

Quantum[®]

Software Interface Guide

Quantum DX/DXi-Series



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Preface

This guide includes the software interface documentation for the following Quantum DX/DXi Series models:

- DX30
- DX100
- DX3000
- DX5000
- DXi3500
- DXi4700
- DXi5500
- DXi6700
- DXi6800
- DXi6900
- DXi7500
- DXi8500

These models include the SCSI medium changer devices, SCSI tape drive devices, and in some models, the SCSI disk drive devices.

Audience

This guide is designed for use by software engineers who have a basic understanding of SCSI, Fibre Channel, and iSCSI principles and technology.

Purpose

This document describes the software interfaces for all DX/DXi Series devices which are available to host systems. Most DX/DXi Series devices are emulations of actual devices. The systems that are not, are based on actual devices with only simple inquiry data changes. For ease of use, the software interface description specifies the deviations between the emulated device and the actual device. Citing only the deviations was necessary to keep the document to a reasonable size with so many devices available. Attempting to fully document all the features of the DX/DXi Series devices would in essence be repeating the many actual product software interface guides. This was believed to be error prone and difficult to navigate. Therefore, for more complete explanations, it is recommended that a user also obtain the actual software interface guides for each of the DX/DXi emulated devices which will be used. Together with both this guide and the actual software interface guide(s) the user should have sufficient documentation to interface to the DX/DXi devices. Specific references for Quantum software interface guides are supplied. General references for other vendors devices are supplied yet will likely require some additional research as they are out of Quantum's document control.

As noted in the specific deviations, not all features and commands for the DX/DXi Series devices are emulated exactly. An attempt was made to emulate the necessary commands such that the DX/DXi devices operate properly for host data applications such as backup, restore, and disaster recovery. There has been extensive testing using a wide range of host applications to insure that the emulations are compliant with this regard and that the deviations taken are appropriate.

Enhanced Data Protection

The Quantum DX/DXi Series devices take advantage of high speed hard disk drives to greatly reduce the time required for backup/restore functions and also improve confidence in completing the backup in the time allowed. The DX/DXi Series device storage uses RAID technology to greatly enhance the reliability of this stored local data.

Document Organization

This guide is organized as follows:

- [Chapter 1, Emulated Quantum Medium Changer SCSI Command Deviations](#) describes the emulated Quantum medium changer SCSI command deviations.
- [Chapter 2, Emulated Quantum Tape Drive SCSI Command Deviations](#) describes the emulated Quantum tape drive SCSI command deviations.
- [Chapter 3, Emulated HP Tape Drive SCSI Command Deviations](#) describes the emulated HP tape drive SCSI command deviations.
- [Chapter 4, Emulated IBM Tape Drive SCSI Command Deviations](#) describes the emulated IBM tape drive SCSI command deviations.
- [Chapter 5, Emulated Quantum Disk Drive SCSI Command Deviations](#) describes the hard drive SCSI command deviations.
- [Chapter 6, Command Control LUN \(CCL\)](#) describes the CCL SCSI command deviations.

Notational Conventions

This manual uses the following conventions:

Caution: Cautions indicate potential hazards to equipment and are included to prevent damage to equipment. Cautions may advise you that failure to take or avoid an action could result in corrupt data or loss of data.

Note: Notes emphasize important information related to the main topic.

WARNING: Warnings indicate potential hazards to personal safety and are included to prevent injury.

This manual uses the following:

- All binary numbers are succeeded by “b”
- All hexadecimal numbers are succeeded by “h”
- Error or attention conditions are represented in parenthesis that translate as follows:

(SK=S ASC=AA ASCQ=QQ)

where:

S = hexadecimal sense key value

AA = hexadecimal additional sense code

QQ = hexadecimal additional sense code qualifier

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Chapter 1

Emulated Quantum Medium Changer SCSI Command Deviations

This section documents where the DX/DXi Series system deviates from an actual Quantum medium changer. For a complete list of the medium changer SCSI commands, refer to the appropriate Quantum library software interface guide.

General Information

The following section provides general information about the emulated medium changer SCSI command deviations:

- **Number of Elements** - The DX/DXi user can configure the number of Storage (i.e. Bin) Elements, Import/Export Elements, and Data Transfer (i.e. Tape Drive) Elements for each Library emulation. The valid element ranges may differ with each system model. [Table 1](#) provides this data. These range limits do not match the actual libraries which are emulated and in most cases allow for a far greater number of elements. This is typically a useful feature since it then supports a far greater number of concurrent backup/restore jobs, which allows for higher throughputs and bandwidth utilization within the Storage Area Network (SAN).
- **Number of tape Cartridge Media** - Together with the larger number of available Storage and Import/Export elements, the user can configure a larger number of Tape Cartridge Media. By supporting more Tape Cartridge Media, this correlates to greater storage capacity than actual physical tape libraries.
- **Import/Export Elements** - Some configurations of the DX/DXi Series do not emulate an Import/Export Element. Because of this, a number of commands are affected. Command Read Element Status indicates a total of zero Import/Export Elements. Commands

Prevent/Allow Medium Removal and Ready Import are unsupported and will return check condition (5h, 20h, and 0h).

Table 1 Emulated Media Changer Information

Model	Storage Elements	Data Transport Elements	Import/Export Elements
DX30	1280	30	0
DX100	5120	55	0
DX3000	800	32	0
DX5000	1600	64	0
DXi3500	1600	64	0
DXi4700	9000	32	240
DXi5500	3200	64	0
DXi6700	9000	80	240
DXi6800	9000	80	240
DXi6900	9000	160	240
DXi7500	9000	160	240
DXi8500	9000	160	240

Initialize Element Status

Implemented per specification.

Initialize Element Status with Range

Implemented per specification.

Inquiry

Standard Page

Mchngr=0 - indicating not an attached Medium Changer Device.

RMB=1 - indicates medium is removable.

NORMACA or NACA=0 - normal ACA is not supported on any Medium Changer emulations.

HiSup=1 - this aids in detection of large number of LUN's.

Vital Product Data Page 80h - Unit Serial Number - The serial number returned does not follow the actual serial number convention of an actual Quantum tape drive; however, it is a unique number consisting of letters and digits that is maintained in persistent system configuration.

Vital Product Data Page 83h - Device Identification Page - is supported. The following device descriptors are returned:

- Code Set=2, Association=0, Identifier Type=1 (ASCII text comprised of the concatenation of VendorID, ProductID, and Serial Number for logical unit)
- Code Set=1, Association=0, Identifier Type=0 (Binary data comprised of vendor specific information for logical unit)
- Code Set=1, Association=1, Identifier Type=2 (Binary data comprised of EUI-64 bit assigned identifier for target port)*
- Code Set=1, Association=1, Identifier Type=3 (Binary data comprised of NAA assigned identifier for target port)*
- Code Set=1, Association=1, Identifier Type=4 (Binary data comprised of the relative target port ID)*

* if the device access is by means of a Fibre Channel interface, these descriptors are also returned.

Table 2 Inquiry-Standard Page
(Vendor ID, Product ID,
Product Revision)

Vendor ID	Product ID	Product Revision	Notes
"ADIC "	"Pathlight VX "	100A	This is a pure Virtual Medium Changer.

Vendor ID	Product ID	Product Revision	Notes
"ADIC "	"Scalar 100 "	100A	This is based on a Physical Medium Changer.
"ADIC "	"Scalar i500 "	100A	This is based on a Physical Medium Changer.
"ADIC "	"Scalar i2000 "	120A	This is based on a Physical Medium Changer.
"ATL "	"M2500 "	100A	This is based on a Physical Medium Changer.
"ATL "	"P1000 6220050"	100A	This is based on a Physical Medium Changer.
"ATL "	"P7000 6438250"	100A	This is based on a Physical Medium Changer.
"QUANTUM "	"DX3000 6532501"	100A	This is a pure Virtual Medium Changer.
"QUANTUM "	"DX5000 6532502"	100A	This is a pure Virtual Medium Changer.
"QUANTUM "	"DXi4500 "	100A	This is a pure Virtual Medium Changer.
"QUANTUM "	"DXi4601 "	100A	This is a pure Virtual Medium Changer.
"QUANTUM "	"DXi4700 "	100A	This is a pure Virtual Medium Changer.
"QUANTUM "	"DXi6700 "	100A	This is a pure Virtual Medium Changer.
"QUANTUM "	"DXi6800 "	100A	This is a pure Virtual Medium Changer.

