DataGeneral

Customer Documentation

Installing and Operating Your 150 Mbyte 1/4–Inch Cartridge Tape Drive

WARNING

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient the receiving antenna
Relocate the computer with respect to the receiver
Move the computer away from the receiver
Plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio-TV Interference Problems," Stock No. 004-000-00345-4. This booklet is available from the U.S. Government Printing Office, Washington, DC 20402.

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe B prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

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Installing and Operating Your 150 Mbyte 1/4-Inch Cartridge Tape Drive

014-001699

This manual covers installation and operation procedures for the following drives:
6536; 6577-A, -E, -F, -I, -J, and -M; 6599-B; 6602; 6639; and 6639-B.

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NOTICE

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Preface

This manual provides specifications, physical and functional descriptions, interface information, and maintenance guidelines for operating and maintaining the Model 6536 cartridge tape drive. It also provides basic information for installing the drive.

Related Documentation

In order to complete the installation procedures and to read or write data to the drive, you will need the owner's manual (or similar document) for the system in which you are installing the drive.

Contacting Data General

- If you have comments on this manual, please use the prepaid Comments form that appears at the back. We want to know what you like and dislike about this manual.
- If you need additional manuals, please use the enclosed TIPS order form (USA only) or contact your Data General sales representative.

Telephone Assistance

If you are unable to solve a problem using any manual you received with your system, and you are within the United States or Canada, contact the Data General Service Center by calling 1-800-DG-HELPS for toll-free telephone support. The center will put you in touch with a member of Data General's telephone assistance staff who can answer your questions.

Free telephone assistance is available with your warranty and with most Data General service options. Lines are open from 8:30 a.m. to 8:30 p.m., Eastern Standard Time, Monday through Friday.

For telephone assistance outside the United States or Canada, ask your Data General sales representative for the appropriate phone number.

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CHAPTER 1
INTRODUCTION

Model 6536 is a streaming tape drive plus integrated controller in a 5 1/4-inch, half-high form factor. The drive uses convenient and reliable 1/4-inch data cartridges and is the ideal solution to the backup requirements of high capacity Winchester disk drives. Other applications include software distribution, transaction logging, data collection, data exchange, and program loading. The Model 6536 tape drive has a formatted data storage capacity of 150 megabytes with a backward read capability for 60 and 125 megabyte cartridges.

Physical Specifications

The tape drive's physical dimensions are shown in Figure 1-1 and in the following tabulation:

DIMENSION	SPECIFICATION
Height	1.625 in (4.126 cm)
Width	5.75 in (14.61 cm)
Depth	8.0 in (20.32 cm)
Weight	3.0 lb (1.36 kg)

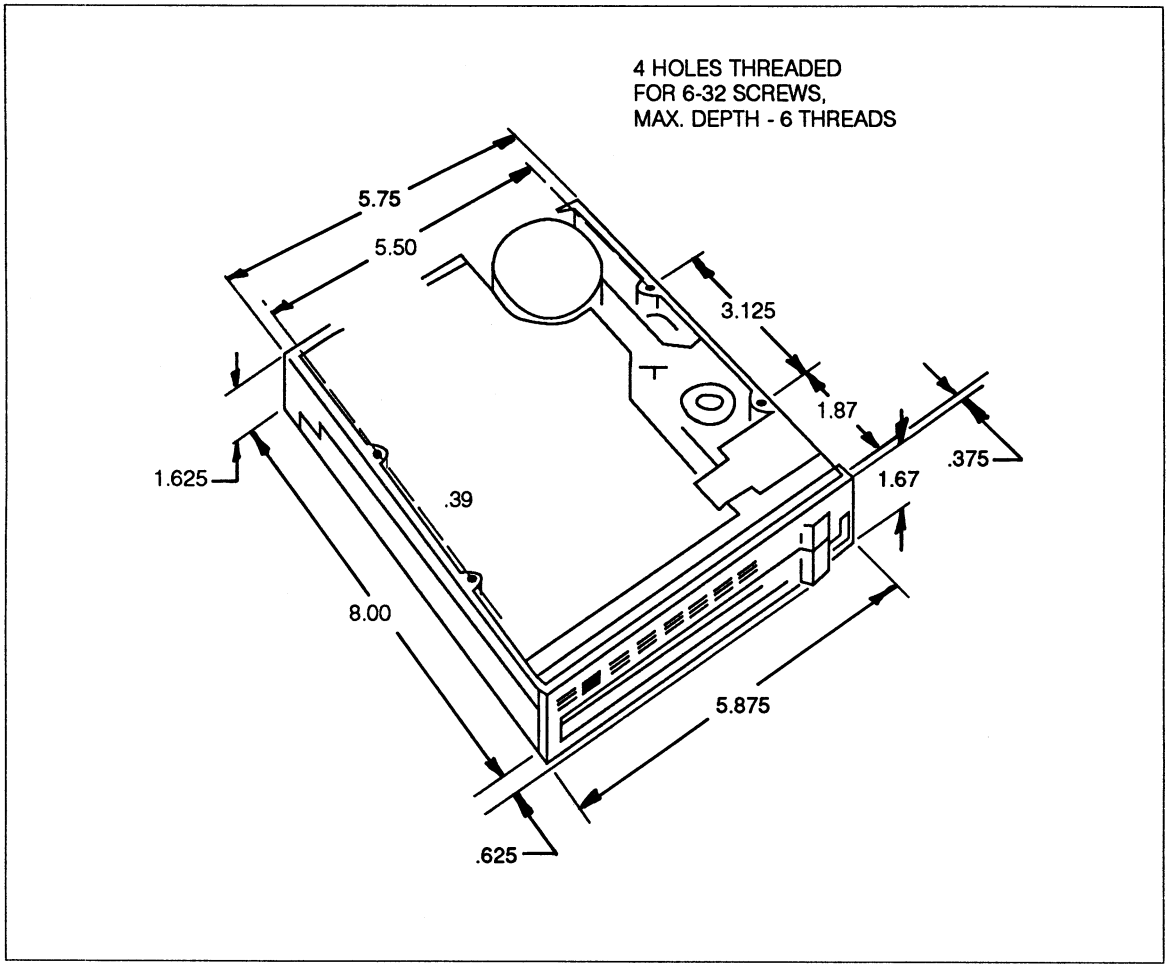

Figure 1-1. Cartridge Tape Drive Dimensional Drawing

Performance Specifications

The drive records to maximum capacity with the use of DC600XTD type data cartridges. To enable backward compatibility in all models, the drives can also recognize different types of data cartridges, and can Read and Write various QIC standard tape formats.

The following table lists the main design specifications of the drives. For backward-compatibility specifications, refer to the data cartridge table on the next page. It provides the entire matrix of data cartridge types and drive Read/Write capabilities.

FEATURE	SPECIFICATION
Capacity (formatted)	125 or 150MB
Track Format	15-/18-Track Serpentine
Flux Density	12,500 ftpi
Data Density	10,000 bpi
Data Transfer Rate (average)	112.5 Kb/sec
Recording Format	QIC-120 or QIC-150
SCSI Data Burst Transfer Rate	1.88 Mb/sec
Data Buffer Size	56 Kb
Tape Speed	90 ips
Speed Variations	Short term + 7% Long term + 4%
Start/Stop Time	300 msec. max.
Head Configuration	Two-track, Read-after-Write (1 track in each direction) separate full tape width Erase.
Recording Code	GCR (0,2) Run Length Limited

Data Cartridge Specifications

The following table lists the types of data cartridges qualified for use in the drives, plus the performance functions of each data cartridge with respect to the drive. The Function column includes backward compatibility.

6536 - Data Cartridge Specifications

DATA CARTRIDGE SPECIFICATION	DATA CARTRIDGE TYPE	MODEL	6536 DRIVE FUNCTIONS	CARTRIDGE CAPACITY
ANSI X3B5/87-217	DC600XTD (high density)	660 (600-ft)	Read/Write QIC-150 format	150Mb
			Read/Write QIC-120 format	125Mb
			Read Only QIC-24 and QIC-11 format	60Mb
ANSI X3B5/85-138	DC600A	560 (600-ft)	Read/Write QIC-120 format	125Mb
			Read Only QIC-24 and QIC-11 format	60Mb
ANSI BSR X3.127	DC300XLP	545 (450 ft)	Read Only QIC-24 format	60Mb

CHAPTER 2
PHYSICAL DESCRIPTION

General

The cartridge tape drive consists of multiple mechanical subassemblies, two electrical assemblies (PCBs), and a front bezel. All are assembled in a half-high, 5 1/4-inch drive chassis.

Drive Mechanics

The following are brief descriptions of the main mechanical subassemblies in the drive. Figure 2-1 shows the location of each subassembly.

