Quantum

SDLT 220 and SDLT 320 Design & Integration Guide

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Revision History

All revisions made to this document are listed below in chronological order.

Document Release	Date	Summary of Changes
A01	April 29, 2002	Initial release.
B	April 30, 2002	Minor changes.

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CHAPTER 1 Introduction

1.1 Purpose and Scope

The purpose of this design and integration guide is to provide detailed information that may be helpful to refer to as you integrate the SDLT 220 and SDLT 320 cartridge tape systems into larger systems. The SDLT 220 and SDLT 320 cartridge tape systems, subsequently referred to in this document as SDLT 220/320, have many characteristics in common, enabling both sets of information to be presented in a single document.

This guide is intended mainly for customers who will be integrating the SDLT drive into their products. Technical knowledge on the part of the user is assumed.

NOTE: Except where clearly noted, the information in this document applies to *both* models of the tape drive.

1.2 Referenced Documents

- *Super DLTtape™ Interactive Library Interface Specification* 66-80000-00
- *SDLT 220 and SDLT 320 Product Manual* 81-85002-01
- *SDLT 220 and SDLT 320 SCSI Interface Guide* 81-85001-01.

1.3 Related Documents

- *Super DLTtape™ DVT Report* 86-80001-01
- *Super DLTtape™ BRC DVT Report* 86-81000-01
- *Super DLTtape™ 320 DVT Report* 86-85001-01
- *SDLT 1.5 (320) Engineering Specification* 82-80005-00
- *DLT Script Tool User Guide* 86-60010-01.

1.4 Structure of this Manual

- **Chapter 1, Introduction**, is the chapter you are currently reading.
- **Chapter 2, General Drive Specifications**, provides a basic product description of the SDLT 220/320 tape drive, and the drive specifications such as dimensions and tolerances, functional, physical vibration and shock, and environmental requirements.
- **Chapter 3, Electrical Specifications**, includes the power supply requirements.
- **Chapter 4, Thermal Specifications**, includes the temperature measurement locations and the thermal profile for the drive.
- **Chapter 5, Regulatory Requirements**, includes safety (UL, CSA, EN/IEC, “GS Mark”) standards, EMI (EEC Directive, VCCI Class B, BSMI Class A, FCC MDOC, AS/NZS, IECS), and acoustic noise emissions.
- **Chapter 6, SCSI and Controller Interface Specification**, is a chapter providing information that “goes beyond” information in the basic SCSI specification. This chapter also provides information about the optional connection to a loader or library system.
- **Chapter 7, Updating the Firmware**, describes the two processes for updating the firmware inside the drives.
- **Chapter 8, Insertion and Extraction Guidelines**, includes the cartridge insertion and ejection guidelines.

1.5 Conventions

This manual uses the following conventions to designate specific elements:

Table 1-1. Typographical Conventions

Element	Convention	Example
Commands	Uppercase (unless case-sensitive)	FORMAT UNIT
Messages	Uppercase	INVALID PRODUCT NUMBER
Hexadecimal Notation	Number followed by lowercase h	25h
Binary Notation	Number followed by lowercase b	101b
Decimal Notation	Number without suffix	512
Acronyms	Uppercase	POST
Abbreviations	Lowercase, except where standard usage requires uppercase	Mb (megabits) MB (megabytes)

1.6 For More Information

The web site ***http://www.superdlttape.com*** includes much valuable information about SDLT systems; or to locate very specific product-related information, visit ***http://www.quantum.com/SDLT***.

For personalized information about Quantum's reliable data protection products, call 1-800-624-5545 in the U.S.A. and Canada.

1.7 Reader Comments

Quantum is committed to providing the best products and service. We encourage your comments, suggestions, and corrections for this manual. Please send all comments to:

Quantum Technical Publications
4001 Discovery Dr.
Suite 1100
Boulder, Colorado USA 80303

1.8 Quantum Diagnostics Tools

Quantum frequently provides new and updated tools to use with its tape drives. For example:

SDLT Update	This utility is a SCSI-based Windows application that allows you to load tape drive firmware and create code upload tapes.
GSLink	Allows you to quickly diagnose the integrity of the drive using an infrared (wireless) communication connector located on the front panel of the tape drive.
Pocket GSLink	Allows you to diagnose the integrity of a Super DLTtape drive using your Pocket PC. This application uses infrared (wireless) communication between your Pocket PC and the Super DLTtape drive. *Pocket GSLink* runs on the Pocket PC 2002 operating system.
Density Select	A utility that enables you to specify that your SDLT 320 tape drive write data cartridges that are backward compatible with your SDLT 220 tape drives.

All tools are available on Quantum's web site, ***http://www.quantum.com***. New tools and utilities get added frequently. Follow the path **Service and Support => DLTtape Drivers and Software** and look at the list to see what is available.

CHAPTER 2 General Drive Specifications

2.1 Product Description

The Quantum Super DLTtape™ System is a highly scalable platform designed for multiple product generations. It is a follow-on to the DLTtape product family, which is the industry standard for mid-range UNIX and NT system backup and archive applications. The SDLT tape system consists of the drive and the tape cartridge; the system is available in either a built-in (internal) model or a tabletop model.

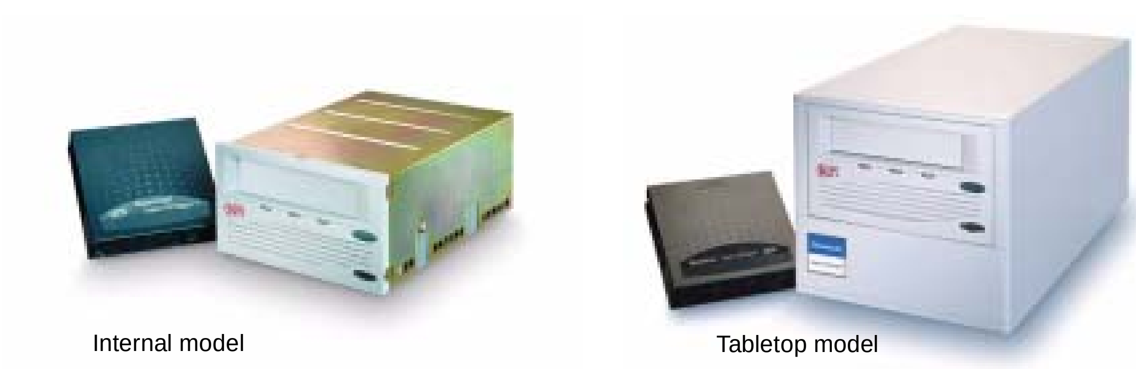


Figure 2-1. SDLT 220/320 Drive System

2.2 SDLT Product Features

SDLT tape drives offer the following product features:

- A streaming tape drive that uses half-inch wide Digital Linear Tape (DLT) media.
- Standard 5.25-inch full-height form factor to simplify integration into system and tape library solutions.
- The SDLT architecture builds on the DLT legacy by offering backward compatibility: data backed up today using the DLT 8000, DLT 7000, DLT 4000, and DLT 1 (Benchmark) systems will be retrievable in the future using SDLT-based systems with DLT IV type media.
- Global Storage Link (GS Link) — An infrared (wireless) interface that provides a wireless remote testing base allowing customers and integrators to access system diagnostic information from the front of the tape system.
- When needed, the SDLT 320 can be operated in a mode that is completely compatible with that of the SDLT 220.
- Handle-free load and unload feature to increase ease of use.
- One of three possible SCSI implementations; these three implementations are listed in “SCSI Interface Type” on page 6-1.

2.2.1 SDLT 220/320 Library Tape Drive Interface

The library tape drive interface (for SDLT drives) is an RS-422 serial port set to 9600 baud, 8 bits per character, no parity, and 2 stop bits. All data sent to or from the library tape drive interface consists of bit-wise encoded hex values.

2.2.2 SDLT 220/320 Front Panel LEDs

Figure 2-2 shows the color, position, and meaning (interpretation) of the three front panel LEDs.

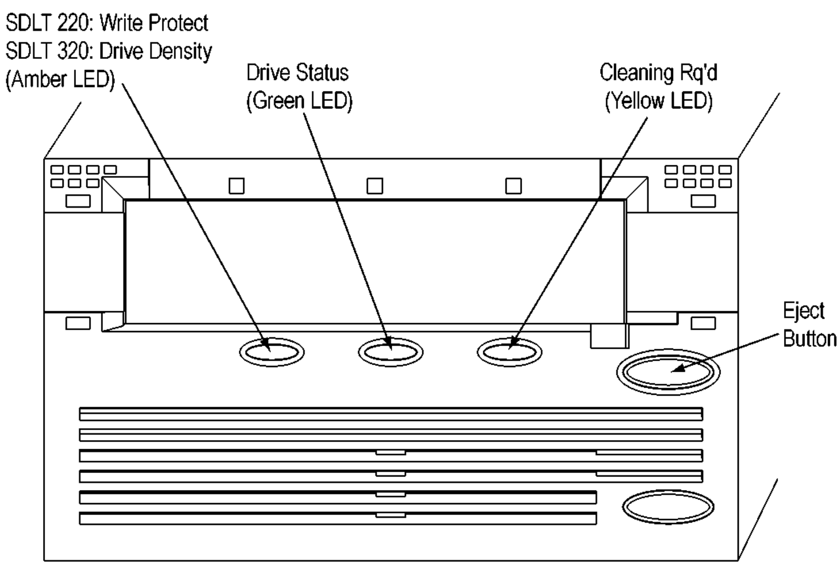


Figure 2-2. SDLT 220/320 Front Panel LEDs

2.3 Dimensions and Tolerances

The following figures show the physical specifications of the SDLT 220/3220 tape drive.

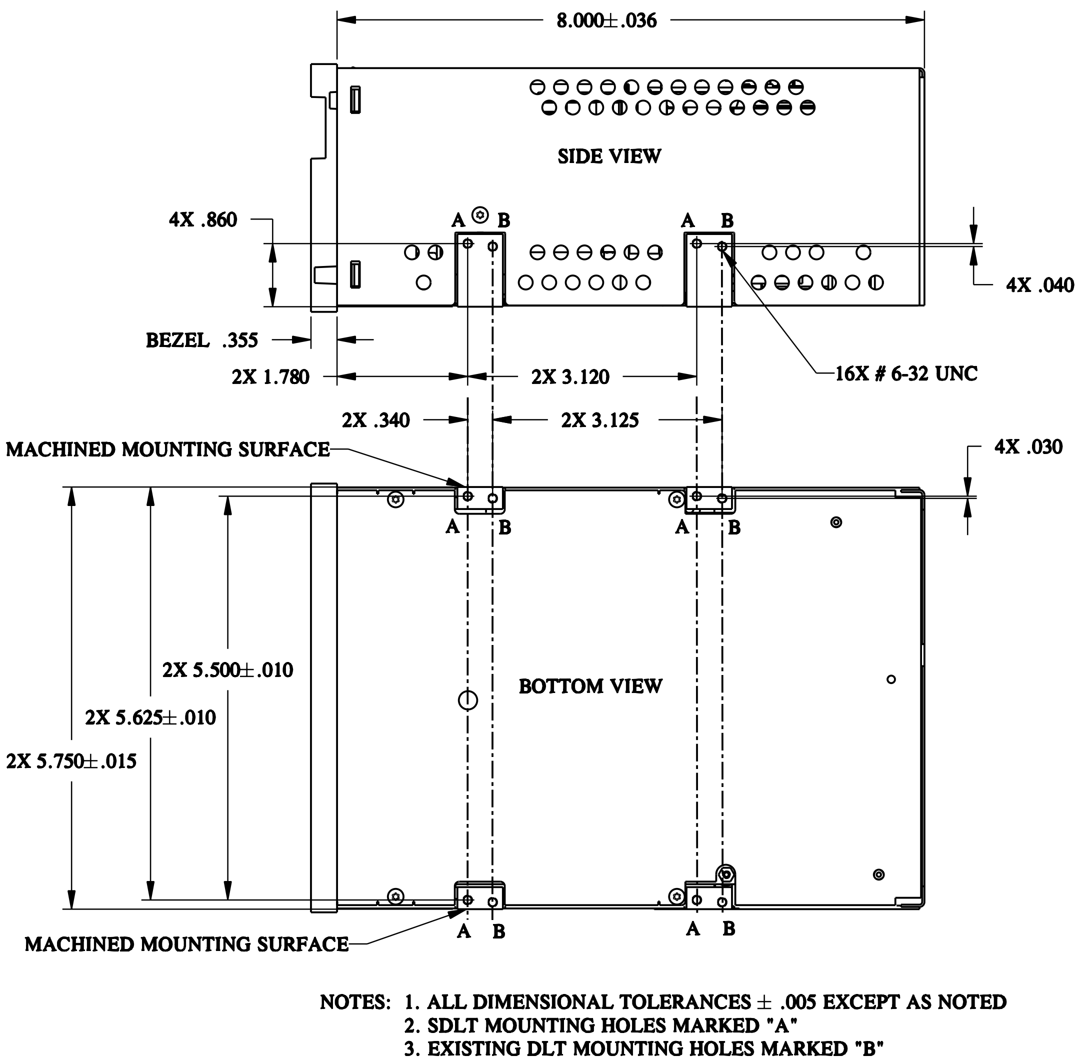


Figure 2-3. Combination Side and Bottom View of SDLT Tape Drive

NOTE: Tape cartridge insertion and ejection distances are shown in Figure 8-1, “Tolerances for Cartridge Insertion and Extraction,” on page 8-6.