Vendor ID	Product ID	Product Revision	Notes
“QUANTUM ”	“DXi6900 ”	100A	This is a pure Virtual Medium Changer.
“QUANTUM ”	“DXi7500 ”	100A	This is a pure Virtual Medium Changer.
“QUANTUM ”	“DXi8500 ”	100A	This is a pure Virtual Medium Changer.
“QUANTUM ”	“PX500 ”	100A	This is based on a Physical Medium Changer.
“QUANTUM ”	“PX720 ”	100A	This is based on a Physical Medium Changer.
“QUANTUM ”	“Scalar i40-i80 ”	120G	This is based on a Physical Medium Changer.
“QUANTUM ”	“Scalar i6000 ”	605A	This is based on a Physical Medium Changer.

Log Sense

PPC=0 - parameter pointer control must be 0h.

SP=0 - does not support saving log parameters

PC=1 - only returns cumulative values for any log parameter.

Refer to the following table:

Table 3 Log Sense-Log Pages

Log Page	Supported
00h - List of Supported Pages	Yes
07h - Last n Error Events	No

Log Page	Supported
2Eh - Tape Alert Parameter alerts 1-64 always return 0h (condition has not occurred)	Yes
30h - Medium Changer Statistics	No
31h - System Monitoring	No
32h - Drive Raw Status	No
33h - Elements Statistics	No
34h - Scan Retries	No
36h - Extended Element Statistics	No
3Eh - Device Status	No

Mode Select 6

Refer to the following table:

Table 4 Mode Select 6/10-
Mode Pages

Mode Page	Supported
02h - Disconnect/Reconnect	No
18h - Fibre Channel Logical unit Control	No
19h - Fibre Channel Port Control	No
1Ch - Informational Exceptions Control	Yes
1Dh - Element Address Assignment As noted under the General Information section, the number of elements may not match an actual Tape Library. Usually, a far greater number is supported.	Yes
1Eh - Transport Geometry Parameters	Yes
1Fh - Device Capabilities	Yes

Mode Select 10

Command not supported. Returns check condition unsupported command (5h, 20h, 0h).

Mode Sense 6

Mode pages supported in **Mode Select** are also supported in **Mode Sense** (see [Table 4](#)).

Page Code 00h - No requested page (i.e. no page data returned).

Page Code 03Fh - return all pages - Implemented per specification.

Mode Sense 10

Command not supported. Returns check condition unsupported command (5h, 20h, 0h).

Move Medium

Implemented per specification.

Persistent Reserve In

Not supported. Returns check condition unsupported command (5h, 20h, 0h).

Persistent Reserve Out

Not supported. Returns check condition unsupported command (5h, 20h, 0h).

Position to Element

Implemented per specification.

Prevent/Allow Medium Removal

Any initiator issuing this command to allow medium removal (Prevent=00b) will allow medium removal for all initiators.

Prevent=00b - Allows medium removal - implemented per specification.

Prevent=01b - Prohibit medium removal - implemented per specification.

Prevent=10b - Not supported, returns check condition (5h,24h,0h).

Prevent=11b - Not supported, returns check condition (5h,24h,0h).

Read Buffer

Command not supported. Returns check condition unsupported command (5h, 20h, 0h).

Read Element Status

Implemented per specification.

Ready Import

Command not supported. Returns check condition unsupported command (5h, 20h, 0h).

Release 6

Only Unit Reservations are supported. Element and Reservation ID Fields must be 0. Third Party Reservations are not supported. A Third Party Device ID field must be 0.

Release 10

Command not supported. Returns check condition unsupported command (5h, 20h, 0h).

Report Device Identifier A3h, (05h)

Not supported. Returns check condition unsupported command (5h, 20h, 0h).

Report LUNS

Implemented per specification.

Request Sense

Implemented per specification.

**Request Volume
Element Address**

Not supported. Returns check condition unsupported command (5h, 20h, 0h).

Reserve 6

Only Unit Reservations are supported. Reservation ID fields must be 0. Third Party Reservations are not supported. Third Party Device ID fields must be 0.

Reserve 10

Command not supported. Returns check condition unsupported command (5h, 20h, 0h).

Send Diagnostic

SelfTst=0 - Self-Test Codes: 00h-07h: returns status GOOD if parameter list length=0h

SelfTst=1 - Self-Test Codes: 00h-07h: returns status GOOD if parameter list length=0h

Send Volume Tag

Command not supported. Returns check condition unsupported command (5h, 20h, 0h).

**Set Device Identifier A4h,
(06h)**

Not supported. Returns check condition unsupported command (5h, 20h, 0h).

Test Unit Ready

Implemented per specification

Write Buffer

Command not supported. Returns check condition unsupported command (5h, 20h, 0h).



Chapter 2

Emulated Quantum Tape Drive SCSI Command Deviations

This chapter documents the emulated Quantum tape drive SCSI command deviations. For a complete list of the Quantum tape drive SCSI commands, refer to the appropriate Quantum drive manual (see www.Quantum.com).

- [Quantum DLT/SDLT Tape Drives](#)
- [Quantum \(Certance\) LTO Tape Drives](#)

Quantum DLT/SDLT Tape Drives

This section documents where the DX/DXi Series system deviates from an actual Quantum tape drive. For a complete list of the Quantum tape drive SCSI commands, refer to the appropriate Quantum tape drive manual.

General Information

The following section provides general information about the emulated Quantum tape drive SCSI command deviations.

- **Tape Cartridge Capacity** - The DX/DXi DLT/SDLT tape cartridge capacity may not necessarily match an actual DLT/SDLT tape cartridge. The user is given the option when creating cartridges to set the capacity depending on the DX/DXi system configuration.

Note: The tape directory for a virtual tape cartridge is limited to a maximum of 32,000 entries. Entries in both Filemarks and Datablocks contribute to this maximum. Writing data with non-fixed block sizes can exhaust the number of available entries.

- MAM (Medium Auxiliary Memory) support - Cartridge MAM is supported. All media will indicate Medium Manufacturer Attribute as Quantum (0x400). All media will indicate Medium Serial Number Attribute (0x401) as blank.
 - The DLT7000 emulated tape drive does not support MAM. Also, the emulated DLT IV tape medium does not support MAM. This matches the behavior of an actual DLT7000 tape drive and DLT IV medium. For the DLT7000, the Read Attribute and Write Attribute commands will return unsupported command check condition (5h, 20h, 0h)
- Tape Drive Compression - When the tape drive is enabled for compression, depending on the system configuration, the data may not actually be compressed.
- FC versus SCSI interface – Where there are different settings/responses which are interface specific, the DX/DXi Series emulates Fibre Channel setting/response.
- WORM Cartridges - WORM (Write Once Read Many) Cartridge Type is not supported in the DXi product. Although, the tape drive emulation will indicate that it has WORM support, no such cartridge types can ever be created in the DXi system.

Erase

Implemented per specification.

Note: The data on the emulated tape cartridge is not physically erased. The tape cartridge directory information is reset to indicate an empty tape cartridge.

Inquiry

Standard Page

HiSup=1 - this aids in detection of large number of LUN's.

Product Revision. Refer to [Table 5](#) for product revisions for actual Quantum tape drives which enjoy wide popularity.

Table 5 Inquiry-Standard Page
(Vendor ID, Product ID,
Product Revision)

Vendor ID	Product ID	Product Revision
“QUANTUM ”	“DLT7000 ”	276B
“QUANTUM ”	“SDLT320 ”	505D
“QUANTUM ”	“SDLT600 ”	292C
“QUANTUM ”	“DLT-S4 ”	1428

Vital Product Data Page 80h - Unit Serial Number - The serial number returned does not follow the actual serial number convention of an actual Quantum tape drive; however, it is a unique number consisting of letters and digits that is maintained in persistent system configuration.

Vital Product Data Page 83h - Device Identification Page - is supported. The following device descriptors are returned:

- Code Set=2, Association=0, Identifier Type=1 (ASCII text comprised of the concatenation of VendorID, ProductID, and Serial Number for logical unit)
- Code Set=1, Association=0, Identifier Type=0 (Binary data comprised of vendor specific information for logical unit)
- Code Set=1, Association=1, Identifier Type=2 (Binary data comprised of EUI-64 bit assigned identifier for target port)*
- Code Set=1, Association=1, Identifier Type=3 (Binary data comprised of NAA assigned identifier for target port)*
- Code Set=1, Association=1, Identifier Type=4 (Binary data comprised of the relative target port ID)*

* if the device access is by means of a Fibre Channel interface, these descriptors are also returned.

