Exabyte™ M12
Mirroring Tape Subsystem

Product
Specification

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Revision History

Revision	Date	Description
000	April 1998	Initial release
001	October 1998	Updated for Eliant 820

Note: The most current revision information is available from the Exabyte web site (www.exabyte.com).

Product Warranty Caution

The Exabyte® M12 Mirroring Tape Subsystem 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 M12 was purchased.**

The warranty for the M12 shall not apply to failures of any unit when:

- The M12 is repaired or modified by anyone other than Exabyte's personnel or approved agent.

- The M12 is physically abused or used in a manner that is inconsistent with the operating instructions or product specification defined by Exabyte.

- The M12 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 M12 is repaired by anyone, including an approved agent, in a manner that is contrary to the maintenance or installation instructions supplied by Exabyte.

- Exabyte's serial number tag is removed.

- The M12 is damaged because of improper packaging on return.

CAUTION

Returning the M12 in unauthorized packaging may damage the unit and void the warranty. If you are returning the M12 for repair, package it in its original packaging (or in replacement packaging obtained from your vendor).

If problems with the M12 occur, contact your vendor; do not void the product warranty by allowing untrained or unauthorized personnel to attempt repairs.

Notes

Contents

About This Specification

This product specification describes the functional, performance, and environmental specifications for the Exabyte® M12 Mirroring Tape Subsystem.

This specification is intended for engineering, purchasing, and marketing personnel who want to evaluate the M12 to determine the feasibility of integrating it into product lines.

Contents of This Specification

This specification contains the following information:

- **Chapter 1** describes general features, configurations, and physical components of the M12.

- **Chapter 2** describes the requirements for installing, configuring, and operating the M12 controller and the tape drives.

- **Chapter 3** provides functional specifications for the M12, including performance, power, and environmental specifications. This chapter also provides information about the M12's size, weight, and shipping specifications, and safety and regulatory agency standards.

- **Chapter 4** describes SCSI specifications for the M12, including an overview of SCSI communications and SCSI configuration requirements.

Related Publications

Exabyte M12 Mirroring Tape Subsystem

- *Exabyte M12 Mirroring Tape Subsystem Installation and Operation,* 328512

Exabyte Mammoth Tape Drive

- *Exabyte Mammoth Installation and Operation,* 306484
- *Exabyte Mammoth Product Specification,* 306482
- *Exabyte Mammoth SCSI Reference,* 306483

Eliant 820 Tape Drive

- *Eliant 820 Installation and Operation,* 317209
- *Eliant 820 Product Specification,* 316593
- *Eliant 820 SCSI Reference,* 316869

Standards

- *ANSI Small Computer System Interface-2 (SCSI-2),* X3.131-1994

Contacting Exabyte

You can contact Exabyte using any of the following methods:

For technical support:	
Exabyte Technical Support	1-800-445-7736
	1-303-417-7792
	1-303-417-7160 (fax)
	support@exabyte.com (e-mail)
EXAfacts™ Fax-on-Demand	1-800-445-7736
	1-303-417-7792
World Wide Web	http://www.exabyte.com
To order supplies and accessories:	
Exabyte Express	1-800-EXATAPE (1-800-392-8273)
	1-972-481-4221
	1-972-406-9081 (fax)
	sales@exabyte.com (e-mail)
To return equipment for service:	
Exabyte Service	1-800-EXATAPE (1-800-392-8273)
	1-303-442-4333
	Scotland: + 44-1-324-564564
	service@exabyte.com (e-mail)

Note: If it is more convenient to your location, contact Exabyte Technical Support in Europe at the following numbers:

Phone: +31-30-254-8890
Fax: +31-30-258-1582

Conventions Used in This Specification

This specification uses special conventions to highlight notes, important information, and cautions. These conventions are explained below.

Note: Notes provide additional information or suggestions about the topic or procedure being discussed.

➤ **Important** Information next to the word "Important" helps you complete a procedure or avoid additional steps.

CAUTION

Boxed text under the word "CAUTION" provides information you must know to avoid damaging the M12 or losing data.

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1 Features and Physical Description

This chapter provides an overview of the Exabyte® M12 Mirroring Tape Subsystem. It includes information about the following topics:

- M12 features
- M12 configuration
- Physical description

The Exabyte M12 Mirroring Tape Subsystem contains one controller card, two field-replaceable Exabyte Mammoth or Eliant 820 tape drives, and an operator panel that includes an LCD display and keypad.

The M12 is shipped with rack mount hardware attached for easy mounting on a standard 19-inch rack. You can convert the M12 to a standalone model by removing the rack-mount hardware (a simple procedure involving the removal of eight screws). The standalone model is shown in Figure 1-1.
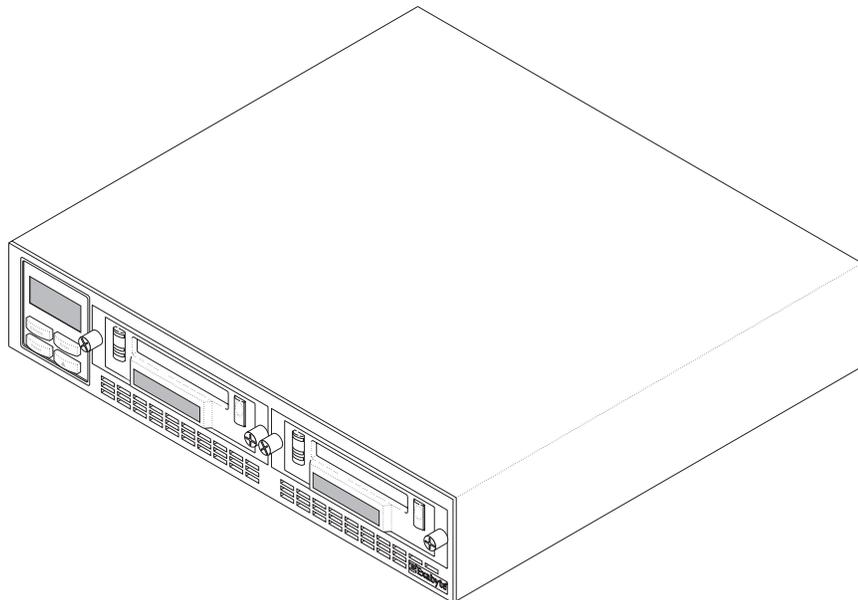
Figure 1-1 Exabyte M12 Mirroring Tape Subsystem (standalone model)

M12 Features

The Exabyte M12 Mirroring Tape Subsystem is an intermediary SCSI device that you can use with any host operating system or software. With the M12, you can:

- Write two identical tape copies of the same data at the same time (data mirroring)

- Restore data from or write data to individual tape drives (data pass thru)

- Copy an Exabyte 8mm tape written in one format to an Exabyte 8mm tape in another format (tape copy)

- Compare the data on two tapes to verify that they contain identical information (tape copy)

The M12 features either two Exabyte Mammoth tape drives or two Eliant 820 tape drives. Both are high-speed, high-capacity tape drives operating on an assumed average data compression ratio of 2:1. Using the M12 has no effect on tape drive speed or performance.

M12 with Exabyte Mammoth tape drives

The M12's Exabyte Mammoth tape drives transfer data at a rate of up to 6 megabytes per second. Each tape drive can store up to 40 gigabytes of compressed data on a single data cartridge. The M12 with Exabyte Mammoth tape drives is shipped with two advanced metal evaporated (AME) Exatape™ data cartridges and one Exabyte Mammoth Cleaning Cartridge.

M12 with Eliant 820 tape drives

The M12's Eliant 820 tape drives transfer data at a rate of up to 2 megabytes per second. Each tape drive can store up to 14 gigabytes of compressed data on a single data cartridge. The M12 with Eliant 820 tape drives is shipped with two metal particle (MP) Exatape™ 8mm data cartridges and one Exabyte Premium 8mm Cleaning Cartridge.

Data Mirroring

Data mirroring allows you to make two identical copies of a backup at the same time. When you select data mirroring, the host sends data to the controller, where it is copied (mirrored) and then transferred to the two tape drives. Data mirroring gives you the security of an extra backup copy that can be stored offsite or safely onsite.

➤ **Important**   Use only 8mm Exatape™ data cartridges of the same length and format for your mirroring backup. Using different data cartridges may result in an incomplete backup.

Data Pass Thru

Data pass thru allows you to communicate with each tape drive individually. Using data pass thru, you can:

- Restore data after a mirroring operation
- Write data to one drive
- Read data from one drive

Tape Copy

Tape copy allows you to copy a tape created in a previous backup to a blank tape. You can use the M12's tape copy feature to make a second copy of a tape or to convert from one 8mm tape format to another. For example, with the Exabyte Mammoth tape drives, you can transfer data from a metal particle (MP) tape written in 8200, 8500, or 8500c data formats to an advanced metal evaporated (AME) tape. With the Eliant 820 tape drives, you can transfer data from an MP tape written in 8200 or 8500 format to an MP tape in 8500c format.

You can also use the tape copy feature to verify that two tapes contain identical information. You can verify while copying from one tape to another or compare two tapes created during a mirroring operation.