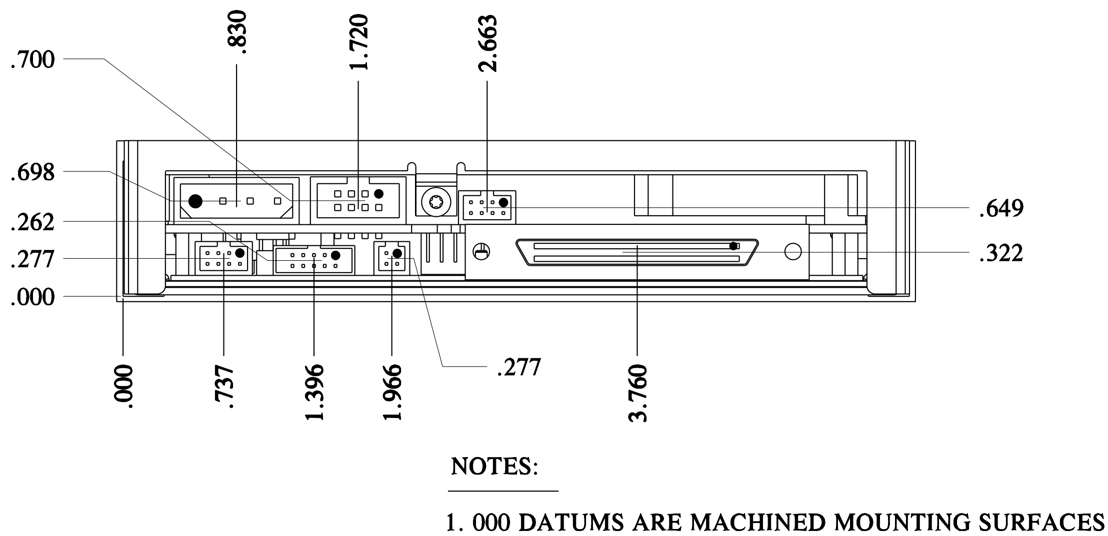


Figure 2-4. Rear View of SDLT 220/320 Tape Drive (Dimensions)

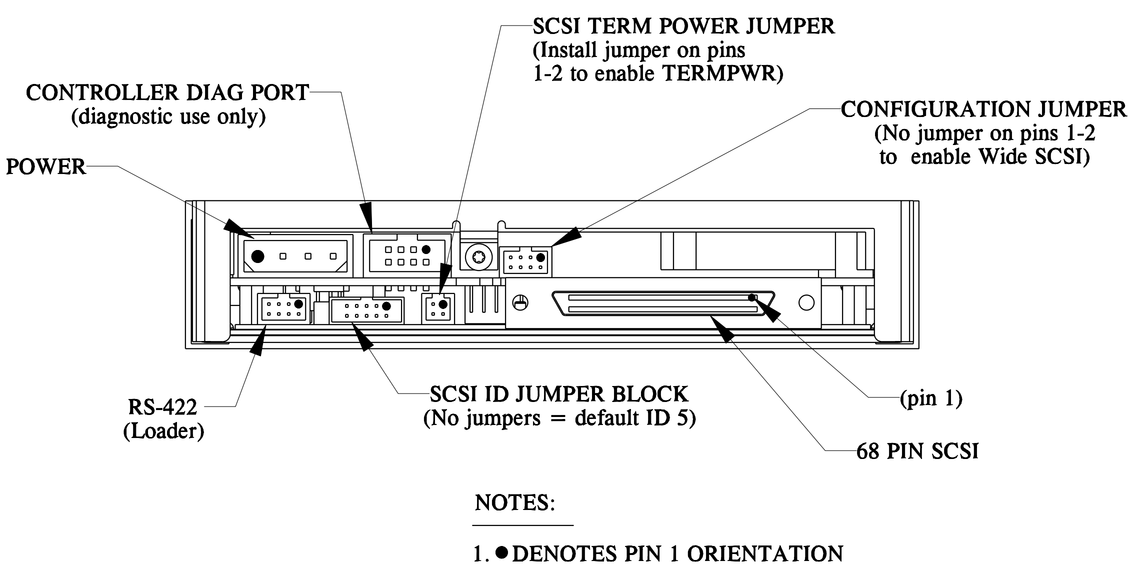


Figure 2-5. Rear View of SDLT 220/320 Tape Drive (Connectors)

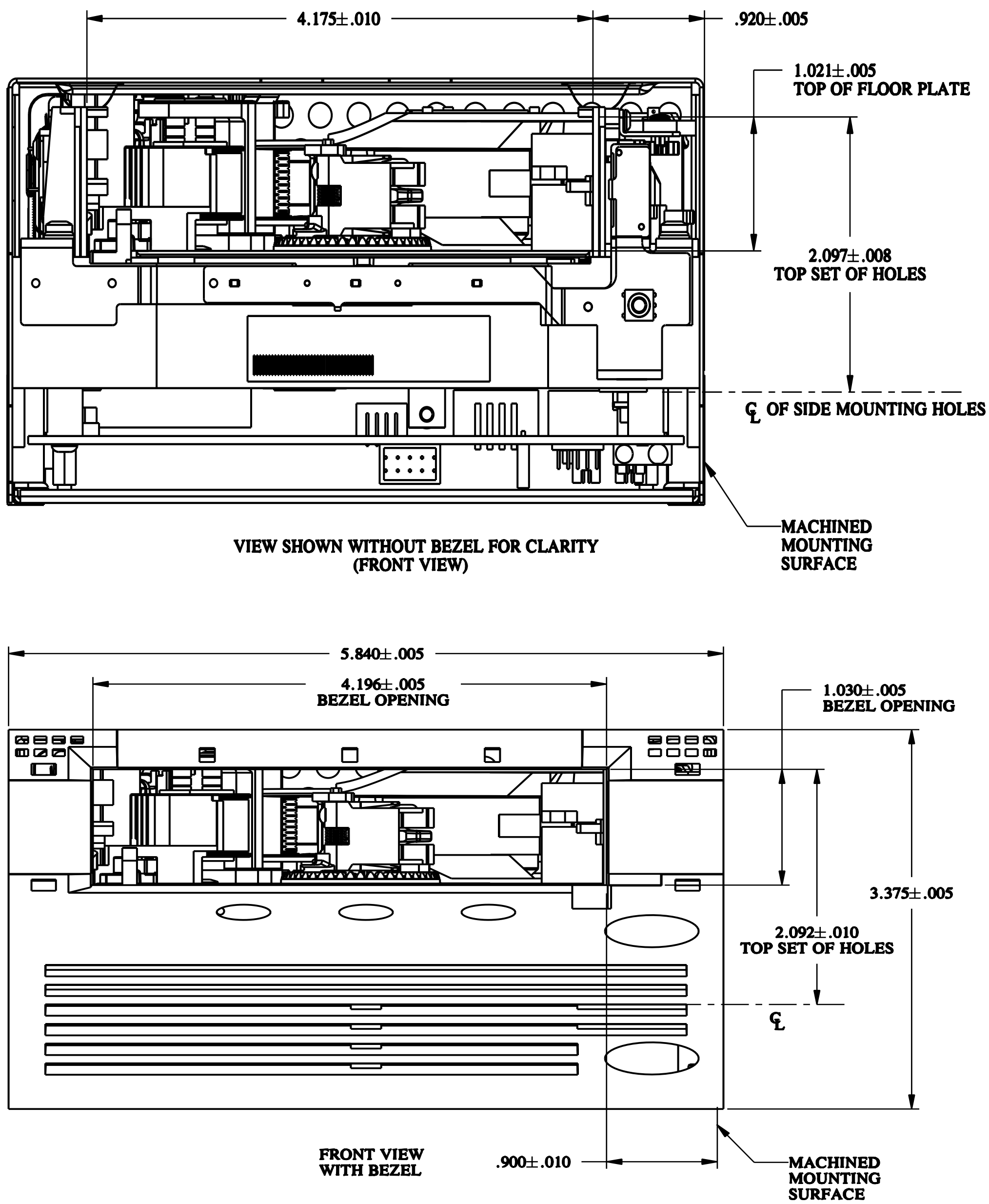


Figure 2-6. Front Views of SDLT 220/320 Tape Drive

2.4 Physical Dimensions

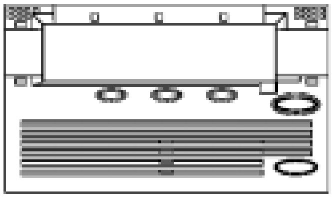
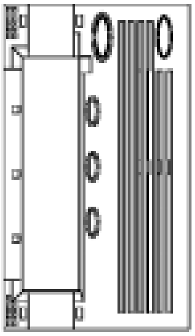
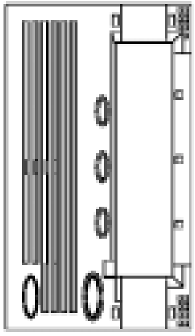
Table 2-1 provides physical dimensions for the SDLT tape system. Table 2-2 shows acceptable operating orientations for the SDLT tape system.

Table 2-1. SDLT 220/320 Physical Dimensions and Shipping Weight

Description	Internal Version	Tabletop Version
Height	82.55 mm (3.25 in) without front bezel; 86.36 mm (3.40 in) with front bezel.	160.02 mm (6.30 in)
Width	146.05 mm (5.75 in) behind front bezel; 148.34 mm (5.84 in) with front bezel.	175.26 mm (6.9 in)
Depth	203.20 mm (8.00 in) measured from back of front bezel; 212.09 mm (8.35 in) including front bezel.	325.12 mm (12.8 in)
Weight*	2.38 kg (5 lbs. 4 oz)	6.27 kg (13 lbs. 13 oz)
Shipping Weight*	3.77 kg (8 lbs. 5 oz)	9.90 kg (21 lbs. 13 oz)

* Weights depend on configuration. The packaging may change depending on the shipping weight.
Note: Mounting hole pattern for the bottom and sides of the system is industry standard.

Table 2-2. Proper and Acceptable Tape Drive Orientations

Orientation	Looks Like This
Typical (Top Side Up)	
Left Side Down	
Right Side Down	

2.5 Reliability

Quantum and its employees and suppliers are committed to providing quality products. The SDLT tape drive system is a very reliable electromechanical device.

2.5.1 Positive Engagement Tape Leader Buckling Mechanism

This buckling mechanism is responsible for engaging the tape leaders upon cartridge load and disengaging them upon cartridge unload. The SDLT tape buckling mechanism has been designed to work with the new leaders of the SDLT tape drive design as well as the leaders of the previous DLT drive design, allowing backward-read compatibility of DLTtape IV cartridges in the SDLT tape system.

Component level tests of buckle arm components have shown at least 250,000 cycles on an SDLT drive without failure, breakage, or binding; this includes the take-up leader, the supply leader, and the media itself.

2.5.2 MTBF

Mean time between failures (MTBF) for the overall tape system is projected to be 250,000 hours. Head life is a minimum of 30,000 tape motion hours and an average of 50,000 tape motion hours. Media durability is 1,000,000 passes.

NOTE: Quantum Corporation does not warrant that predicted MTBF is representative of any particular unit installed for customer use. Actual figures vary from unit to unit.

2.5.3 Load and Unload Cycles

Load and unload cycles are rated at 15,000 for the cartridge itself. Table 2-3 shows the number of load and unload cycles and tape insertions an SDLT drive can perform before it needs to be replaced.

Table 2-3. Load and Unload Cycles (Maximum)

	SDLT 220	**SDLT 320**
Load/unload cycles	100,000	100,000
Tape insertions*	100,000	100,000

* An insertion is when a tape is inserted into the receiver, loaded to BOT, and unloaded.

2.5.4 Data Integrity

SDLT data transfer errors are extremely rare; data integrity for the overall tape system is shown in Table 2-4.

Table 2-4. Data Transfer Error Rates

Error Type	**Frequency**
Error Rates Recoverable READ	<1 error in 10^6 bytes read
Detected, Unrecoverable READ	<1 error in 10^{17} bits read
Undetected READ	<1 error in 10^{27} bits read
Rewrite errors	<5 per 10^6 bytes written

2.6 Functional Specifications

2.6.1 Key Differences Between the SDLT 220 and 320

Table 2-5 compares important features in the SDLT 220 and SDLT 320 products.

