IBM TotalStorage Ultrium Tape Library 3582



# **SCSI** Reference

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#### Note!

Before using this guide and the product it supports, read the information in "Notices" on page 131.

#### First Edition (August 2003)

This edition applies to the *IBM TotalStorage Ultrium Tape Library 3582 SCSI Reference* and to all subsequent releases and modifications until otherwise indicated in new editions.

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## **Read This First**

This is the first edition of the *IBM TotalStorage Ultrium Tape Library 3582 SCSI Reference* (August 2003).

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- Page numbers to which you are referring

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## Preface

This manual contains information about how to use and program the IBM<sup>®</sup> TotalStorage<sup>™</sup> Ultrium Tape Library 3582, hereafter referred to as the 3582 Tape Library. It is intended for use by those who use the Small Computer System Interface (SCSI) to communicate with the library. The book contains the following chapters:

- Chapter 1, "Introduction," on page 1 provides general information about the library and its components.
- Chapter 2, "General SCSI Information," on page 17 provides an overview of SCSI bus operations, messages, and commands.
- Chapter 3, "Using the SCSI Commands," on page 23 provides a detailed description of the SCSI library commands.

### **Related Publications**

Refer to the following publications for additional information about the 3582 Tape Library. To ensure that you have the latest publications, visit the web at:

http://www.ibm.com/storage/lto

## 3582 Tape Library Publications

- IBM TotalStorage Ultrium Tape Library 3582 Setup, Operator, and Service Guide, GA32-0458
- The IBM LTO Ultrium Tape Libraries Guide, SG24-5946

### **Other IBM Publications and Sources**

- For a list of compatible software, operating systems, and servers, visit the web at http://www.ibm.com/storage/lto. Select LTO support, then Interoperability matrix and software (ISVs). Under Supported servers and operating systems or Supported storage management software, select IBM TotalStorage Ultrium Tape Library 3582.
- http://ssddom02.storage.ibm.com/tape/lto/documentation/labelspec.pdf (for bar code and bar code label specifications for LTO Ultrium Tape Cartridges)
- http://publib.boulder.ibm.com/pubs/html/as400/online/chgfrm.htm
- *IBM TotalStorage LTO Ultrium 2 Tape Drive Models T400 and T400F Setup, Operator, and Service Guide,* GA32-0455
- StorageSmart by IBM Ultrium Tape Drive Models T200 and T200F Setup, Operator, and Service Guide, GA32-0435
- IBM TotalStorage LTO Ultrium Tape Drive SCSI Reference, GA32-0450
- IBM Externally Attached Devices Safety Information, SA26-2004
- IBM Ultrium Device Drivers Installation and User's Guide, GA32-0430
- IBM Ultrium Device Drivers Programming Reference, GC35-0483

### **Related Information**

For additional related information, see:

• *Fibre Channel Arbitrated Loop (FC-AL-2)*, published by the American National Standards Institute (ANSI) as NCITS 332:1999.

- *Fibre Channel Tape and Tape Medium Changers (FC-TAPE)*, published by the American National Standards Institute. Final draft available as T11/99-069v4 on the web at http://www.t11.org; actual document available from ANSI as NCITS TR-24:1999.
- *Fibre Channel Protocol for SCSI*, Second Version (FCP-2), published by the American National Standards Institute and available on the web at http://www.t10.org.
- SCSI Parallel Interface-3 (SPI-3), published by InterNational Committee on Information Technology Standards (INCITS) and available on the web at http://www.t10.org.
- *SCSI-3 Stream Commands (SSC)*, published by the American National Standards Institute and available on the web at http://www.t10.org.
- *SCSI Stream Commands-2 (SSC-2)*, published by the American National Standards Institute and available on the web at http://www.t10.org.
- *SCSI Primary Commands-2 (SPC-2)*, published by the American National Standards Institute and available on the web at http://www.t10.org.
- *SCSI Primary Commands-3 (SPC-3)*, published by the American National Standards Institute and available on the web at http://www.t10.org.

Portions of this manual were adapted from documentation provided by the InterNational Committee on Information Technology Standards (INCITS).

## **Chapter 1. Introduction**

The IBM TotalStorage Ultrium Tape Library 3582 is an entry tape library that incorporates high-performance IBM TotalStorage LTO Ultrium 2 Tape Drives for the midrange open systems environment.



Figure 1. IBM 3582 Ultrium Tape Library

The 3582 Ultrium Tape Library can accommodate one or two Ultrium 2 Tape Drives and comes standard with a one-cartridge I/O (input/output; may also be referred to as import/export) station and 23 data cartridge slots giving a native library capacity of 4.8 TB uncompressed data storage (9.6 TB with 2:1 compression). Tape cartridge capacity is up to 200 GB native capacity (400 GB with 2:1 compression) with the IBM TotalStorage LTO Ultrium 200 GB Data Cartridge, and drive performance is up to 35 MB/sec native data transfer rate (70 MB/sec with 2:1 compression) with the IBM LTO Ultrium 2 Tape Drives. The Ultrium 2 Tape Drives come in 2-Gb switched-fabric Fibre Channel, LVD Ultra160 SCSI, or HVD Ultra SCSI interfaces to attach to a wide spectrum of open systems servers.

The 3582 Tape Library has two 7-cartridge removable cartridge magazines, a bar code scanner, and IBM's patented Multi-Path architecture to partition the library into two logical libraries. The library can be configured as a stand-alone desktop unit or can be mounted in an industry-standard 19-inch rack. Optional features include Control Path Failover and a Remote Management Unit/Specialist for remote library management.

The 3582 Tape Library can be used in network-attached storage implementations, including backups and mass storage archives where multi-terabyte capacities are required. IBM LTO Ultrium technology is designed for the heavy demands of automated tape systems. This proven tape technology has enhanced digital speed matching, power management, channel calibration, servo technology, track layout, head design, error correction codes, and data compression, resulting in increased capacity, performance, and reliability in an entry-level, automated tape system.

For the remainder of this guide, the IBM TotalStorage Ultrium Tape Library 3582 will be referred to as the 3582 Ultrium Tape Library. You can visit the 3582 Ultrium Tape Library's web site at http://www.ibm.com/storage/lto for additional information not included in this manual.

## Features

This section describes the features of the 3582 Ultrium Tape Library.

## **Standard Features**

The following features are standard with your library:

- **Multi-function Operator Panel.** The Operator Panel, located on the right above the I/O slot, provides an easy-to-read bitmap display and a five-button keypad to permit you to monitor and control the operations of your library. The liquid crystal display (LCD) provides access to library status, commands, setup, and tools. See "Front Panel Components" on page 4 for more information.
  - **Robotic system.** The robotic system is the media cartridge handling mechanism that responds to commands from the application software to move the cartridges between the storage slots, tape drives, and the I/O slot.
  - **Partitioning.** Partitioning enables you to create logical libraries within a single library. Separate host applications can be run for each logical library.
  - **I/O slot.** The I/O slot enables you to import and export tapes to any slot or drive without unlocking the media access door. See "Interior Components" on page 5 for more information. You can also configure the I/O slot to act as a data storage slot.
  - **Magazines.** Removable cartridge magazines allow you to easily insert and remove tape cartridges.
  - **System integrity.** The cartridge storage slots and robotic system are protected by a door that is lockable by key. Your library can also be configured for password access.
  - **Cartridge inventory.** Whenever you power up your library, it will perform a physical inventory of slots.
  - **Bar Code scanner.** The bar code scanner reads bar code labels and presents label IDs to the LCD and the host without losing storage capacity.
  - **Manual cartridge use.** Individual cartridges can easily be transported to the library by manually opening the I/O door and inserting the cartridge into the I/O slot. The Operator Panel is then used to load the cartridge into another slot.
  - Reverse cartridge protection. The magazines, I/O slot, and rear storage slots employ a design that prevents the cartridges from being inserted incorrectly.
  - **Built-in diagnostics.** Your library includes diagnostic firmware that reports diagnostic results and drive operating status. Your library also includes real-time monitoring of data locations and several types of diagnostic tests.
  - **Autoclean.** Autoclean enables the library to automatically clean the drives when cleaning is required.
  - **Error diagnosis.** Your library includes an Error Log that is accessible from the Operator Panel. An output log, available through the serial port, contains errors, diagnostic messages, and events.
  - **Power Management.** Ultrium 2 tape drives enter sleep mode when neither reading or writing data.

## **Optional Features**

The following features are optional. Instructions for installing these features can be found in the *IBM TotalStorage Ultrium Tape Library 3582 Setup, Operator, and Service Guide.* 

- Additional drive. You can add an additional drive to your library, increasing data access throughput.
- **Control path failover.** Control path failover enables the host device driver to resend a command to an alternate control path for a logical library either to overcome a command failure or to circumvent timeouts that would otherwise interrupt processing.
- **Magazine and dust cover.** Extra magazine and snap-on dust cover and interlocked stacking for offline media storage.
- Native Fibre Channel interface. Fibre Channel technology combines the best features of traditional input/output (I/O) interfaces (such as the throughput and reliability of SCSI and Programmed Control Interrupt) with the best features of networking interfaces (such as the connectivity and scalability of Ethernet and Token Ring). The technology offers a transport mechanism for delivering commands, and provides high performance by allowing processing to be done in the hardware.
- **Rackmount kit.** Your library can be easily converted to a rackmount configuration. The available rackmount kit can be installed on any library.
- **Remote management unit (RMU).** Your library may be equipped for a RMU, which provides remote host operation through a Web browser.

## **Front Panel Components**

Figure 2 shows the components located on the front panel of your library.



Figure 2. Front view

#### **1** Power switch

Two-position switch that controls power to your library.

#### 2 Key lock

Lock that prevents unauthorized media insertion and removal.

#### 3 Keypad

The keypad enables you to view the operational status of the library, perform system configuration, and execute commands.

#### 4 LCD

The LCD provides an easy-to-read bitmap display with backlighting.

#### 5 I/O door

Door for access to the I/O slot. The I/O feature enables you to import or export tape cartridges with the media access door locked.

#### 6 Media access door

Door for loading and removing tape magazines. Door can be locked to prevent media insertion and removal.

#### 7 Serial Number

Identification number for your library.

## **Interior Components**

Figure 3 shows the components located behind the media access and I/O doors of your library:





#### **1** Magazines

Removable cartridge magazines allow for the easy insertion and removal of tape cartridges. The magazines include transparent windows that enable you to view media easily. The magazine handle is designed to allow for single-handed magazine installation and removal. When not in use, magazines can be stacked for easy storage.

#### 2 I/O slot

Enables insertion and ejection of cartridges without interrupting the normal operation of the library.

#### **3** Bar Code scanner

Bar code scanner that reads bar code labels and presents label IDs to the LCD and the host.

Note: Nine fixed data slots are behind the magazines.

## **Rear Panel Components**

Figure 4 and Figure 5 show the components located on the rear panel of your library:



Figure 4. Rear view with a SCSI drive



Figure 5. Rear view with a Fibre Channel drive

#### **1** AC power connector

Receptacle for AC power cord.

#### **2** SCSI connectors

Connections for the interface cable that connect the unit with the host computer or other devices on the SCSI channel (including other library units). The interface cable can be attached to either connector.

#### **3** Fibre Channel connector

Connection for the Fibre Channel interface cable that connects the unit with the host computer.

#### **4** Serial connector

Bidirectional RS-232 port for diagnostic purposes and firmware upgrades.

#### 5 Drive

The 3582 Ultrium Tape Library comes equipped with one Ultrium 2 Tape Drive unless you order an additional drive.

#### 6 Tape Drive Bay

Tape drive bay for adding a second Ultrium 2 Tape Drive.

#### 7 RMU slot

Slot for optional, user-installable RMU that enables remote access to the library using a Web browser.

### Media

The removable data cassettes support the Linear Tape-Open (LTO) format. LTO tapes offer up to 400 GB of compressed (2:1) data storage.



Figure 6. LTO data cartridge

The write-protect switch **1** is used to prevent recording over existing data. To prevent recording or deleting, place the write-protect switch to the closed position. The drive senses the position of the switch and will not allow writing in this position. When inserting cartridges in the library, place the switch in the open position, unless you do not want to record on a specific cartridge.

Note: Store data cartridges in a dry, cool environment.

**CAUTION:** Never reset or power down your computer or library while a function is in process or a tape is moving.

## **Tape Drive Interfaces**

The 3582 Ultrium Tape Library supports the Ultrium 2 Tape Drive with the following interfaces:

- Fibre Channel
- Low Voltage Differential (LVD) Ultra160 SCSI
- High Voltage Differential (HVD) Ultra SCSI

## **Server Attachment**

You can attach the 3582 Ultrium Tape Library to servers by using:

- SCSI interface
- Native Fibre Channel interface

The sections that follow describe each type of interface.

## **SCSI Interface**

The 3582 Ultrium Tape Library operates as a set of SCSI-3 devices. For drives that use a SCSI interface, the following conditions apply:

 The Ultrium 2 Tape Drive can attach to a server through a Low Voltage Differential (LVD) Ultra160 SCSI interface or a High Voltage Differential (HVD) Ultra SCSI interface Each SCSI drive sled uses shielded HD68 connectors and can attach directly to a 2-byte-wide SCSI cable.

Any combination of up to two initiators (servers) and up to four targets (devices) is allowed on a single SCSI bus if the following conditions are met:

- · The SCSI bus is terminated properly at each end
- Cable restrictions are followed according to SCSI-3 standards

Under the SCSI-3 protocol, this type of attachment allows cable lengths of up to 25 m (81 ft) with the appropriate cable and terminator.

## **Fibre Channel Attachment**



**Attention:** This product contains an assembly that complies with the performance standards set by the U.S. Food and Drug Administration for a Class I Laser Product. This laser assembly is registered with the Department of Health and Human Services and is in compliance with IEC825.

The 2-Gb interface is a 200-MB-per-second, full-duplex, serial-communications technology capable of interconnecting Ultrium 2 Tape Drives that are separated by as much as 10 kilometers (7 miles).

Fibre Channel technology combines the best features of traditional input/output (I/O) interfaces (such as the throughput and reliability of SCSI and Programmed Control Interrupt) with the best features of networking interfaces (such as the connectivity and scalability of Ethernet and Token Ring). The technology offers a transport mechanism for delivering commands, and provides high performance by allowing processing to be done in the hardware.

You can establish Fibre Channel connections between Fibre Channel ports that reside in the 3582 Ultrium Tape Library, one or more servers, and the network interconnecting them. The network can consist of such elements as switches, hubs, bridges, and repeaters used in the interconnection.

## **Drive Performance**

If you run applications that are highly dependent on tape-processing speed, you can take advantage of the significant performance improvements provided by the IBM 3582 Ultrium Tape Library.

#### IBM Ultrium 2 Tape Drive

The IBM 3582 Ultrium Tape Library contains the IBM Ultrium 2 Tape Drive. The IBM Ultrium 2 Tape Drive supports Fibre Channel, LVD Ultra160, or HVD Ultra SCSI interfaces. It features two HD68 connectors or one LC Fibre Channel connector. Table 1 on page 9 lists the performance characteristics of the Ultrium 2 Tape Drive.

Deufermence Characteristic	Tape Drive				
	Ultrium 2 Tape Drive				
Native sustained data rate	35 MB/s (with Ultrium 2 media)				
	20 MB/s (with Ultrium 1 media)				
Compressed data rate (at 2:1 compression)	70 MB/s (with Ultrium 2 media)				
	40 MB/s (with Ultrium 1 media)				
Maximum sustained data rate (at maximum compression)	107 MB/s (Ultra160)				
Burst data rate for Low Voltage Differential (LVD) SCSI drives	160 MB/s (Ultra160)				
Burst data rate for High Voltage Differential (HVD) SCSI drives	40 MB/s (Ultra)				
Burst data rate for Fibre Channel drives	200 MB/s				
Nominal load-to-ready time	15 seconds				
Nominal unload time	15 seconds				
Average search time to first byte of data	49 seconds				
Note: All sustained data rates are dependent on the capat	pilities of the interconnect (for example, an UltraSCSI bus				

Table 1. Performance characteristics of the Ultrium 2 Tape Drive

is limited to less than 40MB/sec).

By using the built-in data-compression capability of the tape drives, you can achieve greater data rates than the native data transfer rate. However, the actual throughput is a function of many components, such as the host system processor, disk data rate, block size, data compression ratio, SCSI bus capabilities, and system or application software.

## Speed Matching

To improve system performance, the Ultrium 2 Tape Drive uses a technique called speed matching to dynamically adjust its native (uncompressed) data rate to the slower data rate of a server.

## **Multi-Path Architecture**

The 3582 Ultrium Tape Library features the Storage Area Network (SAN)-ready Multi-Path Architecture, which allows homogeneous or heterogeneous open systems applications to share the library's robotics without middleware or a dedicated server (host) acting as a library manager. The SAN-ready Multi-Path Architecture makes sharing possible by letting you partition the library's storage slots and tape drives into logical libraries. Servers can then run separate applications for each logical library. This partitioning capability extends the potential centralization of storage that the SAN enables. The Multi-Path Architecture is compliant with the following attachment interfaces:

- Small Computer Systems Interface (SCSI)
- Fibre Channel

Whether partitioned or not, the 3582 Ultrium Tape Library is certified for SAN solutions (such as LAN-free backup).

The Multi-Path Architecture also lets you configure an additional control path when the library is not partitioned. A control path is a logical path into the library through which a server sends standard SCSI Medium Changer commands to control the library. An additional control path reduces the possibility that failure in one control path will cause the entire library to be unavailable. Use of the control path failover feature further reduces that possibility (see "Using Multiple Control Paths for Control Path Failover" on page 13).

For details about configuring the library to share robotics, see "Library Sharing" in the next section.

## Library Sharing

The 3582 Ultrium Tape Library's default configuration allows a single application to operate the library through a single control path. Often, however, it is advantageous to be able to share a single library between heterogeneous (dissimilar) or homogeneous (similar) applications. Some applications (and some servers) do not allow for sharing a library between systems. With the 3582 Ultrium Tape Library, however, you can create configurations that enable the library to process commands from multiple heterogeneous applications (such as an IBM @server pSeries<sup>™</sup> application and a Windows NT<sup>®</sup> application) and multiple homogeneous applications (for example, the same application run by several pSeries servers).

From the library's web interface or operator panel, you can perform the following actions:

- Configure the library so that is partitioned into separate logical libraries that independently communicate with separate applications through separate control paths. This configuration (see example 1 in Figure 7 on page 11) requires no special capabilities from the server or application. (For more information, see "Using Multiple Logical Libraries" on page 12.)
- Configure any single logical library (including the entire physical library) so that it is shared by two or more servers that are running the same application. Depending on the capabilities of the server and application, there are several ways to set up this type of configuration. Three typical ways include:
  - Configuring one server (host) to communicate with the library through a single control path; all other servers send requests to that server through a network (see example 2 in Figure 7 on page 11). This configuration is used by Tivoli<sup>®</sup> Storage Manager (TSM).
  - Configuring all of the servers to communicate with the library through a single, common control path (see example 3 in Figure 7 on page 11). This configuration is used in high-availability environments such as IBM's High Availability Clustered Microprocessing (HACMP) and Microsoft®'s Systems Management Server (SMS) and Clustered Server Environments. Multi-initiator configurations are only supported by certain adapters and ISVs. Check with your ISV.
  - Configuring a single logical library to communicate with multiple servers through multiple control paths. This configuration (see example 4 in Figure 7 on page 11) requires that you add control paths (see "Using Multiple Control Paths" on page 12). It is used by Backup Recovery and Media Services (BRMS).

Your library configuration is not limited to the examples shown in "Example Configurations" on page 11. Many configurations are possible, and you can design them according to your business needs.

## **Example Configurations**



Figure 7. Examples of configurations for a 3582 Ultrium Tape Library. Lines from one or more drives to the library controller represent control paths.

## **Using Multiple Logical Libraries**

To maximize your investment, you can use multiple logical libraries to share the physical library between applications or to support mixed drive types for any application.

You can partition the 3582 Ultrium Tape Library into two logical libraries. Each logical library consists of:

- A tape drive
- Storage slots
- Input/output (I/O) slots
- Cartridge accessor

Each logical library has its own control path (a logical path into the library through which a server sends standard SCSI Medium Changer commands to control the logical library). Each logical library control path is available to servers through logical unit number 1 (LUN 1) of the first drive that is defined within that logical library. A logical unit number is a number used by a server to identify a drive.

A logical library cannot share another logical library's tape drives and storage slots. However, it does share the I/O slots and the cartridge accessor on a first-come, first-served basis.

The sections that follow describe these uses for multiple logical libraries. To create or change multiple logical libraries within your library, refer to the *IBM TotalStorage Ultrium Tape Library 3582 Setup, Operator, and Service Guide*.

When automatic cleaning is enabled, any appropriate cleaning cartridge may be used to clean a drive in any configured logical library.

#### Using Multiple Logical Libraries for Library Sharing

Multiple logical libraries are an effective way for the 3582 Ultrium Tape Library to simultaneously back up and restore data from heterogeneous applications. For example, you can partition the library so that it processes commands from Application 1 (about Department X) in Logical Library A and commands from Application 2 (about Department Y) in Logical Library B. In this configuration, the storage slots and drives in each logical library are dedicated to that library and are not shared among other libraries. Commands issued by the applications travel to the library through two unique control paths. Thus, the data processing for Department Y is confined to the storage slots and drives in Logical Library A and processing for Department Y is confined to the storage slots and drives in Logical Library B.

## **Using Multiple Control Paths**

In addition to creating multiple logical libraries, you can also configure any logical library to have more than one control path. When you configure additional control paths, additional library sharing configurations and availability options are made possible. Access to the logical library is on a first-come, first-served basis and each control path for a logical library can accept commands while the library is in use by another control path. By default, a logical library can communicate with the server only through the first LUN-1-enabled drive that is installed in the partition.

**Note:** Microsoft Windows<sup>®</sup> 2000 Removable Storage Manager (RSM) does not support multiple control paths within a logical library. IBM recommends that you disable RSM to use this feature.

To add or remove additional control paths, refer to the section about Access Mode in the *IBM TotalStorage Ultrium Tape Library 3582 Setup, Operator, and Service Guide*.

The sections that follow describe two potential uses for multiple control paths.

#### Using Multiple Control Paths for iSeries and AS/400 Attachment

The use of control paths for the iSeries<sup>™</sup> and AS/400<sup>®</sup> servers is unique. In general, every iSeries adapter must "see" the control path that is associated with the drives to which it is connected. Table 2 lists the quantity of drives that are supported by a particular adapter and operating system (OS/400<sup>®</sup> 5.1 or OS/400 5.2).

Table 2. Quantity of drives that are supported per adapter and operating system for iSeries and AS/400 servers

Tune of Adeptor	Quantity of Ultrium 2 Tape Drives						
Type of Adapter	OS/400 5.1	OS/400 5.2					
HVD	1 to 2	1 to 2					
LVD	1 to 2	1 to 2					
Fibre Channel	1 to 2	1 to 2					
Note: N/A = not applicable							

#### Using Multiple Control Paths for Control Path Failover

Command failures and timeouts are costly. Customers want their libraries to run smoothly and efficiently. To ensure continued processing, the 3582 Ultrium Tape Library offers an optional control path failover feature that enables the host device driver to resend the command to an alternate control path for the same logical library. With control path failover installed, the alternate control path can include another HBA, SAN, or library control path drive. The device driver initiates error recovery and continues the operation on the alternate control path without interrupting the application. Only the IBM AIX<sup>®</sup> device driver currently supports this feature.

The control path failover feature can be enabled at the factory, or it can be ordered as feature code #1680 and installed later. To order the feature, contact your IBM Sales Representative or any authorized IBM Business Partner. The library serial number is required to order this feature (see the section about displaying the serial number in the the *IBM TotalStorage Ultrium Tape Library 3582 Setup, Operator, and Service Guide*.

**Note:** The control path failover feature is activated by a license key. For additional information, see "Access Mode" on page 105.

For more information about using the control path failover feature, see the *IBM Ultrium Device Drivers Installation and User's Guide.* 

## Supported Servers, Operating Systems, and Software

The 3582 Ultrium Tape Library is supported by a wide variety of servers (hosts), operating systems, and adapters. These attachments can change throughout the product's life cycle. To determine the latest attachments, or to get a comprehensive list of compatible software, perform one of the following:

- Visit the web at http://www.ibm.com/storage/lto. Select LTO support, then Interoperability matrix and software (ISVs). Under Supported servers and operating systems or Supported storage management software, select IBM TotalStorage Ultrium Tape Library 3582.
- Contact your IBM Sales Representative.

#### Notes:

- IBM does not provide backup application software with the 3582 Ultrium Tape Library. To order software, contact your IBM Sales Representative, IBM Business Partner, or an independent software provider.
- 2. If you attach your library to a non-IBM platform with non-IBM software, IBM recommends that you contact your software vendor to obtain a matrix of compatible hardware, software, firmware revisions, and adapter cards.

## **Supported Device Drivers**

IBM offers device drivers for the 3582 Ultrium Tape Library. Device drivers enable the drive to interact with a variety of servers. To properly install an IBM device driver (if required), refer to the *IBM Ultrium Device Drivers Installation and User's Guide*. For applications that use other device drivers, see the application's documentation to determine which drivers to use.

IBM maintains the latest levels of device drivers and driver documentation for the IBM TotalStorage Ultrium 2 tape products on the Internet. You can access this material from your browser or through the IBM FTP site by performing one of the following procedures. (Note: If you do not have Internet access and you need information about device drivers, contact your Marketing Representative.)

