EXB-8200 8mm Cartridge Tape Subsystem

Product Specification

Exabyte®

510005-007

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Revision History

Revisions of this manual include the following:

Revision	Date
005	January 1990
006	October 1990
007	November 1991

For information about the changes and enhancements to this revision, refer to page iv.

Product Warranty Caution

The EXB-8200 8mm Cartridge Tape Subsystem (CTS) is warranted to be free from defects in materials, parts, and workmanship and will conform to the current product specification upon delivery. **For the specific details of your warranty, refer to your sales contract or contact the company from which the EXB-8200 was purchased.**

The warranty for the EXB-8200 shall not apply to failures of any unit when:

- The EXB-8200 is repaired by anyone other than the Manufacturer's personnel or approved agent.
- The EXB-8200 is physically abused or is used in a manner that is inconsistent with the operating instructions or product specification defined by the Manufacturer.
- The EXB-8200 fails because of accident, misuse, abuse, neglect, mishandling, misapplication, alteration, faulty installation, modification, or service by anyone other than the factory service center or its approved agent.
- The EXB-8200 is repaired by anyone, including an approved agent, in a manner that is contrary to the maintenance or installation instructions supplied by the Manufacturer.
- The Manufacturer's serial number tag is removed.
- The EXB-8200 is damaged because of improper packaging on return.

CAUTION

Returning the EXB-8200 in unauthorized packaging may damage the unit and void the warranty.

If you are returning the EXB-8200 for repair, package it in its original packaging (or in replacement packaging obtained from your vendor). Refer to the packing instructions in this manual.

If problems with the EXB-8200 occur, contact your maintenance organization; do not void the product warranty by allowing untrained or unauthorized personnel to attempt repairs.

Changes and Enhancements to This Manual

The following changes and enhancements were made to revision 007 of the *EXB-8200 8mm Cartridge Tape Subsystem Product Specification*:

- Updated the list of related publications and the safety and regulatory agency compliance information in Chapter 1.
- Updated and revised the description of the EXB-8200 in Chapter 2.
- Revised the recording parameter values for track density and recorded track length. Clarified the explanations of physical beginning of tape (PBOT), physical end of tape (PEOT), physical blocks, and physical tracks. Corrected the value for the distance of logical beginning of tape (LBOT) from physical beginning of tape (PBOT) in Chapter 3.
- Clarified the explanation of reposition time in Chapter 4.
- Clarified the conditions for data reliability and MTBF in Chapter 5.
- Updated the power specification and power consumption tables in Chapter 6.
- Clarified the environmental specification table. Updated the shock and vibration specifications. Updated the EMC and EMI compliance information in Chapter 7.
- Updated the unpacking instructions, and added instructions for packing and shipping the EXB-8200. Updated the instructions for mounting the EXB-8200. Added instructions for performing the initial power on of the EXB-8200 in Chapter 9.
- Clarified the procedure for loading a data cartridge, and updated the instructions for cleaning the tape heads and tape path in Chapter 10.
- Added an index.

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1 Introduction

This manual describes the functional, performance, and environmental specifications for the EXABYTE® EXB-8200 8mm Cartridge Tape Subsystem (EXB-8200). This manual is for engineering, purchasing, or marketing personnel who want to evaluate the EXB-8200 to determine the feasibility of integrating it into a product line.

1.1 About This Manual

This manual includes the following chapters:

- Chapter 1 provides general information about this manual, lists publications related to the EXB-8200, and describes the EXB-8200's compliance with regulatory and safety agency standards.
- Chapter 2 contains a physical and functional description of the EXB-8200. It provides general information about the EXB-8200's operations, including an explanation of helical scan recording, recorded track format, tape formatting, read-after-write, error correction code (ECC), and tape transport.
- Chapter 3 describes the physical and logical recording format of the EXB-8200.
- Chapter 4 describes the EXB-8200's performance specifications, including write and read access time, tape speed, reposition time, drum rotation period, and data transfer rate.
- Chapter 5 provides information about EXB-8200 service life, data reliability, and machine reliability.
- Chapter 6 describes the EXB-8200's power specifications, including information about voltages, power dissipation, the power connector, and safety considerations.
- Chapter 7 describes environmental specifications for operating, storing, and transporting the EXB-8200.
- Chapter 8 contains information about the Small Computer System Interface (SCSI) characteristics, physical path, command set, and message system.
- Chapter 9 contains guidelines for unpacking, packing and shipping, and installing the EXB-8200, including how to connect it to the power supply, how to set the SCSI ID, and how to mount the EXB-8200.

- Chapter 10 discusses EXB-8200 operation and maintenance. It describes the EXB-8200's controls and indicators, switches, the data cartridge write-protect switch, and the data cartridge load and unload procedures. It also provides procedures for cleaning the EXB-8200's tape heads and tape path.
- A glossary, index, and reader's comment form are included at the back of this manual.

1.2 Related Publications

The following publications provide additional information about the EXB-8200.

EXB-8200

For information about implementing SCSI commands for the EXB-8200, refer to the following publication:

- *EXB-8200 8mm Cartridge Tape Subsystem User's Manual*, 510006

Monitor

For information about installing the Monitor program for the EXB-8200, refer to the following publication:

- *EXB-8200 Monitor Installation and Operation*, 510012

Standards

For information about the standards used for the EXB-8200, refer to the following publications:

- *ANSI Small Computer System Interface (SCSI)*, X3.131-1986
- *ANSI Helical-Scan Digital Computer Tape Cartridge*, X3B5/89-136, Rev. 6
- *Western Digital WD33C92 and WD33C92A SCSI Bus Interface Controller*
- *Western Digital WD33C93 and WD33C93A SCSI Bus Interface Controller*

EXB-8200SX

For information about the EXB-8200SX 8mm Cartridge Tape Subsystem, refer to the following publication:

- *EXB-8200SX 8mm Cartridge Tape Subsystem Product Specification and User's Manual*, 510011

1.3 Safety and Regulatory Agency Standards

Safety Standards

When purchased from EXABYTE Corporation, the EXB-8200 is certified as a component by the following domestic and international product safety standards:

- UL Standard 1950, 1st Edition, Safety of Information Technology Equipment
- UL Standard 478, 4th Edition, Electronic Data Processing Units and Systems
- CSA Standard C22.2 No. 220-M1986, Information Processing and Business Equipment
- CAN/CSA Standard C22.2 No. 950-M89, Safety of Information Technology Equipment
- IEC 950/EN60950, Safety of Information Technology Equipment including Electrical Business Equipment (TUV)

Electromagnetic Compatibility (EMC) Standards

When properly installed with shielded cables and adequate grounding of the SCSI bus and the input power, the EXB-8200 meets the requirements for radiated and conducted emissions as defined by the following standards:

- FCC Rules, Part 15, Class B Computing Devices
- Canadian Department of Communications, Radio Interference Regulation, Digital Apparatus, Class B
- VDE Vfg 1046/1984, Class B
- CISPR Publication 22, 1985, Class A

Electromagnetic Interference (EMI) Standards

When properly installed with shielded cables and adequate grounding of the SCSI bus and the input power, the EXB-8200 will continue to operate without error when subjected to moderate levels of electromagnetic energy as defined by the following standard:

- IEC Publication 801-3, Severity Level 3

Other Test Standards

When shipped, the EXB-8200 is packaged in a manner that complies with the testing criteria defined by the following standard:

- National Safe Transit Association (NSTA) Project 1.

Notes:

2 Description of the EXB-8200

This chapter describes the physical and functional features of the EXB-8200 8mm Cartridge Tape Subsystem. The EXB-8200, shown in Figure 2-1, is a high-performance, high-capacity, true digital data storage device.

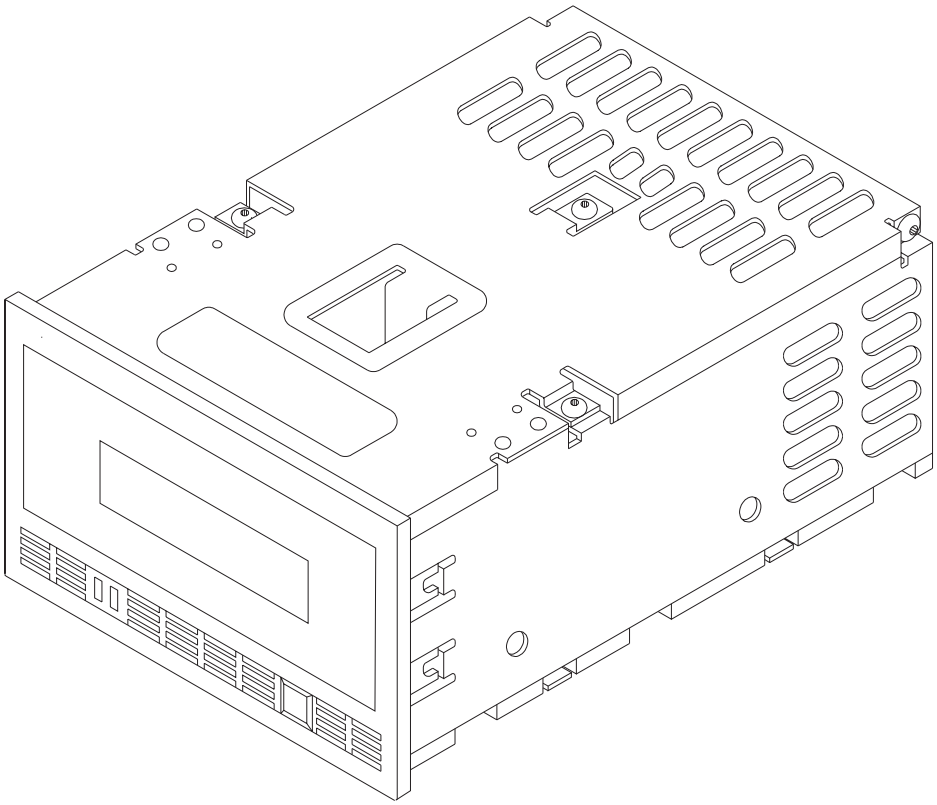

Figure 2-1 EXB-8200 8mm Cartridge Tape Subsystem

The primary features of the EXB-8200 are the following:

- Uses advanced helical scan technology, which affords high areal recording density and data storage capacity.
- Conforms to the dimensions of the industry-standard 5.25-inch form factor.
- Uses the industry-standard metal-particle 8mm data cartridge. The data cartridge is removable, rewritable, and can store up to 2.5 GBytes of formatted user data when written by an EXB-8200. EXABYTE data cartridges are available in three sizes: EXATAPE™ 15m (294 MBytes), EXATAPE 54m (1,174 MBytes), and EXATAPE 112m (2,472 MBytes).

- Includes an integral Small Computer System Interface (SCSI) controller and is available in two SCSI alternatives: single-ended and differential.
- Provides configurable host SCSI bus parity check and full disconnect, arbitration, and reconnect support.
- Provides high-performance read/write access times and high-performance asynchronous SCSI bus data transfer rates of up to 1.5 MBytes per second.
- Employs read-after-write error checking and automatic rewrite using a powerful onboard error correction code (ECC). Error recovery procedures are implemented in the EXB-8200 controller.
- Features a non-recoverable error rate of less than one bit in 10^{13} bits read.
- Contains an integrated 256-KByte speed-matching buffer.
- Features an effective head-to-tape speed of 3.76 meters per second (148 inches per second).

2.1 External Features of the EXB-8200

This section describes the external features of the EXB-8200.

Size and Weight

Designed to meet industry-standard 5.25-inch form factor mounting requirements, the EXB-8200 is 3.25 inches high $\times$ 5.75 inches wide $\times$ 8.00 inches deep (82.5 $\times$ 146.0 $\times$ 203.2 mm). The EXB-8200 weighs 4.5 pounds (2.045 kilograms).

Door and Front Bezel

The door of the EXB-8200 includes a clear window that enables the operator to view the label of the tape in the EXB-8200.

Standard colors for the EXB-8200's front bezel and door include:

- Black
- Pearl White
- Pebble Gray
- Platinum
- Gray

Custom colors can be provided at additional cost.

Controls and Indicators

Figure 2-2 shows the controls and indicators on the front panel of the EXB-8200.

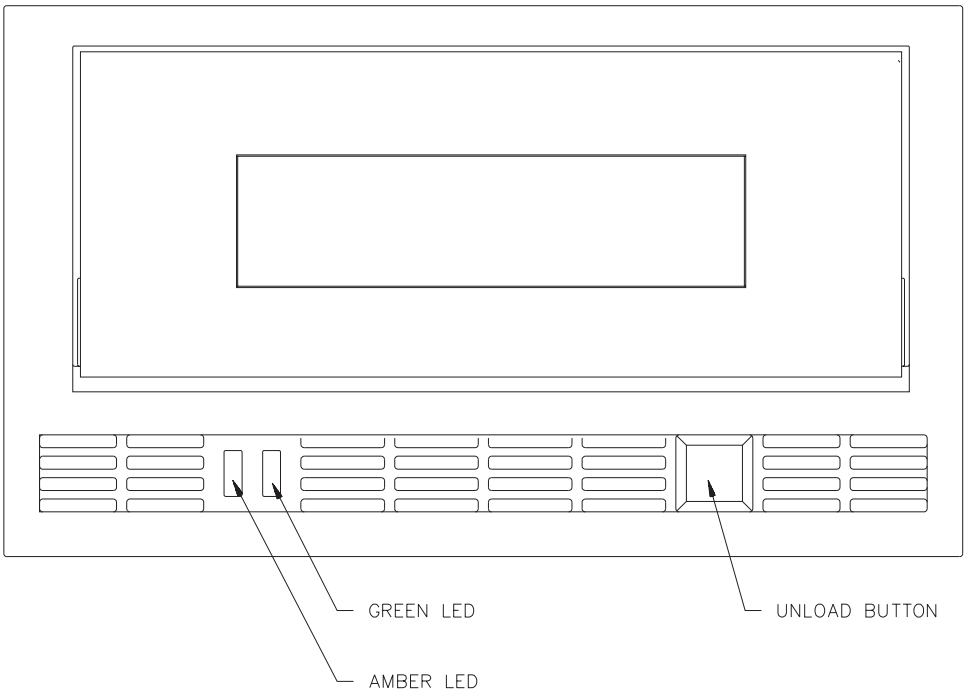

Figure 2-2 Front Panel of the EXB-8200

The EXB-8200 controls and indicators include the following:

Unload Button As described in Chapter 10, the unload button is the only operator control on the EXB-8200. Pushing this button starts the unload procedure. This button can also be used to reset the EXB-8200 after a servo error.