Table 2-5. A Comparison of SDLT 220 and SDLT 320 Features

Parameter	**SDLT 220**	**SDLT 320**
Capacity		
Compressed‡	220 GB	320 GB
Uncompressed	110 GB	160 GB
Data Transfer Rate		
Compressed‡	22 MB/s	32 MB/s
Uncompressed	11 MB/s	16 MB/s
Media Compatibility	SDLT Tape I DLT Tape IV (Read Only) DLT 1 by Benchmark: TRS13 Model (Read Only)	SDLT Tape I DLT Tape IV (Read Only) DLT 1 by Benchmark (Read Only)
‡ The compression rates shown assume an industry standard 2:1 compression ratio. Actual compression ratios achieved depend on the redundancy of data files being recorded.		
Reliability		
MTBF	250,000 Power On Hrs	250,000 Power On Hrs
Media Durability	1,000,000 passes*	1,000,000 passes*
Warranty	3 years	3 years
* A media pass is defined as movement of the tape head over the surface of the media (in either direction).		
Miscellaneous Product Features		
Tape Speed	116 ips	122 ips
Linear Density	133 Kbpi	193 Kbpi
Cache Size	32 MB	64 MB
Interfaces Available	Ultra 2 SCSI, LVD Ultra 2 SCSI, HVD	Ultra 2 SCSI, LVD Ultra 2 SCSI, HVD

2.6.2 SDLT 220/320 Performance Data

Table 2-6 provides performance data for the SDLT tape system. Note: For a comparison of SDLT 220/320 storage capacities, refer to Section 2.6.1, “Key Differences Between the SDLT 220 and 320” on page 2-11.

Table 2-6. SDLT 220/320 Performance Data

Feature	**SDLT 220**	**SDLT 320**
Drive Read / Write Transfer Rate*	11 MB/second, native	16 MB/second, native
Tracks	56 logical tracks; 448 physical tracks	Same
Track Density	1058 tracks per inch (tpi)	Same
Linear Bit Density	133 Kbits per inch (bpi)	193 Kbits per inch (bpi)
Read / Write Tape Speed	116 inches per second (ips)	122 inches per second (ips)
Rewind Tape Speed	160 ips	Same
Linear Search Tape Speed	160 ips	Same
Average Rewind Time	69 seconds	Same
Maximum Rewind Time	140 seconds	Same
Average Access Time (from BOT)	70 seconds	Same
Maximum Access Time (from BOT)	142 seconds	Same
Load to BOT	12 seconds (typical) 40 seconds (unformatted tape)	Same
Unload from BOT	12 seconds	Same
Nominal Tape Tension	Stationary = 3.0 ± 0.5 oz Operating Speed = 3.5 ± 0.5 oz	Same

* Depending on data type and SCSI bus limitations/system configuration.
Note: Data is typical; times may be longer if error recovery time is needed.

2.6.3 Backward-Read Compatibility Transfer Rates

Both the SDLT 220 and SDLT 320 drives feature an optional backward-read compatibility (BRC) mode. When in BRC mode, the drives are capable of reading DLTtape IV tapes with DLT4000, DLT7000, DLT8000, and DLT 1 formats. The BRC transfer rates for the SDLT drive are listed in Table 2-7.

Table 2-7. Backward Read Compatibility (BRC) Transfer Rates

Format	**Cartridge Type**	**Native Capacity (GB)**	**Native Read Transfer Rate (MB/second)**
SDLT 320	SDLT I	160	16.0
SDLT 220	SDLT I	110	11.0
DLT 8000	DLT IV	40	4.0
DLT 7000	DLT IV	35	3.5
DLT 4000	DLT IV	20	1.5
DLT 1 (Benchmark)	DLT IV	40	3.0

Notes:

- Transfer rates quoted are nominal, measured reading uncompressed data.
- Non-SDLT drives will eject a cartridge written in SDLT 320 format.
- The SDLT 320 can read and write the SDLT 220 format at the native SDLT 220 transfer rate of 11.0 MB/sec.

2.6.4 Maximum Data Transfer Rate

The maximum sustained (and burst) data transfer rates for SDLT drives are shown in Table 2-8.

Table 2-8. Maximum Data Transfer Rates

		SDLT 220 Sustained		SDLT 220 Burst Max*	SDLT 320 Sustained		SDLT 320 Burst Max*
Configu ration		**Native**	**Com-pressed‡**		**Native**	**Com-pressed‡**	
HVD (Ultra 1 SCSI)	Narrow	11 MB/sec	20 MB/sec	20 MB/sec	16 MB/sec	20 MB/sec	20 MB/sec
	Wide	11 MB/sec	22 MB/sec	40 MB/sec	16 MB/sec	32 MB/sec	40 MB/sec
LVD (Ultra 2 SCSI)	Narrow	11 MB/sec	22 MB/sec	40 MB/sec	16 MB/sec	32 MB/sec	40 MB/sec
	Wide	11 MB/sec	22 MB/sec	80 MB/sec	16 MB/sec	32 MB/sec	80 MB/sec

* Burst speeds are limited by the SCSI bus itself, not the design of SDLT 220/320 or SDLTtape.
‡ The compression rates shown assume an industry standard 2:1 compression ratio. Actual compression ratios achieved depend on the redundancy of data files being recorded.

NOTE: Cable lengths and cable type can limit attainable transfer rate; for details, refer to "SCSI Cable Length" on page 6-5.

2.6.5 Storage Capacity

For a comparison of SDLT 220/320 storage capacities, refer to "Key Differences Between the SDLT 220 and 320" on page 2-11.

2.6.6 Recording Media Specifications

The following tables provide specifications for Super DLTtape I media. Basic media specifications for the Super DLTtape I are shown in Table 2-9. Operating, storage, and shipping environment limits for the DLTtape IV cartridges are shown in Table 2-10.

Table 2-9. Super DLTtape I Media Specifications

Description	**Specifications**
Width	0.5 in.
Magnetic Coating	300 nm metal particle
Length	1800 feet (1765 feet usable)
Coercivity	1800 Oe
Cartridge Dimensions	4.1 in x 4.1 in x 1.0 in
Shelf Life	30 years min. @ 20°C & 40% RH (non-condensing)
Usage	1,000,000 passes (typical office/computer environment)
Cartridge Housing Color	Green

Table 2-10. DLTtape Media Operating and Storage Limits

Operating Conditions		
Temperature	10° to 40°C (50° to 104°F)	
Relative Humidity	20% to 80% (non-condensing)	
Storage Conditions	**With Data:**	**Without Data:**
Temperature	18° to 28°C (64° to 82°F)	16° to 32°C (66° to 89°F)
Relative Humidity	40% to 60% (non-condensing)	20% to 80% (non-condensing)
Shipping Conditions		
Temperature	-17°C to 49°C (0°F to 120°F)	
Relative Humidity	20 to 80% (non-condensing)	
Maximum Wet Bulb Temperature	26°C (79°F)	
Maximum Dew Point	2°C (36°F)	

2.7 Environmental Requirements

The SDLT tape drive operates in environments that include general offices and workspaces with systems capable of maintaining standard comfort levels.

The following sections provide the operating, non-operating, storage and shipping environmental specifications for the SDLT tape systems (both the internal and the shoebox configurations). For long-term trouble-free operation, it is strongly recommended that DLTtape systems be used in a clean, smoke-free environment.

2.7.1 Temperature and Humidity

The ambient operating environment for the tape drive may not exceed the limits shown in Table 2-11. (The specifications shown in the table are valid for both the internal and tabletop tape drives.)

Table 2-11. Temperature and Humidity Specification

Specification	Operating Limits	Non-Operating Limits (Power On; No Tape Loaded)
Wet Bulb Temperature	25°C (77°F)	25°C (77°F)
Dry Bulb Temperature Range	10°C to 40°C (50°F to 104°F)	10°C to 40°C (50°F to 104°F)
Temperature Gradient	11°C (20°F) / hour (across range)	15°C (27°F) / hour (across range)
Relative Humidity	20% to 80% (non-condensing)	10% to 90% (non-condensing)
Humidity Gradient	10% / hour	10% / hour

2.7.2 Air Flow Requirements

Adequate air flow must be provided for the internal unit to dissipate the heat resulting from drive operation (see CHAPTER 4, “Thermal Specifications” for more details about temperatures inside the drive, and illustrations showing where air flow and various temperatures are measured). The air flow must be sufficient to keep the tape path temperature below 52°C.

NOTE: It is important to realize that the amount of air flow provided for the tape drive determines the maximum ambient temperature in which the drive can operate.

2.7.3 Storage and Shipment

The ambient storage and shipment environment for the tape drive may not exceed the limits shown in Table 2-12. (The specifications shown in the table are valid for both the internal and tabletop tape drives.)

Table 2-12. Drive Storage and Shipment Specifications

Description	Storage (Unpacked or Packed)	Shipping
Wet Bulb Temperature	46°C (114°F)	46°C (114°F)
Dry Bulb Temperature	-40°C to 66°C (-40°F to 150°F)	-40°C to 66°C (-40°F to 150°F)
Temperature Gradient	20°C (36°F) / hour (across range)	20°C (36°F) / hour (across range)
Relative Humidity	10 to 95% (non-condensing)	10 to 95% (non-condensing)
Humidity Gradient	10% / hour	10% / hour

* Note that these specifications apply to the tape drive only. Media specifications are listed in “Recording Media Specifications” on page 2-15.

2.7.4 Altitude

Both the internal and tabletop tape drives operate in normal pressures from –500 to 10,000 feet when operated within the ambient operating environments specified in “Temperature and Humidity” on page 2-17.

The drive will operate to 30,000 feet for temperatures within 15 ± 5 °C.

2.7.5 Particulate Contamination Limits

The ambient operating environment for the tape drive may not exceed the particulate counts shown in Table 2-13.

Table 2-13. Particulate Contamination Limits

Particle Size (microns)	Number of Particles ≥ Particle Size per Cubic Meter	Number of Particles ≥ Particle Size per Cubic Foot
0.1	8.8×10^7	2.5×10^6
0.5	3.5×10^7	1.0×10^6
5.0	2.5×10^5	7.0×10^3

2.8 Shock and Vibration Specifications

The following tables provide non-operating and operating shock and vibration specifications for the SDLT system.

Table 2-14. Non-Operating Shock Specifications (Unpackaged)

Shock (Unpackaged)		
Pulse Shape	Square wave	½ sine pulse
Peak Acceleration	40 G	140 G
Duration	10 ms (180 inches/second)	2 ms
Application	X,Y,Z axes, twice in each axis (once in each direction)	

Table 2-15. Non-Operating Shock Specifications (Packaged, Drop)

Shock (Packaged, Drop)	**Height of Drop**	**Number of Drops**	**Package Weight**
Drop	42 inches 36 inches	16 drops total 16 drops total	0 lbs. < package weight ≤ 20 lbs. 20 lbs. < package weight ≤ 50 lbs.

Table 2-16. Non-Operating Vibration Specifications

Vibration (Unpackaged)		
Type	Sine	Sweep
Frequency Range	5 - 500 - 5 Hz	Upward and downward sweep
Acceleration Level	0.02" DA 1.0 G	Between 5 and 31 Hz (crossover) Between 31 and 500 Hz (crossover)
Application	X,Y,Z axes	Sweep rate = ½ octave /minute
Type	Random	
Frequency Range	10 - 500 Hz	
Acceleration Level	2.0 G	
PSD Envelope	0.008 G^2/Hz	
Application	X,Y,Z axes	Sweep rate = 60 minutes / axis
Vibration (Packaged)		
Type	Random	
Frequency Range	Truck Profile* (0.5 Grms) Air Profile* (1.0 Grms)	
Application	X,Y,Z axes (30 minutes, each profile and each axis, for a total of 3 hours)	
Type	Sine, Sweep, and Dwell	
Frequency Range	5 - 150 - 5 Hz ; 0.5 octave /minute, 0.5 G	
Application	X,Y,Z axes; dwell at lowest resonant frequency in axis for 30 minutes. Additional 30 minutes for each additional resonance; up to 4 resonances total.	
* Air and truck profiles are specified in ASTM D4728, Standard Test Method for Random Vibration Testing of Shipping Containers.		

Table 2-17. Operating Shock and Vibration Specifications

Shock		
Pulse Shape	½ sine pulse	
Peak Acceleration	10 G	
Duration	10 ms	
Application	X,Y,Z axes, twice in each axis (once in each direction)	
Vibration		
Type	Sine	Sweep
Frequency Range	5 - 500 - 5 Hz	Upward and downward sweep
Acceleration Level	0.25 G 0.010" DA	Between 22 and 500 Hz Between 5 and 22 Hz (crossover)
Application	X,Y,Z axes	Sweep rate = 1.0 octave per minute

2.9 Occasional Cleaning of Tape Head

SDLT uses a built-in tape cleaning algorithm in conjunction with a *cleaning tape*. The SDLT cleaning tape is housed in a plastic case, and is light gray in color. Cleaning cartridges expire after 20 cleaning cycles.

CAUTION: Never use a DLT cleaning tape in an SDLT drive; DLT cleaning tapes are incompatible with the SDLT heads.

A yellow LED (light) located on the front bezel of the tape drive indicates when cleaning is needed; the location of this LED (and other front bezel LEDs) is shown in Figure 2-7 on page 2-26.

NOTE: The tape cleaning algorithm is not used for the BRC (backward read compatible) head; this head style does not need cleaning.

2.9.1 Load Time for Cleaning Cartridge

Load (cycle) times for SDLT cleaning cartridges are as follows; these times are accurate ± 20 seconds:

- Shortest load time (1st pass of cleaning cartridge): 2 min. 55 sec.
- Longest load time (20th pass of cleaning cartridge): 10 min. 20 sec.
- “Expired” load time (expired cleaning tape): 4 min. 30 sec.