Table 6 VPD Inquiry Pages

VPD= 1, Inquiry Pages	DLT7000 Support	SDLT320 Support	SDLT600 Support	DLT-S4 Support
00h - List of Supported Pages	Yes	Yes	Yes	Yes
80h - Unit Serial Number	Yes	Yes	Yes	Yes
83h - Device Identification	Yes	Yes	Yes	Yes
B0h - Sequential Access Device Capabilities	N/A	N/A	N/A	Yes
B1h - Manufacturer assigned Serial Number	N/A	N/A	N/A	Yes
C0h - Drive Component Revision Page Firmware (Vendor Specific)	Yes	Yes	Yes	Yes
C1h - Drive Component Revision Page Hardware (Vendor Specific)	No	Yes	Yes	Yes

Load Unload

Implemented per specification.

Locate

Implemented per specification.

Log Select

Only pages supported in **Log Sense** will have the capability to be reset.

Log Sense

Refer to the following table:

Table 7 Log Sense-Log Pages

Log Page	DLT7000 Support	SDLT320 Support	SDLT600 Support	DLT-S4 Support
00h - List of Supported Pages	Yes	Yes	Yes	Yes
02h - Write Error Counter Only parameter codes 0h-6h are supported. Parameter codes related to error counts or retries will always report as 0h.	Yes	Yes	Yes	Yes
03h - Read Error Counter Only parameter codes 0h-6h are supported. Parameter codes related to error counts or retries will always report as 0h.	Yes	Yes	Yes	Yes
07h - Last n Errors Events	No	No	No	No
0Ch - Sequential Access Device	N/A	N/A	No	No
0Dh - Temperature	N/A	No	No	No
18h - Protocol Specific	N/A	N/A	N/A	No
2Eh - Tape Alert Parameter alerts 1-64 always return 0h (condition has not occurred)	Yes	Yes	Yes	Yes
32h - Data Compression	Yes	Yes	Yes	Yes
33h - Device Wellness	No	No	No	No
38h - General Purpose Non-Volatile	N/A	N/A	N/A	No
3Eh - Device Status	No	No	No	No

Mode Select 6 / 10

Refer to the following table:

Table 8 Mode Select 6/10-
 Mode Pages

Mode Page	DLT7000 Support	SDLT320 Support	SDLT600 Support	DLT-S4 Support
01h - Read-Write Recovery Field PER may be changed by has no effect on the tape drive emulation operation.	Yes	Yes	Yes	Yes
02h - Disconnect/Reconnect Fields Maximum Burst Size and DTDC may be changed by have no effect on the tape drive emulation operation.	Yes	Yes	Yes	Yes
0Ah - Control Mode Field RLEC may be changed but has no effect on the tape drive emulation operation.	Yes	Yes	Yes	Yes
0Fh - Data Compression	Yes	Yes	Yes	Yes
10h - Device Configuration Fields SEW, Write Delay Time, and Select Data Compression Algorithm may be changed but has no effect on the tape drive emulation operation.	Yes	Yes	Yes	Yes
11h - Medium Partition	Yes	Yes	Yes	Yes
18h - (Protocol Specific) Logical unit Control	N/A	No	No	No
19h - (Protocol Specific) Port Control	N/A	No	No	No
1Ch - Information Exception Control Fields DEXcpt and Test may be changed but have no effect on tape drive emulation operation.	Yes	Yes	Yes	Yes
25h - Vendor Specific Configuration	N/A	No	No	No
27h - Data Security	N/A	N/A	N/A	No
3Ch - Disaster Recovery	N/A	No	No	No
3Eh - EEPROM	No	No	No	No

Mode Sense 6 / 10

Mode pages supported in **Mode Select** are also supported in **Mode Sense** (see [Table 8](#)).

Page Code 00h - No requested page (i.e. no page data returned).

Page Code 03Fh - return all pages - Implemented per specification.

Persistent Reserve In

Code 00h Read Keys - implemented per specification

Code 01h Read Reservation - implemented per specification

Code 02h Report Capabilities - Persistent Reservation Types EX_AC (Exclusive Access) and EX_AC_RO (Exclusive Access - Registrants Only) are supported.

Code 03h Read Full Status - is not supported.

Persistent Reserve Out

Codes 00h-06h - implemented per specification

Code 07h - Register and Move - is not supported.

Prevent / Allow Medium Removal

Implemented per specification.

Read

Implemented per specification.

Read Attribute

Implemented per specification.

Read Block limits

Maximum Transfer Size is 200000h (i.e. 2 MB).

Read Buffer

Command is not supported. This command will return Unsupported Command Check Condition (5h, 20h, 0h).

Read Position

Partition Number, Number of objects and bytes in the buffer are always return as 0.

Receive Diagnostics

PVC=1, Page Code 00h, Supported Page List - indicates that no other Diagnostic Pages are supported.

PVC=0, returns a hard coded Diagnostic Report Page of length 6 bytes with values of: 01h, 00h, 01h, 00h, 01h, 00h

Release Unit 6/10

For Release 10, parameter list value should be ≤ 255 , otherwise returns check condition, parameter not supported (5h, 26h, 1h).

Report Density Support

Implemented per specification.

Report Device Identifier A3h, (05h)

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Report LUNS

Implemented per specification.

**Report Supported
Opcodes A3h, (0Ch)**

SDLT600, DLT-S4 - Implemented per specification.

DLT7000, SDLT320 - Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Note: The tape drive models of DLT7000 and SDLT320 do not support this OpCode in compliance with their reported support of T10 SPC.

**Report Supported Task
Management Functions
A3h, (0Dh)**

SDLT600, DLT-S4 - Implemented per specification.

DLT7000, SDLT320 - Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Note: The tape drive models of DLT7000 and SDLT320 do not support this OpCode in compliance with their reported support of T10 SPC.

**Report Timestamp A3h,
(0Fh)**

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Request Sense

Implemented per specification.

Reserve Unit 6/10

For Reserve 10, parameter list value should be ≤ 255 , otherwise returns check condition, parameter not supported (5h, 26h, 1h).

Rewind

Implemented per specification.

Send Diagnostics

SelfTst=0

Self-Test Code - 00h is supported.

Self-Test Codes - 01h, 02h, 04h, 05h, 06h return status GOOD if parameter list length is 0.

SelfTst=1

Self-Test Code - 00h is supported.

Self-Test Codes - 01h-07h are not supported and returns check condition (05h, 24h, 00h).

Set Device Identifier
A4h, (06h)

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Set Timestamp
A4h, (0Fh)

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Space

Implemented per specification.

Test Unit Ready

Implemented per specification.

Verify

Implemented per specification.

Write

Implemented per specification.

Write Attribute

Implemented per specification.

Write Buffer

Command is not supported. This command will return Unsupported Command Check Condition (5h, 20h, 0h).

Write Filemarks.

Implemented per specification.

Quantum (Certance) LTO Tape Drives

This section documents where the DX/DXi Series system deviates from an actual Quantum LTO tape drive. For a complete list of the Quantum LTO SCSI commands, refer to the appropriate Quantum LTO tape drive manual.

General Information

- The following section provides general information about the emulated Quantum (Certance) LTO SCSI command deviations.
- Tape Cartridge Capacity - The DX/DXi LTO tape cartridge capacity may not necessarily match an actual LTO tape cartridge. The user is given the option when creating cartridges to set the capacity depending on the DX/DXi system configuration.
- MAM (Medium Auxiliary Memory) support - Cartridge MAM is supported. All media will indicate Medium Manufacturer Attribute as Quantum (0x400). All media will indicate Medium Serial Number Attribute (0x401) as blank.
- Tape Drive Compression - When the tape drive is enabled for compression, depending on the system configuration, the data may not actually be compressed.
- FC versus SCSI versus SAS interface – Where there are different settings/responses which are interface specific, the DX/DXi Series emulates Fibre Channel setting/response.
- WORM Cartridges - WORM (Write Once Read Many) Cartridge Type is not supported in the DXi product. Although, the tape drive emulation will indicate that it has WORM support, no such cartridge types can ever be created in the DXi system.

- Encryption/Decryption: The later model LTO drive types have the capability to encrypt data as it is written to tape medium and decrypt it when reading this data back. This feature is not emulated.
- Multiple Partitions: Multiple partitions are not supported for any Tape Drive Types.

Eraser

Implemented per specification.