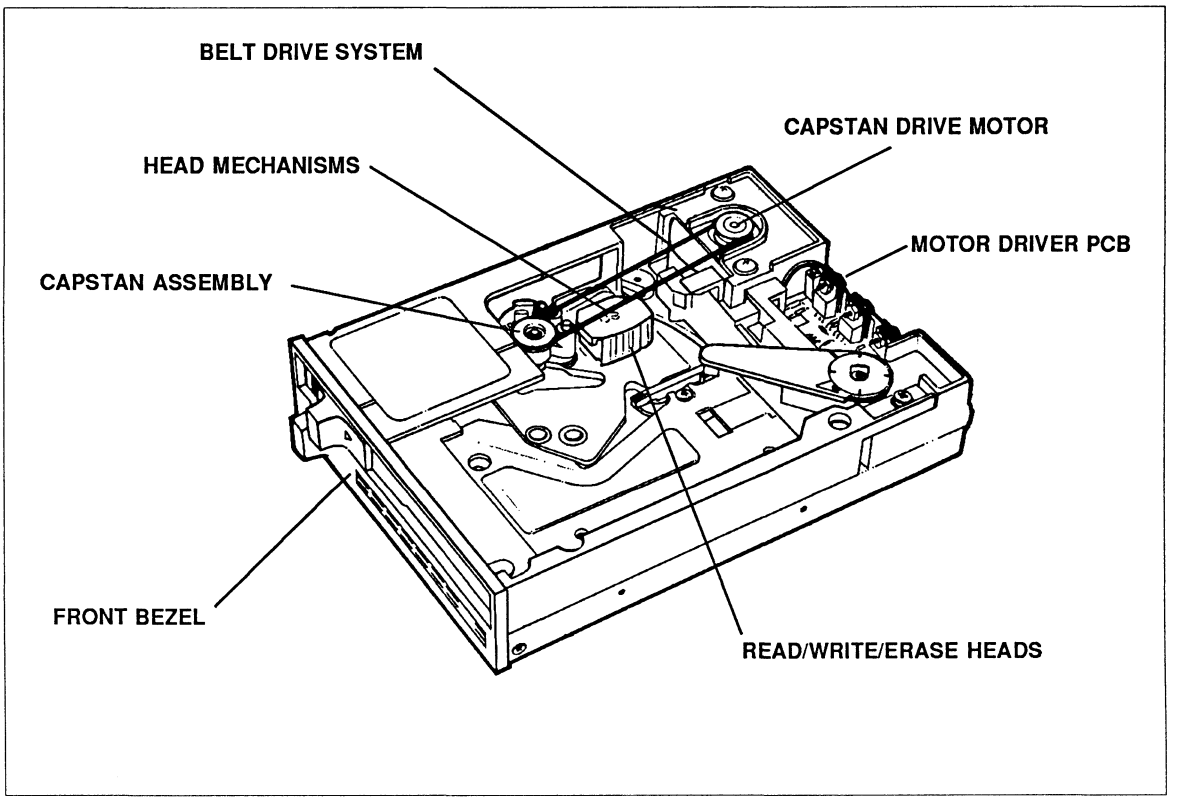

Figure 2-1. Drive Components (Drive Top View)

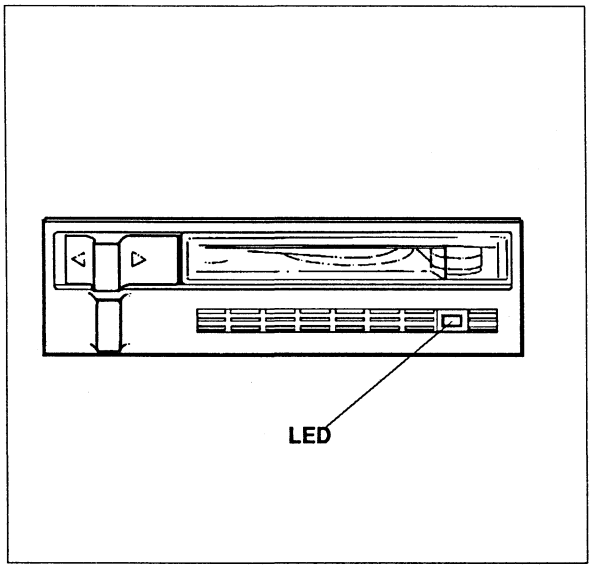

Figure 2-2. Front Bezel and LED

Front Bezel and LED

The Front Bezel (Figure 2-2) of the drive guides the cartridge into the loading aperture and provides control of Electrostatic Discharge (ESD).

The front bezel LED indicates when the tape is in motion or at a position other than the beginning of the tape (BOT). A cartridge should be removed only when the LED is Off.

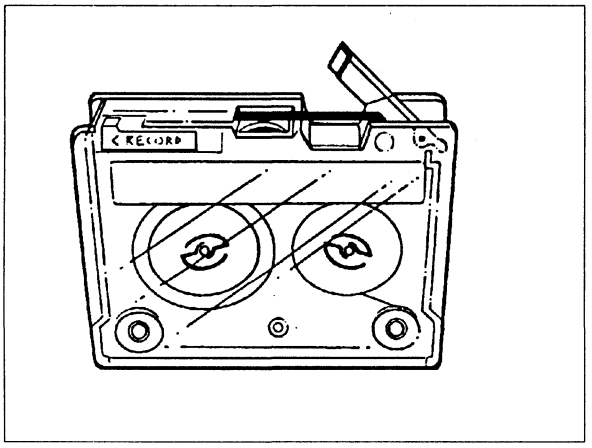

Figure 2-3. 1/4-Inch Data Cartridge

Media

The drive records on industry-standard 1/4-inch data cartridges which have been qualified for the respective drive's recording density, indicated in flux-transitions-per-inch (ftpi). Data cartridges purchased through Data General Corporation are qualified by Data General to operate in the tape drives. Data cartridge specifications for the various models are listed in Chapter 1.

Tape Holes

A number of precisely located holes are found near each end of the tape. These holes are detected by the drive sensor assembly which generates hole-detect signals used to control tape motion. The tape holes are located as follows:

Beginning Of Tape (BOT) - six holes (in pairs) indicating the Beginning-Of-Tape position.

End Of Tape (EOT) - three holes indicating the End-Of-Tape position.

Load Point (LP) - one hole near BOT indicating the start of recorded data.

Early Warning (EW) - one hole near EOT indicating the end of the tape is near.

LP and EW holes exchange functions when the tape is recorded in the reverse direction.

Tape hole format is shown in Figure 2-4. Notice that the distance between BOT and LP holes is 36 inches for the DC300XLP cartridge, 48 inches for the DC600A cartridge, and 60 inches for the DC600XTD cartridge. *The tape drive differentiates between data cartridge types by recognizing these distances.*

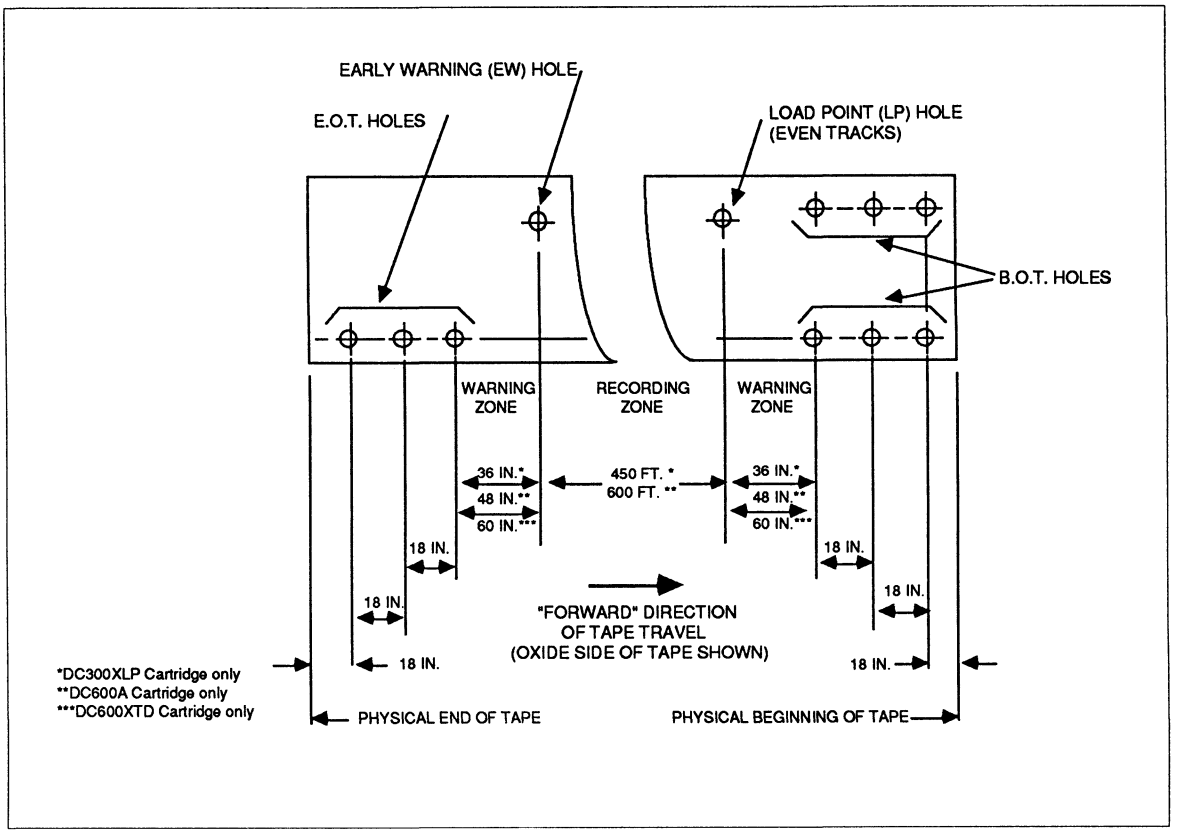

Figure 2-4. Tape Hole Format

CHAPTER 3
INSTALLATION

Computer Systems

Models 6536 is a streaming tape drive for use in backing up files in a computer system. The 6536 stores 150 Mbytes of information on a 1/4-inch tape cartridge. It is designed for installation in the space provided for a 5-1/4 inch diskette drive.

Streaming tape drives are packaged in kits which include all of the items required for installation except standard hardware items and tools.

Guidelines and Cautions

The following guidelines and statements of caution are considered industry standards and apply to the handling and installation of all Data General products.

Electronic components are sensitive to shock and should be handled with care. Sharp jolts or dropping may cause damage to the drive. Always handle the component by its edges only.

When attaching the mounting bracket to the drive, use a screwdriver, not a ratchet tool. Avoid damaging the components on the bottom of the drive by always setting the drive on a flat surface, or on its side.

Some components on the drive may be damaged by the discharge of static electricity. Before you unpack the drive, we recommend you set up an Electrostatic Discharge (ESD) kit and establish a static-safe work environment. Because nonconducting objects cannot be grounded, make sure that the work area is free of all nonconductors such as styrofoam cups, packaging material, wrappers, and vinyl materials such as covered notebooks.

Before removing the drive from its anti-static bag, hold the bag with one hand and touch the metal chassis of your CPU or subsystem chassis with your other hand to discharge any static energy.

Be sure to clean the read/write head at the recommended intervals stated in Chapter 6. Failure to do this can result in excessive data errors.