On the last pass, the cleaning process stops, the tape is rewound, but the cartridge is not ejected. If the tape is loaded again after the 20th pass, it winds all the way to the end of the cartridge and back again without performing the cleaning sequence; the tape does not eject.

2.9.2 Error Reporting (for Cleaning)

NOTE: Use the SDLT Cleaning Tape if cleaning is indicated through your backup software or when the yellow alert light is ON. Do not clean the drive unless the drive specifically indicates cleaning is necessary.

How the Tape Drive Returns Cleaning Status

The General Status Packet, accessible through the RS422 serial interface, contains three unique bits that communicate cleaning information for the drive. Refer to the *Super DLTtape Interactive Library Interface Specification* for details. They are:

- **Cleaning Requested**

  When this bit is set, it tells the library to cycle a cleaning cartridge through the tape drive at the next possible opportunity. The Cleaning Requested bit always sets in conjunction with the Cleaning Required bit (described next).

- **Cleaning Required**

  When this bit is set, it tells the library that it is necessary to cycle a cleaning cartridge through the tape drive before attempting any further tape operation.

- **Cleaning Tape Expired**

  When this bit is set, it indicates that the current cleaning tape has exceeded its use count. This bit is valid only in the following context:

  - After attempting a cleaning application.
  - Until the next cleaning tape is inserted.
  - Until the power is cycled.

How TapeAlert Returns Cleaning Status

An EEPROM parameter named **EnaCleanTA** enables TapeAlert reporting of Cleaning Status. The General Status Packet contains one flag that conveys cleaning information for the drive; it is:

- **Clean Now**

  The **Clean Now** flag will be set on:

  - SDLT HWE(Hard Write Error)/HRE(Hard Read Error) that are not servo related.
  - This flag will not be set unless 100 hours of tape motion has occurred since the last cleaning.

  Corrective action for this flag is a successful cleaning or a power cycle.

Library/Loader Cleaning Error Reporting

The EEPROM parameter **EnaCleanTA** is used to enable the library/loader TapeAlert reporting of cleaning status. The EEPROM parameter **EnaCleanLib** is used otherwise.

SCSI Cleaning Error Reporting

For HWE(Hard Write Error)/HRE(Hard Read Error) that are not related to servo problems, the **Cleaning Requested** ASC/ASCQ (00/17) is reported using the same criteria as setting the TapeAlert **Clean Now** flag. The Sense Key is Medium Error (03h). The **Cleaning Requested** ASC/ASCQ replaces the 0C/00 for HWE or the 11/00 for HRE.

The **Cleaning Requested** ASC/ASCQ is only reported if the EEPROM parameter **EnaCleanSense** is set to 1.

2.9.3 Front Panel Cleaning Light

The Cleaning Required (yellow) LED on the front panel indicates to the operator that cleaning is needed. This feature is enabled by the EEPROM parameter **EnaCleanLight**. The location of the Cleaning Required LED (and other front panel LEDs) is shown in Figure 2-7.

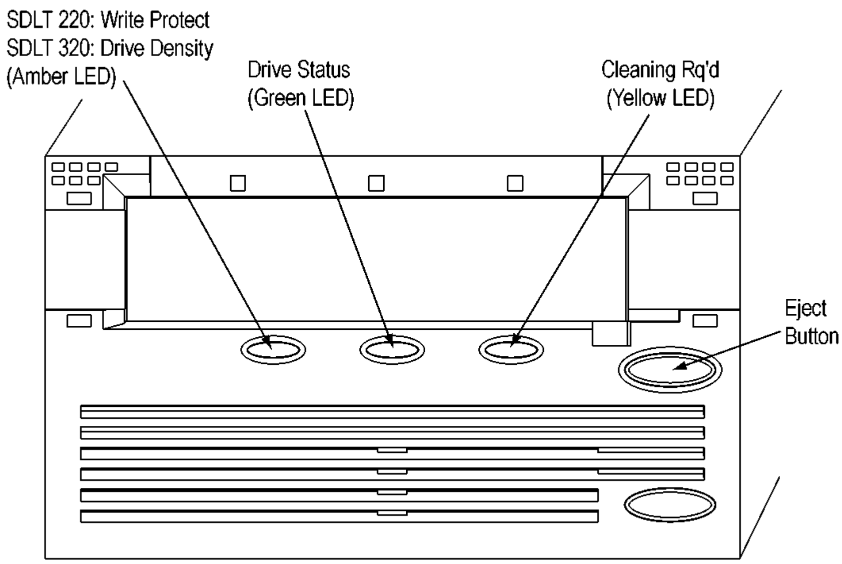


Figure 2-7. Front Panel LEDs

If **EnaCleanLight is** enabled, the yellow LED illuminates steadily for these conditions:

- When a HWE(Hard Write Error)/HRE(Hard Read Error) is encountered, and more than 100 hours have passed since the last cleaning.

Once illuminated, the yellow LED stays lit until one of the following occurs: 1) drive is cleaned successfully, or 2) the drive is reset due to a firmware failure or firmware update, or 3) power is cycled off and on.

CHAPTER 3

Electrical Specifications

3.1 Current and Power Requirements

Table 3-1 on page 3-2 lists the current and power requirements for both versions of the tape system (internal and tabletop). The tabletop version requires AC power.

The highest current (and power) is drawn during the native write modes and backward-read compatibility (BRC) read modes, so they are outlined in Table 3-1. *Standby* is measured with the tape loaded and tensioned or untensioned, and *Idle* is measured with power on with no tape loaded. (The power drawn in these two modes is similar enough that they are listed together.) Power-up current surges are less than those encountered during motor accelerations, and so are not listed separately.

NOTE: In Table 3-1, the current and DC power values are relevant to the internal drive, while the AC power values are relevant to the tabletop drive.

Table 3-1. Current and Power Specifications

Mode	5 V Current (A) MaxPk[1]	MaxRms[2]	Typ[3]	12 V Current (A) MaxPk[1]	MaxRms[2]	Typ[3]	DC Power (W) Max[4]	Typ[5]	AC Power (W) Max[6]	Typ[7]
Standby / Idle	3.2	3.0	2.9	0.6	0.5	0.4	20	19	34	29
Media Loading / Unloading	3.8	3.1	2.9	4.8	1.0	0.7	25	24	38	33
220/320 Write– Motor Start[8]	6.1	3.1	3.0	4.8	1.0	0.7	25	24	33	30
220/320 Write– Streaming	6.3	4.3	3.8	2.1	0.7	0.7	28	27	42	38
Max for SDLT Modes[9]		4.3			1.0		28		42	
BRC Read– Motor Start[8]	3.9	3.0	2.8	2.3	0.7	0.6	23	22	38	32
BRC Read– Streaming	5.2	3.3	3.1	1.8	0.7	0.6	24	22	41	33
Max for BRC Modes[9]		3.3			0.7		24		41	

1. The Max-Peak value represents short current spikes drawn for durations of < 50us. On the 12V supply, the peaks correspond to the pulse width modulated switching of the motors. These values are calculated from the average of Peak-ripple-current + 2 sigma, measured at +5% DC voltage.
2. The Max-Rms value is the average of the maximum RMS current drawn during this operating mode. These values are calculated from the average of RMS current + 3 sigma, measured at nominal DC voltage.
3. The typical current is calculated from the average of all RMS current drawn during this operating mode, measured at nominal DC voltage.
4. The Max DC power is calculated from the typical DC power + 3 sigma, measured at nominal DC voltage. This value takes into account that the peak currents on the 5V and 12V do not occur at the same time.
5. The Typical DC power is calculated from the average RMS DC power drawn during this operating mode, measured at nominal DC voltage. This value also takes into account that the peak currents on the 5V and 12V do not occur at the same time.
6. The Max AC power is calculated from the typical AC power in tabletop drives + 3 sigma.
7. The Typical AC power is calculated from the average of AC power drawn in tabletop drives.
8. The motor start modes draw the most current from the 12V supply, so they are shown separately. These events last < 1 second and occur at a duty cycle of less than 25%.
9. The Max values for each mode are based on the Max-rms values, since the peak values are of very short duration.

3.2 Power Supply Tolerances

One of the functions of the power supply is to transform the AC power to DC, and to step the voltage down from 115/220 Vac to 5 Vdc and 12 Vdc.

3.2.1 Voltage Tolerances

Voltage tolerances are:

- 5 Vdc ± 5%
- 12 Vdc ± 5%

3.2.2 DC Voltage Monitoring

The tape drive will monitor the two input voltages and take protective measures when the voltages fall or rise beyond the below specified ranges:

Table 3-2. DC Voltage Monitoring

Supply Voltage	Low Voltage Trip Point
5 Volt	4.75 Volts
12 Volt	11.4 Volts

3.2.3 Power Cycle Time

Test results show that an SDLT drive is able to power up and perform reliably with up to 11 seconds of delay time between the 5V and the 12V source. The drive is also able to power up and perform successfully with rise times of up to 11 seconds on either the 5V and the 12V supply (while the other is stable).

3.2.4 Supply Transient Voltage

Allowable power supply transient voltage is:

- 5 Volt rail – 60 mV (peak to peak)
- 12 Volt rail – 1.6 V (peak to peak).

CHAPTER 4

Thermal Specifications

4.1 Over Temperature Condition

This chapter presents the results of extensive experimentation and measurements of drive temperatures, and the resultant impact on SDLT 220/320 drive performance.

An Overtemp condition is defined to be when the calculated Tape Path Temp = 52 degrees C. At that point, the tape is rewound, unloaded, and ejected *if not in a library*. If the drive *is* in a library, the tape does not eject.

> **CAUTION:** Although the Overtemp condition occurs when the Tape Path Temp = 52 degrees C, Quantum recommends the operating environment of the drive be maintained such that the temperature of the tape path not exceed 50 degrees C; this provides a 2 degrees C margin of safety.

The front temperature sensor is the point used to calculate drive temperature (even though it is not the hottest point inside the drive). The calculated Tape Path Temp for the SDLT 220/320 drive is derived using the following formulas:

- Embedded bezel Tape Path Temp = Front Sensor Temp + 3 degrees C
- Library bezel Tape Path Temp = Front Sensor Temp + 6 degrees C

If not in a library, and if the drive temperature exceeds the operating threshold, any current tape operation is aborted, the tape is rewound, unloaded, and ejected from the drive. SCSI status then indicates that the drive is in the over temperature condition.

If a SCSI command is aborted as a result of the over-temperature condition, the drive returns status of: Hardware Error, Warning — Specified Temperature Exceeded (04h, 0Bh, 01h).

4.2 Air Flow Measurements

Air flow is measured in the location shown in Figure 4-1. At the specified location, the air flow needs to be at least 125 LFM (linear feet per minute).

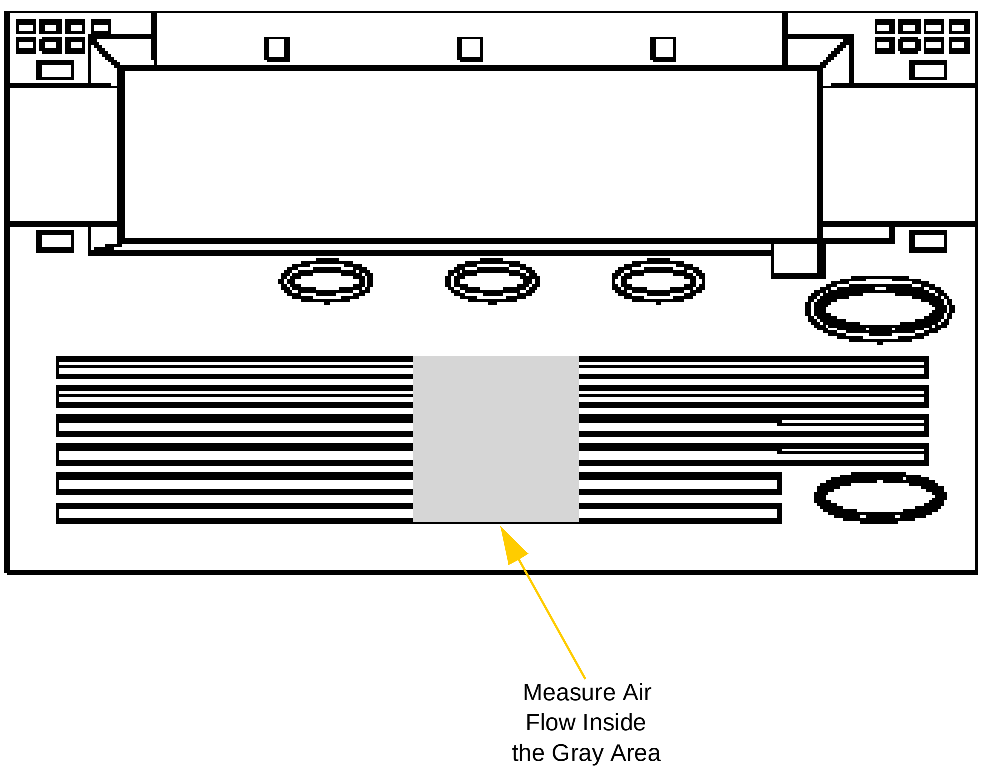


Figure 4-1. Library Bezel—Where to Measure Air Flow

4.3 Thermal Measurement Locations

The Electronics Interface Module (EIM) comprises two boards: the Integrated Controller Module (ICM) board, and the Host Interface Module (HIM) board. Temperatures are measured on the ICM board in the locations shown in Figure 4-2, on the HIM board on the Qlogic chip shown in Figure 4-3, and on the drive's front bezel in the locations shown in Figure 4-4.