Note: The data on the emulated tape cartridge is not physically erased. The tape cartridge directory information is reset to indicate an empty tape cartridge.

Inquiry

Standard Page

HiSup=1 - this aids in detection of large number of LUN's.

Product Revision. Refer to [Table 9](#) for product revisions for actual Certance tape drives which enjoy wide popularity.

Table 9 Standard Page Product Revision

Vendor ID	Product ID	Product Revision
"CERTANCE"	"ULTRIUM 2 "	1880
"CERTANCE"	"ULTRIUM 3 "	1856

Vital Product Data Page 80h - Unit Serial Number - The serial number returned does not follow the actual serial number convention of an actual Quantum tape drive; however, it is a unique number consisting of letters and digits that is maintained in persistent system configuration.

Vital Product Data Page 83h - Device Identification Page - is supported. The following device descriptors are returned:

- Code Set=2, Association=0, Identifier Type=1 (ASCII text comprised of the concatenation of VendorID, ProductID, and Serial Number for logical unit)

- Code Set=1, Association=0, Identifier Type=0 (Binary data comprised of vendor specific information for logical unit)
- Code Set=1, Association=1, Identifier Type=2 (Binary data comprised of EUI-64 bit assigned identifier for target port)*
- Code Set=1, Association=1, Identifier Type=3 (Binary data comprised of NAA assigned identifier for target port)*
- Code Set=1, Association=1, Identifier Type=4 (Binary data comprised of the relative target port ID)*

* if the device access is by means of a Fibre Channel interface, these descriptors are also returned.

Table 10 VPD Inquiry Pages

VPD=1, Inquiry Pages	Support LTO-2	Support LTO-3
00h - List of Supported Pages	Yes	Yes
80h - Unit Serial Number	Yes	Yes
83h - Device Identification	Yes	Yes
B0h - Sequential Access Device Capabilities	N/A	Yes
C0h - Drive Component Revision Page Firmware	Yes	Yes
C1h - Drive Component Revision Page Hardware	Yes	Yes
C2h - Drive Component Revision	Yes	Yes
C3h - Drive Component Revision	Yes	Yes
C4h - Drive Component Revision	Yes	Yes
C5h - Drive Component Revision	Yes	Yes
C6h - Drive Component Revision	Yes	Yes
DFh - Drive Status	Yes	Yes

Load Unload

Implemented per specification.

Locate Implemented per specification.

Log Select Only pages supported in **Log Sense** will have the capability to be reset.

Log Sense Refer to the following table:

Table 11 Log Sense-Log Pages

Log Page	Support LTO-2	Support LTO-3
00h - List of Supported Pages	Yes	Yes
02h - Write Error Counter Only parameter codes 0h-6h are supported. Parameter codes related to error counts or retries will always report as 0h.	Yes	Yes
03h - Read Error Counter Only parameter codes 0h-6h are supported. Parameter codes related to error counts or retries will always report as 0h.	Yes	Yes
0Ch - Sequential Access Device	N/A	N/A
14h - Device Statistics	No	No
16h - Diagnostic Data	No	No
2Eh - Tape Alert Parameter alerts 1-64 always return 0h (condition has not occurred)	Yes	Yes
30h - Tape Usage	No	No
31h - Tape Capacity	Yes	Yes
32h - Data Compression	Yes	Yes
33h - Error Events	No	No

Log Page	Support LTO-2	Support LTO-3
3Eh - Device Status	Yes	Yes

Mode Select 6 / 10

Table 12 Mode Select 6/10-
Mode Pages

Mode Page	Support LTO-2	Support LTO-3
02h - Disconnect/Reconnect Fields Maximum Burst Size and DTDC may be changed by have no effect on the tape drive emulation operation.	Yes	Yes
0Ah - Control Mode Field RLEC may be changed but has no effect on the tape drive emulation operation.	Yes	Yes
0Fh - Data Compression	Yes	Yes
10h - Device Configuration Fields SEW, Write Delay Time, and Select Data Compression Algorithm may be changed but has no effect on the tape drive emulation operation.	Yes	Yes
1Ch - Information Exception Control Fields DEXcpt and Test may be changed but have no effect on tape drive emulation operation.	Yes	Yes
1Dh - Medium Configuration	N/A	Yes
21h - Drive Capabilities Control	No	No

Mode Sense 6 / 10

Mode pages supported in **Mode Select** are also supported in **Mode Sense** (see [Table 12](#)).

Page Code 00h - No requested page (i.e. no page data returned).

Page Code 03Fh - return all pages - Implemented per specification.

Persistent Reserve In

Code 00h Read Keys - implemented per specification

Code 01h Read Reservation - implemented per specification

Code 02h Report Capabilities - Persistent Reservation Types EX_AC (Exclusive Access) and EX_AC_RO (Exclusive Access - Registrants Only) are supported.

Code 03h Read Full Status - is not supported.

Persistent Reserve Out

Codes 00h-06h - implemented per specification

Code 07h - Register and Move - is not supported.

Prevent / Allow Medium Removal

Implemented per specification.

Read

Implemented per specification.

Read Attribute

Implemented per specification.

Read Block limits

Maximum Transfer Size is 200000h (i.e. 2 MB).

Read Buffer

Command is not supported. This command will return Unsupported Command Check Condition (5h, 20h, 0h).

Read Position

Partition Number, Number of objects and bytes in the buffer are always return as 0.

Receive Diagnostics

PVC=1, Page Code 00h, Supported Page List - indicates that no other Diagnostic Pages are supported.

PVC=0, returns a hard coded Diagnostic Report Page of length 6 bytes with values of: 01h, 00h, 01h, 00h, 01h, 00h

Release Unit 6/10

For Release 10, parameter list value should be ≤ 255 , otherwise returns check condition, parameter not supported (5h, 26h, 1h).

Report Density Support

Implemented per specification.

Report Device Identifier A3h, (05h)

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Report LUNS

Implemented per specification.

Report Supported Opcodes A3h, (0Ch)

Certance LTO3 - Implemented per specification

Certance LTO2 - Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Note: The tape drive model Certance LTO2 does not support this OpCode in compliance with its reported support of T10 SPC.

Report Supported Task Management Functions A3h, (0Dh)

Certance LTO3 - Implemented per specification

Certance LTO2 - Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Note: The tape drive model Certance LTO2 does not support this OpCode in compliance with its reported support of T10 SPC.

Request Sense

Implemented per specification.

Reserve Unit 6/10

For Reserve 10, parameter list value should be ≤ 255 , otherwise returns check condition, parameter not supported (5h, 26h, 1h).

Rewind

Implemented per specification.

Send Diagnostics

SelfTst=0

Self-Test Code - 00h is supported.

Self-Test Codes - 01h, 02h, 04h, 05h, 06h return status GOOD if parameter list length is 0.

SelfTst=1

Self-Test Code - 00h is supported.

Self-Test Codes - 01h-07h are not supported and returns check condition (05h, 24h, 00h).

Set Device Identifier A4h, (06h)

Command is not supported. This command will return Unsupported Command Check Condition (5h, 20h, 0h).

Space Implemented per specification.

Test Unit Ready Implemented per specification.

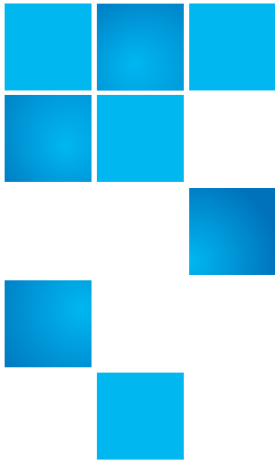
Verify Implemented per specification.

Write Implemented per specification.

Write Attribute Implemented per specification.

Write Buffer Command is not supported. This command will return Unsupported Command Check Condition (5h, 20h, 0h).

Write Filemarks. Implemented per specification.



Chapter 3

Emulated HP Tape Drive SCSI Command Deviations

This chapter documents the emulated HP tape drive SCSI command deviations. For a complete list of the HP LTO tape drive SCSI commands, refer to the appropriate HP drive manual (see www.hp.com).

HP LTO Tape Drive Emulation

This section documents where the DX/DXi Series system deviates from an actual HP tape drive. For a complete list of the HP SCSI commands, refer to the appropriate HP drive manual.

General Information

The following section provides general information about the emulated HP LTO SCSI command deviations.

- **Tape Cartridge Capacity** - The DX/DXi LTO tape cartridge capacity may not necessarily match an actual LTO tape cartridge. The user is given the option when creating cartridges to set the capacity depending on the DX/DXi system configuration.