M12 Configuration

The M12 Mirroring Tape Subsystem operates as an independent SCSI device between the host and two tape drives. The controller card (located inside the M12's enclosure) connects to each tape drive individually. The host also connects to the controller card, making a total of three separate SCSI buses, as shown schematically in Figure 1-2.
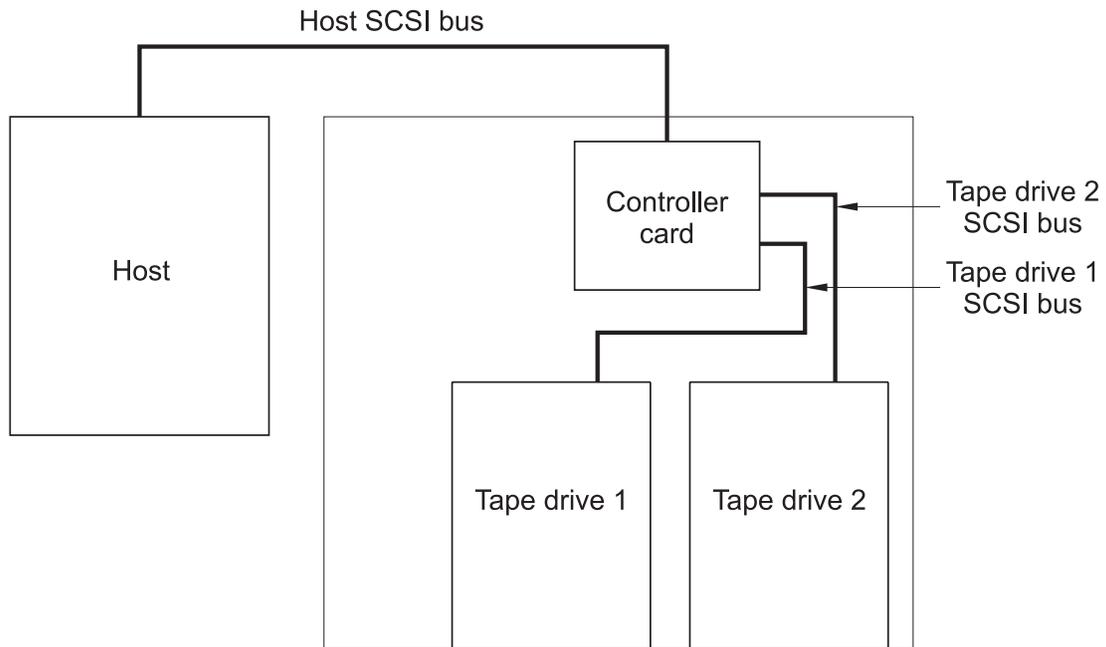
Figure 1-2 M12 position on the SCSI bus

Configuration in Mirroring Mode

The actual SCSI configuration for a controller in mirroring mode is shown in Figure 1-3.
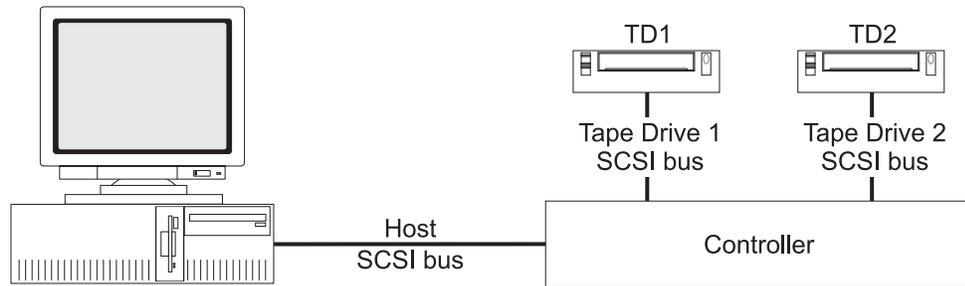
Figure 1-3   Actual configuration in mirroring mode

Although the controller is physically positioned between the host and the two internal tape drives, the host does not perceive the controller as a target ID and "sees" only one tape drive on the SCSI bus, as shown in Figure 1-4.
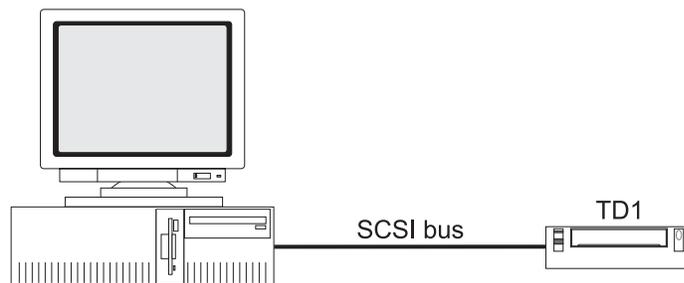
Figure 1-4   Configuration "seen" by the host in mirroring mode

Configuration in Pass Thru Mode

The actual SCSI configuration for a controller in pass thru mode is shown in Figure 1-5.

Figure 1-5 Actual configuration in pass thru mode

Although the controller is physically positioned between the host and the two internal tape drives, the host does not perceive the controller as a target ID on the SCSI bus and "sees" only one tape drive on the SCSI bus, as shown in Figure 1-6.
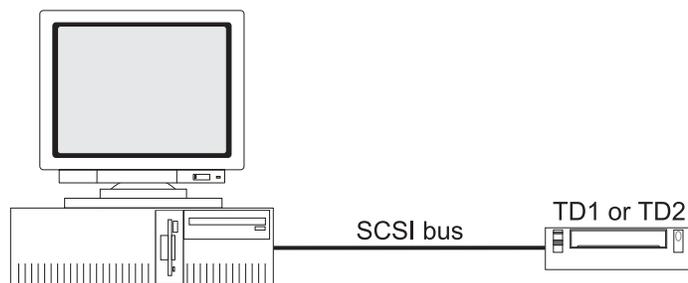
Figure 1-6 Configuration "seen" by the host in pass thru mode

Physical Description

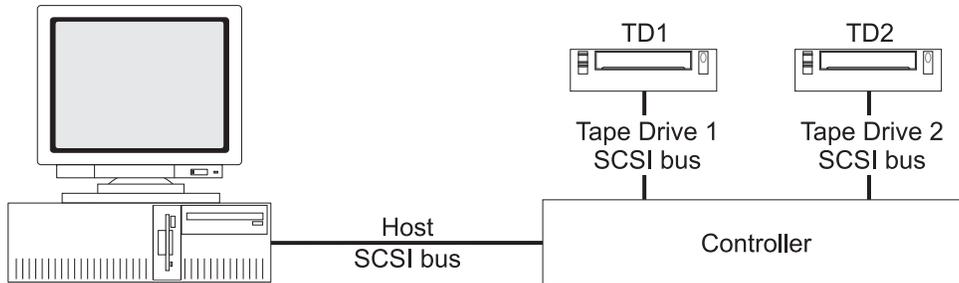The Exabyte M12 Mirroring Tape Subsystem is housed in an Exabyte enclosure containing the controller card, two tape drives, three cooling fans, and a power supply.

Size and Weight

The dimensions of the M12 (with rack-mount hardware attached) are shown in Figure 1-7. The M12 with Exabyte Mammoth tape drives weighs 27.0 pounds (12.3 kg). The M12 with Eliant 820 tape drives weighs 26.4 pounds (12.1 kg).
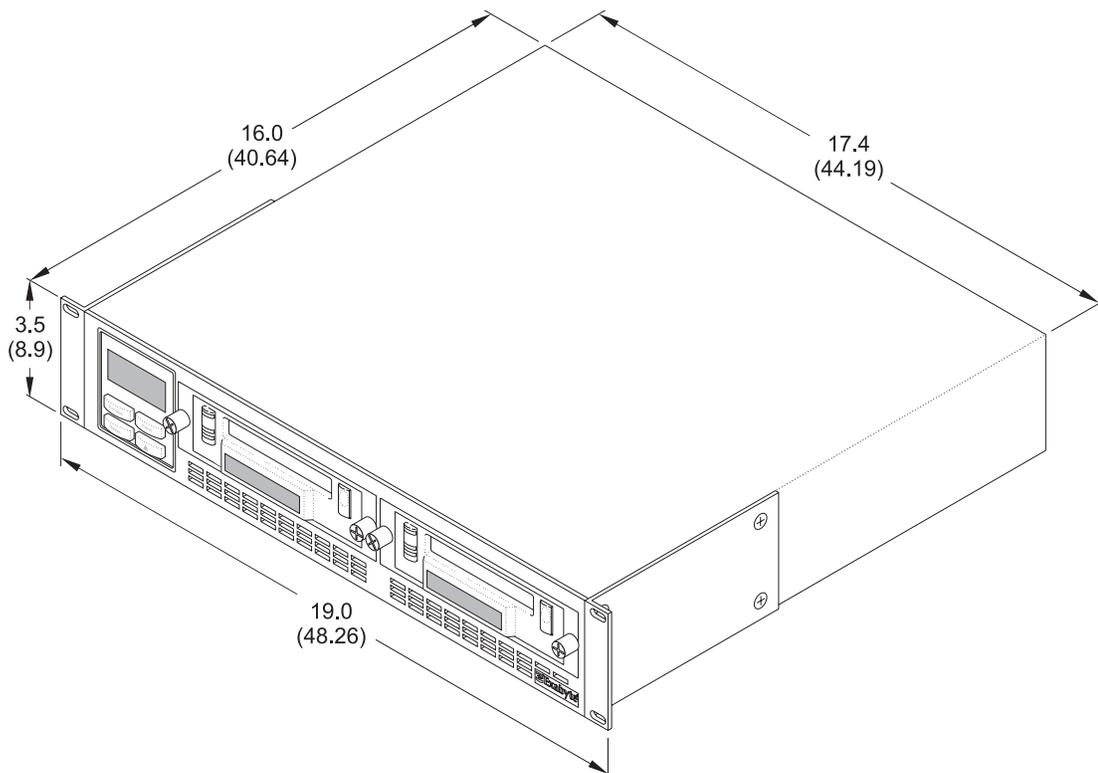
Figure 1-7 Dimensions of the M12 (rack-mount model)

Color

The standard M12 enclosure is pearl white. For custom color information, contact your Exabyte account manager.

