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**TZ877 Series  
Magazine Tape Subsystem  
Owner's Manual**

Order Number: EK-TZ877-OM. A01

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# Preface

## Purpose

This manual introduces the TZ877 magazine tape subsystem and describes operating procedures.

## Manual Structure

Chapter 1, Overview, provides a basic product description and specifications for the TZ877 magazine tape subsystem.

Chapter 2, Operation, describes the power-on process, the keys and indicators on the operator control panel (OCP), the operating modes of the Mode Select key, and the magazine and cartridge removal and replacement processes.

Chapter 3, Error Conditions and Problem Resolutions, describes the necessary conditions to use OCP buttons, backup operation failures, error indications, and power problems.

Chapter 4, Head Cleaning, describes how to clean the tape drive read/write heads via the magazine.

Appendix A, VMS Operating System Commands, describes VMS commands used with tape devices.

Appendix B, Using the TZ877 Subsystem with the ULTRIX Operating System, describes how to add the TZ877 subsystem to your ULTRIX operating system, how to get maximum capacity and performance from the TZ877 subsystem, using the TZ877 for unattended backups, and using various ULTRIX commands to save information on the TZ877 subsystem.

Appendix C, Service Offerings, describes maintenance plans offered by Digital Services.

## Intended Audience

This manual is intended for the TZ877 subsystem owner. It is for system managers, computer operators, or anyone who uses magazine tape subsystems. Prior knowledge of and experience with VMS, ULTRIX, or OSF1 operating systems and commands and tape devices is assumed.

## Conventions

The term *TZ877* refers to the TZ877 magazine tape subsystem.

The term *OCP pushbuttons* refers to the Eject, Load/Unload, Slot Select, and Density Select buttons on the operator control panel (OCP) of the TZ877 subsystem.

This chapter describes the TZ877 magazine tape subsystem and its functions.

## 1.1 General Description

The TZ877 magazine tape subsystem (Figure 1–1) is an electromechanical device that performs automatic, sequential tape operations. The TZ877 subsystem when operating in noncompressed mode has a maximum transfer rate of 1.25 Mbytes/s. When operating in compressed mode the maximum transfer rate is 2.5 Mbytes/s write and 3 Mbytes/s read.

The TZ877 subsystem can store:

- More than 10.0 GB data native cartridge capacity, 70.0 GB total
- More than 20.0 GB data at a 2:1 compression ratio, 140.0 GB total

The TZ877 loads and unloads tape cartridges into and from a tape drive to:

- Provide a degree of unattended backup
- Perform single cartridge operations

In addition, the TZ877 executes operating system commands, qualifiers, and parameters to store data from user disk areas to the tape drive.

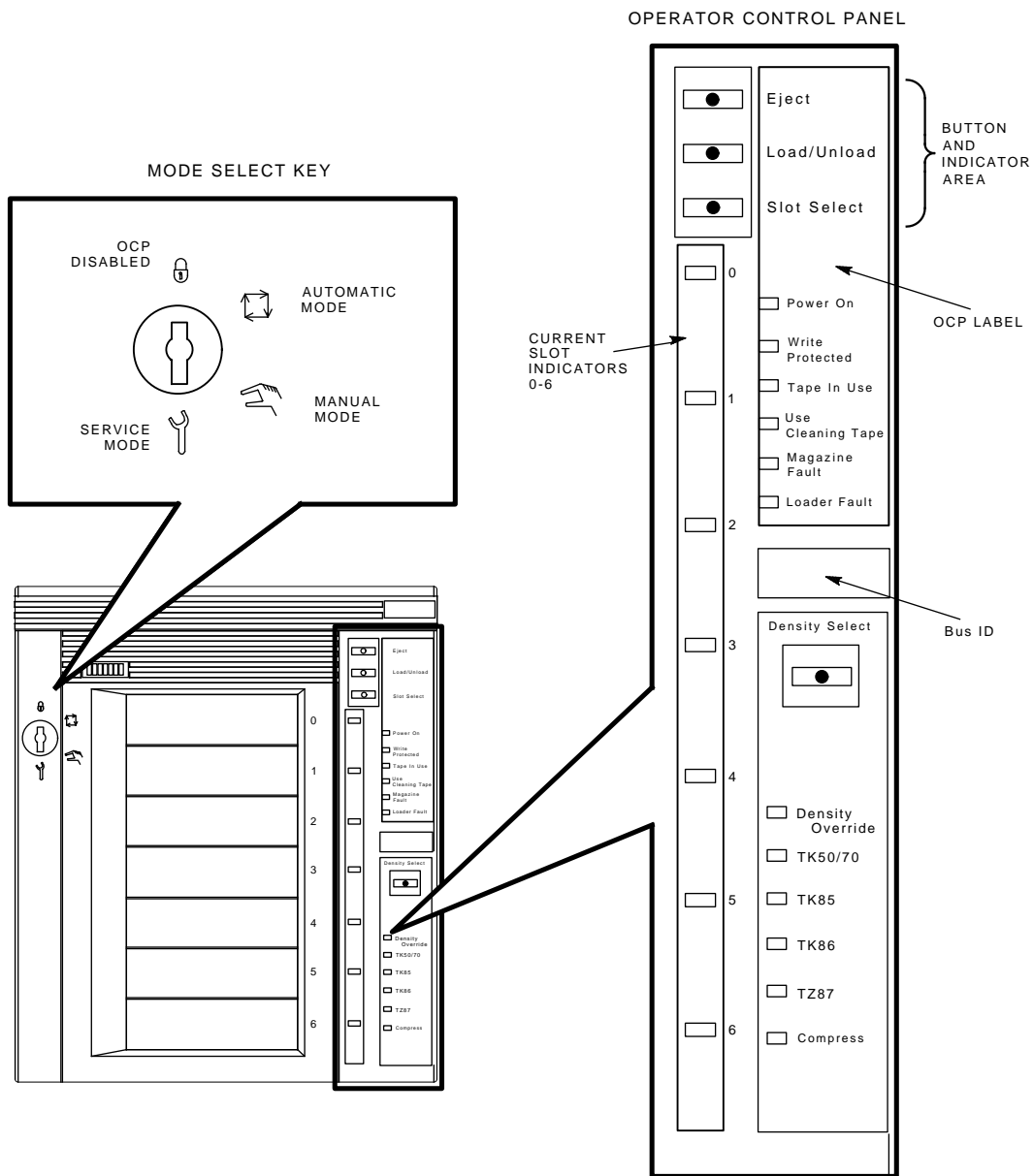
The TZ877 subsystem includes:

- TZ87 tape drive with Electronic Control Module (ECM)
- Seven cartridge, SCSI-2 Medium Changer device (loader)

Figure 1–1 shows the TZ877 front panel.

**Overview**  
**1.1 General Description**

**Figure 1-1 Front View of the TZ877 Magazine Tape Subsystem**



ZKO-1217-07-DG

## 1.2 Configuration

The TZ877 subsystem can be configured on VAX and RISC systems and it is available for systems with a SCSI bus. The bus is an electrical connection that allows the system's central processing unit (CPU) and main memory to communicate with a device such as the TZ877.

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**NOTE**

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Depending on the model of your TZ877 subsystem, SCSI connections may be supported at a maximum of 25 meters (82 ft).

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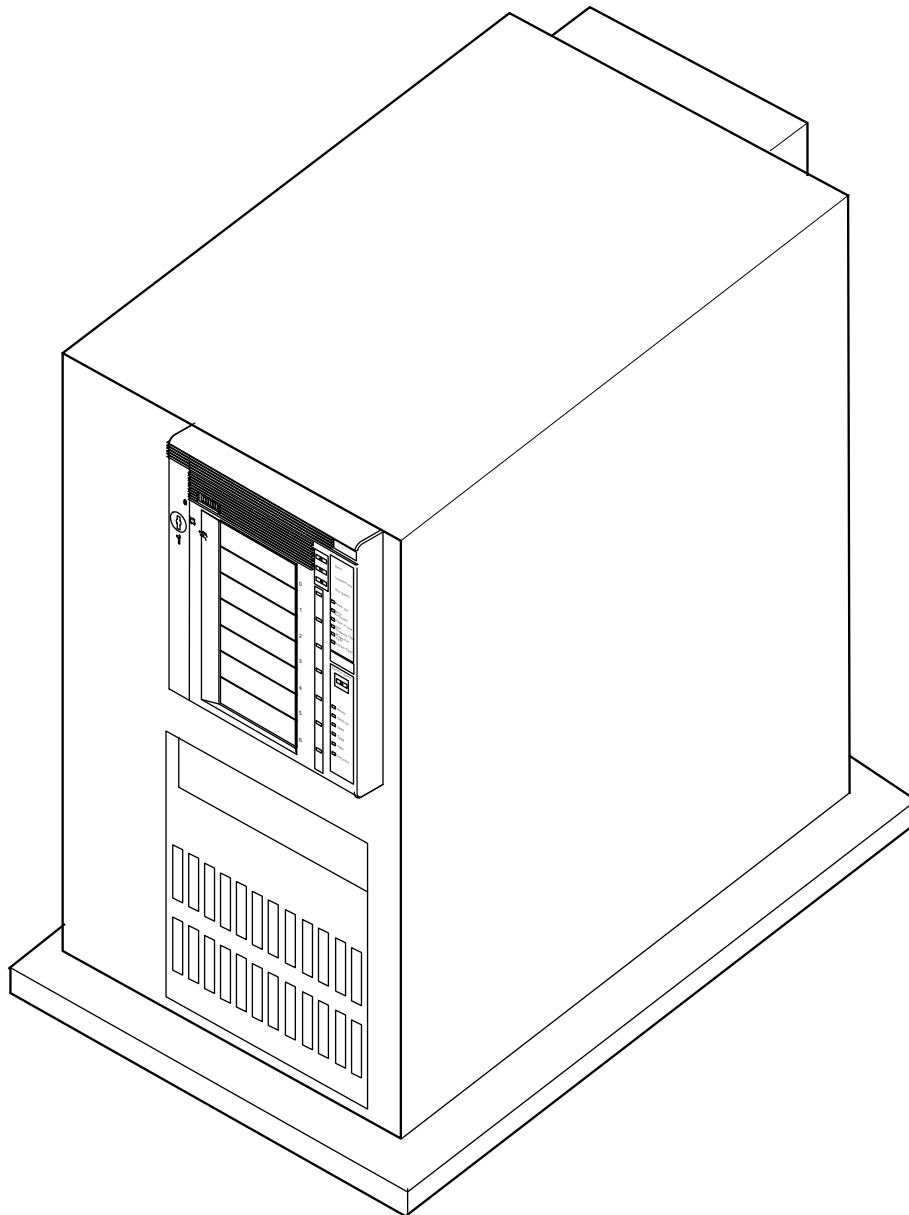
The TZ877 can be installed in a variety of storage cabinets and is also available in pedestals. For example:

The TZ877 installs in the:

- SZ107 pedestal (Figure 1-2), which contains one factory-installed TZ877 in the upper compartment.
- SW500 or SW800 storage systems

**Overview**  
**1.2 Configuration**

**Figure 1–2 SZ107 Pedestal**



ZKO-1217-25-DG

### 1.2.1 Operating System Support

The TZ877 is supported by various VMS versions with certain restrictions (Table 1-1).

Table 1-1 TZ877 VMS Restrictions

VMS Version	Restrictions <sup>1</sup>
<5.3	X
5.3	1,2,3
5.4	1,2,3
5.4-1	1,2,3
5.4-2	1,2,3,4
5.4-3	1,2,3,4
5.5	1,2,
5.5-1	1,2,3
5.5-2	1,2,

<sup>1</sup>KEY

X = Not supported

1 = VMS SHOW DEVICE command indicates "generic SCSI tape" and ERROR LOGGING indicates "GENERIC MK SUBSYSTEM." This has little impact on most applications.

2 = Standalone BACKUP *not* supported. You cannot create a standalone BACKUP tape.

3 = Writing CompacTape III TK85 and TK86 media format is supported by the loader front panel, but is not supported from the command line interface because Open VMS support of density selection is not available as of this printing.

4 = Sequential autoloading of tapes not supported when doing a multi-volume backup (Timeout too short for cycling period).

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**NOTE**

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VAXsimPLUS does not support SCSI devices.

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## Overview

### 1.2 Configuration

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#### Performance Consideration

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The VMS backup performance rate of your TZ877 subsystem can depend on your system processor. For example:

- Connecting directly to an embedded bus adapter on such systems as the VAXstation 4000-60, -90, MicroVAX 3100-30, -40, -80, DEC3000-400, -500 and DEC4000-6x0 provides optimum performance.
  - Connecting to a MicroVAX/VAXserver 3xxx (Q-bus) system with a KZQSA adapter can reduce the rate of performance but does not limit the drive's data storage capacity.
  - Other factors that can affect the TZ877 subsystem's performance include: operating system configuration, backup user account configuration tuning, the backup utility used, the options selected on the backup utility, file system throughput, file fragmentation, block size, compression (on/off), dta type (if compression is on), the amount of CPU memory available, and I/O channel bandwidth. See Appendices A and C for more information on some of these considerations.
- 

### 1.3 Node ID Label

The operator control panel (OCP) on the TZ877 subsystem has a space for a node ID label you can add. The label identifies the device bus ID number. (This label is in the label kit.) The node ID is preset during manufacturing to zero (0). The Digital Services engineer verifies this setting during installation at the site.

### 1.4 Operating Modes

The TZ877 subsystem operates—via the Mode Select key (Figure 1-3) in the following modes:

- **OCP Disabled mode** — Locks the subsystem into the enclosure and locks the receiver. The pushbuttons on the OCP — Eject, Load/Unload, Slot Select — are disabled. This mode automatically loads the next tape cartridge into the drive after you issue the DISMOUNT command.
- **Automatic mode** — Is the subsystem's default or normal mode. It locks the subsystem into the enclosure but leaves the receiver unlocked. This mode automatically loads the next tape cartridge into the drive after you issue the DISMOUNT command. The OCP pushbuttons remain enabled.