LEDs The green and amber LEDs on the front of the EXB-8200 indicate the status of EXB-8200 operations.These indicators are described further in Chapter 10.

2.2 Internal Components of the EXB-8200

The internal components of the EXB-8200 consist of an 8mm tape transport mechanism and recording channel, servo, data formatter (data buffer and data flow electronics), controller, interface electronics, software, and package parts designed and produced by EXABYTE. As shown in Figure 2-3, the EXB-8200 contains the following printed circuit boards (cards):

- An RW card that controls read and write functions.
- A CD card that controls clocking and detection functions.
- A DF card that controls data formatting (encoding during write operations and decoding during read operations).
- An MX (microprocessor) card that provides controller logic for the system.
- A DB, DS, or DR card that provides data buffering and SCSI bus protocol functions.
- An SV (servo) card that controls all mechanical functions.

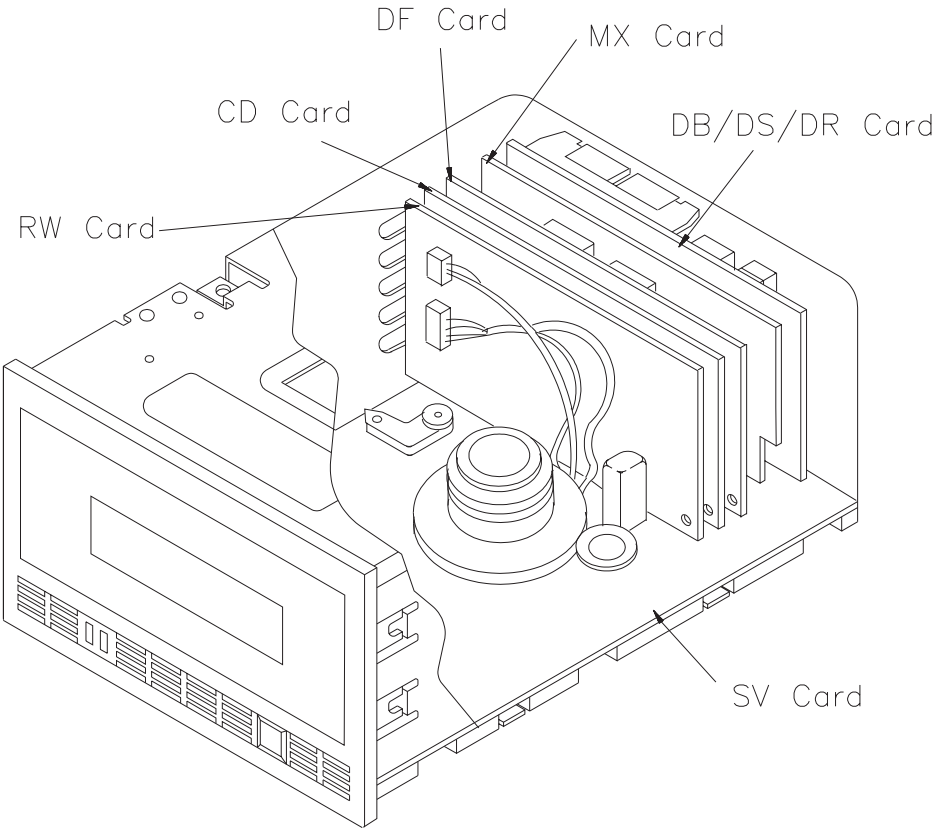

Figure 2-3 EXB-8200 Cartridge Tape Subsystem (Internal View)

2.3 EXB-8200 Functional Description

This section describes the following functional features of the EXB-8200:

- Helical scan recording
- Recorded track format
- Read-after-write checking
- Error correction code
- Read interchange
- System interface and control
- Data formatter
- Write, read, and erase electronics
- Motion control system
- Tape transport mechanism
- Start/stop and streaming operations

Helical Scan Recording

Helical scan recorders write very narrow tracks at an acute angle to the edge of the tape. This recording method creates a track length that is several times longer than the width of the tape. Tracks can be accurately positioned by the geometry of the tape path to precise minimal tolerances, resulting in a very high number of tracks per inch. When combined with a high linear flux density, very high areal density results.

Read, write, and servo heads are mounted on a drum that rotates constantly at 1800 rpm, resulting in an effective head-to-tape speed of approximately 3.76 meters per second (148 inches per second). Actual tape movement is 10.89 millimeters per second (0.5 inches per second). Forces acting upon the tape and various component mechanisms are correspondingly low, resulting in long life for both media and tape transport.

The combination of the helical wrap of the tape around the drum, the rotational motion of the head/drum assembly, and the linear motion of the tape causes the heads to trace a path (or track) across the tape that is 71.7 millimeters (2.82 inches) long, at an acute angle of approximately 5 degrees to the bottom edge of tape. See Figure 2-4 for an illustration of the position of the recorded tracks on the tape.

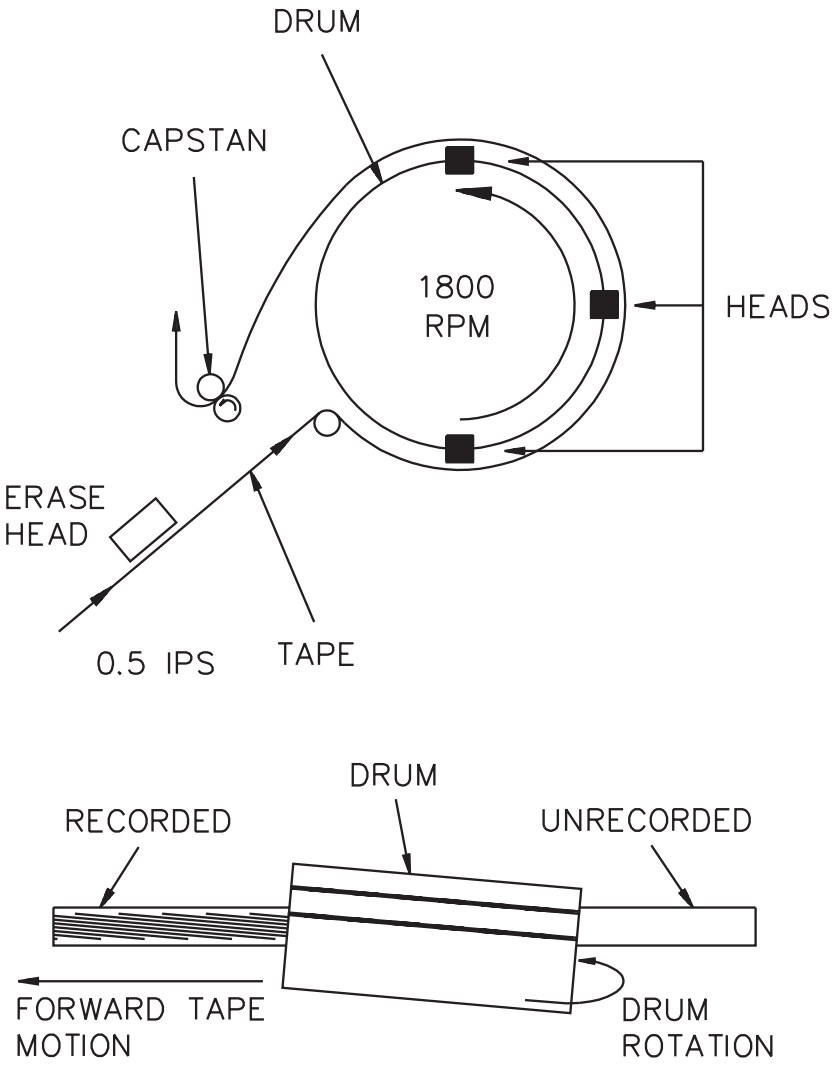

Figure 2-4 EXB-8200 Helical Scan Recording

Recorded Track Format

Figure 2-5 illustrates the recorded track format. Each recorded track consists of eight fixed length physical blocks and a servo zone. Each physical block can contain up to 1,024 bytes of user data. Additional bytes consisting of address, ECC, and cyclic redundancy check (CRC) information are appended to each block by the EXB-8200's data formatter. The address, ECC, and CRC bytes do not affect the data capacity of the tape.

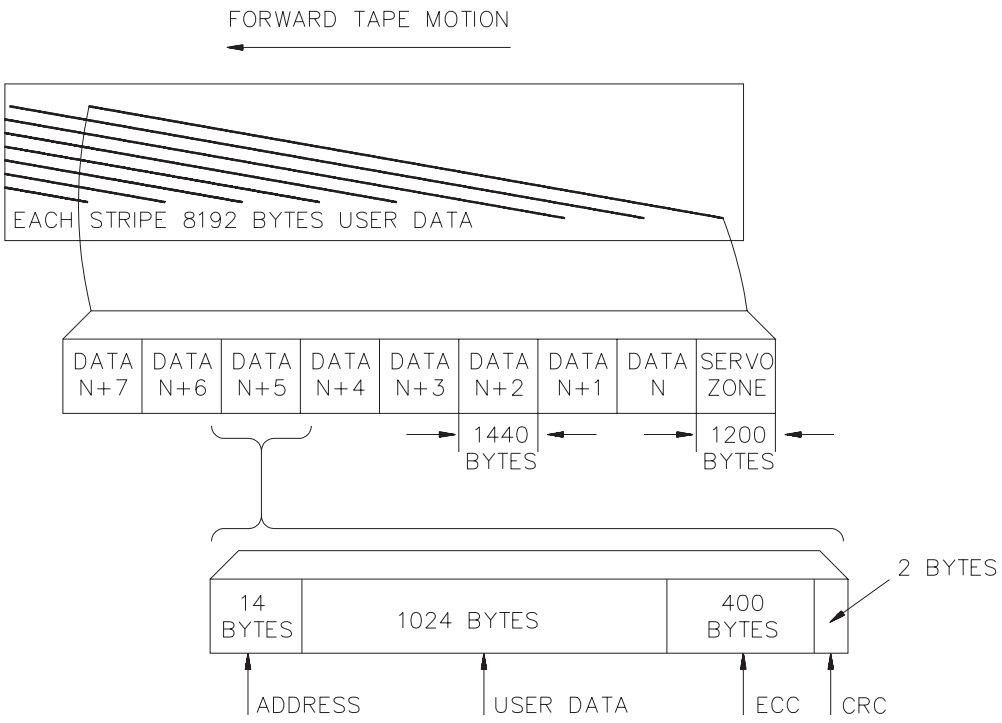

Figure 2-5 EXB-8200 Recorded Track Format

Read-After-Write Checking

During write operations, the EXB-8200 records servo information and formatted user data blocks on the same track and performs a read-after-write check of the recorded user data. If an error is detected during this read-back check, error recovery procedures are performed without host intervention and without repositioning of the tape. See Figure 2-6 for an illustration of the read-after-write procedure.

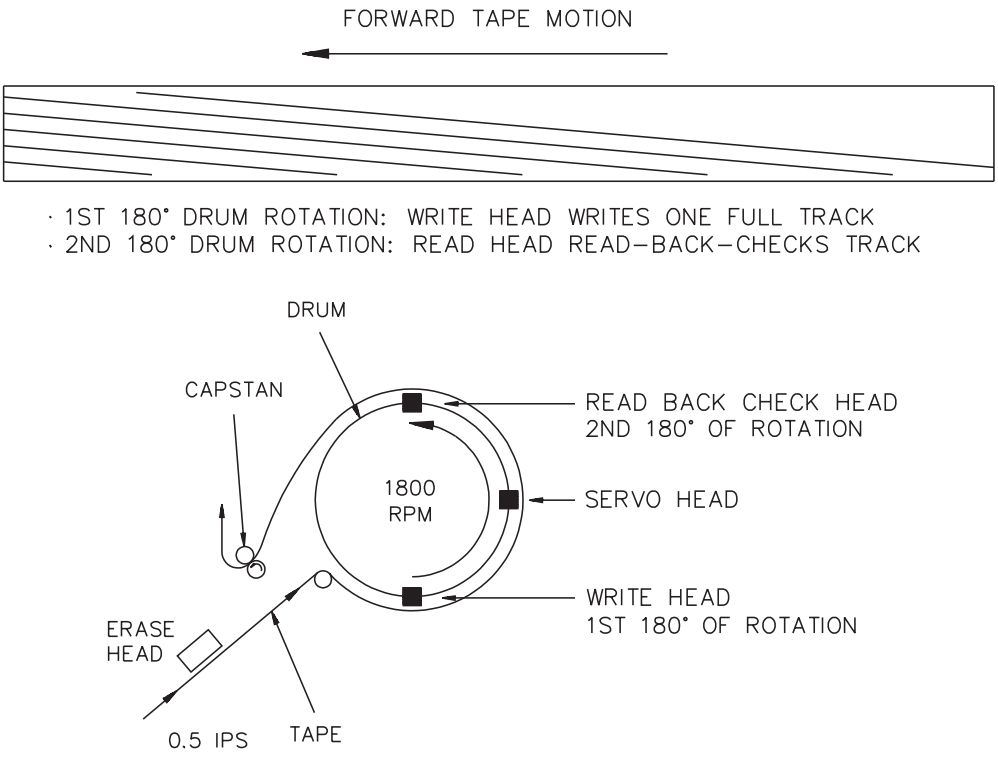

Figure 2-6 EXB-8200 Read After Write

Error Correction Code

The EXB-8200 employs a powerful error correction code (ECC) to ensure data reliability. The Reed/Solomon ECC algorithm can correct a burst as long as 264 consecutive bytes in error and as many as 80 additional random errors in each data block. The ECC is capable of multiple burst and random error corrections. It has been designed to be extremely effective against the types of error patterns characteristic of cartridge tape subsystems.

Read Interchangeability

Data cartridges written by an EXB-8200 can be read by any other EXB-8200, EXB-8200SX, or EXB-8500. This “read interchangeability” is accomplished through use of a proprietary, track-following servo technique that ensures proper head-to-track alignment. During read operations, the EXB-8200’s servo head samples servo information recorded in adjacent tracks. It uses this servo information to control linear tape velocity, resulting in accurate positioning of the read head over each track.

System Interface and Control

Users access the EXB-8200 through the SCSI bus. The EXB-8200 is operated as a sequential access device and responds to appropriate SCSI commands (listed in Section 8.3). In general, the EXB-8200 supports most of the commands and sequences supported by devices operated as nine-track tape systems. Error recovery procedures are controlled by the EXB-8200 in a manner that is transparent to the host system; complete error statistics are retained for all operations and are available through the REQUEST SENSE command.