NOTE: While the most critical temperatures are usually found along the tape path, data for other key areas inside the drive, such as the processor and other important circuits and chips that are known to produce heat, are included as well.

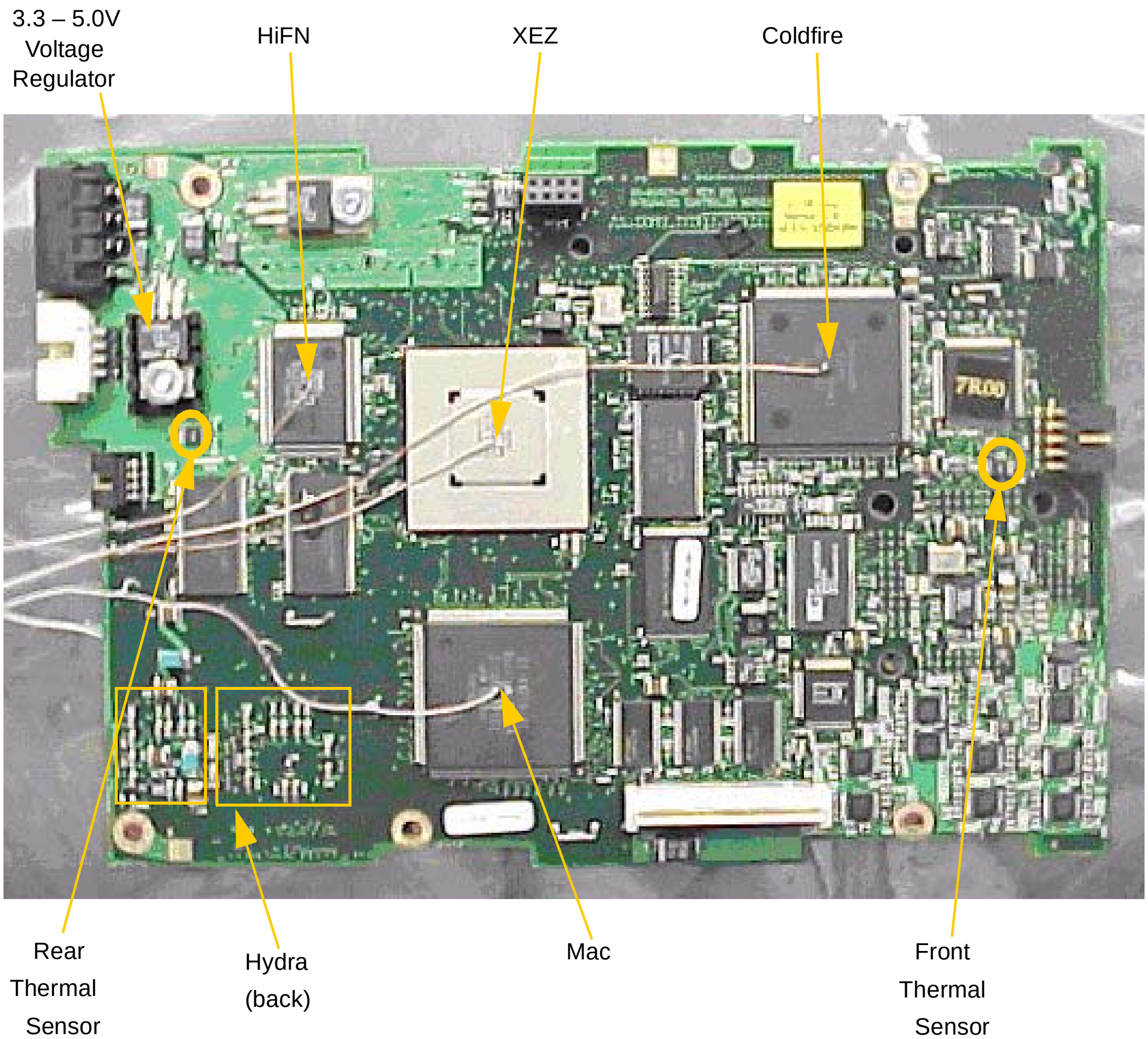


Figure 4-2. ICM Board Thermal Measurement Locations

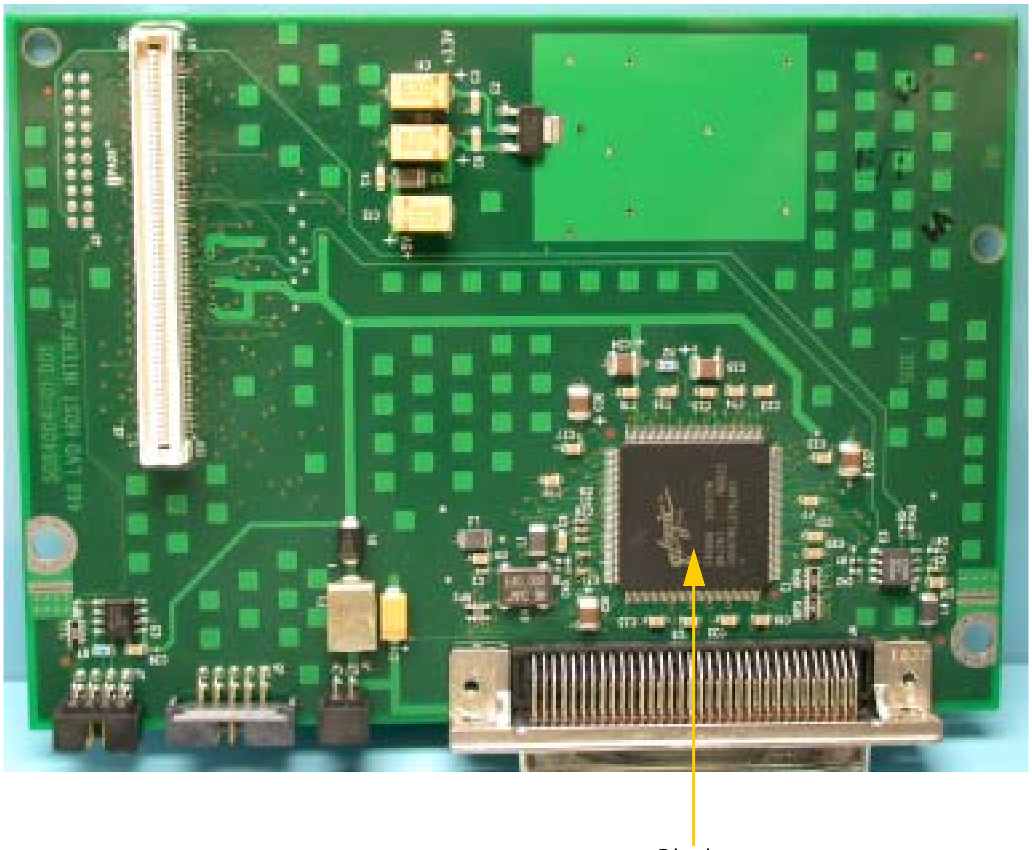


Figure 4-3. HIM Board Thermal Measurement Location

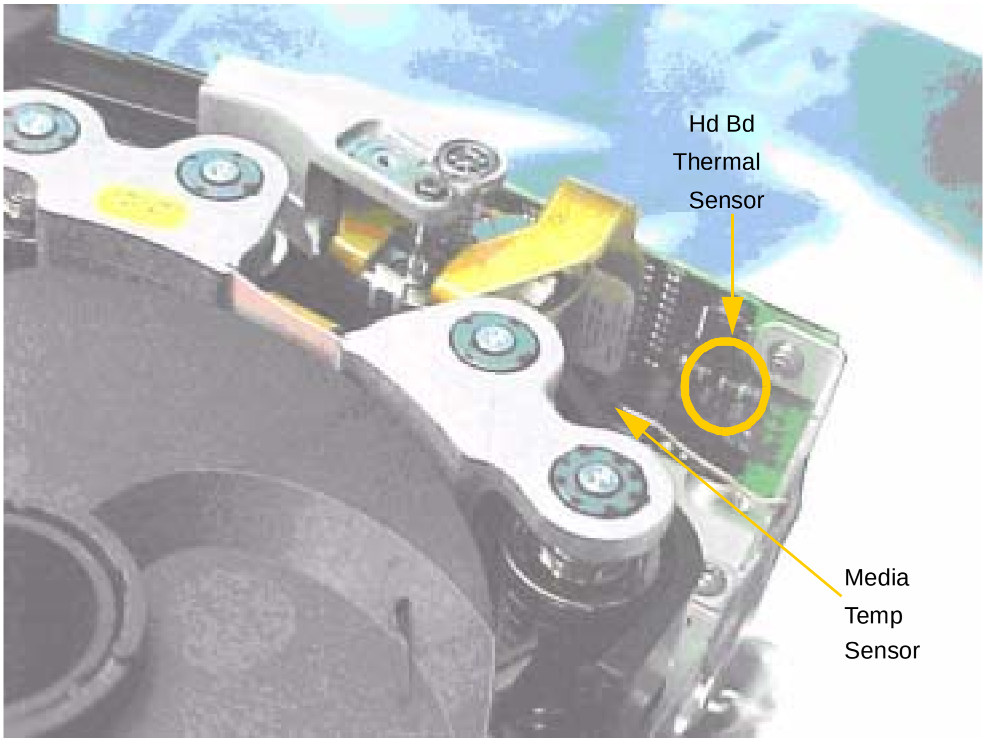


Figure 4-4. Tape Path Thermal Measurement Locations

4.4 SDLT 220/320 Thermal Profile

This section lists the temperature of key module components and media at the extremes of the SDLT 220/320 operating specification as well as at room temperature. Both styles of bezel were tested: 1) Embedded, and 2) Library.

NOTE: The information in this thermal profile section is not intended to serve as a temperature specification, nor is it intended to replace the temperature specifications of individual chips or chipsets. This information is provided by Quantum *solely* as a guideline, and is representative of temperatures that you can expect to observe during typical tape drive operation.

To evaluate different modes of operation, data was recorded either with data compression enabled or disabled. Thermocouples were affixed to key board components as shown in Figure 4-2. In addition, a thermocouple was placed within the tape path enclosure to monitor the approximate temperature of the media, as shown in Figure 4-4.

The results of the testing are listed in Table 4-1 and Table 4-2 below.

Table 4-1. SDLT 220/320 Steady State Temperatures: Embedded Bezel

Component		10 degrees C Ambient		25 degrees C Ambient		40 degrees C Ambient		Case Maximum * Continuous Operating Temperature (degrees C)
		Compression 2:1		Compression 2:1		Compression 2:1		
		On	**Off**	**On**	**Off**	**On**	**Off**	
		Temperature (degrees C)		Temperature (degrees C)		Temperature (degrees C)		
1	HiFN	42.4	39.9	57.4	55.0	72.5	69.6	96
2	Hydra 1	45.8	46.5	61.3	62.0	77.4	76.9	113
3	Hydra 2	42.3	42.9	57.6	58.5	73.6	73.2	113
4	Coldfire	23.3	23.4	38.5	38.5	53.6	53.5	83
5	3.3-5.0 V Reg	34.2	33.4	49.4	48.8	64.7	63.8	119
6	Front Sensor	17.0	17.0	32.0	32.0	47.0	47.0	52
7	Rear Sensor	35.2	34.3	50.2	49.9	65.8	64.7	125
8	Headboard	33.2	33.9	47.7	48.4	62.8	62.7	125
9	Qlogic	29.7	29.3	45.3	45.0	60.9	60.1	80
10	Media Sensor (Heads)	19.3	19.6	34.6	34.7	50.3	50.2	n/a

* The number in the Case Maximum Continuous Operating Temperature column are absolute limits that should not be exceeded. In other words, expect physical component damage or failure if you exceed these operating temperature limits by not providing adequate air flow through the drive.

Table 4-2. SDLT 220/320 Steady State Temperatures: Library Bezel

Component		10 degrees C Ambient		25 degrees C Ambient		40 degrees C Ambient		Case Maximum * Continuous Operating Temperature (degrees C)
		Compression 2:1		Compression 2:1		Compression 2:1		
		On	**Off**	**On**	**Off**	**On**	**Off**	
		Temperature (degrees C)		Temperature (degrees C)		Temperature (degrees C)		
1	HiFN	37.3	34.7	52.1	49.7	66.5	64.6	96
2	Hydra 1	38.6	39.2	54.1	54.4	68.5	69.5	113
3	Hydra 2	35.8	36.4	51.2	51.5	65.8	66.6	113
4	Coldfire	20.8	20.6	35.8	35.8	50.8	50.9	83
5	3.3-5.0 V Reg	29.1	28.3	44.1	43.5	59.0	58.7	119
6	Front Sensor	14.0	14.0	29.0	29.0	44.0	44.0	52
7	Rear Sensor	29.1	29.0	44.0	43.9	59.0	58.9	125
8	Headboard	31.7	32.5	46.4	46.9	60.2	61.2	125
9	Qlogic	25.0	24.6	40.3	39.9	55.4	55.2	80
10	Media Sensor (Heads)	19.2	19.3	34.5	34.5	49.3	49.6	n/a

* The number in the Case Maximum Continuous Operating Temperature column are absolute limits that should not be exceeded. In other words, expect physical component damage or failure if you exceed these operating temperature limits by not providing adequate air flow through the drive.