Front Panel Components

Figure 1-8 shows the main front panel components of the M12 with Exabyte Mammoth tape drives.
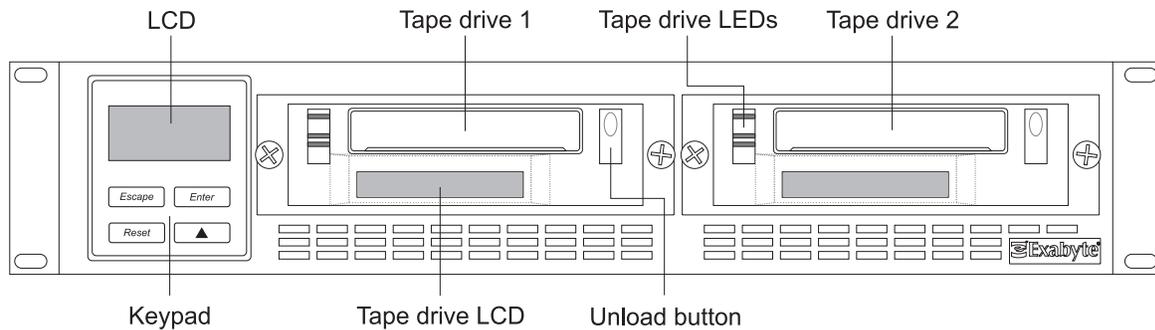
Figure 1-8 Front panel components with Mammoth tape drives

Figure 1-9 shows the main front panel components of the M12 with Eliant 820 tape drives.
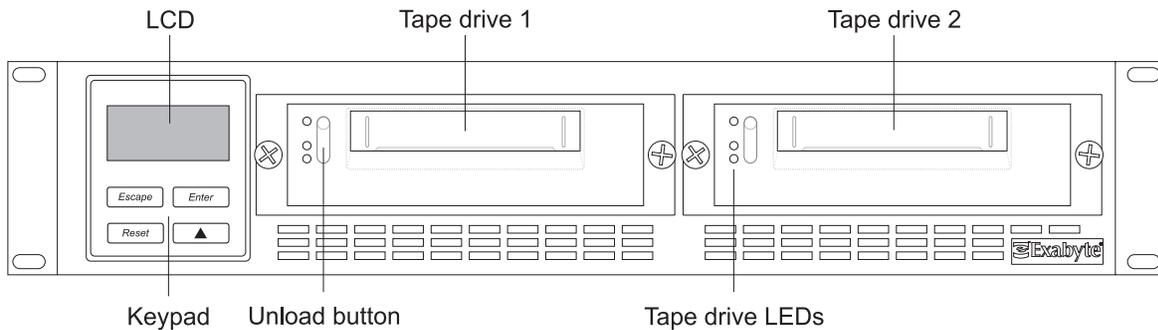
Figure 1-9 Front panel components with Eliant 820 tape drives

Operator Panel (LCD and Keypad)

The operator panel consists of the liquid crystal display (LCD) and the keypad. The LCD displays four lines of text, each up to 20 characters long. Below the LCD is the keypad, containing four push buttons that are used to navigate through LCD menu options.

Tape Drives

The M12 contains two field-replaceable Exabyte Mammoth or Eliant 820 tape drives.

Tape Drive LEDs

Each tape drive contains three light-emitting diodes (LEDs). These LEDs illuminate when the M12 is powered on and provide additional tape drive status information.

Unload Button

Each tape drive contains an unload button, used to eject a data cartridge from the tape drive.

Tape Drive LCD

If the M12 contains Exabyte Mammoth tape drives, each tape drive contains an LCD that displays the tape drive's operational status.

Back Panel Components

Figure 1-10 shows the back panel of the M12.
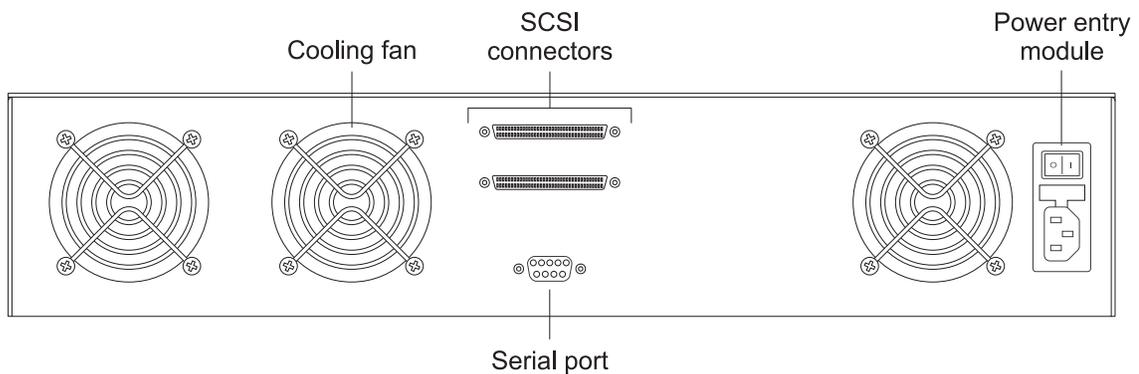
Figure 1-10   Back panel components

Cooling Fans

Three cooling fans increase air ventilation throughout the M12's enclosure. The cooling fans automatically power on when the power switch is turned on.

SCSI Connectors

The M12 contains two wide (68-pin) SCSI connectors. The host SCSI cable attaches to one of the SCSI connectors. The other SCSI connector can be used for an external terminator or another cable (if the M12 is not the last device on the host SCSI bus). The M12's SCSI connectors are not designated "In" or "Out"; you can attach a cable or a terminator to either SCSI connector.

The M12 is available in a single-ended or differential SCSI configuration. Make sure you match the SCSI configuration of the M12 to the SCSI configuration of your host computer. For example, if your host computer contains a differential SCSI host bus adapter card, the M12 must also contain a differential SCSI configuration.

Power Entry Module

The M12 is grounded through the power entry module. The power entry module includes the following components:

- **Power connector** – the AC line voltage input to the internal power supply that allows you to connect a power cord to the M12.

- **Power switch** – a rocker switch that controls the power-on status of the M12.

- **Fuse drawer** – a pull-out compartment containing one active and one spare fuse.

Serial Port

Exabyte use only.

2 Installation and Operation

This chapter describes the requirements for installing and using the M12 Mirroring Tape Subsystem and tape drives, including information about:

- Installation requirements
- Configuration of the M12
- Operation of the M12
- Operation of the tape drives

Installation Requirements

Installing the M12 involves the following steps:

- Obtaining the necessary equipment and accessories
- Connecting the M12 to the SCSI bus
- Connecting the power cord

This section describes the requirements for these steps. For detailed installation instructions, refer to *Exabyte M12 Mirroring Tape Subsystem Installation and Operation.*

Obtaining Equipment and Accessories

The M12 is equipped with a power cord, host SCSI cable, and an external SCSI terminator. Table 2-1 describes all the equipment and accessories necessary for operation of the M12.

Table 2-1 Required equipment and accessories

Equipment/Accessories	Requirements
Power cord	A 120 VAC power cord is included with the M12. See page 3-2 if you are using a different input voltage.
SCSI cable	One wide (single-ended or differential) host SCSI cable is included with the M12. See page 4-3 for additional SCSI cable requirements.
SCSI terminator	One external wide (single-ended or differential) host SCSI terminator is included with the M12. See page 4-6 for additional SCSI terminator requirements.
SCSI adapter	If you are connecting a narrow SCSI host to the M12, you need a narrow-to-wide SCSI adapter. See page 4-5 for SCSI adapter requirements.
Data cartridges	Two advanced metal evaporated (AME) Exatape 8mm data cartridges are included with the M12 with Exabyte Mammoth tape drives. Two metal particle (MP) Exatape 8mm data cartridges are included with the M12 with Eliant 820 tape drives. Additional data cartridges are available from Exabyte.
Cleaning cartridge	One Exabyte Mammoth Cleaning Cartridge is included with the M12 with Exabyte Mammoth tape drives. One Exabyte Premium 8mm cleaning cartridge is included with the M12 with Eliant 820 tape drives. Additional cleaning cartridges are available from Exabyte.