Data Formatter

The data formatter consists of the 256-KByte data buffer and the data flow electronics.

Data Buffer The data buffer consists of 256 KBytes of DRAM that is organized as a nine-bit wide, dual-port, circular memory. Data transfers for SCSI and the data flow electronics take place to and from the data buffer asynchronously.

Logical user data blocks are formatted into physical blocks in the data buffer for recording to tape. Initiation of data buffer transfer operations and management of buffer storage space is performed in firmware.

Data Flow Electronics The data flow electronics consist of the write encoder and read decoder.

The write encoder receives data blocks from the data buffer and converts the data from parallel to serial. It appends ECC information, inserts synchronization markers, and performs interleave sequencing of bytes through the modulation encoder and bit serializer. Tag and address information is appended to each data block. The bit stream is then sent to the write head driver circuit.

The read decoder receives a serial data bit stream and clock from the clocking and detection circuit. It detects synchronization markers and determines alignment to data, demodulates data bytes, assembles data blocks, and corrects them if necessary.

Write, Read, and Erase Electronics

The write electronics consist of a write compensation circuit and the write head driver circuit.

The read electronics consist of preamplifier and equalization circuits for the read and servo channels and circuits for data detection and recovery and alignment of the data clock.

The erase electronics consist of a frequency generator and current driver for the erase head. The erase electronics are used simultaneously with the write electronics; that is, during a write operation, tape is always erased before it reaches the write head.

Motion Control System

The motion control system is operated by EXABYTE-developed firmware through a dedicated microprocessor located on the SV (servo) card. The motion control system consists of the following:

- Drum and capstan servos
- Circuits to drive the reel motor, load motor, mode change motor, and control solenoid
- Sensor interface circuits for the drum, capstan, and reel tachometers
- Sensor interface circuits for the load and mode states
- Sensor interface circuits for physical beginning of tape (PBOT), physical end of tape (PEOT), tape length and type, and write protect and door closed states.

Tape Transport Mechanism

The tape transport mechanism is manufactured by Sony to EXABYTE specifications to allow operation of the EXB-8200 as a digital cartridge tape subsystem. The tape transport mechanism is compatible with standard 8mm cartridges in all respects.

Start/Stop and Streaming Operations

The EXB-8200 can operate as either a start/stop or streaming tape device. The mode of operation depends on the rate at which the initiator can transfer data to the EXB-8200. To sustain operation in the streaming mode, the initiator must be able to asynchronously transfer data to the EXB-8200 at a

minimum of 246 Kbytes per second. If the initiator cannot maintain this transfer rate, starting and stopping occur automatically based on the data buffer motion and reconnect thresholds.

Notes:

3 Recording Format

The recording format defines the arrangement of information recorded on the tape, such as user data, filemarks, and the indicator for logical beginning of tape (LBOT). The recording format takes two forms:

- A physical format that is relative to the functions of the EXB-8200 data path, recording channel, and motion control system.
- A logical format that is relative to the host software. User data, filemarks, and LBOT are written in a format understood by the host.

3.1 Recording Parameters

The parameters used by the EXB-8200 to record data on metal-particle tape are shown in Table 3-1.

Table 3-1 EXB-8200 Recording Parameters

Parameter	Value
Linear recording density:	
Flux	2,126 FR/mm (54,000 FR/in.)
Bit	1,701 bits/mm (43,200 bits/in.)
Track width	0.025 mm (0.00098 in.)
Track pitch	0.031 mm (0.00122 in.)
Track density	32.248 tracks/mm (819.101 tracks/in.)
Areal recording density:	
Flux	68.6 KFR/mm^2 (44.2 MFR/$in.^2$)
Bit	54.9 Kbits/mm^2 (35.4 Mbits/$in.^2$)
Track angle (reference angle)	4.9 degrees
Wrap angle	221 degrees
Edge guard band	1.0025 mm (0.039 in.)
Recorded track length	71.673 mm (2.82 in.)

3.2 Physical Format

The following definitions explain the physical format of the tape and the information recorded on the tape.

Physical Beginning of Tape (PBOT)

The physical beginning of tape (PBOT) is the point at which the translucent leader material is attached to the media. This position is detected by an optical sensor in the tape transport mechanism.

Physical End of Tape (PEOT)

The physical end of tape (PEOT) is the point at which the translucent trailer material is attached to the media. This position is detected by an optical sensor in the tape transport mechanism and is reported by the controller to the host.

Physical Blocks

Data transferred to the EXB-8200 is recorded to tape in physical blocks. Each physical block is 1,440 bytes long and consists of the following:

- 1,024 bytes of user data
- 400 bytes of ECC information
- 2 bytes of cyclic redundancy check (CRC) data
- 14 bytes of header data

The EXB-8200 can use multiple physical blocks to record a logical block of data that exceeds 1,024 bytes. The ECC, CRC, and header bytes do not affect the data capacity of the tape.

Physical Tracks

A physical track consists of eight physical blocks of data. Therefore, each physical track on the tape can contain up to 8,192 bytes of user data.

The data zone of a track consists of a preamble, data segments, and a postamble. The preamble is a string of bits consisting of all 1's. The data segments consist of the physical blocks (encoded user data, ECC, CRC, and header information). The postamble is a string of bits consisting of all 1's. Composition of the data zone is the same regardless of the types of blocks recorded in the track.

Servo Information for Track-Following Servo Electronics

Each data track contains servo information that is used by track-following servo electronics to optimize tracking. This ensures reliable data interchange between the EXB-8200 and the host as well as read-interchangeability of tapes recorded on other EXB-8200s, EXB-8200SXs, or EXB-8500s (in EXB-8200 format). The servo information contains a signal that is written to tape during each write operation. During a read operation, the signal is sampled by the servo head. The servo head runs between adjacent tracks and compares the servo information on both tracks. If the signal amplitudes from both tracks are not equal, tape speed is adjusted to equalize them. This ensures proper alignment of the read head.

3.3 Logical Format

The following definitions explain the logical characteristics of the information recorded on the tape.

Logical Blocks

A logical block is a block of data transferred from the host to the EXB-8200. The length of a logical block can be from 1 byte to 240 KBytes. Logical blocks can be fixed or variable in length. Logical blocks that exceed 1,024 bytes are divided into 1,024-byte segments for recording in physical blocks on the tape.

Gap Bytes

If a logical block transferred from the host contains less than 1,024 bytes or cannot be equally divided by 1,024, gap bytes are added to the end of the data to make each incomplete physical block equal to 1,024 bytes. This operation is performed automatically by the EXB-8200.

Gap Blocks

Each track of data written to tape consists of eight physical blocks of user data. Whenever the last track of data written to tape contains less than eight physical blocks, the EXB-8200 adds gap blocks to the track to make it equal to eight blocks. Gap blocks cannot be accessed by a WRITE, READ, or any other command available to the user. The gap blocks are recorded only at the discretion of the EXB-8200.

Gap Tracks

When the EXB-8200 stops at the end of a write operation, a single gap track consisting of eight gap blocks is written following the last track containing data blocks. The gap track provides the track orientation required to append data. When a subsequent write operation begins, the controller repositions the tape and records the data on the next track adjacent to the gap track.

Filemarks

The EXB-8200 uses filemarks to quickly locate particular blocks of data during a search. Two types of filemarks are provided: long and short. A long filemark is 270 tracks long. A short filemark is 60 tracks long.

Each filemark consists of an erased length of tape (erase gap) followed by an analog tape mark (ATM) and a digital tape mark (DTM). An ATM consists of 11 identical tracks of servo data containing a 184 KHz signal that is recognized by the EXB-8200 during a search. A DTM consists of 10 identical tracks of servo data and information identifying the filemark's number on the tape. For long filemarks, the erase gap is 249 tracks long. For short filemarks, the erase gap is 39 tracks long.

A long filemark can be erased by an ERASE or WRITE command. A short filemark is erasable only when writing from logical beginning of tape (LBOT) or from a preceding long filemark. The information contained in filemarks is defined by the EXB-8200 and cannot be accessed or changed by the user.

Logical Beginning of Tape (LBOT)

The logical beginning of tape (LBOT) is recorded on the tape by a write operation at a point approximately 28 inches from the physical beginning of tape (PBOT).

LBOT consists of an erased length of tape followed by a series of tracks that are used to indicate the LBOT's location and to perform initial automatic calibration of the servo system. The first track containing data blocks is recorded directly after the last track containing LBOT information. The information contained in the LBOT tracks is defined by the EXB-8200 and cannot be accessed or changed by the user.

The tape can be repositioned and a write operation can be performed that erases the LBOT and records a new LBOT in the same space. This process occurs when a write operation is performed at LBOT on a previously written tape.

If an error occurs while the EXB-8200 is writing LBOT, it attempts to rewrite the LBOT once before indicating an error.

Logical End of Tape (LEOT)

The logical end of tape (LEOT) is determined by the number of recorded blocks that occur after LBOT. For this purpose, lengths of erased segments are converted into an equivalent number of blocks. The number of blocks between LBOT and LEOT is different for each size and type of data cartridge. The EXB-8200 supports the domestic P6 cartridge type, the European P5 cartridge type, and the international operating mode (PI). Tape size is determined by the EXB-8200's tape autosizing feature and the cartridge type specified by the MODE SELECT command. Refer to the *EXB-8200 8mm Cartridge Tape Subsystem User's Manual* for information about tape types and the autosizing feature. The user's manual also provides tables indicating the number of blocks between LBOT and LEOT and the approximate number of blocks between LEOT and PEOT.

Notes:

4 Performance Specifications

This chapter describes the performance specifications for the following EXB-8200 functions:

- Write access time
- Read access time
- Tape speed
- Reposition time
- Drum rotation period
- Data transfer rate

4.1 Write Access Time

Write access time is the time from the EXB-8200's receipt of the last byte of the WRITE command to the return of REQ requesting that the initiator transfer the first bytes of data across the SCSI bus. Write access time is a maximum of 950 microseconds.

4.2 Read Access Time

Read access time is the time from the EXB-8200's receipt of the last byte of the READ command to the return of REQ to the initiator indicating that the EXB-8200 is ready to transfer the first data bytes across the SCSI bus. If there is read data in the data buffer when the READ command is received, read access time is a maximum of 900 microseconds.

4.3 Tape Speed

The nominal tape speed at which data may be recorded and read is 10.89 mm per second (0.429 inch per second). Short-term speed variation is limited to ±3% of nominal over any 66.6 millisecond period synchronized to drum rotation. Long term speed variation is ±0.5%.

File search tape speed File search operations are performed at 10 times the nominal tape speed to allow quick access (108.9 mm per second or 4.29 inches per second).

Rewind tape speed Rewind tape speed averages 75 times the nominal tape speed (816.7 mm per second or 32.2 inches per second).

Rewind times for P6 and P5 cartridges are shown in Table 4-1. The rewind times are calculated as follows:

Rewind Time in Seconds = Length in Meters $\times$ 1.224

Typically, the actual time is slightly longer than the calculated number. Factors that affect the rewind times include the following:

- Friction within the data cartridge
- Friction within the EXB-8200
- The actual length of the tape (normally greater than the listed length)
- Acceleration and deceleration factors.

These factors have the greatest effect on the smaller cartridge sizes.

Table 4-1 Rewind Time by Cartridge Size

Data Cartridge	Length (meters)	EXATAPE*	Rewind Time (min:sec)
P6-15	14.7	15m	0:18
P6-30	27.7		0:34
P6-60	53.6	54m	1:06
P6-90	77.9		1:35
P6-120	105.5		2:09
P5-15	20.6		0:25
P5-30	38.7		0:47
P5-60	75.0		1:32
P5-90	111.2	112m	2:16

*EXATAPE data cartridges are currently available for purchase through EXABYTE and are recommended for use with all EXABYTE products.

4.4 Reposition Time

Reposition time starts when the initiator issues a command that stops the EXB-8200's motion control system and ends when the tape is repositioned, at nominal speed, so that the next byte of data can be transferred. Reposition time is independent of any interface delays.

Reposition time ranges from 1.082 seconds to 1.115 seconds.

4.5 Drum Rotation Period

The drum rotation period is 33.3 milliseconds (1800 rpm) ±0.1%. The nominal effective head-to-tape speed is 3.76 meters per second (148.0 inches per second).

4.6 Data Transfer Rate

The maximum burst data transfer rate is limited by the performance of the SCSI host adapter, the Western Digital WD33C93 or WD33C93A for single-ended SCSI, the WD33C92 or WD33C92A for differential SCSI, and the EXB-8200 buffer control hardware. The maximum burst asynchronous data transfer rate does not exceed 1.5 MBytes per second.

Typical burst performance is approximately 1.2 MBytes per second. This level of performance has been measured with the EXB-8200 attached to an Adaptec SCSI development system.

The EXB-8200 has a sustained asynchronous data transfer rate of 246 KBytes per second.

Notes:

5 Reliability Specifications

This chapter describes the following reliability specifications for the EXB-8200:

- Service life
- Data reliability
- Machine reliability

5.1 Service Life

The EXB-8200 has been designed to exceed a useful service life of five years, during which time all performance and reliability specifications, as described in this manual, apply.

5.2 Data Reliability

The EXB-8200 writes and reads fixed length physical blocks containing up to 1,024 bytes of user data. Data reliability is specified as a bit error rate based on 1,024 user data bytes per block. The bit error rate is the number of errors occurring per total number of bits transferred to the host. A block error rate in units of one error per total number of blocks transferred to the host is also provided.

Conditions for Data Reliability

The conditions under which the specifications for data reliability apply are as follows:

- The 8mm data cartridges used with the EXB-8200 must conform to the industry standards for metal-particle tape.
- Data cartridges must be written and read on an EXB-8200 that is properly grounded, operated, and maintained as described in this manual.
- Environmental conditions for the EXB-8200 and the 8mm cartridges must be maintained as specified in Chapter 7.
- The EXB-8200 must be cleaned with an EXABYTE or EXABYTE-approved 8mm Cleaning Cartridge, using the procedure described in Section 10.5.