Input power, measured at the drive, must be maintained within the following recommended limits to ensure reliable operation:

+5 V, ± 5%
+12 V, ± 10%

Unpacking and Inspection

To unpack equipment, place all shipping containers on a flat, stable surface and carefully remove and verify contents. Save container and packing materials for any future reshipment.

Despite the precautions taken in preparing your drive for shipment, damage may still result from careless handling. If any of the contents or containers appear to be damaged, immediately notify your carrier and your distributor.

Pre-Installation Information

Dimensions

The weight of the drive is 3.0 pounds (1.36 kg). Other physical dimensions are shown in Figure 3-1.

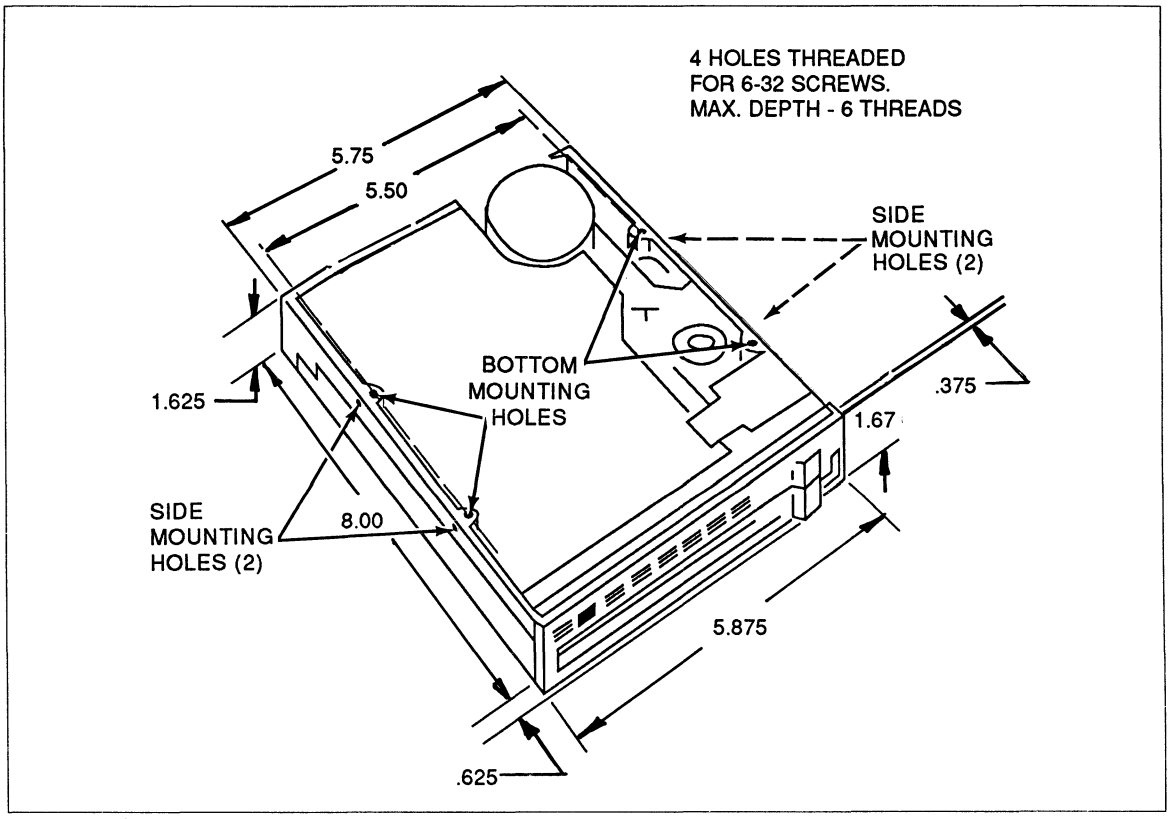

Figure 3-1. Drive Dimensional Drawing

Mounting Positions

The tape drive may be mounted in either of the positions shown in Figure 3-2. Horizontal positioning is recommended; however, when vertical mounting is desired, the recommended position is with the head loading lever at the top as shown.

Threaded mounting holes for 6-32 screws are provided in the drive chassis — four on the bottom (Figure 3-1) and two in each side of the frame. Do not over-tighten any of the mounting screws such that pressure causes excessive stress to the chassis. The bottom tapped holes allow only a maximum depth of six threads.

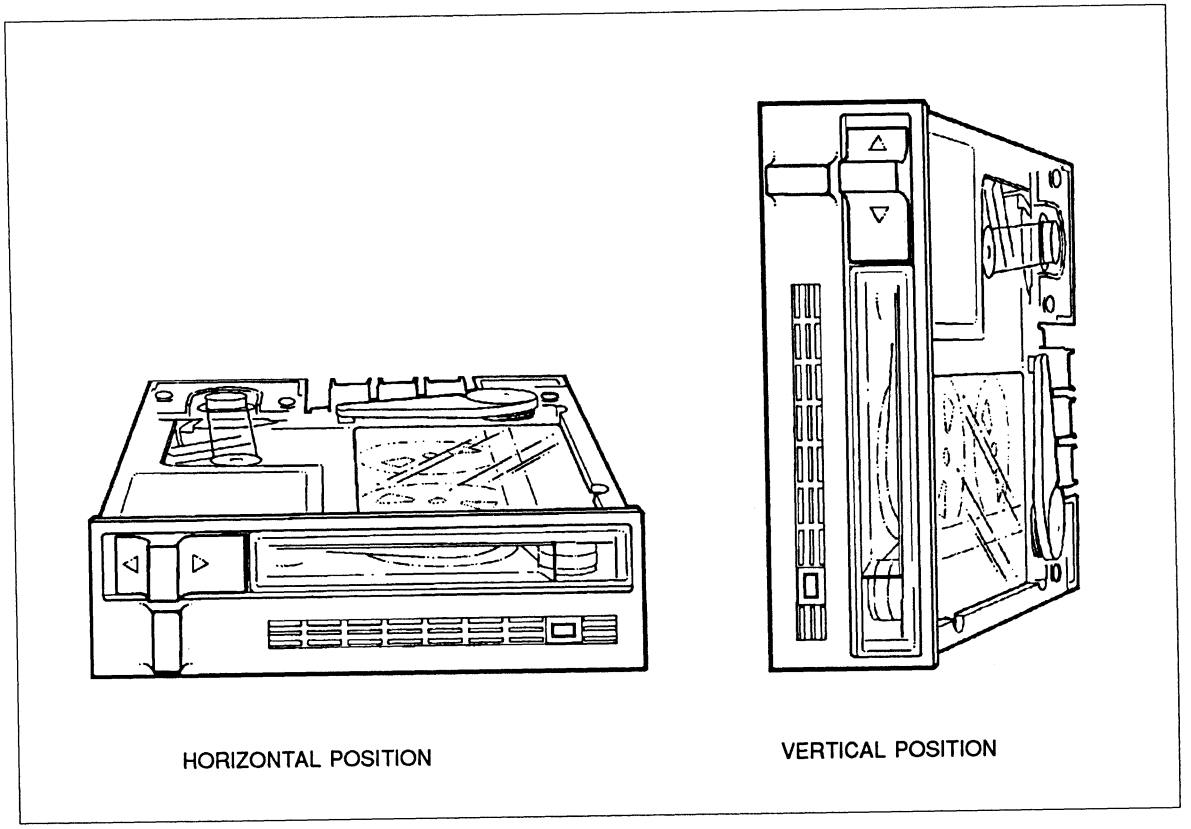

Figure 3-2. Drive Mounting Positions

Host Interface Connector

SCSI control signals are transmitted to and from the drive via the host interface connector (Figure 3-3). Connector pin assignments are listed in Chapter 5. The recommended mating connecter is a 3M 3425-6600, Burndy FRE-50BF-1, KEL-AM RFM25-2852-0, or equivalent.

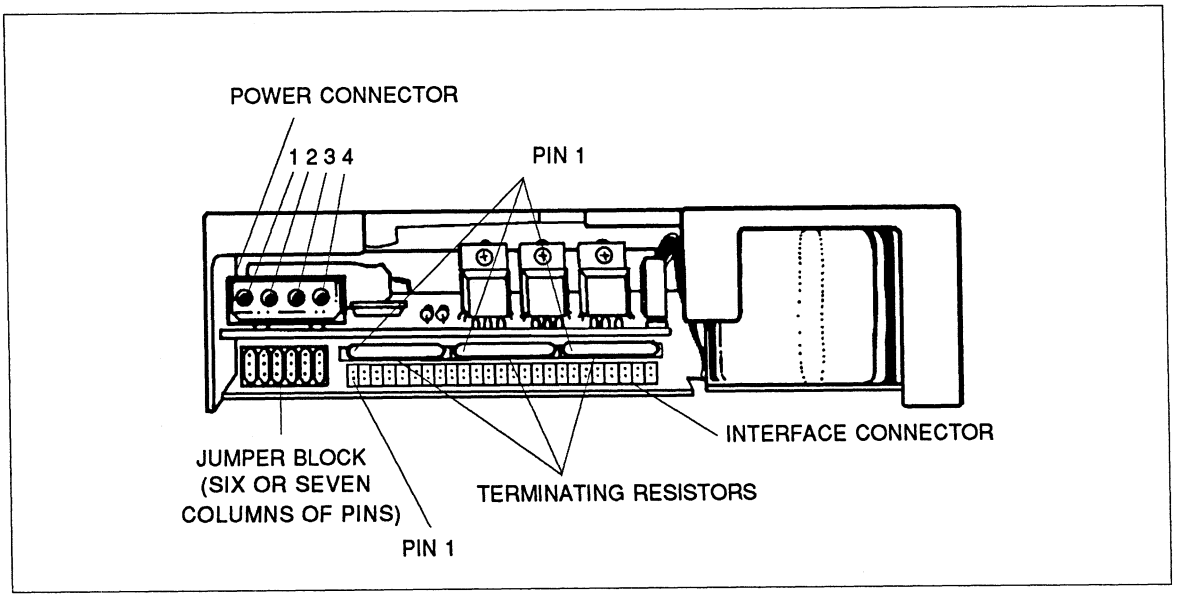

Figure 3-3. Drive Rear View

Power Connector

The power input connector (Figure 3-3) has four pins, with pin 1 on the right-hand side as you view the drive from the rear. The DC power connector is an AMP 641737-1. The mating connector requires an AMP 1-480424-0 housing with AMP 60617-1 pins (or equivalent).