Note: The tape directory for a virtual tape cartridge is limited to a maximum of 32,000 entries. Entries in both Filemarks and Datablocks contribute to this maximum. Writing data with non-fixed block sizes can exhaust the number of available entries.

- Tape Drive Compression - When the tape drive is enabled for compression, depending on the system configuration, the data may not actually be compressed.
- MAM (Medium Auxiliary Memory) support - Cartridge MAM is supported. All media will indicate Medium Manufacturer Attribute as Quantum (0x400). All media will indicate Medium Serial Number Attribute (0x401) as blank.
- Fibre Channel vs. SCSI vs. SAS Interface - Where there are different settings/responses which are interface specific, the DX/DXi Series emulates the Fibre Channel setting/response.
- WORM Cartridges - WORM (Write Once Read Many) Cartridge Type is not supported in the DXi product. Although, the tape drive emulation will indicate that it has WORM support, no such cartridge types can ever be created in the DXi system.
- Encryption/Decryption: The later model LTO drive types have the capability to encrypt data as it is written to tape medium and decrypt it when reading this data back. This feature is not emulated.
- Multiple Partitions: Multiple partitions are not supported for any Tape Drive Types.

**Maintenance In- Vendor
Unique: A3h, (1Fh)**

A number of vendor unique commands are based off this OpCode (Service Action) yet none of them are supported. Returns check condition, invalid CDB field (5h, 24h, 0h).

**Maintenance Out -
Vendor Unique: A4h,
(1Fh)**

A number of vendor unique commands are based off this OpCode (Service Action) yet none of them are supported. Returns check condition, unsupported command (5h, 20h, 0h).

Allow Overwrite: 82h

Command is not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Erase

Setting “Long” does not over write the entire tape cartridge data area with Data Set Separators.

Note: The data on the emulated tape cartridge is not physically erased. The tape cartridge directory information is reset to indicate an empty tape cartridge.

Inquiry

Standard Page

HiSup=1 - this aids in detection of large number of LUN’s.

Product Revision. Refer to [Table 13](#) for product revisions for actual HP tape drives which enjoy wide popularity.

Table 13 Inquiry-Standard Page (Vendor ID, Product ID, Product Revision)

Vendor ID	Product ID	Product Revision
“HP ”	“Ultrium 1-SCSI ”	E38W
“HP ”	“Ultrium 2-SCSI ”	S53Z
“HP ”	“Ultrium 3-SCSI ”	M23Z
“HP ”	“Ultrium 4-SCSI ”	H44Z
“HP ”	“Ultrium 5-SCSI ”	I30Z

Vital Product Data Page 80h - Unit Serial Number - The serial number returned does not follow the actual serial number convention of an actual HP LTO tape drive; however, it is a unique number consisting of letters and digits that is maintained in persistent system configuration.

Vital Product Data Page 83h - Device Identification Page - is supported. The following device descriptors are returned:

- Code Set=2, Association=0, Identifier Type=1 (ASCII text comprised of the concatenation of VendorID, ProductID, and Serial Number for logical unit)
- Code Set=1, Association=0, Identifier Type=0 (Binary data comprised of vendor specific information for logical unit)
- Code Set=1, Association=1, Identifier Type=2 (Binary data comprised of EUI-64 bit assigned identifier for target port)*
- Code Set=1, Association=1, Identifier Type=3 (Binary data comprised of NAA assigned identifier for target port)*
- Code Set=1, Association=1, Identifier Type=4 (Binary data comprised of the relative target port ID)*

* if the device access is by means of a Fibre Channel interface, these descriptors are also returned.

Table 14 VPD Inquiry Pages

VPD=1, Inquiry Pages	Support LTO-1	Support LTO-2	Support LTO-3	Support LTO-4	Support LTO-5
00h - List of Supported Pages	Yes	Yes	Yes	Yes	Yes
80h - Unit Serial Number	Yes	Yes	Yes	Yes	Yes
83h - Device Identification	Yes	Yes	Yes	Yes	Yes
85h - Management Network Address	N/A	N/A	N/A	No	No
86h - Extended Inquiry	N/A	N/A	Yes	Yes	Yes
87h - Mode Page Policy	N/A	N/A	N/A	Yes	Yes
88h - SCSI Ports	N/A	N/A	N/A	No	No
B0h - Sequential Access Device Capabilities	N/A	N/A	Yes	Yes	Yes
B1h - Manufacturer assigned Serial Number	N/A	N/A	N/A	No	No
B2h - Tape Alert Supported Flags	N/A	N/A	N/A	No	No
C0h - Drive Component Revision Page Firmware	Yes	Yes	Yes	Yes	Yes

VPD=1, Inquiry Pages	Support LTO-1	Support LTO-2	Support LTO-3	Support LTO-4	Support LTO-5
C1h - Drive Component Revision Page Hardware	Yes	Yes	Yes	Yes	Yes
C2h - Drive Component Revision Page PCA	Yes	Yes	Yes	Yes	Yes
C3h - Drive Component Revision Page Mechanism	Yes	Yes	Yes	Yes	Yes
C4h - Drive Component Revision Page Head Assembly	Yes	Yes	Yes	Yes	Yes
C5h - Drive Component Revision Page ACI	Yes	Yes	Yes	Yes	Yes
C6h - Drive Component Revision Page IO Firmware	N/A	Yes	Yes	N/A	N/A

Load Unload

Implemented per specification.

Locate

Implemented as per specification.

Log Select

Only pages supported in **Log Sense** will have the capability to be reset.

Log Sense

Refer to the following table:

Table 15 Log Sense-Log Pages

Log Page	Support LTO-1	Support LTO-2	Support LTO-3	Support LTO-4	Support LTO-5
00h - List of Supported Pages	Yes	Yes	Yes	Yes	Yes

Log Page	Support LTO-1	Support LTO-2	Support LTO-3	Support LTO-4	Support LTO-5
02h - Write Error Counter Only parameter codes 0h-6h are supported. Parameter codes related to error counts or retries will always report as 0h.	Yes	Yes	Yes	Yes	Yes
03h - Read Error Counter Only parameter codes 0h-6h are supported. Parameter codes related to error counts or retries will always report as 0h.	Yes	Yes	Yes	Yes	Yes
0Ch - Sequential Access Device	No	No	No	No	No
0Dh - Temperature	N/A	N/A	No	No	No
11h - DTD Status	N/A	N/A	N/A	N/A	No
13h - Requested Recovery	N/A	N/A	N/A	N/A	No
18h - Protocol Specific	N/A	N/A	No	No	No
2Eh - Tape Alert Parameter alerts 1-64 always return 0h (condition has not occurred)	Yes	Yes	Yes	Yes	Yes
30h - Tape Usage	No	No	No	No	No
31h - Tape Capacity	Yes	Yes	Yes	Yes	Yes
32h - Data Compression	Yes	Yes	Yes	Yes	Yes
33h - Device Wellness	N/A	N/A	N/A	N/A	No
34h - Performance	No	No	No	No	No
3Eh - Device Status	N/A	N/A	No	No	No

Mode Select 6 / 10

Refer to the following table:

Table 16 Mode Select 6/10-
Mode Pages

Mode Page	Support LTO-1	Support LTO-2	Support LTO-3	Support LTO-4	Support LTO-5
01h - Read-Write Recovery field PER may be changed by has no effect on the tape drive emulation operation.	Yes	Yes	Yes	Yes	Yes
02h - Disconnect/Reconnect Fields maximum Burst Size and DTDC may be changed by have no effect on the tape drive emulation operation.	Yes	Yes	Yes	Yes	Yes
0Ah - Control Mode Field RLEC may be changed but has no effect on the tape drive emulation operation.	Yes	Yes	Yes	Yes	Yes
0Ah, sub-page 01h - Control Mode Extension sub-page	N/A	N/A	N/A	No	No
0Fh - Data Compression	Yes	Yes	Yes	Yes	Yes
10h - Device Configuration Fields SEW, Write Delay Time, and Select Data Compression Algorithm may be changed but has no effect on the tape drive emulation operation.	Yes	Yes	Yes	Yes	Yes
10h, sub-page 01h - Device Configuration Extension sub-page Fields TARPf, TAsER, TARCP, and TAPSLD may be changed but has no effect on the tape drive emulation operation.	N/A	N/A	N/A	No	Yes
11h - Medium Partition	Yes	Yes	Yes	Yes	Yes
18h - (Protocol Specific) Logical unit Control	No	No	No	No	No
19h - (Protocol Specific) Port Control	No	No	No	No	No
1Ah - Power condition	N/A	N/A	N/A	No	No

Mode Page	Support LTO-1	Support LTO-2	Support LTO-3	Support LTO-4	Support LTO-5
1Ch - Information Exception Control Fields Perf, DExcpt, Test, and MRIE may be changed but has no effect on the tape drive emulation operation.	Yes	Yes	Yes	Yes	Yes
1Dh - Medium Configuration	N/A	N/A	N/A	Yes	Yes
3Ch - Time Device	N/A	N/A	No	No	No
3Dh - Extended reset (vendor specific)	N/A	N/A	N/A	No	No
3Eh - CD-ROM Emulation/Disaster Recovery	No	No	No	No	No

Mode Sense 6 / 10

Mode pages supported in **Mode Select** are also supported in **Mode Sense** (see [Table 16](#)).