Restrictions for Data Reliability

The following types of errors are excluded from the determination of data reliability:

- Errors caused by a failure of the EXB-8200
- Errors caused by faulty or damaged cartridges or media
- Errors caused by failure to comply with input power and grounding requirements, interference from external sources, or incorrect system operation or failure
- Errors that are corrected by the EXB-8200's ECC
- Errors that occur in blocks other than blocks containing user data

Write Reliability

Write reliability is determined by the rate of permanent write errors. During a write operation, the EXB-8200 uses read-back checking to determine whether data blocks are correctly written to tape. When a read-back check detects an error in a data block, the EXB-8200 rewrites the block. The EXB-8200 keeps track of the number of times blocks are rewritten and stores this number in a counter available through the REQUEST SENSE command.

If a data block can be correctly rewritten, the error is considered a temporary write error and does not affect write reliability. If a data block cannot be correctly written after a maximum of 11 rewrite attempts (12 write attempts total), the error is a permanent write error. When a permanent write error occurs, the EXB-8200 returns Check Condition status and stops writing data to tape.

The rates for permanent write errors are:

Bit error rate (data interchange mode)	1.0×10^{-12}
Block error rate	8.2×10^{-9}

Read Reliability

Read reliability is determined by the rate of permanent read errors. If, during a read operation, the EXB-8200 cannot read a block that has been correctly written, it attempts to reread the block. The EXB-8200 keeps track of the number of times it attempts to reread a block and stores this number in a counter available through the REQUEST SENSE command.

If a data block can be correctly reread, the error is considered a temporary read error and does not affect read reliability. If a data block cannot be correctly read after a maximum of 9 reread attempts (10 read attempts total), the error is a permanent read error. When a permanent read error occurs, the EXB-8200 returns Check Condition status and stops reading data from tape.

The rates for permanent read errors are:

Bit error rate (data interchange mode)	1.0×10^{-13}
Block error rate	8.2×10^{-10}

5.3 Machine Reliability: Mean Time Between Failures (MTBF)

The mean time between failures (MTBF) for the EXB-8200 is 40,000 hours for units manufactured after November 1, 1990.

MTBF is defined as:

$$\text{MTBF} = \frac{\text{Total Power-on Hours}}{\text{Number of Relevant Equipment Failures}}$$

where:

Total Power-on Hours =	The total time the EXB-8200 is drawing current from the input power supply system.
Number of Relevant Equipment Failures =	Those failures that cannot be corrected by operating personnel and require the intervention of maintenance personnel.

Test Conditions

The MTBF value is determined under the following conditions:

- A minimum of 32 EXB-8200s are tested, with each unit installed for 5,000 hours.
- MTBF is specified for a maximum duty cycle of 10%. Duty cycle is defined as:

$$\text{Duty Cycle} = \frac{\text{Total Hours of Mechanical Operation}}{\text{Total Power-on Hours}} \times 100\%$$

- The EXB-8200s are tested at the following ambient temperature and relative humidity:

  23° C ± 2° C

  50% relative humidity ± 10% (non-condensing)

- The EXB-8200s are operated in accordance with operating specifications.

Conditions for the MTBF Value

The conditions under which the MTBF value applies are as follows:

- The 8mm data cartridges used must conform to the industry standards for metal-particle tape.
- Environmental conditions for the EXB-8200 and 8mm cartridges must be maintained as specified in Chapter 7.
- The EXB-8200 must be cleaned with an EXABYTE or EXABYTE-approved 8mm Cleaning Cartridge using the procedure described in Section 10.5.

Restrictions for the MTBF Value

The following types of failures are excluded from the calculation of MTBF:

- Failures arising from incorrect operating procedures
- Cable failures, power supply failures, or other failures not caused by equipment
- Failures caused by incorrect grounding procedures or by interference from external sources
- Media failures, or any failures or degraded performance caused by use of faulty or damaged media

- New failures that arise from continued use of a failed, misaligned, or damaged EXB-8200
- Failures caused by incorrect maintenance procedures, and all failures that occur within the first 40 power-on hours of any maintenance activity that includes the modification, adjustment, or replacement of any EXB-8200 assembly
- Failures of new EXB-8200s that occur within the first 40 power-on hours

Notes:

6 Power Specifications

This chapter lists the power specifications for the EXB-8200, including information about voltages, power dissipation, the power connector, and safety agency considerations.

6.1 Voltages

The EXB-8200 operates from the standard DC supply voltages: +5 volts and +12 volts. Table 6-1 shows the power specifications for the EXB-8200. All specified voltages are DC; no AC power is used. The EXB-8200 does not provide any overvoltage or overcurrent protection.

Table 6-1 EXB-8200 Power Specifications at +5 and +12 Volts DC

	+5 Volts DC	**+12 Volts DC**
Voltage Tolerance	±5%	±5%
Ripple and Noise (60 Hz to 20 MHz)*	125 mVpp max	125 mVpp max
Load current:		
Minimum	1.2 A	170 mA
Maximum	2.8 A	400 mA
Peak	2.8 A	650 mA

* The ripple voltage is included in the total voltage tolerance.

Table 6-2 lists the typical power consumption at +5 volts DC and +12 volts DC for the most commonly performed SCSI functions.

Table 6-2 Typical Power Consumption for Common SCSI Functions at +5 and +12 Volts DC

Function	+5 Volts DC				+12 Volts DC			
	Amps		Watts		Amps		Watts	
	Min	Max	Min	Max	Min	Max	Min	Max
Power up	1.6	2.6	8.0	13.0	0.24	0.41	2.9	4.9
Load tape	1.5	2.6	7.5	13.0	0.24	0.42	2.9	5.0
Unload tape	1.5	2.6	7.5	13.0	0.22	0.40	2.6	4.8
Write tape	1.6	2.2	8.0	11.0	0.22	0.50	2.6	6.0
Read tape	1.8	2.2	9.0	11.0	0.24	0.38	2.9	4.6
Rewind	1.5	2.2	7.5	11.0	0.20	0.65	2.4	7.8
Search	1.5	2.2	7.5	11.0	0.24	0.40	2.9	4.8
Stopped	1.5	1.8	7.5	9.0	0.23	0.31	2.8	3.7

Average Wattage The average wattage for +5 volts DC is 10.41 watts. The average wattage for +12 volts DC is 4.48 watts. The total average wattage for the EXB-8200 is 14.89 watts.

6.2 Power Dissipation

The maximum average power dissipation is 15 watts (±1 watt).

6.3 Power Connector

The power connector used in the EXB-8200 is compatible with the power connector used for standard 5.25-inch devices. The EXB-8200's P1 power connector (AMP No. 641737-1; EXABYTE No. 004008) has the pin assignments shown in Table 6-3.

Table 6-3 Pin Assignments for the P1 DC Power Connector

P1 Pin No.	Assignment
1	+12 V
2	Ground, 12 V return
3	Ground, 5 V return
4	+5 V

6.4 Safety Agency Considerations

Safety agency certification requires that the supplied voltages be from the following:

- A Safety Extra-Low Voltage source (per IEC 950).
- A Class 2 transformer rated at 30 volts RMS sinusoidal or less.
- An isolating transformer, or a power supply that includes an isolating transformer, with open-circuit potential or no-load output of not more than 42.4 volts peak or 60 VDC. The energy available is limited so that the current under any condition of load, including short circuit, is not more than 8 amps after one minute of operation.

Notes:

7 Environmental Specifications

This chapter discusses the following environmental specifications for the EXB-8200:

- Operating temperature and humidity
- Air flow
- Particulate contamination
- Shock and vibration
- Electrostatic discharge
- Acoustic noise
- Electromagnetic interference
- Radiated emission susceptibility

Table 7-1 lists the general environmental specifications for the EXB-8200.

Table 7-1 EXB-8200 Environmental Specifications

	EXB-8200 operating[b]	**EXB-8200 in storage[c] or not operating[d]**	**EXB-8200 being transported[c]**
Ambient Temperature Range[a]	+5° to +40°C (+41° to +104°F)	–40° to +60°C (–40° to +140°F)	–40° to +60°C (–40° to +140°F)
Temperature Variation[e]	1°C per minute; max 10°C per hour (2°F per minute; max 18°F per hour)	1°C per minute; max 20°C per hour (2°F per minute; max 36°F per hour)	1°C per minute; max 20°C per hour (2°F per minute; max 36°F per hour)
Relative Humidity[e]	20% to 80% Non-condensing	10% to 90% Non-condensing	10% to 90% Non-condensing
Wet Bulb	26°C max (79°F max)		
Altitude	–304.8 m to +3,048 m (–1,000 ft. to +10,000 ft.)	–304.8 m to +3,048 m (–1,000 ft. to +10,000 ft.)	–304.8 m to +12,192 m (–1,000 ft. to +40,000 ft.)

[a] The temperature specifications for the EXB-8200 assume that temperature measurements are made at the tape path.

[b] All operating measurements include an EXATAPE data cartridge. These measurements assume that the EXB-8200 is installed according to the installation instructions in this manual.

[c] The EXB-8200 has not been unpacked, and a data cartridge is not packed with the EXB-8200.

[d] The EXB-8200 has been unpacked but is not operating, and a data cartridge is not inserted.

[e] The data cartridge's temperature and humidity must be allowed to stabilize in the specified ambient environment for 24 hours.

7.1 Operating Environment

Figure 7-1 indicates the operating temperature and humidity ranges for the EXB-8200. The dotted line represents the operating environment. Table 7-2 defines the temperature and humidity points shown in Figure 7-1.

Table 7-2 Temperature and Humidity Points for Figure 7-1

Point	Temperature	Humidity
A	5°C	80%
B	29°C	80%
C	40°C	34%
D	40°C	20%
E	5°C	20%

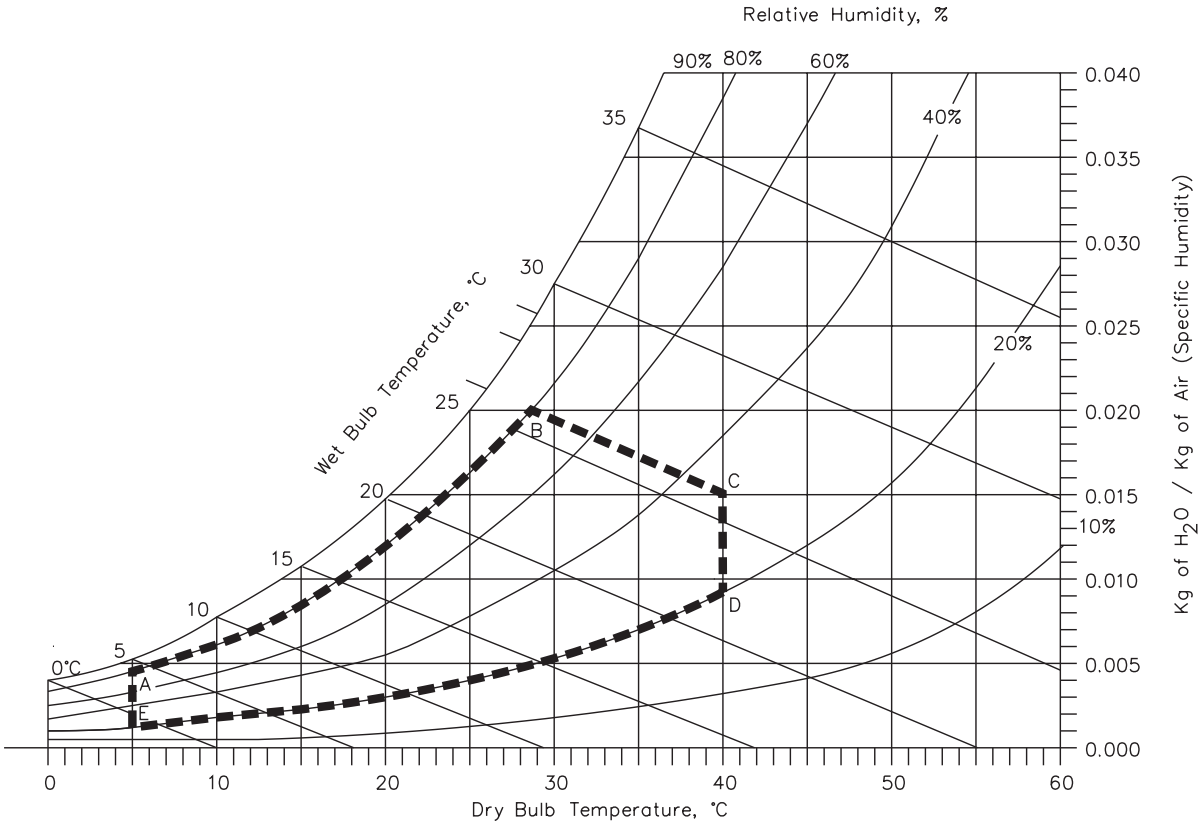

Figure 7-1 Temperature and Humidity Ranges for EXB-8200 Operation

7.2 Air Flow Requirements

Adequate air flow must be provided through the vents in the rear of the EXB-8200 to dissipate heat resulting from approximately 15 watts of power consumption. The air flow around the entire drive must be sufficient to prevent the tape path temperature from exceeding 40° C (104° F). However, air flow within the enclosure must not force air into the tape path. Otherwise, particulate contamination of the media can result in data errors.

7.3 Particulate Contamination Limits

Particulate contamination should not exceed the counts shown in Table 7-3.

Table 7-3 EXB-8200 Particulate Contamination Limits

Particle Size (microns)	Number of Particles ≥ Particle Size Per Cubic Meter	Number of Particles ≥ Particle Size Per Cubic Foot
0.1	8.8×10^7	2.5×106
0.5	3.5×10^7	1.0×106
5.0	2.5×10^5	7.0×103

Figure 7-2 shows the particulate contamination profile of a typical office compared to the specifications for the EXB-8200. Contamination profiles of individual office areas vary.