4.4.1 Temperature Comparison — SDLT 220 versus SDLT 320

The SDLT 220 and 320 models have many characteristics in common, including similar temperature profiles. In Table 4-3 and Table 4-4, the differences in operating temperature between the two models are shown highlighted in the Δ column.

Embedded Bezel

This section lists empirical temperature data from measurements taken while using the embedded bezel.

Table 4-3. SDLT 320 versus SDLT 220 with Embedded Bezel, Compression On (2:1)

		25 degrees C Ambient			40 degrees C Ambient		
Sensor		**SDLT 320***	**SDLT 220‡**	**Δ**	**SDLT 320***	**SDLT 220‡**	**Δ**
1	HiFN	57.4	54.4	3.0	72.5	67.7	4.8
2	Hydra 1	61.3	57.9	4.4	77.4	72.4	5.0
3	Hydra 2	57.6	54.8	2.8	73.6	69.3	4.3
4	Coldfire	38.5	38.3	0.2	53.6	53.3	0.3
5	3.3-5.0 V Reg	49.4	47.9	1.5	64.7	62.4	2.3
6	Front Sensor	32.0	32.0	0.0	47.0	47.0	0.0
7	Rear Sensor	50.2	48.6	1.6	65.8	62.8	3.0
8	Headboard	47.7	48.3	-0.6	62.8	61.8	1.0
9	Qlogic	45.3	44.2	1.1	60.9	59.2	1.7
10	Media Sensor (Heads)	34.6	34.7	-0.1	50.3	49.5	0.8

* These temperatures measured on SDLT 320 drives.
‡ These temperatures measured on SDLT 320 drives running in 220 read/write mode.

Results show certain components running hotter in 320 mode than 220 mode. The HiFN (compression chip) runs slightly hotter, and the Hydra chips (read channels) also run hotter. Both of these trends are to be expected as the data transfer rate is increased from 11 MB/s (220) to 16 MB/s (320). However, most other components show very little difference between the two modes.

Library Bezel

This section lists empirical temperature data from measurements taken while using the library bezel.

Table 4-4. SDLT 320 versus SDLT 220 with Library Bezel, Compression On (2:1)

		25 degrees C Ambient			40 degrees C Ambient		
Sensor		**SDLT 320***	**SDLT 220‡**	**Δ**	**SDLT 320***	**SDLT 220‡**	**Δ**
1	HiFN	52.1	48.6	3.5	66.5	63.8	2.7
2	Hydra 1	54.1	50.6	3.5	68.5	66.1	2.4
3	Hydra 2	51.2	48.4	2.8	65.8	63.7	2.1
4	Coldfire	35.8	35.7	0.1	50.8	50.8	0.0
5	3.3-5.0 V Reg	44.1	42.6	1.5	59.0	57.8	1.2
6	Front Sensor	29.0	29.0	0.0	44.0	44.0	0.0
7	Rear Sensor	44.0	42.5	1.5	59.0	57.9	1.1
8	Headboard	46.4	46.3	0.1	60.2	60.8	-0.6
9	Qlogic	40.3	39.5	0.8	55.4	54.8	0.6
10	Media Sensor (Heads)	34.5	34.5	0.0	49.3	49.4	-0.1

* These temperatures measured on SDLT 320 drives.
‡ These temperatures measured on SDLT 320 drives running in 220 read/write mode.

Again, the results show similar components running hotter in 320 mode than 220 mode. The HiFN (compression chip) is slightly hotter and the Hydra chips (read channels) also run hotter. Overall, the drive running in 220 mode parallels the drive’s performance when running in 320 mode for both the embedded and library bezels. For both bezel types, there is little to no difference in the tape path temperatures.

CHAPTER 5 Regulatory Requirements

Regulatory requirements that apply to the SDLT tape system include:

- Safety
- Electromagnetic emissions
- Acoustic.

5.1 Safety Regulations

This section lists the safety regulations that the SDLT tape system meets or exceeds, such as UL, CSA, EN/IEC, and “GS” Mark.

5.1.1 Safety Certifications

The SDLT tape system meets or exceeds requirements for safety in the United States (UL 1950), Canada (CSA950 C22.2 No. 950) and Europe (EN60950/IEC 950), and is certified to bear the GS mark.

5.1.2 Safety Requirements

Safety requirements include:

- UL1950: Information Technology Including Electrical Business Equipment
- CSA950 C22.2 No. 950: Information Technology Including Electrical Business Equipment
- EN60950/IEC 950: Information Technology Including Electrical Business Equipment.

5.2 Electromagnetic Field Specifications

Quantum SDLT tape drives are electrical devices; as such, this equipment generates, uses, and may emit radio frequency energy. The drives may emit energy in other frequencies, as well, as discussed in the following subsections.

5.2.1 Electromagnetic Emissions

The internal version of the tape system complies with FCC Class A in a standard enclosure; the tabletop version complies with the FCC Class B limits.

5.2.2 Electromagnetic Interference Susceptibility

The following table lists the Electromagnetic Interference (EMI) certifications.

Table 5-1. EMI Regulations and Certifications

Type	**Regulation/Certification**
EEC Directive 89/336 CE	BS6527 (UK) EN55022 (EU) EN55024 (EU)
CFR 47, 1995	FCC Rules Part 15B Class B (MDOC)
IECS-003	Canada
V-3/97.04	VCCI Class B (Japan)
CNS 13438	BSMI Class A (Taiwan)
AS/NZS 3548	Australia / New Zealand (C-Tick Mark)

5.2.3 Conducted Emissions

Limits for Class B equipment are in the frequency range from 0.15 to 30 MHz.

Table 5-2. Conducted Emissions

Frequency Range	Limits dB	
	Quasi-peak	**Average**
0.15 to 0.50 MHz	66 to 56*	56 to 46
0.50 to 5 MHz	56	46
5 to 30 MHz	60	50
* The limit decreases linearly with the logarithm of the frequency.		

5.2.4 Radiated Emissions

Limits of radiated interference field strength, in the frequency range from 30 MHz to 1000 MHz at a test distance of 10 meters, are listed in Table 5-3.

Table 5-3. Radiated Emissions

Frequency Range	Quasi-peak limits dB (µV/m)	
	Class A	**Class B**
30 to 230 MHz	40	30
230 to 1000 MHz	46	37
Above 1000 MHz	54	Not applicable

5.2.5 Susceptibility and ESD Limits

The following tables list radiated, magnetic radiated, and conducted susceptibility and ESD failure level limits for the tape system.

NOTE: Proper ESD protection must be observed when handling Quantum tape drive products.

Table 5-4. Radiated, Magnetic Radiated, and Conducted Susceptibility

Type	Specifications	Comments
Radiated Immunity: High Frequency, Electric Fields	3 V/m (rms), 80% modulated, 1 kHz, 26 – 1000 MHz	No errors* No screen distortion
Magnetic Radiated: Low Frequency, Magnetic Fields	3 A/m @ 230V/50 Hz	No errors* No screen distortion
EFT: Fast Transient (Bursts) for Power and Data Cables	2 kV	No errors*
PLT: High Energy Transient Voltage for Power Cables	1.2 kV (Differential) 2.5 kV (Common mode)	No errors*
Low-level Conducted‡ Interference for AC and DC Cables	3 V/m (rms), 80% modulated, 1 kHz, 0.15 – 80 MHz	No errors* No screen distortion

* The SDLT tape system shall maintain normal operation both in Read/Write and in Standby conditions. No errors attributable to the test shall be encountered.

‡ Conducted: The transient voltage is the actual peak voltage above the normal AC voltage from the power source. The maximum energy in a single pulse from the transient generator must be limited to 2.5 W.

Table 5-5. Electrostatic Discharge (ESD) Failure Level Limits

Failure Type	Equipment	Specifications	Comments
Hardware	Office	1 to 12 kV	No operator intervention (soft recoverable allowed)
Hardware	Office	Up to 15 kV	No component damage; operator intervention allowed (soft/hard errors allowed)

5.3 Acoustic Noise Emissions

The following table provides the tape system's acoustic noise emission levels, both as noise power and sound pressure.

Table 5-6. Acoustic Noise Emissions, Nominal

Acoustics – Preliminary declared values per ISO 9296 and ISO 7779/EN27779		
Mode	**Noise Power Emission Level (LNPEc) Internal Version**	**Tabletop Version**
Idle	Not applicable	5.4 Bel
Streaming	5.9 Bel	5.9 Bel
Mode	**Sound Pressure Level (LPAc) Internal Version**	**Tabletop Version**
Idle	Not applicable	42 dB
Streaming	47 dB	53 dB

CHAPTER 6 SCSI and Controller Interface Specification

6.1 SCSI Interface Type

The SDLT drive is available in either of two possible SCSI interface versions; these versions provide three possible SCSI interface types:

- Multimode Single-Ended (MSE) card provides one of two interfaces
  - Low Voltage Differential (LVD) running at 80 MB/second, or
  - Single Ended (SE) running at 40 MB/second.
- High Voltage Differential (HVD) card running at 40 MB/second.

6.2 Setting the SCSI ID

Each device on the SCSI bus must have a unique SCSI ID address assigned to it. For specific recommendations for assigning SCSI IDs, refer to the system or SCSI controller documentation.

Internal drives can be configured for SCSI ID addresses that range from 0 to 15 in one of two ways:

- Jumper the 10-pin SCSI ID block located on the back of the drive (Figure 6-1 on page 6-4), OR
- In a library setting, you can set the IDs through firmware. (The firmware default = SCSI ID 5 and assumes no jumpers are installed on the jumper block.)

NOTE: The default setting for the tape drive is 5; the host adapter setting is typically SCSI ID 7. If you choose to omit all jumpers from the SCSI ID block, the tape drive will use the default setting of 5.

This section discusses setting the SCSI ID on the internal drive via the jumper block. Table 6-1 lists the SCSI ID address and jumper settings.

Table 6-1. SCSI ID Address Selections

SCSI ID	**Jumper Across Pins:**				
	9-10*	**7-8**	**5-6**	**3-4**	**1-2**
0	1	0	0	0	0
1	1	0	0	0	1
2	1	0	0	1	0
3	1	0	0	1	1
4	1	0	1	0	0
5 (default)	0	0	0	0	0
6	1	0	1	1	0
7	1	0	1	1	1
8	1	1	0	0	0
9	1	1	0	0	1
10	1	1	0	1	0
11	1	1	0	1	1
12	1	1	1	0	0
13	1	1	1	0	1
14	1	1	1	1	0
15	1	1	1	1	1
0 = No Jumper installed, 1 = Jumper installed					
* Jumpering Pins 9-10 forces the drive to ignore the firmware value and read the value jumpered on the block.					

6.3 Hardware (Connectors)

The SCSI interface is made available via the back panel of the drive, as shown in Figure 6-1 and Figure 6-2 below.