## Overview

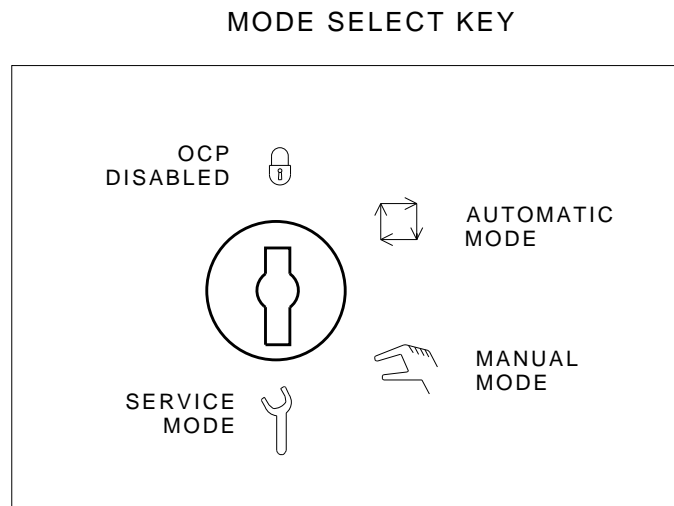
### 1.4 Operating Modes

- **Manual mode** — Locks the subsystem into the enclosure but leaves the receiver unlocked. This mode allows for single cartridge operations only. The OCP pushbuttons remain enabled. Loading and unloading of cartridges is *not* automatic; operator intervention is required to select the next cartridge.
- **Service mode** — Unlocks the subsystem from the enclosure. The subsystem is no longer in Automatic mode. This mode is for Digital Services engineers to use when performing servicing procedures.

You can select these modes using the Mode Select key (Figure 1-3) on the front of the TZ877 subsystem.

See Chapter 2 for information on using the modes and the Mode Select key.

**Figure 1-3 TZ877 Subsystem Mode Select Key Symbols**



SHR\_X1025D\_89

## Overview

### 1.5 Hardware Components

## 1.5 Hardware Components

The TZ877 magazine tape subsystem consists of the following major hardware components (Figure 1–4):

- Loader transfer assembly
- Magazine
- TZ87 tape drive and controller module
- Rear chassis

### 1.5.1 Loader Transfer Assembly

The TZ877 subsystem has a loader transfer assembly that contains the electromechanical assemblies required to store and move cartridges for use by the TZ87 tape drive.

You must insert cartridges into the magazine and insert (and close) the magazine into the receiver. Then:

1. An internal elevator mechanism, in the loader transfer assembly, moves to each of the storage slots.
2. The elevator loads and unloads cartridges into the drive.
3. After the cartridges are used, the elevator returns the cartridges to their original storage slots in the magazine.

The loader transfer assembly:

- Scans the magazine for cartridges
- Unloads cartridges from the magazine
- Loads cartridges into the drive
- Unloads cartridges from the drive
- Returns cartridges to their original slots in the magazine

The loader transfer assembly also contains buttons and indicators called the operator control panel (OCP). Chapter 2 details the OCP.

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#### NOTE

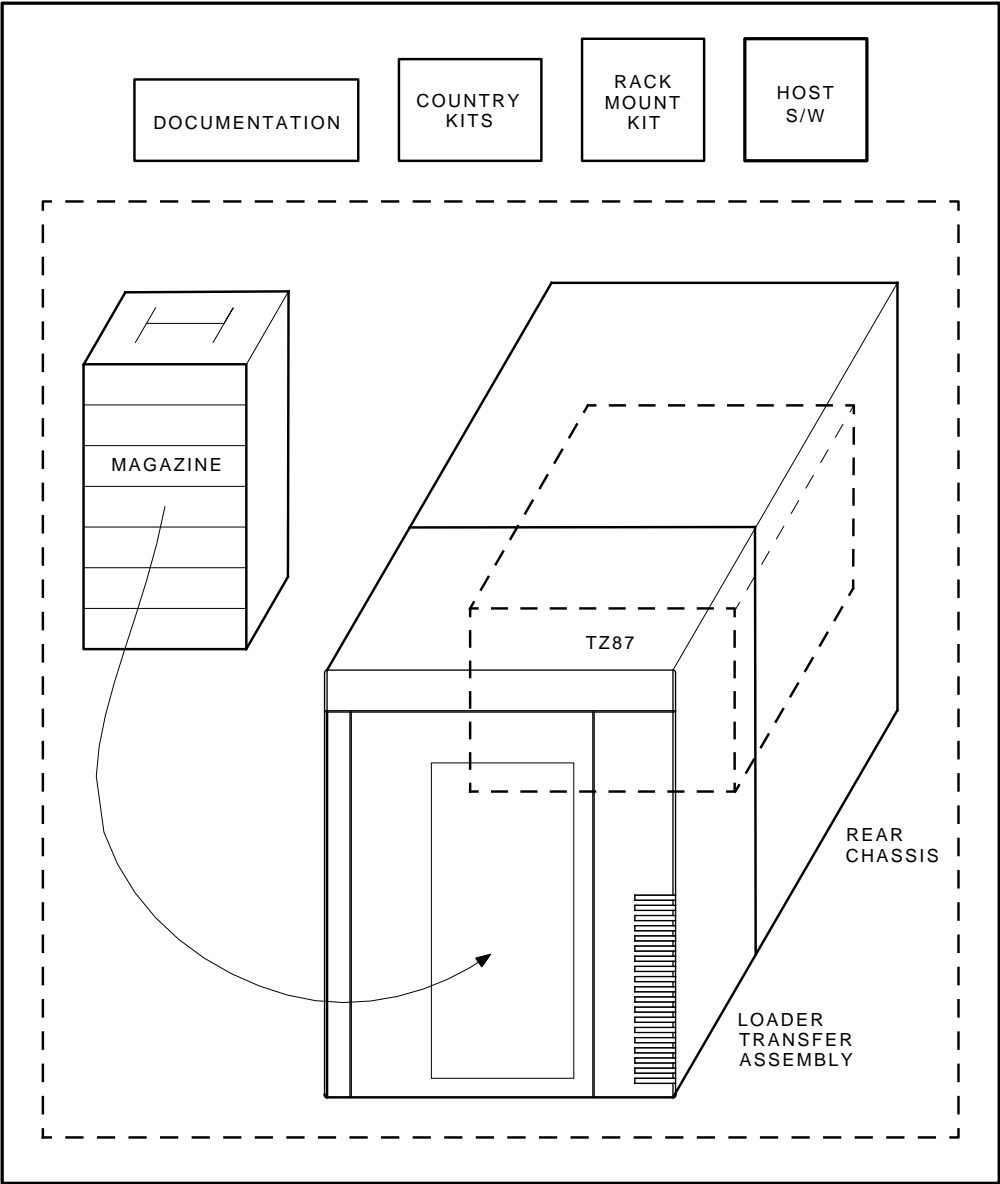
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Do not press the Load/Unload button on the TZ877 OCP to abort functions of the loader transfer assembly. Type `Ctrl/Y`, `Ctrl/C`, or terminate the process that is using the subsystem instead.

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**Overview**  
**1.5 Hardware Components**

**Figure 1-4 TZ877 Magazine Tape Subsystem Block Diagram**



ZKO-1217-03-DG

## Overview

### 1.5 Hardware Components

#### 1.5.2 Magazine

The magazine is a removable storage rack that can store up to seven CompacTape III, CompacTape II, or CompacTape cartridges. The magazine includes seven slots in which the cartridges are loaded. These slots are numbered from 0 to 6 on the *front* of the magazine.

#### 1.5.3 TZ87 Tape Drive

Using TZ87 density, the TZ87 tape drive, in the rear chassis of the TZ877 subsystem, is a streaming tape drive that can use CompacTape III cartridges to store:

- Up to 10.0 GB of data
- Up to 20.0 GB at 2:1 compression

Using TK85 or TK86 density, up to 2.6 GBF and 6.0 GBF of data can be stored respectively.

#### 1.5.4 SCSI Controller Module

As part of the drive, the SCSI controller module:

- Connects the TZ877 subsystem to the host system through the SCSI bus
- Initiates commands from the host system to the TZ87 tape drive and TZ877 subsystem

#### 1.5.5 Rear Chassis

The following lists the other components found in the rear chassis and their functions:

- Power supply—provides power to the rear chassis components and to the loader transfer assembly
- Fan—cools the entire TZ877 subsystem
- Handle motor assembly—lifts and lowers the drive's handle when cartridges are ready for loading into, or unloading from, the drive

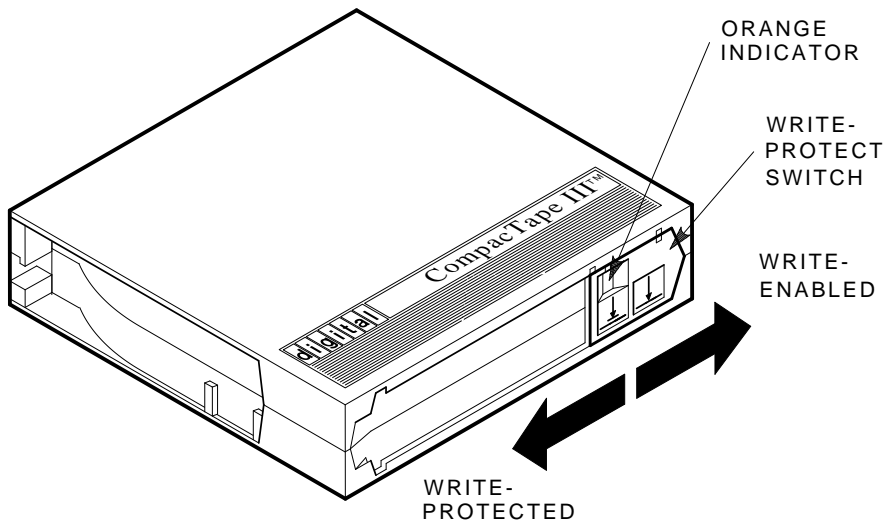
## 1.6 CompacTape III Cartridge

### 1.6 CompacTape III Cartridge

The CompacTape III cartridge (Figure 1-5) is a 4-1/8 inch square, dark gray, plastic cartridge containing 1200 feet of 1/2 inch magnetic, metal particle (MP) tape.

The cartridge has a write-protect switch to prevent accidental erasure of data. When the switch is moved to the left and the small orange rectangle is visible, data cannot be written to the tape. A package of slide-in labels and a cartridge handling information sheet are provided with each CompacTape III cartridge.

Figure 1-5 CompacTape III Cartridge



SHR\_X1020C\_89

## Overview

### 1.6 CompacTape III Cartridge

#### 1.6.1 Reading and Writing Data

The TZ87 drive reads and writes data in a two-track parallel, serpentine fashion. To read/write 128 tracks (64 pairs) on the tape, the TZ87 tape drive:

- Travels the entire length of tape on two tracks (at approximately 100 inches per second)
- Steps the head and reverses tape direction, and continues to read/write on the next two tracks.

#### 1.6.2 Cartridge Compatibility

Older CompacTape cartridges can be loaded for read or read/write purposes into the TZ87 tape drive. Any cartridges recorded by the TK50, TK70 or TZ30 drives can be read by the TZ87 tape drive. Any cartridges recorded by the TK85, TK86, or TZ87 tape drive can be read and written by the TZ87 drive.

Use Table 1–2 to determine cartridge compatibility with the TZ87 drive:

**Table 1–2 Read/Write Cartridge Compatibility with the TZ87 Drive**

Cartridge Type/Format (Capacity)	Read/Write Ability in the TZ87
CompacTape/TK50 (95 MBF)	Read only
CompacTape II/TK70 (296 MBF)	Read only
CompacTape III/TK85 (2.6 GBF)	Read/write in 85 mode <sup>1, 2</sup>
CompacTape III/TK86 (6.0 GBF)	Read/write in 86 mode <sup>1, 2</sup>
CompacTape III/TZ87 (10.0 GBF, 20.0 GBF assumes 2:1 compression)	Read/write in 87 mode <sup>1, 2</sup>
CompacTape III/blank	Read/write in 85 <sup>1</sup> , 86 <sup>1</sup> , or 87 mode, as selected

<sup>1</sup>Read/write, backward compatible with drive of selected density

<sup>2</sup>Recording format can be changed to 85, 86, or 87 mode on a write from BOT.

#### 1.6.3 Selecting Density with the TZ877

You can select density by using the Density Select button (Chapter 2) on the TZ877 operator control panel. The TZ87 tape drive defaults to using TZ87 format (high density) for all writes from Beginning of Tape (BOT)—unless TK85 or TK86 formats have been selected either on the OCP, or by the host. If you use the OCP to select a format, then it overrides any format selected by the host. When you append data to the tape cartridge, the current media density is used.

**Overview**  
**1.6 CompacTape III Cartridge**

**1.6.3.1 Using the ULTRIX Operating System**

If you use ULTRIX, you can use the operating system to select density. For more information, see Appendix B.

**1.6.4 Cartridge Reliability**

To ensure the reliability of cartridges that:

- Contain recorded data and may be archived for a long time
- Do not contain recorded data

Store the cartridges in a clean, controlled environment with the following conditions:

- Environmental temperature: 18.3°C to 26.1°C (65°F to 79°F)
- Relative humidity: 20% to 60%
- Guaranteed number of passes: 500,000
- A backed up file can be restored 500,000 times
- Overall tape/head motion can be 500,000 hours minimum

## Overview

### 1.7 Specifications

### 1.7 Specifications

Table 1–3 lists the specifications for the TZ877 magazine tape subsystem, and Table 1–4 lists those for the TZ87 tape drive.

