrostatic Discharge Bracket

9. Peel the existing stability label off the rear of the power supply.

10. Put the new stability label (supplied) on the rear of disk drive in the center of the small rear cover (Figure A-20).

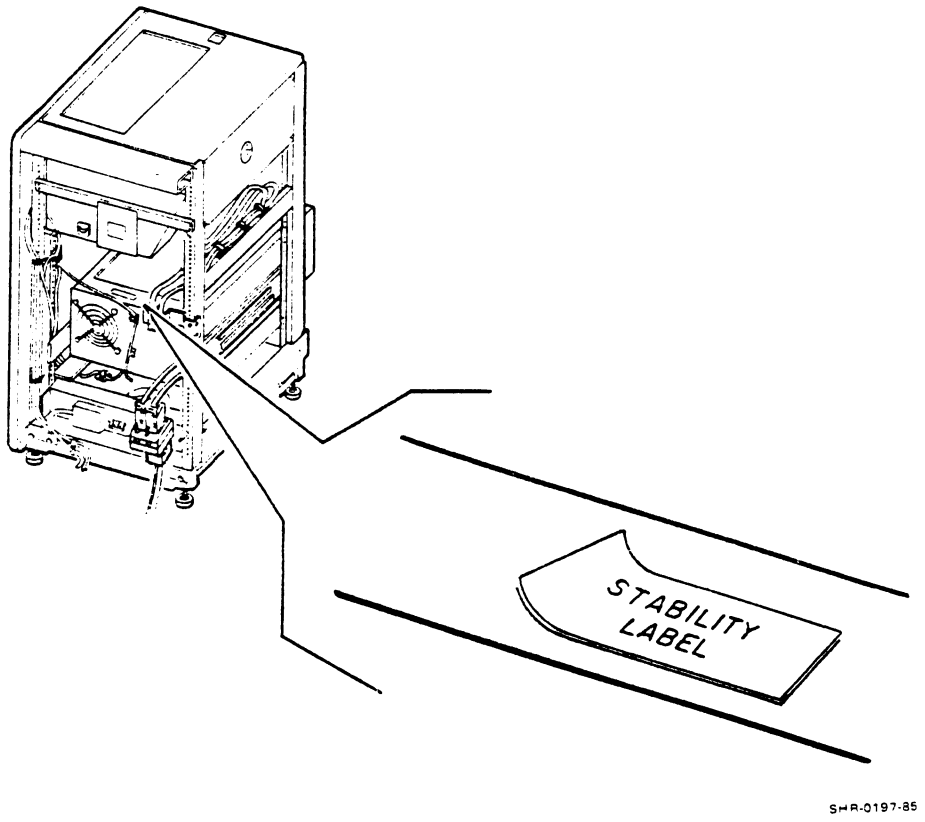

Figure A-20 Mounting the New Stability Label

11. Connect the power sequence jumper plug assembly to the "sequence in" connector next to the SI cables, where they connect to the disk unit. The sequence in connector is marked "IN."

12. Re-assemble the rear door and re-attach the ground wire.

13. Attach the horizontal stabilizer (H9544-HC) to the TU80/81 cabinet as shown in the TU80 or TU81 User Guide.

14. Run the necessary cables out from their cable exit points (host interface cables and power controller cord), then close and lock the rear door.

This concludes the installation procedure.

Refer to the appropriate RA8X Disk Drive User Guide (EK-ORA8X-UG) for instructions on setting up the disk drive and running acceptance diagnostics to verify that it works correctly.

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