The power connector pin assignments are:

Pin 1	+12 VDC
Pin 2	+12 Return
Pin 3	+5 Return
Pin 4	+5 VDC

Terminating Resistors

The SCSI bus must be terminated at both ends. If the tape drive is the last on the system daisy chain, and the CPU or subsystem does not terminate externally (check the CPU or subsystem owner's manual) it is necessary to install three terminating resistors on the drive. The locations of these resistors are shown in Figure 3-3.

External Terminator Power Option

External terminator power is not usually supplied to the I/O connector of the drive. If your CPU or storage subsystem does not supply terminator power, you will need to install a jumper as described in Chapter 4.

Jumper Configuration

The configuration jumper block on the rear assembly may have six or seven columns of pins as shown in Figure 3-3. Each jumper clip selects a given pair. More information about the configuration jumper block is provided in Chapter 4.

CHAPTER 4
FUNCTIONAL DESCRIPTION

Basic Drive Functions

Cartridge Loading and Ejecting

The cartridge is loaded as shown in Figure 4-1. The cartridge head loading lever should be in the open position as shown. When the cartridge is fully inserted, move the cartridge loading lever toward the cartridge as far as it will go. Loading is complete once the loading lever is locked into position. Moving the loading lever to the locked position secures the cartridge and moves the Read/Write head into the Read/Write position.

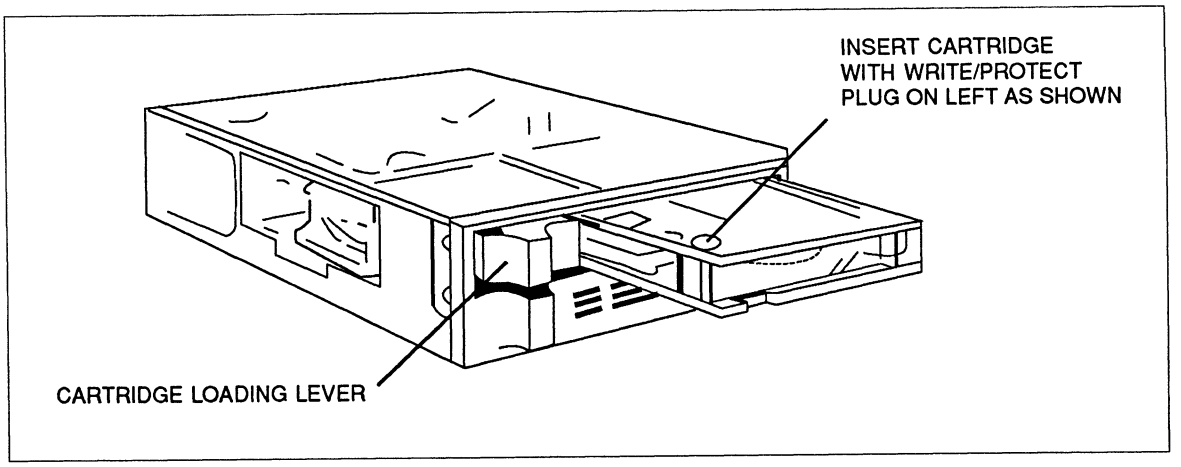

Figure 4-1. Cartridge Loading

The cartridge is ejected by sliding the loading lever away from the cartridge. The head assembly retracts, and the cartridge ejection system pushes the cartridge up and out of the drive.

Write Protection

The tape cartridge is equipped with a Write-Protect lever which is positioned prior to cartridge insertion to either allow or inhibit writing on the tape (see Figure 4-2). The Safe Switch in the drive (refer to Chapter 3) detects the position of the cartridge Write-Protect lever.

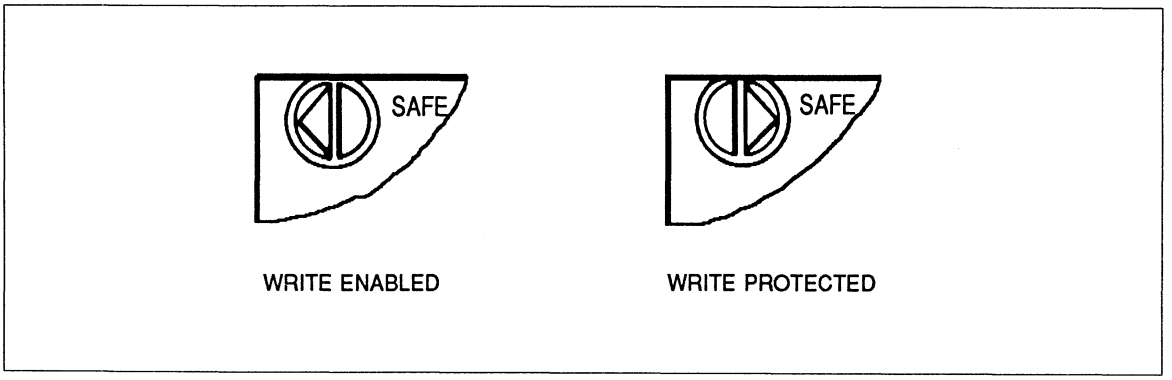

Figure 4-2. Cartridge Write-Protect Lever

Tape Motion

Tape motion is controlled by the Motor Driver PCB. The Motor Driver LSI circuits send the motion control signals to the capstan drive motor. When a cartridge is loaded in the drive, the motor capstan makes contact with a belt capstan in the cartridge. The belt capstan drives both the supply and take-up hubs in the cartridge, causing the tape to move past the Read and Write heads and the tape-hole sensors.

Special Drive Functions

Direct Block Addressing

Instead of sequentially searching through tracks for a requested block of data, the operation programming on the EPROM, together with the microprocessor, can enable the head to step directly to the track where the requested block of data is located.

Edge-Of-Tape and Reference-Burst Sensing

To write on a blank cartridge, the drive must first locate the nominal position for Track 0. With edge-of-tape sensing, the drive senses the bottom edge of the tape and uses this reliable reference plane to step the heads to Track 0 position. The Track 0 reference burst is then written in the Load Point zone, between the BOT holes and the start of recorded data, on Track 0. All other tracks are then positioned with respect to Track 0.

To Read a tape cartridge, the drive uses reference-burst sensing to automatically align the heads to the center of the reference burst on Track 0.

Quick End-Of-Data Access

To append data to a previously recorded tape, the drive initially locates the End-Of-Data (EOD) position on the tape. Specific commands in the firmware permit quick positioning to EOD. The drive can skip over recorded tracks to the track containing the last recorded data, and then directly access the EOD position. This provides a great time saver over drives which must search through every track of data until the EOD position is located.

Data Handling Buffer

The drive has a 56-Kbyte data buffer. This large buffer size permits efficient handling of high data burst transfer rates, such as the SCSI interface with 1.88 megabytes per second.

Backward Compatibility

The Model 6536 tape drive reads from (but does not write to) 310 oersted tape cartridges, such as the DC300XL, which are recorded in the QIC-11 and QIC-24 (4- and 9-track) format. The drive differentiates between tape types by detecting the distance between the BOT and Load Point holes in the tape (Refer to Chapter 2).

It is also able to read DC600A tapes which are recorded in the 4- or 9-track format, and differentiates between 4- or 9-track format and 15-track format tapes as follows: The drive initially searches for the reference burst in the nominal 15-track, Track 0 location. If the reference burst is not found, the drive then searches for the reference burst in the nominal 4- or 9-track, Track 0 location. On the DC600XTD tapes, the drive differentiates between tapes recorded in 15-track or 18-track format by reading a special format control block used on the 18-track format.

Additionally, the Model 6536 uses the SCSI Mode Select command to allow format selection by the host.

Configuration Jumper Block

The configuration jumper block on the rear assembly has either six or seven columns of pins. The version of the drive with six columns has a total of nine pairs of pins. The version with seven columns has a 10th pair used to set the source of the external terminator power (see Figure 3-4). Each jumper clip selects a given pair.

When a jumper is placed in the DIAGNOSTIC position on the configuration jumper block, the drive is in the diagnostic mode. When this occurs, the interpretation of the remaining jumper pairs differs from their interpretation in the operational mode.

In the operational mode (diagnostic jumper removed) the jumper pairs are used to specify the following configuration data:

- parity check enable/disable
- one of eight available disconnect (transfer) sizes
- the drive controller's bus ID
- the source of external terminator power (on the seven-column version of the drive)

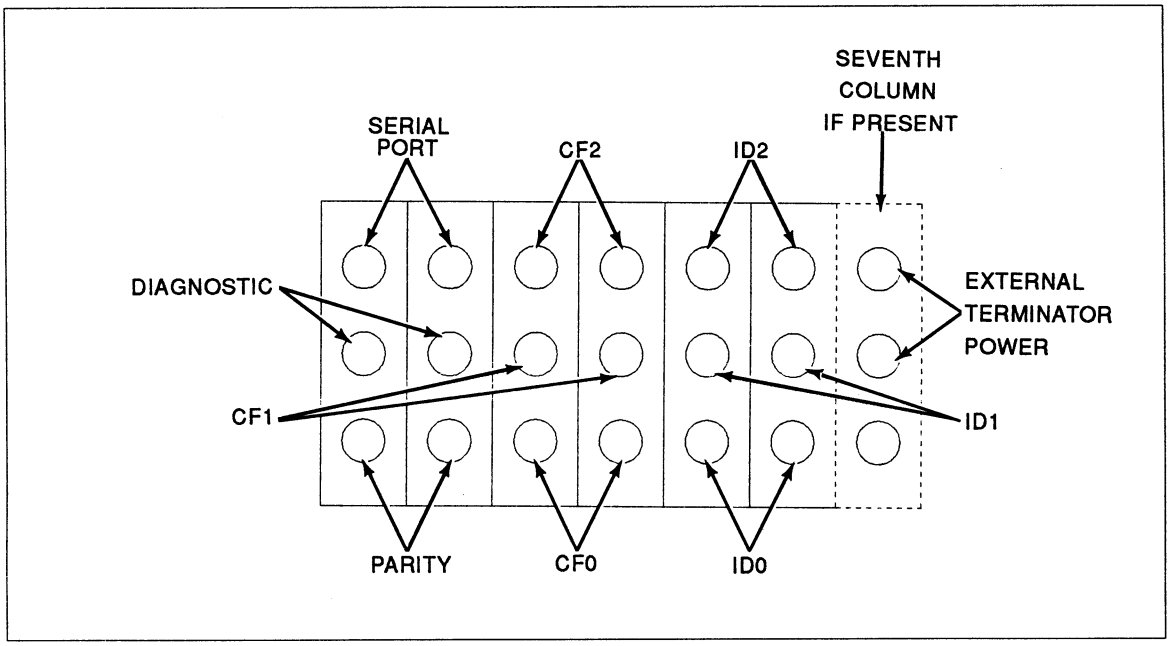

Figure 4-3. Configuration Jumper Block

Parity

Parity check is enabled by installing a single jumper pair clip in the PARITY ENABLE location as shown in Figure 4-3.