**Table 1–3 TZ877 Magazine Tape Subsystem Specifications**

Characteristic	Specifications
Height	26.47 cm (10.42 in)
Width	22.20 cm (8.74 in)
Length	64.77 cm (25.5 in)
Weight	24.95 kg (55 lb)
Noise level	62 dB
Environmental temperature	
Operating	10°C to 40°C (50°F to 104°F)
Nonoperating	–40°C to 66°C (–40°F to 150.8°F)
Humidity	
Operating	20% to 80% noncondensing
Nonoperating	10% to 95%
Certification	
EMI	Meets applicable FCC, VDE, and FTZ standards for Class A devices
Safety	Meets UL, CSA, TUV "BG" MARK and IEC standards
Maximum number of cartridges	7
Electrical rating	100 to 120/220 to 240 V ac, 2/1 A
AC power consumption	110 W, typical 113 W, maximum
Communications interface	SCSI-2 bus (single-ended or differential)
Cycle time	50 s, maximum



## Overview 1.7 Specifications

**Table 1–4 TZ87 Tape Drive Specifications**

<b>Characteristic</b>	<b>Specification(s)</b>
Mode of operation	Streaming
Media	12.77 mm (1/2 in) unformatted magnetic tape
Track density	256 tracks/in
Bit density	62,500 bits/in
Number of tracks	128
Transfer rate, raw native	1.71 MB/s
Transfer rate, user native uncompressed	1.25 MB/s
Transfer rate, user compressed <sup>1</sup>	More than 2.50 MB/s maximum write More than 3.00 MB/s maximum read
Tape speed	110 in/s
Track format	Two-track parallel, serpentine recording
Cartridge capacity	10.0 GB, formatted, native 20.0 GB, formatted, compressed Assumes 2:1

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<sup>1</sup>Compression ratio is data dependent.

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## Overview

### 1.8 Supplies and Related Documents

## 1.8 Supplies and Related Documents

Use Table 1–5 to order additional cartridges or magazines. Contact your Digital sales representative, or call Digital's DECdirect ordering service at 1-800-DIGITAL.

**Table 1–5 Supplies**

Order Number	Description
TK85-HC	CleaningTape III Cartridge. One cartridge ships with the TZ877 subsystem.
TK85-M	Magazine. Ships with the TZ877 subsystem.
TK85K-01	CompacTape III Cartridge. Seven cartridges ship with the TZ877 subsystem.
TK85K-07	CompacTape III data cartridge (quantity, 7)
TK85K-A0	CompacTape III data cartridge (quantity, 1008)

Use the documents in Table 1–6 as supplements to this manual.

**Table 1–6 Related Documents**

Order Number	Title
AA-Z407B-TE	<i>VAX/VMS Backup Utility Reference Manual</i>
AI-Y506B-TE	<i>Guide to VAX/VMS Disk and Magnetic Tape Operations</i>
AA-Z424A-TE	<i>VAX/VMS Mount Utility Reference Manual</i>
EK-OTZ87-OM	<i>TZ87 Cartridge Tape Subsystem Owner's Manual</i>
EK-OTZ87-RC	<i>TZ87 Tape Drive Operator's Reference Card</i>
EK-SZ107-IG	<i>SZ107 Storage Subsystem Installation Guide</i>

## 2.1 Introduction

This chapter explains TZ877 subsystem operation including:

- Power-on process
- Mode Select key modes
- Operator control panel (OCP) indicator functions
- Slot Select, Load/Unload, and Eject button functions
- Magazine cartridge insertion and removal

## 2.2 Power-On Process

Table 2–1 explains what happens during each phase of the TZ877 operation.

**Table 2–1 Loader Power-on Self-test**

Phase	What Happens
1	When you turn on the TZ877 subsystem, the Loader Fault and Power On indicators on the loader OCP light.
2	One second later, all OCP indicators light. Within 15 seconds, power-on self-test (POST) of the loader mechanics completes. <ul style="list-style-type: none"> <li>• If the Magazine Fault and Loader Fault indicators turn off, loader POST <b>succeeded</b>.</li> <li>• If the Magazine Fault and Loader Fault indicators stay on, loader POST <b>failed</b>.</li> </ul>
3	A few seconds later, the drive controller resets the loader.

(continued on next page)

**Operation**  
**2.2 Power-On Process**

**Table 2–1 (Cont.) Loader Power-on Self-test**

Phase	What Happens						
4	Loader POST starts again.						
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 60%; text-align: left;">If ...</th> <th style="text-align: left;">Then POST ...</th> </tr> </thead> <tbody> <tr> <td>The Magazine Fault and Loader Fault indicators turn off and shortly after, all OCP indicators, except for Power On, turn off,</td> <td><b>Passed</b></td> </tr> <tr> <td>The Magazine Fault and Loader Fault indicators stay on,</td> <td><b>Failed</b></td> </tr> </tbody> </table>	If ...	Then POST ...	The Magazine Fault and Loader Fault indicators turn off and shortly after, all OCP indicators, except for Power On, turn off,	<b>Passed</b>	The Magazine Fault and Loader Fault indicators stay on,	<b>Failed</b>
If ...	Then POST ...						
The Magazine Fault and Loader Fault indicators turn off and shortly after, all OCP indicators, except for Power On, turn off,	<b>Passed</b>						
The Magazine Fault and Loader Fault indicators stay on,	<b>Failed</b>						

**NOTE**

If the Magazine Fault indicator or Loader Fault indicator remains on, POST has detected an error. See Chapter 3 for error conditions.

- |   |   |
|---|---|
| 5 | The elevator scans the magazine to determine which slots contain cartridges.  |
| 6 | If the subsystem magazine has a cartridge in slot 0, and no cartridge is in the drive, these indicators should be on: <ul style="list-style-type: none"> <li>• Power On</li> <li>• Eject</li> <li>• Load/Unload</li> <li>• Slot Select</li> <li>• Slot 0</li> </ul> |

## 2.3 Mode Select Key

The Mode Select key (Figure 2–1) can:

- Lock the loader transfer assembly into the enclosure
- Lock the receiver closed

The Mode Select key has four modes:

- OCP Disabled
- Automatic
- Manual
- Service

OCP Disabled, Automatic, and Manual modes are for operational use. Service mode is for servicing procedures.

### 2.3.1 Operating Modes

The following modes are for operational use:

- **OCP Disabled mode** — When the magazine is inserted into the receiver and the receiver is closed, the loader transfer assembly scans the magazine. The first cartridge in the magazine automatically loads into the drive.

Operations stop if you are copying data to tape and one of the following happens:

- The storage capacity of the last tape cartridge is exceeded
- No tape cartridge is in the next sequential slot in the magazine

To lock the TZ877 subsystem into the enclosure and lock the receiver: set the Mode Select key to **OCP Disabled** mode. The OCP pushbuttons are disabled.

- **Automatic mode** — This mode is the default, or normal, mode of the TZ877 subsystem. It automatically loads and unloads cartridges as necessary during backup procedures.

Operations stop if you are copying data to tape and one of the following happens:

- The storage capacity of the last tape cartridge is exceeded
- No tape cartridge is in the next sequential slot in the magazine

## Operation

### 2.3 Mode Select Key

To lock the TZ877 subsystem into its normal operating position in the enclosure but leave the receiver unlocked: set the Mode Select key to **Automatic** mode. The receiver can be opened and all OCP pushbuttons are enabled.

- **Manual mode** — Automatic loading and unloading of cartridges does not occur in this mode. You must press the Load/Unload button to move each cartridge. This mode is most useful for, but not restricted to, copying specific files to or from tape.

To lock the TZ877 subsystem into the enclosure: set the Mode Select key to **Manual** mode. The receiver is unlocked and can be opened. All OCP pushbuttons are on.

---

#### NOTE

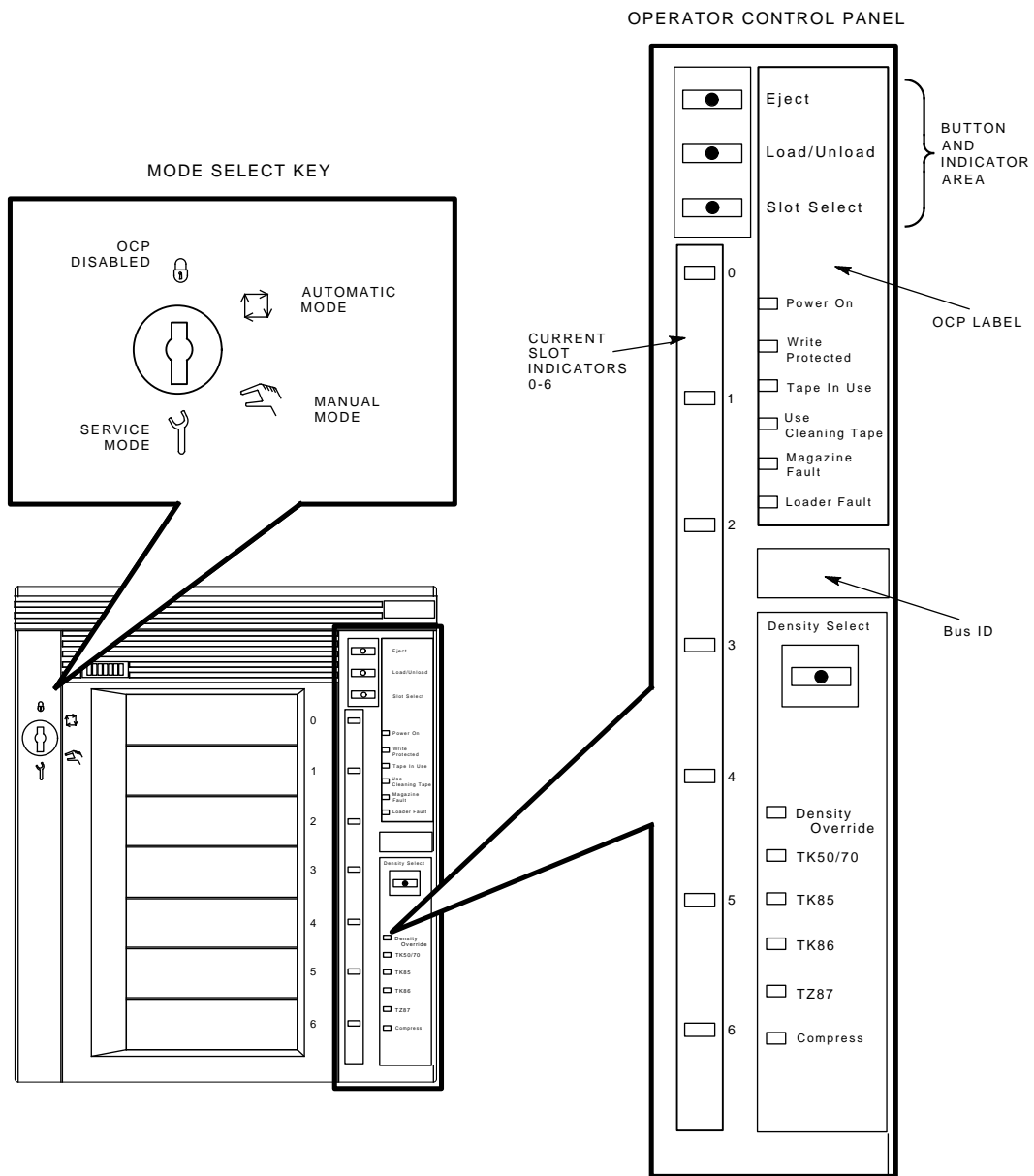
---

During Manual mode, the cartridge returns to the magazine, but the current Slot Select indicator does not advance forward to the next available cartridge.

---

## Operation 2.3 Mode Select Key

Figure 2-1 TZ877 Operator Control Panel



ZKO-1217-07-DG

## Operation

### 2.3 Mode Select Key

#### 2.3.2 Service Mode

Service mode is for servicing the subsystem by a Multivendor Customer Services engineer.

To unlock the TZ877 subsystem from its enclosure and remove it from its normal operating position: set the Mode Select key to **Service** mode. The receiver is unlocked and can be opened.

### 2.4 Operator Control Panel

The TZ877 operator control panel (OCP) has 4 OCP pushbuttons and 23 indicators that are used with the Mode Select key (Table 2–2). See Section 2.3 for information on the Mode Select key and its functions. See Section 2.5 for more details on button and indicator operations.

**Table 2–2 TZ877 Operator Control Panel**

Button/Indicator	Color	State	Function
Eject button	–	–	Opens the receiver, allowing access to the magazine for removal and insertion of cartridges. Also can be used to unload the tape from the drive to the magazine.
Eject indicator	Green	On	Indicates a magazine fault, and that you can press the Eject button to unload cartridges from the drive to the magazine and to open the receiver.
Load/Unload button	–	–	Loads the currently selected cartridge into the tape drive. Unloads the cartridge currently in the tape drive. Resets the subsystem if there is a loader fault.
Load/Unload indicator	Green	On	You can press the Load /Unload button.
Slot Select button	–	–	Increments the current slot indicator to the next slot.

(continued on next page)



**Operation**  
**2.4 Operator Control Panel**

**Table 2–2 (Cont.) TZ877 Operator Control Panel**

<b>Button/Indicator</b>	<b>Color</b>	<b>State</b>	<b>Function</b>
Slot Select indicator	Green	On	You can press the Slot Select button. Pressing this button moves the current slot indicator to the next slot.
Power On indicator	Green	On	The TZ877 is in a known good power state (ac and dc voltages are within tolerance).
Write Protected indicator	Orange	On	The cartridge currently in the drive is write-protected by one of these methods:  Setting the write-protect switch to write-protect.  Using software write-protect qualifiers.
Tape In Use indicator	Yellow	Off	The current cartridge is write-enabled.
		Slow blinking	The tape is rewinding.
		Rapid blinking	Tape is reading or writing.
		On steadily	A cartridge is in the drive and the tape is not moving.
Use Cleaning Tape indicator	Orange	On	No cartridge is in the drive.  The read/write head needs cleaning. See Chapter 4.
Magazine Fault indicator	Red	On	Indicates a magazine failure.
Loader Fault indicator	Red	On	Indicates a loader transfer assembly error or drive error.