- Using a browser, type one of the following:
  - http://www.ibm.com/storage/lto (select either Technical Support or LTO Support)
  - ftp://ftp.software.ibm.com/storage/devdrvr
  - ftp://207.25.253.26/storage/devdrvr
- Using an IBM FTP site, enter the following specifications:
  - FTP site: ftp.software.ibm.com
  - IP Addr: 207.25.253.26
  - Userid: anonymous
  - Password: (use your current e-mail address)
  - Directory: /storage/devdrvr

IBM provides PostScript- and PDF-formatted versions of its documentation in the /storage/devdrvr/Doc directory:

- IBM\_ultrium\_tape\_IUG.ps and IBM\_ultrium\_tape\_IUG.pdf contain the current version of the *IBM Ultrium Device Drivers Installation and User's Guide*
- IBM\_ultrium\_tape\_PROGREF.ps and IBM\_ultrium\_tape\_PROGREF.pdf contain the current version of the *IBM Ultrium Device Drivers Programming Reference*

Device drivers and utilities for each supported server are beneath /storage/devdrvr/ in the following directories (the device driver for the iSeries or AS/400 server is included in the OS/400 operating system):

- AIX
- HPUX
- Linux
- Solaris
- · Windows

## **Chapter 2. General SCSI Information**

This chapter details the 3582 Tape Library Medium Changer SCSI protocol. The supported commands, messages, and options are listed.

## **General Characteristics**

The 3582 Tape Library can operate in two modes:

- SCSI via LUN 1 of a drive SCSI port
- Auto-loader mode, in which SCSI commands to the library mechanism are not supported. Cartridges are loaded into drives in sequential order, with cartridges being exchanged after a drive reports an unloaded cartridge.

When attached to a LUN 1 drive, the library can be switched to report SCSI INQUIRY information in native mode, as well as in various compatible modes. Refer to the *IBM TotalStorage Ultrium Tape Library 3582 Setup, Operator, and Service Guide* for information regarding INQUIRY string compatibility mode selections.

## **Element Addressing**

A host initiator references a storage location with element addresses. The 3582 Tape Library uses a default addressing scheme, as seen in Table 3. Storage slots are addressed left to right and front to back. Drives are addressed left to right. The I/O station contains a single slot, addressed left to right. All addresses are consecutive within their device type. Elements may not be installed, and will be indicated as such in Table 3 and Table 4.

Addressing Range	Cell Definition
4096 (0x1000)	Storage Slot (Storage Elements)
16 (0x10)	I/O Station (Import/Export Elements)
256 (0x100)	Tape Drive (Data Transport Elements)
1 (0x01)	Medium Changer (Media Transport Element)

Table 3. Default addressing scheme for Partition One

Table 4. Default addressing scheme for Partition Two (if applicable)

Addressing Range	Cell Definition
8192 (0x2000)	Storage Slot (Storage Elements)
16 (0x10)	I/O Station (Import/Export Elements)
512 (0x200)	Tape Drive (Data Transport Elements)
1 (0x01)	Medium Changer (Media Transport Element)

The default addressing scheme for Partition 2 is the same as Partition 1 for all releases up to and including 2.11B.

**Note:** The compatibility mode selects how the 3582 Tape Library responds to the SCSI INQUIRY command.

## **SCSI Commands**

The following SCSI command information relates exclusively to the operation of the 3582 Tape Library. The drive relays library INQUIRY commands when it is ready. The library reports via the drive that it is becoming ready. The library is ready within 5 minutes after power on, if a bar code scanner is not enabled, and may take up to 20 minutes to become ready, if a bar code scanner is enabled. For detailed information about each command, see the indicated reference page in Table 5.

## **Device Commands**

Table 5 lists the library commands that are supported by the SCSI medium changer and the recommended maximum command time-out values. The maximum command time-out values take into account that the library may be performing a request from the Remote Management Unit (RMU) at the time a SCSI command is received and therefore queued. Although most operations are handled within seconds, Table 5 lists maximum (worst-case) time-out values, which a host application should set and obey, prior to terminating a SCSI command request. If the library operates in partitioned mode, time-out values may have to be increased for motion commands, as motion commands from separate partitions are queued.

**Note:** If the library is partitioned, the time-out values should adjust for the worst-case time-out values from a pending motion command in the other partition.

OP Code	SCSI Command	Command Time-out Value	Reference Page
07h	INITIALIZE ELEMENT STATUS (Scanner enabled)	20 minutes	24
	INITIALIZE ELEMENT STATUS (Scanner NOT enabled)	3 minutes <sup>a</sup>	
E7h	INITIALIZE ELEMENT STATUS WITH RANGE (Scanner enabled)	20 minutes	26
	INITIALIZE ELEMENT STATUS WITH RANGE (Scanner disabled)	3 minutes <sup>b</sup>	
12h	INQUIRY	10 seconds	28
4Ch	LOG SELECT	30 seconds	37
4Dh	LOG SENSE	30 seconds	41
15h	MODE SELECT	30 seconds	60
1Ah	MODE SENSE	30 seconds	69
A5h	MOVE MEDIUM	3 minutes <sup>c</sup>	83
5Eh	PERSISTENT RESERVE IN	30 seconds	85
5Fh	PERSISTENT RESERVE OUT	30 seconds	88
2Bh	POSITION TO ELEMENT	30 seconds	92
1Eh	PREVENT/ALLOW MEDIUM REMOVAL	10 seconds	94
3Ch	READ BUFFER	30 seconds <sup>d</sup>	96
B8h	READ ELEMENT STATUS	30 seconds	99

Table 5. Supported SCSI commands

Table 5. Supported SCSI commands (continued)

OP Code	SCSI Command	Command Time-out Value	Reference Page
17h	RELEASE	30 seconds	112
03h	REQUEST SENSE	10 seconds	113
16h	RESERVE	30 seconds	119
01h	REZERO UNIT	30 seconds	121
1Dh	SEND DIAGNOSTIC	30 seconds <sup>e</sup>	122
00h	TEST UNIT READY	10 seconds	127
3Bh	WRITE BUFFER	30 seconds <sup>f</sup>	128

#### Notes:

<sup>a</sup> The Initialize Element Status time-out value assumes a fully populated unit. If the scanner is enabled, each cartridge is moved in front of the scanner and then returned to the originating cartridge location. If the scanner is not enabled, only a cartridge presence test is performed.

<sup>b</sup> The Initialize Element Status With Range time-out value assumes a fully populated unit, and a full-range specification. If the scanner is enabled, each cartridge is moved in front of the scanner and then returned to the originating cartridge location. If the scanner is not enabled, only a cartridge presence test is performed.

<sup>c</sup> The MOVE MEDIUM command assumes a move from one storage element to another. The time-out value applies also to a move from a data transfer element to a storage element, a storage element to a data transfer element, or a data transfer element to a data transfer element, if the cartridge has been unloaded by a host, prior to receiving the Move Medium request. If the library requires to issue an UNLOAD command to a data transfer element, the time-out value needs to adjust and account for the maximum time a data transfer element takes to rewind and unload a tape cartridge. The unload and rewind time varies among different types of data transfer elements.

<sup>d</sup> The SEND DIAGNOSTIC command request is based on a single test-cycle request. If multiple test cycles are requested, make adjustments based on the number of test cycles requested.

<sup>e</sup> The Read Buffer time-out value is based on a 16K-data-chunk request. Adjust the time-out value if larger data chunks are requested.

<sup>f</sup> The Write Buffer time-out value is based on a 16K-data-chunk receipt. Adjust the time-out value if larger data chunks are sent.

## **SCSI Command Format**

The SCSI command format adheres to the SCSI-2 standard. Table 6 describes the command descriptor block (CDB) fields that are common to all commands.

Table 6. SCSI command format

Command Field	Description
Logical Unit Number Field	The Logical Unit Number Field is ignored.
Reserved Field	The word Reserved or Rsvd refers to a field defined by the SCSI standard as 0. The library checks the field for 0. If the field is not 0, the library returns Check Condition status with a sense key of Illegal Request.
Control Byte Field	The Control Byte (the last byte of the CDB) contains the LINK, FLAG, RESERVED, and VENDOR SPECIFIC bit fields as specified by the SCSI-2 standard. Invalid bit settings in the CONTROL byte are reported according to the SCSI-2 standard for the CONTROL byte bit field definitions. The vendor-unique portion of the CONTROL byte contains 2-bit fields, which are defined within the specific command if used.
Field Not Implemented	This description indicates that the field is a SCSI standard but is not supported by the 3582 Tape Library.

## **SCSI Command Status Byte**

The 3582 Tape Library returns status information via the drive. See Table 7 for the library's return-status bytes.

Table 7. SCSI command status byte

Status	Value	Description
Good	00h	The library successfully completed the command.
Check Condition	02h	An error condition occurred during command processing. The REQUEST SENSE command responds with detailed error information.
Reservation Conflict	18h	A SCSI initiator attempts to access the library after it has been reserved by another initiator with a RESERVE command.

## **Other SCSI Functionality**

Other SCSI functionality of the library includes Unit Attention conditions.

## **Unit Attention Condition**

Unit Attentions are reported under the following circumstances:

- A reset occurred.
- A firmware (microcode) update completes.
- A library magazine is removed or installed.
- The import/export element status changed.
- An inventory status changed.
- Mode parameters changed.
Chapter 3. Using the SCSI Commands

## **INITIALIZE ELEMENT STATUS (07h)**

The INITIALIZE ELEMENT STATUS command causes the 3582 Tape Library to examine the storage cells for cartridge presence. Bar code labels are scanned if a scanner is installed. Use the READ ELEMENT STATUS command to return the information obtained by the INITIALIZE ELEMENT STATUS command.

If the inventory is valid, no scan will be performed.

The library supports two INITIALIZE ELEMENT STATUS commands:

- The INITIALIZE ELEMENT STATUS command updates the entire cartridge inventory.
- The INITIALIZE ELEMENT STATUS WITH RANGE command updates a specific part of the cartridge inventory.
- **Note:** Because the library operates in Auto Inventory Mode, an inventory is normally guaranteed and an INITIALIZE ELEMENT STATUS command will not cause any bar code scan operations, but return successful status immediately.

## **CDB** Format

Table 8. INITIALIZE ELEMENT STATUS CDB

Bits	7	6	5	4	3	2	1	0		
Bytes										
0		Op Code (07h)								
1	Logic	cal Unit Nu	mber		Reserved					
2		Reserved								
3				Rese	erved					
4		Reserved								
5	NoScan	Scan Control								

## **Parameters**

#### Logical Unit Number (LUN)

This field is ignored.

#### NoScan

This bit, in the vendor-specific field of the Control byte, indicates whether cartridge labels should be scanned with the bar code scanner.

- If set to 1, bar code labels are not scanned.
- If set to 0, bar code labels are scanned.
- **Note:** Data transfer elements are not scanned. If cartridge bar code labels in data transfer elements are not known, the cartridge is scanned during a MOVE MEDIUM command from the data transfer element.

## Status

**Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier combinations.

After processing the INITIALIZE ELEMENT STATUS command, the library returns a status byte as follows:

**Good** The library returns a Good status when it can process the command without errors.

#### **Check Condition**

The library returns a Check Condition status when the following situations occur:

- A Unit Attention condition is pending for the initiator.
- An unrecoverable hardware error is experienced.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.
- A problem is encountered while scanning the cartridges.
- The library is not ready because it is offline.

## **INITIALIZE ELEMENT STATUS WITH RANGE (E7h)**

The INITIALIZE ELEMENT STATUS WITH RANGE command causes the 3582 Tape Library to examine a range of cells for cartridge presence. Bar code labels are scanned if a scanner is installed. Use the READ ELEMENT STATUS command to return the information obtained by the INITIALIZE ELEMENT STATUS WITH RANGE command.

If the inventory is valid, no scan will be performed.

The library supports two Initialize Element Status commands:

- The INITIALIZE ELEMENT STATUS WITH RANGE command updates a specific part of the cartridge inventory.
- The INITIALIZE ELEMENT STATUS command updates the entire cartridge inventory.

## CDB Format

#### The INITIALIZE ELEMENT STATUS WITH RANGE CDB format is shown in Table 9.

Table 9. Initialize Element Status With Range CDB

Bits	7	6	5	4	3	2	1	0	
Bytes									
0		Op Code (E7h)							
1	Log	ical Unit Num	nber		Reserved				
2	MSB								
:		Starting Element Address							
3		LSB							
4		Reserved							
5		Reserved							
6	MSB								
:		Number of Elements							
7		LSB							
8				Rese	erved				
9	NoScan				Control				

## **Parameters**

#### Logical Unit Number

This field is ignored.

#### Range

This field indicates which elements to check. Values are:

- **0** Initialize all elements.
- 1 Initialize the range of elements specified by the Element Address field and Number of Elements field.

#### **Starting Element Address**

The Starting Element Address specifies the start address of a set of Element Addresses. This field is ignored if the Range field is 0.

Note: The Starting Element Address must be a valid element address.

#### Number of Elements

This field specifies the number of elements to scan. This field is ignored if the Range field is 0.

#### NoScan

This bit in the vendor-specific field of the Control byte indicates whether cartridge labels should be scanned with the bar code scanner.

- Set to 1 if you do not want bar code labels to be scanned.
- Set to 0 if you want bar code labels to be scanned.
- **Note:** A request to scan only one or more occupied data transfer elements will be rejected because data transfer elements are not scanned. If the range spans across data transfer elements, the command is performed without scanning data transfer elements. Cartridges in data transfer elements are scanned during a Move Medium request from a data transfer element to a new destination.

## Status

After processing the INITIALIZE ELEMENT STATUS WITH RANGE command, the library returns a status byte as follows:

**Good** The library returns a Good status when it can process the command without errors.

#### Check Condition

The library returns a Check Condition status when the following situations occur:

- A Unit Attention condition is pending for the initiator.
- The library has experienced an unrecoverable hardware error.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.
- The library encounters a problem while scanning the cartridges.
- The library is not ready because it is offline.
- **Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier combinations.

## **INQUIRY (12h)**

The INQUIRY command requests that the 3582 Tape Library return information about its device parameters.

## **CDB** Format

The INQUIRY CDB format is shown in Table 10.

Table 10. Inquiry CDB

Bits	7	6	5	4	3	2	1	0		
Bytes										
0		Op Code (12h)								
1	Log	jical Unit Num	nber		Reserved					
2		Page Code								
3				Rese	erved					
4		Allocation Length								
5				Cor	ntrol					

## **Parameters**

#### Logical Unit Number

This field is ignored.

#### Enable Vital Product Data (EVPD)

The EVPD bit indicates which Vital Product Data pages option to report. Set the EVPD bit to request the following:

- **0** Standard inquiry data. See Table 11 on page 29.
- 1 Vital product data, based on the Page Code field. See Table 12 on page 31.
- Page Code

This field contains the page number of the vital product data page to be returned for this INQUIRY command, if the EVPD bit is set to 1. The library supports the following page codes:

- **00h** Supported Vital Product Data pages
- 80h Unit Serial Number page
- **C0h** Firmware Revision page
- **D0h** Vendor Specific page
- E0h Implemented SCSI Command page
- E1h Implemented Vendor Specific Command page
- FFh Failover Key page

Note: The page code must be set to 0h if the EVPD bit is set to 0.

#### Allocation Length

The Allocation Length field specifies the maximum number of bytes that were allocated for returned inquiry data. An Allocation Length of 0 indicates that no Inquiry data is to be transferred. This condition is not considered an error. The library transfers the lesser of either the number of bytes specified by the Allocation Length field or all of the available inquiry data. The lengths for inquiry data returned by the library are:

- 3Ah (58) bytes for the standard inquiry data
- 09h (9) bytes of Supported Vital Product Data page
- 16h (22) bytes for the Unit Serial Number page
- 1Ah (26) bytes for the Firmware Revision page
- 16h (22) bytes for the Supported SCSI-2 Command page
- 05h (5) bytes for the Vendor-Specific Command page
- 24h (36) bytes for the Failover Key page

## Response

The INQUIRY response returns information as shown in Table 11.

Table 11. IBM standard inquiry data format

Bits	7	6	5	4	3	2	1	0		
Bytes										
0	Pe	ripheral Qual	ifier		Perip	heral Device	Туре			
1	RMB			Dev	ice-Type Mod	difier				
2	ISO V	ersion	ECMA	Version		ANSI-Appro	oved Version			
3	AENC	AENC TrmIOP NormACA HiSupport Response Data Format								
4		Additional Length								
5				Rese	erved					
6	BQue	EncSrv (0)	BarC	Multip (0)	Mchngr (0)	Obsolete	Addr32 (0)	Addr 16		
7	RelAdr	WBus32	WBus16	Sync	Linked	Rsvd	Cmd Que	SftRe		
8	MSB									
:		Manufacturer								
15		LSB								
16	MSB									
:	Device Type and Model Number									
31								LSB		
32	MSB									
:				Product Re	vision Level					
35								LSB		
36	MSB									
:			IB	M Plant of Ma	anufacture Co	ode				
37								LSB		
38	MSB									
:				Serial Numb	er of Device					
49								LSB		
50										
:				ASCI	I "00"					
51										

## INQUIRY (12h)

#### Table 11. IBM standard inquiry data format (continued)

52				
:	Rese	erved		
55				
56	Reserved	Clocking	QAS (0b)	IUS (0b)
57	Rese	erved		

#### **Peripheral Qualifier**

This field is always set to 00b.

#### **Peripheral Device Type**

The value returned by this field is set to 01000b, indicating a Medium Changer device.

**RMB** The Removable Medium Bit is set to 1 to indicate that media is removable.

#### **Device-Type Modifier**

Returned as 0000000b, indicating no modification.

#### **ISO Version**

Returned as 00b.

#### **ECMA Version**

Returned as 00b.

#### **ANSI (Approved Version)**

Returned as 0010b, indicating compliance with ANSI Version SCSI-2.

#### Asynchronous Event Notification Capability (AENC)

Returned as 0b, which indicates that AENC is not supported.

#### Terminate I/O Process (TrmIOP)

Returned as 0b, which indicates that TrmIOP message is not supported.

#### Additional Length

Returned as 35h, which indicates 53 additional bytes of data, exclusive of the Additional Length byte, that is available to the initiator.

**BQue** For SCSI devices, the BQue field is set to 0 to indicate that the drive does not support tagged queueing.

For Fibre Channel devices, the BQue field is set to 1 to indicate that the drive supports tagged queueing.

#### Barcode (BarC)

Returned as 0b if a bar code scanner is not configured.

Returned as 1b if a bar code scanner is configured.

#### 16 Bit Addressing (Addr16)

For SCSI devices, the Addr16 field is set to 1 to indicate that the drive supports 16 SCSI IDs.

For Fibre Channel devices, this field is set to 0.

#### **Relative Address (RelAdr)**

Returned as 0b, which indicates that the library does not support relative addressing.

#### Wide Bus 32 (Wbus32)

Returned by the drive to indicate whether it supports 32-bit transfers.

#### Wide Bus 16 (Wbus16)

Returned by the drive to indicate whether it supports 16-bit transfers.

#### Synchronous Transfer (Sync)

Returned by the drive to indicate whether it supports synchronous transfers.

#### Linked Commands (Linked)

Returned as 0b, which indicates that linked commands are not supported.

#### Command Queuing (CmdQue)

Returned as 0b, which indicates that command queuing is not supported.

#### Soft Reset (SftRe)

Returned as 0b to indicate that the library does not support a soft reset alternative to a reset condition.

#### Manufacturer

Returns the manufacturer name, depending on the selected library compatibility mode.

In native mode, the vendor identification field reports "IBM". Unused bytes are padded with the space character.

**Note:** The compatibility mode applies to the INQUIRY command only. SCSI command processing performs as described in this manual.

#### **Device Type and Model Number**

Reports the library model, depending on the selected compatibility mode.

In native mode the product identification field reports "ULT3582-TL". Unused bytes are padded with the space character.

#### **Production Revision Level**

Returned as the ASCII representation of the firmware revision level. Unused bytes are padded with the space character.

#### IBM Plant of Manufacture Code

Returned as the ASCII representation of the manufacturing facility. Unused bytes are padded with the space character.

#### Serial Number of Device

Returned as right justified with leading zeros (in ASCII).

- **QAS** Quick Arbitrates Support (QAS) is set to 0 to indicate the drive does not support quick arbitration and selection.
- **IUS** Information Unit Support (IUS) is set to 0 to indicate the drive does not support information unit transfers.

#### Supported Vital Product Data Page (00h)

Table 12 shows the format of the Supported Vital Product Data page.

|--|

Bits	7	6	5	4	3	2	1	0		
Bytes										
0	Pe	ripheral Quali	fier	Peripheral Device Type						
1		Page Code = 00h								
2		Reserved								
3		Page Length = 7h								
4		First Page Code Supported								

## INQUIRY (12h)

Table 12. Supported vital product data page (continued)

5	Second Page Code Supported
6	Third Page Code Supported
7	Fourth Page Code Supported
8	Fifth Page Code Supported
9	Sixth Page Code Supported
10	Seventh Page Code Supported

#### **Peripheral Qualifier**

This field is set to 00b.

#### **Peripheral Device Type**

The value returned by this field is set to 01000b, indicating a Medium Changer device.

#### Page Code

Returned as 00h, which indicates the Supported Vital Product Data page.

#### Page Length

Returned as 07h, which indicates the remaining bytes in this page exclusive of the Page Length byte.

#### First Page Code Supported

Returned as 00h, which indicates support for the Supported Vital Product Data page.

#### Second Page Code Supported

Returned as 80h, which indicates support for the Unit Serial Number page.

#### Third Page Code Supported

Returned as C0h, which indicates support for the Firmware Revision page.

#### Fourth Page Code Supported

Returned as D0h, which indicates support for a page that is not described here.

#### Fifth Page Code Supported

Returned as E0h, which indicates support for the Implemented SCSI-2 Command page.

#### Sixth Page Code Supported

Returned as E1h, which indicates support for the Implemented Vendor Specific Command page.

#### Seventh Page Code Supported

Returned as FFh, which indicates support for the Implemented Failover Key page.

#### Unit Serial Number Page (80h)

Table 13 shows the format of the Unit Serial Number page.

Table 13. Unit Serial Number page

Bits	7	6	5	4	3	2	1	0		
Bytes										
0	Pe	ripheral Quali	fier		Peripheral Device Type					
1		Page Code = 80h								
2		Reserved								

Table 13. Unit Serial Number page (continued)

3	Page Length = 10h
4	
:	Serial Number
15	
16	
:	First Storage Element
19	

#### **Peripheral Qualifier**

This field is set to 00b.

#### **Peripheral Device Type**

The value returned by this field is set to 01000b, indicating a Medium Changer device.

#### Page Code

The value returned for this field is 80h, which is the Page Code for the Unit Serial Number page.

#### Page Length

The value returned for this field is 10h, which indicates the number of remaining bytes in this page exclusive of the Page Length byte.

#### Serial Number

Right justified with leading zeros in ASCII (same as Inquiry Standard Data bytes 38-49).

#### **First Storage Element**

This is the ASCII representation of four hexadecimal digits of the element address of the first storage slot.

## Firmware Revision Page (C0h)

Table 14 shows the format of the Firmware Revision page.

Table 14. Firmware Revision page

Bits	7	6	5	4	3	2	1	0	
Bytes									
0		Periphera	I Qualifier		Peripheral Device Type				
1		Page Code = C0h							
2		Reserved							
3				Page Len	gth = 16h				
4	MSB								
:		Revision							
25								LSB	

#### **Peripheral Qualifier**

This field is set to 00b.

#### Peripheral Device Type

The value returned by this field is set to 01000b, indicating a Medium Changer device.

#### Page Code

The value returned for this field is C0h, which is the Page Code for the Firmware Revision page.

### Page Length

The value returned for this field is 16h, which indicates the number of remaining bytes in this page exclusive of the Page Length byte.

#### Revision

Returned as the ASCII representation (22 bytes) of the firmware revision level in the form Firmware Revision=xxxx, where xxxx is equal to the firmware level.

## Inquiry Page (D0h)

The contents of this page are not specified in this document.

## Implemented SCSI-2 Command Page (E0h)

Table 15 shows the format of the Implemented SCSI-2 Command Page.

Table 15. Implemented SCSI-2 Command page (E0h)

Bits	7	6	5	4	3	2	1	0		
Bytes										
0	Pe	ripheral Qual	ifier		Perip	heral Device	Туре			
1		Page Code = B0h								
2		Reserved								
3				Page Ler	igth = 12h					
4				TEST UNIT	READY 00h					
5				REZERO	UNIT 01h					
6				REQUEST	SENSE 03h					
7			INI	FIALIZE ELEM	ENT STATUS	6 07h				
8				INQUI	RY 12h					
9		RESERVE 16h								
10		RELEASE 17h								
11		MODE SELECT 15h								
12				MODE SE	ENSE 1Ah					
13				SEND DIAG	NOSTIC 1Dh					
14			PREVE	NT/ALLOW M	EDIUM REMO	OVAL 1Eh				
15			F	POSITION TO	ELEMENT 2	Зh				
16				WRITE BL	JFFER 3Bh					
17				READ BU	FFER 3Ch					
18		LOG SELECT 4Ch								
19				LOG SE	NSE 4Dh					
20				MOVE ME	DIUM A5h					
21			F		IT STATUS B	8h				

#### **Peripheral Qualifier**

This field is set to 00b.

#### **Peripheral Device Type**

The value returned by this field is set to 01000b, indicating a Medium Changer device.

#### Page Code

The value returned for this field is E0h, which is the Implemented SCSI-2 Command page.

#### Page Length

The value returned for this field is 12h, which indicates the number of remaining bytes in this page exclusive of the Page Length byte.

#### **Implemented SCSI-2 Commands**

Byte 4 through byte 20 list the implemented SCSI-2 commands for the 3582 Tape Library. See Table 5 on page 18 for the command code associated with each command.

#### Vendor Specific Page (E1h)

The contents of this page are not specified in this document.

### Failover Key Page (FFh)

Table 16 shows the format of the Failover Key Page.

Table 16. Failover Key page (FFh)

Bits	7	6	5	4	3	2	1	0	
Bytes									
0	Peripheral Qualifier			Peripheral Device Type					
1				Page Co	de = C0h				
2		Reserved							
3				Page Len	gth = 20h				
4	MSB								
:		Failover Key							
35								LSB	

#### **Peripheral Qualifier**

This field is set to 00b.