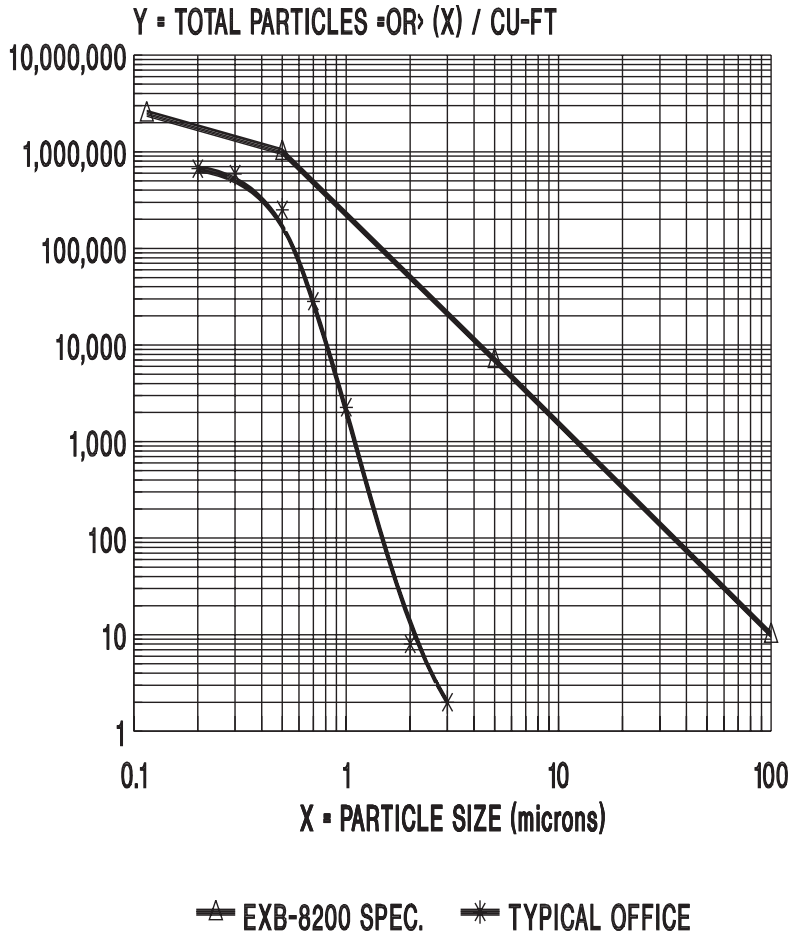

Figure 7-2 Particulate Contamination Specification Compared to a Typical Office

7.4 Shock and Vibration

The EXB-8200 meets the following shock and vibration specifications.

Shock Specifications

Table 7-4 lists the shock specifications for the EXB-8200. The operating shock levels indicate how much shock the EXB-8200 can withstand while reading and writing data. The non-operating and storage shock levels indicate how much shock the EXB-8200 can withstand when it is not operating. After withstanding this amount of shock, the EXB-8200 will operate normally.

Table 7-4 EXB-8200 Shock Limits

Operating	Storage[a] or Not Operating[b]	Transportation[a]
3 g for 5 ms[c] 2 g for 11 ms[c]	45 g at a velocity change of 192 inches per second[d]	NSTA Project 1A

[a] The EXB-8200 has not been unpacked.

[b] The EXB-8200 has been unpacked, but no tape motion is occurring.

[c] A minimum of 20 shock pulses were applied to each of the three orthogonal axes. The shock pulses were half-sine waves and were applied at a rate not exceeding one shock per second.

[d] A minimum of three trapezoidal shock pulses of 45 g were applied to each of the EXB-8200's six sides at a velocity change of 192 inches per second (equivalent height equals 48 inches).

Vibration Specifications

Table 7-5 lists the vibration specifications for the EXB-8200 during operation, non-operation, storage, and transportation. The operating specifications indicate the amount of vibration the EXB-8200 can withstand while reading and writing data.

Table 7-5 EXB-8200 Vibration Limits

Random vibration[a] applied during operation	
5-350 Hz	PSD = 0.0002 g^2/Hz
350-500 Hz	Slope = –6 dB/Oct
500 Hz	PSD = 0.0001 g^2/Hz
Random vibration[b] applied during non-operation[c] and storage[d]	
5-100 Hz	PSD = 0.020g^2/Hz
100-137 Hz	Slope = –6 dB/Oct
137-350 Hz	PSD = 0.0107 g^2/Hz
350-500 Hz	Slope = –6 dB/Oct
500 Hz	PSD = 0.0052 g^2/Hz
Transportation[d]	
NSTA Project 1A	

[a] A 0.3 g RMS random vibration spectrum is applied to each of three orthogonal axes for a minimum of 20 minutes per axis.

[b] A 2.41 g RMS random vibration spectrum is applied to each of three orthogonal axes for a minimum of 20 minutes per axis.

[c] The EXB-8200 has been unpacked, but no tape motion is occurring.

[d] The EXB-8200 has not been unpacked.

7.5 Electrostatic Discharge (ESD)

When properly installed with a shielded cabinet, shielded cables, and adequate grounding of the SCSI bus and input power, the EXB-8200 can withstand discharges applied to those points accessible during normal use as follows:

- 10,000 volts without affecting the permanent read error rate or requiring operator intervention
- 15,000 volts without sustaining permanent damage
- 20,000 volts from a charged cartridge inserted into the drive without sustaining damage or errors

7.6 Acoustic Noise

When the EXB-8200 is operating in streaming mode for a read or write operation, the octave band (Hz) A-weighted sound power levels (decibels) do not exceed the upper limits specified in Table 7-6. The EXB-8200 has an NC rating of 50 or better.

Table 7-6 EXB-8200 Acoustic Noise Limits

Octave Band Center Frequencies (Hz)						
125	250	500	1000	2000	4000	8000
53 dB	48 dB	47 dB	47 dB	47 dB	45 dB	40 dB

7.7 Electromagnetic Compatibility (EMC)

When properly installed with a shielded cabinet, shielded cables, and adequate grounding of the SCSI bus and the input power, the EXB-8200 meets the requirements for radiated emissions as defined by the following standards:

- FCC Rules, Part 15, Class B Computing Devices
- Canadian Department of Communications, Radio Interference Regulation, Digital Apparatus, Class B
- VDE Vfg 1046/1984, Class B
- CISPR Publication 22, 1985, Class A

7.8 Electromagnetic Interference (EMI) Susceptibility

When properly installed with a shielded cabinet, shielded cables, and adequate grounding of the SCSI bus and the input power, the EXB-8200 will continue to operate without error when subjected to moderate levels of electromagnetic energy as defined by the following standard:

- IEC Publication 801-3, Severity Level 3

Notes:

8 Small Computer System Interface (SCSI) Characteristics

The Small Computer System Interface (SCSI) implemented for the EXB-8200 conforms to the following standard for a sequential access device:

- ANSI Small Computer System Interface specification X3.131-1986, Revision 17B, Conformance Level 2

The EXB-8200 uses one of the following Western Digital SCSI Bus Interface Controllers:

- WD33C93 or WD33C93A for single-ended SCSI configurations
- WD33C92 or WD33C92A for differential SCSI configurations

Implementation characteristics of the SCSI controller include the following:

- Support for single-ended or differential SCSI configurations
- SCSI bus parity checking configurable through the MODE SELECT command
- Asynchronous data transfer support
- Standard, non-shielded 50-pin ribbon cable connector
- Support for multiple initiator configurations

In addition, the EXB-8200's SCSI controller implements the disconnect, reconnect, and arbitration feature. This feature releases the EXB-8200 from the SCSI bus so that it can operate under its own internal intelligence system, enabling the SCSI bus to perform other I/O requests.

8.1 Physical Path

The SCSI physical path definition is implemented by the EXB-8200 using an eight-port, daisy-chained bus that includes the following features:

- Single-host or multiple-host computer system
- Bus contention handled by distributed arbitration on a prioritized basis
- Accommodation of multiple peripheral device types
- Asynchronous communication of up to 1.5 MBytes/sec (12 Mbits/sec)
- Multiple overlap of peripheral device operations
- Orientation toward intelligent peripheral devices
- Enhanced operation with buffered devices

8.2 SCSI Message System

The SCSI message system supported by the EXB-8200 allows communication between the initiator and the EXB-8200 for physical path management. Table 8-1 lists the messages supported by the EXB-8200.

Note: The EXB-8200 does not support the extended message format or the use of linked commands; therefore, these messages are not included.

Table 8-1 SCSI Messages Supported by the EXB-8200

Hex Value	Message	Direction*	
		In	Out
00h	Command Complete	✓	
02h	Save Data Pointer	✓	
03h	Restore Pointers	✓	
04h	Disconnect	✓	
05h	Initiator Detected Error		✓
06h	Abort		✓
07h	Message Reject	✓	✓
08h	No Operation		✓
09h	Message Parity Error		✓
0Ch	Bus Device Reset		✓
80h or C0h	Identify	✓	✓

*In: EXB-8200 to initiator
Out: Initiator to EXB-8200

Refer to the *EXB-8200 8mm Cartridge Tape Subsystem User's Manual* for detailed information about SCSI communications and messages.

8.3 SCSI Command Set

The EXB-8200 SCSI command set consists of 18 commands from the Group 0 sequential access device command set. These commands are listed in Table 8-2. Refer to the *EXB-8200 8mm Cartridge Tape Subsystem User's Manual* for detailed descriptions of these commands.

Table 8-2 SCSI Commands Supported by the EXB-8200

Command	OP code
ERASE	19h
INQUIRY	12h
LOAD/UNLOAD	1Bh
MODE SELECT	15h
MODE SENSE	1Ah
PREVENT/ALLOW MEDIUM REMOVAL	1Eh
READ	08h
READ BLOCK LIMITS	05h
RECEIVE DIAGNOSTIC RESULTS	1Ch
RELEASE UNIT	17h
REQUEST SENSE	03h
RESERVE UNIT	16h
REWIND	01h
SEND DIAGNOSTICS	1Dh
SPACE	11h
TEST UNIT READY	00h
WRITE	0Ah
WRITE FILEMARKS	10h

Notes:

9 Shipping and Installing the EXB-8200

This chapter describes the requirements for unpacking, packing and shipping, and installing the EXB-8200. It includes information about connecting the EXB-8200, setting the SCSI ID, and mounting the EXB-8200.

9.1 Unpacking the EXB-8200

The EXB-8200 is shipped in a protective container that meets the National Safe Transit Association specification (Project 1A). Follow these steps to unpack the EXB-8200:

1. Place the shipping carton on a flat, level surface.
2. Remove the adhesive tape from the top of the carton and open the carton flaps.
3. Carefully remove the packing material from the top of the EXB-8200.
4. Holding the bottom edges of the EXB-8200, lift it out of the carton and place it on a flat, level surface.
5. Check the contents of the carton against the packing list and inspect the EXB-8200 for possible damage. If a part is missing or damage has occurred, notify the carrier and your vendor immediately.
6. Let the EXB-8200 acclimate to the operating environment for at least two hours before applying power.

Note: If the EXB-8200 has been stored for more than six months, follow the instructions in Section 9.6 when applying power for the first time.

Important

If you plan to re-use the packaging to ship the EXB-8200, you must not modify the packaging in any way. Modifications to the packaging may prevent the environmental specifications discussed in Chapter 7 from being met and may void the EXB-8200's warranty.

9.2 Packing and Shipping the EXB-8200

This section describes packing and shipping requirements and provides instructions for packing and shipping the EXB-8200.

Shipping Carton

To avoid damaging the EXB-8200 when repacking and shipping it, you must use the original shipping carton and packing materials (or replacement packaging obtained from the vendor). The shipping carton and packing materials are not intended to be used for shipping items other than or in addition to an EXB-8200.

When originally shipped, the EXB-8200 is sealed in a static protection bag with either one drive per carton (single pack) or four drives per carton (four pack). The single-pack shipping carton is 15 inches long × 12⅝ inches wide × 10¼ inches high (38.1 × 32.1 × 26.0 cm). The four-pack shipping carton is 23½ inches long × 13½ inches wide × 10⅞ inches high (59.7 × 34.3 × 27.6 cm).

The shipping carton and internal packing materials are designed so that an enclosed EXB-8200 does not receive a shock greater than 45 g when the carton is dropped on any surface, corner, or edge from the following heights:

- 48 inches (121.9 cm) at a velocity change of 192 inches per second (488 cm per second) for the single-pack carton
- 36 inches (91.4 cm) at a velocity change of 167 inches per second (424 cm per second) for the four-pack carton

Both sizes of shipping cartons meet the criteria described in the National Safe Transit Association (NSTA) Project 1A for packaged products weighing less than 100 pounds. The weight of a single-pack carton containing one EXB-8200 is approximately 6 pounds (2.72 kilograms). The weight of a four-pack carton containing four EXB-8200s is approximately 22 pounds (9.98 kilograms).

The EXB-8200's packing materials are reusable, recyclable, and environmentally safe. The materials contain no chlorofluorocarbons (CFCs) or heavy metals.

Environmental Requirements for Transportation

The environmental specifications listed in Table 9-1 must be met whenever the EXB-8200 is transported.

Table 9-1 Environmental Specifications for Transporting the EXB-8200

Temperature Range	–40° to +60°C (–40° to +140°F)
Temperature Variation	1°C per minute up to a maximum of 20°C per hour (2°F per minute up to a maximum of 36°F per hour)
Relative Humidity	10% to 90% non-condensing
Wet Bulb	26°C max (79°F max)
Altitude	–304.8 m to +12,192 m (–1,000 ft to +40,000 ft)

Procedure for Packing and Shipping the EXB-8200

If you need to ship an EXB-8200 or return it to your vendor for repair, carefully follow the instructions in this section to avoid damaging the EXB-8200 or voiding your warranty.

Required Packing Materials

To pack an EXB-8200, you must have the following materials:

- Original single-pack shipping carton—if you do not have the original packaging materials, contact your vendor to receive new materials

  Note: Do not use a four-pack shipping carton to reship a single EXB-8200. If you do use a four-pack, you must place four EXB-8200s in the box.

- Original top and bottom packing cushions
- Two-inch packing tape

Packing and Shipping Instructions

To pack and ship an EXB-8200, follow these steps:

1. Obtain the original single-pack shipping carton or contact your vendor to receive a new one.
2. Assemble the carton and tape it shut at the bottom.
3. Place the bottom packing cushion in the carton, with the fitted space for the EXB-8200 facing up.
4. Place the EXB-8200 in the bottom packing cushion's fitted space as shown in Figure 9-1.
5. Place the top packing cushion over the EXB-8200, with the cardboard side facing down, as shown in Figure 9-1.
6. Close the carton. Tape the top seam so that the carton is completely closed.