(continued on next page)

**Operation**  
**2.4 Operator Control Panel**

**Table 2–2 (Cont.) TZ877 Operator Control Panel**

<b>Button/Indicator</b>	<b>Color</b>	<b>State</b>	<b>Function</b>
Current slot indicators 0–6	Green	On	Identifies the current slot (see Slot Select button). Each current slot indicator blinks when its corresponding cartridge moves to or from the drive. Also used with the Magazine Fault or Loader Fault indicator to show the type of fault (Sections 3.5.1 and Section 3.5.2).
Density Select	Green	On	Indicates you can choose a density on the OCP.
Auto	Yellow	On	Host selection is disabled. Selection mode is manual.
TK50/70	Yellow	On	Indicates all of the following: <ul style="list-style-type: none"> <li>• Tape was recorded in TK50/70 format.</li> <li>• You chose to read the tape in TK50/70 format.</li> </ul>
TK85	Yellow	On	Indicates one or all of the following: <ul style="list-style-type: none"> <li>• Tape was recorded in TK85 format.</li> <li>• You chose to read/write the tape in TK85 format.</li> </ul>
		Blinking	Indicates tape is recorded in another density. You selected this density for a write from BOT.

(continued on next page)

**Operation**  
**2.4 Operator Control Panel**

**Table 2–2 (Cont.) TZ877 Operator Control Panel**

<b>Button/Indicator</b>	<b>Color</b>	<b>State</b>	<b>Function</b>
TK86	Yellow	On	Indicates one or all of the following: <ul style="list-style-type: none"> <li>• Tape was recorded in TK86 format.</li> <li>• You chose to read/write the tape in TK86 format.</li> </ul>
		Blinking	Indicates tape is recorded in another density. You selected this density for a write from BOT.
TZ87	Yellow	On	Indicates one or all of the following: <ul style="list-style-type: none"> <li>• Tape was recorded in TZ87 format.</li> <li>• You chose to read/write the tape in TZ87 format.</li> </ul>
		Blinking	Indicates tape is recorded in another density. You selected this density for a write from BOT.
Compress	Yellow	On	You selected Compression mode.
		Off	Compression mode is disabled.
Density Override	Yellow	On	A density selection has been set from the drive's front panel.
		Off(default)	Density selection is under host control, or automatic
		Blinking	You are in density selection mode.

## Operation

### 2.5 Slot Select, Load/Unload, Eject, and Density Select Button Functions

## 2.5 Slot Select, Load/Unload, Eject, and Density Select Button Functions

The Slot Select, Load/Unload, Eject, and Density Select buttons are OCP pushbuttons. They contain a green indicator and are operable only when their corresponding indicators are on.

---

#### NOTE

---

The Load/Unload button has three functions: *load*, *unload*, and *reset*. If a loader fault has occurred and the Loader Fault indicator is on, press the Load/Unload button to reset the TZ877 subsystem.

---

### 2.5.1 Selecting a Cartridge

To select a cartridge: Press the **Slot Select** button to advance the slot indicator light to the next available slot. After a successful initialization, the TZ877 subsystem automatically selects the first slot that has a cartridge and the Slot Select button becomes active. The Load/Unload and Eject indicators remain on during slot selection.

### 2.5.2 Loading the Cartridge

Press the **Load/Unload** button to load the cartridge into the drive. If no cartridge is loaded, this action causes the Select Slot, Load/Unload, and Eject indicators to turn off, and the elevator to move to the selected slot, indicated by the light. The cartridge is then removed from the magazine and placed in the elevator. The elevator moves to the drive position and inserts the cartridge into the drive.

The indicators remain off until the tape has loaded to the beginning of the tape (BOT). After the cartridge is loaded into the drive, the Eject and Load/Unload indicators turn on, and the corresponding buttons are enabled. The Slot Select indicator remains off.

### 2.5.3 Selecting Density

---

#### NOTE

---

The only time you can change tape density is on a write from BOT. You cannot change density on a read operation.

---

## 2.5 Slot Select, Load/Unload, Eject, and Density Select Button Functions

### Modes of Selecting Density

You can select density through any of the following modes:

1. Use the front panel Density Select button. Using the selection button always overrides other methods.
2. Use a host selection—assuming operating system support. If you do not use the Density Select button, host selection is used.
3. Use the native format. If you do not use an OCP or host selection, then the default (TZ87) format is used.

### How to Select Density

To select density with the TZ87:

1. Press the **Load/Unload** button to load the cartridge into the drive.
2. Use one of the selection methods to select the desired format (TK85, TK86 or TZ87).
3. Issue a command that will cause a write from BOT; for example, from VMS, use the **INITIALIZE** command.
4. After calibration completes, the yellow Tape in Use indicator remains lit, and one of the yellow tape density indicators will light to indicate current density of tape.
5. You can use the **Density Select** button at any time, not just after loading a tape. (A new selection will not take place until you do a write from BOT.) The controller remembers the command you gave until you do one of the following:
  - Change the selection made.
  - Unload the tape. When you unload the tape, the controller forgets the density selection.
  - Eject the magazine from the loader.

## Operation

### 2.5 Slot Select, Load/Unload, Eject, and Density Select Button Functions

**Table 2–3 Results of Density Selection**

If . . .	Then . . .
You did not use the Density Select button	The LEDs show the actual density when the tape is reading and writing. The LEDs light steadily and the Selection LED is off.
You used the Density Select button, and if the actual tape density is the same as the density you selected	The LED next to one of the yellow indicators showing actual density selection and Density Select is on steady. For example, if the actual tape density is TZ87 and the selected tape density is TZ87, then the LED next to TZ87 lights.
You used the Density Select button, and if the actual tape density differs from the density selected:	<p>The LED next to the actual density lights steadily. The LED next to the selected density blinks and the Density Select LED flashes.</p> <p>For example, if the actual tape density is TZ87 and the selected density is TK86, the TZ87 LED lights steadily, the TK86 LED blinks, and the Density Select LED blinks. On a write from BOT the tape is reformatted to the selected density and following occurs: the TZ87 indicator shuts off, the TK86 indicator lights steadily, and the Density Select indicator lights steadily.</p>

**NOTE**

To select density over the SCSI bus, implement a Mode Select (SCSI-2) command with the desired density and write data to the tape from BOT.

#### 2.5.4 Unloading the Cartridge

**CAUTION**

Do not press the Load/Unload button until backup or other tape operations are stopped at the terminal. Doing so can result in operation failure and drive unavailability.

When you press the Load/Unload button:

1. The Slot Select, Load/Unload, Eject, and Density Select indicators turn off
2. The cartridge unloads from the drive into the magazine
3. Automatic operation now stops and the Select Slot operation does not move in increments.

## 2.5 Slot Select, Load/Unload, Eject, and Density Select Button Functions

4. The indicators turn on once the cartridge is returned to the magazine.

The Load/Unload indicator must be on before you press the button to load or unload a cartridge. If the Loader Fault indicator is on, showing a malfunction, press the Load/Unload button to reset the subsystem and try to clear the error.

### 2.5.5 Opening the Receiver

The **Eject** button opens the receiver for insertion or removal of the magazine. The Eject button is disabled when the Mode Select key is in the OCP Disabled position. The Eject button can also be used to *unload* a tape from the drive.

When a cartridge is . . .	Then . . .
Not in the drive, the Slot Select, Load/Unload, Eject, and Density Select indicators are on before any operation begins.	Pressing the Eject button causes all indicators to turn off. The elevator then returns to its home position and the receiver opens. Once you close the receiver again, a magazine scan begins. When the scan completes, the indicators turn back on.
In the drive, the Eject and Load /Unload indicators are on before the operation begins.	Pressing the Eject button causes both indicators to turn off, and the cartridge unloads from the drive and moves back into the magazine. The receiver then opens to allow access to the magazine. Once you close the receiver again, a magazine scan begins. When the scan completes, the indicators turn back on.

## 2.6 Magazine

The front of the magazine has numbers 0 through 6 that indicate the number of the slot.

**NOTE**

Insert and remove all cartridges at the *front* of the magazine.

### 2.6.1 Inserting a Cartridge into the Front of the Magazine

To simplify cartridge insertion: Place the magazine on a flat surface with the slots facing you (Figure 2–3). Each slot is numbered to ensure you are inserting the cartridge correctly into the front of the magazine. Usually, cartridges are inserted into consecutive slots.

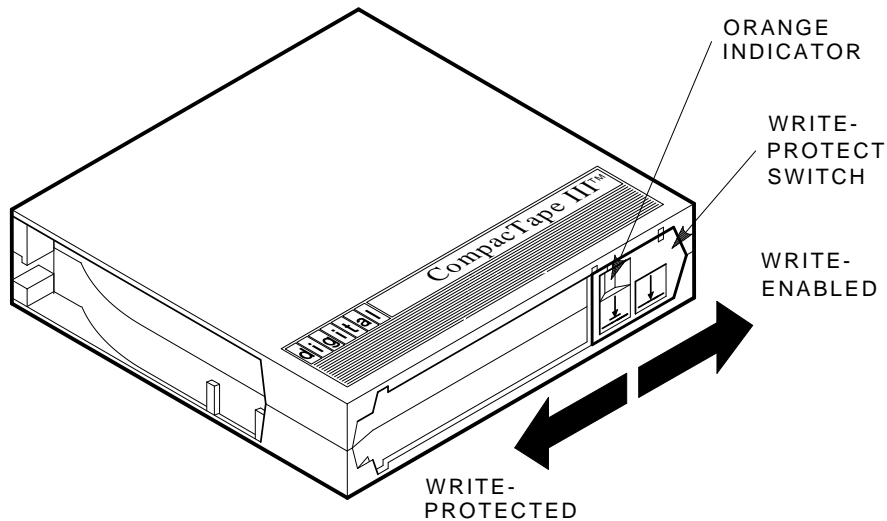
## Operation

### 2.6 Magazine

To insert a cartridge into the magazine:

1. Grasp the cartridge with the CompacTape III label facing up and the write-protect switch facing you (Figure 2-2).
2. Set the cartridge's write-protect switch to the desired position. If you want to:
  - Write on the tape, slide the switch to the right (orange indicator is not visible).
  - Write-protect the tape, slide the switch to the left (orange indicator is visible).
3. Insert the cartridge (Figure 2-3) by pushing it into the slot until it stops and you hear a click. A small metal tab holds the cartridge in place.

Figure 2-2 Write-Protect Switch on a Cartridge

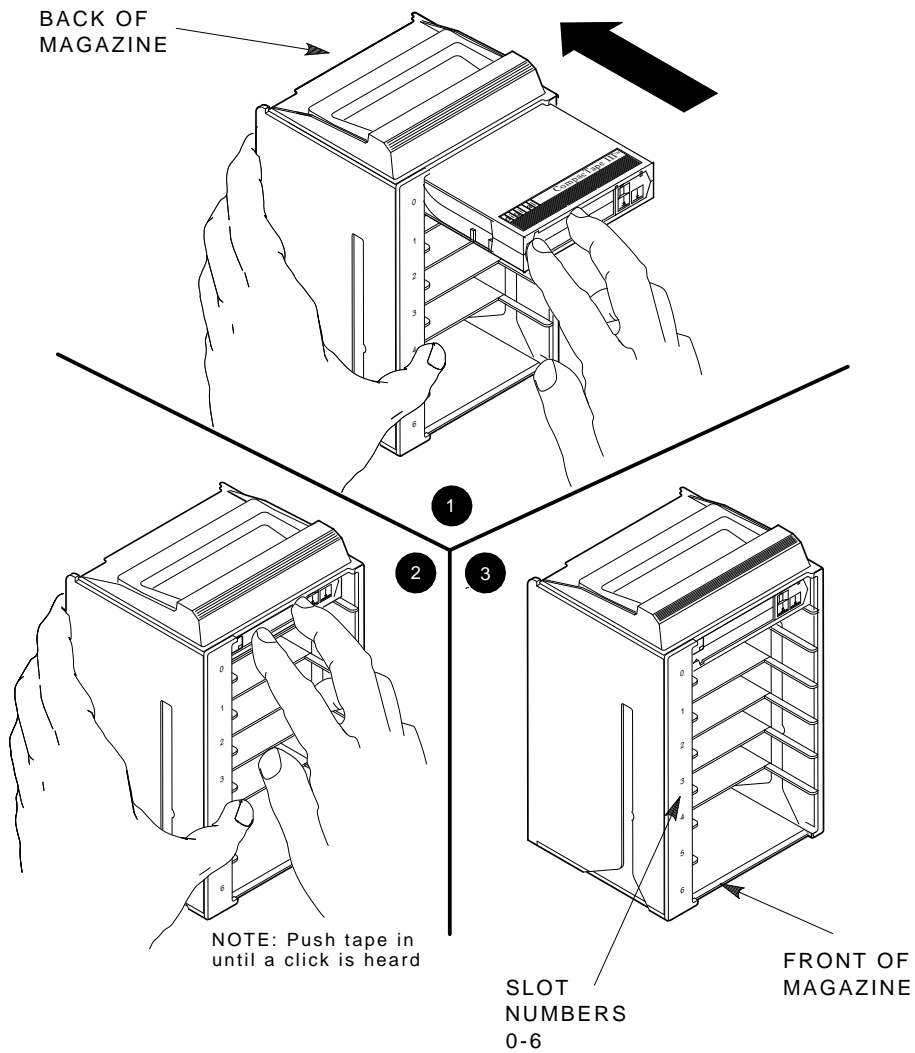


SHR\_X1020C\_89



**Operation  
2.6 Magazine**

**Figure 2-3 Inserting a Cartridge into the Magazine**



SHR\_X1021\_89

## Operation

### 2.6 Magazine

#### 2.6.2 Removing a Cartridge from the Magazine

To remove a cartridge from the magazine: At the front of the magazine, press the cartridge in until it stops and you hear a click (Figure 2–4). Then release the cartridge. The slot uses a spring-release action.

---

**NOTE**

---

Never apply labels to the top or bottom of tape cartridges. Doing so can cause cartridge jams in the TZ877 subsystem. Use the space on the front of the cartridge for labels. If a jam occurs, call your Multivendor Customer Services representative.

---

#### 2.6.3 Removing the Magazine from the Receiver

To remove the magazine from the receiver, ensure:

1. The Power On indicator is on (Figure 2–1).
2. The tape drive is unloaded.
3. The Eject indicator is on. (It must be on before you can press the Eject button.)