Connecting the Power Cord

The M12 is shipped with a 120 VAC three-conductor power cord for use in the United States and Canada. You must supply power cords for other input voltages or when using the M12 outside of the United States and Canada. For more information on power cord specifications, see page 3-2.

Connecting the M12 to the SCSI Bus

The cables connecting the M12 to the host and tape drives form three separate SCSI buses. However, you only need one SCSI cable to connect the M12 to the host, since the two SCSI cables connecting the controller card to the tape drives are contained within the M12's enclosure.

If the M12 is the last device on the host SCSI bus, you must use an external terminator (shipped with the M12) to terminate the bus. If the M12 is not the last device on the SCSI bus, you must appropriately terminate the last device on the bus. See page 4-6 for SCSI terminator requirements.

SCSI Connectors

The SCSI connectors are wide (68-pin) and are available in either a single-ended or differential SCSI configuration. If you have a narrow (50-pin) host, you can connect to the M12 by using an adapter. You cannot, however, mix SCSI configurations between the M12 and the host. For example, if your host contains a single-ended SCSI host bus adapter card, your M12 must use a single-ended configuration. See page 4-3 for SCSI cable and adapter requirements.

SCSI IDs

You can set the SCSI ID for the M12 using the Configuration Menu (0 to 7 for a narrow host; 0 to 15 for a wide host). For information about configuration, see the following section, "Configuration of the M12."

The SCSI ID for each tape drive is set at the factory to 0. Since the tape drives are on independent SCSI buses, this SCSI ID setting will not interfere with the SCSI ID for any other devices you attach to the host SCSI bus.

Configuration of the M12

After you install the M12, you can power it on and configure it for operation. Using the Configuration menu, you can select the following options:

- Host computer SCSI configuration (narrow or wide)

- SCSI ID for the M12 (0 through 7 for a narrow host; 0 through 15 for a wide host)

Operation of the M12

Using the M12's keypad and LCD, you can access online and offline operations. Online operations involve data transfer between the host, the controller, and the tape drives. Offline operations do not require host involvement.

Online operations include mirroring and pass thru. Offline operations include diagnostics and tape copying.

Menu Options

The M12's menu options can be viewed from the LCD. Using the keypad, you can access the menu structure and the following menu screens:

- Status screen
- Summary screen

Figure 2-1 shows an overview of the menu structure.

Figure 2-1 M12 menu structure
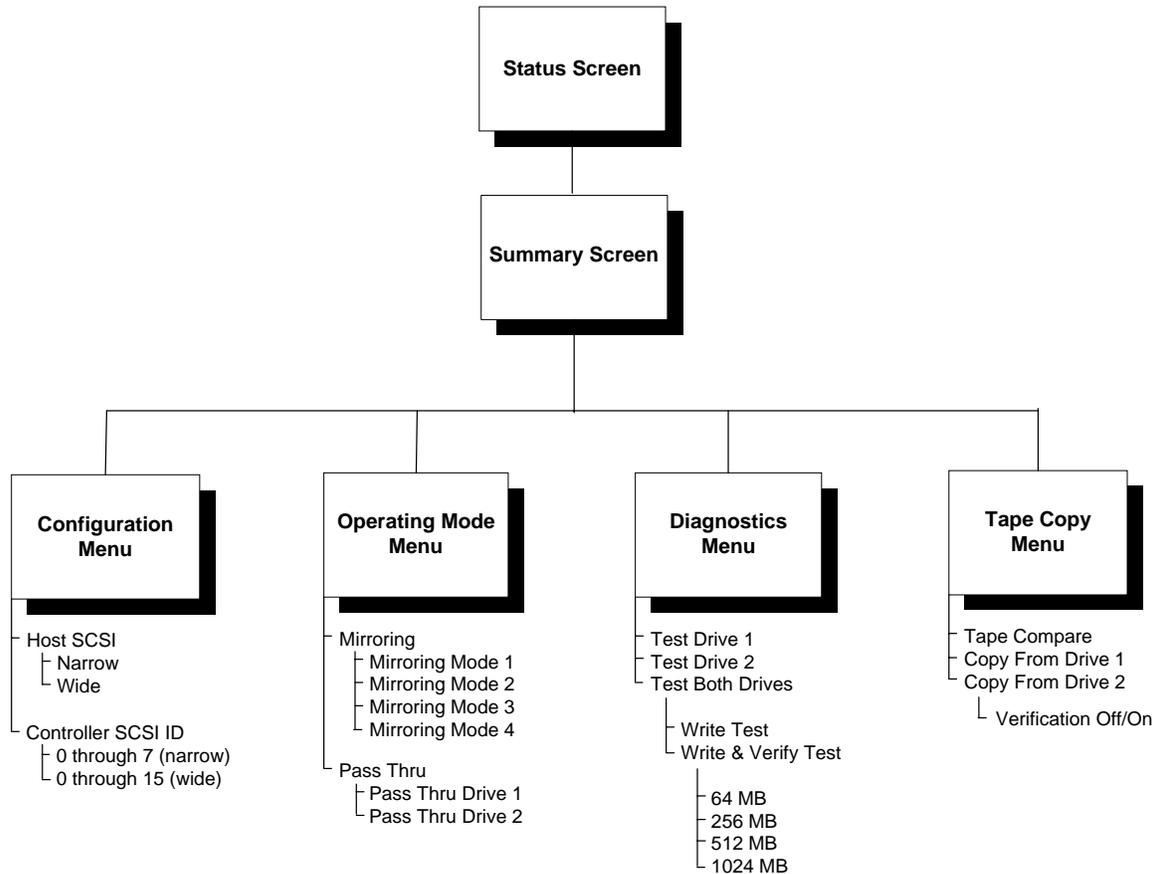
You can select options from the menu by using the keypad, as described in Table 2-2.

Table 2-2 M12 keypad options

Key	Description
[Escape]	Exits from the current screen and displays the previous menu.
[Enter]	Selects the menu or option currently displayed.
[Reset]	Resets the controller and tape drives.
[^]	Advances to the next menu option.

Status Screen

After the M12 is powered on, the Status screen appears on the LCD. The Status screen includes the following information:

- Line 1 – Current operating mode (*n* represents a number between 1 and 4; see page 2-7 for a description of mirroring modes)

- Line 2 – The tape drives that the M12 can detect after completing its power-on self-test

- Line 3 – The tape drives that the M12 is communicating with in the current operating mode

- Line 4 – The key to press (^) so that you can view the Summary screen

An example of the Status screen is shown below.

```
Mirroring   Mode   n
Drives   Present   1 & 2
Active   Drives     1 & 2
(   ^   )   Summary   Screen
```

If the M12 cannot detect one of the tape drives, the Drives Present line displays an "X" in place of the drive number.

If an error occurs during a mirroring operation, the Active Drives line displays "C," "E," or "M" in place of the drive number. See Table 2-5 on page 2-9 for information about these mirroring error codes.

Summary Screen

From the Status screen, you can access the Summary screen. The Summary screen includes the following information:

- Line 1 – The SCSI ID of the M12 and the SCSI configuration of the host computer (narrow or wide)

- Line 2 – The SCSI configuration of the M12 (single-ended or differential)

- Line 3 – The revision number of the firmware

- Line 4 – The key to press (⌂) so that you can view the next menu

An example of the Summary screen is shown below.

```
S C S I    I D    n              W I D E
                                 D I F F
R E V   M - i x x
( ^ )   N e x t   M e n u
```

Online Operations

You can select the following online operations by using the Operating Mode menu:

- Mirroring
- Pass thru

Mirroring

When you select mirroring, data is sent from the host, copied (mirrored) at the controller, and passed simultaneously to both tape drives.

Four options are available within the Mirroring menu: Mirroring Mode 1 through Mirroring Mode 4. These options allow you to choose whether you want a mirroring operation to continue despite a media or tape drive failure.

The features of each mirroring mode are described in Table 2-3.

Table 2-3   Mirroring mode backup and restore features

	Mirroring Mode 1	**Mirroring Mode 2**	**Mirroring Mode 3**	**Mirroring Mode 4**
Backup	The backup stops if any errors occur. You either have two valid backup copies or none at all.		The backup continues even if an error occurs on one tape drive. You are assured of at least one good backup copy.	
Restore	The restore requires both tapes from the mirrored set to be present.	The restore requires only one tape from the mirrored set, giving you the freedom to store the other tape off site.	The restore requires only one tape from the mirrored set, giving you the freedom to store the other tape off site.	The restore requires both tapes from the mirrored set to be present.

➤ **Important**   To perform a read or restore operation in Mirroring Mode 2 and Mirroring Mode 3, you must install the cartridge in tape drive 1.

Table 2-4 describes whether a mirroring operation will continue or stop if an error occurs during backup or restore.