External Terminator Power

Drives with seven columns of jumper pins can be configured to select the source of external terminator power. Placing a jumper on the pair shown in Figure 4-3 selects the drive as the source. Removing the jumper selects the CPU or storage subsystem in which the drive is installed as the source.

Drive Identification

On SCSI drives, drive identification (ID) can be specified. The top jumper pair labeled (ID2) represents the Most Significant Bit. Note that the ID determines the priority of the controller during the bus arbitration phase, with value zero representing the lowest priority. Value 7 is always dedicated to the initiator and should never be specified as the drive controller ID. In multi-user/multi-initiator systems (where more than two SCSI devices, including the host, are connected to the bus), each device must have a unique ID and initiators should have the priority IDs. Drives are set at the factory on unit ID3.

UNIT ID	JUMPER LOCATION* ID 0	ID1	ID2	
0				
1	X			
2		X		
3**	X	X		
4			X	
5	X		X	
6		X	X	
7	X	X	X	

* X = Jumper Installed
** Standard Factory Setting

Selectable Buffer Disconnect

The buffer transfer size option can be selected which best suits the application. During lengthy data transfer operations, this feature periodically frees the host bus for other operations.

The three jumper pairs in the center column (Figure 4-3) are used to specify the 3-bit code required to select disconnect size. The top pair (CF2) represents the Most Significant Bit. The disconnect codes are as follows:

DISCONNECT SIZE	JUMPER LOCATION* CF0	CF 1	CF2	
2K				
4K	X			
6K		X		
8K	X	X		
12K			X	
16K**	X		X	
24K		X	X	
32K	X	X	X	

* X = Jumper Installed
** Standard Factory Setting

Disconnect size represents the maximum number of bytes that can be transferred over the bus during a single data phase. Disconnect size determines system performance. This can affect overall system performance in configurations where more than two SCSI devices must arbitrate for bus time. Since all but the currently communicating SCSI device pair (that is, the current target and the initiator) must wait for the bus in order to proceed with data transfers, disconnect size should be set to permit bus arbitration to occur at shorter intervals. This will help optimize the amount of independent off bus processing that multiple devices can perform in parallel. When the disconnect size is unnecessarily short, productive processing time is sacrificed to the overhead associated with bus arbitration. The optimal setting of disconnect size is a function of both the number of devices that share the bus and the speed at which they can independently process bursts of data.

Data Transfer Formatting

The data block contains 512 bytes of information in all data transfer formatting systems.. The block format is as shown in Figure 4-4. The method of recording is non-return to zero, change on one (NRZI). Data is encoded using the group code recording (GCR) method, where four bits of data (called a nibble) is encoded into a 5-bit group.

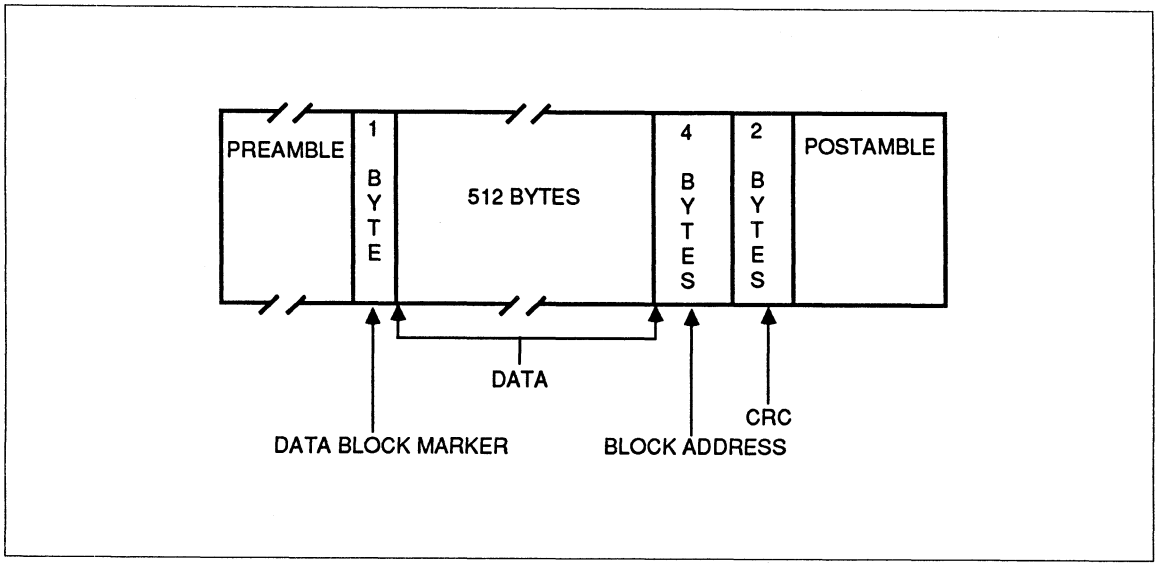

Figure 4-4. Data Block Format

Serpentine Recording

"Serpentine" accurately describes the streaming tape drive pattern of recording serial data on tape. The recorded tape logically appears to consist of one long, winding track. Actually, the logically adjacent tracks are recorded, one track at a time, in opposite directions (even-numbered tracks in the forward direction and odd-numbered tracks in the reverse direction). This process takes advantage of the tape cartridge bi-directional capabilities and, thus, avoids time-consuming rewinds. The 9-track, 15-track, and 18-track serpentine patterns are illustrated in Figures 4-5, 4-6, and 4-7.

Here is a basic description of how the serpentine pattern is created. Writing begins on Track 0 with the lower pair of heads enabled while moving from BOT to EOT. When EOT is reached, the lower pair of heads is disabled and the upper pair of heads is enabled. The capstan motor is then reversed, and Track 1 is written while the tape moves from EOT to BOT. When BOT is reached the tape motion pauses. The head assembly is positioned at the next track pair, and the above process is repeated until all tracks are written.