Page Code 00h - No requested page (i.e. no page data returned).

Page Code 03Fh - return all pages - Implemented per specification.

Persistent Reserve In

Code 00h Read Keys - implemented per specification

Code 01h Read Reservation - implemented per specification

Code 02h Report Capabilities - Persistent Reservation Types EX_AC (Exclusive Access) and EX_AC_RO (Exclusive Access - Registrants Only) are supported.

Code 03h Read Full Status - is not supported.

Persistent Reserve Out

Codes 00h-06h - implemented per specification

Code 07h - Register and Move - is not supported.

Prevent / Allow Medium Removal

Implemented per specification.

Read

Implemented per specification

Read 6 (CD-ROM mode)

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Read 10 (CD-ROM mode)

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Read Capacity (CD-ROM mode)

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Read Position

Implemented per specification.

Read Toc (CD-ROM mode)

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Read Media Serial Number ABh, (01h)

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Read Attribute

Implemented per specification.

Read Block limits

Maximum Transfer Size is 200000h (i.e. 2 MB).

Read Buffer

Command is not supported. This command will return Unsupported Command Check Condition (5h, 20h, 0h).

Receive Diagnostics

PVC=1, Page Code 00h, Supported Page List - indicates that no other Diagnostic Pages are supported.

PVC=0, returns a hard coded Diagnostic Report Page of length 6 bytes with values of: 01h, 00h, 01h, 00h, 01h, 00h

Release Unit 6/10

For Release 10, parameter list value should be ≤ 255 , otherwise returns check condition, parameter not supported (5h, 26h, 1h).

Report Density Support

Implemented per specification.

Report Device Identifier A3h, (05h)

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Report LUNS

Implemented per specification.

**Report Supported
OpCodes A3h, (0Ch)**

HP LTO4, HP LTO5 - Implemented per specification

HP LTO1, HP LTO2, HP LTO3 - Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Note: The tape drive models HP LTO1, HP LTO2, and HP LTO3 do not support this OpCode in compliance with their reported support of T10 SPC.

**Report Supported Task
Management Functions
A3h, (0Dh)**

HP LTO4, HP LTO5 - Implemented per specification

HP LTO1, HP LTO2, HP LTO3 - Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Note: The tape drive models HP LTO1, HP LTO2, and HP LTO3 do not support this OpCode in compliance with their reported support of T10 SPC.

**Report Target Port
Groups A3h, (0Ah)**

Command not supported.

Request Sense

Implemented per specification.

Reserve Unit 6/10

For Reserve 10, parameter list value should be ≤ 255 , otherwise returns check condition, parameter not supported (5h, 26h, 1h).

Rewind

Implemented per specification.

Security Protocol In (SPIN): A2h

HP LTO1, HP LTO2, HP LTO3, HP LTO4 - Command is not supported. Returns check condition, unsupported command (5h, 20h, 0h).

HP LTO5 - This feature is minimally supported. It indicates that tape data encryption/decryption is disabled. SecurityProtocol[Security Protocol Specific] of 00h[0000h], 00h[0001h], 20h[0000h], 20h[0001h] are supported.

Security Protocol Out

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Seek (CD-ROM)

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Send Diagnostics

SelfTst=0

Self-Test Code - 00h is supported.

Self-Test Codes - 01h, 02h, 04h, 05h, 06h return status GOOD if parameter list length is 0.

SelfTst=1

Self-Test Code - 00h is supported.

Self-Test Codes - 01h-07h are not supported and returns check condition (05h, 24h, 00h).

Set Capacity

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Set Device Identifier A4h, (06h)

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Space

Implemented per specification.

Start / Stop (CD-ROM mode)

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Test Unit Ready

Implemented per specification.

Verify

Implemented per specification.

Write

Implemented per specification.

Write Attribute

Implemented per specification.

Write Buffer

Command is not supported. This command will return Unsupported Command Check Condition (5h, 20h, 0h).

Write Filemarks

Implemented per specification.



Chapter 4

Emulated IBM Tape Drive SCSI Command Deviations

This chapter documents the emulated IBM tape drive SCSI command deviations. For a complete list of the IBM LTO tape drive SCSI commands, refer to the appropriate IBM drive manual (see www.ibm.com).

IBM LTO Tape Drive Emulation

This section documents where the DX/DXi Series system deviates from an actual IBM LTO tape drive. For a complete list of the IBM LTO SCSI commands, refer to the appropriate IBM drive manual.

General Information

The following section provides general information about the emulated IBM LTO SCSI command deviations.

- **Tape Cartridge Capacity** - The DX Ultrium LTO tape cartridge capacity may not necessarily match an actual Ultrium LTO tape cartridge. The user is given the option when creating cartridges to set the capacity depending on the DX system configuration.

Note: The tape directory for a virtual tape cartridge is limited to a maximum of 32,000 entries. Entries in both Filemarks and Datablocks contribute to this maximum. Writing data with non-fixed block sizes can exhaust the number of available entries.

- MAM (Medium Auxiliary Memory) support - Cartridge MAM is supported. All media will indicate Medium Manufacturer Attribute as Quantum (0x400). All media will indicate Medium Serial Number Attribute (0x401) as blank.
- Tape Drive Compression - When the tape drive is enabled for compression, depending on the system configuration, the data may not actually be compressed.
- FC versus SCSI interface – Wherever there is different responses for SCSI and FC interface, emulation response will be always FC.
- WORM Cartridges - WORM (Write Once Read Many) Cartridge Type is not supported in the DXi product. Although, the tape drive emulation will indicate that it has WORM support, no such cartridge types can ever be created in the DXi system.
- Encryption/Decryption: The later model LTO drive types have the capability to encrypt data as it is written to tape medium and decrypt it when reading this data back. This feature is not emulated.
- Multiple Partitions: Multiple partitions are not supported for any Tape Drive Types.
- APPEND-ONLY WriteMode is supported for IBM LTO5.

Allow Overwrite: 82h

IBM LTO5 - Implemented per specification

IBM LTO1, IBM LTO2, IBM LTO3, IBM LTO4 - Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Note: The tape drive models IBM LTO1, IBM LTO2, IBM LTO3, and IBM LTO4 do not support this OpCode in compliance with their reported support of T10 SPC.

Erase

Setting “Long” does not over write the entire tape cartridge data area with Data Set Separators.

Note: The data on the emulated tape cartridge is not physically erased. The tape cartridge directory information is reset to indicate an empty tape cartridge.

Format Medium: 04h

Command is not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Inquiry

Standard Page

HiSup=1 - this aids in detection of large number of LUN’s.

Product Revision. Refer to [Table 17](#) for product revisions for actual IBM tape drives which enjoy wide popularity.

Table 17 Inquiry-Standard Page (Vendor ID, Product ID, Product Revision)

Vendor ID	Product ID	Product Revision
“IBM ”	“ULTRIUM-TD1 ”	5AU1
“IBM ”	“ULTRIUM-TD2 ”	67U1
“IBM ”	“ULTRIUM-TD3 ”	73P5
“IBM ”	“ULTRIUM-TD4 ”	82FB
“IBM ”	“ULTRIUM-TD5 ”	A5M0

Vital Product Data Page 80h - Unit Serial Number - The serial number returned does not follow the actual serial number convention of an actual IBM LTO tape drive; however, it is a unique number consisting of letters and digits that is maintained in persistent system configuration.