#### **Peripheral Device Type**

The value returned by this field is set to 01000b, indicating a Medium Changer device.

#### Page Code

The value returned for this field is C0h, which is the page code for the Firmware Revision page.

#### Page Length

The value returned for this field is 16h, which indicates the number of remaining bytes in this page exclusive of the Page Length byte.

#### **Failover Key**

The value indicates if failover is enabled.

## Status

After processing the INQUIRY command, the library returns a status byte as follows:

**Good** The library returns a Good status when it can process the command without errors.

#### **Check Condition**

The library returns a Check Condition status when a reserved bit is set to 1 or a parameter is invalid in the CDB.

**Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier combinations.

## LOG SELECT (4Ch)

The LOG SELECT command allows the host to set statistical information for the 3582 Tape Library.

This command can be used to press operator panel buttons.

## **CDB** Format

	log Colool	000							
Bits	7	6	5	4	3	2	1	0	
Bytes									
0				Op Cod	le (4Ch)				
1	Logic	al Unit Nu	mber		Reserved		PCR	SP	
2	Р	С		•	Rese	erved	•		
3				Rese	erved				
4				Rese	erved				
5				Rese	erved				
6				Rese	erved				
7	MSB								
8		Parameter List Length							
								LSB	
9				Cor	ntrol				

Table 17. Log Select CDB

## **Parameters**

#### Logical Unit Number

This field is ignored.

- **PCR** The Parameter Code Reset (PCR) bit must be set to 0. Log Parameters cannot be reset.
- **SP** The Save Parameter (SP) bit must be set to 0. The library does not support saving of parameters.
- **PC** The Page Control (PC) field defines the type of parameter values to be selected. See Table 18.

Table 18. Page Control field

Туре	Log Select Parameter Values
00b	Current threshold values
01b	Current cumulative values
10b	Default threshold values
11b	Default cumulative values

The PC field is always set to 01b. This value causes the library to apply cumulative values of any log parameter rather than threshold or default values.

#### Parameter List Length

The Parameter List Length field specifies the length in bytes of the LOG SELECT parameter list that is transferred during the DATA OUT phase. The

parameter list length is equal to the length of a single Parameter List Header (4 bytes) plus the lengths of the page to be transferred. See Table 19.

Table 19. Log Select pages

Page	Length in bytes
Operator Panel Button page	05h

## **Parameter List Header**

Table 20. Parameter List header

Bits	7	6	5	4	3	2	1	0		
Bytes										
0	Rese	erved			Page	Code				
1				Rese	erved					
2	MSB	<i>I</i> /SB								
3				Page Ler	ngth (n-3)					
								LSB		
4			I	Log Param	eter (First	)				
: n										
		Log Parameter (Last)								

#### Page Code

Identifies which log page is being transferred. See Table 19 for the legal values.

#### Page Length

The total number of bytes that follow the Page Length if it is more than a byte. The value set for this field depends on the value specified for the Page Code.

#### Log Parameters

Valid Log Parameters are: LCD Panel Button Log page.

#### Log Parameter Format

Following the four-byte page header are one or more log parameters. Table 21 indicates the format of the log parameter structure.

Table 21. Log Parameter format

	Bits	7	6	5	4	3	2	1	0		
Bytes											
0		MSB									
1			Parameter Code								
			LSB								
2		DU=0	DS=1 TSD=0 ETC=0 TMC=0 RSVD LP						LP=1		
3		Parameter Length (n-4)									

Table 21. Log Parameter format (continued)

4	Log Parameter (First)
:	
n	
	Log Parameter (Last)

#### **Parameter Code**

The Parameter Code field identifies which log parameter was transferred. The valid values for this field depend on the type of transferred log page.

#### **Disabled Update (DU)**

The DU parameter control bit is always 0, which indicates that the library updates the log parameter value to reflect all events that should be recorded by that parameter.

#### **Disable Save (DS)**

The DS parameter control bit is always 1, which indicates that the library does not support saving of the particular log parameter.

#### Target Save Disable (TSD)

The TSD parameter control bit is always 0, which indicates that the library provides a self-defined method for saving log parameters.

#### **Enable Threshold Comparison (ETC)**

The ETC parameter control bit is always 0, which indicates a comparison to the threshold value is not performed whenever the cumulative value is updated.

#### **Threshold Met Criteria (TMC)**

The TMC parameter control bit is always 0, which indicates the basis for comparison of the cumulative and threshold values.

#### List Parameter (LP)

The LP parameter control bit is set to 0 for counter data and set to 1 for a list parameter.

#### Parameter Length

The number of bytes that follow exclusive of the Parameter Length field.

#### **Parameter Value**

The Parameter Value field can be designated by one of the following:

- A data counter for an event.
- A value that indicates the state of a component of the library hardware. If this field is 1, the state of the component is on. If this field is 0, that state of the component is off.

## **Operator Panel Button Log Page (38h)**

The Operator Panel Button Log page provides a means to press Operator Panel Buttons, which in combination with the READ BUFFER command, provide a means to navigate through and view the Operator Panel display. Table 22 shows the Operator Panel Button Log page format.

Table 22.	Operator	Panel	Button	Log	page	format
-----------	----------	-------	--------	-----	------	--------

Bits	7	6	5	4	3	2	1	0			
Bytes											
0											
1		Parameter Code (Button Number)									

Table 22. Operator Panel Button Log page format (continued)

2	DU=0	DS=1	TSD=0	ETC=0	TMC=0	RSVD	LP=1			
3		Parameter Length=1h								
4		Reserved F								

#### **Parameter Code**

The parameter code indicates which button should be pressed. See Table 23.

Table 23. Button numbers

Button Number (hex)	Name	Description
1	Button — UP	UP button
2	Button — DOWN	DOWN button
3	Button — LEFT	LEFT button
4	Button — RIGHT	RIGHT button
5	Button — ACTION	ACTION button

#### **Parameter Length**

The number of bytes that follow exclusive of the Parameter Length field. The length is set to 1h.

#### Pressed

Set to 1 if button shall be pressed.

Set to 0 if button shall not be pressed.

## Status

After processing the LOG SELECT command, the library returns a status byte as follows:

**Good** The library returns a Good status when the library processes the command without errors.

#### **Check Condition**

The library returns a Check Condition status when the following situations occur:

- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.
- The library detects a noncorrectable parity error while receiving the LOG SELECT data.
- A parameter in the LOG SELECT data is invalid.
- **Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier combinations.

## LOG SENSE (4Dh)

The LOG SENSE command allows the initiator to retrieve statistical information about the 3582 Tape Library.

## **CDB** Format

The LOG SENSE CDB format is shown in Table 24.

Table 24. LOG SENSE CDB

	Bits	7	6	5	4	3	2	1	0	
Bytes										
0					Op Cod	e (4Dh)				
1		Logical Unit Number				Reserved		PPC	SP	
2		Р	С			Page	Code			
3					Rese	erved				
4					Rese	erved				
5		MSB								
					Paramete	er Pointer				
6									LSB	
7		MSB								
					Allocatio	n Length				
8			LSB							
9					Cor	ntrol				

## **Parameters**

- **PPC** The Parameter Pointer Control (PPC) bit is always 0. A Parameter Pointer Control bit value of 0 requests that the library return data starting with the parameter code specified in the Parameter Pointer field and return the number of bytes specified in the Allocation Length field in ascending order. A PPC bit of 0 and a Parameter Pointer field of 0 requests that the library return all available parameter data for that page code.
- **SP** The Save Parameters (SP) bit is always set to 0 and indicates that the library performs the LOG SENSE command and does not save the log parameters.
- **PC** The Page Control (PC) field is always set to 01b. This value causes the library to return cumulative values of any log parameter rather than threshold or default values.

**Note:** A request for Log Page 2Eh supports PC 00b and 01b to return threshold or cumulative values.

#### Page Code

The Page Code field identifies which log page is being requested by the initiator. See Table 25 on page 42. If the page is not supported, the command terminates with a CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the ASC/ASCQ set to INVALID FIELD IN CDB.

## LOG SENSE (4Dh)

Page Code	Page Name	Page Description
00h	Supported Log Pages	Returns list of supported log pages
2Eh	TapeAlert Log	Returns the 64 TapeAlert flags
30h	System Statistics Log	Returns system statistics and retry counts
31h	Sensor State Log	Returns system sensor state information
32h	History of Failure Events Log	Returns history of most recent failure events
33h	Element Statistics Log	Returns element statistics and retry counts
34h	Cartridge Scan Retries Log	Returns number of times the library had to retry scanning the cartridge at a specific element address
38h	LCD Panel Button Log	Returns LCD Panel button settings information
3Ah	Drive Status Log	Returns drive status information
3Bh	Drive Error Data Log	Returns drive error information
3Ch	Drive Cleaning Support Log	Returns drive cleaning support
3Dh	Drive Information Log	Returns drive information
3Eh	Supported Media Log	Returns media support information for installed drives

Table 25. Legal values for Page Code field

#### **Parameter Pointer**

The Parameter Pointer field enables the initiator to specify at which parameter within a log page the requested data should begin.

- **Note:** Except for the History of Failure Events log page, a Parameter pointer of 0 requests all available log parameters for the specified log page.
- When requesting the TapeAlert Log page, the Parameter Pointer specifies the first tape alert flag from which parameter data is to be sent. The library returns data for the specified flag and all other flags in ascending order.
- When requesting the System Statistic Log page or the Sensor State Log page, the Parameter Pointer specifies the first Log Parameter Code from which parameter data is to be sent. The library returns data for the specified code and all other codes in ascending order.
- When requesting the LCD Panel Button Log page, the Parameter Pointer specifies the first button number from which parameter data is to be sent. The library returns data for the specified button and all other buttons in ascending order.
- When requesting the History of Failure Events Log page, the Parameter Pointer specifies an index value between -49 and 0. The library returns a history failure record for that index and all other indices, in previous to most recent order, for up to 50 events, where 0 is the index of the most recent failure event and -49 is the index of the oldest failure event.
- When requesting the Element Statistics Log page, the Cartridge Scan Retries Log page, the Drive Error Data Log page, the Drive Status Log page, or the Drive Information Log page, the Parameter Pointer specifies an element address value. The library returns the parameter data for that element and all other elements in ascending order. Data is returned until

the value specified in the Allocation Length field has been reached or until the library completes sending parameter data for the element with the highest element address.

- When the initiator requests the Supported Media Log page, the Parameter Pointer specifies a media domain or type. The library returns the parameter data for that domain or type and all other domains or types in ascending order. Data is returned until the value specified in the allocation length field has been reached or until the library completes parameter data for the highest domain or type definition.
- When the initiator requests the Drive Cleaning Log page, the Parameter Pointer specifies a drive domain or type. The library returns the parameter data for that domain or type and all other domains or types in ascending order. Data is returned until the value specified in the allocation length field has been reached or until the library completes parameter data highest domain or type definition.

#### **Allocation Length**

The Allocation Length field is used to determine the maximum amount of returned data. If the Allocation Length value exceeds the amount of transfer data, the library terminates the Data In phase after all of the data transfers. Specify FFFFh to include all available data.

## Response

The Log Sense command returns a single log page specified in the Page Code field of the CDB.

#### Log Page Format

The following is a description of the log pages and their respective log page structure. The four-byte page header, followed by zero or variable length log parameters, is returned in ascending order. See Table 26.

Bits	7	6	5	4	3	2	1	0
Bytes								
0	Rese	Reserved Page Code						
1		Reserved						
2	MSB	ISB						
:		Page Length (n-3)						
3								LSB
4		Log Parameter (First)						
:								
n	Log Parameter (Last)							

Table 26. Log Sense page header format

#### Page Code

The Page Code field identifies which log page is being transferred. See Table 25 on page 42 for the legal values.

#### Page Length

The Page Length field may indicate the total number of bytes that follow the Page Length byte or the amount of data that may be returned. The value returned for this field depends on the value specified for the Page Code and the Parameter Pointer in the CDB. See "CDB Format" on page 41.

#### Log Parameters

Log Parameters are data structures that are contained in log pages as follows:

- Data counters that capture a count of a particular event
- A numeric value indicating the state of the library hardware
- · A string that contains the library failure event history

#### Log Parameter Format

Following the four-byte page header are one or more log parameters. Table 27 indicates the format of the log parameter structure.

	Bits	7	6	5	4	3	2	1	0	
Bytes										
0		MSB	MSB							
			Parameter Code							
1									LSB	
2		DU	DS	TSD	ETC	TN	/IC	RSVD	LP	
1					Parameter I	_ength (n-3)				
4										
:					Paramet	er Value				
n										

#### **Parameter Code**

The Parameter Code field identifies which log parameter was transferred. The valid values for this field depend on the type of requested log page.

#### **Disabled Update (DU)**

The DU parameter control bit is always 0, which indicates that the library updates the log parameter value to reflect all events that should be recorded by that parameter.

#### **Disable Save (DS)**

The DS parameter control bit is always 1, which indicates that the library does not support saving of the particular log parameter.

#### Target Save Disable (TSD)

The TSD parameter control bit is always 0, which indicates that the library provides a self-defined method for saving log parameters.

#### **Enable Threshold Comparison (ETC)**

The ETC parameter control bit is always 0, which indicates that a comparison to the threshold value is not performed whenever the cumulative value is updated.

#### Threshold Met Criteria (TMC)

The TMC parameter control bit is always 0, which indicates the basis for comparison of the cumulative and threshold values.

#### List Parameter (LP)

The LP parameter control bit is set to 0 for counter data and set to 1 for a list parameter.

#### **Parameter Length**

The Parameter Length field specifies the length in bytes of the Parameter Value field.

#### **Parameter Value**

The Parameter Value field can be designated by one of the following:

- A data counter for an event which can be either a one-byte flag or two-byte or four-byte value.
- A value that indicates the state of a component of the library hardware. If this field is 1, the state of the component is on. If this field is 0, that state of the component is off.
- A string that describes a history event.

## Supported Log Page (00h)

The Supported Log Page lists all log pages that the 3582 Tape Library supports. Table 28 lists the format for the log page header and respective supported log pages.

Table 28. Supported log page

Bits	7	6	5	4	3	2	1	0	
Bytes									
0	Reserved		Page code						
1		Reserved							
2		David Langth (200D)							
3				Tage Leng	un – 000Dh				
4				Supported Lo	g Page (00h)				
5				TapeAlert I	Page (2Eh)				
6			Sys	stem Statistics	Log Page (3	30h)			
7			S	ensor State L	og Page (31	h)			
8			History	of Failure Ev	ents Log Pag	je (32h)			
9			Elei	ment Statistic	s Log Page (3	33h)			
10			Cartric	dge Scan Ret	ries Log Page	e (34h)			
11			LC	D Panel Butto	n Log Page (	(38)			
12			C	Drive Status L	og Page (3Ał	ו)			
13		Drive Error Data Log Page (3Bh)							
14		Drive Cleaning Support Log Page (3Ch)							
15			Driv	ve Information	Log Page (3	BDh)			
16			Sup	ported Media	Log Page (3	BEh)			

#### Page Code

This value is always 000000b for the Support Log Pages.

#### Page Length

This value is 000Dh.

#### TapeAlert Log Page (2Eh)

The TapeAlert Log page returns all 64 TapeAlert flags. Each flag is reported in the format as shown in Table 29 on page 46.

## LOG SENSE (4Dh)

Table 29. TapeAlert format

	Bits	7	6	5	4	3	2	1	0		
Bytes											
0			Parameter Code								
1			Parameter Code								
2		DU = 0	DS = 1	TSD = 0	ETC = 0	ТМС	C = 0	RSVD	LP = 0		
3			Parameter Length = 01h								
4		Reserved TA flag									

#### Parameter Code

The Parameter Code field is set to the TapeAlert flag number.

#### Parameter Length

The Parameter Length field is set to 0x01.

#### TA Flag

This field is set to 1 if set.

Flags 1, 2, 3, 4, 7, 8, 13, 14, 15, 16, 17, 19, 20, 21, 23, 24, 28, and 32 are supported by the 3582 Tape Library.

#### System Statistics Log (30h)

The System Statistics Log page returns the cumulative library system statistics from nonvolatile RAM. See Table 30. The format is shown in Table 27 on page 44. These values are not reset after power cycles or resets.

Table 30. System statistics saved in nonvolatile RAM

Log Parameter Function	Log Parameter Code	DU	DS	TSD	ETC	тмс	LP	Parameter Length
Total Number of Swaps	0000h	0	1	0	0	0	0	4
Total Number of Pick Retries	0001h	0	1	0	0	0	0	4
Total Number of Put Retries	0002h	0	1	0	0	0	0	4
Total Number of Scans	0003h	0	1	0	0	0	0	4
Total Number of Scan Retries	0004h	0	1	0	0	0	0	4
Total Number of Move Retries	0005h	0	1	0	0	0	0	4
Total Number of I/E Station Cycles	0006h	0	1	0	0	0	0	4

#### Sensor State Log (31h)

The Sensor State Log page returns the current sensor states for various system sensors. See Table 31. The format is shown in Table 27 on page 44.

Table 31. Sensor state information

Log Parameter Function	Log Parameter Code	DU	DS	TSD	ETC	тмс	LP	Parameter Length
Door Open Sensor	0000h	0	1	0	0	0	1	1
Door Lock Sensor	0001h	0	1	0	0	0	1	1

Log Parameter Function	Log Parameter Code	DU	DS	TSD	ETC	тмс	LP	Parameter Length
Retract Sensor (See Note)	0002h	0	1	0	0	0	1	1
Cartridge Presence Sensor	0003h	0	1	0	0	0	1	1
Reserved	0004h	0	1	0	0	0	1	1
Magazine 1 Presence Sensor	0005h	0	1	0	0	0	1	1
Magazine 2 Presence Sensor	0006h	0	1	0	0	0	1	1
Reserved	0007h	0	1	0	0	0	1	1
IE Present Sensor	0008h	0	1	0	0	0	1	1
IE Lock Sensor	0009h	0	1	0	0	0	1	1
IE Open Sensor	000Ah	0	1	0	0	0	1	1

Table 31. Sensor state information (continued)

**Note:** The Retract Sensor Log page will report the gripper to be always retracted, regardless of the picker mechanism actually being retracted or not. The log parameter is provided for compatibility with other library models, where host applications might query the sensor state prior to issuing a MOVE MEDIUM command.

## History of Failure Events Log (32h)

The History of Failure Events Log page returns a history of the most recent failure events that have happened in the 3582 Tape Library. The library's history buffer contains up to 50 entries. It can receive up to 50 failure events in response to each LOG SENSE command.

Each of the failure events is a string that consists of six fields:

- The time stamp in hours, minutes, and seconds, indicating how long ago the failure event occurred.
- The Service Action Code (SAC), symbolizing the failure event.
- The error code that caused the SAC.
- The error type associated with the error code.
- The LCD alert number associated with the SAC.
- The Tape Alert flag associated with the SAC.

Table 32 shows the History of Events Log page format.

Table 32. History of Failure Events Log page format

Bits	7	6	5	4	3	2	1	0	
Bytes									
0	MSB	ISB							
		Parameter Code							
1		LSB							
2	DU = 0	DS = 1	TSD = 0	ETC = 0	ТМС	ς = 0	RSVD	LP = 1	
1		Parameter Length = 32h							
4									
:		50 character failure event							

Table 32. History of Failure Events Log page format (continued)

53

#### **Parameter Code**

The Parameter Code field indicates the index of the history failure record as follows:

- 0 is the index of the most recent failure event.
- -49 is the index of the oldest failure event.

#### **Parameter Length**

The Parameter Length field indicates the number of bytes that follow exclusive of the Parameter Length field. The value is 50.

#### Element Statistics Log (33h)

The Element Statistics page returns cumulative statistics of total cartridge puts, put retries, and pick retries. These values are stored in nonvolatile RAM for each element.

The value specified for the Parameter Pointer field of the CDB determines the value that is returned in the Parameter Code field of the Element Statistics page. This value specifies the first element for the returned information.

An Element Statistics page is returned in ascending order for all subsequent elements until the allocation length specified is reached or all information elements are returned.

# **Note:** The starting element address specified in the CDB must be a valid element address.

Table 33 shows the Element Statistics page format.

Bits	7	6	5	4	3	2	1	0	
Bytes									
0	MSB								
			Para	meter Code (	Element Add	ress)			
1		LSB							
2	DU = 0	DS = 1	TSD = 0	ETC = 0	ТМС	C = 0	RSVD	LP = 0	
3		Parameter Length = 0Ch							
4	MSB	SB							
:		Total Puts							
7								LSB	
8	MSB								
				Total Pu	t Retries				
9								LSB	
10	MSB								
:				Total	Picks				
13		LSB							
14	MSB								
		Total Pick Retries							

Table 33. Element Statistics page format

Table 33. Element Statistics page format (continued)

15	LSB

#### **Parameter Code**

The Parameter Code field indicates the element address for the returned statistical information.

#### Parameter Length

The Parameter Length field indicates the number of bytes that follow exclusive of the Parameter Length field. The value is 0x0C.

#### **Total Puts**

The Total Puts field indicates the total number of cartridge puts to the element location.

#### **Total Put Retries**

The Total Put Retries field indicates the total number of retry puts to the element indicated by the element address.

#### **Total Picks**

The Total Picks field indicates the total number of cartridge picks from the element location.

#### **Total Pick Retries**

The Total Pick Retries field indicates the number of retry pick operations from the element address.

#### Cartridge Scan Retries Log (34h)

The Cartridge Scan Retries page returns the total number of retried cartridge scans of the element address. This value is reset whenever the 3582 Tape Library is reset, powered on, or the magazines are exchanged.

The value specified for the Parameter Pointer field of the CDB determines the value that is returned in the Parameter Code field of the Cartridge Scan Retries page. This value specifies the first element for the returned information.

A Cartridge Scan Retries page is returned for all subsequent elements until the allocation length specified is reached or all element are returned.

**Note:** The element starting address specified in the CDB must be a valid element address.

Table 34 shows the Cartridge Scan Retries page format.

Bits	7	6	5	4	3	2	1	0
Bytes								
0	MSB							
				Paramet	er Code			
1								LSB
2	DU = 0	DS = 1	TSD = 0	ETC = 0	ТМС	c = 0	RSVD	LP = 0
3		Parameter Length = 0x02						
4	MSB							
				Total Sca	n Retries			
5								LSB

Table 34. Cartridge Scan Retries page format

#### **Parameter Code**

The Parameter Code field indicates the element address for the returned statistical information.

#### **Parameter Length**

The Parameter Length field indicates the number of bytes that follow exclusive of the Parameter Length field. The value is 2.

#### **Total Scan Retries**

The Total Scan Retries field indicates the total number of retried scans of the cartridge in the element address. Scan retries are kept with the cartridge and are reset each time the library is reset, powered-on, or the door is opened.

#### LCD Panel Button Log Page (38h)

The LCD Panel Button Log page returns parameters that indicate if a display panel button is pressed. Table 35 shows the LCD Panel Button page format.

Table 35. LCD Panel Button Log page format

Bits	7	6	5	4	3	2	1	0
Bytes								
0								
		Parameter Code (Button Number)						
1								
2	DU = 0	DS = 1	TSD = 0	ETC = 0	ТМС	ς = 0	RSVD	LP = 1
3		Parameter Length = 01h						
4	Reserved Pressed							

#### **Parameter Code**

The Parameter Code is the button number. See Table 36.

#### Table 36. Button numbers

Button Number (hex)	Name	Description
1	Button - UP	UP button
2	Button - DOWN	DOWN button
3	Button - LEFT	LEFT button
4	Button - RIGHT	RIGHT button
5	Button - ACTION	ACTION button

- 01h Button\_UP
- 02h Button\_DOWN
- 03h Button\_LEFT
- 04h Button\_RIGHT
- 05h Button\_ENTER

#### **Parameter Length**

The Parameter Length field indicates the number of bytes that follow exclusive of the Parameter Length field. This value is 01h.

#### Pressed

This field is set to 1 if button is pressed, 0 if not pressed.

## Drive Status Log Page (3Ah)

The Drive Status Log page returns drive status. Table 37 shows the Drive Status Log page format.

Table 37. Drive Status Log page format

Bits	7	6	5	4	3	2	1	0
Bytes								
0	MSB							
			Para	meter Code (	Element Add	ress)		
1								LSB
2	DU = 0	DS = 1	TSD = 0	ETC = 0	ТМС	C = 0	RSVD	LP = 0
3		Parameter Length = 03h						
4								
	Drive Domain or Type							
5								
6	RSVD	СР	CN	CA	CS	TR	DR	DC

#### Parameter Code

The Parameter Code is the Drive Transport element address.

#### Parameter Length

The Parameter Length field indicates the number of bytes that follow exclusive of the Parameter Length field. The value of this field is 03h.

#### **Drive Domain or Type**

This field indicates drive domain and drive type. See Table 40 on page 53.

#### **CP** (Cleaning Possible)

The CP bit, if set, indicates that cleaning of this drive by the library is possible.

#### **CN (Cleaning Needed)**

The CN bit, if set, field indicates that cleaning is requested by this drive.

#### CA (Cleaning Active)

The CA bit, if set, indicates that automatic library initiated cleaning is activated for this drive.

#### CS (Cleaning Supported)

The CS bit, if set, indicates that cleaning is supported for this drive.

#### **TP (Tape Present)**

If the DC bit is set to 0, this bit is undefined.

- If the DC bit and the DR bit are set to 1, the following conditions apply:
- If the TP bit is set to 0, a tape is not present.
- If the TP bit is set to 1, a tape is present.

#### DR (Drive Ready)

If the DC bit is set to 0, this bit is undefined.

If the DC bit is set to 1, the following conditions apply:

- The DC bit, if set to 1, indicates the drive is ready for library communication.
- If set to 0, the DR bit indicates the drive is not ready for library communication.