Table 2-4   Mirroring mode error responses

	Mirroring Mode 1	**Mirroring Mode 2**	**Mirroring Mode 3**	**Mirroring Mode 4**
Backup Error	An error on either tape drive causes the backup to stop.		An error on one tape drive does not stop the backup. It continues with the remaining drive.	
Restore Error	An error on either tape drive causes the restore to stop.	An error on the drive from which the data is being read causes the restore to stop.	An error on the drive from which the data is being read causes the restore to stop.	An error on one tape drive does not stop the restore. It continues with the remaining drive.

If you are using Mirroring Modes 3 or 4 and an error occurs on one tape drive during a backup, you can use the offline tape copy feature to create a second copy from the good backup tape. See page 2-10 for information about the Tape Copy menu.

If an error occurs during mirroring, two types of error codes can appear on the Active Drives line of the M12's LCD. These errors are reported to the M12 as C, E, or M, as described in Table 2-5.

Table 2-5   Mirroring error codes

Error	Description
C	In Mirroring Modes 3 and 4, C indicates a drive that has been disabled because of an error. However, a C error does not cause the operation to stop; the backup or restore continues with the other drive. To clear a C error, you must reset the M12 manually or through SCSI.
E	In all mirroring modes, E indicates which drive is causing the error. Some E errors (for example, hardware errors) cause the mirroring operation to stop. To clear an E error that has caused the mirroring operation to stop, you must reset the M12 manually or through SCSI.
M	In Mirroring Mode 4, M indicates that the tapes do not contain identical information. The M12 returns a Media Error to the host (Sense Key = 3h, ASC = 30h, ASCQ = 1h). The mirroring backup or restore operation does not begin. To clear an M error and continue the backup, you can instruct the application software to overwrite the tapes. To clear an M error and continue the restore, you can switch to pass thru mode or obtain matching tapes from the mirrored backup set. (To determine whether the tapes contain identical data, you can use the tape compare feature in the Tape Copy menu. See page 2-10 for information about this feature.)

Pass Thru

When you select Pass Thru as a menu option, the host communicates with each tape drive individually. You can use pass thru to restore data from individual tapes following a mirroring operation. You can also use pass thru to write to or read from one tape at a time.

Note: When you use pass thru mode, you can restore data from a tape created in any of the mirroring modes.

Offline Operations

You can select the following offline operations by using the menu selections on the M12's LCD:

- Diagnostics
- Tape Copy

Diagnostics

Diagnostics is an offline operation that allows you to test the performance of the tape drives. You can test one tape drive at a time or both tape drives simultaneously. When you select options within the Diagnostics menu, you can write data to tape, read data from tape, and verify that write and read operations have been performed successfully. Any write, read, or verify errors that occur are displayed on the M12's LCD.

Tape Copy

Tape copy is an offline operation that allows you to copy data, compare data, or convert data from one 8mm format to another. Using the Tape Copy menu, you can:

- Copy data from a valid backup tape to a blank tape.

- Verify after a mirroring operation that both tapes contain identical information.

- Transfer data from a metal particle (MP) tape to an advanced metal evaporated (AME) tape (with Mammoth drives only).

- Transfer data from an MP tape written in 8200 or 8500 format to an MP tape in 8500 or 8500c format (with Eliant 820 drives only).

The Tape Copy menu contains three menu options:

- **Tape Compare** – allows you to compare two tapes (both containing data) to ensure that they contain identical data.

- **Verification Off** – allows you to copy from a tape containing data to a blank tape without verifying that the source data matches the target data.

- **Verification On** – allows you to copy from a tape containing data to a blank tape and verify that the source data matches the target data.

Resetting the M12

You can reset the M12 from the keypad on the operator panel. Resetting the M12 causes the controller and the tape drives to perform their power-on self-tests.

Tape Drive Operation

Tape drive operation involves these procedures:

- Using data cartridges
- Monitoring the tape drive status
- Cleaning the tape drive with a cleaning cartridge
- Resetting the tape drive (if an error occurs)

Figure 2-2 shows the controls and indicators for operating the Exabyte Mammoth tape drive.
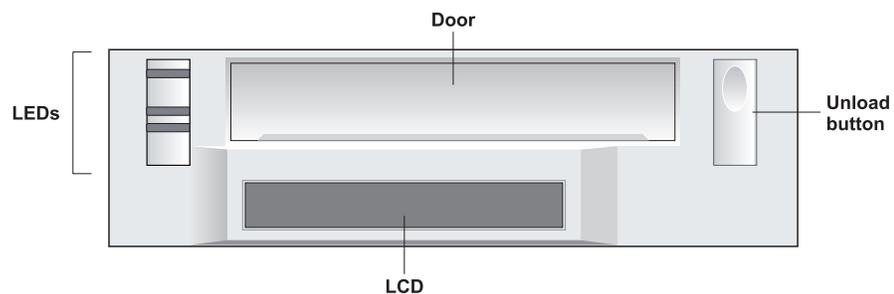

Figure 2-2   Exabyte Mammoth front panel components

Figure 2-3 shows the controls and indicators for operating the Eliant 820 tape drive.
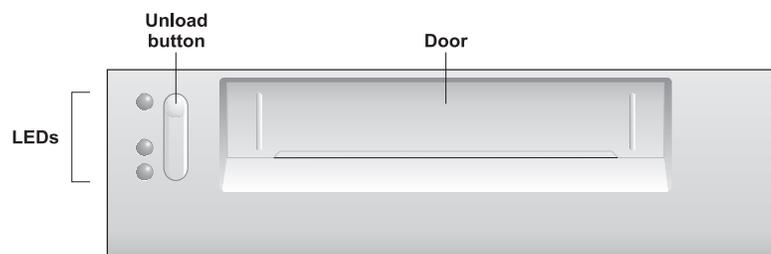

Figure 2-3   Eliant 820 front panel components

Using Data Cartridges

Exabyte strongly recommends you use Exatape™ data-grade media with all Exabyte tape drives. Exatape media meets specifications that are the most stringent in the industry. The following sections describe the use of appropriate data cartidges with the Exabyte Mammoth tape drive and the Eliant 820 tape drive.

Exabyte Mammoth Tape Drive

The Exabyte Mammoth tape drive uses data-quality, 8mm advanced metal evaporated (AME) Exatape™ data cartridges, available from Exabyte in 22m or 170m lengths. These cartridges require no formatting or other media conditioning before use.

Table 2-6 provides approximate data capacities for each length of Exatape AME cartridge.

Table 2-6 Approximate data capacities of Exatape AME data cartridges[a]

Length	Approximate capacity
170m	40 gigabytes
22m	5 gigabytes

[a] Assumes data is written at a 2:1 compression ratio.

The Exabyte Mammoth tape drive can also read data from metal particle (MP) tape when it is written in 8500c, 8500, or 8200 formats. The tape drive cannot read data written in 8200c format.

> ➤ **Important**   Although the Exabyte Mammoth tape drive can read data from metal particle (MP) tape, it cannot write data to this type of tape. You must use Exatape data-grade advanced metal evaporated (AME) media for writing data.

Eliant 820 Tape Drive

The Eliant 820 tape drive uses data-quality removable, rewritable 8mm metal particle (MP) Exatape™ data cartridges, available from Exabyte in lengths of 15m, 54m, 112m, or 160m XL. These cartridges require no formatting or other media conditioning before use.

Table 2-7 provides the approximate data capacities for each length of Exatape MP cartridge.

Table 2-7   Approximate data capacities of Exatape MP data cartridges[a]

Length	Approximate capacity
15m	1.2 gigabytes
54m	4.7 gigabytes
112m	10.0 gigabytes
160m XL	14.0 gigabytes

[a] Assumes data is written in 8500c format at a 2:1 data compression ratio.

The 160m XL data cartridge is the recommended tape for the Eliant 820. The Exatape 160m XL tape features a Recognition System (RS) stripe on the tape leader. The Eliant 820 automatically ejects 160m data cartridges or equivalent length video cartridges that are not equipped with the Recognition System stripe.

➤ **Important**   The Eliant 820 does not support advanced metal evaporated (AME) data cartridges. These cartridges are automatically ejected.

Manually Loading and Unloading a Cartridge

To load a cartridge, insert it into the tape drive door. The Exabyte Mammoth is ready for read and write operations when the middle LED is on. The Eliant 820 is ready for read and write operations when the bottom LED is on.

To unload a cartridge, press the unload button. The tape drive then completes any command in process, writes any buffered information to tape, rewinds to the beginning of the tape, and ejects the cartridge.

Monitoring Tape Drive Status

Exabyte Mammoth Tape Drive

The Exabyte Mammoth tape drive contains three LEDs for indicating its operational status. The LEDs have the following, general meanings:

- **Top LED (amber)**. When this LED is flashing, an error has occurred. When this LED is on, the tape drive needs to be cleaned.

- **Middle LED (green)**. When this LED is on, tape is loaded and the tape drive is ready to begin operations.

- **Bottom LED (green)**. When this LED is flashing, tape motion is occurring.

The following table describes the LED combinations that occur during normal Exabyte Mammoth tape drive operation. (You may occasionally observe other LED sequences associated with error reporting or code loading.)