Vital Product Data Page 83h - Device Identification Page - is supported. The following device descriptors are returned:

- Code Set=2, Association=0, Identifier Type=1(ASCII text comprised of the concatenation of VendorID, ProductID, and Serial Number for logical unit)
- Code Set=1, Association=0, Identifier Type=0 (Binary data comprised of vendor specific information for the logical unit)
- Code Set=1, Association=1, Identifier Type=2 (Binary data comprised of EUI-64 bit assigned identifier for logical unit) *
- Code Set=1, Association=1, Identifier Type=3 (Binary data comprised of NAA assigned identifier for logical unit) *
- Code Set=1, Association=1, Identifier Type=4 (Binary data comprised of the relative target port ID) *

* If the device access is by means of a Fibre Channel interface, these descriptors are also returned.

Table 18 VPD Inquiry Pages

VPD= 1, Inquiry Pages	Support LTO-1	Support LTO-2	Support LTO-3	Support LTO-4	Support LTO-5
00h - List of Supported Pages	Yes	Yes	Yes	Yes	Yes
03h - Firmware Designation	Yes	Yes	Yes	No	No
80h - Unit Serial Number	Yes	Yes	Yes	Yes	Yes
83h - Device Identification	Yes	Yes	Yes	Yes	Yes
87h - Mode Page Policy	N/A	N/A	N/A	Yes	Yes
88h - SCSI Ports	No	No	No	No	No
B0h - Sequential Access Device Capabilities	No	No	No	Yes	Yes
C0h - Drive Component Revision Page Firmware	Yes	Yes	Yes	Yes	Yes
C1h - Drive Component Revision Page Hardware	N/A	N/A	N/A	Yes	Yes
C7h - Device Unique Configuration ACI	N/A	N/A	N/A	No	No
C8h - Mode Parameter Default Settings IO Firmware	N/A	N/A	N/A	No	No

VPD= 1, Inquiry Pages	Support LTO-1	Support LTO-2	Support LTO-3	Support LTO-4	Support LTO-5
D0h/E0h - Vendor Unique IID	No	No	No	No	No
D1h/E1h - Vendor Unique IID	No	No	No	No	No

Load Unload

Implemented as per specification.

Locate

Implemented as per specification.

Log Select

Only pages supported in **Log Sense** will have the capability to be reset.

Log Sense

Refer to the following table:

Table 19 Log Sense-Log Pages

Log Page	Support LTO-1	Support LTO-2	Support LTO-3	Support LTO-4	Support LTO-5
00h - List of Supported Pages	Yes	Yes	Yes	Yes	Yes
02h - Write Error Counter Only parameter codes 0h-6h are supported. Parameter codes related to error counts or retries will always report as 0h.	Yes	Yes	Yes	Yes	Yes
03h - Read Error Counter Only parameter codes 0h-6h are supported. Parameter codes related to error counts or retries will always report as 0h.	Yes	Yes	Yes	Yes	Yes

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 IBM LTO Tape Drive Emulation

Log Page	Support LTO-1	Support LTO-2	Support LTO-3	Support LTO-4	Support LTO-5
06h - Non-Medium Errors	N/A	N/A	No	No	No
0Ch - Sequential Access Device	No	No	No	No	No
0Dh - Temperature	N/A	N/A	No	No	No
11h - DTD Status	No	No	No	No	No
14h - Device Statistics Log	No	No	No	No	No
16h - Tape Diagnostic Data Log	N/A	N/A	No	No	No
17h - Volume Statistics	N/A	N/A	N/A	N/A	No
18h - Protocol Specific	N/A	N/A	No	No	No
1Ah - Power Condition Transitions	N/A	N/A	N/A	N/A	No
1Bh - Data Compression	N/A	N/A	N/A	N/A	No
2Eh - Tape Alert Parameter alerts 1-64 always return 0h (condition has not occurred)	Yes	Yes	Yes	Yes	Yes
30h - Tape Usage	No	No	No	No	No
31h - Tape Capacity	Yes	Yes	Yes	Yes	Yes
32h - Data Compression	Yes	Yes	Yes	Yes	Yes
33h - Write Errors	N/A	N/A	N/A	N/A	No
34h - Read Forward Errors	N/A	N/A	No	No	No
37h - Read Performance Characteristics	N/A	N/A	N/A	No	No
38h - Bytes/Block Transferred	N/A	N/A	No	No	No
39h - Host Port 0 Interface Errors	N/A	N/A	No	No	No
3Ah - Drive Control Verification	N/A	No	No	No	No
3Bh - Host Port 1 Interface Errors	N/A	N/A	No	No	No
3Ch - Drive Usage Information	No	No	No	No	No

Log Page	Support LTO-1	Support LTO-2	Support LTO-3	Support LTO-4	Support LTO-5
3Dh - Subsystem Statistics	N/A	N/A	No	No	No
3Eh - Device Status	N/A	N/A	No	No	No

Mode Select 6 / 10

Refer to the following table:

Table 20 Mode Select 6/10-
Mode Pages

Mode Page	Support LTO-1	Support LTO-2	Support LTO-3	Support LTO-4	Support LTO-5
01h - Read-Write Recovery Field PER may be changed by has no effect on the tape drive emulation operation.	Yes	Yes	Yes	Yes	Yes
02h - Disconnect/Reconnect Fields maximum Burst Size and DTDC may be changed by have no effect on the tape drive emulation operation.	Yes	Yes	Yes	Yes	Yes
0Ah - Control Mode Field RLEC may be changed but has no effect on the tape drive emulation operation.	Yes	Yes	Yes	Yes	Yes
0Ah, sub-page 01h - Control Mode Extension sub-page	N/A	N/A	N/A	No	No
0Fh - Data Compression	Yes	Yes	Yes	Yes	Yes
10h - Device Configuration Fields SEW, Write Delay Time, and Select Data Compression Algorithm may be changed but has no effect on the tape drive emulation operation.	Yes	Yes	Yes	Yes	Yes

Mode Page	Support LTO-1	Support LTO-2	Support LTO-3	Support LTO-4	Support LTO-5
10h, sub-page 01h - Device Configuration Extension sub-page WriteMode setting of 0 (WRITE-ANYWHERE) and 1 (APPEND-ONLY) are supported.	N/A	N/A	N/A	N/A	Yes
11h, Medium Partition	N/A	N/A	N/A	N/A	No
18h - (Protocol Specific) Logical unit Control	No	No	No	No	No
19h - (Protocol Specific) Port Control	No	No	No	No	No
1Ch - Information Exception Control Fields DExcpt and Test may be changed but have no effect on tape drive emulation operation.	Yes	Yes	Yes	Yes	Yes
1Dh - Medium Configuration	N/A	N/A	N/A	Yes	Yes
24h - Vendor Specific Control	No	No	No	No	No
2Fh - Behavior Configuration	No	No	No	No	No
3Dh - LEOT	No	N/A	N/A	N/A	N/A

Mode Sense 6 / 10

Mode pages supported in **Mode Select** are also supported in **Mode Sense** (see [Table 20](#)).

Page Code 00h - No requested page (i.e. no page data returned).

Page Code 03Fh - return all pages - Implemented per specification.

Persistent Reserve In

Code 00h Read Keys - implemented per specification

Code 01h Read Reservation - implemented per specification

Code 02h Report Capabilities - Persistent Reservation Types EX_AC (Exclusive Access) and EX_AC_RO (Exclusive Access - Registrants Only) are supported.

Code 03h Read Full Status - is not supported.

Persistent Reserve Out

Codes 00h-06h - implemented per specification
Code 07h - Register and Move - is not supported

Prevent / Allow Medium Removal

Implemented per specification.

Read

Implemented per specification.

Read Attribute

Implemented per specification.

Read Block limits

Maximum Transfer Size is 200000h (i.e. 2 MB).

Read Buffer

Command is not supported. This command will return Unsupported Command Check Condition (5h, 20h, 0h).

Read Position

Implemented per specification.

Receive Diagnostics

PVC=1, Page Code 00h, Supported Page List - indicates that no other Diagnostic Pages are supported.

PVC=0, returns a hard coded Diagnostic Report Page of length 6 bytes with values of: 01h, 00h, 01h, 00h, 01h, 00h

Release Unit 6/10

Implemented per specification.

Report Density Support

Implemented per specification.

Report LUNS

Implemented per specification.

**Report Supported
OpCodes: A3h, (0Ch)**

IBM LTO5 - Implemented per specification

IBM LTO1, IBM LTO2, IBM LTO3, IBM LTO4 - Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Note: The tape drive models IBM LTO1, IBM LTO2, IBM LTO3, and IBM LTO4 do not support this OpCode in compliance with their reported support of T10 SPC.