#### **DC (Drive Communication)**

The DC bit, if set to 1, indicates this drive is capable of drive communication with the library. If set to 0, indicates this drive is not capable of communicating with the library.

### Drive Error Data Log Page (3Bh)

The Drive Error Data Log page returns drive information for error analysis. Table 38 shows the Drive Error Data page format.

Table 38. Drive Error Data Log page format

Bits	5 7	6	5	4	3	2	1	0
Bytes								
0	MSB							
			Para	ameter Code	(Element Add	dress)		
1								LSB
2	DU = 0	DS = 1	TSD = 0	ETC = 0	ТМС	C = 0	RSVD	LP = 0
3				Paramet	er Length			
4								
				Drive Dom	ain or Type			
5								
6	Tape Alert Major Revision							
7		Tape Alert Minor Revision						
8	Flag 8	Flag 7	Flag 6	Flag 5	Flag 4	Flag 3	Flag 2	Flag 1
9	Flag 16	Flag 15	Flag 14	Flag 13	Flag 12	Flag 11	Flag 10	Flag 9
10	Flag 24	Flag 23	Flag 22	Flag 21	Flag 20	Flag 19	Flag 18	Flag 17
11	Flag 32	Flag 31	Flag 30	Flag 29	Flag 28	Flag 27	Flag 26	Flag 25
12	Flag 40	Flag 39	Flag 38	Flag 37	Flag 36	Flag 35	Flag 34	Flag 33
13	Flag 48	Flag 47	Flag 46	Flag 45	Flag 44	Flag 43	Flag 42	Flag 41
14	Flag 56	Flag 55	Flag 54	Flag 53	Flag 52	Flag 51	Flag 50	Flag 49
15	Flag 64	Flag 63	Flag 62	Flag 61	Flag 60	Flag 59	Flag 58	Flag 57
16		•		Reported E	Error Length			
17								
:				Raw Drive Er	ror Informatio	on		
144								

#### **Parameter Code**

The Parameter Code is the Drive Transport element address.

#### Parameter Length

The Parameter Length is the length of the parameter data, which may be from 13 bytes up to 141 bytes.

#### **Drive Domain or Type**

This field indicates drive domain and drive type. See Table 40 on page 53.

#### **Tape Alert Major Revision**

This field is set to the Tape Alert major revision number. This field is set to 0 if not present.

#### **Tape Alert Minor Revision**

This field is set to the Tape Alert minor revision number. This field is set to 0 if not present.

#### Flags 1 - Flags 64

This field is set according to the Tape Alert Flag Specifications for the drive.

#### Reported Error Length

This field indicates how much raw drive error information follows. This field is set in the range 0h - 80h.

#### **Raw Drive Error Information**

This field is a report of raw drive error bytes, as defined by the drive's serial communication interface specification.

#### Drive Cleaning Support Log Page (3Ch)

The Drive Cleaning Support Log page returns parameters that indicate if the library is capable of initiating drive cleaning for a specific drive domain or type. Table 39 shows the Drive Cleaning Support Log page format.

Table 39. Drive Cleaning Support page format

Bi	ts 7	6	5	4	3	2	1	0
Bytes								
0	MSB	•						
		Parameter Code (Domain or Type)						
1								LSB
2	DU = 0	DS = 1	TSD = 0	ETC = 0	ТМС	ς = 0	RSVD	LP = 1
3		Parameter Length = 01h						
4		Reserved Clean						

#### **Parameter Code**

This field is set to the drive domain or type. See Table 40.

Table 40. Drive domain or type

Drive Type	Domain or Type
Benchmark DLT1 Drive	01h/05h
Quantum SDLT Drive	01h/06h
SONY AIT-1/AIT-2 Drive	02h/01h
IBM LTO Drive	03h/01h
HP LTO Drive	03h/02h
Seagate LTO Drive	03h/03h
UNKNOWN	FFh/FFh

#### Parameter Length

The Parameter Length field indicates the number of bytes that follow exclusive of the Parameter Length field. The value is 01h.

**Clean** This field is set to 1 if the drive domain or type supports library-initiated drive-cleaning operations.

**Drive Information Log Page (3Dh)** The Drive Information Log page returns drive and loaded cartridge information. Table 41 shows the Drive Information page format.

Table 41. Drive Information Log page format

E	Bits 7	6	5	4	3	2	1	0
Bytes								
0	MSB							
			Para	meter Code (	Element Add	ress)		
1								LSB
2	DU = 0	DS = 1	TSD = 0	ETC = 0	ТМС	ς = 0	RSVD	LP = 1
3				Parameter L	ength = A3h			
4								
				Drive Dom	ain or Type			
5		-						
6	AFW valid	FW valid	SN valid	APID valid	PID valid	AVID valid	VID valid	SID valid
7	TTRE valid	CCLC valid	CLC valid	WCR valid	RCR valid	DMC valid	DCC valid	DLC valid
8	RSVD	TFSP2 valid	TCP2 valid	TFSP1 valid	TCP1 valid	PTWE valid	TTWE valid	PTWE valid
9				Rese	erved			
10				SCS	SI ID			
11								
:				Vend	or ID			
18								
19								
:		Alternate Vendor ID						
26								
27								
:				Produ	uct ID			
42								
43								
:				Alternate	Product ID			
58								
59								
:				Serial I	Number			
74								
75								
:				Firmwar	e Levels			
90								
91								
:				Alternate Firr	nware Levels			
106								

107	MSB
:	Drive Load Count
110	LSB
111	MSB
:	Drive Clean Count
114	LSB
115	MSB
:	Drive Motion Count
118	LSB
119	MSB
:	Read Compression Ratio
122	LSB
123	MSB
:	Write Compression Ratio
126	LSB
127	MSB
:	Cartridge Load Count
130	LSB
131	MSB
:	Cleaning Cartridge Load Count
134	LSB
135	MSB
:	Temporary Tape Read Errors
138	LSB
139	MSB
:	Permanent Tape Read Errors
142	LSB
143	MSB
:	Temporary Tape Write Errors
146	LSB
147	MSB
:	Permanent Tape Write Errors
150	LSB
151	MSB
:	Iape Capacity Partition 1
154	LSB
155	
:	Iape Free Space Partition 1
158	LSB
1	

Table 41. Drive Information Log page format (continued)

## LOG SENSE (4Dh)

#### Table 41. Drive Information Log page format (continued)

159	MSB
:	Tape Capacity Partition 2
162	LSB
163	MSB
:	Tape Free Space Partition 2
166	LSB

#### **Parameter Code**

The Parameter Code is the Drive Transport element address.

#### Parameter Length

The Parameter Length field indicates the number of bytes that follow exclusive of the Parameter Length field. The value is A3h.

#### Drive Domain/Type

This field indicates drive domain and drive type. See Table 40 on page 53.

SID valid 0 1	SCSI ID field is not valid. SCSI ID field is valid.
VID valid 0 1	Vendor ID field is not valid. Vendor ID field is valid.
AVID valid 0 1	Alternate Vendor ID field is not valid. Alternate Vendor ID field is valid.
PID valid 0 1	Product ID field is not valid. Product ID field is valid.
APID valid 0 1	Alternate Product field is not valid. Alternate Product field is valid.
SN valid 0 1	Serial Number field is not valid. Serial Number field is valid.
FW valid 0 1	Firmware Level field is not valid. Firmware Level field is valid.
AFW valid 0 1	Alternate Firmware Level field is not valid. Alternate Firmware Level field is valid.
DLC valid 0 1	Drive Load Count field is not valid. Drive Load Count field is valid.
DCC valid 0 1	Drive Clean Count field is not valid. Drive Clean Count field is valid.
DMC valid 0	Drive Motion Count field is not valid.

1	Drive Motion Count field is valid.			
RCR valid 0 1	Read Compression Ratio field is not valid. Read Compression Ratio field is valid.			
WCR valid 0 1	Write Compression Ratio field is not valid. Write Compression Ratio field is valid.			
CLC valid 0 1	Cartridge Load Count field is not valid. Cartridge Load Count field is valid.			
CCLC valid 0 1	Cleaning Cartridge Load Count field is not valid. Cleaning Cartridge Load Count field is valid.			
TTRE valid 0 1	Temporary Tape Read Error field is not valid. Temporary Tape Read Error field is valid.			
PTRE valid 0 1	Permanent Tape Read Errort field is not valid. Permanent Tape Read Error field is valid.			
TTWE valid 0 1	Temporary Tape Write Error field is not valid. Temporary Tape Write Error field is valid.			
PTWE valid 0 1	Permanent Tape Write Error field is not valid. Permanent Tape Write Error field is valid.			
TCP1 valid 0 1	Tape Capacity Partition 1 field is not valid. Tape Capacity Partition 1 field is valid.			
TFSP1 valid 0 1	Tape Free Space Partition 1 field is not valid. Tape Free Space Partition 1 field is valid.			
TCP2 valid 0 1	Tape Capacity Partition 2 field is not valid. Tape Capacity Partition 2 field is valid.			
TFSP2 valid 0 1	Tape Free Space Partition 2 field is not valid. Tape Free Space Partition 2 field is valid.			
<b>SCSI ID</b> This fie	eld is set to indicate the drive SCSI ID.			
Vendor ID This field is an 8-ASCII-character vendor identification. It is filled with blanks if not present.				

#### Alternate Vendor ID

This field is an 8-ASCI-character alternate vendor identification. It is filled with blanks if not present.

#### **Product ID**

This field is a 16-ASCII-character product identification. It is filled with blanks if not present.

#### Alternate Product ID

This field is a 16-ASCII-character alternate product identification. It is filled with blanks if not present.

#### Serial Number

This field is a 16-ASCII-character drive serial number followed by blanks if the serial number is shorter than 16 characters.

#### **Firmware Levels**

This field is a 16-ASCII-character drive and controller firmware level. It is filled with blanks if not present.

#### Alternate Firmware Levels

This field is a 16-ASCII-character drive and controller alternate firmware level. It is filled with blanks if not present.

#### **Drive Load Count**

This field indicates the total drive cartridge load count.

#### **Drive Clean Count**

This field indicates the total drive clean cartridge load count.

#### **Drive Motion Count**

This field indicates the total drive power-on time in hours.

#### **Read Compression Ratio**

This field indicates the read compression ratio \* 100 for the drive.

#### Write Compression Ratio

This field indicates the write compression ratio \* 100 for the drive.

#### **Cartridge Load Count**

This field indicates the load count for the cartridge.

#### **Cleaning Cartridge Load Count**

This field indicates the load count for the cleaning cartridge.

#### **Temporary Tape Read Errors**

This field indicates the amount of the temporary read errors for the tape.

#### **Permanent Tape Read Errors**

This field indicates the amount of the permanent read errors for the tape.

#### **Temporary Tape Write Errors**

This field indicates the amount of the temporary write errors for the tape.

#### Permanent Tape Write Errors

This field indicates the amount of the permanent write errors for the tape.

#### **Tape Capacity Partition 1**

This field indicates the tape capacity (KB), or capacity for partition1 if the tape is partitioned.

#### Tape Free Space Partition 1

This field indicates the tape's free space (KB), or free space for partition1 if the tape is partitioned.

#### **Tape Capacity Partition 2**

This field indicates the tape capacity (KB) for partition2 if the tape is partitioned.

#### **Tape Free Space Partition 2**

This field indicates the tape's free space (KB) for partition2 if the tape is partitioned.
# Supported Media Log (3Eh)

The Supported Media Log page returns log parameters that indicate the current media support for the specified drive domain and type. The parameter code specifies the media domain and media type. Table 42 lists the format for the Supported Media Log page.

Table 42. Log parameters for supported media

Log Parameter Function	Log Parameter Code	DU	DS	TSD	ЕТС	тмс	LP	Parameter Length (See Note)
DLT1 Media Support	0105h	0	1	0	0	0	1	3
SDLT Media Support	0106h	0	1	0	0	0	1	2
8mm AIT Media Support	0201h	0	1	0	0	0	1	1
IBM LTO Media Support	0301h	0	1	0	0	0	1	1
HP LTO Media Support	0302h	0	1	0	0	0	1	1
Seagate LTO Media Support	0303h	0	1	0	0	0	1	1

**Note:** The Parameter Value field, which follows the Parameter Length field, contains ASCII characters representing one or more media types supported within the requested drive domain or type. Supported values are:

- C DLT III
- D DLT IV
- E DLT IIIXT
- S SDLT
- A AIT
- 1 LTO

# Status

After processing the LOG SENSE command, the library returns a status byte as follows:

**Good** The library returns Good status when it can process the command without errors.

## **Check Condition**

- A Unit Attention condition is pending for the initiator.
- A reserved bit set to 1 or a parameter is invalid in the CDB.
- **Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier combinations.

# MODE SELECT (15h)

The MODE SELECT command enables a host to send new operating parameters to the 3582 Tape Library. The specified parameters configure the library for current operations and future operations beyond reset and power-on sequences if the command specified that the values need to be saved.

Issue a MODE SENSE command with the PC field set to 1h and the Page Code field set to 3Fh before the MODE SELECT command is issued. This determines which mode parameters are supported, which mode parameters are changeable, and the supported length of each page. When issuing a MODE SELECT command, the parameters are not changed until the library verifies the new parameters. If the parameters are invalid, the parameters are not changed and the appropriate errors are returned.

**Note:** The values sent to the library apply to all initiators in a multiple-initiator environment. When an initiator issues a MODE SELECT command that changes any current operating parameters, the library returns a Check Condition status with a sense key of Unit Attention (6h), an ASC (2Ah), and an ASCQ (01h) (mode parameters have changed) to all other initiators that issue a request to the library.

# **CDB** Format

Table 43 shows the format of the MODE SELECT CDB.

Bits	7	6	5	4	3 2 1		0				
Bytes											
0	Op Code (15h)										
1	Logica	al Unit Num	ıber	PF		SP					
2	Reserved										
3				Reserved	ł						
4	Parameter List Length										
5	Control										

Table 43. MODE SELECT CDB

# **Parameters**

#### Logical Unit Number

This field is ignored.

- **PF** The Page Format (PF) bit indicates that the data sent by the host after the MODE SELECT header and block descriptors complies with the definition of pages in the SCSI-2 specification. The value must be set to 1.
- **SP** The Save Parameters (SP) bit instructs the library to save all savable pages as follows:
  - **0** Current values are changed by those values sent to the 3582 Tape Library. Values are not stored in nonvolatile RAM.
  - 1 Current values are changed and saved to nonvolatile RAM and used by the 3582 Tape Library.

#### Parameter List Length

The Parameter List Length field specifies the length in bytes of the MODE

SELECT parameter list that is transferred during the Data Out phase. A 0 parameter list length indicates that no data is transferred. The parameter list length is equal to the length of a single Parameter List Header (4 bytes) plus the lengths of all pages to be transferred.

See Table 44 for Mode Select Code Field descriptions.

Table 44.	MODE	SELECT	code	fields
rubic i i.	MODE		oouo	noiao

Page Code	Page Name	Page Description
00h	Parity page	Provides a means to enable or disable parity checking for the library SCSI bus.
1Dh	Element Address Assignment page	Provides a means to change SCSI element address assignments and respective element ranges.
22h	LCD Mode page	The liquid crystal display (LCD) mode page provides a means to enable or disable operator panel access.
2Ah	Mixed Media page	Provides a means to enable or disable media type related bar code and media type reporting.
2Ch	Autocleaning page	Provides a means to enable or disable library initiated drive cleaning operations.
2Dh	Operating Mode page	Provides a means to change library operational modes.

## Response

The MODE SELECT Response consists of a Parameter List Header, followed by 0 or more pages.

## **Parameter List Header**

See Table 45 for the format of the Parameter List header. All fields are reserved and are set to 0. Send the header only if sending additional mode pages.

Table 45. Parameter List header

Bits	7	6	5	4	3	2	1	0				
Bytes												
0		Reserved										
1					Reserved	l						
2		Reserved										
3		Reserved										

## Parity Page (00h)

The format of the Parity page is shown in Table 46.

Table 46. Parity mode page

Bits	7	6	5 4 3 2 1 0							
Bytes										
0	Rese	Reserved Page Code								
1	Parameter List Length = 02h									
2	Reserved	Parity	Reserved							
3	Maximum Parity Retries									

#### Page Code

The Page Code identifies the Parity page. The value of this field must be 0h.

#### **Parameter List Length**

The Parameter Length is 02h (2), which indicates two additional bytes of data.

#### Parity

This field enables or disables parity checking of the SCSI bus. Two values are available:

- **0** Disable parity checking.
- 1 Enable parity checking.

The Parity bit may also be enabled by the operator panel parity option. Use the same method to disable the parity bit.

#### **Maximum Parity Retries**

This field designates the maximum number of times to retry the message out, command out, or Data Out phase after a parity error. The valid values for this field range from:

- 0 No retries are performed.
- **255** The maximum retries are performed.

The default value for this field is 1.

## Element Address Assignment Page (1Dh)

Element address assignments refer to the physical elements (locations) in the 3582 Tape Library. There are four element types:

- Storage cells
- Input/Output (I/O) station
- Tape drives
- · Medium changer

The library assigns default addresses to each element.

**Note:** The actual number of installed elements cannot be changed by the field values on the Element Address Assignment page. Specifying a value other than the determined number returns a Check Condition status, with the sense key set to Illegal Request.

Element addresses must not overlap. The highest possible element address cannot exceed FFFEh.

Table 47 shows the format of the Element Address Assignment page.

Table 47. Element Address Assignment page

Bits	7	6	5	4	3	2	1	0		
Bytes										
0	Rese	erved	Page Code							
1	Parameter List Length=12h									

2	MSB		
3		First Medium Transport Element Address	LSB
4	MSB		
5		Number of Medium Transport Elements	LSB
6	MSB		
7		First Storage Element Address	LSB
8	MSB		
9		Number of Storage Elements	LSB
10	MSB		
11		First Import/Export Element Address	LSB
12	MSB		
13		Number of Import/Export Elements	LSB
14	MSB		
15		First Data Transfer Element Address	LSB
16	MSB		
17		Number of Data Transfer Elements	LSB
18		Reserved	
19		Reserved	

Table 47. Element Address Assignment page (continued)

#### Page Code

The Page Code identifies the Element Address Assignment page. The value of this field must be 1Dh.

## Parameter List Length

This field indicates the length of the address assignment parameter list. The value of the field is 12h, which indicates 18 additional bytes of parameter data.

### First Medium Transport Element Address

The starting medium changer element address. The default value is 0x0001.

## Number of Medium Transport Elements

The number of available medium changer elements. This value is set to 0x0001.

## First Storage Element Address

The starting storage element address. The default value is 0x1000.

#### Number of Storage Elements

The number of available storage elements. The number depends on the library model and supported media type.

### First Import/Export Element Address

The starting insert/eject station element address. The default value is 0x0010.

## Number of Import/Export Elements

The number of available Import/Export station elements. The number depends on the library model and supported media type.

#### First Data Transfer Element Address

The starting tape drive element address. The default value is 0x0100.

#### Number of Data Transfer Elements

The number of tape drive positions. The number depends on the library model, number of drives, and supported media type.

## LCD Mode Page (22h)

The format of the LCD Mode page is shown on Table 48.

Table 48. LCD Mode page

Bits	7	6	5 4 3 2 1 0							
Bytes										
0	Reser	Reserved Page Code								
1		Parameter List Length = 02h								
2	Reserved	Reserved LCD Reserved								
3	Reserved									

#### Page Code

The Page Code identifies the LCD Mode page. The value of this field is 22h.

#### Parameter List Length

This field indicates the length of the LCD Mode parameter list. The value of the field is 2h which indicates 2 additional bytes of parameter data.

#### LCD Security

This bit controls the LCD security change. If the LCD Security Valid bit is 1, LCD security can be enabled or disabled as follows:

- LCD Security is disabled.
- LCD Security is enabled.

LCD Security can be enabled using the Operator Panel or SCSI Mode Select command. If LCD Security is activated by the Operator Panel or Mode Select command, it must be deactivated by the requestor. If the LCD security is enabled, the following events are disabled:

- · Performing diagnostics from the Operator Panel
- All Setup options
- Changing the mode or state
- Operator Panel command options that involve cartridge movement

Attempts to perform any of the above events result in an error message.

## Mixed Media Page (2Ah)

The vendor-unique Mixed Media page provides support to identify media types and associated tape drives that may be configured and supported in a single 3582 Tape Library. The format for the Mixed Media page is shown in Table 49.

**Note:** After modifying the mixed media configuration, and INITIALIZE ELEMENT STATUS command must be used to update the library's database.

Table 49. Mixed Media mode pag
--------------------------------

Bits	7	6	5 4 3 2 1							
Bytes										
0	Rese	erved	ved Page Code							
1		Parameter List Length = 02h								
2	Reserved Volser Vendor Extend N Enable ASCQ RES EI							Media ID Enable		
3	Reserved									

## Page Code

The Page Code identifies the Mixed Media page. The value of this field must be 2Ah.

## **Parameter List Length**

The Parameter List length field has a value of 02h.

## Media ID Enable (Media Identifier Enable)

This field indicates if the 3582 Tape Library expects bar code labels containing media identification:

- **0** Media Identification mode is disabled. The library does not interpret bar code media identifiers and operates in either default or extended bar code support mode.
- 1 Media Identification mode is enabled. The library expects and scans the bar code media identifiers to report media types and media domains. This mode requires the use of a six-character bar code with media identifiers.

## Extend RES (RES Extension Enable)

This field indicates whether Read Element Status and Request Volume Element Address commands return extended element status information:

- **0** Extended Status is not returned.
- 1 Extended Status is returned. See "READ ELEMENT STATUS (B8h)" on page 99.

#### Vendor ASCQ

The Vendor ASCQ bit field indicates which ASC/ASCQ is returned if a Move Media command is issued to a location not supporting the current media domain:

- **0** Move Medium command is rejected with a sense key of Illegal Request and ASC/ASCQ of 3Bh/A0h (Media Incompatible with Destination).
- 1 Move Medium command is rejected with a sense key of Illegal Request and ASC/ASCQ of 30h/00h (Incompatible Media installed).

## Volser Enable (Volser Extension Enable)

This bit field operates in conjunction with the Media ID bit field to indicate that scanned media identifiers be reported as the first character when listed in Read Element Status commands. Two values are available if operating in Media ID mode:

- **0** The volume tag (volser) information returns only the six-character volser label.
- **1** The volume tag (volser) information returns the media identification character, followed by the actual six-character volser.

## Autocleaning Page (2Ch)

Table 50 shows the format of the Autocleaning page.

Table 50. Autocleaning mode page

Bits	7	6	5	5 4 3 2 1 0							
Bytes											
0	Res	Reserved Page Code									
1		Parameter List Length = 04h									
2			Res	served			AC	DC			
3					Hour						
4		Minute									
5	Reserved										

#### Page Code

The Page Code identifies the Autocleaning Mode page. The value of this field must be 2Ch.

#### Parameter List Length

This field indicates the length of the Autocleaning parameter list. The value of this field is 04h, which indicates four additional bytes of parameter data.

## AC

- 0 Enable Autocleaning.
- **1** Disable Autocleaning.
- **DC** If the AC field has a value of 1, the DC field has the following meaning:
  - **0** Enable Delayed Cleaning.
  - 1 Disable Delayed Cleaning.

## Notes:

- 1. If AC is not active, the DC Hour and Minute fields are ignored.
- 2. The library does not currently support delayed cleaning. This field must be set to 0.
- **Hour** If Delayed Cleaning is activated, the hour reports at which hour Delayed Cleaning is scheduled (00-23).
  - **Note:** The library does not currently support delayed cleaning. This field must be set to 0.

#### Minute

If Delayed Cleaning is activated, the minute reports at which minute within the hour Delayed Cleaning is scheduled (00-59).

**Note:** The library does not currently support delayed cleaning. This field must be set to 0.

## **Operating Mode Page (2Dh)**

This section describes the fields and associated values for the Operating Mode Page.

Table 51 shows the format of the Operating Mode Page.

Table 51. Operating mode page

Bits	7	6	5	4	3	2	1	0	
Bytes									
0	Rese	erved			Page	Code			
1			Pa	arameter Lis	st Length =	= 03h			
2			Reserve	d		PA	AT	AI	
3		Op-Mode							
4		Reserved							

## Page Code

The Page Code identifies the Operating Mode page. The value of this field is 2Dh.

## Parameter List Length

This field indicates the length of the Operating Mode parameter list. The value of the field is 03h, which indicates three additional bytes of parameter data.

## AT (Auto Teach)

This field has the following meaning:

- **0** Auto-Teach (automatic configuration) should not be activated.
- 1 Auto-Teach (automatic configuration) should be activated.
- **Note:** The library does not support manual teach operations. This field must be set to 1.

## AI (Auto Inventory)

This field has the following meaning:

- **0** Automatic Inventory should not be activated.
- 1 Automotic Inventory should be activated.
- **Note:** The library does not support manual inventory operations. This field must be set to 1.

## PA (Partitioning Active)

This field has the following meaning:

- **0** Neither the library nor the host indicates that partitioning is active.
- 1 The library or host partitions storage positions

The library uses this flag to present operator warnings in case of insert and eject operations into and from configured partitions. Operator alerts remind of careful location selections in order not to affect an incorrect partition.

## **Op-Mode (Operational Mode)**

Set to:

- **0** Normal mode of operation.
- 2 Allow the library to issue an UNLOAD command to data transfer elements if the cartridge is not unloaded by the host.

# Status

After processing the MODE SELECT command, the library returns a status byte as follows:

**Good** The library returns Good status when it can process the command without errors.

## **Check Condition**

- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.
- The library detects a noncorrectable parity error while receiving the MODE SELECT data.
- A parameter in the MODE SELECT data is invalid.
- **Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier combinations.