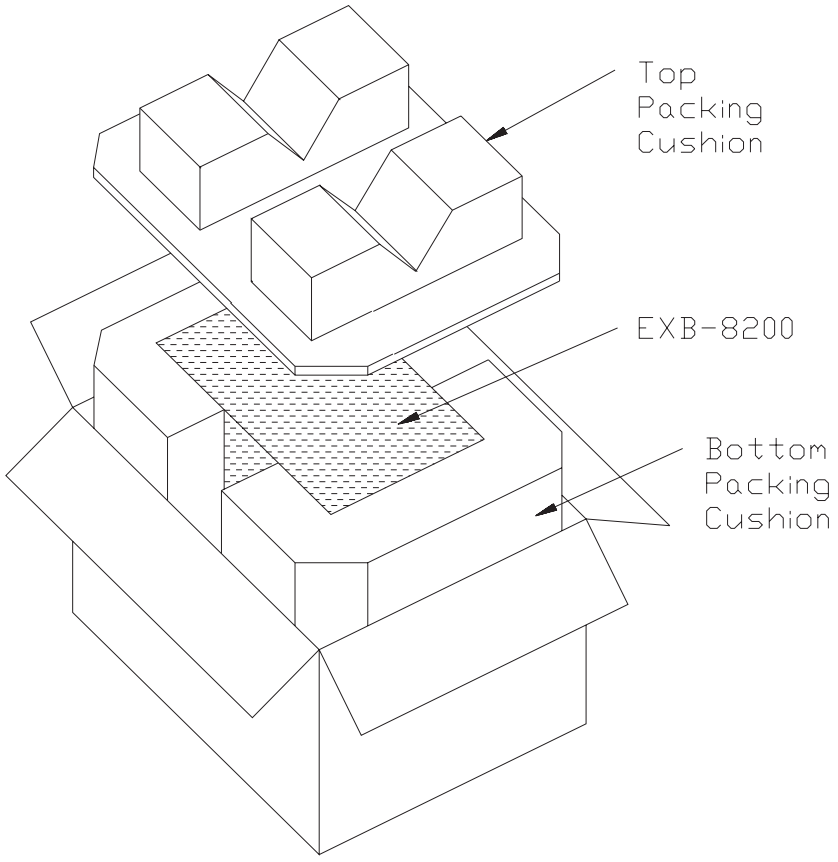

Figure 9-1 Single-Pack Carton and Packing Materials for the EXB-8200

9.3 Connecting the EXB-8200

This section discusses requirements for connecting the EXB-8200 to the power supply and the SCSI bus.

Power Connector Requirements

The system power cable connector should be an AMP No. 1-480424-0 female connector. Figure 9-2 shows the location of the P1 power connector at the back of the EXB-8200. See Table 6-3 for the pin assignments for the P1 power connector. A grounding hole, shown in Figure 9-2, is provided for mounting a grounding screw.

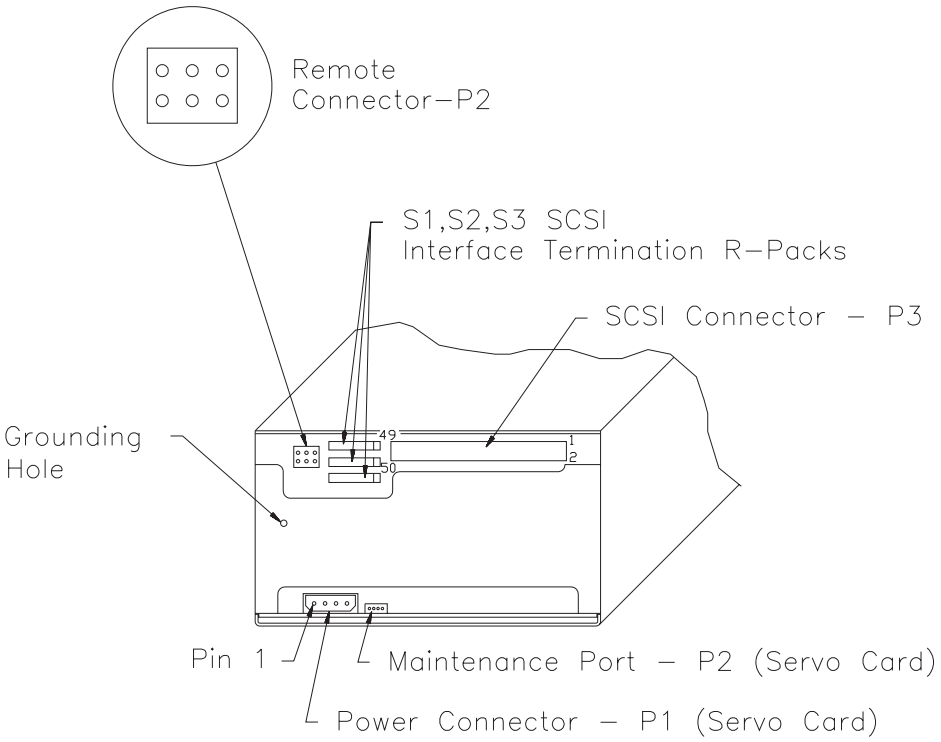

Figure 9-2 EXB-8200 Back Panel Connectors and Controls (DR card)

SCSI Connector Requirements

The SCSI connector, labeled P3, is located at the rear of the EXB-8200, as shown in Figure 9-2. The SCSI connector is a keyed 50-pin male ribbon cable connector, as described in ANSI SCSI specification, X3.131-1986. The system cable connector must be a 50-pin female ribbon cable connector (AMP No. 1-499575-2 or equivalent). For P3 SCSI connector pin-out assignments, see the *EXB-8200 8mm Cartridge Tape Subsystem User's Manual.*

9.4 Setting the SCSI ID

The SCSI ID for the EXB-8200 can be selected from 0 through 7. The SCSI ID is sensed on power-up, SCSI bus reset, and device reset. The EXB-8200's device LUN is hard wired as LUN 0.

Depending on the type of interface card you have (DR, DS3, or DB), you can use either a remote connector or DIP switches to set the SCSI ID. The choices for the various cards are described in the following sections.

Setting the SCSI ID for the DR Card

To set the SCSI ID for the DR card, you can use a remote connector (Molex® 14-57-3065 or equivalent), as shown in Figure 9-3. The remote connector can be attached to the card, or jumpers can be placed on the appropriate pins. The DR card is supplied with jumpers installed.

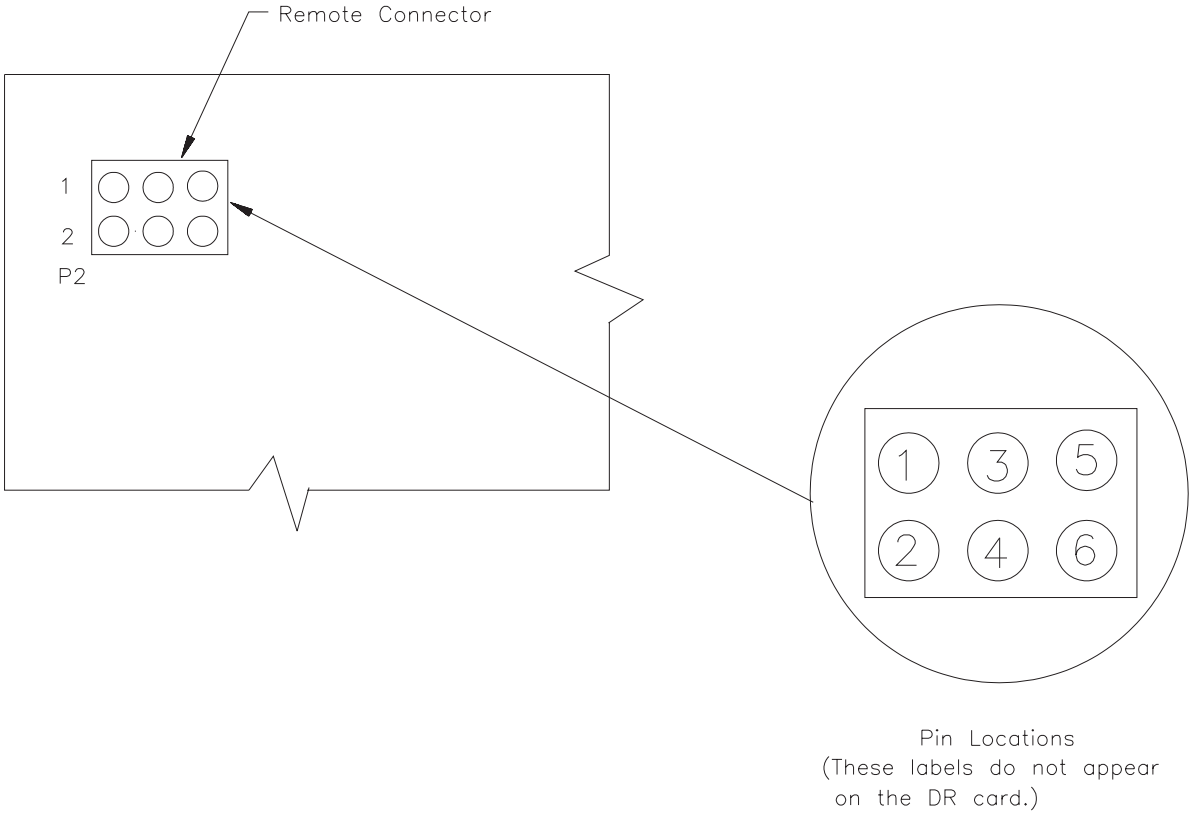

Figure 9-3 Remote Connector on the DR Card

Table 9-2 lists the pin assignments for the remote connector.

Table 9-2 Remote Connector Pin Assignments

Pin	Signal
1	SCSI ID Bit 2 (MSB)
2	Ground
3	SCSI ID Bit 1
4	Ground
5	SCSI ID Bit 0 (LSB)
6	Ground

Figure 9-4 shows the jumper connections and corresponding SCSI IDs for the DR card.

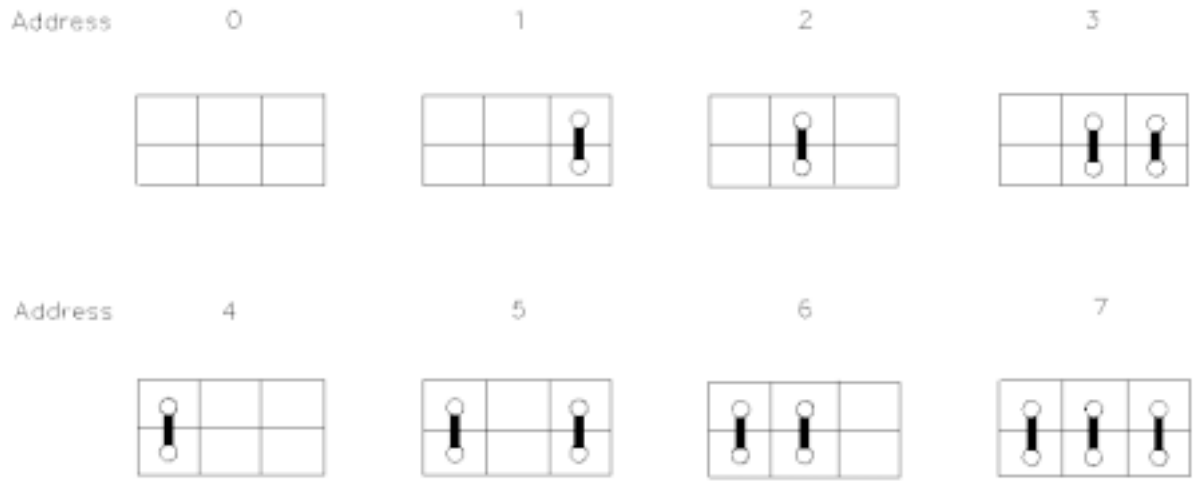

Figure 9-4 SCSI ID Jumper Connections for the DR Card

Setting the SCSI ID for the DS3 Card

To set the SCSI ID for the DS3 card, you can use a remote connector or DIP switches. Figure 9-5 shows the remote connector and DIP switches at the rear of the EXB-8200 for the DS3 card. The pin assignments for the remote connector are the same as for the DR card (see Table 9-2).

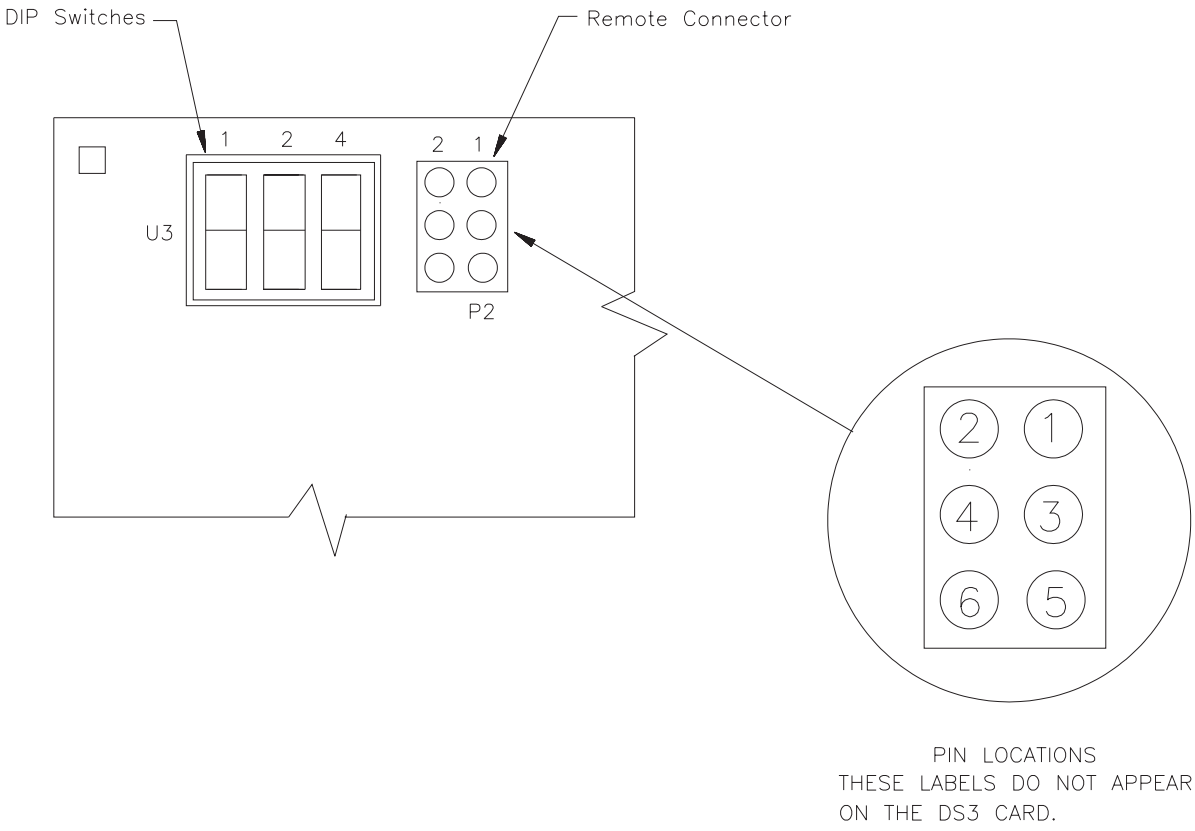

Figure 9-5 DIP Switches and Remote Connector on the DS3 Card (Note: DB card DIP switches are in same location as DS3 card DIP switches)

Figure 9-6 shows the DIP switch settings and the corresponding SCSI IDs for the DS3 (and DB) card.