**Report Supported Task
Management Functions
A3h, (0Dh)**

IBM LTO5 - Implemented per specification

IBM LTO1, IBM LTO2, IBM LTO3, IBM LTO4 - Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Note: The tape drive models IBM LTO1, IBM LTO2, IBM LTO3, and IBM LTO4 do not support this OpCode in compliance with their reported support of T10 SPC.

**Report Timestamp A3h,
(0Fh)**

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Request Sense

Sense Data - fields Error Flag Data, Current Wrap, and SCSI Address are not supported an return 0.

Reserve Unit 6/10

Implemented per specification.

Rewind

Implemented per specification.

Security Protocol In (SPIN)

IBM LTO1, IBM LTO2, IBM LTO3, IBM LTO4 - Command is not supported. Returns check condition, unsupported command (5h, 20h, 0h).

IBM LTO5 - This feature is minimally supported. It indicates that tape data encryption/decryption is disabled. SecurityProtocol[Security Protocol Specific] of 00h[0000h], 00h[0001h], 20h[0000h], 20h[0001h] are supported.

Security Protocol Out

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Send Diagnostics

SelfTst=0

Self-Test Code - 00h is supported.

Self-Test Codes - 01h, 02h, 04h, 05h, 06h return status GOOD if parameter list length is 0.

SelfTst=1

Self-Test Code - 00h is supported.

Self-Test Codes - 01h-07h are not supported and returns check condition (05h, 24h, 00h).

Set Capacity

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Set Timestamp A4h, (0Fh)

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Space

Implemented per specification.

Test Unit Ready

Implemented per specification.

Verify

Immed field is ignored.

Write

Implemented per specification.

Write Attribute

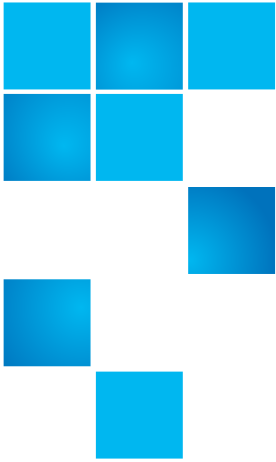
Implemented per specification.

Write Buffer

Command is not supported. This command will return Unsupported Command Check Condition (5h, 20h, 0h).

Write Filemarks

Implemented per specification.



Chapter 5

Emulated Quantum Disk Drive SCSI Command Deviations

This chapter describes the Virtual Disk Driver SCSI command support.

SCSI Reference

All SCSI commands are based on the SCSI Block Commands (SBC-2) specifications, Rev-16 November-13 2004 and on the SCSI Primary Commands (SPC-2), Rev-20 July-18 2001

SCSI Commands errors

Any SCSI command not understood by the virtual disk driver returns a Check Condition with Illegal Request.

SCSI Commands

Start Stop Unit

This command is accepted, but has no effect, always returns status GOOD.

Test Unit Ready

This command is accepted, but has no effect, always returns status GOOD.

Synchronize Cache

This command is accepted, but has no effect, always returns status GOOD.

Verify

This command is accepted, but has no effect, always returns status GOOD.

Verify 16

This command is accepted, but has no effect, always returns status GOOD.

Reserve 6

This command is accepted, but has no effect, always returns status GOOD.

Release 6

This command is accepted, but has no effect, always returns status GOOD.

Reserve 10

This command is accepted, but has no effect, always returns status GOOD.

Release 10

This command is accepted, but has no effect, always returns status GOOD.

Read 6

As per SBC-2. Can return CHECK CONDITION with MEDIUM ERROR, or ILLEGAL REQUEST.

Read 10

As per SBC-2. Can return CHECK CONDITION with MEDIUM ERROR, or ILLEGAL REQUEST.

Read 16

As per SBC-2. Can return CHECK CONDITION with MEDIUM ERROR, or ILLEGAL REQUEST.

Write 6

As per SBC-2. Can return CHECK CONDITION with MEDIUM ERROR, or ILLEGAL REQUEST.

Write 10

As per SBC-2. Can return CHECK CONDITION with MEDIUM ERROR, or ILLEGAL REQUEST.

Write 16

As per SBC-2. Can return CHECK CONDITION with MEDIUM ERROR, or ILLEGAL REQUEST.

Write Verify 10

Behaves as a WRITE 10, no actual data verification is done. Can return CHECK CONDITION with MEDIUM ERROR, or ILLEGAL REQUEST.

Inquiry

A subset of behaviors mentioned in SPC-2 is supported.

Report LUNS

A subset of behaviors mentioned in SPC-2 is supported.

Read Capacity 10

A subset of behaviors mentioned in SBC-2 is supported.

Mode Sense 6

As per SPC-2:

Table 21 Mode Sense Pages

Mode Pages	Description
0x00	Return short LBA with number of blocks and block length
0x02	Disconnect-Reconnect mode page
0x03	Obsolete (Format Device mode page)
0x04	Obsolete (Rigid Disk Geometry mode page)
0x08	Caching mode page
0x0a	Control mode page
0x1c	Informational Exceptions Control mode page
0x3f	Send all the above mode pages

Request Sense

As per SPC-2, always return NO SENSE.

Service Action In 16

Returns in a buffer the highest block number (LBA) and the size in bytes of a block:

Byte number	Contents
0-7	Highest block number
8-12	Size of a block in bytes



Chapter 6

Command Control LUN (CCL)

This section documents where the DXi Series system deviates from a SCSI Array Controller Device (e.g. RAID) as defined in the T10 SAM/SCC specifications. This is a type 12 (i.e. 0Ch) SCSI device. There is no actual device that this emulation was based upon.

This device is also commonly referred to by Quantum as a **Command Control LUN** or **CCL**.

The main purpose for including this DXi emulation is to handle a special circumstance. It has been noted that some older operating systems require the Array Controller Device (e.g. RAID) to be mapped at LUN 0 in order to detect large number of LUNs beneath it on this port. While it is typical that these LUNs are usually SCSI disk devices, it has been observed that other SCSI devices will also be detected. In the case of DXi, these SCSI devices are VTL's which can now be configured with large number of SCSI tape devices. Without this requirement, the operating system will not automatically scan for large number of LUNs (usually > 8 LUNs). This emulation should only be configured for this special circumstance. With this main purpose in mind, the rational is to emulate only the minimal SCSI command set to satisfy this special requirement. Most importantly, it needs to properly handle the **Report LUNs**, **Inquiry**, **Request Sense**, and **Test Unit Ready** commands in order to properly support device detection.

General Information

The following section provides general information about the emulated CCL command deviations from the SAM/SCC specifications.

Inquiry

The inquiry page is as follows:

Standard Page

Vendor Identification "QUANTUM "

Product Identification "DXi CCL "

Vital Product Data Page 80h - Unit Serial Number

The serial number returned may not follow any actual serial number convention of an actual Array Controller Device; however, it is a unique number consisting of letters and digits that is maintained by persistent system configuration.

Vital Product Data Page 83h

Device Identification Page - is supported.

The following device descriptors are returned:

- Code Set=1, Association=0, Identifier Type=3 (Binary data comprised of NAA assigned identifier for logical unit) *
- Code Set=1, Association=1, Identifier Type=3 (Binary data comprised of NAA assigned identifier for target port) *
- Code Set=1, Association=1, Identifier Type=4 (Binary data comprised of the relative target port ID) *

* If the device access is by means of a Fibre Channel interface, these descriptors are also returned.

Maintenance In

Not supported. Returns check condition, unsupported command (5h, 20h, 0h).

Persistent Reserve In

Code 00h Read Keys - implemented per specification

Code 01h Read Reservation - implemented per specification

Code 02h Report Capabilities - Persistent Reservation Types EX_AC (Exclusive Access) and EX_AC_RO (Exclusive Access - Registrants Only) are supported.

Code 03h Read Full Status - is not supported.

Persistent Reserve Out

Codes 00h-06h - implemented per specification

Code 07h - Register and Move - is not supported

Redundancy Group In

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h)

Request Sense

Implemented as per SAM specifications.

Release Unit 6/10

3rd party reservation is not supported

Report LUNS

Implemented as per SAM specification

Reserve Unit 6/10

3rd party reservation is not supported

Test Unit Ready

Implemented as per SAM specification

Volume Set In

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h)

Volume Set Out

Command not supported. Returns check condition, unsupported command (5h, 20h, 0h)