# MODE SENSE (1Ah)

The MODE SENSE command reports one or all mode parameter pages to the initiator. The transfer data includes four bytes of parameter list header and the specific number of the requested page bytes. Byte counts are:

# CDB Format

Table 52. MODE SENSE CDB

Bits	7	6	5	4	3	2	1	0			
Bytes											
0				Op Coc	le (1Ah)						
1	Log	Logical Unit Number Rsvd DBD Reserved									
2	P	C			Page	Code					
3				Rese	erved						
4		Allocation Length									
5		Control									

# **Parameters**

## Logical Unit Number

This field is ignored.

**DBD** The Disable Block Descriptor (DBD) bit is not used, and must be set to 1.

PC

The Page Control field indicates the type of page parameter values to be returned to the host as shown in Table 53.

**Note:** Issue a MODE SENSE with the PC parameter set to 1 and the Page Code parameter set to 3Fh to receive a list of supported pages, page length information, as well as changeable parameter definitions.

Table 53. MODE SENSE page control definition

Pag	e Control	Description				
0	0	Report current parameter values defined by the default values if no saved values exist.				
0	1	Report changeable values.				
1	0	Report default values.				
1	1	Report saved values (default values if no pages are previously saved).				

## Page Code

The Page Code field determines which pages should be reported. See Table 54.

Table 54. Supported pages

Page Code	Description
00h	Parity page

Page Code	Description
1Ch	TapeAlert page
1Dh	Element Address Assignment page
1Eh	Transport Geometry Descriptor page
1Fh	Device Compatibilities page
22h	LCD page
23h	LCD Panel and Soft Key Configuration page
2Ah	Mixed Media page
2Ch	Autocleaning page
2Dh	Operating Mode page
3Fh	All pages

Table 54. Supported pages (continued)

#### **Allocation Length**

This field specifies the number of bytes that the host allocated for returned MODE SENSE data. An Allocation Length of 0 means that the library returns no MODE SENSE data. This is not considered an error and a status of GOOD is returned.

# Response

The Mode Sense Response consists of a Parameter List header, followed by 0 or more pages.

## **Parameter List Header**

See Table 55 for the format of the Parameter List header.

Table 55. Parameter List header

Bits	7	6	5	4	3	2	1	0				
Bytes												
0				Sense Da	ata Length							
1				Rese	erved							
2		Reserved										
3		Reserved										

## Sense Data Length

The Sense Data Length specifies the length in bytes that is available to be transferred during the DATA IN phase. The Sense Data Length does not include itself but does include the remaining three bytes of the Parameter List header.

# Parity Page (00h)

The format of the Parity page is shown in Table 56.

Table 56. Parity Mode page

Bits	7	6	5	4	3	2	1	0	
Bytes									
0	PS	Rsvd			Page	Code			
1		Parameter List Length = 02h							

Table 56. Parity Mode page (continued)

2	Reserved	Parity	Reserved
3			Maximum Parity Retries

**PS** The value returned for this field is 1, which specifies the ability to save this page to nonvolatile memory.

#### Page Code

The return value of 00h identifies the Parity page.

#### Parameter List Length

The Parameter Length is 02h (2), which indicates two additional bytes of data.

#### Parity

This field enables or disables parity checking of the SCSI bus. Two values are available:

- **0** Disable parity checking.
- **1** Enable parity checking.

## Maximum Parity Retries

This field designates the maximum number of times to retry the message out, command out, or data out phase after a parity error. The valid values for this field range from:

- **0** No retries are performed.
- **255** The maximum retries are performed.

The default value for this field is 1.

## **TapeAlert Page (1Ch)**

This section describes the fields and associated values for the TapeAlert page. Table 57 shows the format of the TapeAlert page.

Bit	s 7	6	5 4 3 2 1 0						
Bytes									
0	PS	RSVD			Page	Code			
1			F	Parameter List	Length = 0A	h			
2	Perf		Reserved		DExcpt	Test	RSVD	LogErr	
3		Rese	erved			MF	RIE		
4									
:				Interva	l Timer				
7									
8									
:		Report Count/Test Flag Number							
11									

Table 57. TapeAlert mode page

**PS** Set to 0 to indicate the library does not support saving of parameters.

#### Page Code

The Page Code identifies the TapeAlert Mode page. The value of this field must be 1Ch.

## Parameter List Length

This field is set to 0Ah (10), which indicates that 10 additional bytes follow.

**Perf** Set to 0 in the 3582 Tape Library to indicate the exception information can cause delays that are acceptable.

#### DExcpt

Set to 1 in the 3582 Tape Library to indicate that reporting of information about exception operations is disabled. The MRIE field is ignored. The software must poll the TapeAlert Log page.

**Test** Set to 0 in the 3582 Tape Library to indicate false information about exception conditions are not generated.

#### LogErr

Set to 0 in the 3582 Tape Library if log information about exception conditions is vendor specific.

**MRIE** Set to 0 in the 3582 Tape Library to indicate that exception conditions are not reported.

#### **Interval Timer**

Set to 0 in the 3582 Tape Library to indicate that the target will only report the informational exception condition one time.

## **Report Count**

Set to 0 in the 3582 Tape Library to indicate that this value is not supported.

## Element Address Assignment Page (1Dh)

Table 58 shows the format of the Element Address Assignment page.

#### Table 58. Element Address Assignment mode page

Bits	7	6	5	4	3	2	1	0	
Bytes									
0	PS	Rsvd			Page	Code	•		
1			ŀ	Parameter	List Lengt	h			
2	MSB		First Modi	um Transn	ort Flomo	nt Addross			
3			T II St Medi			nt Address		LSB	
4	MSB		Number	of Medium	Transport	Flements			
5			Number		Transport	Liemento		LSB	
6	MSB		Firet	Storage E	lomont Ad	droce			
7			1 1130	olorage L		uless		LSB	
8	MSB		Nue	abor of Sta	raga Elam	onto			
9		Number of Storage Elements							
10	MSB		<b>_</b>						
11			⊦irst Im	port/Expor	t Element .	Address		LSB	

Table 58. Element Address Assignment mode page (continued)

	MCD
12	INIOD
	Number of Import/Export Elements
13	
	LSB
	MSB
14	
	First Data Transfer Element Address
15	LSB
16	MSB
	Number of Data Transfer Elements
17	
	LSB
18	Reserved
	10001700
19	Reserved

**PS** The value of the PS field is 1. This indicates that the page can be saved.

## Page Code

Identifies the Element Address Assignment page. The value of this field is 1Dh.

## Parameter List Length

The length of the Element Address Assignment parameter list. The value of the field is 12h, which indicates 18 additional bytes of parameter data.

## **First Medium Transport Element Address**

The starting medium changer element address. The default value is 0x0001.

## Number of Medium Transport Elements

The number of available medium changer elements. This value is set to 0x0001.

#### **First Storage Element Address**

The starting storage element address. The default value is 0x1000.

## Number of Storage Elements

The number of available storage elements. The number depends on the library model and supported media type.

#### First Import/Export Element Address

The starting I/O station element address. The default value is 0x0010.

#### Number of Import/Export Elements

The number of available I/E station elements. The number depends on the library model and supported media type.

#### First Data Transfer Element Address

The starting tape drive element address. The default value is 0x0100.

### Number of Data Transfer Elements

The number of tape drive positions. The number depends on the library model, number of drives, and supported media type.

## Transport Geometry Descriptor Page (1Eh)

Table 59 on page 74 shows the format of the Transport Geometry Descriptor page.

Table 59. Transport Geometry Descriptor mode page

Bits	7	6	5 4 3 2 1 0						
Bytes									
0	PS	Rsvd			Page	Code			
1				Parameter L	ength = 02h				
2		Reserved Rotate							
3		Member Number in Transport Element Set							

**PS** The Page Savable (PS) field value is 0. This indicates that the library cannot save this page to nonvolatile memory.

#### Page Code

Identifies the Transport Geometry Descriptor page. The value of this field is 1Eh.

#### **Parameter Length**

The length of the Transport Geometry Descriptor parameter list. The value of the field is 02h, which indicates two additional bytes of parameter data.

#### Rotate

Identifies the ability of the medium changer to handle two-sided media. Because the library uses only one-sided media, the value for this field is 0.

#### Member Number in Transport Element Set

The specific medium changer in the system to which this descriptor applies. Because the library has only one transport element, the value for this field is 0.

## **Device Capabilities Page (1Fh)**

See Table 60 for the format of the Device Capabilities page format.

Table 60. Device Capabilities mode page

Bits	7	6	5	5 4 3 2 1 0						
Bytes										
0	PS	Rsvd			Page	Code				
1			F	Parameter List	t Length = 0E	h				
2		Reserved DT 1 I/E 1 ST 1 MT 0						MT 0		
3		Reserved								
4		Rese	erved		MT to DT 0	MT to I/E 0	MT to ST 0	MT to MT 0		
5		Rese	erved		ST to DT 1	ST to I/E 1	ST to ST 1	ST to MT 0		
6		Rese	erved		I/E to DT 1	I/E to I/E 1	I/E to ST 1	I/E to MT 0		
7	Reserved DT to DT 1 DT to					DT to I/E 1	DT to ST 1	DT to MT 0		
8										
15		Reserved								
15										

**PS** The value returned for this field is 0. The library cannot save this page to nonvolatile memory.

## Page Code

This field identifies the page code for the Device Capabilities page. The returned value is 1Fh.

## Parameter Length

The Parameter Length is 0Eh (14), which indicates 14 additional bytes of device capabilities data.

## Data Transfer (DT)

The value returned for this field is 1. The tape drives can store cartridges.

#### Import/Export (I/E)

The value returned for this field is 1. The I/O station can store cartridges.

#### Storage Location (ST)

The value returned for this field is 1. The storage cells can store cartridges.

#### Medium Transport (MT)

The value returned for this field is 0. The medium changer cannot store cartridges.

#### MT to DT

The value returned for this field is 0. The library does not support the MOVE MEDIUM (A5h) command when the source is the medium changer and the destination is a tape drive.

## MT to I/E

The value returned for this field is 0. The library does not support the MOVE MEDIUM (A5h) command when the source is the medium changer and the destination is the I/O station.

## MT to ST

The value returned for this field is 0. The library does not support the MOVE MEDIUM (A5h) command when the source is the medium changer and the destination is a storage cell.

#### MT to MT

The value returned for this field is 0. The library does not support the MOVE MEDIUM (A5h) command when the source is the medium changer and the destination is the medium changer.

#### ST to DT

The value returned for this field is 1. The library supports the MOVE MEDIUM (A5h) command when the source is a storage cell and the destination is a tape drive.

## ST to I/E

The value returned for this field is 1. The library supports the MOVE MEDIUM (A5h) command when the source is a storage cell and the destination is the I/O station.

## ST to ST

The value returned for this field is 1. The library supports the MOVE MEDIUM (A5h) command when the source is a storage cell and the destination is a storage cell.

#### ST to MT

The value returned for this field is 0. The library does not support the MOVE MEDIUM (A5h) command when the source is a storage cell and the destination is the medium changer.

## I/E to DT

The value returned for this field is 1. The library supports the MOVE MEDIUM (A5h) command when the source is the I/O station and the destination is a tape drive.

## I/E to I/E

The value returned for this field is 1. The library supports the MOVE MEDIUM (A5h) command when the source is the I/O station and the destination is the I/O station.

## I/E to ST

The value returned for this field is 1. The library supports the MOVE MEDIUM (A5h) command when the source is the I/O station and the destination is a storage cell.

## I/E to MT

The value returned for this field is 0. The library does not support the MOVE MEDIUM (A5h) command when the source is the I/O station and the destination is the medium changer.

## DT to DT

The value returned for this field is 1. The library supports the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is a tape drive.

## DT to I/E

The value returned for this field is 1. The library supports the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is the I/O station.

#### DT to ST

The value returned for this field is 1. The library supports the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is a storage cell.

## DT to MT

The value returned for this field is 0. The library does not support the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is the medium changer.

## LCD Mode Page (22h)

The format of the LCD Mode page is shown in Table 61.

Table	61.	LCD	Mode	page
-------	-----	-----	------	------

Bits	7	6	5	4	3	2	1	0			
Bytes											
0	PS	Rsvd	Page Code								
1		Parameter List Length = 02h									
2	Rsvd	LCD Security	D Iurity								
3		Reserved									

**PS** The value returned for this field is 1. The library can save this page to nonvolatile memory.

#### Page Code

The value of this field is 22h.

## Parameter List Length

The Parameter List Length indicates two additional bytes of data.

#### **LCD Security**

This bit controls the LCD security:

- **0** LCD Security is disabled.
- 1 LCD Security is enabled.

**Note:** LCD Security can be enabled using the Operator Panel. If the LCD security is enabled, the following events are disabled:

- · Performing diagnostics from the operator panel
- All Setup options
- · Changing the mode or state
- · Operator Panel command options that involve cartridge movement

Attempts to perform any of the above events result in an error message.

## LCD Panel and Soft Key Configuration Page (23h)

The format for the LCD Panel and Soft Key Configuration Page is shown in Table 62. This page returns information regarding any supported soft keys, selectable on the display.

Table 62. LCD Panel and soft key configuration mode page

Bits	7	6	5	4	3	2	1	0					
Bytes													
0	PS	PS Rsvd Page Code											
1		Parameter List Length											
2		Graphic Mode											
3				Color	Mode								
4				Bits Pe	er Pixel								
5				Data I	ormat								
6													
				Wi	dth								
7													
8													
				He	ght								
9													
10				Notify O	n Update								
11				Update	Period								
12				Rese	erved								
13				Rese	erved								
14				Rese	erved								
15				Number o	Soft-keys								
15+s+1				Soft-key bu	ton number								
15+s+2				Rese	erved								
15+s+3				Loft Edgo	(in nivola)								
15+s+4				Len Luge	(III pixeis)								
15+s+5				Diabt Eda	(in pixels)								
15+s+6					(in pixels)								
15+s+7				Ton Edge									
15+s+8				ioh Eaĝe	(iii pixeis)								

Table 62. LCD Panel and soft key configuration mode page (continued)

15+s+9	Battam Edge (in nivels)
15+s+10	Bottom Edge (in pixels)

**PS** The value of the PS field is 0. This indicates that the page cannot be saved.

#### Page Code

This page code identifies the LCD and Soft Key Configuration Mode page. The value of this field is 23h.

#### Parameter List Length

The Parameter List Length is a minimum of 14 bytes if no soft button is configured. The length increases by 10 bytes for each configured soft key.

- s = 0 for first softkey
- s = 10 for second softkey
- s = 20 for third softkey
- s = 30 for fourth softkey

#### **Graphic Mode**

This field indicates whether the LCD Panel is in text mode or graphic mode:

- 0 Text mode
- 1 Graphic mode

#### **Color Mode**

Reserved until color displays are supported.

#### **Bits Per Pixel**

Indicates the bits per pixel:

#### Text mode

8 indicates ASCII; 16 indicates UNICODE.

#### Graphics mode

Set to the number of bits used for each pixel.

#### **Data Format**

Format that the panel will be returning.

**0** Normal data format

1 Data is flipped and rotated

#### Width

#### Text mode

Number of characters.

#### Graphic mode

Number of pixels.

#### Height

This field indicates the height of an object displayed on the panel:

#### Text mode

Number of characters.

#### **Graphics mode**

Number of pixels.

## Notify On Update

This field indicates if the library will notify of panel updates:

- 1 The library will asynchronously notify of panel updates.
- **0** The library will not asynchronously notify of panel updates.

## **Update Period**

How often the panel can be changed, in seconds.

## Number of Soft-keys

The number of configured soft keys, in addition to, or instead of, any physical hard keys.

## Soft-key Button Number

The number of the button, which is also the parameter number of the Log Sense/Log Select LCD Button page to check and set the button state.

The 3582 Tape Library does not support soft keys.

#### Left Edge

Pixel number of the left edge for each soft-key (minimum X). Currently not supported.

## **Right Edge**

Pixel number of the right edge for each soft-key (maximum X). Currently not supported.

#### Top Edge

Pixel number of the top edge for each soft-key (minimum Y). Currently not supported.

#### **Bottom Edge**

Pixel number of the bottom edge for each soft-key (maximum Y). Currently not supported.

## Mixed Media Page (2Ah)

The Mixed Media page provides information regarding support for mixed media and cartridge types. The format for the Mixed Media page is shown in Table 63.

Table 63. Mixed Media mode page

Bits	7	6	5	4	3	2	1	0				
Bytes												
0	PS	Reserved	Page Code									
1		Parameter List Length = 02h										
2		Rese	erved		Volser Enable	Rsvd	Rsvd	Media ID Enable				
3		Reserved										

**PS** The value returned for this field is 1. The library can save this page to nonvolatile memory.

## Page Code

The value of this field is 2Ah.

## Parameter List Length

The Parameter List Length is 02h (2), which indicates 2 additional bytes of data.

## Media ID Enable (Media Identifier Enable)

This field indicates if the 3582 Tape Library expects bar code labels, containing media identification:

- **0** Media Identification mode is disabled. The 3582 Tape Library does not interpret bar code media identifiers and operates in either default or extended bar code support mode.
- 1 Media Identification mode is enabled. The 3582 Tape Library will expect and scan the bar code media identifiers to report media types and media domains. This mode requires the use of a six-character bar code with media identifiers.

## Extend RES (RES Extension Enable)

This field indicates whether Read Element Status and Request Volume Element Address commands return extended element status information:

- 0 Extended Status is not returned.
- 1 Extended Status is returned. See "READ ELEMENT STATUS (B8h)" on page 99.

## Volser Enable (Volser Extension Enable)

This bit field operates in conjunction with the Media ID bit field to indicate that scanned media identifiers be reported as the first characters when listed in Read Element Status commands. Two values are available if operating in Media ID mode:

- **0** The volume tag (volser) information returns only the six-character volser label.
- **1** The volume tag (volser) information returns the media identification characters, followed by the actual six-character volser.

# Autocleaning Page (2Ch)

Table 64 shows the format of the Autocleaning page.

Bits	7	6	5	4	3	2	1	0			
Bytes											
0	PS	RSVD		Page Code							
1		Parameter List Length = 04h									
2		Reserved AC DC									
3				Ho	our						
4		Minute									
5				Rese	erved						

Table 64. Autocleaning mode page

**PS** The value of the PS field is 1. This indicates that the page can be saved.

## Page Code

The Page Code identifies the Autocleaning page. The value of this field is 2Ch.

## Parameter List Length

0

The length of the Autocleaning parameter list. The value of the field is 04h, which indicates 4 additional bytes of parameter data.

## AC

indicates Autocleaning is not active.

- 1 indicates Autocleaning is active.
- **DC** If the AC field is 1, the DC field has this meaning:
  - **0** Delayed Cleaning is not active.
  - **1** Delayed Cleaning is active.
- **Hour** If Delayed Cleaning is activated, the hour reports at which hour Delayed Cleaning is scheduled (00-23).

#### Minute

If Delayed Cleaning is activated, the minute reports at which minute within the hour Delayed Cleaning is scheduled (00-59).

## **Operating Mode Page (2Dh)**

Table 65 shows the format of the Operating Mode page.

Table 65. Operating Mode page

	Bits	7	6	5	4	3	2	1	0			
Bytes												
0		PS	RSVD		Page Code							
1			Parameter List Length = 03h									
2				Reserved			PA	AT	AI			
3			Op-Mode									
4			Reserved									

**PS** The value of the PS field is 1. This indicates that the page can be saved.

#### Page Code

The Page Code identifies the Operating Mode page. The value of this field is 2Dh.

#### Parameter List Length

This field indicates the length of the Operating Mode parameter list. The value of the field is 03h which indicates three additional bytes of parameter data.

#### AT (Automatic Teach)

Always set to 1 to indicate that the library will configure automatically.

#### AI (Automatic Inventory)

Always set to 1 to indicate that the library will perform automatic inventory operations whenever necessary.

## PA (Partitioning Active)

Set to 1 if the library or host partitions storage positions.

Set to 0 if neither the library nor host indicates that partitioning is active.

The library uses this flag to present operator warnings in case of insert and eject operations into and from configured partitions. Operator alerts remind of careful location selections in order not to affect an incorrect partition.

#### **Op-Mode (Operational Mode)**

Set to:

- **0** Normal mode of operation.
- 2 The 3582 Tape Library can issue an UNLOAD command to the drive if the cartridge is not ejected by the host.

# Status

After processing the MODE SENSE command, the library returns a status byte as follows:

**Good** The library returns Good status when it can process the command without errors.

## **Check Condition**

- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.
- **Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier combinations.

# **MOVE MEDIUM (A5h)**

The MOVE MEDIUM command enables the initiator to request that the medium changer move a cartridge from one element address to another specific element address. See "MODE SELECT (15h)" on page 60 for a matrix with the valid source and destination element address combinations.

When using this command with the source and destination address set to the same tape drive, the medium changer pushes the cartridge back into the drive.

The host application should issue an UNLOAD command to the drive and verify completion of the logical unload prior to issuing the MOVE MEDIUM command.

# **CDB** Format

**Note:** The 3582 Tape Library shall respond with a Good status whenever a received MOVE MEDIUM command exactly matches the saved last successful MOVE MEDIUM command and the current status of the source element is empty or inaccessible.

The MOVE MEDIUM CDB format is shown in Table 66.

Tahle	66	MOVE	MEDIUM	CDB
Iable	00.	NOVL	NLDION	UUU

Bits	7	6	5	4	3	2	1	0					
Bytes													
0		Op Code (A5h)											
1	Log	ical Unit Nun	nber			Reserved							
2	MSB	3											
:		Transport Element Address											
3		LSB											
4	MSB												
:				Source	Address								
5								LSB					
6	MSB												
:				Destinatio	n Address								
7								LSB					
8				Rese	erved								
9		Reserved											
10		Reserved Invert											
11				Cor	ntrol								

# **Parameters**

Logical Unit Number

This field is ignored.

## **Transport Element Address**

This field should be 0 or the element address of the medium transport element.

**Note:** If a cartridge bar code label is a data transfer element is not known, the cartridge will be scanned during the MOVE MEDIUM command.

## Source Address

This field specifies the element address from where the cartridge is to be taken.

#### **Destination Address**

This field specifies the element address where the cartridge is to be placed.

#### Invert

This field indicates whether the medium needs to be flipped. The library does not support the Invert function. The value for this field must be 0.

## Status

After processing the MOVE MEDIUM command, the library returns a status byte as follows:

**Good** The library returns a Good status when it can process the command without errors.

## **Check Condition**

- A Unit Attention condition is holding for the initiator.
- The 3582 Tape Library has experienced an unrecoverable hardware error.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.
- The cartridge inventory indicates that the move operation cannot be performed.
- After a move attempt, the library finds that the source is empty or the destination is occupied.
- The library is not ready because it is offline.
- A drive may have reported an error.
- **Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier combinations.

# **PERSISTENT RESERVE IN (5Eh)**

The PERSISTENT RESERVE IN command is used for reservation management to show what types of Reservations and Reservation Keys exist. This command is used with libraries supporting LUN 1 environments only and is handled by a LUN-1-enabled drive.

# **CDB** Format

The PERSISTENT RESERVE IN CDB format is shown in Table 67.

Table 67. PERSISTENT RESERVE IN CDB

Bits	7	6	5	4	3	2	1	0				
Bytes												
0		Operation Code (5Eh)										
1		Reserved Service Action										
2		Reserved										
3				Rese	erved							
4				Rese	erved							
5				Rese	erved							
6				Rese	erved							
7												
:		Allocation Length										
8												
9				Cor	ntrol							

# **Parameters**

## Service Action

This field indicates requested tasks to be performed by the target device. The following values are supported:

- · 00000b Read all registered reservation keys
- 00001b Read all current persistent reservations

## **Allocation Length**

This field is used to set the maximum number of bytes to be transferred.

## Control

This field is the last byte of the command descriptor block. The value is set to 0. There are no vendor-specific bits.

## Parameter Data for Read Keys

Parameter data for Read Keys is shown in Table 68.

Table 68. Parameter data for Read Keys

Bits	7	6	5	4	3	2	1	0		
Bytes										
0				-						
:		Generation								
3										
4										

## PERSISTENT RESERVE IN (5Eh)

Table 68. Parameter data for Read Keys (continued)

:	Additional Length
7	
8	
:	First Reservation Key
15	
16	
:	Additional Reservation Keys
n	

## Generation

This field is a counter for PERSISTENT RESERVE OUT command requests.

## Additional Length

This field is a count of the number of bytes in the Reservation Key list.

## **First Reservation Key**

The first reservation key defined.

## Additional Reservation Keys

This field supports a maximum of one reservation key per initiator.

## **Parameter Data for Read Reservations**

Parameter data for Read Keys is shown in Table 69.

## Table 69. Parameter data for Read Keys

Bits	7	6	5	4	3	2	1	0	
Bytes									
0									
:				Gene	ration				
3									
4									
:				Additiona	al Length				
7									
8									
:		Reservation Descriptors							
n									

## Generation

This field is a counter for PERSISTENT RESERVE OUT command requests.

## **Additional Length**

This field is a count of the number of bytes in the Reservation Key list.

## **Reservation Descriptors**

Reservation descriptors are shown in Table 70.

Table 70. Read Reservations Descriptor

Bits	7	6	5	4	3	2	1	0			
Bytes											
0											
:				Reserva	tion Key						
7											
8											
:				Scope-spec	ific Address						
11											
12				Rese	erved						
13		Sc	оре			Ту	pe				
14											
:		Extent Length									
15											

## **Reservation Key**

This field can be set to any value.

## Scope-specific Address

This field is set to 0.

**Scope** This field is set to 0h to indicate that the persistent reservation applies to the entire logical unit.

#### **Type** This field has one of the following values:

- 3h Exclusive Access
- 6h Exclusive Access, Registrants only

#### Extent Length

This field is set to 0.

## Status

After processing the PERSISTENT RESERVE IN command, the library returns a status byte as follows:

**Good** The library returns a Good status when it can process the command without errors.

## **Check Condition**

- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.
- **Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier combinations.

# PERSISTENT RESERVE OUT (5Fh)

The PERSISTENT RESERVE OUT command is used for reservation management and allows different types of Reservations and Reservation Keys to be created or removed. This command is used with libraries supporting LUN 1 environments only and is handled by a LUN-1-enabled drive.