Table 2-8 Exabyte Mammoth tape drive LED states

	Tape Drive State							
	POST or reset	**Error or failed POST**	**Ready (no tape loaded)**	**Ready (tape loaded)**	**Normal tape motion**	**High speed motion**	**Time to clean**	**Clean in progress**
Top LED (Error/Clean)	●	✳	n/a	n/a	n/a	n/a	●	●
Middle LED (Tape Ready)	●	❍	❍	●	●	●	n/a	●
Bottom LED (Tape Motion)	●	❍	❍	❍	✳	✳ fast	n/a	✳

Legend: ❍ = off ● = on ✳ = flash n/a = not applicable (may be any state)

In addition to the LEDs, the Exabyte Mammoth tape drives include a liquid crystal display (LCD) that displays information about the tape drive's operational status. For a detailed list of messages that may appear on the LCD, refer to *Exabyte M12 Mirroring Tape Subsystem Installation and Operation*.

Eliant 820 Tape Drive

The Eliant 820 tape drive contains three LEDs for indicating its operational status. The LEDs have the following, general meanings:

- **Top LED (amber)**. When this LED is flashing, the tape drive either has an error or needs to be cleaned.

- **Middle LED (green)**. When this LED is flashing, SCSI bus activity is occurring.

- **Bottom LED (green)**. When this LED is on, a tape is loaded. When it is flashing, tape motion is occurring or the tape drive needs cleaning.

The following table describes various LED combinations that occur during normal Eliant 820 tape drive operation. (You may occasionally observe other LED sequences associated with error reporting or code loading.)

Table 2-9 Eliant 820 tape drive LED states

	Tape Drive State									
	POST	**Failed POST**	**Ready–no tape loaded**	**Ready–tape loaded**	**Normal tape motion**	**High-speed tape motion**	**SCSI bus reset**	**Error**	**Time to clean**	**Cleaning in progress**
Top LED (error)	●	✳ fast	○	○	○	○	●	✳ slow	✳ fast	○
Middle LED (SCSI)	●	✳ irreg	✳ irreg	✳ irreg	✳ irreg	✳ irreg	✳ irreg	n/a	n/a	✳ irreg
Bottom LED (tape)	●	○	○	●	✳ slow	✳ fast	●	○	✳ fast	✳ slow

Legend:

● = On   ○ = Off   ✳ = Flashing: ✳ **slow** =   1 flash/second (0.94 Hz)

✳ **fast** =   4 flashes/second (3.76 Hz)

✳ **irreg** =   Rate of flash varies with SCSI bus activity. If the tape drive is not connected to the SCSI bus, this LED will be off.

Cleaning the Tape Drive

The tape drive's tape heads and tape path should be cleaned on a regular basis. Cleaning the tape drive helps to ensure that it will perform according to its specifications. The tape drive's cleaning requirement depends on the number of tape motion hours and the type of tape being used (MP or AME). The following sections briefly describe the proper procedures for cleaning the Exabyte Mammoth tape drive and the Eliant 820 tape drive. For detailed cleaning instructions, refer to *Exabyte M12 Mirroring Tape Subsystem Installation and Operation.*

Cleaning Exabyte Mammoth

When the Exabyte Mammoth tape drive requires cleaning, the top LED turns on. To help maintain data integrity and reliability, you should clean the tape drive as soon as possible after the LED turns on. For cleaning the Exabyte Mammoth tape drive, use an Exabyte Mammoth 8mm Cleaning Cartridge (included with the M12) or a cleaning cartridge approved by Exabyte for use with Mammoth tape drives.

➤ **Important**   When you insert an AME cartridge after reading MP tape, the top LED turns on and the cartridge is ejected. Before you can use the AME tape, you must clean the tape drive with an Exabyte Mammoth Cleaning Cartridge (or a cleaning cartridge approved by Exabyte for use with Mammoth).

Cleaning Eliant 820

When the Eliant 820 tape drive requires cleaning, the top and bottom LEDs flash. To help maintain data integrity and reliability, you should clean the tape drive as soon as possible after the LEDs begin flashing. For cleaning the Eliant 820 tape drive, use an Exabyte Premium 8mm Cleaning Cartridge (included with the M12) or a cleaning cartridge approved by Exabyte for use with the Eliant 820.

> ➤ **Important**   The Eliant 820 does not support the
> cleaning cartridge designed for Exabyte Mammoth
> tape drives. It also does not support older versions of
> the Exabyte 8mm cleaning cartridge. The Eliant 820
> automatically ejects these cleaning cartridges without
> performing a cleaning.

Resetting the Tape Drive

To reset one or both of the tape drives, power the tape drive off and back on again. For Exabyte Mammoth tape drives, you can also reset the drive by pressing and holding the unload button for at least 10 seconds. Pressing the unload button after a servo error resets Eliant 820 tape drives.

Notes

3 Functional Specifications

This chapter includes specifications for the Exabyte M12 Mirroring Tape Subsystem, including specifications for performance, power, environment, and shipping. This chapter also includes information about safety and agency standards.

Performance Specifications

The M12 supports normal, fast, and Ultra wide SCSI data transfer rates to the host. The M12 supports fast narrow SCSI data transfer rates to the Exabyte Mammoth tape drives and normal SCSI data transfer rates to the Eliant 820 tape drives.

The M12 does not affect tape drive performance and therefore does not limit backup time, data transfer speeds, search speed, or data capacity.

Note: For tape drive performance specifications, see the *Exabyte Mammoth Product Specification* or the *Eliant 820 Product Specification.*

Power Specifications

This section describes the various power specifications for the M12.

AC Input Voltages and Power

The M12 includes an internal power supply that is capable of accepting 100 to 240 VAC at 50 to 60 Hz. The M12 has automatic AC input voltage selection.

The M12 is capable of continuous operation when the AC power experiences intermittent operation, voltage surges, and voltage spikes. The M12 includes an AC line filter to reduce conducted emissions.

AC Power Consumption

The power consumption of the M12 varies depending on the functions being performed by the M12's controller and tape drives. The M12 consumes a minimum of 32.4 watts and a maximum of 48 watts (AC true power). Based on the AC true power consumption, the M12 generates between 111 and 164 BTU/hour.

AC Power Cord

The M12 is shipped with a 7-foot (2.1-meter), three-conductor, 18 AWG power cord for 120 volt use in the United States and Canada. As shown in Figure 3-1, the power cord has a molded NEMA 5-15P male connector on one end and a molded IEC 320 female connector on the other end. The power cord is UL Listed and CSA Certified.
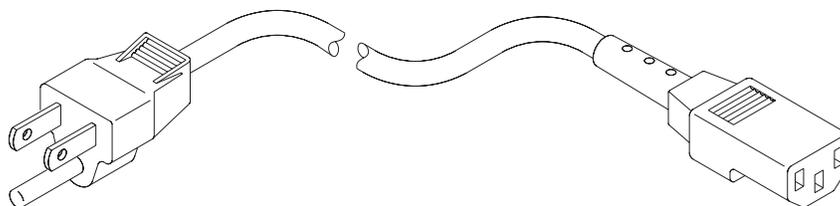
Figure 3-1 120 VAC power cord for the United States and Canada

If you plan to use other input voltages or use the M12 outside of the United States or Canada, you must supply a power cord that meets the following specifications.

United States and Canada 220 VAC power cord

- The power cord must have a molded NEMA 6-15P attachment plug on one end.

- The power cord must have a molded IEC 320 female connector on the other end.

- The cordage must be an SJT or SVT type, 3-conductor, 18 AWG minimum.

- The power cord must comply with local electrical code.

International 230 VAC power cord

- The power cord must have a grounded attachment plug of the proper type, rating, and safety approval for the intended country.

- The power cord must have an IEC 320 female connector on one end.

- The cordage must be harmonized to CENELEC publication HD-21. The electrical characteristics and rating must be minimum H05VVF3G0.75 (6 A).

Power Switch

The M12 includes a rocker switch located on the back panel that is used to power the M12 on and off.

Fuse

The M12 operates with a 1.6 amp, 250 volt fuse. The fuse drawer, located between the power switch and the power entry module, contains a spare fuse.

Environmental Specifications

Environmental specifications include the following:

- Operating environment
- Acoustic noise limits
- Shock and vibration

Table 3-1 summarizes the environmental specifications for operating, storing, and shipping the M12.

Table 3-1   Environmental specifications

	Operating	In storage[a] or not operating[b]	Being shipped[a]
Temperature range	5°C to 35°C (+ 41°F to 104°F)	–40°C to + 60°C (–40°F to + 140°F)	–40°C to + 60°C (–40°F to 140°F)
Temperature variation[c]	10° C per hour, maximum (18° F per hour, maximum)	20° C per hour, maximum (36° F per hour, maximum)	
Relative humidity[a]	20% to 80% Non-condensing	10% to 90% Non-condensing	10% to 90% Non-condensing
Wet bulb temperature	26° C (79° F) max	29° C (84° F) max	29° C (84° 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+ 40,000 ft)	-304.8 m to + 12,192 m (-1,000 ft to + 40,000 ft)

[a] The M12 is in its original packaging.

[b] The M12 is unpacked but not powered on.

[c] The M12's temperature and humidity must be allowed to stabilize in the specified ambient environment for 24 hours.

Operating Environments

Figure 3-2 is a psychrometric chart that indicates the operating temperature and humidity ranges for the M12. The dotted line represents the operating environment limits. Table 3-2 defines the temperature and humidity points shown in Figure 3-2.