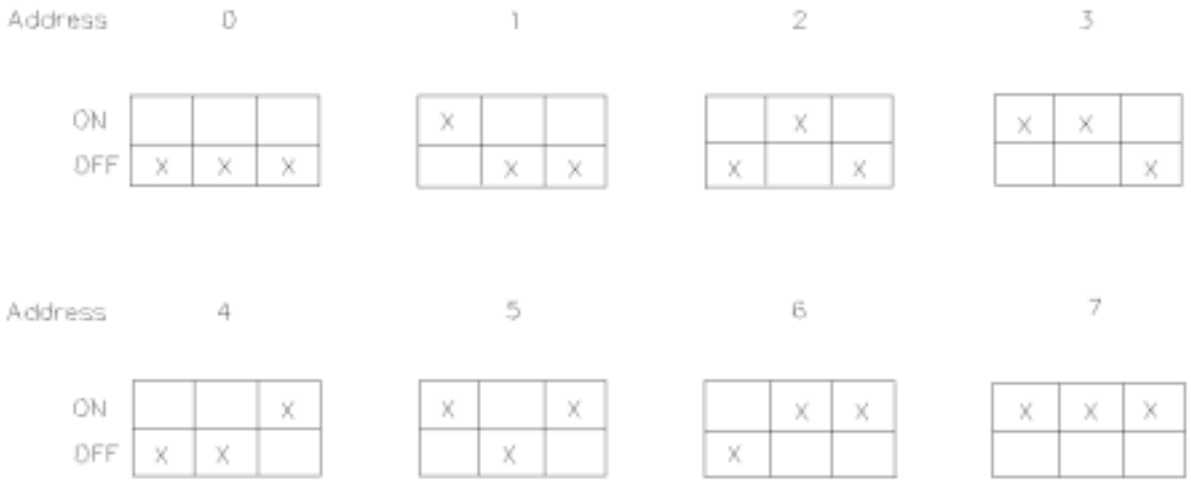

Figure 9-6 SCSI ID DIP Switch Settings for the DS3 and DB Cards

Figure 9-7 shows the jumper connections and the corresponding SCSI IDs for the DS3 card.

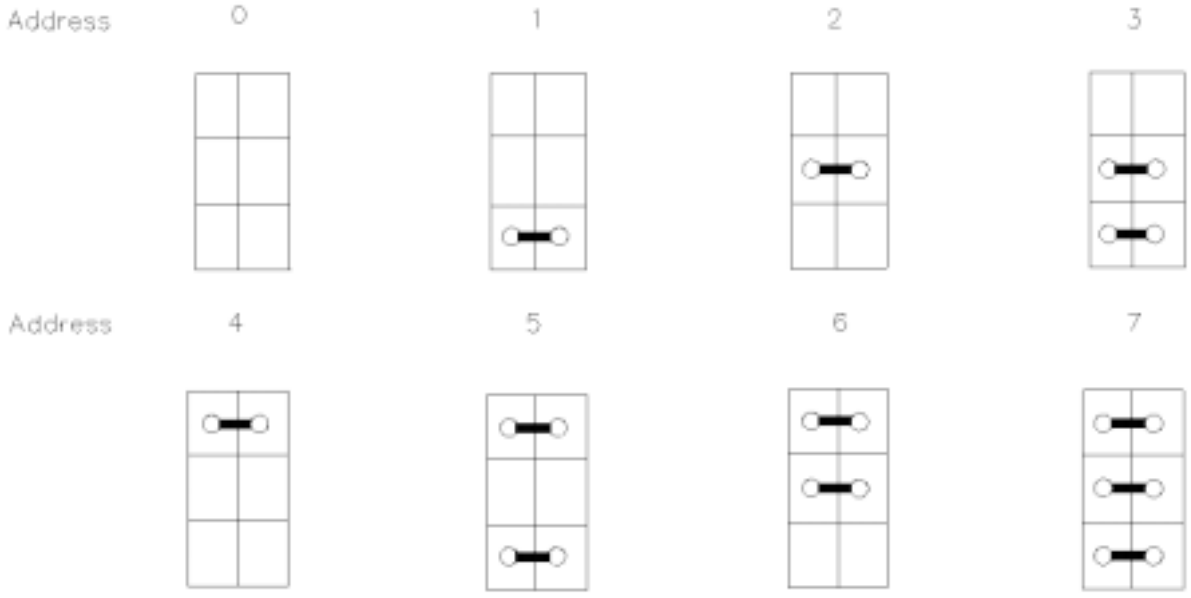

Figure 9-7 SCSI ID Jumper Connections for the DS3 Card

Note: If you use a remote switch or jumpers to set the SCSI ID for the DS3 card, the DIP switches must be set at address 0. Similarly, if you use the DIP switches to set the SCSI ID, the remote switch or jumpers must be set at address 0 or removed.

Setting the SCSI ID for the DB Card

With the DB card, you can use DIP switches to set the SCSI ID. The DIP switch settings are the same as for the DS3 card. These settings are shown in Figure 9-6.

9.5 Mounting the EXB-8200

Two sets of mounting holes are provided for mounting the EXB-8200: one set on the sides of the EXB-8200 and one set on the bottom. Figure 9-8 shows the mounting holes on the sides of the EXB-8200, and Figure 9-9 shows the mounting holes on the bottom of the EXB-8200.

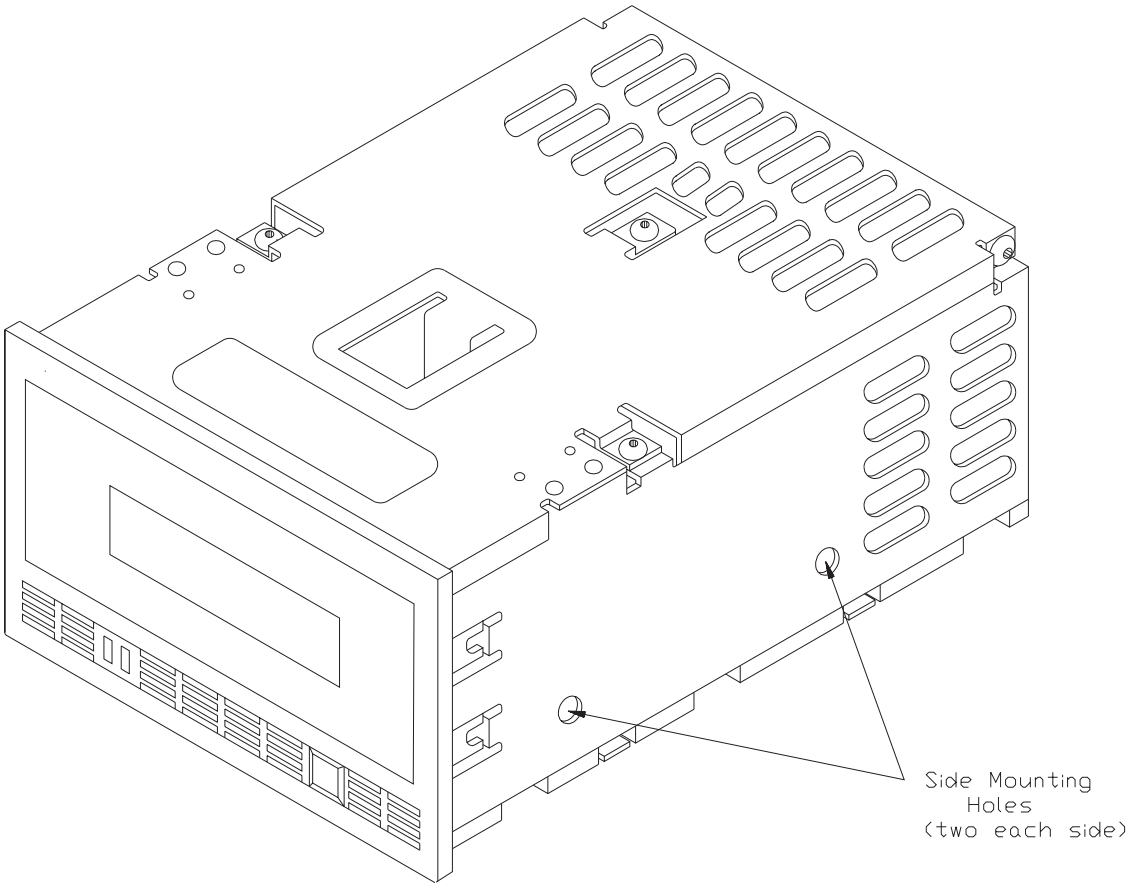

Figure 9-8 Location of Mounting Holes on the Sides of the EXB-8200

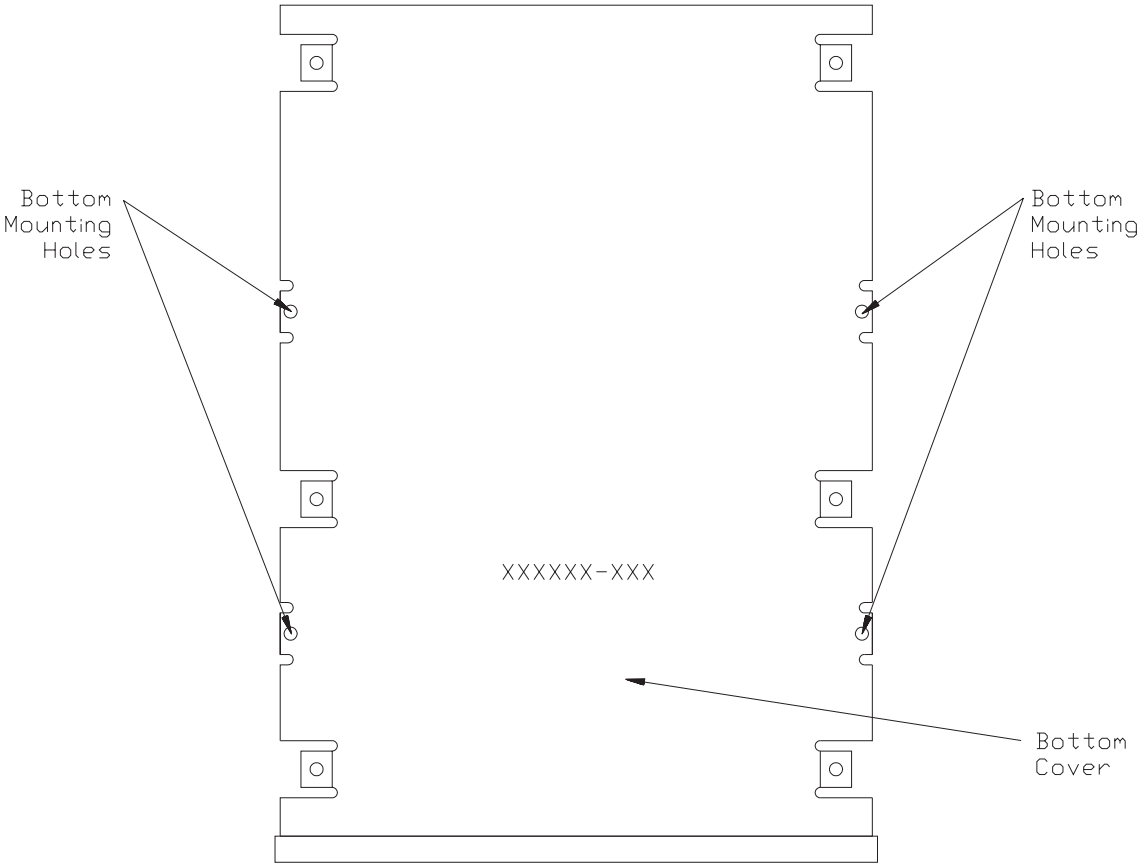

Figure 9-9 Location of Mounting Holes on the Bottom of the EXB-8200

The EXB-8200's mounting holes are designed for the standard 5.25-inch form factor mounting requirements. The EXB-8200 can be installed in systems with larger form factors using a mounting frame suitable for the specific system. The EXB-8200 can be mounted either stationary or sliding, and either horizontally or vertically. In the horizontal configuration, the door opens down from the top of the EXB-8200. In the vertical configuration, the EXB-8200 can be mounted so that the door opens either to the right or left.

Mounting Requirements

To mount the EXB-8200, use one or the other of the two sets of mounting holes. Each set consists of four mounting holes, and you must use all four holes in the set that you choose.

The mounting location for the EXB-8200 must meet the following conditions:

- The EXB-8200's ventilation holes must be free of obstruction so that adequate airflow is provided (Chapter 7 discusses airflow requirements for the EXB-8200).

- There must be no distortion of the EXB-8200's metal housing.

Figure 9-10 shows the size and spacing of the mounting holes for the EXB-8200.