Then:

1. Press the Eject button (Figure 2–1) to open the receiver.
2. Grasp the receiver after it opens (Figure 2–5), and gently pull it forward to access the magazine.
3. Grasp the magazine's handle only to lift the magazine out of the receiver.

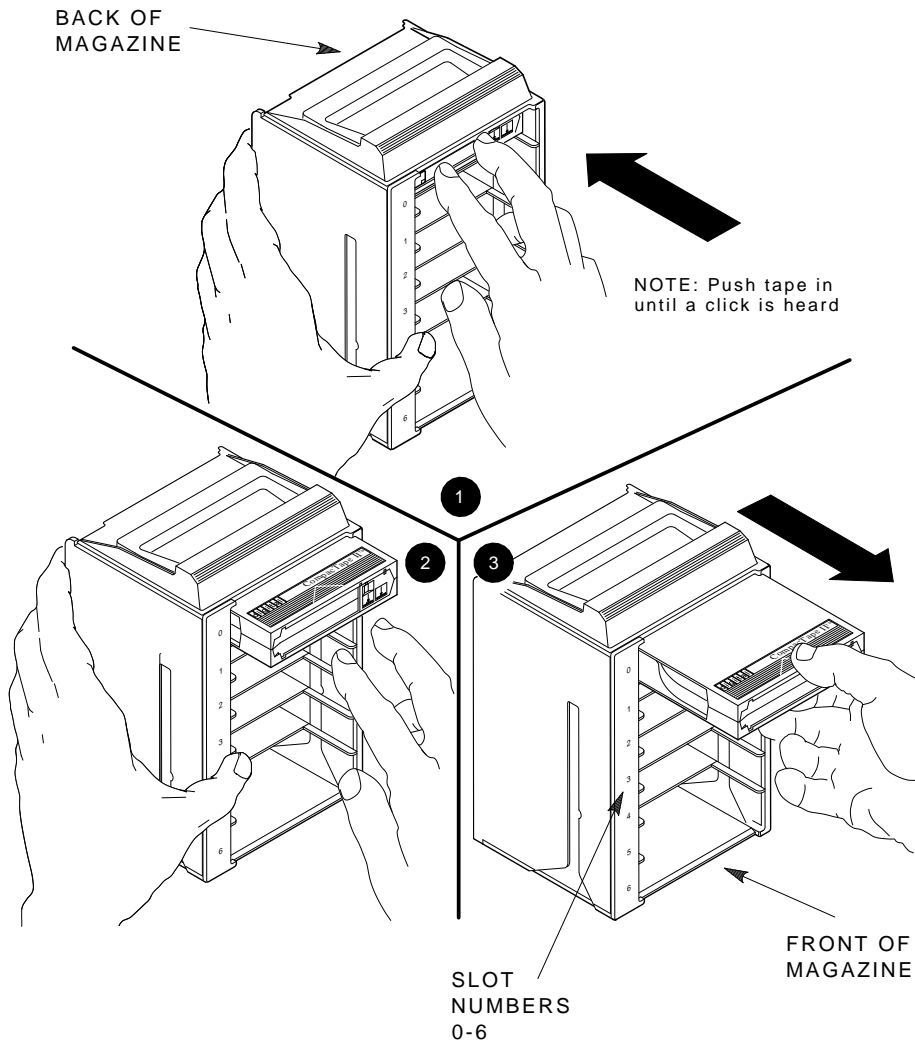
#### 2.6.4 Installing the Magazine into the Receiver

To install the magazine into the receiver:

1. Hold the magazine by the handle and slide the magazine down into the receiver (Figure 2–5). The magazine is slotted, you can restore it in the correct orientation only.
2. Push the receiver closed.
3. Observe that the receiver is fully closed in the TZ877 subsystem before proceeding.

**Operation  
2.6 Magazine**

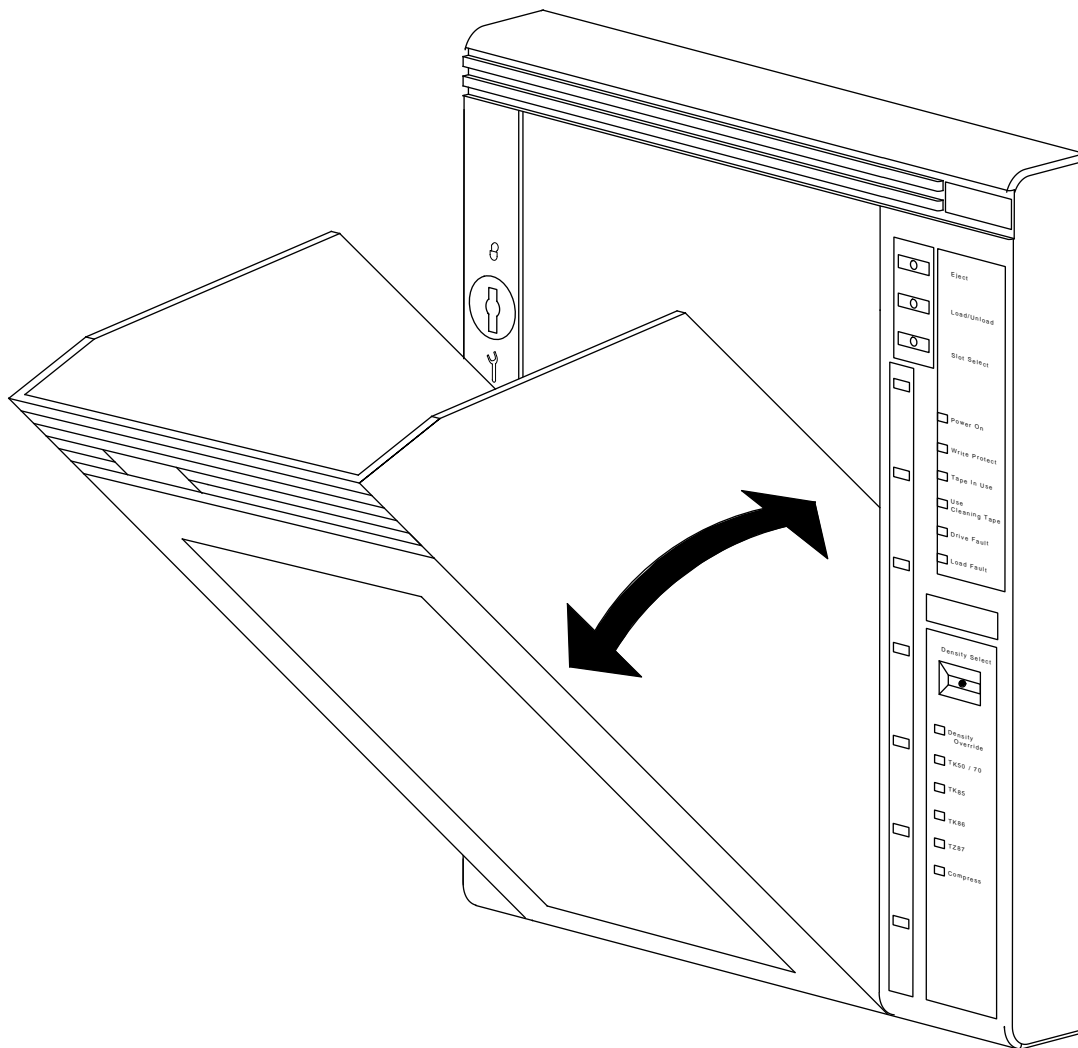
**Figure 2-4 Removing a Cartridge from the Front of the Magazine**



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## Operation 2.6 Magazine

Figure 2-5 Receiver Opened



ZKO-1217-15-DG

## 2.7 Configure the TZ877

This section describes how to configure the TZ877 including:

Topic	Section
Configuration Guidelines	Section 2.7.1
Switchpack Location	Section 2.7.2
To Disable Parity Checking	Section 2.7.3
Changing the SCSI ID	Section 2.7.4

The TZ877 is factory set to SCSI ID 5.

If your system generates parity, the TZ877 can check for correct parity on the SCSI bus.

### 2.7.1 Configuration Guidelines

Your system uses the SCSI ID to identify or address the TZ877. Follow these guidelines when configuring the TZ877 for use on your system:

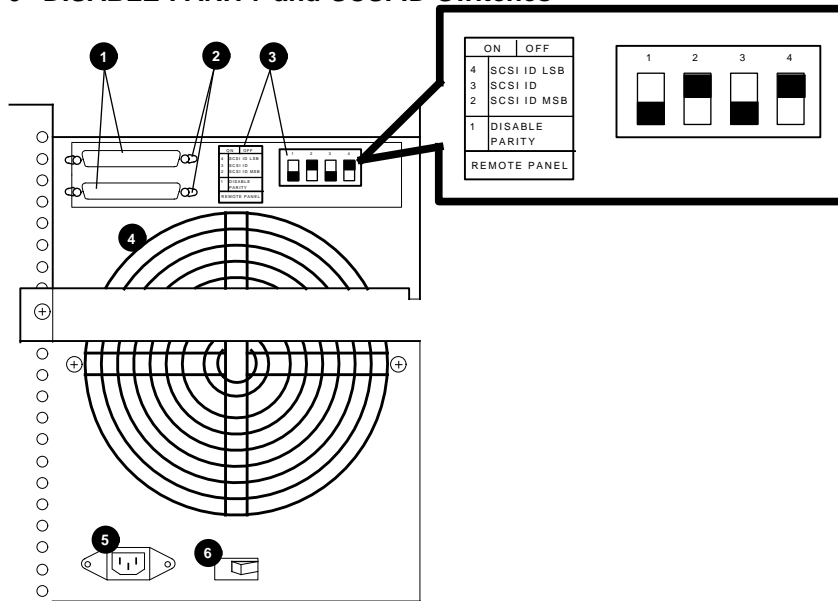
If you are installing the TZ877 as . . .	Then . . .
The only SCSI device on the bus	You can leave the SCSI ID factory setting as is.
One of multiple SCSI devices on the bus	Be sure to use a SCSI ID that is unique from any other device or system ID on the SCSI bus.
The last or only device on the SCSI bus	You must terminate the bus by installing a terminator.

### 2.7.2 Switchpack Location

Figure 2–6 shows the location of the DISABLE PARITY and SCSI ID switchpack.

**Operation**  
**2.7 Configure the TZ877**

**Figure 2-6 DISABLE PARITY and SCSI ID Switches**



ZKO-1217-29-DG

- 
- 1** SCSI Connectors
  - 2** Wire Cable Clamps
  - 3** Decal and SCSI ID Switchpack
  - 4** Fan
  - 5** Power Connector
  - 6** Power Switch
-

---

**CAUTION**

---

Never use a pencil to press the switches on the switchpack.

---

### **2.7.3 To Disable Parity Checking**

If your system does not generate parity, you can disable parity on the TZ877 by repositioning the switches on the loader rear panel.

To disable parity checking: set the DISABLE PARITY switch to ON (Figure 2–6) by pressing down on the left side switch 1.

### **2.7.4 Changing the SCSI ID**

You can change the SCSI ID by repositioning the switches on the rear panel of the TZ877. To change the SCSI ID:

1. Look at the first column in the label Figure 2–6 and choose a SCSI ID.
2. Next to the SCSI ID you chose from Figure 2–6, look across at the Switch 2, Switch 3, and Switch 4 columns. See what the setting should be for each switch at the chosen ID.

For example, if you chose SCSI ID 3, then the setting for Switch 2 is Off; Switch 3 is On; and Switch 4 is On.

Switch 2 is the most significant bit (MSB) and switch 4 is the least significant bit (LSB).

If the switch setting should be:

- On, press in the left side of the switch on the rear of the TZ877 (Figure 2–6).
- Off, press in the right side of the switch on the rear of the TZ877 (Figure 2–6).





---

## Error Conditions and Problem Resolutions

### 3.1 In This Chapter

This chapter describes:

- The necessary conditions to ensure the OCP pushbuttons **Slot Select**, **Load/Unload**, **Eject**, and **Density Select** operate effectively
- Instructions on resolving BACKUP operation failures
- Magazine and loader faults and how to clear them
- What to check if a power problem occurs

### 3.2 Conditions Necessary for Button Operation

Be sure to review information in the previous chapters to ensure you are correctly operating the TZ877 magazine tape subsystem.

Before pressing the Slot Select, Load/Unload, Eject, or Density Select button on the TZ877 OCP, check for the conditions listed in Table 3-1 and ensure that the:

- Power On indicator is on
- Receiver is closed
- Mode Select key is *not* set to OCP Disabled

Pressing these buttons has no effect if their indicators are off.

---

#### NOTE

---

Do not press the Load/Unload button to abort any function of the TZ877 subsystem. Type **Ctrl/Y** or **Ctrl/C** instead.

---

## Error Conditions and Problem Resolutions

### 3.2 Conditions Necessary for Button Operation

See Chapter 2 for more information on the functions of the TZ877 OCP buttons.

**Table 3–1 TZ877 OCP Button Conditions**

<b>If you want to . . .</b>	<b>First make sure the . . .</b>	<b>Then press this button . . .</b>
Select another slot in the magazine	Magazine contains at least two cartridges Slot Select indicator is on	Slot Select
Load the selected cartridge into the tape drive	Magazine contains at least one cartridge Load/Unload indicator is on	Load/Unload
Return the selected cartridge to its original slot in the magazine	Load/Unload indicator is on	Load/Unload
Clear a magazine or loader fault	Load/Unload indicator is on Magazine Fault or Loader Fault indicator is on	Load/Unload
Open the receiver, or unload the cartridge from the drive and open the receiver	Eject indicator is on	Eject

**Error Conditions and Problem Resolutions**  
**3.3 Backup Operation Failure**

### **3.3 Backup Operation Failure**

Some manual operations, if not performed correctly, may cause backup operations to fail during BACKUP:

- Loading write-protected CompacTape III cartridges when executing write operations
- Selecting the incorrect cartridge slot from which to initialize operations

### **3.4 Avoiding Basic Problems**

Follow these guidelines when operating the TZ877 subsystem to avoid basic problems:

- Use CompacTape III cartridges.
- Check the tape leader in the cartridge by lifting the cartridge latch that opens the door to expose the leader. Be sure the leader is in the same position as the one shown in Figure 3-1.