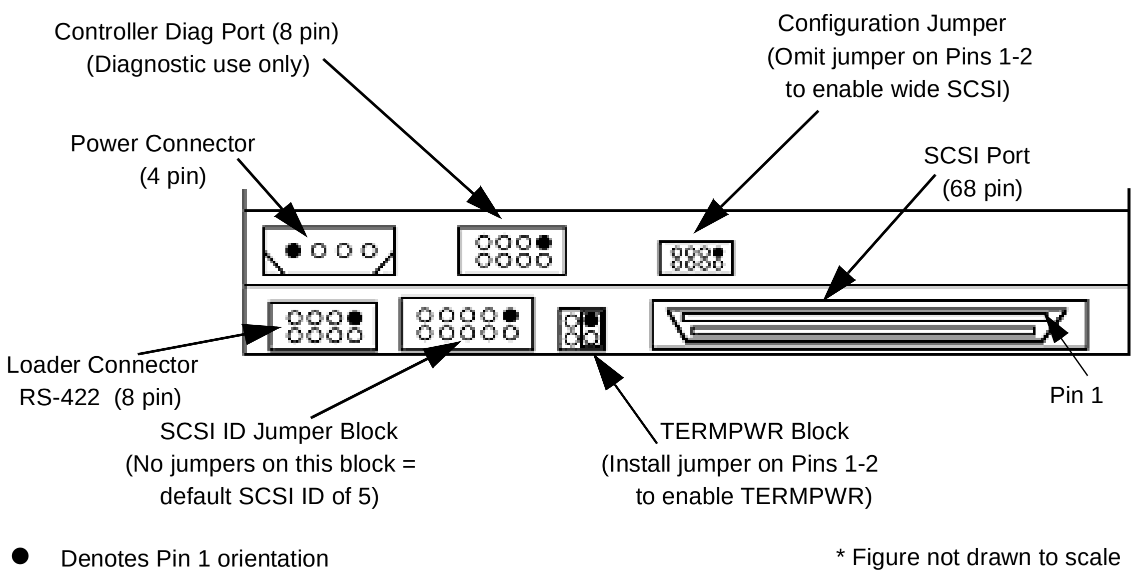


Figure 6-1. Connectors on the Back Panel

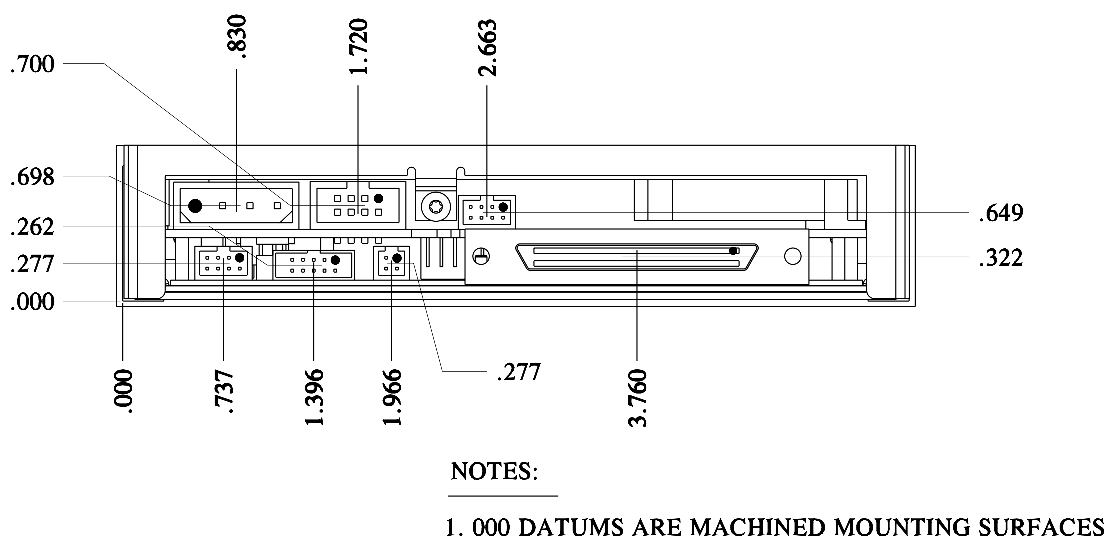


Figure 6-2. Back Panel Connector Locations (Drawn to Scale)

6.4 SCSI Stub Lengths

The SCSI interface resides on the Host Interface Module (HIM). Quantum provides two versions, namely:

- LVD (50-84004-01)
- HVD (50-84008-01)

The longest recorded stub lengths on the latest version of each style of PCB are listed in Table 6-2.

Table 6-2. SCSI Interface Stub Lengths

Board	Stub Length	Signal Name	From	To
LVD	1.543 inches	SCSI_SEL_H	E1-70	J4-27
HVD	1.853 inches	SCSI_DBP0_L	E7-38	J4-49

6.5 SCSI Cable Length

This section lists the recommended SCSI cable lengths for optimum drive performance; cable lengths are:

- 25 meters for Differential Ended Transmission Mode (LVD)
- 6 meters for Single-Ended Transmission Mode (HVD)

For optimum drive performance, limit the cables to a length of 6 meters (in all cases).

6.6 Power On Self Test

When power is applied to the tape system, the system performs a Power On Self Test (POST). POST completes in approximately ten seconds. While POST is running, the tape system responds BUSY to SCSI commands. The tape system also responds to various SCSI messages during POST.

During this time, if a host tries to negotiate Synchronous or Wide transfers, the tape system will negotiate to Asynchronous or Narrow. It may take longer than the duration of POST for the drive to become ready.

Table 6-3. Indicator Pattern During POST

Stage	What Can Be Observed
1	The LEDs light in a progressing pattern from left to right.
2	The red and yellow LEDs are extinguished and the green LED flashes until POST completes.
3	If POST fails, the green and yellow LED will illuminate steadily and the red LED will blink.

6.7 SCSI Command Timeout

Table 6-4 shows the length of time a SCSI command “waits” for a response before it times out.

Table 6-4. SCSI Command Timeout Values

Command	Timeout
ERASE	6 hours (overwrite entire tape)
INQUIRY	500 milliseconds
LOAD/UNLOAD	16 minutes
LOCATE	6 hours
LOG SELECT	500 milliseconds
LOG SENSE	500 milliseconds
MODE SELECT	500 milliseconds
MODE SENSE	500 milliseconds

Table 6-4. SCSI Command Timeout Values (Continued)

Command	Timeout
PREVENT/ALLOW MEDIA REMOVAL	500 milliseconds
READ	1 hour
READ BLOCK LIMITS	500 milliseconds
READ BUFFER	3 minutes
READ POSITION	500 milliseconds
RECEIVE DIAGNOSTICS	500 milliseconds
RELEASE UNIT	500 milliseconds
REQUEST SENSE	500 milliseconds
RESERVE UNIT	500 milliseconds
REWIND	4 minutes
SEND DIAGNOSTICS	20 minutes
SPACE	6 hours (directory may need rebuilding)
TEST UNIT READY	500 milliseconds
VERIFY	1 hour
WRITE	1 hour
WRITE BUFFER (UPDATE FLASH)	10 minutes
WRITE FILEMARK	1 hour

6.8 SCSI and Power Connectors

This section describes how to use the connectors that are provided on the back of the SDLT tape drive. The arrangement of these connectors is shown in Figure 6-1 on page 6-4.

6.8.1 Power

The pin orientation for the 4-pin power connector (TERMPWR) located on the back of the internal tape drive is shown in Figure 6-4 on page 6-15. Pin assignments for the power connector are listed in Table 6-9 on page 6-14.

6.8.2 SCSI

Pin assignments for the three possible SCSI connectors are listed in Tables 6-6 through 6-8; Multimode Single-Ended (MSE) and Single Ended (SE) mode in Table 6-6 on page 6-10, MSE Low Voltage Differential (LVD) mode in Table 6-7 on page 6-12, and High Voltage Differential (HVD) mode in Table 6-8 on page 6-13.

1. Prior to connecting the SDLT drive to the host computer, make sure the drive and computer are turned OFF.

2. If you are connecting several devices to the SCSI bus, connect only the drive to the host computer at this time. Confirm that the host computer and drive are communicating correctly before adding additional devices.

3. The SCSI bus must be terminated at each end. This drive may need to be terminated:

   - if the SDLT drive is the only device connected to the SCSI bus, OR
   - if the SDLT drive is one of several devices connected to the SCSI bus, and it is the last device connected to the SCSI bus.

4. If the answer to step 3 was affirmative, attach a “Y” connector to the drive’s SCSI connector; then attach the SCSI cable to one leg of the “Y” and attach the terminator to the other leg. Carefully connect the cables, to avoid bending or damaging the connector pins.

5. Attach the power cables to the drive. Check the SCSI cable and termination connections and ensure that they are attached correctly and seated firmly.

6.9 Loader/Library Controller Interface

The loader connector (for library tape drive interface) is an RS-422 serial port set to 9600 baud, 8 bits per character, no parity, and 2 stop bits. All data sent to or from the library tape drive interface consists of bit-wise encoded hex values.

This 8-pin optional loader connector provides signals to be used when the tape drive is part of a loader/library configuration. The loader connector provides a “universal port” that can support various serial interface protocols. The electrical signals from the SDLT drive need to be translated to the appropriate serial interface protocol by a hardware and software interface system.

The Molex part numbers for this connector are:

- Connector terminals: 50394-8052
- Connector body: 51110-0850

Figure 6-3 shows a representation of the connector; pin assignments for the loader connector are listed in Table 6-5.

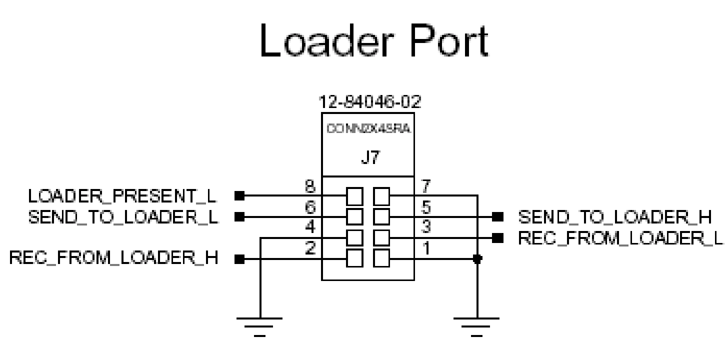


Figure 6-3. Loader Connector
(Internal Version Shown)

Table 6-5. 8-Pin Loader Connector Pin Assignments

Signal Name	Pin Number	Pin Number	Signal Name
Ground	1	5	SEND_TO_LOADER_H
REC_FROM_LOADER_H	2	6	SEND_TO_LOADER_L
REC_FROM_LOADER_L	3	7	Ground
Ground	4	8	LOADER_PRESENT_L

Table 6-6. MSE and SE Mode SCSI Connector Pin Assignments

Signal Name	Pin Number	Pin Number	Signal Name
Ground	1	35	-DB(12)
Ground	2	36	-DB(13)
Ground	3	37	-DB(14)
Ground	4	38	-DB(15)
Ground	5	39	-DB(P1)
Ground	6	40	-DB(0)
Ground	7	41	-DB(1)
Ground	8	42	-DB(2)
Ground	9	43	-DB(3)
Ground	10	44	-DB(4)
Ground	11	45	-DB(5)
Ground	12	46	-DB(6)
Ground	13	47	-DB(7)
Ground	14	48	-DB(P0)
Ground	15	49	Ground
DIFFSENS	16	50	Ground
TERMPWR	17	51	TERMPWR
TERMPWR	18	52	TERMPWR
Reserved	19	53	Reserved
Ground	20	54	Ground

Table 6-6. MSE and SE Mode SCSI Connector Pin Assignments (Continued)

Ground	21	55	-ATN
Ground	22	56	Ground
Ground	23	57	-BSY
Ground	24	58	-ACK
Ground	25	59	-RST
Ground	26	60	-MSG
Ground	27	61	-SEL
Ground	28	62	-C/D
Ground	29	63	-REQ
Ground	30	64	-I/O
Ground	31	65	-DB(8)
Ground	32	66	-DB(9)
Ground	33	67	-DB(10)
Ground	34	68	-DB(11)
Note: The minus sign (-) next to a signal indicates active low.			

Table 6-7. MSE LVD Mode SCSI Connector Pin Assignments

Signal Name	Pin Number	Pin Number	Signal Name
+DB(12)	1	35	-DB(12)
+DB(13)	2	36	-DB(13)
+DB(14)	3	37	-DB(14)
+DB(15)	4	38	-DB(15)
+DB(P1)	5	39	-DB(P1)
+DB(0)	6	40	-DB(0)
+DB(1)	7	41	-DB(1)
+DB(2)	8	42	-DB(2)
+DB(3)	9	43	-DB(3)
+DB(4)	10	44	-DB(4)
+DB(5)	11	45	-DB(5)
+DB(6)	12	46	-DB(6)
+DB(7)	13	47	-DB(7)
+DB(P)	14	48	-DB(P)
Ground	15	49	Ground
DIFFSENS	16	50	Ground
TERMPWR	17	51	TERMPWR
TERMPWR	18	52	TERMPWR
Reserved	19	53	Reserved
Ground	20	54	Ground
+ATN	21	55	-ATN
Ground	22	56	Ground
+BSY	23	57	-BSY
+ACK	24	58	-ACK
+RST	25	59	-RST
+MSG	26	60	-MSG
+SEL	27	61	-SEL
+C/D	28	62	-C/D
+REQ	29	63	-REQ
+I/O	30	64	-I/O

Table 6-7. MSE LVD Mode SCSI Connector Pin Assignments (Continued)

+DB(8)	31	65	-DB(8)
+DB(9)	32	66	-DB(9)
+DB(10)	33	67	-DB(10)
+DB(11)	34	68	-DB(11)

Table 6-8. HVD Mode SCSI Connector Pin Assignments

Signal Name	Pin Number	Pin Number	Signal Name
+DB(12)	1	35	-DB(12)
+DB(13)	2	36	-DB(13)
+DB(14)	3	37	-DB(14)
+DB(15)	4	38	-DB(15)
+DB(P1)	5	39	-DB(P1)
Ground	6	40	Ground
+DB(0)	7	41	-DB(0)
+DB(1)	8	42	-DB(1)
+DB(2)	9	43	-DB(2)
+DB(3)	10	44	-DB(3)
+DB(4)	11	45	-DB(4)
+DB(5)	12	46	-DB(5)
+DB(6)	13	47	-DB(6)
+DB(7)	14	48	-DB(7)
+DB(P)	15	49	-DB(P)
DIFFSENS	16	50	Ground
TERMPWR	17	51	TERMPWR
TERMPWR	18	52	TERMPWR
Reserved	19	53	Reserved
+ATN	20	54	-ATN
Ground	21	55	Ground
+BSY	22	56	-BSY

Table 6-8. HVD Mode SCSI Connector Pin Assignments (Continued)

+ACK	23	57	-ACK
+RST	24	58	-RST
+MSG	25	59	-MSG
+SEL	26	60	-SEL
+C/D	27	61	-C/D
+REQ	28	62	-REQ
+I/O	29	63	-I/O
Ground	30	64	Ground
+DB(8)	31	65	-DB(8)
+DB(9)	32	66	-DB(9)
+DB(10)	33	67	-DB(10)
+DB(11)	34	68	-DB(11)

Table 6-9. 4-Pin Power Connector Pin Assignments

Pin Number	Signal Name
1	+12 VDC
2	Ground (+12V return)
3	Ground (+5V return)
4	+5 VDC

6.10 Configuring the Drive

Configure the internal drive for TERMPWR or Wide/Narrow SCSI.