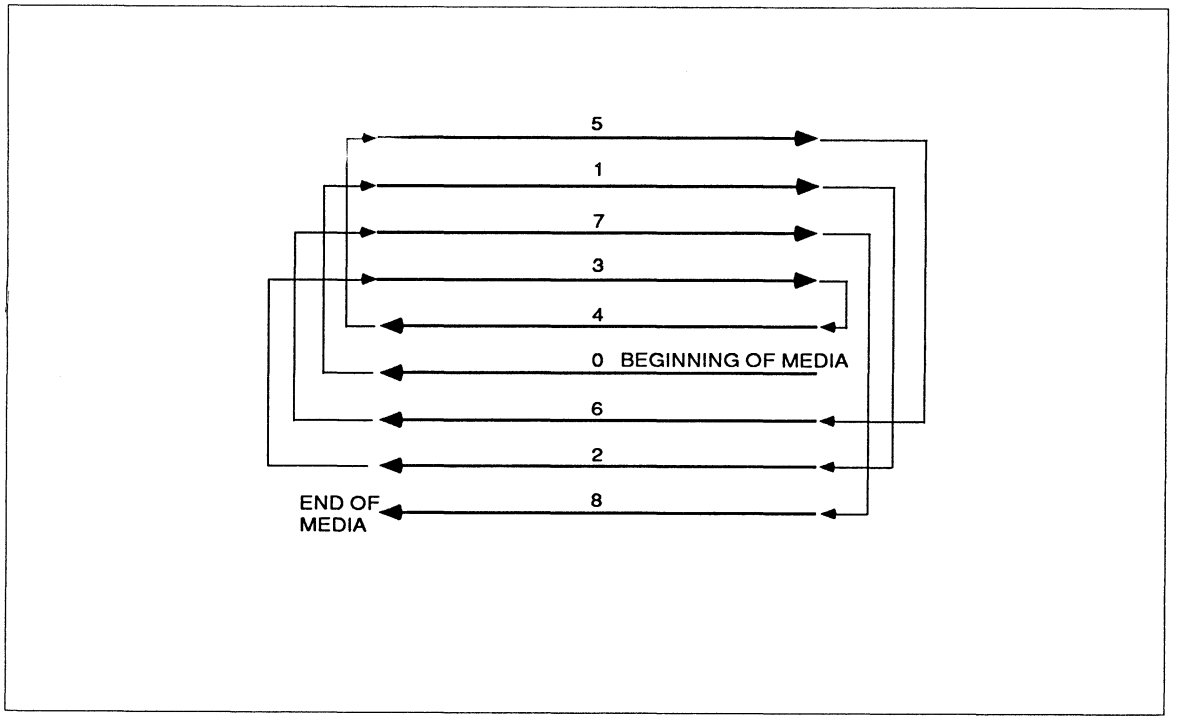

Figure 4-5. Serpentine Recording Pattern: 9-Track

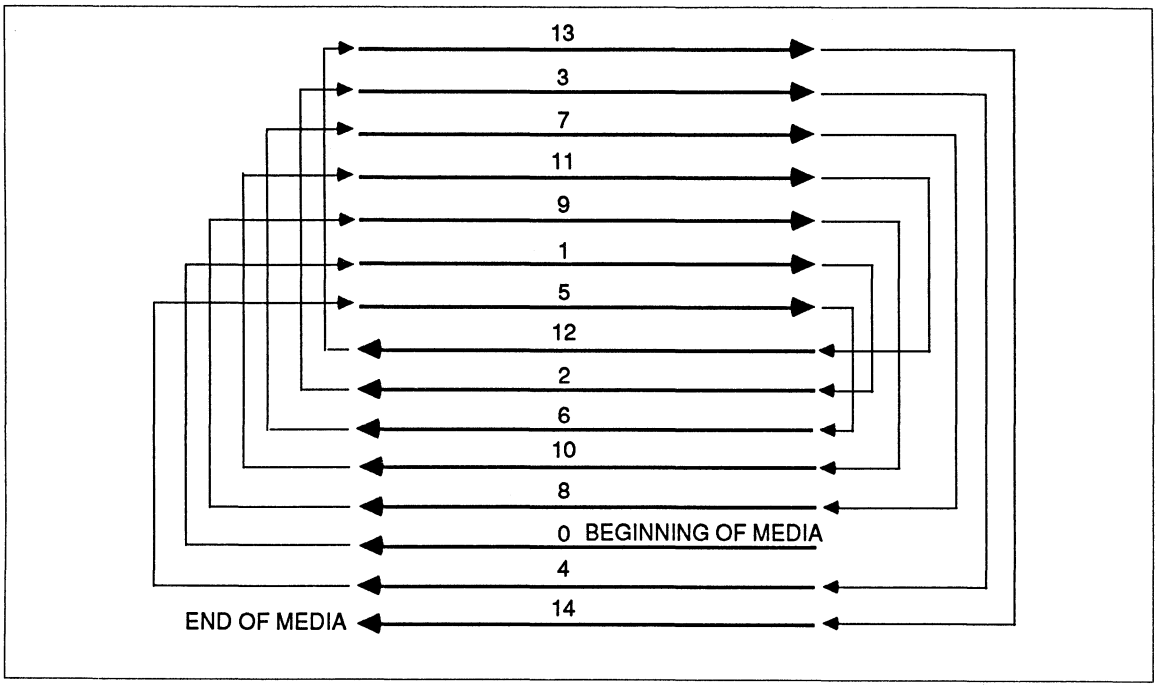

Figure 4-6. Serpentine Recording Pattern: 15-Track (120Mbyte)

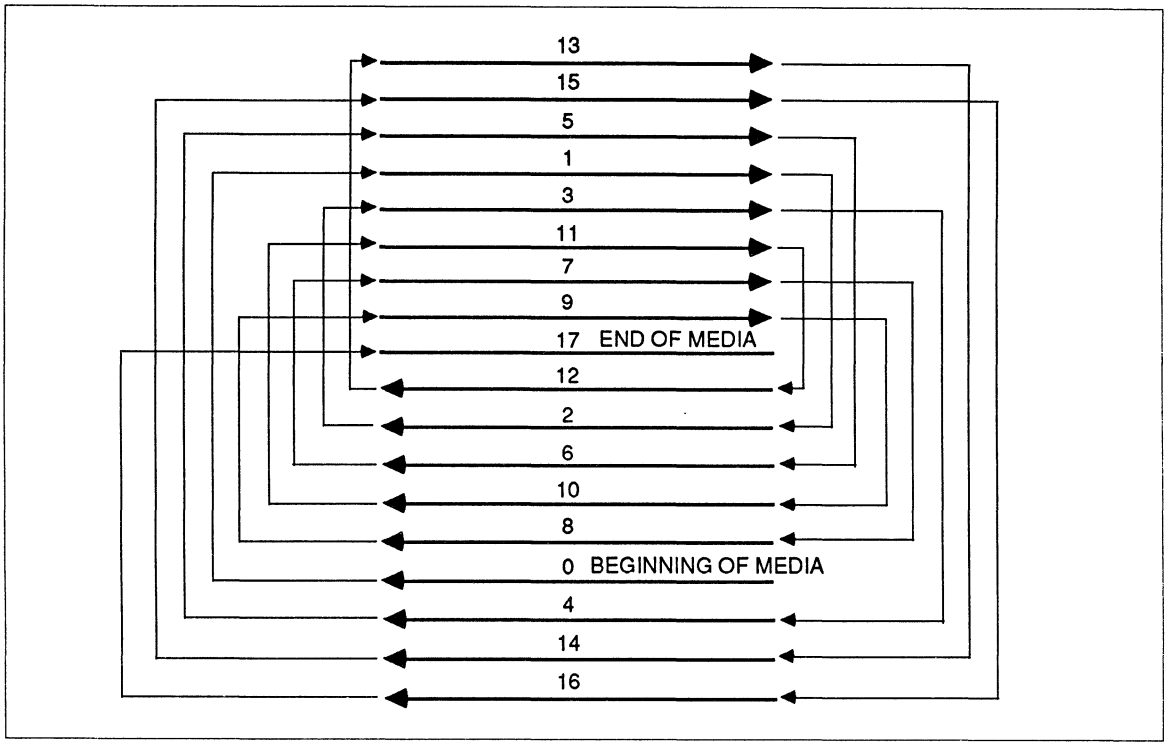

Figure 4-7. Serpentine Recording Pattern: 18-Track (150Mbyte)

Read/Write Head Operation

The upper and lower Read-after-Write head pair construction permits Read-after-Write error detection and the bi-directional serpentine track pattern just described.

To the right of the head pairs is the full tape-width AC erase head. The erase head precedes the write head on Track 0. As Track 0 is written, the erase head erases the full width of the tape and is disabled at the end of Track 0. The drive command set also allows for a full erase pass prior to writing.

The head assembly is positioned vertically by a stepper motor. The stepper motor and associated control circuits move the head assembly the required number of electronically calculated steps to a designated track. Precise positioning of the head assembly is essential to assure media interchangeability from one drive to another. Edge-of-tape-sensing is used to precisely locate the position for Track 0, and then Track 0 is used as a reference point to step to the other track locations.

Erase Operation

When track 0 is selected and the Erase-Enable signal is true, the erase head is activated, and the tape is erased. As a signal is being applied to track 0 by the erase head, the entire tape is erased. Erasing the entire tape ensures that new data will not be written over old data. To enable the Erase/Write circuit, the tape cartridge must not have the Write-Protect lever in the safe position, and the Write-Enable signal must be true.

Write Data (Backup) Operation

Each formatted block of data is written immediately after the preceding block. Assuming the proper control signal protocol is in progress, Write may be commanded by the host under certain conditions. In any case, the drive circuits verify that the cartridge is in place and not Write-Protected. If the host has not issued a tape position command to begin recording, the drive will default to the beginning of tape (BOT) before writing can begin.

Writing to tape can begin following a Read operation. In this case, the last file written on tape is found, and the drive waits in the vicinity where the last data was recorded. When a write command is received, data blocks supplied are written after the previously recorded block of data.

When writing data to a streaming tape, the tape is in constant motion. For the tape to remain in constant motion, the flow of data from the host must be sufficient to keep the tape drive buffers full of data. If data transfers from the host are interrupted, an underrun occurs. If data transfers from the host are under 90Kbytes, the tape will not stop but the drive may, at intervals, write a duplicate of the preceding data block. The duplicate block is transparent to the host. If the data falls below 45Kbytes, the drive responds by writing a second copy of the last block and then writes a large postamble, stopping tape motion, changing direction, and positioning data over already written data. When the data transfers resume, the drive searches for the end of the last block and begins writing. Underruns need to be avoided since they consume tape and the repositioning takes time, thereby reducing data throughput.

When a Write operation is in process and the early warning hole for the last track is sensed, the drive will stop accepting data from the host at the next block boundary. The drive finishes writing all data blocks contained in the buffers and then raises the EXCPT- signal to the host. In response, the host may command the writing of one block of data or a file mark before the drive reports that the tape is at the end of media again, after which it may again proceed to the writing of another data block. This block, or blocks, of data may be used to describe the file as incomplete.

Read Data (Restore) Operation

To restore data, a Read command is given at the beginning of the tape, and the drive then starts tape motion in search of data. When the first block is successfully read, a ready signal is inserted and transfer of data blocks to the host begins. The drive then continues to read and transmit data to the host until the end of data on tape is found or the end of a specified block of data to be restored is completed.

As long as the host can maintain the required data transfer rate, the drive keeps the tape in motion. If, for some reason, the data transfer is interrupted, the drive stops tape motion, reverses tape direction, and positions over previously read data. This is called a Read underrun. When the host is able to begin transferring data, the drive starts tape motion and continues to read data. The repositioning routine generated by Read underruns reduce the average data throughput.

CHAPTER 5
INTERFACE

Hardware Configuration

The drive signal interface is accomplished by advanced LSI circuitry. Firmware, resident in the drive circuits and interface PCB, controls the SCSI logic for exchange of formatted message, status, data, and command information between the drive and its host via the signal interface. The following paragraphs describe the drive's signal interface to the host.

Connector

Hardware interface is through a 50-pin connector (J1) which is mounted on the Main PCB at the rear of the drive. SCSI models use a right-angle, dual-row pin connector shown in Figure 5-1.

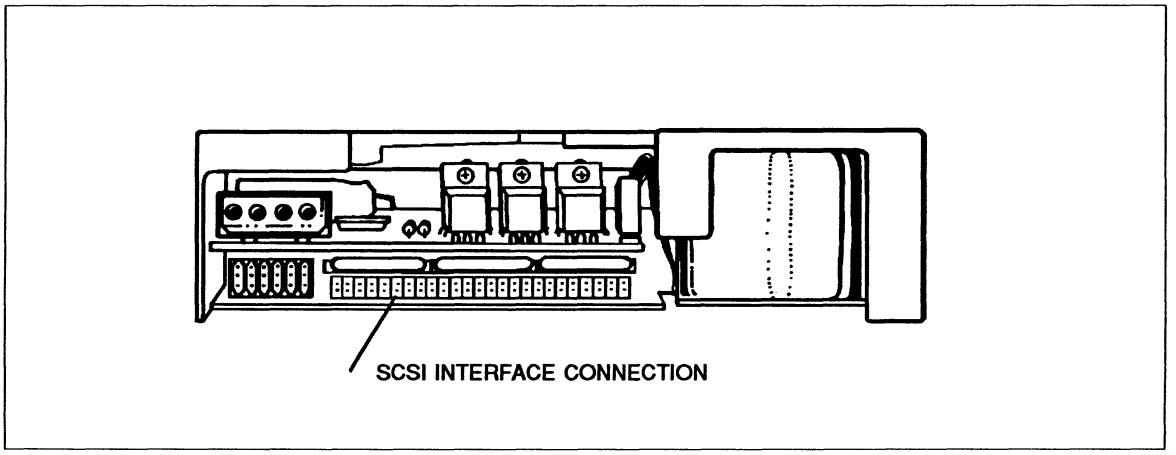

Figure 5-1. Drive Rear View

Signal Conventions

The following conventions are used to describe interface signal notation.