---

**CAUTION**

---

Do not touch the exposed magnetic tape. If the tape leader is not in the correct position, use a new cartridge.

---

- Be sure that the receiver is fully closed and the current slot indicator is on for the starting cartridge.
- Be sure that *no* slots in the magazine are empty between the starting cartridge and the expected completion cartridge.

---

**NOTE**

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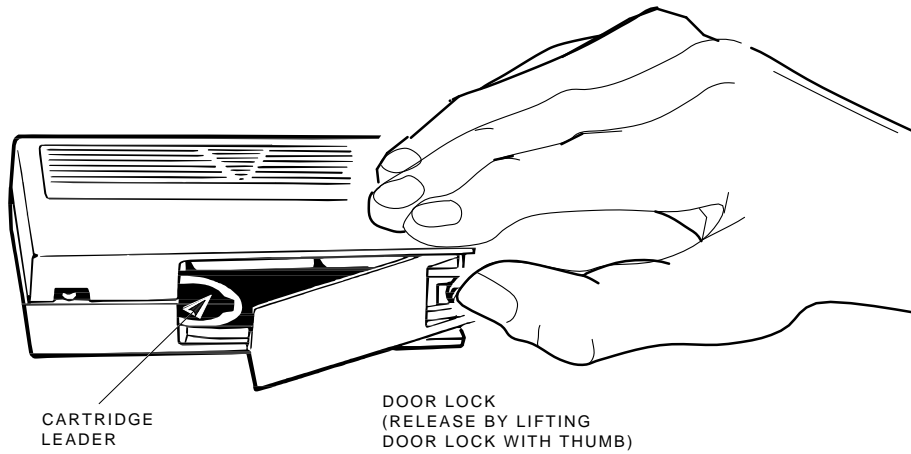
The TZ877 subsystem unloads and loads the next cartridge when the subsystem receives an UNLOAD command from the system.

---

## Error Conditions and Problem Resolutions

### 3.4 Avoiding Basic Problems

Figure 3–1 Opening the Cartridge Door to Check the Tape Leader



SHR-0002-86  
SHR\_X1027\_89\_CPG

## 3.5 Error Conditions

Error indications fall into two main categories:

- **Magazine Fault** — In most cases, this is an operator-correctable condition, indicated when the Magazine Fault indicator is on. If you cannot resolve the fault, call your Multivendor Customer Services representative.
- **Loader Fault** — This is a condition that most likely requires service from a Multivendor Customer Services representative. It is indicated when the Loader Fault indicator is on.

## Error Conditions and Problem Resolutions

### 3.5 Error Conditions

#### 3.5.1 Magazine Fault Description

A magazine fault indicates an inconsistency between what the loader transfer assembly has done with a cartridge and the actual state detected by the subsystem.

Inconsistent magazine status occurs when:

- The magazine is full and an extra cartridge is in the drive
- The magazine is full and an extra cartridge is in the elevator
- The loader has loaded a cartridge into the drive, but the cartridge has been manually removed
- The flag is set in the magazine, but no cartridge is present
- An unrecognized cartridge is in the magazine

When these conditions are present, the Magazine Fault indicator is on, indicating a situation that can be corrected by the operator. The Eject indicator is also on to inform you that this is the only function available at this time.

Slot indicators are as follows:

- Slots 6 and 0 light, indicating a cartridge in the drive was not loaded by the loader transfer assembly.
- Slots 5 and 0 light, indicating you need to replace any missing cartridges in the magazine.

---

**NOTE**

---

The Slot 0 indicator is on in all error conditions to indicate that an error occurred. It is not a Slot Select indicator in this case.

---

##### 3.5.1.1 Clearing a Magazine Fault

To clear a magazine fault, first try pressing the Load/Unload button. If the fault does not clear, press the Eject button to open the receiver and remove the magazine to locate the cartridge error. After you have cleared the error, try loading and unloading cartridges to verify operation.

## Error Conditions and Problem Resolutions

### 3.5 Error Conditions

#### 3.5.2 Loader Fault Description

A loader fault indicates the TZ877 subsystem detected a fatal error in either the loader transfer assembly or the tape drive. In some loader transfer assembly errors, the subsystem retries the error three times before indicating failure. All loader faults generate an error log as well as light the Loader Fault indicator and an associated subcode.

The Loader Fault indicator indicates errors in the loader transfer assembly, controller module, and drive. The suspected location of a fault is indicated by the following slot indicators:

- Slots 4 and 0 light, indicating a controller module fault.
- Slots 5 and 0 light, indicating a loader transfer assembly fault.
- Slots 6 and 0 light, indicating a drive fault.

---

**NOTE**

---

Error indicators do not blink. During hardware failures, the controller module determines action.

---

##### 3.5.2.1 Clearing a Loader Fault

When a loader fault occurs, the Load/Unload and Eject indicators are on. When you press the Load/Unload button, the TZ877 subsystem attempts to clear the error. When you press the Eject button, the receiver opens to let you access the magazine.

## 3.6 Power Problems

If the Power On indicator is not on, or your system does not recognize the TZ877 subsystem:

- Verify that the subsystem is pushed completely into the enclosure. (Power to the loader transfer assembly is disabled when it slides forward.)
- Verify with your system manager that the subsystem configuration is correct.
- Call your Multivendor Customer Services representative.

# 4

---

## Head Cleaning

### 4.1 Introduction

The Tx877 magazine tape subsystem uses the CleaningTape III cartridge (Figure 4-1) for cleaning the read/write head in the tape drive.

### 4.2 Using the CleaningTape III Cartridge

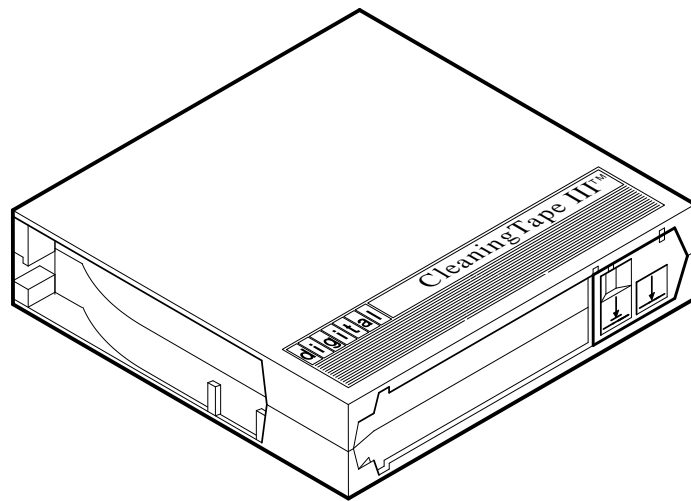
The CleaningTape III cartridge is a yellow plastic cartridge containing 1200 feet of 1/2-inch, magnetic particle (MP) cleaning tape. You can use the CleaningTape III cartridge approximately 20 times before it expires.

You should not have to use the cleaning tape periodically. Use it only if the subsystem indicates a problem. For example, a cleaning indicator is on, or a hard read/write error occurs.

## Head Cleaning

### 4.2 Using the CleaningTape III Cartridge

Figure 4-1 CleaningTape III Cartridge



SHR\_X1020E\_89



## Head Cleaning

### 4.2 Using the CleaningTape III Cartridge

To clean the read/write head: Insert the CleaningTape III cartridge into the magazine where it then loads into the drive (Section 4.3).

---

#### NOTES

---

Perform the head cleaning procedure only when the orange Use Cleaning Tape (4-2) indicator is on.

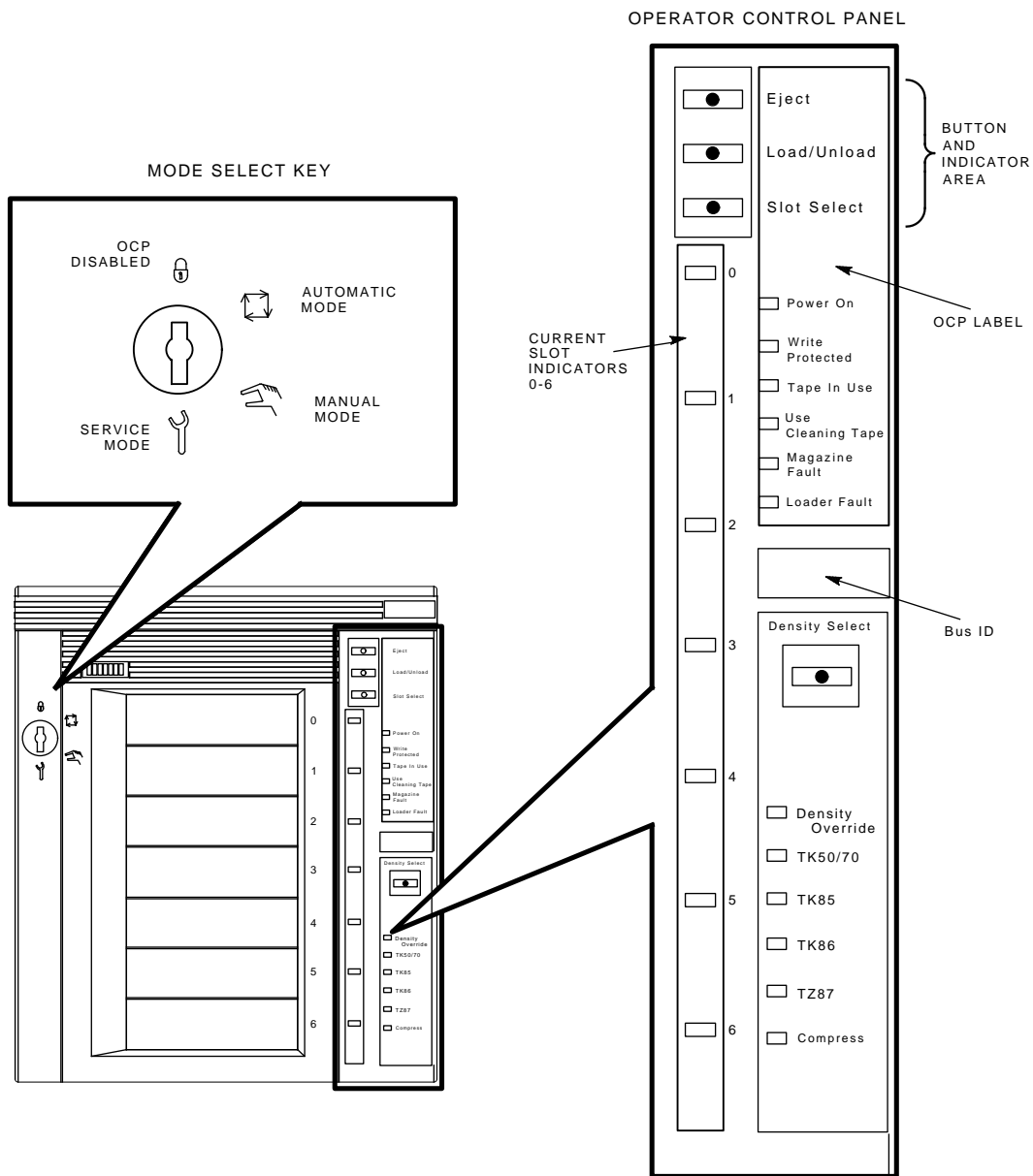
If the Loader Fault indicator is on, clear the fault before proceeding with head cleaning.

---

# Head Cleaning

## 4.2 Using the CleaningTape III Cartridge

Figure 4-2 TZ877 Operator Control Panel



ZKO-1217-07-DG

### 4.3 Inserting the CleaningTape III Cartridge into the Magazine

## 4.3 Inserting the CleaningTape III Cartridge into the Magazine

Be sure to use a CleaningTape III cartridge.

---

**CAUTION**

---

To use the cleaning procedure, you must return the CompacTape III cartridges to their *original* slots, and remove the cleaning cartridge from the magazine after the cleaning procedure is done.

---

To clean the read/write head (Figure 4-2):

1. Press the Load/Unload button to remove any cartridge that may be in the drive, and to return the cartridge to the magazine.
2. Press the Eject button to open the receiver and remove the magazine.
3. Insert the CleaningTape III cartridge into the first slot of the magazine.
4. Insert the magazine into the receiver; close the receiver.
5. Press the Load/Unload button to load the cleaning cartridge into the drive.  
Once the cleaning cartridge is loaded, the drive begins the head cleaning procedure. When the cleaning procedure is complete, the cleaning cartridge automatically returns to the magazine.
6. Press the Eject button to remove the magazine.
7. Remove the cleaning cartridge from the magazine and replace the CompacTape III cartridge in the magazine.

---

**NOTE**

---

If the Use Cleaning Tape indicator remains on, the cleaning cycle was not successful due to an expired cartridge. Replace the cleaning cartridge and repeat the cleaning process.

If a particular cartridge causes the Use Cleaning Tape indicator to turn on frequently, it is suggested this cartridge be backed up on another, and then discarded. A damaged cartridge may cause unnecessary use of the CleaningTape III.

---



# A

---

## VMS Operating System Commands

### A.1 Introduction

The TZ877 magazine tape subsystem uses most of the standard magnetic tape commands that can be invoked under VMS operating system version 5.4-2 or later.

This appendix is a reference only; it does not include all the details that may be involved in using VMS commands.

For more information about VMS commands and command files, see the *VAX/VMS Guide to Using Command Procedures* (AA-H782B-TE), *VAX/VMS Command Language User's Guide* (AA-DO23C-TE), or the *VMS System Manager's Manual* (AA-LA00B-TE).