Table 3-2 Temperature and humidity points for psychrometric chart

Point	Temperature	Humidity
A	5° C	80%
B	29° C	80%
C	35° C	50%
D	35° C	20%
E	5° C	20%
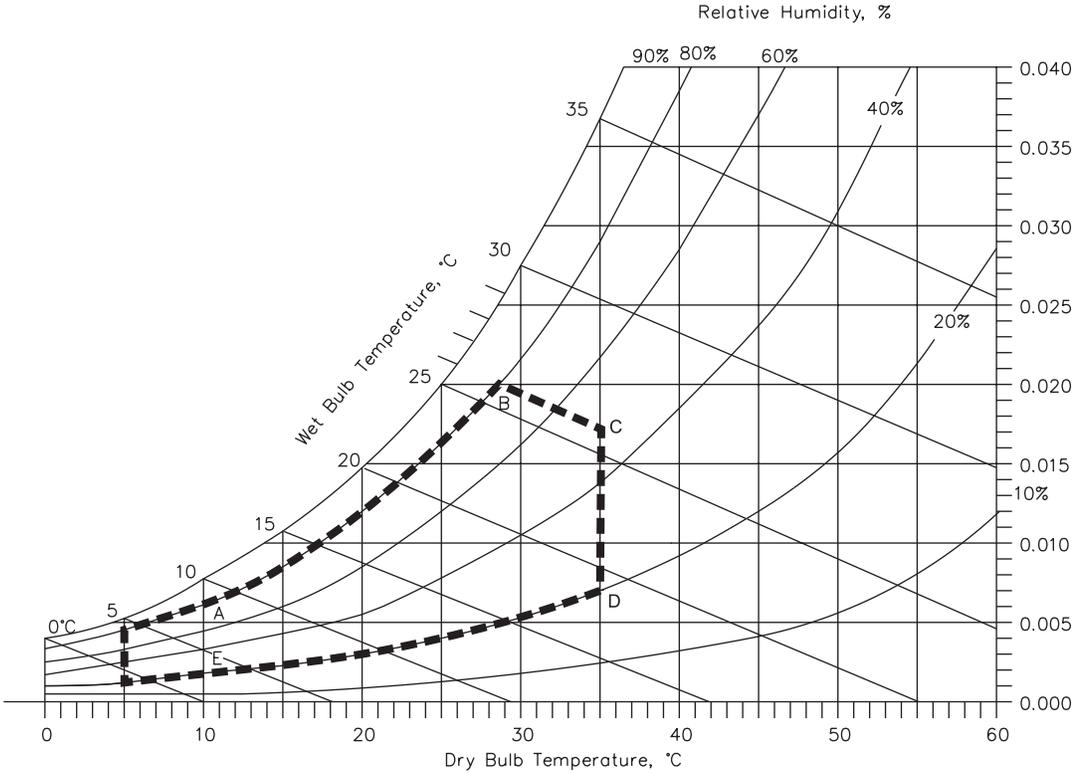
Figure 3-2 Temperature and humidity ranges for operation

Shock Specifications

Table 3-3 lists the shock specifications for the M12. The operating shock levels indicate how much shock the M12 can withstand while it is performing online and offline operations. After withstanding this amount of shock, the M12 will operate normally.

Table 3-3 Shock specifications

Operating (reading and writing)	Transportation (shipped in original packaging)[b]	Handling
3 g 5 ms[a]	ISTA Procedure 1A	Drop per IEC 68-2-31

[a] A minimum of 20 shock pulses are applied to each of the six sides. The shock pulses are half-sine waves and are applied at a rate not exceeding one shock per second.

Vibration Specifications

Table 3-4 lists the vibration specifications for the M12 during operation, storage, and transportation. The operating specifications listed in this table indicate the amount of vibration that the M12 can withstand while performing online and offline operations.

Table 3-4 Vibration specifications

Random vibration[a] applied during operation (reading and writing)	
1 Hz	PSD= 0.0000040 g^2/Hz
5 Hz	PSD= 0.0000270 g^2/Hz
10 to 150 Hz	PSD= 0.0004048 g^2/Hz
200 to 400 Hz	PSD= 0.0001079 g^2/Hz
Vibration applied during shipping (in original packaging)	
ISTA Procedure 1A	
Swept sine applied during operation[b], and non-operation and storage[c]	
5 to 500 to 5 Hz	

[a] A 30 G RMS random vibration spectrum is applied to each of three orthogonal axes for a minimum of 20 minutes per axis.

[b] Three sweeps at one octave per minute are applied to each axis at 0.3 g (peak) input.

[c] Three sweeps at one octave per minute are applied to each axis at 0.75 g (peak) input.

Acoustic Noise Limits

The overall, averaged A-weighted sound pressure level (in decibels) for the M12 does not exceed the upper limits described in Table 3-5.

Table 3-5 Acoustic noise limits

Operating mode	L_{pA}[a]
The M12 is powered on and idle.	55 dBA
The M12 is powered on, and the tape drives are performing a high-speed search or rewind operation (less than 2 minutes duration).	56 dBA

[a] L_{pA} is the average A-weighted sound pressure level over the following frequency range: 5 Hz to 12.5 KHz.

Shipping Specifications

This section describes the shipping requirements for the M12.

Shipping Carton

The M12 is sealed in a static protection bag and is shipped with one unit per carton. Table 3-6 shows the dimensions and weight of the carton.

Table 3-6 Shipping dimensions and weights

Dimensions	Weight
24.0 inches long 22.5 inches wide 10.0 inches high ($61 \times 57 \times 25$ cm)	36.5 pounds (16.6 kg) with Mammoth 35.9 pounds (16.4 kg) with Eliant 820

The shipping carton and internal packing materials are designed so that the enclosed M12 does not receive a shock greater than 30 g when the carton is dropped on any surface, corner, or edge from a height of 24 inches (61 cm).

The shipping carton passes the tests described in the International Safe Transit Association (ISTA) Procedure 1A for packaged products weighing less than 100 pounds.

Packing Materials

The packing materials are unbleached, reusable, recyclable, and environmentally safe. The materials contain no chlorofluorocarbons (CFCs) or heavy metals.

To avoid damaging the M12, use the original shipping carton and packing materials (or replacement packaging obtained from your vendor) when repacking and shipping it. The shipping carton and packing materials are not intended to be used for shipping items other than the Exabyte M12 Mirroring Tape Subsystem.

Safety and Regulatory Agency Compliance

This section describes the M12's compliance with safety and regulatory agency standards.

> ➤ **Important**   To comply with the following regulations and standards, the M12 must be properly installed in office or industrial environments with shielded cables and adequate grounding of the SCSI bus and the input power.

Safety Agency Standards

The Exabyte M12 Mirroring Tape Subsystem complies with and is certified to the applicable requirements of the following domestic and international product safety standards:

- UL Standard 1950, 3rd Edition, Information Technology Equipment, including Electrical Business Equipment

- CSA Standard C22.2 No. 950-95, Safety of Information Technology Equipment, including Electrical Business Equipment

- IEC 950 (EN60950), Safety of Information Technology Equipment, including Electrical Business Equipment

Radiated and Conducted Radio Frequency Emissions (EMI)

The M12 meets the requirements for radiated and conducted emissions as defined by the following standards:

- FCC Rules and Regulations, Class A, Part 15: Radio Frequency Devices, Subpart B: Unintentional Radiators.

- Industry Canada Notice, ICES-003, Class A, Digital Apparatus.

- CISPR 22: 1993 (EN 55022: 1994), Class A.

Electrostatic Discharge (ESD) Immunity

The M12 complies with EN 61000-4-2: 1995, Electromagnetic Compatibility (EMC), Part 4: Testing and Measurement Techniques, Part 2: Electrostatic Discharge (ESD) Immunity.

Exabyte tests to the following increased test values:

- Up to 15,000 volts air-gap discharge applied to all non-metallic/non-conductive surfaces

- Up to 8,000 volts direct discharge applied to all metallic/conductive surfaces

In each case, there is no degradation or non-recoverable loss of function due to damage of equipment or firmware.

Radiated Radio Frequency Field Immunity

The M12 complies with EN 61000-4-3:1996 and ENV 50204:1995, Electromagnetic Compatibility (EMC), Part 4: Testing and Measurement Techniques, Part 3: Radiated Radio-frequency Immunity.

The M12 will continue to operate without error while being exposed to an electromagnetic field of 10 volts/meter.

Electrical Fast Transients (EFT)/Burst Immunity

The M12 complies with EN 61000-4-4: 1995, Electromagnetic Compatibility (EMC), Part 4: Testing and Measurement Techniques, Part 4: Electrical Fast Transient/Burst Immunity.

The M12 will continue to operate without error when exposed to EFT of ± 2000 volts on the AC power ports and ± 1000 volts on the I/O ports (SCSI and serial ports).

Surge Immunity

The M12 complies with EN 61000-4-5:1995, Electromagnetic Compatibility, Part 5 - Surge Immunity.

The M12 will continue to operate without error after being subjected to surges up to ± 2000 volts.