- active = True; inactive = False
- signal name or abbreviation followed by a - (dash) indicates that the signal is active-Low; for example: ONL-

All interface signals are active-Low.

Pin Assignments and Descriptions

All odd pins, except Pin 25, are connected to signal ground at the host. Pin 25 is left open. Pin 26 is reserved for providing optional terminator power (+5V).

PIN NO.	SIGNAL	DESCRIPTION	SIGNAL DRIVER
2	DB(0)-	Data Bus Bit 0 (LSB)	
4	DB(1)-	Data Bus Bit 1	
6	DB(2)-	Data Bus Bit 2	
8	DB(3)-	Data Bus Bit 3	
10	DB(4)-	Data Bus Bit 4	
12	DB(5)-	Data Bus Bit 5	
14	DB(6)-	Data Bus Bit 6	
16	DB(7)-	Data Bus Bit 7 (MSB)	
18	DB(P)-	Data Bus Parity	
20	GROUND		
22	GROUND		
24	GROUND		
26	TERMINATOR POWER	+5V	
28	GROUND		
30	GROUND		
32	ATN-	Attention	Initiator
34	GROUND		
36	BSY-	Busy	
38	ACK-	Acknowledge	Initiator
40	RST-	Reset	
42	MSG-	Message	Target
44	SEL-	Select	Target/Initiator
46	C/D-	Control/Data	Target
48	REQ-	Request	Target
50	I/O-	Input/Output	Target

Signal Descriptions

The drive interface consists of 18 signals. Nine are control lines and nine are data lines (data lines include the parity signal option). These signals are described as follows:

BSY- (Busy) is an "OR-tied" signal which indicates that the data bus is in use.

SEL- (Select) is used by an initiator to select a target, or by a target to re-select an initiator.

C/D- (Control/Data) is driven by a target and indicates whether CONTROL or DATA information is on the data bus. True indicates CONTROL.

I/O- (Input/Output) is driven by a target and controls the direction of data movement on the data bus with respect to an intiator. This signal is also used to distinguish between Selection and Re-selection phases. True indicates input to the initiator.

MSG- (Message) is driven by a target during the Message phase.

REQ- (Request) is driven by a target to indicate a request for a REQ/ACK data transfer handshake.

ACK- (Acknowledge) is driven by an initiator to indicate an acknowledgement for a REQ/ACK data transfer handshake.

ATN- (Attention) is driven by an initiator to indicate the ATTENTION condition.

RST- (Reset) is an "OR-tied" signal that indicates the RESET condition.

DB(7-0,P) (Data Bus) are eight data-bit signals plus a parity-bit signal that form the data bus. DB(7) is the MSB and has the highest priority during the ARBITRATION phase. Data parity is odd and is a jumper-selectable option. Parity is not valid during the ARBITRATION phase.

The BSY- and RST- signals are the only OR-tied signals. In ordinary operation of the bus, these signals may be simultaneously driven by two or more drivers. Any signal other than BSY- and RST- may employ OR-tied or three-state drivers. There is no operational problem in mixing OR-tied and three-state drivers on signals other than BSY- and RST-. DB(P) is not to be driven False during the ARBITRATION phase.

SCSI Configuration

Model 6536 is configured with a SCSI interface for communication with a host. The SCSI is implemented in compliance with ANSI X3.131 (Small Computer System Interface) and QIC-104 (SCSI sequential storage device implementation standard), and the information provided in this chapter is to be used in conjunction with ANSI X3.131 and QIC-104.

Controller ID

The drive controller network ID is configured by the jumpers on the rear assembly.

Bus Arbitration

Full SCSI arbitration with disconnect and reconnect is supported for multi-target/multi-initiator systems.

Logical Unit Addressing

A single tape drive in the system is logical unit number (LUN) zero. The drive always addresses LUN zero of the connected initiator.

Vendor-Unique Random Access Support

The drive command set includes support for random access processing and applications. The vendor-unique SEEK BLOCK command performs rapid positioning of the tape to a specified block location. Conversely, the specific block address of the tape's current position may be obtained with the REQUEST BLOCK ADDRESS command.

Support is also provided for user applications that maintain strategic block addresses in a trailing directory. Typically, a directory maintains the beginning block for each of the individual files on the tape. For the case that the directory is located at the end-of-recorded-data, the SPACE command functions permit rapid positioning to the directory.

These capabilities are expanded upon in the individual command descriptions.

Message Codes

The following messages are supported by the drive:

CODE	DESCRIPTION	DIRECTION
00H	Command Complete	In
02H	Save Data Pointer	In
04H	Disconnect	In
05H	Initiator Detected Error	Out
06H	Abort	Out
07H	Message Reject	In/Out
08H	No Operation	Out
0AH	Linked Command Complete	In
0BH	Linked Command CompleteWith Flag	In
0CH	Bus Device Reset	Out
80H-87H	Identify (no Disconnect/ Reconnect)	In/Out
C0H-C7H	Identify (Disconnect/Reconnect)	Out

Status Codes

The following 4-bit status codes are used by the drive:

STATUS CODE (4-BITS) 4 3 2 1	DEFINITION
0 0 0 0	Good Status
0 0 0 1	Check Condition
0 1 0 0	Busy
1 0 0 0	Intermediate Status
1 1 0 0	Reservation Conflict

Command Codes

The following X3.131 Group 0 commands for sequential access devices are implemented by the drive.

CODE	TYPE	COMMAND NAME
00H	O	Test Unit Ready
01H	M	Rewind
02H	V	Request Block Address
03H	M	Request Sense
05H	E	Read Block Limits
08H	M	Read
0AH	M	Write
0CH	V	Seek Block
10H	M	Write File Marks
11H	O	Space
12H	E	Inquiry
13H	O	Verify
14H	O	Recovered Buffered Data
154H	O	Mode Select
16H	O	Reserve Unit
17H	O	Release Unit
19H	O	Erase
1AH	O	Mode Sense
1BH	O	Load/Unload
1DH	O	Send Diagnostic
1EH	O	Prevent/Allow Medium Removal

KEY M = mandatory command
E = extended command
O = optional command
V = vendor-unique.

ANSI X3.131 Conformance Statement

ALTERNATIVES

(1) Single-ended drivers
(2) Termination power supplied by the cable
(3) Parity implemented (jumpered)
(4) Hard reset
(5) Reservation queueing is NOT implemented

LEVEL

0, 1, and 2

OPTIONAL COMMANDS

(1) Test Unit Ready
(2) Send Diagnostic
(3) Space
(4) Verify
(5) Recover Buffered Data
(6) Mode Select
(7) Reserve Unit
(8) Release Unit
(9) Erase
(10) Mode Sense
(11) Load/Unload
(12) Copy
(13) RD/WRT Buffer

OPTIONAL MESSAGES

Send:

(1) Save Data Pointer
(2) Restore Pointers
(3) Disconnect with flag
(4) Message Reject
(5) Linked Command Complete
(6) Linked Command Complete
(7) Identify

Receive:

(1) Initiator Detected Error
(2) Abort
(3) Message Reject
(4) No operation
(5) Bus Device Busy
(6) Identify

OTHER OPTIONS

(1) "Fixed" block transfer lengths only.
(2) Space blocks, file marks, sequential file marks, and EOD (forward and reverse).
(3) Verify is Medium verification only.
(4) Mode Select allows change to buffered mode only.
(5) Support 3rd party reservation.
(6) Live in both single and multi-initiator systems.

VENDOR-UNIQUE COMMANDS

(1) Seek block
(2) Request block address

CHAPTER 6
PREVENTIVE MAINTENANCE

Reliability

The cartridge tape drive's reliability is very high: more than 15,000 hours Mean-Time-Between-Failure (MTBF). This figure for MTBF includes all power-on and operational time, but excludes maintenance periods. Operational time (tape movement) is assumed to be 20% of the power-on time.

The Mean-Time-To-Repair (MTTR) for the drive is 1/2 hour. this represents the average time required by a field engineer (or equivalent) to diagnose and repair a defective drive by replacing the drive.

Preventive Maintenance

The tape drives require no special maintenance; however, observing common-sense precautions can help ensure long, reliable service. Exercise reasonable care when using and storing any cartridge and establish a schedule for cleaning the heads and the cartridge slot in the tape drive.

Maintain a clean, dust-free environment within the temperature and humidity limits listed in the specifications in the last chapter of this manual. Follow the data cartridge manufacturer's recommendations for cartridge storage requirements. Keep all liquids away from your drive and tapes to prevent spills into the equipment.

Do not open the cartridge access door or touch the tape; fingerprints can cause data to be misread. Store a cartridge in its protective box away from heat sources and electromagnetic fields when it is not in the tape drive. Do not place cartridges on the computer, monitor, or any peripheral device.

Retension the tape before recording to a new cartridge by using the retension command in your tape drive utility software. A tape stored for extended periods should always be retensioned before re-use. When a stored tape is moved to an environment with a greatly different temperature, allow the tape to slowly achieve ambient temperature before using it.

Cleaning the Tape Drive Heads

Tape drive heads should be cleaned periodically to ensure reliable operation. A regular schedule should be established depending on use.