# **CDB** Format

The PERSISTENT RESERVE OUT CDB format is shown in Table 71.

Table 71. PERSISTENT RESERVE OUT CDB

Bits	7	6	5	4	3	2	1	0	
Bytes									
0				Operation	Code (5Fh)				
1		Reserved			:	Service Actior	ı		
2		Scop	oe (0)			Ту	ре		
3				Rese	erved				
4				Rese	erved				
5				Rese	erved				
6				Rese	erved				
7									
:		Parameter List Length (18)							
8									
9				Cor	itrol				

# **Parameters**

## **Service Action**

This field indicates requested tasks to be performed by the target device. Refer to Table 72 for the values of Service Action codes.

Table 72. Values for Service Action codes

Code	Name	Description	PERSISTENT RESERVE Generation Field Incremented?
00h	REGISTER	Registers a reservation key with the device server or unregisters a reservation key	Yes
01h	RESERVE	Creates a persistent reservation with a specified SCOPE and TYPE	No
02h	RELEASE	Releases the selected persistent reservation	No
03h	CLEAR	Clears all reservation keys (for example, registrations) and all persistent reservations	Yes
04h	PREEMPT	Preempts persistent reservations or removes registrations	Yes

Table 72.	Values for	Service Act	ion codes	(continued)

Code	Name	Description	PERSISTENT RESERVE Generation Field Incremented?
05h	PREEMPT AND ABORT	Preempts persistent reservations or removes registrations and aborts all tasks for all preempted initiator ports	Yes
06h	REGISTER AND IGNORE EXISTING KEY	Registers a reservation key with the device server or unregisters a reservation key	Yes
07h - 1Fh	PREEMPT		

- **Scope** This field indicates whether a persistent reservation applies to an entire logical unit, a portion of the logical unit, or an element. The value is set to 0 to indicate that a persistent reservation can only be applied to the entire logical unit for LUN 1 configurations.
- **Type** The value in the Type field specifies characteristics of the persistent reservation being established for all data blocks. Refer to Table 73 for the values of Type codes.

Table 73. Values for Type Codes

Code	Name	Drive Support	Description of Drive Support
0h	N/A	Not Supported	Obsolete
1h	Write Exclusive	Not Supported	Reads Shared (see Note 1) Writes Exclusive (see Note 3) Persistent Reservation Holder (see Note 5)
2h	N/A	Not Supported	Obsolete
Зh	Exclusive Access	IBM Ultrium 1 and Ultrium 2	Reads Exclusive (see Note 2) Writes Exclusive (see Note 3) Persistent Reservation Holder (see Note 5)
4h	N/A	Not Supported	Obsolete
5h	Writer Exclusive - Registrants Only	Not Supported	Reads Shared (see Note 1) Writes Exclusive (see Note 3) Persistent Reservation Holder (see Note 5)
6h	Exclusive Access - Registrants Only	IBM Ultrium 1 and Ultrium 2	Reads Exclusive (see Note 2) Writes Exclusive (see Note 4) Persistent Reservation Holder (see Note 5)
7h	Write Exclusive - All Registrants	Not Supported	Reads Shared (see Note 1) Writes Exclusive (see Note 4) Reads Exclusive (see Note 6)
8h	Exclusive Access - All Registrants	Not Supported	Reads Exclusive (see Note 2) Writes Exclusive (see Note 4) Persistent Reservation Holder (see Note 6)
9h - Fh	Reserved		

## **PERSISTENT RESERVE OUT (5Fh)**

Table 73. Values for Type Codes (continued)

Code	Name	Drive Support	Description of Drive Support

#### Notes:

- 1. **Reads Shared:** Any application client on any initiator port may initiate tasks that request transfers from the storage medium or cache of the logical unit to the initiator port.
- Reads Exclusive: Any task from any initiator port other than the initiator port that holds the persistent reservation that requests a transfer from the storage medium or cache of the logical unit to the initiator port will be terminated with RESERVATION CONFLICT status.
- Writes Exclusive: Any task from any initiator port other than the initiator port that holds the persistent reservation that requests a transfer from the initiator port to the storage medium or cache of the logical unit will be terminated with RESERVATION CONFLICT status.
- Writes Exclusive: A task that requests a transfer to the storage medium or cache of the logical unit from an initiator port that is not currently registered with the device server will be terminated with RESERVATION CONFLICT status.
- Persistent Reservation Holder: The initiator port that delivered the PERSISTENT RESERVE OUT command with RESERVE, PREEMPT, or PREEMPT AND ABORT service action as identified by its registered reservation keys.
- 6. **Persistent Reservation Holder:** Any registered initiator port as identified by a zero reservation key value.

#### Control

The control field is the last byte of the command descriptor block. The value is set to 0. There are no vendor-specific bits.

#### Parameter List Length

This field specifies the number of bytes of command parameter data to be sent from the application client to the device server.

The Parameter List is shown in Table 74.

Bits	7	6	5	4	3	2	1	0
Bytes								
0								
:				Reserva	tion Key			
7								
8								
:			Se	ervice Action I	Reservation K	ley		
15								
16								
:				Scope-spec	ific Address			
19								
20				Reserved				APTPL
21				Rese	erved			
22								
:				Obs	olete			
23								

Table 74. PERSISTENT RESERVE OUT parameter list

## **Reservation Key**

This field can be set to any value.

#### Service Action Reservation Key

This field can be set to any value.

## **Scope-specific Address**

This field is set to 0.

## Activate Persist Through Power Loss (APTPL)

This field is set to 0.

## Status

After processing the PERSISTENT RESERVE OUT command, the library returns a status byte as follows:

**Good** The library returns a Good status when it can process the command without errors.

**Busy** The library returns Busy status when it is processing a command for a different initiator or when a motion command is in the process of being aborted.

## **Reservation Conflict**

The library returns Reservation Conflict status when it is reserved by a different initiator.

## **Check Condition**

- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.

# **POSITION TO ELEMENT (2Bh)**

The POSITION TO ELEMENT command enables the initiator to move the medium changer to a specific element address position.

# **CDB** Format

The POSITION TO ELEMENT CDB format is shown in Table 75.

Table 75. POSITION TO ELEMENT CDB

	Bits	7	6	5	4	3	2	1	0
Bytes									
0					Op Cod	le (2Bh)			
1		Log	jical Unit Num	nber			Reserved		
2		MSB							
					Transport Ele	ment Address	6		
3									LSB
4		MSB							
					Destinatio	n Address			
5									LSB
6					Rese	erved			
7			Reserved						
8					Reserved				Invert
9					Rese	erved			

# **Parameters**

## Logical Unit Number

This field is ignored.

#### **Transport Element Address**

This field contains either 0 or the element address of the medium changer.

#### **Destination Element Address**

This field contains the element address for the move. Specifying the medium changer address positions parks the medium changer in the home position. Using this address allows easy access to cartridges.

**Invert** This field indicates whether the medium needs to be flipped. The library does not support the invert function. The value for this field must be 0.

# Status

After processing the POSITION TO ELEMENT command, the library returns a status byte as follows:

**Good** The library returns a Good status when it can process the command without errors.

## **Check Condition**

- The library has experienced an unrecoverable hardware error.
- · A Unit Attention condition is pending for the initiator.

- The library is not ready because it is offline.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.
- The library encounters a problem during the positioning operation.
- **Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier combinations.

# PREVENT/ALLOW MEDIUM REMOVAL (1Eh)

The PREVENT/ALLOW MEDIUM REMOVAL command requests that the library enable or disable the removal of medium from the library. Because the 3582 Tape Library does not contain any mechanism to disable the removal of media, this command is supported logically for compatibility reasons only, without activating any locking mechanism.

# **CDB** Format

Table 76 shows The PREVENT/ALLOW MEDIUM REMOVAL CDB format.

Table 76. PREVENT/ALLOW MEDIUM REMOVAL CDB

Bits	7	6	5	4	3	2	1	0
Bytes								
0				Op Coc	le (1Eh)			
1	Log	Logical Unit Number Reserved						
2				Rese	erved			
3				Rese	erved			
4		Reserved Prevent						Prevent
5	P/A O	P/A Options Control						

# **Parameters**

## Logical Unit Number

This field is ignored.

## Prevent

The Prevent bit indicates the following:

- **0** Allow media removal.
- 1 Prevent media removal. This field is applicable until either a power-on reset, command reset, or all initiators have issued an ALLOW MEDIUM REMOVAL command by setting the Prevent field to 0.

## P/A Options

The P/A Options field is present for compatibility with other libraries. It is ignored.

# Status

After processing the PREVENT/ALLOW MEDIUM REMOVAL command, the library returns a status byte as follows:

**Good** The library returns a Good status when it can process the command without errors.

## **Check Condition**

- · A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.
- The value of a field in the P/A options field is invalid.
## PREVENT/ALLOW MEDIUM REMOVAL (1Eh)

**Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier combinations.

# **READ BUFFER (3Ch)**

The READ BUFFER command is used in conjunction with the WRITE BUFFER command as a diagnostic function for testing target memory, SCSI bus integrity, uploading trace and error log information, or operator display information. This command does not alter the behavior of the library.

# **CDB** Format

The READ BUFFER CDB format is shown in Table 77.

	Bits	7	6	5	4	3	2	1	0		
Bytes											
0			Op Code (3Ch)								
1		Log	Logical Unit Number Reserved Mode								
2			Buffer ID								
3		MSB	ASB								
:			Buffer Offset								
5			LSB								
6		MSB									
:					Allocatio	n Length					
8									LSB		
9			Control								

**Note:** Invalid modes will be rejected with sense code Illegal Request, Parameter Not Supported, (5/2601).

## **Parameters**

The function of this command and the meaning of fields within the command descriptor block depend on the contents of the mode field.

#### Logical Unit Number

This field is ignored.

**Mode** The mode determines the mode of operation. Valid mode field values are defined in Table 78.

Table 78. Mode field definition

	Mode					
Bit 2	Bit 1	Bit 0				
0	1	0	Data Mode			
0	1	1	Descriptor Mode			

#### Data Mode

In Data Mode, the DATA IN phase contains buffer data from the buffer identified in the buffer ID field.

## **Descriptor Mode**

In Descriptor Mode, a maximum of four bytes of READ BUFFER descriptor information is returned. The library returns the descriptor information for the buffer specified by the buffer ID. If there is no

buffer associated with the specified buffer ID, the library returns all zeros in the READ BUFFER descriptor. The buffer offset field is reserved in this mode. The allocation length should be set to four or greater. The library transfers the lesser of the allocation length or four bytes of READ BUFFER descriptor. The READ BUFFER descriptor is defined as shown in Table 79.

Bits	7	6	5	4	3	2	1	0
Bytes								
0				Offset B	oundary			
1	MSB							
:				Buffer	Length			
3								LSB

### **Offset Boundary**

The Offset Boundary field always returns 0.

#### **Buffer Length**

The Buffer Length field specifies the maximum buffer capacity. During a READ BUFFER operation, less data may be transferred, because the library terminates the DATA IN phase when either the allocation length bytes have been transferred, or when all available buffer data, up to the maximum buffer capacity, has been transferred to the initiator, whichever is less.

#### Buffer ID

The Offset Boundary field returns the boundary alignment Buffer ID code assignments for the READ BUFFER command are the same as for the WRITE BUFFER command. If an unsupported buffer ID code is selected, the library returns Check Condition status, sets the sense key to Illegal Request and sets the additional sense code to Illegal Field in the CDB. The library terminates the DATA IN phase when allocation length bytes are transferred to the initiator or the end of the buffer is reached, whichever amount is less.

Note: Prior to writing to Buffer ID 7, the drives need to be selected with the SEND DIAGNOSTIC command. See "SEND DIAGNOSTIC (1Dh)" on page 122.

Table 80 outlines the supported buffer ID and the associated description.

Buffer ID	Description	Buffer Offset	R/W	Modes
0x00	Failure Log	0	Read	2, 3
0x01	Library Controller Microcode	0	Read/Write	2, 3
0x02	Engineering Test Buffer	0	Read/Write	3, 5
0x03	Reserved	0	-	-
0x04	Reserved	0	-	-
0x04	Reserved	0	-	-
0x06	Operator Panel Display Data <sup>a</sup>	0	Read	2, 3

Table 80. Buffer ID description

## **READ BUFFER (3Ch)**

Buffer ID	Description	Buffer Offset	R/W	Modes
0x07	Drive Firmware <sup>b</sup>	0	Write	-
0x08	Previous System Event Log	0	Read	2, 3
0x09	Current System Event Log	0	Read	2, 3
0x0A	Error Event Log	0	Read	2, 3
0x0B	Reserved	0	-	-
0x0C	Reserved	0	-	-
0x0D	Reserved	0	-	-
0x0E	Reserved	0	-	-
0x0F	Reserved	0	-	-

Table 80. Buffer ID description (continued)

### Notes:

<sup>a</sup> See "LCD Panel and Soft Key Configuration Page (23h)" on page 77 for Operator Panel width and height information to determine the amount of bytes that can be read.

<sup>b</sup> Prior to writing to Buffer ID 7, one or more drives need to be selected with the SEND DIAGNOSTIC command. See "SEND DIAGNOSTIC (1Dh)" on page 122.

## **Buffer Offset**

The buffer offset field contains the byte offset within the specified buffer from which data is transferred. The initiator should conform to the offset boundary requirements returned in the READ BUFFER descriptor. If the library is unable to accept the specified buffer offset, it returns Check Condition status, sets the sense key to Illegal Request, and sets the additional sense code to Illegal Field in the CDB.

### Allocation Length

The Allocation Length is determined by the Mode and Buffer ID.

## Response

The Buffer Response is determined by the mode and Buffer ID.

## Status

After processing the READ BUFFER command, the library returns a status byte as follows:

**Good** The library returns a Good status when it can process the command without errors.

#### **Check Condition**

- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.
- **Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier combinations.

# **READ ELEMENT STATUS (B8h)**

# **CDB** Format

The READ ELEMENT STATUS CDB format is shown in Table 81.

## Table 81. READ ELEMENT STATUS CDB

Bits	7	6	5	4	3	2	1	0
Bytes								
0				Op Cod	e (B8h)			
1	Logic	Logical Unit Number PVolTag Element Type Code						
2	MSB							
:			St	arting Elen	nent Addre	SS		
3								LSB
4	MSB							
:		Number of Elements						
5								LSB
6			Rese	erved			CurData	DVCID
7	MSB							
:				Allocation	n Length			
9								LSB
10				Rese	erved			
11				Cor	ntrol			

# **Parameters**

## Logical Unit Number (LUN)

This field is ignored.

## **PVolTag**

This field indicates whether the volume tag (bar code label) information is returned. The possible values are:

- **0** Do not return volume tag information.
- **1** Return volume tag information.

**Note:** VolTags can only be reported if the library has a bar code scanner installed, and such support is indicated in the INQUIRY response.

## **Element Type Code**

This field specifies the selected element types for the return information. See Table 82.

Table 82. Element Type Code

Bit 3	Bit 2	Bit 1	Bit 0	Selected element type
0	0	0	0	All element types reported (from starting address).
0	0	0	1	Medium Transport Element.
0	0	1	0	Storage Element.
0	0	1	1	Insert/Eject Element.

Table 82. Element Type Code (continued)

0 1 0 0 Data Transfer Element.
--------------------------------

**Note:** The medium changer transfers a cartridge for one element location to another and does not retain a cartridge. If the VolTag bit is set to 1 and the Element Type Code is 0001b, the library returns element status information only. It returns NULLs for the volume tag information.

#### **Starting Element Address**

This field indicates the starting element address. Elements equal to or greater than the starting address are returned.

**Note:** The Starting Element Address field must indicate a valid element but does not necessarily have to match the element type code field.

## Number of Elements

This field specifies the maximum number of element descriptors to return.

## CurData

This field is ignored.

#### DVCID

This field indicates whether device identifiers for a specified range are returned. The possible values are:

- **0** Do not return device identifiers.
- 1 If available, return the device identifiers.

#### Allocation Length

This field specifies the byte length for returned element descriptors. Only complete element descriptors are returned. The library returns element descriptors until one of the following conditions are met:

- · All available element descriptors are returned.
- The number of element descriptors specified in the Number of Elements field are returned.
- The number of bytes of complete element descriptors specified in the Allocation Length field are returned.
- There is less allocation length space available than is required by the next complete element descriptor.

## Response

### **Element Status Header**

Table 83 provides the format for the Element Status header. The library returns one header for each READ ELEMENT STATUS command.

Table 83. Element Status header

Bits	7	6	5	4	3	2	1	0
Bytes								
0	MSB							
:			First I	Element Ad	dress Rep	oorted		
1								LSB
2	MSB							

Table 83. Element Status header (continued)

:	Number of Elements Reported	
3		LSB
4	Reserved	
5	MSB	
:	Byte Count of Report Available	
7		LSB

### **First Element Address Reported**

This field indicates the lowest element address found.

#### Number of Elements Reported

This field indicates the number of elements available to be reported.

#### Byte Count of Report Available

This field indicates the number of available element status bytes that meet the CDB requirements. The value does not include the 8-byte Element Status header and is not adjusted to match the value specified in the Allocation Length field of the CDB.

## **Element Status Page**

Table 84 shows the format of the Element Status Page header. The library returns one Element Status Page header for each group of element descriptors of the same type.

Bits	7	6	5	4	3	2	1	0			
Bytes											
0		Element Code Type									
1	PVolTag	VolTag AVolTag Reserved									
2	MSB	MSB									
:	Element Descriptor Length										
3											
4	Reserved										
5	MSB										
:	Byte Count of Descriptor Data Available										
7								LSB			

Table 84. Element Status Page format

#### **Element Type Code**

This field indicates the specific element type being returned by the element descriptor. See Table 82 on page 99.

#### **PVolTag**

This field indicates that the primary volume tag (bar code label) information is present or not:

- **0** Volume tag bytes are omitted.
- **1** Volume tag bytes are included.

#### AVolTag

Alternate volume tags are not supported. The return value for this bit field is 0.

### **Element Descriptor Length**

This field indicates the number of bytes contained in a single element descriptor.

	Table 85.	Element	Descriptor	Length
--	-----------	---------	------------	--------

Mode	Fie	eld	Value
3582 Tape Library	PVolTag = 0	DVCID = 0	10h all
default	PVolTag = 0	DVCID = 1	10h non-drives50h drives
	PVolTag = 1	DVCID = 0	34h all
	PVolTag = 1	DVCID = 1	34h non-drives74h drives

#### Byte Count of Descriptor Data Available

This field indicates the number of element descriptor data bytes available for the elements of this element type that met the CDB requirements. This value represents the Element Descriptor Length field multiplied by the number of element descriptors for this element type. This value does not include the 8-byte Element Status Page header.

### **Element Descriptors**

The following sections contain the field definitions for the following element descriptors:

- · Medium transport element: medium changer.
- Storage elements: storage cells.
- · Import/Export elements: insert/eject cells.
- Data transfer elements: tape drives.

Each element descriptor includes the element address and status flags. Sense code and other information depends on the element type.

### Medium Transport Element Descriptor

Only one medium transport element, the medium changer, exists. Table 86 shows the Medium Transport Element Descriptor format.

Bits	7	6	2	1	0				
Bytes									
0	MSB	ЛSB							
:				Element	Address				
1		L							
2	Reserved Except Rsvd Fu							Full	
3	Reserved								
4	Additional Sense Code								
5	Additional Sense Code Qualifier								
6									
:	Reserved								
8									
9	SValid	Invert			Rese	erved			

Table 86. Medium Transport Element Descriptor format (continued)

10	MSB
:	Source Storage Element Address
11	LSB
36 bytes	Primary Volume Tag Information(Field omitted if PVolTag = 0)
4 bytes	Reserved(Field moved up if Primary Volume Tag Information field is omitted)
1 byte	Media Domain(Field moved up if Primary Volume Tag Information field is omitted)(Field omitted if Extend_RES in Mixed Media Page 2Ah is not set)
1 byte	Media Type(Field moved up if Primary Volume Tag Information field is omitted)(Field omitted if Extend_RES in Mixed Media Page 2Ah is not set)
1 byte	Element Domain(Field moved up if Primary Volume Tag Information field is omitted)(Field omitted if Extend_RES in Mixed Media Page 2Ah is not set)
1 byte	Element Type(Field moved up if Primary Volume Tag Information field is omitted)(Field omitted if Extend_RES in Mixed Media Page 2Ah is not set)

#### **Element Address**

This field contains the element address of the medium changer.

#### Except

This field is set to 0.

Full This field is set to 0.

## Additional Sense Code

This field is set to 0.

## Additional Sense Code Qualifiers

This field is set to 0.

SValid This field is set to 0.

Invert This field is set to 0.

## Source Storage Element Address

This field is set to 0.

## **Primary Volume Tag**

Volume tag information consists of a volume identifier field of 32 bytes, followed by two reserved bytes, followed by a two-byte sequence number field. The volume identifier consist of a left-justified sequence of ASCII characters. Unused positions are set to blank characters (20h).

The library reports no volume identifier for the medium transport element descriptor. The reserved bytes and the sequence number field is set to 0.

#### Storage Element Descriptor

Each storage cell is a storage element. Table 87 shows the format of the Storage Element Descriptor.

Table 87. Storage Element Descriptor format

Bits	7	6	5	4	3	2	1	0
Bytes								
0	MSB							
:				Element	Address			
1								LSB

## **READ ELEMENT STATUS (B8h)**

	elelage =									
2		Rese	erved	Access	Except	Rsvd	Full			
3		Reserved								
4		Additional Sense Code								
5		Additional Sense Code Qualifier								
6										
:		Reserved								
8										
9	SValid Invert Reserved									
10	MSB									
:	Source Element Address									
11	LSF									
36 bytes		Primary Volume Tag Information(Field omitted if PVolTag = 0)								
4 bytes	Reserved(Field moved up if Primary Volume Tag Information field is omitted)									
1 byte	Media Domain(Field moved up if Primary Volume Tag Information field is omitted)(Field omitted if Extend_RES in Mixed Media Page 2Ah is not set)									
1 byte	Media Type(Field moved up if Primary Volume Tag Information field is omitted)(Field omitted if Extend_RES in Mixed Media Page 2Ah is not set)									
1 byte	Eleme omitte	ent Domair ed)(Field or	i(Field moved up if P mitted if Extend_RES	rimary Vol in Mixed	ume Tag Ir Media Pag	nformation le 2Ah is n	field is ot set)			
1 byte	Elerr omitte	nent Type( ed)(Field o	Field moved up if Pri mitted if Extend_RES	mary Volu in Mixed	me Tag Inf Media Pag	ormation fi je 2Ah is n	eld is ot set)			

Table 87. Storage Element Descriptor format (continued)

#### **Element Address**

This field contains the address of the cartridge storage cell.

#### Access

This field indicates that the medium changer can access the storage cell in a magazine.

- 1 The cell can be accessed. It is installed and configured.
- **0** The cell cannot be accessed. It may not be installed.

### Except

The exception field indicates the current condition of the cartridge cell as follows:

- **0** The storage cell is in a normal condition.
- 1 The storage cell is in an abnormal condition as specified in the Additional Sense Code (ASC) and Additional Sense Code Qualifier (ASCQ) fields.
- **Full** This field indicates if a storage cell contains a cartridge as follows:
  - **0** The storage cell is empty.
  - **1** The storage cell is full.

## Additional Sense Code (ASC)

See Table 90 on page 111 for the supported ASC values.

## Additional Sense Code Qualifier (ASCQ)

See Table 90 on page 111 for the supported ASCQ values.

- **SValid** This bit field indicates the validity of the Source Element Address field as follows:
  - **0** The Source Element Address field is invalid.
  - 1 The Source Element Address field is valid.
- **Invert** Double-sided media is not supported. This field is 0.

### **Source Element Address**

This field indicates the previous element address of the cartridge.

### **Primary Volume Tag Information**

Volume tag information consists of a 32-byte volume identifier field, followed by two reserved bytes, followed by a two-byte sequence number field. The volume identifier consist of a left-justified sequence of ASCII characters. Unused positions are set to blank characters (20h).

When the PVolTag field in the CDB is set to 1, the volume identifier field contains the volume tag (bar code label) information for the element address. The reserved bytes and the sequence number field is set to 0.

The bar code information is reported based on the library scanner mode:

### Default

A six-character bar code label is reported.

### Media ID

If the library's Mixed Media mode page parameter Volser Enable is set (1b), the media identifier or identifiers are reported, followed by the bar code label. If the library's Mixed Media mode page parameter Volser Enable is reset (0b), the six-character bar code label is reported.

#### Extended

The scanner reads a bar code label, which contains at least five characters (with a maximum of 16). The bar code label may include media identifiers and checksum characters.

## Import/Export Element Descriptor

The 3582 Tape Library supports a single Input/Output (I/O) station (also known as the Import/Export station). Each cell in an I/O station has an element address. Table 88 shows the format of the Import/Export Element Descriptor.

Bit	s 7	7 6 5 4 3 2 1									
Bytes											
0	MSB	ASB									
1		Element Address									
		LSI									
2	Rese	Reserved InEnab ExEnab Access Except Imp/Exp Ful									
3		Reserved									
4		Additional Sense Code									
5		Additional Sense Code Qualifier									
6											
:		Reserved									
8											

Table 88. Import/Export Element Descriptor

## **READ ELEMENT STATUS (B8h)**

#### Table 88. Import/Export Element Descriptor (continued)

9	SValid	Invert	Reserved			
10	MSB					
11			Source Element Address			
						LSB
36 bytes			Primary Volume Tag Information (Field omitted if PVolTag = 0)			
4 bytes			Reserved			
-	(Field	l moved ι	up if Primary Volume Tag Information	field i	s omitted)	
1 byte			Media Domain			
	(Field	l moved ι	up if Primary Volume Tag Information	field i	s omitted)	
	(Field	l omitted	if Extend_RES in Mixed Media Page	2Ah i	s not set)	
1 byte			Media Type			
	(Field	l moved ι	up if Primary Volume Tag Information	field i	s omitted)	
	(Field	l omitted	if Extend_RES in Mixed Media Page	2Ah i	s not set)	
1 byte			Element Domain			
	(Field	l moved ι	up if Primary Volume Tag Information	field i	s omitted)	
	(Field	l omitted	if Extend_RES in Mixed Media Page	2Ah i	s not set)	
1 byte			Element Type			
	(Field	l moved u	up if Primary Volume Tag Information	field i	s omitted)	
	(Field	l omitted	if Extend_RES in Mixed Media Page	2Ah i	s not set)	

## **Element Address**

This field contains the address of the insert/eject station element cell.