Conducted Radio Frequency Field Immunity

The M12 complies with EN 61000-4-6:1996, Electromagnetic Compatibility (EMC), Part 6: Conducted Radio Frequency Immunity.

The M12 will continue to operate without error while being exposed to a field of 10 volts $_{(rms)}$.

Voltage Dips, Interruptions, and Variations Immunity

The M12 complies with EN 61000-4-11:1994, Electromagnetic Compatibility, Part 11: Voltage Dips, Short Interruptions, and Voltage Variations Immunity.

The M12 will continue to operate without error after being exposed to a 70% voltage dip for 10 milliseconds (ms). The M12 will be self-recoverable or can be restored by the operator after being exposed to a 40% voltage dip for 100 ms and after a power interruption of 5 seconds.

Harmonic Emissions

This product meets the requirements for harmonic emissions as defined by EN 60555-2: 1987, Disturbances in Supply Systems Caused by Household Appliances and Similar Electrical Equipment, Part 2, Harmonics.

Voltage Fluctuations and Flicker

This product meets the requirements for voltage fluctuations as defined by EN 60555-3: 1987, Disturbances in Supply Systems Caused by Household Appliances and Similar Electrical Equipment, Part 3: Voltage Fluctuations.

Notes

4 SCSI Specifications

This chapter provides Small Computer System Interface (SCSI) specifications for the Exabyte M12 Mirroring Tape Subsystem, including information about the following:

- General information about SCSI
- SCSI configuration for the M12

Note: For information about how the tape drives support SCSI communications, see the *Exabyte Mammoth SCSI Reference* or the *Eliant 820 SCSI Reference.*

General Information About SCSI

SCSI is a standard that enables host computers and peripheral equipment, such as the controller or tape drives, to communicate. The physical components in a SCSI system consist of the following:

- **Initiator.** A SCSI bus adapter card installed in a host computer allows the computer to act as the *initiator* of SCSI operations. The initiator (host) can send commands, messages, and data across the SCSI bus to targets such as libraries or tape drives. The initiator can also receive data, messages, and status from the targets.

- **Targets**. The tape drives are independent *targets* capable of receiving commands from the initiator. The initiator (host) sends commands through the controller to the target devices. The M12's controller is essentially transparent to the host, which means that during normal operation it is not perceived by the host as a target device.

SCSI bus. The *SCSI bus* provides a pathway for passing information between the initiator and the targets. As described on , the controller card is positioned between the host computer and two tape drives. The three SCSI cables extending from the controller card (two of which are internal, connecting the controller to the tape drives) represent three separate *SCSI buses*.

Up to eight devices (including one or more initiators) can be cabled together to form a narrow SCSI bus. Wide SCSI buses can include up to 16 devices. Devices at each end of an individual SCSI bus are terminated with SCSI terminators.

Each device attached to a SCSI bus has a unique SCSI ID that identifies it during communication. The SCSI ID of the M12 can range from 0 to 7 if the host computer contains a narrow host bus adapter card; the M12's SCSI ID can range from 0 to 15 if the host computer contains a wide host bus adapter card. Each tape drive is set to SCSI ID 0 at the factory.

SCSI Configuration for the M12

This section provides information about SCSI configuration requirements for the M12, including information about the following:

- SCSI cable and adapter requirements
- SCSI terminator requirements

SCSI Cable and Adapter Requirements

Table 4-1 describes SCSI cable and adapter requirements for the host SCSI bus.The M12 is shipped with a wide (68-pin) single-ended or differential SCSI cable; all other cables and adapters referred to in the following table are available from Exabyte.

Table 4-1 SCSI cable and adapter requirements

M12 SCSI configuration...	Connecting to...	You will need...
Wide, single-ended	Wide, single-ended host	Wide, single-ended SCSI cable (shipped with the M12)
	Narrow, single-ended host	Wide, single-ended SCSI cable (shipped with the M12) plus narrow-to-wide SCSI adapter
Wide, differential	Wide, differential host	Wide, differential SCSI cable (shipped with the M12)
	Narrow, differential host	Wide, differential SCSI cable (shipped with the M12) plus narrow-to-wide SCSI adapter

SCSI Cable Specifications

If you use a host SCSI cable other than the wide (68-pin) cable provided with your M12, your cable must conform to SCSI-3 specifications. Table 4-2 lists the specifications for external SCSI-3 cables.

Table 4-2 Host SCSI cable specifications

Characteristic	Single-ended	Differential
Cable impedance (in Ohms)[a]	Max 96 Nom 90 Min 84	Max 160 Nom 122 Min 115
Impedance difference between any two signals on the same cable[b]	12 Ohms	20 Ohms
Conductor size[b]	# 30 AWG min	
Cable skew delay[c]	4 nS	
Propagation delay	5.4 nS/meter max	
Pair-to-pair propagation delta delay	0.15 nS/meter max	
Signal attenuation	0.095 db max/meter @ 5 MHz[d]	

[a] Excluding TERMPWR conductors

[b] Recommended specification

[c] The maximum difference in propagation time allowed between any two SCSI bus signals measured between any two SCSI devices

[d] Measured differentially

SCSI Cable Length

The maximum length of the SCSI cable (including internal and external cables) depends on whether your host contains a single-ended or differential SCSI configuration, as follows:

- **For single-ended SCSI configurations:** If your host is able to accommodate a data transfer rate of more than 10 MB per second, the maximum allowable bus length is 1.5 meters (4.9 feet). If your host is able to accommodate a data transfer rate between 5 MB and 10 MB per second, the maximum allowable bus length is 3 meters (9.8 feet). If your host limits data transfers to 5 MB per second or less, the maximum allowable bus length is 6 meters (19.7 feet).

- **For differential SCSI configurations:** The maximum allowable bus length is 25 meters (82 feet).

To determine the cable length of each bus, measure the lengths of the SCSI cables connecting each device for that bus and add those lengths together. That is the total length of external cable.

To that sum, add the following SCSI cable lengths *for each bus*:

Host bus   For the host bus, add 45.7 cm (18.0 in) for the M12, plus the internal SCSI cable length specified in your host computer documentation.

Tape drive buses   You do not need to calculate cable length for the tape drive SCSI buses. They are located inside the M12 enclosure and do not form a SCSI bus with any other devices.

SCSI Adapter Specifications

To ensure proper performance of the controller and tape drives, the following narrow (50-pin) to wide (68-pin) adapters are recommended and are available from Exabyte:

- Single-ended (50-pin male to 68-pin female), part number 320224
- Differential (50-pin male to 68-pin female), part number 320225

Note: All Exabyte narrow-to-wide adapters provide high-end data bit termination so that high data bits do not continue to the narrow device. You can either place the narrow device last on the SCSI bus, or make sure it is followed by other narrow devices.

SCSI Terminator Requirements

The M12's controller card connects to three separate SCSI buses: the host and two tape drives. The two tape drive SCSI buses contain internal termination. You need to terminate only the host SCSI bus.

Termination can be active or passive. If your host can transfer data at more than 5 MB per second, use active termination. If your host limits data transfer to 5 MB per second or less, use either active or passive termination. For best results on a single-ended bus, use active termination.

To terminate the host computer, refer to the instructions in your computer installation manual. To terminate the M12 (assuming that it is the last device on the SCSI bus), place the external terminator that is shipped with the M12 over one of the host SCSI connectors, as shown in Figure 4-1.
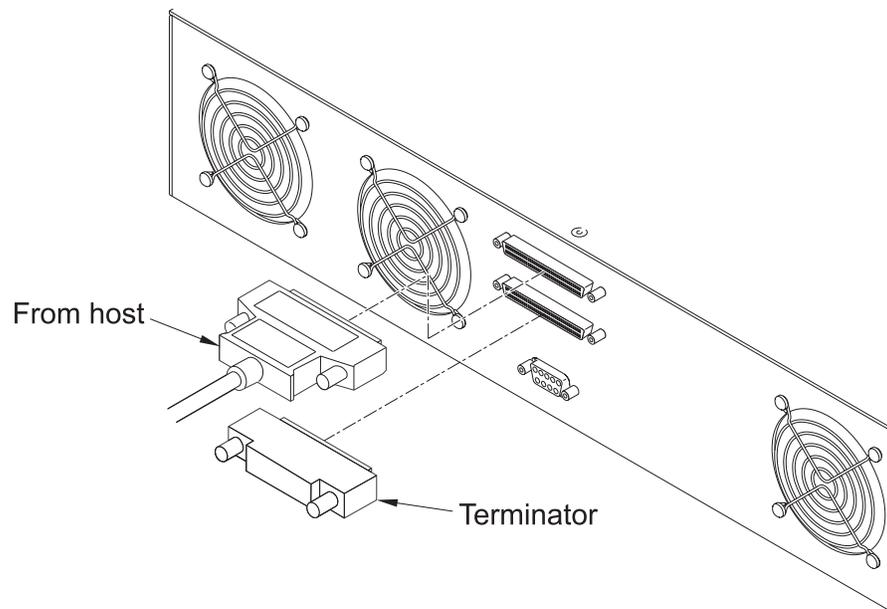
Figure 4-1   Termination of the host SCSI bus at the M12

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