Cleaning Schedule

The recommended cleaning schedule is:

- After an initial pass with a new tape cartridge
- After eight hours of normal use

Clean sensor hole and tape cartridge cavity whenever dirt or dust is visible.

Cleaning Supplies

- Low pressure aerosol air
- Head cleaning kit, Model Number 10154
  or
- Head cleaning replacement kit, Model Number 10189
- Lint-free cotton swabs or any industry acceptable head-cleaning swabs may be used if Data General head cleaning pads (shipped with the head cleaning kit) are not available.

Cleaning Procedure

1. Remove the tape cartridge and turn OFF power to the computer.
2. Carefully blow out dust from the sensor hole and tape cartridge cavity with aerosol air.
3. Push the head loading lever as far as you can toward the cartridge loading aperture. This will move the heads into an accessible position for cleaning.
4. Moisten a swab in the head-cleaning fluid until it is saturated but not dripping.
5. Carefully clean the head by wiping only in the directions that the tape travels. DO NOT WIPE PERPENDICULAR TO THE TAPE MOVEMENT DIRECTION OR USE A CIRCULAR, SCRUBBING MOTION. See Figure 6-1.
6. Discard used swab and repeat Steps 3 and 4 with new swabs until the head is clean.
7. Following the procedure in Step 4, use a new, dry swab to remove any remaining cleaning fluid from the head.
8. Return the head to a nonoperating position by pushing the head loading lever away from the cartridge loading aperture.
9. Turn ON the computer.

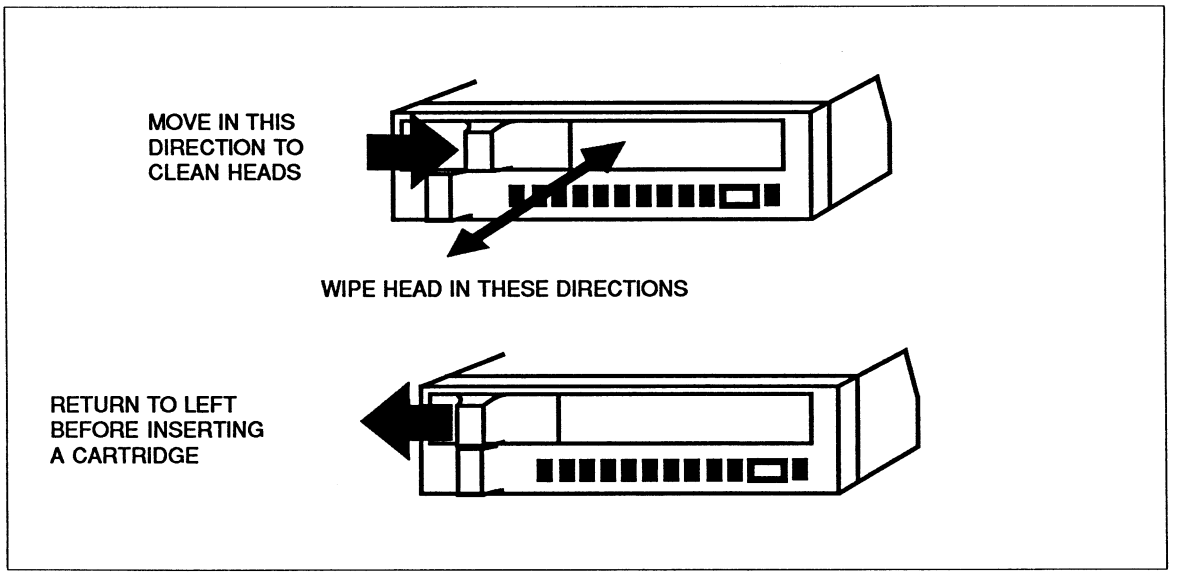

Figure 6-1. Head and Sensor Cleaning

APPENDIX A
OPERATIONAL AND ENVIRONMENTAL SPECIFICATIONS

Note: These specifications apply to the tape drive only, not to the drive installed in a CPU or storage subsystem.

Operational Specifications

FEATURE	SPECIFICATION	
Temperature	5 to 45 degrees C (41 to 113 degrees F)	
Thermal Gradient	1 degree C/minute	
Relative Humidity	20 to 80% noncondensing	
Maximum Wet BulbTemperature	26 Degrees C	
Altitude	-1,000 to 15,000 ft.	
Shock	2.5 g's maximum, 11 msecs.	
Vibration (1/2 sine wave) peak-peak displacement peak acceleration	 0.005 inch maximum 5 to 63 Hz 0.50 g maximum 63 to 500 Hz	
Power	±12V	±5V
Tolerance (incl. max. rippleof 100 mV)	±10%	±5%
Standby Current	0.2 amps nom.	1.1 amps nom.
Operational Current	0.8 amps. nom. 1.7 amps. max.	1.1 amps. nom. 1.5 amps. max.
Tape Start Surge (up to 300 msec.)	2.5 amps. max.	
Power Dissipation (operational)	9.6 watts typ. 22.4 watts max. 33 watts max. (tape start surge)	5.5 watts typ. 7.8 watts max.

Environmental Specifications

FEATURE	SPECIFICATION
Temperature	-30 to 60 degrees C (-22 to 140 degrees F)
Thermal Gradient	1 degree C/minute
Relative Humidity	5 to 85% noncondensing
Altitude	-1,000 to 50,000 ft.
Shock	25 g's maximum, 11 msecs.
Vibration (1/2 sine wave) peak-peak displacement peak acceleration	 0.1 inch maximum 5 to 17 Hz 1.5 g maximum 17 to 500 Hz

INDEX

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TO ORDER

1. An order can be placed with the TIPS group in two ways:
   a) MAIL ORDER – Use the order form on the opposite page and fill in all requested information. Be sure to include shipping charges and local sales tax. If applicable, write in your tax exempt number in the space provided on the order form.

      Send your order form with payment to:

      Data General Corporation
      ATTN: Educational Services/TIPS G155
      4400 Computer Drive
      Westboro, MA 01581–9973

   b) TELEPHONE – Call TIPS at (508) 870–1600 for all orders that will be charged by credit card or paid for by purchase orders over $50.00. Operators are available from 8:30 AM to 5:00 PM EST.

METHOD OF PAYMENT

2. As a customer, you have several payment options:
   a) Purchase Order – Minimum of $50. If ordering by mail, a hard copy of the purchase order must accompany order.
   b) Check or Money Order – Make payable to Data General Corporation.
   c) Credit Card – A minimum order of $20 is required for Mastercard or Visa orders.

SHIPPING

3. To determine the charge for UPS shipping and handling, check the total quantity of units in your order and refer to the following chart:

Total Quantity	Shipping & Handling Charge
1–4 Units	$5.00
5–10 Units	$8.00
11–40 Units	$10.00
41–200 Units	$30.00
Over 200 Units	$100.00

   If overnight or second day shipment is desired, this information should be indicated on the order form. A separate charge will be determined at time of shipment and added to your bill.

VOLUME DISCOUNTS

4. The TIPS discount schedule is based upon the total value of the order.

Order Amount	Discount
$1–$149.99	0%
$150–$499.99	10%
Over $500	20%

TERMS AND CONDITIONS

5. Read the TIPS terms and conditions on the reverse side of the order form carefully. These must be adhered to at all times.

DELIVERY

6. Allow at least two weeks for delivery.

RETURNS

7. Items ordered through the TIPS catalog may not be returned for credit.
8. Order discrepancies must be reported within 15 days of shipment date. Contact your TIPS Administrator at (508) 870–1600 to notify the TIPS department of any problems.

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9. Customers outside of the United States must obtain documentation from their local Data General Subsidiary or Representative. Any TIPS orders received by Data General U.S. Headquarters will be forwarded to the appropriate DG Subsidiary or Representative for processing.

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Attn: Educational Services/TIPS G155
4400 Computer Drive
Westboro, MA 01581 - 9973

BILL TO:

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ATTN: _____
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CITY _____
STATE _____ ZIP _____

SHIP TO: (No P.O. Boxes - Complete Only If Different Address)

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STATE _____ ZIP _____

Priority Code _____ (See label on back of catalog)

_____ _____ _____ _____ _____
Authorized Signature of Buyer (Agrees to terms & conditions on reverse side) | Title | Date | Phone (Area Code) | Ext.

ORDER #	QTY	DESCRIPTION	UNIT PRICE	TOTAL PRICE

A SHIPPING & HANDLING

☐ UPS	ADD
1-4 Items	$ 5.00
5-10 Items	$ 8.00
11-40 Items	$ 10.00
41-200 Items	$ 30.00
200+ Items	$100.00

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☐ UPS Blue Label (2 day shipping)
☐ Red Label (overnight shipping)

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Order Amount	Save
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$150 - $499.99	10%
Over $500.00	20%

Tax Exempt # or Sales Tax (if applicable) _____

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Less Discount See B	-
SUB TOTAL	
Your local* sales tax	+
Shipping and handling - See A	+
TOTAL - See C	

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☐ Purchase Order Attached ($50 minimum)
P.O. number is _____. (Include hardcopy P.O.)
☐ Check or Money Order Enclosed
☐ Visa ☐ MasterCard ($20 minimum on credit cards)

Account Number | Expiration Date

_____
Authorized Signature
(Credit card orders without signature and expiration date cannot be processed.)

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PLEASE ALLOW 2 WEEKS FOR DELIVERY.
NO REFUNDS NO RETURNS.

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Form 702
Rev. 8/87

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- ___ Introduction to the product
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- ___ Operating Guide
- ___ Other _____

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	Is it easy to read?	☐	☐
	Is it easy to understand?	☐	☐
	Are the topics logically organized?	☐	☐
	Is the technical information accurate?	☐	☐
	Can you easily find what you want?	☐	☐
	Does it tell you everything you need to know?	☐	☐
	Do the illustrations help you?	☐	☐

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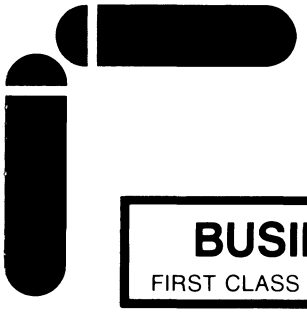

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