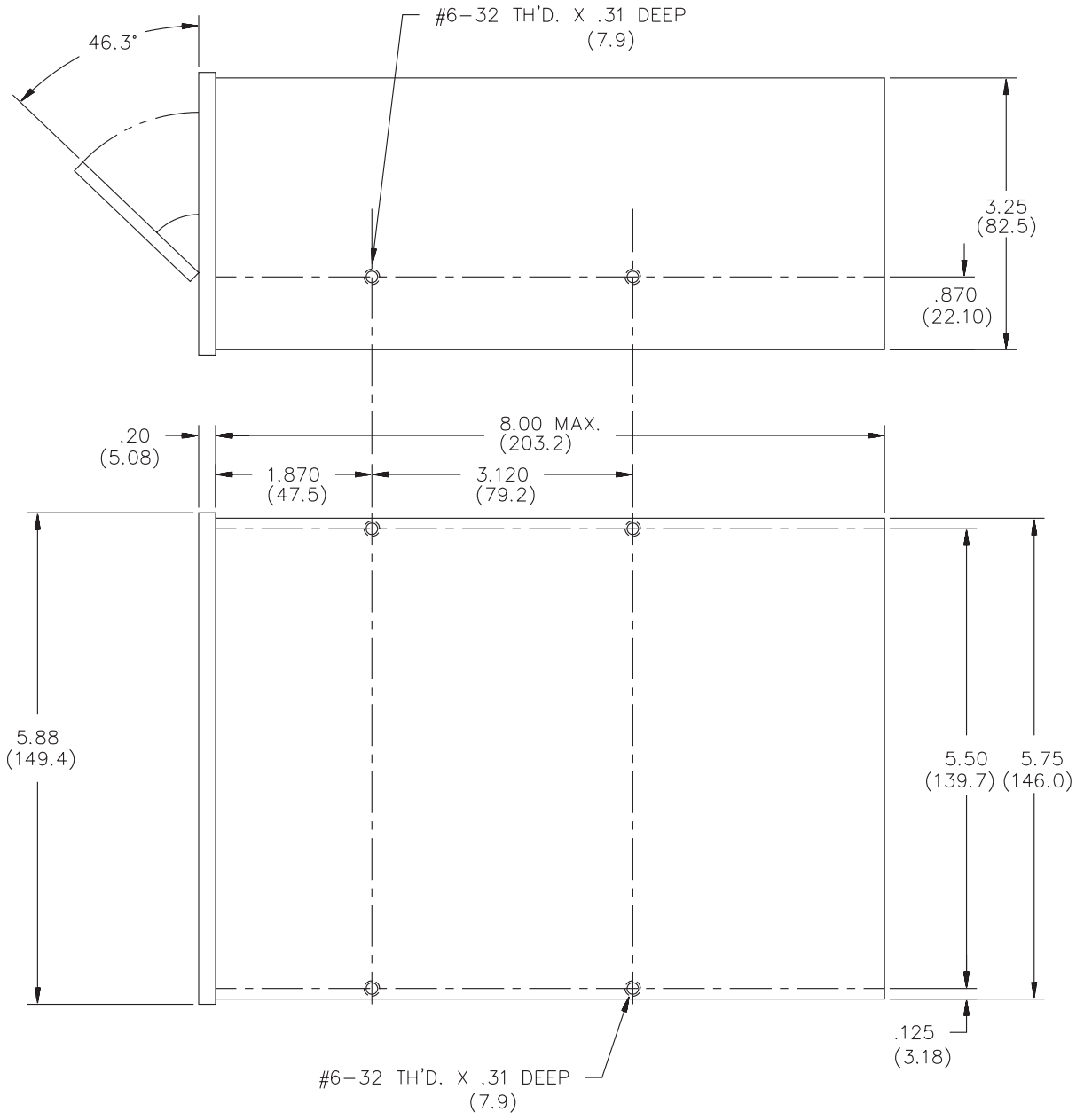

Figure 9-10 External Dimensions of the EXB-8200 in Inches (and Millimeters)

9.6 Performing the Initial Power On

After you have connected the EXB-8200 to the power supply, you can perform the initial power on. As described in this section, the procedure for performing the initial power on depends on how long the EXB-8200 has been stored.

EXB-8200 Stored for Less Than Six Months

If the EXB-8200 has been stored for less than six months, perform the initial power on as follows:

- Apply power to the EXB-8200. If the EXB-8200 is connected correctly, both the amber and green LEDs will be lit. After the power-on initialization and self-test have completed, both LEDs will be turned off. This takes about 65 seconds.

The EXB-8200 is now ready for normal operation.

EXB-8200 Stored for Six Months or More

If the EXB-8200 has been stored for six months or more, perform the following steps to ensure that the EXB-8200's internal lubrication is properly distributed:

1. Connect the EXB-8200 to a suitable test system through the SCSI interface.
2. Apply power to the EXB-8200. If the EXB-8200 is connected correctly, both the amber and green LEDs will be lit. After the power-on initialization and self-test have completed, both LEDs will be turned off. This takes about 65 seconds.
3. Press the unload button on the front of the EXB-8200 and insert a data cartridge.
4. Push the door shut and wait while the EXB-8200 loads the tape and positions it at the logical beginning of tape (LBOT). This takes about 50 seconds.
5. Issue a WRITE command to write approximately 500 MBytes of data to the tape.
6. Issue a REWIND command to rewind the tape to LBOT.
7. Issue a READ command to read the data written on the tape in step 5.

8. Repeat steps 5 through 7 at least two times or for two hours (whichever is greater).

   Note: If the EXB-8200 has been stored for a long period, errors may occur during the break-in period. If an error occurs, reset the EXB-8200 and repeat steps 4 through 8 as appropriate.

When you have completed step 8, the EXB-8200 is ready for normal operation.

10 Operating and Maintaining the EXB-8200

This chapter provides basic information about operating and maintaining the EXB-8200. Refer to the *EXB-8200 8mm Cartridge Tape Subsystem User's Manual* for complete information about EXB-8200 operation.

10.1 EXB-8200 Controls and Indicators

All operator controls and indicators are located on the front panel of the EXB-8200, as shown in Figure 10-1.

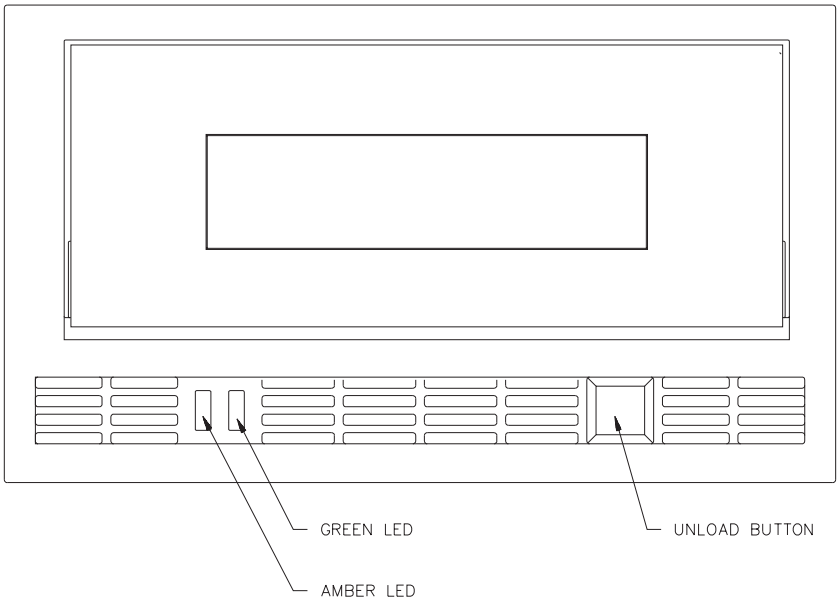

Figure 10-1 EXB-8200 Front Panel Controls and Indicators

Unload Button/Servo Error Reset Button

The unload button is a push-button switch that can be used to rewind, unload, and eject the data cartridge. If a data cartridge is not currently loaded, the unload button opens the front door of the EXB-8200. This button can also be used to reset the EXB-8200 after a servo error has occurred.

Green and Amber LEDs

The green and amber LEDs indicate the status of EXB-8200 operations, including the following:

Power-Up Initialization

During power-up initialization, both the amber and green LEDs are on, indicating that the EXB-8200 is performing power-on self-test diagnostics. The time required to complete self-test diagnostics and initialization routines is 65 seconds maximum. When the diagnostics are complete, both LEDs are turned off.

Power-On

Upon completion of the self-test diagnostics, the green LED indicates the status of the EXB-8200. When the green LED is on, a data cartridge is loaded and the EXB-8200 is ready.

SCSI Activity

Variable blinking of the amber LED when the EXB-8200 is ready indicates activity on the SCSI bus between the host and the EXB-8200. Interface activity can occur any time after the EXB-8200 is powered on.

10.2 Data Cartridge Write-Protect Switch

The 8mm data cartridge is equipped with a write-protect switch to prevent unintentional overwriting of data on the tape. To set the write-protect switch, remove the data cartridge from the drive. Using a ballpoint pen or other suitable instrument, move the write-protect switch to the desired position, as shown in Figure 10-2.

If the red switch in the recessed area at the bottom of the cartridge is visible, the data cartridge is write-protected and cannot be written to or erased. Conversely, if the red switch is not visible, the data cartridge is write-enabled and can be written to or erased.

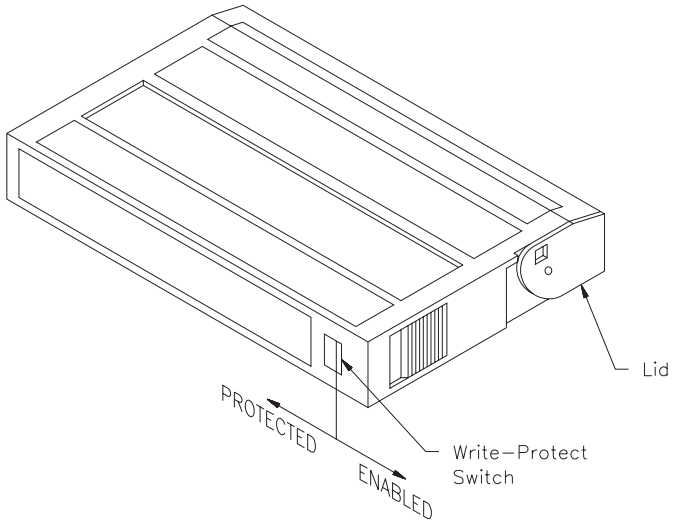

Figure 10-2 Write-Protect Switch on 8mm Data Cartridge

10.3 Loading a Data Cartridge into the EXB-8200

To load a data cartridge into the EXB-8200, follow these steps:

1. Make sure that the write-protect switch on the data cartridge has been set correctly for the desired operation.
2. If the EXB-8200's door is closed, press the unload button to open the door. Figure 10-1 shows the location of the unload button.
3. Insert the data cartridge, label side up, with the write-protect switch facing you.
4. Gently close the door. The data cartridge is automatically loaded (unless No Autoload has been specified by the MODE SELECT command, as discussed in the *EXB-8200 8mm Cartridge Tape Subsystem User's Manual*).

10.4 Unloading a Data Cartridge from the EXB-8200

To unload a data cartridge from the EXB-8200, press the unload button located on the front panel of the drive or issue the UNLOAD command. The green LED is turned off as the unload operation begins.

The EXB-8200 rewinds the tape, then unloads and ejects the cartridge unless one of the following conditions exist:

- The EXB-8200 is not powered up.
- The EXB-8200 is in a busy state.
- There is a contingent connection to or from the host.
- The PREVENT MEDIUM REMOVAL command has been issued by the initiator. In this situation, if you press the unload button, nothing happens. If you issue the UNLOAD command, the tape is rewound and unloaded but not ejected.
- Data remains in the EXB-8200 buffer from a previous write operation. If you press the unload button, nothing happens. In this situation, if you issue the UNLOAD command, the data is written to the tape and the tape is rewound, unloaded, and ejected.

10.5 Cleaning the Tape Heads and Tape Path

The EXB-8200 tape heads and tape path require cleaning either once a month or after 30 GBytes of data transfer, whichever occurs first. For planning purposes, approximately 1 GByte of data is transferred for every hour of continuous streaming operation.

To clean the tape heads and tape path, use only EXABYTE-approved 8mm cleaning cartridges.

CAUTION

Do not use any cleaning method other than the one described in this section to clean the EXB-8200 tape heads and tape path. Use of a different method will void the EXB-8200's warranty and may damage the drive.

Follow these steps to use an EXABYTE-approved 8mm cleaning cartridge:

1. Apply power to the EXB-8200. When the power-up cycle is complete, open the door by pressing the unload button. If a data cartridge is in the EXB-8200, remove the cartridge. Leave the door open.

2. Place the cleaning cartridge into the EXB-8200 and close the door.

   The EXB-8200 automatically senses the introduction of a cleaning cartridge and performs the cleaning process. When the process is complete, the cleaning cartridge is automatically unloaded and ejected. The average cleaning cycle is 15 seconds.

   Note: If the cleaning cartridge is ejected from the EXB-8200 without completing the 15 second cleaning cycle, the cleaning cartridge has reached the end of its useful life and should be discarded.

Important

Do not rewind and re-use the cleaning cartridge. To prevent contamination of the EXB-8200, do not use the cleaning cartridge for more than the number of cleaning cycles specified on the cartridge label.

3. After the cleaning cycle is complete, remove the cleaning cartridge and record the date the cleaning was performed on the cartridge label.

4. Store the cleaning cartridge for future use, or discard it if it has been used three times (for a three-pass cleaning cartridge) or twelve times (for a twelve-pass cleaning cartridge).

Notes:

Glossary

This glossary includes definitions of the terms, abbreviations, and acronyms used in this manual.

ATM	Analog tape mark.
bus devices	Initiator or target devices connected to the SCSI bus.
byte	Eight bits or one character.
C	Centigrade (Celsius).
CRC	Cyclic redundancy check.
DTM	Digital tape mark.
ECC	Error correction code.
EOD	End of data.
EOM	End of medium.
F	Fahrenheit.
GBytes	Gigabytes.
h	Hexadecimal (base 16) numbering system. Numbers followed by a lowercase “h” are hexadecimal values. All other numbers are decimal values.
host	The computer system that acts as the initiator of an operation.
Hz	Hertz.
ID (SCSI)	The bit-significant representation of the SCSI address, referring to one of the signal lines (0-7).
initiator	Usually a host system that requests an operation to be performed by the target.
KBytes	Kilobytes.

KHz	Kilohertz.
LBOT	Logical beginning of tape. The LBOT is the point at which the tape is positioned following a load or rewind operation.
LED	Light emitting diode
LEOT	Logical end of tape. The LEOT is a point on the tape before PEOT where an EOM warning is issued to the initiator during write or write filemark operations.
LUN	Logical unit number.
mA	Milliamp.
Mbits	Megabits.
MBytes	Megabytes.
mm	Millimeter, (0.03937 inches).
ms	Millisecond.
µs	Microsecond.
MTBF	Mean time between failures.
mVpp	Millivolts peak-to-peak.
ns	Nanosecond.
NSTA	National Safe Transit Association.
PBOT	Physical beginning of tape. The PBOT is the point at which the tape is attached to the translucent leader.
PEOT	Physical end of tape. The PEOT is the point at which the tape is attached to the translucent trailer.
rpm	Revolutions per minute.
SCSI	Small Computer System Interface.

status	Information sent from the target to the initiator upon completion of a command.
target	A bus device (usually a peripheral device) that performs an operation requested by an initiator. The EXB-8200 is a target.
VDC	Volts DC.

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