### A.2 Tape Device Specific Commands

Use the following commands to operate the TZ877 subsystem:

- ALLOCATE
- BACKUP
  - MOUNT/FOREIGN
  - BACKUP
  - DISMOUNT
- COPY
  - INITIALIZE
  - MOUNT
  - COPY
  - DISMOUNT

## VMS Operating System Commands

### A.2 Tape Device Specific Commands

#### A.2.1 ALLOCATE Command

**ALLOCATE** provides exclusive access to a device and optionally establishes a logical name for that device. Once you have allocated a device, other users cannot access that device until you explicitly **DEALLOCATE** it, or until you log out. Use the following format to allocate the TZ877 subsystem:

```
$ ALLOCATE device name: [logical name]
```

For example, to allocate the TZ877 for your use and assign it to the logical name *TAPE1*, do the following:

```
$ ALLOCATE MIA0:TAPE1
```

The TZ877 subsystem's physical device name is assigned by your system manager after it is installed.

#### A.2.2 DEALLOCATE Command

**DEALLOCATE** cancels the exclusive access you assign to a device with the **ALLOCATE** command.

```
$ DEALLOCATE device name: [logical name]
```

#### A.2.3 BACKUP Command

**BACKUP** provides protection against file volume corruption by creating functionally equivalent backup copies.

Use the following format to back up a file:

```
$ BACKUP/NOCRC/GROUP=0/BLOCK_size=65534/media_format=compaction  
/label=[volume label]  
filename.ext [device-name or logical name]:filename.bck
```

In addition to backing up single files, you can back up lists of files and entire volumes.

## VMS Operating System Commands

### A.2 Tape Device Specific Commands

---

#### NOTE

---

By selecting the /NOCRC and /GROUP=0 qualifiers and a large block size with the /BLOCK qualifier (65534 is the largest possible block size), you can achieve better performance from the TZ877 subsystem. The previous command line excludes the use of the host-available CRC error detection/correction capability, and depends on the embedded error checking and correction capabilities of the TZ877. TZ877 error correction capabilities relate specifically to the TZ877 subsystem—not to the entire system.

Use of the /NOCRC qualifier requires a systems management decision relative to the incremental difference in data integrity versus a performance tradeoff. In most cases, TZ877 internal error detection and correction capabilities are sufficient to ensure data integrity and recovery. The host-level CRC provides another level of error detection and correction, which may be important under some conditions.

---

Refer to your system manuals before deciding on qualifiers for use with the **BACKUP** command. For detailed information about **BACKUP** and other VMS tape commands, see the *VAX/VMS Backup Utility Reference Manual* (AA-Z407B-TE).

#### A.2.4 MOUNT Command

The **MOUNT** commands lets you make a magnetic tape volume available for processing. Note that it loads the tape with the protection set according to the write-protect switch on the cartridge.

Use the following format to mount a tape with the TZ877 subsystem:

```
$ MOUNT/FOREIGN/BLOCK_SIZE=65534/[device name]
[volume label] [logical name]
```

As an example, to make TAPE1 available for processing, type the following:

```
$ MOUNT/FOREIGN/MEDIA_FORMAT=COMPACTION/MIA0
```

The console displays a message:

```
TAPE1 MOUNTED ON MIA0:
```

You must use the /FOREIGN qualifier when you are performing **BACKUP** commands. Do not use it when you are performing **COPY** commands.

## VMS Operating System Commands

### A.2 Tape Device Specific Commands

---

#### NOTE

---

Caching is normally enabled on VMS systems. If it is not, you can use the following command:

```
$ MOUNT/CACHE=TAPE_DATA
```

---

For more information, see the *VAX/VMS Mount Utility Reference Manual* (AA-Z424A-TE).

#### A.2.5 COPY Command

Use the **COPY** command with the TZ877 subsystem to copy files from cassette tape.

In the following example, the **MOUNT** command requests that the volume labeled *GMB001* be mounted on the tape drive at *MIA0* and assigns the logical name *TAPE1*.

**COPY** uses the logical name *TAPE1* for the input file specification. All files on *MIA0* are copied to the current default disk and directory. The files keep their original file names and file types.

```
$ MOUNT MIA0: GMB001 TAPE1:  
$ COPY TAPE1:*. * *. *
```

---

#### NOTE

---

Using the **COPY** command to move multiple files may not achieve optimum performance. Check with your system manager for more information.

---

#### A.2.6 DISMOUNT Command

The **DISMOUNT** command cancels the **MOUNT** command, makes the unit unavailable for processing, and rewinds the tape.

To eject a tape cassette from the tape drive, you must rewind and unload the tape. Use the following format:

```
$ DISMOUNT logical name or device name:
```

To rewind to the beginning of the tape (BOT) without unloading it, use the following format:

```
$ DISMOUNT/NOUNLOAD logical name or device name:
```



## VMS Operating System Commands A.2 Tape Device Specific Commands

### A.2.7 INITIALIZE Command

---

#### CAUTION

---

Be sure you are using a scratch tape before initializing; otherwise, any existing data on the tape will be destroyed.

---

Use the **INITIALIZE** command to specify the device name and write a volume name to the magnetic tape volume loaded into the TZ877 subsystem. The tape must be write-enabled for initializing.

Use the following format:

```
$ INITIALIZE device name: [volume label]
```

As an example, to initialize the device *TAPE1* and assign the volume name *GMB001*, type the following:

```
$ INITIALIZE/BLOCK_SIZE=65534/MEDIA_FORMAT=COMPACTION/  
TAPE1: GMB001
```

For detailed information regarding volume names and magnetic tape operations, see the *Guide to VAX/VMS Disk and Magnetic Tape Operations* (AA-M539A-TE).



# B

---

## Using the TZ877 Subsystem with the ULTRIX Operating System

### B.1 Introduction

This appendix is intended for those using the TZ877 tape subsystem with the ULTRIX operating system.

This appendix includes:

- Adding the TZ877 subsystem to your ULTRIX system
- Tips on getting maximum capacity and performance
- Using the TZ877 for unattended backups
- Using various ULTRIX commands to save information on the TZ877

### B.2 Adding the TZ877 to the ULTRIX System

Before connecting the TZ877 to the SCSI bus:

1. Locate the SCSI ID switches at the rear of the TZ877.
2. Ensure the SCSI ID (target ID) number for the TZ877 is unique. The recommended ID is 5. Use SCSI ID 5 only if no other device on the bus has SCSI ID 5.
3. Ensure all other devices on the SCSI bus have unique SCSI IDs.

#### B.2.1 Connecting the TZ877 to ULTRIX

To connect the TZ877 subsystem to the ULTRIX system:

1. Physically connect the TZ877 cable(s) to the ULTRIX system.
2. Ensure an entry for the TZ877 is specified in the ULTRIX system configuration file. If you have to modify your configuration file by adding an entry, then you must build a new kernel and reboot the system. This is explained in Section B.2.3 and Section B.2.4.

## Using the TZ877 Subsystem with the ULTRIX Operating System

### B.2 Adding the TZ877 to the ULTRIX System

3. Create logical device names for your TZ877, explained in Section B.2.5.

#### B.2.2 Checking the ULTRIX System Configuration File

Locate the ULTRIX system's configuration file. It should be in the `/usr/sys/conf` directory under the mips or VAX system subdirectory.

The configuration file name is the same as the system name and must contain an entry for the TZ877 subsystem.

If . . .	Then . . .
An entry does not exist,	You need to create an entry in the configuration file.
An entry already exists,	You do not need to change the configuration file.

#### B.2.3 Creating an Entry

An entry has the following format:

tape name at controller device#

An example entry for Bus 0, SCSI ID 5:

tape tz5 at sii0 drive 5

To create an entry in the configuration file:

1. Refer to Table B-1 to determine the name according to your SCSI target ID and your bus number. Usually, users have one bus, Bus 0. Find the name, listed under the Bus 0 or Bus 1 columns.

For example: The name for SCSI Target ID 5, Bus 0 is tz5.

**Table B-1 Determining the Tape Name**

SCSI Target ID	Bus 0	Bus 1
0	tz0	tz8
1	tz1	tz9
2	tz2	tz10
3	tz3	tz11

(continued on next page)

## Using the TZ877 Subsystem with the ULTRIX Operating System

### B.2 Adding the TZ877 to the ULTRIX System

Table B-1 (Cont.) Determining the Tape Name

SCSI Target ID	Bus 0	Bus 1
4	tz4	tz12
5	tz5	tz13
6	tz6	tz14
7	tz7	tz15

2. Determine the name of the controller to which the TZ877 subsystem is connected.
3. Include the words tape, name, controller, and the device# in the entry.

#### B.2.4 Building the Kernel, Rebooting the System

If you added an entry to your configuration file, you must rebuild the kernel and reboot the system. Be sure to save the original kernel before rebooting the system.

For example:

```
$ /etc/doconfig          (create a new kernel)
$ mv /vmunix /vmunix.old (save the old kernel)
$ mv new_kernel_name /vmunix (move the new kernel to the root directory)
$ /etc/shutdown -r now    (reboot the system)
```

#### B.2.5 Creating Logical Device Names for the TZ877 Subsystem

Use the MAKEDEV command located in the `/dev` directory to create logical device names.

For example:

```
$ cd /dev
$ MAKEDEV tz5
```

Leads to some or all of the following logical device names:

```
/dev/nrmt0l
/dev/nrmt0h
/dev/rmt0l
/dev/rmt0h
/dev/rmt0m
/dev/nrmt0m
/dev/rmt0a
```

## Using the TZ877 Subsystem with the ULTRIX Operating System

### B.2 Adding the TZ877 to the ULTRIX System

/dev/nrmt0a

- *mt* (in the middle of the logical name) means *magnetic tape* device.
- *nr* means *no rewind* when the utility completes. Use the no rewind option when more than one operation is being performed to the same tape.
- *r* means *rewind* when the utility completes.
- *0* is the logical unit number.
- *l* means *low* density.
- *h* means *high* density.
- *m* means *medium* density.
- *a* means *auxiliary* density.

---

#### NOTE

---

Since the TZ877 is a high density tape subsystem, be sure to use the logical device names including *h*. The only exception is if modifications are made to allow selection of TK85, TK86, or TK87 (native) densities for writing via the other device entries (Section B.5).

---

### B.3 Getting Maximum Capacity and Performance

The TZ877 subsystem stores data at different capacities, depending on the drive format in which the TZ87 drive is writing. Use Table B-2 to see the capacity with each drive format.

**Table B-2 Maximum Capacity**

Drive Format	Data Amount Per Cartridge	Data Amount Total
TZ87, no compression	More than 10.0 GB	70.0 GB (minimum)
TZ87, with compression	More than 20.0 GB, depending on data type	140.0 GB (typical)
TZ86	6.0 GB	42.0 GB
TZ85	2.6 GB	18.2 GB

The TZ877 runs at maximum streaming rates of 1.25 MB/s in non-compression mode, 2.5 MB/s (write, depending on compression ratio and data) and 3.0 MB/s (read, depending on decompression ratio and data) in compression mode.

## Using the TZ877 Subsystem with the ULTRIX Operating System

### B.3 Getting Maximum Capacity and Performance

#### B.3.1 Getting Maximum Storage Capacity and Recommendations

This section explains how to maximize the functions of the TZ877 subsystem. To get maximum storage capacity when writing in TK85 or TK86 format, Use block sizes that are integral multiples of 4096 bytes, such as 4k, 8k, 12k, 16k, and so forth. It is **recommended** you use larger block sizes of 16k, 24k, or 32k when writing in TK85 or TK86 format. These larger block sizes:

- Allow more efficient data processing by the host and on the SCSI bus
- Maximize capacity

Block size does not have much effect on capacity when the TZ877 subsystem is writing in TZ87 format, but data rates can be affected.

Some utilities and commands default to using block sizes that cause lower capacity and I/O rates. For example:

If you use . . .	Then you can fit . . .
A 512 byte block size when writing in TK85 format (this is the <b>dd</b> command's default)	About 320 MB of data on the tape
A 512 byte block size when writing in TK86 format	About 750 MB of data on the tape
A 512 byte block size when writing in TZ87 format	About 10 GB (no compression) and 20 GB (with compression) of data on the tape
Recommended block sizes	<ul style="list-style-type: none"><li>• 2.6 GB for TK85 format</li><li>• 6.0 GB for TK86 format</li><li>• 10.0 GB (minimum) for TZ87 format (not much effect)</li></ul>

Most utilities used for tape I/O let you select block size through command line switches.

#### NOTE

If you are not using ULTRIX V4.2a or later, with the latest Common Access Method (CAM) software kit installed, you have a tape file length limit of 2.1 GB.

With striping or disk array techniques or when running the tar command to back up multiple file systems, remember the 2.1 GB limit.

## Using the TZ877 Subsystem with the ULTRIX Operating System

### B.3 Getting Maximum Capacity and Performance

Plan backups so that a tar or dump set does not exceed the 2.1 GB limit. However, you can store multiple save sets on the same cartridge.

---

#### B.3.2 Maximizing Performance

To handle bursts of data, the TZ877 subsystem has about 2 MB of cache memory. This minimizes repositioning and keeps I/O rates as high as the host can handle.

The TZ877 runs at maximum peak streaming rates of 1.25 MB/s in non-compression mode, 2.5 MB/s (write, depending on compression ratio and data) and 3.0 MB/s (read, depending on decompression ratio and data) in compression mode.

If a nonoptimal block size is used, the possible average I/O rate is limited. When writing TK85 or TK86 format, the recommended block sizes are: 16k, 24k, or 32k. You can use larger block sizes of 36k, 40k, and so forth, but increased performance is unlikely.

Other factors that can limit performance:

- Data fragmentation on disks
- Oversubscribing to the I/O channel bandwidth
- Processing speed and host CPU loads
- Memory size

### B.4 Doing Unattended Backups

This section explains how to use the TZ877 subsystem as an unattended backup device.

Unattended backups require some extra planning, since the **dump** utility is the only utility to support automatic cycling of tape cartridges at this time on the TZ877 subsystem. Other backup utilities must complete before reaching the end of the cartridge to avoid having the utility unload the cartridge and require user input to continue.

When the utility you are using completes, the **mt** command, with the **offline** option, can be used to cause the loaded cartridge to unload and the next cartridge to load. Then the **tar** utility or whatever utility you are using can be used to back up the next set of files to be saved. This can be automated by writing a shell script.