#### InEnab

This field indicates that the insert/eject station supports cartridge-loading mechanism to enable medium changer access (the insert/eject station magazine is present). The value for this field is 1.

#### **ExEnab**

This field indicates that the insert/eject station supports cartridge unloading mechanism to disable medium changer access (the insert/eject station magazine is removed). The value for this field is 1.

#### Access

This field indicates whether the medium changer can access the cartridge in the insert/eject station as follows:

- **0** The insert/eject station magazine is removed and the medium changer cannot access cartridges.
- 1 The insert/eject station magazine is present and the medium changer can access cartridges.

#### Except

This field indicates the current condition of the insert/eject station cell as follows:

- **0** The insert/eject station cell is in a normal state.
- 1 The insert/eject station cell is in an abnormal state as indicated by the Additional Sense Code (ASC) and Additional Sense Code Qualifier (ASCQ) field.

#### Imp/Exp

- This field indicates how the cartridge was placed in the insert/eject station cell:
- **0** The medium changer placed the cartridge in the insert/eject station.
- 1 The operator placed the cartridge in the insert/eject station.
- **Full** This field indicates that this insert/eject station cell contains a cartridge as follows:
  - **0** No cartridge in the cell.
  - **1** Cartridge in the cell.

#### Additional Sense Code (ASC)

If the insert/eject station cell is in an abnormal state, this field contains 83h (131). See Table 90 on page 111 for supported ASC values.

#### Additional Sense Code Qualifier (ASCQ)

Supported ASCQ values are listed in Table 90 on page 111.

- **SValid** This bit field indicates the validity of the Source Element Address field as follows:
  - **0** The Source Element Address field is invalid.
  - 1 The Source Element Address field is valid.
- **Invert** Double-sided media is not supported. This field is set to 0.

### **Source Element Address**

This field indicates the previous element address of the cartridge.

#### **Primary Volume Tag Information**

Volume tag information consists of a 32-byte volume identifier field, followed by two reserved bytes, followed by a two-byte sequence number field. The volume identifier consist of a left-justified sequence of ASCII characters. Unused positions are set to blank characters (20h).

When the PVolTag field in the CDB is set to 1, the volume identifier field contains the volume tag (bar code label) information for the element address. The reserved bytes and the sequence number field is set to 0.

The bar code information is reported based on the library scanner mode:

#### Default

A six-character bar code label is reported.

#### Media ID

If the library's Mixed Media mode page parameter Volser Enable is set (1b), the media identifier, followed by the bar code label is reported. If the library's Mixed Media mode page parameter Volser Enable is reset (0b), the six-character bar code label is reported.

## Extended

The scanner reads a bar code label, which contains at least five characters (with a maximum of 16). The bar code label may include media identifiers and checksum characters.

#### **Data Transfer Descriptor Page**

The Data Transfer Elements are the tape drives. Table 89 on page 108 shows the format of the Data Transfer Element Descriptor page.

## **READ ELEMENT STATUS (B8h)**

### Table 89. Data Transfer Element Descriptor page format

Bits	7	7 6 5 4 3 2 1 0								
Bytes										
0	MSB	MSB								
1		Element Address								
		LSB								
2		Reserved Access Except Reserved Full								
3		Reserved								
4		Additional Sense Code								
5		Additional Sense Code Qualifier								
6	NotBus	NotBus Reserved IDValid LUValid Reserved Logical Unit Number								
7				SCSI Bus	s Address					
8				Rese	erved					
9	SValid	Invert			Rese	rved				
10	MSB	MSB								
11	Source Element Address									
	LSB									
36 bytes	Primary Volume Tag Information									
	(Field omitted if PVolTag = 0)									
1 byte	Reserved Code Set									
1 byte	Reserved Identifier Type									
1 byte	Reserved									
1 byte		Id	entifier Le	ngth = X (	where X is	Oh to 40	ר)			
x bytes			Device Ide	entifier (O	mitted if DV	CID = 0				
64 - x bytes	Identifier Pad (Omitted if DVCID = 0)									
1 byte	Media Domain									
	(Field moved up if Primary Volume Tag Information field or									
	device identifier field is omitted) (Field omitted if Extend RES in Mixed Media Page 2Ah is not set)									
1 byte	(Field Strifted II Exterio_Field II Winded Wiedla Fage ZAIF is Hot set)									
	(Field moved up if Primary Volume Tag Information field is omitted)							ted)		
	(Field	d omitted if	f Extend_	RES in N	lixed Medi	a Page 2	2Ah is not	set)		
1 byte		Field move	ed up if F	Element Primary V	Domain olume Tag	Informati	ion field or			
			device	identifier	field is or	nitted)				
	(Field	d omitted if	f Extend_	RES in N	lixed Medi	a Page 2	2Ah is not	set)		
1 byte		Field move	ad up if E	Elemer Primary W	nt Type	Informati	ion field or			
			device	identifier	field is or	nitted)				
	(Field	d omitted if	f Extend_	RES in N	lixed Medi	a Page 2	2Ah is not	set)		

## **Element Address**

This field contains the element address of the tape drive.

#### Access

This field indicates whether the medium changer can pick or place a cartridge at the tape drive location as follows:

- **0** The cartridge at the tape drive is not accessible to the medium changer (cartridge is not unloaded).
- **1** The cartridge at the tape drive is accessible by the medium changer (cartridge is unloaded or not present).

#### Except

The exception field indicates the current condition of the tape drive as follows:

- **0** The tape drive is in a normal state.
- 1 The tape drive is in an abnormal state as indicated by the Additional Sense Code (ASC) and the Additional Sense Code Qualifier (ASCQ) fields.
- **Full** This field indicates if the tape drive contains a cartridge as follows:
  - **0** No cartridge in tape drive.

1 Cartridge in tape drive.

### Additional Sense Code (ASC)

This field contains the value 83h (131) or 42h (66) if the tape drive is in an abnormal state. See Table 90 on page 111 for supported ASC values.

### Additional Sense Code Qualifier (ASCQ)

Supported ASCQ values are listed in Table 90 on page 111.

#### **NotBus**

This field is not supported and is set to 0.

## IDValid

This field indicates whether the drive SCSI ID (byte 7) is valid:

- 0 The SCSI ID is not valid.
- 1 The SCSI ID is valid.

#### LUValid

This field is not supported and is set to 0.

#### **Logical Unit Number**

This field is ignored.

## **SCSI Bus Address**

This field contains the tape drive SCSI address (0 .. F).

- **SValid** This bit field indicates the validity of the Source Element Address field as follows:
  - **0** The Source Element Address field is invalid.
  - 1 The Source Element Address field is valid.
- **Invert** Double-sided media is not supported. This field is 0.

## Source Element Address

This field indicates the previous element address location of a cartridge.

## Primary Volume Tag Information

Volume tag information consists of a 32-byte volume identifier field, followed by two reserved bytes, followed by a two-byte sequence number field. The volume identifier consist of a left-justified sequence of ASCII characters. Unused positions are set to blank characters (20h).

When the PVolTag field in the CDB is set to 1, the volume identifier field contains the volume tag (bar code label) information for the element address. The reserved bytes and the sequence number field is set to 0.

The bar code information is reported based on the library scanner mode:

#### Default

A six-character bar code label is reported.

#### Media ID

If the library's Mixed Media mode page parameter Volser Enable is set (1b), the media identifier or identifiers are reported, followed by the bar code label. If the library's Mixed Media mode page parameter Volser Enable is reset (0b), the six-character bar code label is reported.

#### Extended

The scanner reads a bar code label, which contains at least five characters (with a maximum of 16). The bar code label may include media identifiers and checksum characters.

#### Code Set

This field is set to:

- 0h Reserved.
- **1h** The identifier field contains binary values.
- **2h** The identifier field contains ASCII values.

#### **Identifier Type**

This field is set to:

- **0h** The Identifier, if the Identifier Length is set, lists the vendor-specific device serial number only.
- **1h** The Identifier lists the eight-byte Vendor ID, followed by vendor-specific unique identifier information.
- **2h** The Identifier contains a Canonical form of IEEE Extended Unique Identifier, 64-bit (EUI-64). In this case, the Identifier Length field is set to 8.
- **3h** The Identifier contains an FC-PH Name\_identifier.

#### **Identifier Length**

This field contains the length in bytes of the following Device Identifier information. If no device identifier is available, or the DVCID bit in the CDB is 0, the Identifier Length field is 0h and the Code Set and Identifier Type field are also 0h. If the DCVID bit is set, the Identifier Length may be set between 0 and 64 (40h) bytes, depending on the associated drive type.

#### **Device Identifier**

This field provides up to 64 bytes of device identifier information for the device associated with the data transfer element. The format depends on the Identifier Type. Depending on the drive type, the identifier field may contain serial number information or drive inquiry page information.

The length of valid device Identifier information is specified by the Identifier Length. If the DVCID bit in the CDB is 0, this field is omitted.

## **Identifier Pad**

**Note:** If the DVCID bit is set in the CDB, the combined size of the Device Identifier Field and Identifier Pad field will always be 64 (0x40) bytes.

This field pads device identifier information with ASCII characters 32 (20h) to a fixed byte offset to assure that the following media and element information fields are accessed consistently at the same location, regardless of varying device identifier lengths.

If the DVCID bit in the CDB is 0, this field is omitted. If the DVCID bit is set and the Identifier Length is 0, this field will be 64 bytes long.

## ASC and ASCQ Values for Abnormal States

Table 90 describes the ASC and ASCQ values and corrective actions for an abnormal element descriptor condition.

	Table	90.	ASC	and	ASCQ	values
--	-------	-----	-----	-----	------	--------

ASC	ASCQ	Description	Action
83h	00h	Label Questionable	The bar code label is questionable. Issue an INITIALIZE ELEMENT STATUS (07h) or INITIALIZE ELEMENT STATUS WITH RANGE (E7H) command.
	01h Label Read Problem d		The bar code label is either not read correctly, or too short or long.
	02h	Magazine Questionable	The magazine is not present in the library.
	03h	Label and Full Status Questionable	The library was powered on or a front door was opened. Either action could invalidate the cartridge inventory.
	04h	Data Transfer Element not installed	The data transfer element is currently not installed or not responding for library access.
	09h	Label missing	A bar code label is missing.

## Status

After processing the READ ELEMENT STATUS command, the library returns a status byte as follows:

**Good** The library returns a Good status when can process the command without errors.

#### **Check Condition**

- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.
- The library is not ready because it is offline.
- **Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier combinations.

# RELEASE (17h)

The RELEASE command enables the initiator to release a previous reservation. It is not an error to issue the RELEASE command when no previous reservation was made. The RELEASE command is initiator dependent. Only the initiator previously reserving the library may release the library.

# **CDB** Format

The RELEASE CDB format is shown in Table 91.

Table 91. RELEASE CDB

Bits	7	6	5	4	3	2	1	0	
Bytes									
0		Op Code (17h)							
1	Logic	Logical Unit Number 3rdPty Third Party Device ID Element							
2				Reserv	ation ID				
3				Rese	erved				
4		Reserved							
5				Cor	ntrol				

# **Parameters**

#### Logical Unit Number

This field is ignored.

## 3rdPty

The third-party (3rdPty) field is not supported. This value must be set to 0.

### **Third Party Device ID**

The Third Party Device ID is not supported. This field must be set to 0.

#### Element

The value of the Element bit field is set to 0.

#### **Reservation Identification**

The Reservation Identification field is not supported. This field indicates the initiator-established value to identify a specific reservation request. If the Element field is set to 0, this field is ignored.

## Status

After processing the RELEASE command, the library returns a status byte as follows:

**Good** The library returns a Good status when it can process the command without errors.

## **Check Condition**

- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.
- **Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier conditions.

# **REQUEST SENSE (03h)**

The REQUEST SENSE command enables the initiator to request sense data from the target. Sense data (18 bytes) is provided in extended sense data format. The sense data is saved for each individual initiator. The data is preserved for each initiator until either the REQUEST SENSE command or any other command is received.

# **CDB** Format

The REQUEST SENSE CDB format in shown in Table 92.

Table 92. REQUEST SENSE CDB

Bits	7	6	5	4	3	2	1	0	
Bytes									
0		Op Code (03h)							
1	Logic	Logical Unit Number Reserved							
2				Rese	erved				
3				Rese	erved				
4		Allocation Length							
5				Cor	ntrol				

# **Parameters**

## Logical Unit Number (LUN)

This field is ignored

## **Allocation Length**

This field specifies the number of sense bytes requested by the initiator.

## Response

## **Sense Information Format**

The Sense Information format is shown in Table 93.

Table 93. Sense Information Format

Bit	s 7	6	5	4	3	2	1	0
Bytes								
0	Valid			Erro	r Code = (	0x70		
1				Rese	erved			
2		Rese	erved			Sens	e Key	
3	MSB							
:			Co	ommand S	pecific Byt	tes		
6								LSB
7			A	dditional S	ense Leng	jth		
8	MSB							
:				Informati	on Bytes			
11								LSB

## **REQUEST SENSE (03h)**

Table 93. Sense Information Format (continued)

12		Additional Sense Code (ASC)							
13		Additional Sense Qualifier (ASCQ)							
14			Service A	ction Code					
15	SKSV	C/D	Reserved	BPV	Bit Pointer				
16	MSB								
17			Field F	Pointer					
						LSB			

**Valid** The Valid field is set to 0 to indicate the information field does not contain valid information.

#### Error Code

The Error Code field is set to 70h to indicate that the 3582 Tape Library will return only current errors.

#### Sense Key

The Sense Key values are shown in Table 94.

### Table 94. Sense Keys

Sense Key	Description
0h	No Sense. No specific sense key information to report.
2h	Not Ready. The library is not ready to perform motion commands.
4h	Hardware Error. A hardware error was detected and operator intervention may be required.
5h	Illegal Request. The CDB or supplied parameter data contains an unsupported or illegal parameter.
6h	Unit Attention. The library's operating status changed. The cartridge inventory may be invalid.
Bh	Command Aborted. The library aborted a command. The initiator may try the command again.

#### Information Bytes

This field is not supported and is set to 0.

### Additional Sense Length

This field specifies the number of additional sense bytes to follow after this byte. The value returned is 0Ah (10) to indicate that 10 more bytes of sense data are available.

#### **Command Specific Bytes**

Command Specific Bytes are not supported by the library. The value returned is 0.

#### Additional Sense Code (ASC)

This field denotes a specific error condition. Refer to Table 95 on page 115. Additional information is provided in the Additional Sense Code Qualifier (ASCQ).

## Additional Sense Code Qualifier (ASCQ)

This field provides additional information for the ASC. Refer to Table 95 on page 115.

### Service Action Code

This field contains a service action code that indicates to a Customer Service representative what problem is to be fixed.

**Note:** It is possible for the Service Action Code to change after a SCSI command or Operator Panel operation completes.

#### Sense Key Specific Value (SKSV)

The SKSV returns the following values:

- **0** The information in bytes 15 through 17 are not valid.
- 1 The information in bytes 15 through 17 are valid for a Sense Key of Illegal Request (05h) only.

#### Command/Data (C/D)

The C/D byte indicates which parameter, command or data caused the Check Condition status:

- **0** Indicates that the illegal parameter was detected in the Parameter List supplied by the initiator.
- 1 Indicates that the illegal parameter was detected in the CDB.

### Bit Pointer Valid (BPV)

- **0** Indicates that the Bit Pointer field is not valid.
- 1 Indicates that the Bit Pointer field is valid.

## **Bit Pointer**

This field indicates which bit of the byte designated by the field pointer is in error. For a multi-bit field, it points to the most significant bit of the field.

### **Field Pointer**

This field indicates which byte of the CDB or Parameter List (starting with 00) was in error. For a multi-byte field, the Field Pointer points to the most significant byte.

#### **Returned Error Codes**

Table 95 lists the Additional Sense Codes (ASC) and Additional Sense Code Qualifiers (ASCQ) associated with particular Sense Keys.

Table 95. Additional Sense Codes and Qualifiers

Sense Key	Condition	ASC	ASCQ	Description
00h	No Sense	00h	00h	No Additional Sense Code.
02h	Not Ready	04h	00h	The library is not ready due to an unknown cause.
			01h	The library is becoming ready.
			03h	The library is not ready and a manual intervention is required.
			83h	A door is open and a magazine is missing.
			8Dh	Offline

04h	Hardware Error	15h	01h	A mechanical positioning error occurred.
			80h	The medium changer lost a cartridge.
			81h	The medium changer could not pick a cartridge.
			83h	The medium changer could not place a cartridge.
		3Bh	0Dh	The destination element is full.
			0Eh	The source element is empty.
		3Fh	80h	Could not erase EEPROM.
			84h	Could not program EEPROM.
		40h	01h	Cartridge in gripper at power-on.
			80h	Component (number - 80) failure.
			91h	Picker error.
			A0h	Could not move on the extend (Z) axis.
			A1h	Could not home the extend (Z) axis.
			B0h	Could not move on the horizontal (X) axis.
			B1h	Could not home the horizontal (X) axis.
			C0h	The medium changer could not move.
			E0h	The medium changer lost power.
		44h	00h	Internal target failure.
		53h	00h	A drive did not load or unload a tape.
			82h	Cannot lock the I/E station.
			83h	Cannot unlock the I/E station.
		55h	00h	A system device is not available.
		83h	00h	The bar code label is questionable.
			01h	Label too short, too long or duplicate.
			03h	Cell status and bar code questionable.
			09h	The bar code label is missing.
		84h	00	Firmware error.

Table 95. Additional Sense Codes and Qualifiers (continued)

				,
05h	Illegal Request	1Ah	00h	Parameter List length error.
		20h	00h	Illegal opcode in CDB.
		21h	01h	Invalid element address in CDB.
		24h	00h	Invalid field in CDB.
			80h	Attempt to write a read-only buffer.
		25h	00h	Illegal LUN.
		26h	00h	Invalid field in Parameter List.
			01h	A Parameter is not supported.
			02h	Invalid parameter in Parameter List.
			80h	Parameter data checksum failure.
		30h	00h	Incompatible media installed.
		30Bh	0Dh	Destination element full for MOVE MEDIUM command.
			0Eh	Source element empty for MOVE MEDIUM command.
			85h	Destination of MOVE MEDIUM command cannot be medium changer.
			86h	Source of MOVE MEDIUM command cannot be medium changer.
			87h	Cartridge stuck in tape drive.
			90h	Source cartridge loaded into tape drive and not accessible.
			A0h	Media type does not match destination media type.
		3Dh	00h	Invalid bit in "Identify" message.
		3Eh	00h	Incorrect LUN configuration.
		44h	00h	Firmware detected an internal logic failure.
		53h	01h	A drive did not unload a tape.
			80h	Cartridge rejected in the insert/eject station because it was not properly loaded.
			81h	The insert/eject station magazine was removed.
		55h	00h	A system device is not available.
		83h	00h	Bar code label is questionable.
			01h	Label is too short, too long or duplicate.
			02h	Cartridge magazine not installed.
			03h	Cell status and bar code questionable.
			04h	Drive not installed.
			09h	The bar code label is missing.

Table 95. Additional Sense Codes and Qualifiers (continued)

06h	Unit Attention	28h	00h	Door or doors opened and closed, or Not Read/Ready transition.
			01h	I/O station status changed.
		29h	00h	Power-on, SCSI bus reset, or Bus device reset occurred.
			80h	Reset for permanent error occurred.
			81h	Reset into degraded mode of operation.
		2Ah	01h	Mode parameters have been changed.
			01h	New firmware loaded.
0Bh	Abort	43h	00h	Message received at inappropriate time.
		45h	00h	Host rejected "Identify" message sent for reselection.
		47h	00h	Message system was disabled during parity error detection on SCSI bus, message system enabled but initiator rejected "Restore Data Pointer," or all parity error retries exhausted.
		48h	00h	Received an "Initiator Detected Error" or initiator rejected "Restore Data Pointer" in response to an "Initiator Detected Error."
		4Eh	00h	Disconnect during command processing.

Table 95. Additional Sense Codes and Qualifiers (continued)

## Status

After processing the REQUEST SENSE command, the library returns a status byte as follows:

**Good** The library returns a Good status when it can process the command without errors.

## **Check Condition**

The library returns a Check Condition status when a reserved bit is set to 1 or a parameter is invalid in the CDB.

**Note:** See "Response" on page 113 for reported SCSI Sense Code, Additional Sense Code and Additional Sense Code Qualifier combinations.

# **RESERVE** (16h)

The RESERVE command enables the initiator to reserve the entire 3582 Tape Library or specific elements. The reservation remains in effect until:

- The initiator that made the reservation sends another RESERVE command with the same Reservation Identification number (this supersedes any previous reservation).
- The initiator that made the reservation sends a RELEASE command.
- A reset, or a power-on action of the library is performed.
- **Note:** After reserving the entire 3582 Tape Library, only the INQUIRY, RELEASE, REQUEST SENSE, and ALLOW MEDIUM REMOVAL commands are accepted from other initiators. All other commands result in a Reservation Conflict status.

# **CDB** Format

The RESERVE CDB is shown in Table 96.

Table 96. Reserve CDB

Bits	7	6	5	4	3	2	1	0	
Bytes									
0		Op Code (16h)							
1	Logic	al Unit Nu	mber	3rdPty	Third Par	ty Device	ID	Element	
2		Reservation Identification							
3	MSB								
4				Element L	ist Length				
								LSB	
5				Cor	ntrol				

## **Parameters**

#### Logical Unit Number

This field is ignored.

#### 3rdPty

The third-party (3rdPty) field is not supported. This value must be set to 0.

#### Third Party Device ID

The Third Party Device ID is not supported. This field must be set to 0.

#### Element

The value of this field is set to 0.

#### **Reservation Identification**

The Reservation Identification field is not supported. This field allows an assignment of a one-byte identification number for this elements reservation request. The identification number can be used with a subsequent RELEASE command to release the reserved elements associated with the Reservation Identification.

#### Element List Length

This field is set to 0.

# Status

After processing the RESERVE command, the library returns a status byte as follows:

**Good** The library returns a Good status when it can process the command without errors.

## **Check Condition**

- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.
- **Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier conditions.

# **REZERO UNIT (01h)**

The REZERO UNIT command moves the accessor to the home position.

# CDB Format

The REZERO UNIT CDB format is shown in Table 97. Bytes 1 through 5 are set to 0.

Table 97. REZERO UNIT CDB

Bits	7	6	5	4	3	2	1	0	
Bytes									
0		Op Code (01h)							
1	Logic	Logical Unit Number Reserved							
2				Rese	erved				
3				Rese	erved				
4		Reserved							
5				Cor	ntrol				

# Status

After processing the REZERO UNIT command, the library returns a status byte as follows:

**Good** The library returns a Good status when it can process the command without errors.

## **Check Condition**

- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.
- **Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier conditions.

# SEND DIAGNOSTIC (1Dh)

The SEND DIAGNOSTIC command instructs the library to perform either a collective diagnostic test or individual diagnostic procedures. The command is currently supported but always returns a status of GOOD without executing any commanded self tests.

The RECEIVE DIAGNOSTIC RESULTS command is not supported.

# **CDB** Format

The SEND DIAGNOSTIC CDB format is shown in Table 98.

Table 98. Send Diagnostic CDB

Bits	7	7 6 5 4 3 2 1 0								
Bytes										
0		Op Code (1Dh)								
1	Logic	Logical Unit Number PF Rsvd Self Test Dev Ofl UnitOfl								
2		Reserved								
3	MSB									
:		Parameter List Length								
4								LSB		
5		Control								

## **Parameters**

## Page Format (PF)

The value for this field should be set to 1 to conform to the SCSI-2 standard.

#### SelfTest

The value of this field is as follows:

- **0** Perform the diagnostic tests specified in the parameter list.
- **1** Perform a 3582 Self Test. The Self Test performs the following tests:

#### Sensor test

The library tests all sensors.

## **Home Medium Changer**

The medium changer is moved to the home position on the horizontal and reach axes.

## **Cycle Horizontal Axis**

The medium changer is moved from the home position to the end of the vertical axis and then back to the home position.

## DevOfl (Device Offline)

This bit field is not supported. The value for this bit must be set to 0.

## UnitOfl (Unit Offline)

This bit field is not supported. The value of this bit must be set to 0.

## Parameter List Length

This field specifies the parameter list transfer length. See Table 99 on page 123

123.

Table 99. Parameter list length values for self test

Self-test	Parameter List Length Value Must Be	Self-test Action
1	0	No data is transferred. Good status is returned.
0	0	No data is transferred. Good status is returned.
0	10	A 10-byte parameter list follows.

Note: If the parameter list length results in a truncated page, a Check Condition status is returned. See "Response" on page 113.

## Send Diagnostic Parameter List

The value in the Parameter List Length field determines the length of the parameter list. Either a 0 or 10-byte page length may be specified.

Depending on the specified page code, the element address and diagnostic parameter vary. Only page codes 0x82 and 0x8C require an element address. Page codes 0x81h to 0x87 indicate the test count in the diagnostic parameter field, page code 0x8C specifies drive-specific read or write buffer and image size information.