## Using the TZ877 Subsystem with the ULTRIX Operating System

### B.4 Doing Unattended Backups

To do an unload operation:

1. Position the Mode Select key switch located on the TZ877 subsystem front panel to the **Automatic** mode or locked position. This enables automatic loading and unloading.
2. Issue the **mt offline** command.

#### B.4.1 Developing Unattended Backup Shell Scripts

To develop a shell script for doing unattended backups onto a TZ877 subsystem:

1. Choose a backup utility that can control the blocking factor on tape. This will help you fully use the capacity and I/O rates of the TZ877 subsystem.
2. Plan what file systems are to be saved on each tape cartridge. Ensure that the total amount of data to be written on each cartridge is less than
  - a. 2.6 GB for TK85 format
  - b. 6.0 GB for TK86 format
  - c. 10.0 GB (no compression), 20 GB (with compression) for TZ87 format
3. Use **mt offline** commands at the appropriate points to cause automatic cycling to the next cartridge as needed.
4. Test the script to verify it operates as intended.

## Using the TZ877 Subsystem with the ULTRIX Operating System

### B.4 Doing Unattended Backups

The following is an example of a script:

```
#
#*****
#
# Nightly backup script for system DEVSYS
#
# Note: Setup loader to have cartridge #0 loaded before starting
#
#*****
#
# Cartridge 0: backup user directories
#
mt -f /dev/rmt2h rewind
tar -b 32k -cf /dev/rmt2h /usr/users/gimli
tar -b 32k -rf /dev/nrmt2h /usr/users/legolas
tar -b 32k -rf /dev/nrmt2h /usr/users/pippin
tar -b 32k -rf /dev/nrmt2h /usr/users/merry
mt -f /dev/rmt2h offline
#
# Cartridge 1: backup project disk A
#
dd if=/dev/rz1a of=/dev/rmt2h bs=32768
mt -f /dev/rmt2h offline
#
# Cartridge 2: backup project disk B
#
dd if=/dev/rz2a of=/dev/rmt2h bs=32768
mt -f /dev/rmt2h offline
#
# Cartridge 3: backup some filesystems
#
dump 0dsf 62500 301292 /dev/nrmt2h /dev/rrz0a
dump 0dsf 62500 301292 /dev/nrmt2h /dev/rrz0b
mt -f /dev/rmt2h offline
#
```

## Using the TZ877 Subsystem with the ULTRIX Operating System

### B.5 Selecting Density

## B.5 Selecting Density

You can select write density from the TZ877 OCP panel or from the ULTRIX host if the CAM software is installed and supports the TZ87 drive. If the CAM software is installed, but does not support the TZ87 drive, you can change the CAM software to support the drive by changing the:

- /usr/sys/data/cam\_data.c file to recognize the TZ877
- /usr/sys/h/devio.h file to define the TZ877

---

#### NOTE

---

Recent releases of ULTRIX (V4.3) support the TZ877. If you have recent releases that support the TZ87, do not make the following changes.

---

Only experienced programmers should change the cam\_data.c and the devio.h files. You must rebuild the kernel to add the changes. (See the configuration guidelines earlier in this appendix. Check the CAM software documentation for information about adding new devices.)

To allow density selection from the host:

1. Edit the /usr/sys/h/devio.h file to define the device name. Ensure a copy of the original is preserved and can be restored if necessary.
  - a. Search for DEV\_TZ85
  - b. Make a copy of the definitions for DEV\_TZ857
  - c. In the copy, change DEV\_TZ857 to DEV\_TZ877
2. Edit the /usr/sys/data/cam\_data.c file to set densities allowed. Ensure a copy of the original is preserved and can be restored if necessary.
  - a. Search for tz85\_dens.
  - b. Make a copy of the tz85\_dens table.
  - c. In the copy, change TZ85 references to TZ87
  - d. In the copy, in lines ending with

```
| DENS_BUF_VALID,
```

```
add
```

## Using the TZ877 Subsystem with the ULTRIX Operating System

### B.5 Selecting Density

```
| DENS_COMPRESS_VALID
```

before the comma. This results in these lines ending with

```
| DENS_BUF_VALID | DENS_COMPRESS_VALID,
```

- e. In the copy, change the density code to 0x18 in the rmtxl entry.
- f. In the copy, change the density code to 0x19 in the rmtxm entry.
- g. In the copy, leave the density code in the rmtxa alone.
- h. In the copy, change the density code to 0x19 in the rmtxh entry, and on the same line, change the compressionj code (labeled as such in the line above) from NULL to 0x01.
- i. In the copy, change all other density codes to 0x19.

This process sets up device:

- rmtxa entries to select TK85
  - rmtxl entries to select TK86
  - rmtxm entries to select TK87 (no compression)
  - rmtxh and rmtxa entries to select TZ87 (with compression)
3. Further edit the /usr/sys/data/cam\_data.c file to use the TZ877 density table just defined.
    - a. Search for TZ857 further down in cam\_data.c
    - b. Make a copy of the TZ857 device descriptor tables.
    - c. In the copy, change TZ857 references to TZ877
    - d. In the copy, change &tz85\_dens to &tz87\_dens.
  4. Save the current kernel (/vmunix).
  5. Build a new kernel.
  6. Reboot the system with the new kernel.

## Using the TZ877 Subsystem with the ULTRIX Operating System

### B.6 Using ULTRIX Tape Commands

## B.6 Using ULTRIX Tape Commands

This section describes ULTRIX commands used to operate the TZ877 subsystem.

The TZ877 subsystem uses standard magnetic tape commands to do backup and restore operations. The **tar** and **dump/restore** commands are used most often.

### B.6.1 Using the tar Command

The **tar** command, which operates on files and directories, writes and reads tapes. The **tar** utility uses the specified block size or defaults to 10k byte block sizes. If you select TK85 or TK86 densities, then the default block size results in a 16% decrease of maximum capacity and I/O rates.

Table B-3 lists the options you can use with the **tar** command.

**Table B-3 Common tar Options**

Option	Meaning
b	Block size in bytes (n) Block size in kilobytes (nk) nb = n x 512 bytes in a block
c	Create tape, writes from beginning
f	Tape device argument to follow
r	Append to the end of the tape
t	Table of contents of tape
u	Back up all new or modified files from last backup
v	Verbose
x	Extract from tape (read)

The following examples show command lines with the **tar** command to:

- Write a file to tape:  

```
$ tar -cf /dev/rmt0h filename -b 64k
```
- Read a file from tape to your current directory:  

```
$ tar -fx /dev/rmt1h filename
```

## Using the TZ877 Subsystem with the ULTRIX Operating System

### B.6 Using ULTRIX Tape Commands

#### B.6.2 Using the dump Command

To use the **dump** command, you need system privileges. This command lets you write an entire file system to tape. Ensure that the current directory is not within the file system being backed up, except when backing up from the root directory.

The **dump** command uses 10k byte block sizes. When using TK85 or TK86 densities, a 16% reduction in capacity and I/O rates can result from using these block sizes.

Table B-4 lists the options you can use with the **dump** command.

**Table B-4 Common dump Options**

Option	Meaning	Recommended Value
d	Tape density in bits per inch	62500
f	Tape device	
n	Notify all privileged accounts, the status of dump	
s	Size of tape in feet	301292 (uncompressed) 301292 (compressed)
u	Update the /etc/dumpdates file with the date	
0-9	Dump level	

The following examples show command lines with the **dump** command:

```
$ dump 0dsf 62500 301292 /dev/rmt0m {uncompressed TZ87 format} device entry  
/dev/rrz1a  
$ dump unsf 62500 301292 /dev/rmt0h /usr/users
```

Dump level 0 is the highest and dumps the whole file system.

Dump level 9 is the lowest. All files modified since the last dump of the same or lower dump level are dumped.

#### B.6.3 Using the restore Command

The **restore** command reads a tape that is backed up with the **dump** command. The **restore** command can read a file, a directory, or the entire tape.

The **restore** command uses 10k byte block sizes. When using TK85 or TK86 densities, a 16% reduction in capacity and I/O rates can result from using these block sizes.

## Using the TZ877 Subsystem with the ULTRIX Operating System

### B.6 Using ULTRIX Tape Commands

Table B-5 lists the options you can use with the **restore** command.

**Table B-5 Common restore Options**

Option	Meaning
f	Tape device
r	Read everything from tape
i	Interactive
v	Verbose
x	Extract

The following example shows a command line with the **restore** command:

```
$ restore -xvf filename
```

#### B.6.4 Using the dd Command

Use the **dd** command to perform a device-to-device copy. The copy is done by file or by image, depending on the specification of the input or output device files.

Disks have two types of device files, image and block:

- If the disk image file (/dev/rrxxx) is used, performance is faster.
- If the disk block file (/dev/rxxx) is used, it is easier to retrieve a single file later.

The **dd** command uses the specified block size, or if none is given, a default of 512 bytes. When writing in TK85 or TK86 formats, an 87% reduction in capacity and performance can result from using the default block size. It is important to specify a more optimal block size.

The default block size does not affect capacity when writing in the TZ87 format.

Table B-6 lists the options you can use with the **dd** command.

**Table B-6 Common dd Options**

Option	Meaning	Recommended Value
if	Input file	
of	Output file	
bs	Input and output block size (bytes)	32768
ibs	Input block size (bytes)	32768 for tape
obs	Output block size (bytes)	32768 for tape

## Using the TZ877 Subsystem with the ULTRIX Operating System

### B.6 Using ULTRIX Tape Commands

The following examples show command lines with the **dd** command to:

- Write to tape with the block device file:  

```
$ dd if=/dev/rz1a of=/dev/rmt1h bs=32768
```
- Write to tape with the image device file:  

```
$ dd if=/dev/rrz1a of=/dev/rmt1h bs=32768
```
- Read a tape:  

```
$ dd if=/dev/rmt1h of=/dev/rz1a ibs=32768
```

#### B.6.5 Using the **ltf** Command

Use the **ltf** command to write and read ANSI tapes. This command operates on files and directories and uses the specified block size. Otherwise, the command defaults to 2048 byte blocks. This block size results in a 50% decrease of capacity and I/O rates when writing in TK85 or TK86 formats.

Table B-7 lists the options you can use with the **ltf** command.

**Table B-7 Common ltf Options**

Option	Meaning
B	Specify a block size to use
c	Create tape, writes from beginning
f	Tape device argument to follow
u	Back up all new or modified files from last backup
t	Table of contents of tape
v	Verbose
x	Extract from tape (read)

The following examples show command lines with the **ltf** command to:

- Write a file to tape:  

```
$ ltf -cf /dev/rmt0h filename -B 16k
```
- Read a file from tape to your current directory:  

```
$ ltf -fx /dev/rmt1h filename
```



## Using the TZ877 Subsystem with the ULTRIX Operating System

### B.6 Using ULTRIX Tape Commands

#### B.6.6 Using the **mt** Command

The **mt** (magnetic tape) command allows you to give certain commands to the tape drive.

Table B-8 lists the options you can use with the **mt** command.

**Table B-8 Common mt Options**

Option	Meaning
<code>eof</code>	Write file mark(s)
<code>bsf</code>	Backward space file(s)
<code>bsr</code>	Backward space record(s)
<code>fsf</code>	Forward space file(s)
<code>fsr</code>	Forward space record(s)
<code>offline</code>	Unload the tape
<code>rewind</code>	Rewind to the beginning of medium
<code>status</code>	Obtain information from the drive

The following examples show command lines with the **mt** command to:

- Get the status of a drive:  

```
$ mt -f /dev/rmt0h status
```
- Rewind the default drive:  

```
$ mt rewind
```
- Write two file marks to the default drive:  

```
$ mt eof 2
```

#### B.6.7 Using the **cpio** Command

The **cpio** command allows you to save files and directories on tape and other media and retrieve these files.

Table B-9 lists the options you can use with the **cpio** command.

## Using the TZ877 Subsystem with the ULTRIX Operating System

### B.6 Using ULTRIX Tape Commands

**Table B-9 Common cpio Options**

Option	Meaning
c	Write or read header information in ASCII character form
d	Create directories as needed
i	Copy in
o	Copy out
t	Table of contents of tape
v	Verbose

The following examples show command lines with the **cpio** command to:

- Write to tape all files and subdirectories from your current directory:

```
$ find . -print | cpio -ocv > /dev/rmt0h
```

- List all files and subdirectories that are on the tape:

```
$ cpio -ictv < /dev/rmt0h
```

- Retrieve all files and subdirectories from the tape:

```
$ cpio -icdv < /dev/rmt0h
```

- Retrieve selective files from the tape:

```
$ cpio -icv < 'filename' < /dev/rmt0h
```

# C

---

## Service Offerings

Digital Equipment Corporation offers a range of flexible service plans.

### **C.1 On-Site Service**

On-site service offers the convenience of service at your site and insurance against unplanned repair bills. For a 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.

### **C.2 BASIC Service**

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 periods, and to include Saturdays, Sundays, and holidays. Under the BASIC service plan, all parts, materials, and labor are covered in full.

### **C.3 DECservice Plan**

The DECservice plan offers a premium, on-site service for producing committed response to remedial service requests made during contracted hours of coverage. Remedial maintenance will be performed continuously until the problem is resolved, which makes this service ideal for customers requiring maximum service performance. Under the DECservice plan all parts, materials, and labor are covered in full.

### **C.4 Carry-In Service**

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 SERVICenter sites worldwide, factory-trained personnel repair your unit within 2 days. This service is available on selected terminals and systems. Contact your local unit. Digital SERVICenter sites are open during normal business hours, Monday through Friday.

**Service Offerings**  
**C.5 DECmailer Service**

**C.5 DECmailer Service**

DECmailer service offers expert repair at a per use charge. This service is designed 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 5 days.

**C.6 Per Call Service**

Per call service offers a maintenance program on a noncontractual, time-and-materials-cost basis. It is appropriate for customers who have to perform first-line maintenance, but may occasionally need in-depth support from Digital Services.