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Table 100. Diagnostic type availability

Page Code	Diagnostic Name	Element Address	Diagnostic Parameter	Description
81h	Home Medium Changer	Reserved	1	The medium changer is moved to its home position.
82h	Cycle Get/Put Cartridge	Storage Element Address	1–255	The medium changer gets a present cartridge and puts it back into the same storage location.
83h	Cycle Gripper Fingers	Reserved	1–255	The medium changer gripper fingers are opened and closed.
85h	Cycle Horizontal Axis	Reserved	1–255	The medium changer is moved to the home position on the horizontal axis, moved to the end of the horizontal axis, and returned to the home position.
86h	Cycle Reach Axis	Reserved	1–255	The medium changer reach axis moves forward and backward.
87h	Cycle Move Cartridge	Reserved	1–255	The medium change moves a cartridge from the first available full storage cell to the last available empty storage cell and back to the source cell.

## SEND DIAGNOSTIC (1Dh)

Page Code	Diagnostic Name	Element Address	Diagnostic Parameter	Description
8Ch	Drive Element Selection	Drive Element Address	See drive-specific 10-byte parameter data	Selects and deselects a drive before and after a Write Buffer command or Read Buffer command. Write Buffer or Read Buffer commands will be applied to all previously selected drives. Drives must be deselected after the Write Buffer or Read Buffer command completes.

Table 100. Diagnostic type availability (continued)

## **10-Byte Test-Specific Send Diagnostic Parameter**

Table 101 shows the 10-Byte Test-Specific Send Diagnostic parameter list format.

Table 101.	10-Bvte	Test-Specific	Send	Diagnostic	parameter	list

В	its	7	6	5	4	3	2	1	0		
Bytes											
0					Page	Code					
1					Rese	erved					
2	Ν	MSB									
3			Parameter List Length = 06h								
			LSB								
4	Ν	MSB									
5					Element	Address					
									LSB		
6	Ν	MSB									
9		Diagnostic Parameter									
Ŭ									LSB		

## Page Code

Specifies which test is requested. Table 101 lists the Page Code field values and a description of the tests.

## **Parameter List Length**

This field value is set to 06h (6), to indicate that six additional bytes follow.

### **Element Address**

Specifies a storage cell element address for the Cycle Get/Put cartridge test (82h). For all other page codes, except page code 8Ch, Drive Selection, set the field value to 0.

#### **Diagnostic Parameter**

Specifies the number of times to start the test specified in the Page Code field. See Table 101 for a list of supported test parameter values.

## **10-Byte Drive-Specific Send Diagnostic Parameter**

Table 102 on page 125 shows the 10-Byte Drive-Specific Send Diagnostic parameter list format when requesting the Drive Element Selection.

## SEND DIAGNOSTIC (1Dh)

Prior to any Write Buffer or Read Buffer command, one or more drives need to be selected to allow Read and Write Buffer commands to operate on the selected drives. After the Read or Write Buffer commands have completed, you must deselect the drives.

**Note:** You must deselect the drives after any Read or Write buffer command, regardless of whether or not the command was successful.

Bits	7	6	5	4	3	2	1	0
Bytes								
0				Page	Code			
1				Rese	erved			
2	MSB							
3			Para	ameter Lis <sup>.</sup>	t Length =	06h		
		LSB						
4	MSB	ISB						
5				Element	Address			
								LSB
6		Reserved WB Select						
7	MSB							
9				Buffe	r Size			
								LSB

Table 102. 10-Byte Drive-Specific Send Diagnostic parameter list

## Page Code

The Page Code is set to 8Ch. Table 102 lists the Page Code field values and a description of the tests.

#### Parameter List Length

This field is set to 06h (6) to indicate that six additional bytes follow.

#### **Element Address**

The element address of the specific drive.

## Select

- 1 Indicates that the drive shall be selected for subsequent Write Buffer or Read Buffer commands.
- **0** Indicates that the drive selection shall be turned off.

## WB

- 1 Indicates that the drive shall be selected or deselected for a Write Buffer command, which will prepare the drive accordingly before a Write Buffer command and after completion of a Write Buffer command.
- **0** Indicates that the drive shall be selected or deselected for a Read Buffer command, which will prepare the drive accordingly before a Read Buffer command and after completion of a Read Buffer command.
- **Note:** Selecting a drive with a specific WB setting requires you to deselect the drive with the same WB setting.

### **Buffer Size**

This field specifies the overall size of the data to be read or written.

## Status

After processing the SEND DIAGNOSTIC command, the library returns a status byte as follows:

**Good** The library returns Good status when it can process the command without errors.

### **Check Condition**

- A Unit Attention condition is pending for the initiator.
- The library is not ready because it is offline.
- A reserved bit is set to 1 or a parameter is invalid in the CDB or SEND DIAGNOSTIC command parameter list.
- The library encounters a hardware problem while trying to perform the requested test.
- **Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier combinations.

## **TEST UNIT READY (00h)**

The TEST UNIT READY command enables the initiator to verify that the 3582 Tape Library is ready to accept commands.

The library does not check whether a different initiator has reserved any or all of it. A status, indicating a Reservation Conflict, may be returned for the next command.

# CDB Format

The TEST UNIT READY CDB format is shown in Table 103.

Table 103. TEST UNIT READY CDB

Bits	7	6	5	4 3 2 1 0				
Bytes								
0		Op Code (00h)						
1	Logical Unit Number Reserved							
2				Rese	rved			
3				Rese	rved			
4		Reserved						
5	Control							

## **Parameters**

### Logical Unit Number (LUN)

This field is ignored. Bytes 2 through 5 are set to 0.

## Status

After processing the TEST UNIT READY command, the library returns a status byte as follows:

**Good** The library returns a Good status when it can process the command without errors.

## Check Condition

- A Unit Attention condition is pending for the initiator.
- The library has detected an unrecoverable hardware error.
- · The library is not ready because it is offline.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.
- **Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier combinations.

# WRITE BUFFER (3Bh)

The WRITE BUFFER command is used for firmware upgrade operations. See Table 105 for supported WRITE BUFFER command Mode parameter values.

## **CDB** Format

The WRITE BUFFER CDB format is shown in Table 104.

Table 104. WRITE BUFFER CDB

	Bits	7	6	5	4	3	2	1	0
Bytes									
0					Op Cod	e (3Bh)			
1		Log	Logical Unit Number Reserved Mode						
2					Buffe	er ID			
3		MSB	ISB						
:			Buffer Offset						
5									LSB
6		MSB							
:					Parameter	List Length			
8		LSE							
9			Control						

## Logical Unit Number

This field is ignored.

**Mode** The Mode field specifies how the library interprets the function of the command. The mode field format is defined in Table 105.

**Note:** Invalid modes will be rejected with sense code Illegal Request, Parameter Not Supported, (5/2601).

Table 105. Mode field definition

	Mode		Description		
Bit 2	Bit 1	Bit 0	Description		
0	1	1	Descriptor Mode		
1	0	1	Download Microcode and Save Mode		
0	1	0	Data Mode		

## **Descriptor Mode**

The Descriptor Mode can be selected for READ BUFFER commands only to select reporting of buffer information for the specified buffer ID.

## **Download Microcode and Save Mode**

The Download Microcode and Save mode specifies that a library firmware image be written to the control memory space of the library. Data is written in sections, starting at Buffer offset 0, until all of the data has been transferred to the library. After the last firmware image block has been received and saved, command completion status will be returned, and the library will reboot.

## Data Mode

The Data Mode specifies that data be written to the specified buffer ID.

## Buffer Id

This field specifies the buffer identifier for the transfer data. This field definition is dependent on the specified Mode field parameter. See Table 106 for the definition.

Note: Prior to writing to Buffer ID 7, the drives need to be selected with the SEND DIAGNOSTIC command. See "SEND DIAGNOSTIC (1Dh)" on page 122.

Buffer ID	Description	Buffer Offset	R/W	Mode
0x00	Failure Log	0	Read	2, 3
0x01	Library Controller Microcode	0	Read/Write	3, 5
0x02	Engineering Test Buffer	0	Read/Write	3, 5
0x03	Reserved	0	-	-
0x04	Reserved	0	-	-
0x05	Reserved	0	-	-
0x06	Operator Panel Display Data (See Note 1)	0	Read	2, 3
0x07	Drive Firmware (See Note 2)	0	Write	2
0x08	Previous System Event Log	0	Read	2, 3
0x09	Current System Event Log	0	Read	2, 3
0x0A	Error Event Log	0	Read	2, 3
0x0B	Reserved	0	-	-
0x0C	Reserved	0	-	-
0x0D	Reserved	0	-	-
0x0E	Reserved	0	-	-
0x0F	Reserved	0	-	-

Table 106. Buffer ID and description

#### Notes:

1. See "LCD Panel and Soft Key Configuration Page (23h)" on page 77 for Operator Panel width and height information to determine the amount of bytes that can be read.

2. Prior to writing to Buffer ID 7, one or more drives need to be selected with the SEND DIAGNOSTIC command. See "SEND DIAGNOSTIC (1Dh)" on page 122.

## **Buffer Offset**

The Buffer Offset field indicates the data offset where the write operation should commence. All buffers start at 0. If data segments are written, the buffer offset must indicate the data offset of the first byte being sent with the data segment.

#### Parameter List Length

This field specifies the data length of the buffer data being transferred. Data may be written in data blocks. Each data block length must be specified until all data blocks have been written.

# Status

After processing the WRITE BUFFER command, the library returns a status byte as follows:

**Good** The library returns a Good status when it can process the command without errors.

## **Check Condition**

- The initiator has a Unit Attention condition pending.
- A reserved bit is set to 1 or a parameter is invalid in the CDB.
- **Note:** See "Response" on page 113 for reported SCSI Sense Code and Additional Sense Code, Additional Sense Code Qualifier combinations.
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## Glossary

This glossary defines the special terms, abbreviations, and acronyms that are used in this publication.

## Numbers

**2:1 compression.** The relationship between the quantity of data that can be stored with compression as compared to the quantity of data that can be stored without compression. In 2:1 compression, twice as much data can be stored with compression as can be stored without compression.

**IBM TotalStorage Ultrium Tape Library 3582.** A device that can be attached to a supported server and used to write data to and from magnetic tape.

# Α

**adapter card.** A circuit board that adds function to a computer.

archive. A collection of files in a designated place.

**ASCII.** American Standard Code for Information Interchange.

**automatic cleaning.** Represented as Auto Clean on the library's operator panel, a function that lets you specify that the library automatically clean the tape drive head with a cleaning cartridge.

## В

**bar code.** A code representing characters by sets of parallel bars of varying thickness and separation which are read optically by transverse scanning.

**bar code label.** A specially coded label that can be affixed to a tape cartridge and which enables a device to identify the cartridge and its volume serial number. The bar code label must be affixed to a tape cartridge to enable the library to identify the cartridge and its volume serial number.

**bar code reader.** In the tape library, a device specialized for scanning and reading bar codes and converting them into either the ASCII or EBCDIC digital character code.

**bit.** Either of the digits 0 or 1 when used in the binary numbering system.

**browser.** A client program that initiates requests to a web server and displays the information that the server returns.

bus. See SCSI bus.

**byte.** A string consisting of a certain number of bits (usually 8) that are treated as a unit and represent a character. A fundamental data unit.

# С

**capacity.** The amount of data that can be contained on storage media and expressed in bytes of data.

cartridge. See tape cartridge.

**cartridge storage slot.** Individual slot located within a magazine that is used to house tape cartridges.

CD. Compact disc.

CDB. See command descriptor block.

**cleaning cartridge.** A tape cartridge that is used to clean the heads of a tape drive. Contrast with *data cartridge*.

**command descriptor block.** Fields that are common to all commands. They include Logical Unit Number field, Reserved field, Control Byte field, and Field Not Implemented.

**compact disc (CD).** A disc, usually 4.75 inches in diameter, from which data is read optically by means of a laser.

**compression.** The process of eliminating gaps, empty fields, redundancies, and unnecessary data to shorten the length of records or blocks.

**configure.** To describe to a system the devices, optional features, and programs installed on the system.

#### D

**data.** Any representations such as characters or analog quantities to which meaning is, or might be, assigned.

**data cartridge.** A tape cartridge dedicated to storing data. Contrast with *cleaning cartridge*.

data compression. See compression.

data transfer rate. The average number of bits, characters, or blocks per unit time passing between corresponding equipment in a data transmission system. The rate is expressed in bits, characters, or blocks per second, minute, or hour.

**default setting.** The value that is assumed when none is explicitly specified.

**device.** Any hardware component or peripheral, such as a tape drive or tape library, that can receive and send data.

**device driver.** A file that contains the code needed to use an attached device.

**diagnostic.** A software program that is designed to recognize, locate, and explain faults in equipment or errors in programs.

differential . See High Voltage Differential (HVD).

disable. To make nonfunctional.

**download.** To transfer programs or data from a computer to a connected device, typically a personal computer.

**drive.** See IBM Ultrium 1 Tape Drive or IBM Totalstorage LTO Ultrium 2 Tape Drive.

**drive head.** The component that records an electrical signal onto magnetic tape, or reads a signal from tape into an electrical signal.

#### Ε

eject. To remove or force out from within.

**electronic mail.** Correspondence in the form of messages transmitted between user terminals over a computer network.

e-mail. See electronic mail.

enable. To make functional.

erase. To remove recorded matter from a magnetic tape.

**Ethernet.** Local area network (LAN) technology that transmits information between computers at speeds of 10 and 100 million bits per second (Mbps).

**export.** Pertaining to the tape library, to remove media from the library using the I/O station.

#### F

**failover.** The routing of all transactions to a second device when the first device fails.

**Fibre Channel.** An optics cable utilizing filaments to transmit data.

file. A named set of records stored or processed as a unit.

**file transfer protocol (FTP).** In the Internet suite of protocols, an application layer protocol that uses TCP and Telnet services to transfer bulk-data files between machines or hosts (servers).

**firmware.** Proprietary code that is usually delivered as firmware as part of an operating system. Firmware is more efficient than software loaded from an alterable medium and more adaptable to change than pure hardware circuitry. An example of firmware is the Basic Input/Output System (BIOS) in read-only memory (ROM) on a PC motherboard.

**FTP site.** Any electronic repository of information that uses the File Transfer Protocol (FTP) for transferring files to and from servers. Use of an FTP site requires a user ID and possibly a password.

#### G

GB. gigabyte.

gigabyte (GB). 1 000 000 000 bytes.

## Η

head. See drive head.

**High Voltage Differential (HVD/DIFF).** A logic signaling system that enables data communication between a supported server and another device, such as the tape library. HVD signaling uses a paired plus and minus signal level to reduce the effects of noise on the SCSI bus. Any noise injected into the signal is present in both a plus and minus state, and is thereby canceled. Synonymous with *differential*.

**host**. The controlling or highest-level system in a data communication configuration. Synonymous with *server*.

HVD. High voltage differential.

#### 

**IBM TotalStorage LTO Ultrium 2 Tape Drive.** A data-storage device that controls the movement of the magnetic tape IBM LTO Ultrium Tape Cartridges. The drive houses the mechanism (drive head) that reads and writes data to the tape. Its native data capacity is 200 GB per cartridge; with 2:1 compression, its capacity is up to 400 GB.

**IBM Ultrium 1 Tape Drive.** A data-storage device that controls the movement of the magnetic tape in IBM LTO Ultrium Tape Cartridges. The drive houses the mechanism (drive head) that reads and writes data to the tape. Its native data capacity is 100 GB per cartridge; with 2:1 compression, its capacity is up to 200 GB. The drive is also known as the IBM Ultrium Internal Tape Drive.

ID. Identifier.

**import.** Pertaining to the tape library, to insert media into the library using the I/O station.

**initialize.** To format a magnetic tape, write a label (VOLSER) on the tape, and leave the tape empty except for the system files containing the structure information. All former contents of the tape are lost.

**insert.** Pertaining to the tape library, to place a tape cartridge into a cartridge storage slot in the library.

**install.** To set up for use or service. The act of adding a product, feature, or function to a system or device either by a singular change or by the addition of multiple components or devices.

**Internet.** The worldwide collection of interconnected networks that use the Internet suite of protocols and permit public access.

inventory. A survey of tape cartridges in the library.

I/O. Input/output.

# Κ

KB. Kilobyte. 2 to the power of 10 or 1024 bytes.

# L

LAN. Local Area Network.

label. See bar code label.

**label area.** On the LTO Ultrium tape cartridge, a recessed area next to the write-protect switch where a label must be affixed.

LCD. See liquid crystal display.

Linear Tape-Open (LTO). A type of tape storage technology developed by the IBM Corporation, Hewlett-Packard, and Seagate. LTO technology is an "open format" technology, which means that its users will have multiple sources of product and media. The "open" nature of LTO technology enables compatibility between different vendors' offerings by ensuring that vendors comply with verification standards. The LTO technology is implemented in two formats: the Accelis format focuses on fast access; the Ultrium format focuses on high capacity. The Ultrium format is the preferred format when capacity (rather than fast access) is the key storage consideration. An Ultrium cartridge has a compressed data capacity of up to 200 GB (at 2:1 compression) and a native data capacity of up to 100 GB. The Ultrium format is designed with a 4-generation road map that provides for up to 1.6 TB per cartridge (at 2:1 compression) in Generation 4, with compressed transfer rate of up to 320 MB per second.

**liquid crystal display (LCD).** A low-power display technology used in computers and other I/O devices.

**load.** Pertaining to the tape library and following the insertion of a tape cartridge into a cartridge storage slot,

the act (performed by the picker) of transferring the cartridge from the storage slot to the drive and of positioning the tape (performed by the tape drive) for reading or writing by the drive head.

**Local area network (LAN).** A computer network that spans a relatively small area. Most LANs are confined to a single building or group of buildings.

Low Voltage Differential (LVD). A low-noise, low-power, and low-amplitude electrical signaling system that enables data communication between a supported server and another device such as the tape library. LVD signaling uses two wires to drive one signal over copper wire. The use of wire pairs reduces electrical noise and cross talk. This method of data transmission requires a cable that is no longer than 25 meters (82 ft.).

LTO. Linear Tape-Open.

LVD. Low voltage differential.

#### Μ

MB. Megabyte.

media. The plural of medium.

media capacity. See capacity.

**media-type identifier.** Pertaining to the bar code on the bar code label of the IBM Ultrium Tape Cartridge, a 2-character code, L1, that represents information about the cartridge. L identifies the cartridge as one that can be read by devices which incorporate LTO technology; 1 indicates that it is the first generation of its type.

**medium.** A physical material in or on which data may be represented, such as magnetic tape.

megabyte (MB). 1 000 000 bytes.

## Ν

**native data capacity.** The amount of data that can be stored without compression on a cartridge.

**native data transfer rate.** The average number of bits, characters, or blocks per unit of time that pass between corresponding equipment in a data transmission system. The rate is express in bits, characters, or blocks per second, minute, or hour.

#### 0

**operating environment.** The temperature, relative humidity rate, and wet bulb temperature of the room in which the tape library routinely conducts processing.

**operating system.** The master computer control program that translates the user's commands and allows application programs to interact with the computer's hardware.

Ρ

PDF. Portable Document Format.

**pick.** Pertaining to the tape library, to remove, by means of a robotic device, a tape cartridge from a storage slot, tape drive, or I/O station.

**picker.** An electromechanical device located on the picker assembly that moves cartridges between the cartridge storage slots, tape drives, or I/O station.

**picker assembly.** The mechanism in the tape library that moves cartridges between the storage slots, tape drives, and the I/O station. The assembly includes the rotary axis motor, sensors, picker, and bar code reader.

**Portable Document Format (PDF).** A standard specified by Adobe Systems, Incorporated, for the electronic distribution of documents. PDF files are compact, can be distributed globally (via e-mail, the web, intranets, or CD-ROM), and can be viewed with the Acrobat Reader, which is software from Adobe Systems that can be downloaded at no cost from the Adobe Systems home page.

**PostScript.** A standard specified by Adobe Systems, Incorporated, that defines how text and graphics are presented on printers and display devices.

**power cord.** A cable that connects a device to a source of electrical power.

**power switch.** Located on the back of the tape library, a toggle switch that lets you turn the power to the library on or off.

**put.** Pertaining to the tape library, to place, by means of a robotic device, a tape cartridge into a storage slot or drive.

# R

**rack.** A unit that houses the components of a storage subsystem, such as the tape library.

**rackmount kit.** A packaged collection of articles used to install the rack-mounted version of the tape library.

**read.** To acquire or interpret data from a storage device, from a data medium, or from another source.

**relative humidity.** The ratio of the amount of water vapor actually present in the air to the greatest amount possible at the same temperature.

**Remote Management Unit (RMU).** Device that allows user access to the library using a web browser.

**remove.** Pertaining to the tape library, to take a tape cartridge from a cartridge storage slot.

RMU. Remote Management Unit

**robotics.** The picker and any associated mechanisms that move a tape cartridge within the tape library.

# S

SAC. Service Action Code

SAN. Storage Area Network

SCSI. Small computer systems interface.

SCSI-2. Small computer systems interface-2.

**SCSI bus.** (1) A collection of wires through which data is transmitted from one part of a computer to another. (2) A generic term that refers to the complete set of signals that define the activity of the Small Computer Systems Interface (SCSI).

SCSI bus cable. See SCSI bus.

SCSI cable. See SCSI bus.

**SCSI commands.** An operation performed by a target (tape drive) for an initiator (host). The command is initiated by the operator from the host console.

**SCSI connector.** One of the set of all female and male connectors on the SCSI bus.

**SCSI device.** Anything that can connect into the SCSI bus and actively participate in bus activity.

**SCSI ID.** The hexadecimal representation of the unique address (0-F) which a user assigns to the tape library and which is used in SCSI protocols to identify or select the drive. The user normally assigns and sets the SCSI ID when installing the drive.

**server.** A functional unit that provides services to one or more clients over a network. Examples include a file server , a print server, and a mail server. The pSeries, iSeries, HP, and Sun are servers. Synonymous with *host*.

**sled.** Pertaining to a tape library, the enclosure that contains the tape drive.

Small Computer Systems Interface (SCSI). A

standard used by computer manufacturers for attaching peripheral devices (such as tape drives, hard disks, CD-ROM players, printers, and scanners) to computers (servers). Pronounced "scuzzy". Variations of the SCSI provide for faster data transmission rates than standard serial and parallel ports (up to 160 MB per second). The variations include:

- Fast/Wide SCSI: Uses a 16-bit bus, and supports data rates of up to 20 MBps.
- SCSI-1: Uses an 8-bit bus, and supports data rates of 4 MBps.
- SCSI-2: Same as SCSI-1, but uses a 50-pin connector instead of a 25-pin connector, and supports multiple devices.
- Ultra SCSI: Uses an 8- or 16-bit bus, and supports data rates of 20 or 40 MBps.
- Ultra2 SCSI: Uses an 8- or 16-bit bus and supports data rates of 40 or 80 MBps.
- Ultra3 SCSI: Uses a 16-bit bus and supports data rates of 80 or 160 MBps.

Small Computer Systems Interface-2 (SCSI-2). See Small Computer Systems Interface (SCSI).

**Storage Area Network (SAN).** High-speed, open-standard scalable network of storage devices and servers providing accelerated data access.

storage slot. See cartridge storage slot.

## Т

**TapeAlert.** A patented technology from Hewlett-Packard that monitors the status of a tape device and media, and detects problems as they occur.

**TapeAlert flags.** Status and error messages that are generated by the TapeAlert utility and display on the host console. The messages indicate the type of problem and tell how to resolve it.

**tape cartridge.** A removable storage device that consists of a housing containing a belt-driven magnetic tape wound on a supply reel and a takeup reel.

tape drive. See IBM Ultrium 1 Tape Drive or IBM Totalstorage LTO Ultrium 2 Tape Drive.

TB. Terabyte.

**teach.** A process where the bar code scanner reads the fiducial labels to identify the types of storage and tape drives installed in the library.

**terminate, termination.** To prevent unwanted electrical signal reflections by applying a device (a terminator) that absorbs the energy from the transmission line.

**terminator.** (1) A part used to end a SCSI bus. (2) A single-port, 75- $\Omega$  device that is used to absorb energy from a transmission line. Terminators prevent energy from reflecting back into a cable plant by absorbing the radio frequency signals. A terminator is usually shielded,

which prevents unwanted signals from entering or valid signals from leaving the cable system.

terabyte (TB). 1 000 000 000 000 bytes.

toggle. To alternate between two states.

transfer rate. See data transfer rate.

## U

**Ultra SCSI.** See Small Computer Systems Interface (SCSI).

**Ultra160 SCSI.** See Small Computer Systems Interface (SCSI).

**Ultrium Tape Drive.** See *IBM Ultrium 1 Tape Drive* or *IBM TotalStorage LTO Ultrium 2 Tape Drive.* 

**unload.** Pertaining to the tape library, the act (performed by the tape drive) of rewinding the tape into the cartridge and ejecting it from the drive and the act (performed by the picker) of transferring the cartridge to a cartridge storage slot.

#### V

**VOLSER.** Volume serial number.

**volume serial number (VOLSER).** A number that a computer assigns to a tape cartridge when it prepares (initializes) the cartridge for use.

**voltage.** The electric potential or potential difference expressed in volts.

#### W

Web. See World Wide Web.

wet bulb temperature. The temperature at which pure water must be evaporated adiabatically at constant pressure into a given sample of air in order to saturate the air under steady-state conditions. Read from a wet-bulb thermometer.

**World Wide Web.** A network of servers that contain programs and files. Many of the files contain hypertext links to other documents available through the network.

write. To make a permanent or transient recording of data in a storage device or on a data medium.

write protected. A tape volume is write protected if some logical or physical mechanism causes the device processing the tape volume to prevent the program from writing on the volume.

write-protect switch. Located on the LTO Ultrium tape cartridge, a switch that prevents accidental erasure of data. Pictures of a locked and unlocked padlock

appear on the switch. When you slide the switch to the locked padlock, data cannot be written to the tape. When you slide the switch to the unlocked padlock, data can be written to the tape.

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