6.10.1 TERMPWR

A SCSI bus must be terminated at each end of the bus. All signals not defined as RESERVED, GROUND, or TERMPWR shall be terminated exactly once at each end of the bus. At least one device must supply terminator power (TERMPWR).

To enable TERMPWR, install the jumper across Pins 1 and 2 (Figure 6-4) on the TERMPWR jumper block. Remove the jumper to disable TERMPWR. Pins 3 and 4 on this block are reserved and require no jumpering.

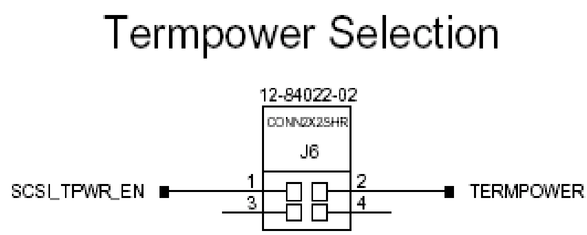


Figure 6-4. TERMPWR Connector

6.10.2 Wide SCSI

The 8-pin Configuration Jumper Block allows you to enable or disable the wide SCSI bus. The default setting is for the wide SCSI bus to be enabled; there is no jumper across Pins 1 and 2 when wide SCSI is enabled (refer to Figure 6-1 on page 6-4). To disable wide SCSI, install a jumper across Pins 1 and 2. Pins 3 through 8 are reserved and require no jumpering.

CHAPTER 7

Updating the Firmware

7.1 Updating the Code

When you need to update the firmware in a drive, you can do it either of two ways:

- Build a firmware image tape; this tape can be used in either a manual firmware update or in a Library setting.
- Update the firmware over the SCSI bus.

Both of these approaches are described briefly in the following subsections.

NOTE: For more information about other diagnostics tools provided by Quantum, refer to Section 1.8, "Quantum Diagnostics Tools" on page 1-6.

7.1.1 Update the Firmware Using the SCSI Bus

SDLT Update is a tool that allows you to update a drive's firmware (using the SCSI bus), or to create a code update (CUP/FUP) tape for an SDLT drive.

SDLT Update is available on Quantum's web site, ***http://www.quantum.com***. Follow the path *Service and Support* -> *DLTtape Drivers and Software* and download the *SDLT Update* package. For detailed instructions to use while updating the firmware, refer to that tool's built-in online help.

7.1.2 Making a FUP/CUP Tape

SDLT Update is a tool that allows you to update a drive's firmware (using the SCSI bus), or to create a code update (CUP/FUP) tape for an SDLT drive.

SDLT Update is available on Quantum's web site, ***http://www.quantum.com***. Follow the path *Service and Support -> DLTtape Drivers and Software* and download the *SDLT Update* package. For detailed instructions about how to make the tape, refer to that tool's built-in online help.

7.1.3 Using a CUP/FUP Tape

Follow these steps to use a CUP/FUP tape that was previously created by you or someone else:

1. Verify that the drive is turned on (power is applied), and the Green (Drive Status) LED is on, but not blinking.

2. Verify that the drive's tape opening is empty. (In other words, if any other tape cartridge is in the drive, unload and eject it.)

3. Press and hold the Eject button for six seconds; after six seconds, the Amber (Write Protect) LED will begin to blink.

4. Release the Eject button, then quickly press and release the Eject button again. At this point, the Amber and Green LEDs start blinking synchronously in a regular, rhythmic pattern. The drive is now in Firmware Upgrade mode.

   You now have a "window" of one minute to insert the tape cartridge. If you do *not* insert a CUP/FUP tape and the one minute time window expires, both LEDs will stop blinking, although the Green LED will remain on (steadily illuminated). The drive is now out of Firmware Upgrade mode and can be used in a normal manner (once you insert a data tape cartridge). To put the drive back in Firmware Upgrade mode, repeat steps 2, 3, and 4 above.

5. Insert the CUP/FUP tape that was previously created.

6. After you insert the tape, the Amber LED and the Green LED will change their pattern, and start blinking in an alternating pattern. The drive is now performing the Firmware Upgrade.

NOTE: The Firmware Upgrade will fail the microcode update process if the firmware personalities do not match; this will be noted in the history log, along with the reason for the failure.

7. Wait several minutes for the update process to complete. The Amber and Green LEDs will blink the entire time that memory is being updated.

8. When the update is complete, the drive resets itself and goes through POST. The tape is rewound, unloaded, and ejected from the drive. SCSI status will indicate that microcode has been updated (06h, 3F, 01).

NOTE: If the drive is mounted in a tape automation library, the tape is not automatically ejected, but it is rewound to BOT and unbuckled in preparation for unloading.

7.2 Code Update Using the Library Tape Drive Interface

The library tape drive interface (for SDLT) enables updating the policy/servo firmware with a new version—that is to say, image—via tape update. Follow these steps:

1. Make certain the drive contains no cartridge.
2. Send the CODE UPDATE REQUEST command.
3. Send the library ATTENTION command, then check the Tape Motion Status field of the returned General Status Packet to verify the tape drive is in the Ready for Code Update (0x09) state.
4. Load the cartridge containing the new firmware into the drive.
5. Send the library ATTENTION command, then check the Tape Motion Status field of the returned General Status Packet to verify the cartridge is loading (0x07). Note: It takes about a minute to get into the Cup in Progress state.
6. Send the library ATTENTION command, then check the Tape Motion Status field of the returned General Status Packet to verify the cartridge is in the Cup in Progress (0x0A) state.
7. Send the library ATTENTION command, then check the Policy Firmware Revision field to verify that the update completed successfully.
8. Unload the cartridge and remove it from the drive.

CAUTION: During the firmware update, when reprogramming the new image into the flash EEPROMs is actually in progress, a power failure (but not bus RESET) or **power cycling the unit causes the controller module to be unusable**. When doing a firmware update, take reasonable precautions to prevent a power failure.

7.2.1 Firmware (Code) Update Troubleshooting

This section lists common behaviors that you may notice as you update the tape drive's firmware. For example:

- Updating the same revision

  If a code update is requested and the code revision being updated is the same as the code revision already in the unit, the system updates controller code but not servo-specific code. The steps for this type of update are the same as for a normal update.

- Updating fails, which causes the drive to be reset; the problem can result from any of the following circumstances:
  - Cartridge contains incompatible update image.
  - Cartridge does not contain an update image.
  - No cartridge in the drive.

CHAPTER 8

Insertion and Extraction Guidelines

8.1 Applicable Library Commands

The following lists of commands are provided for customers who are using library interface commands to communicate with the drive.

NOTE: Use the ATTENTION command to poll the status of the drive; once the status is obtained, programmatically examine the contents of the General and Extended Status packets to ascertain the *exact* status of the drive.

For detailed information about these commands, refer to the *Super DLTtape™ Interactive Library Interface Specification* (66-800000-00) document.

8.1.1 Loading

These commands pertain to loading the cartridge:

- ATTENTION
- LOAD
- DISABLE AUTO TAPE THREAD
- ENABLE AUTO TAPE THREAD.

8.1.2 Unloading

These commands pertain to unloading the cartridge:

- ATTENTION
- EJECT
- UNLOAD
- UNLOAD and EJECT
- DISABLE EJECT ON SCSI UNLOAD
- ENABLE EJECT ON SCSI UNLOAD
- DISABLE AUTO TAPE THREAD
- ENABLE AUTO TAPE THREAD.

8.2 Loading a Tape Cartridge

Complete this subsection to load a tape cartridge into the front of the tape drive. Because this subsection of the manual refers to some of the front panel LEDs and controls, it describes the process for *manually* loading a tape cartridge.

1. Insert the cartridge. Push the cartridge fully into the tape drive.
2. The Drive Status LED blinks to show that the tape is loading. When the tape reaches the BOT (Beginning Of Tape) marker, the LED lights steadily. The tape is now ready for use.

8.2.1 Load Forces, Placement, and Timing

The mechanics of the loading process—including tight tolerances—are important and cannot be ignored.

Insertion Depth

When loading the cartridge into the drive, the distance the picker is expected to move is important; this distance is shown in Figure 8-1 on page 8-6.

Cartridge Insertion Force

When loading the cartridge into the drive, the load force applied should be 2.5 ± 0.25 lbs. force. This force needs to be applied either: 1) directly in the horizontal and vertical center of the cartridge, or 2) symmetrically around the center of the cartridge. Do not press unevenly (or asymmetrically) on the cartridge, because it can cause premature wear to internal mechanical components.

Insertion Velocity

The insertion velocity must be in the range: 1.5 inch/sec ≤ *velocity* < 0.

Hold Time for Loading (Dwell Time)

When loading the cartridge into the drive, the maximum time that the picker should hold the cartridge is 250ms (0.25 second). If a longer hold time is used, buckling and possible reel driver engagement problems could occur.

Debounce Time

The time allowed for the tape to stop moving (delay after insertion) is 50 ms.

Initialization Time

Initialization time is the maximum time for the SDLT drive to come ready after cartridge load; the time necessary for the drive to “ready itself” varies according to the characteristics and history of the media:

- **Blank Media** (never been written or degaussed): Typically when a blank media is inserted into the SDLT drive, the drive completes its algorithms for cartridge load within 1 ½ minutes. **Worst case** time for a blank media could be up to 10 minutes. (This worst case time includes all of the error recovery algorithms that may need to be invoked.)
- **Written Media**: Typically when a written media is inserted into the SDLT drive, the drive completes its algorithms for cartridge load within 15 seconds.

8.3 Unloading a Tape Cartridge

Complete this subsection to unload a tape cartridge. Because this subsection of the manual refers to some of the front panel LEDs and controls, it describes the process for *manually* unloading a tape cartridge.

> **CAUTION:** Remove the tape cartridge from the tape drive *before* turning off host power. Failure to remove a tape cartridge may result in cartridge or tape drive damage.

1. Press the Eject button, or issue an appropriate system software command. The drive completes any active writing of data to the tape. The Drive Status LED blinks as the tape rewinds.

2. When the tape is finished rewinding, the drive ejects the cartridge and the Drive Status LED lights steadily.

   Do not rush removal of the tape cartridge. Wait until the drive ejects the cartridge and the Drive Status LED lights steadily before removing the cartridge.

3. Remove the cartridge from the drive and return the cartridge to its plastic case to protect the cartridge from damage.

8.3.1 Unload Forces, Placement, and Timing

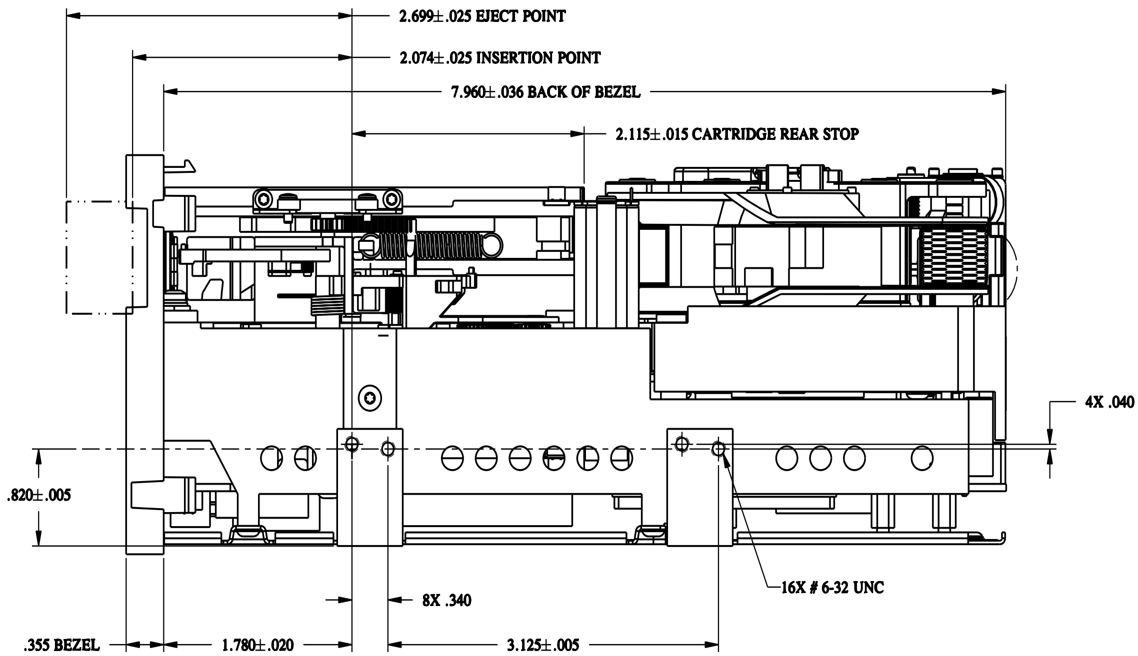


Figure 8-1. Tolerances for Cartridge Insertion and Extraction

Eject Distance

When ejecting a cartridge from the drive, the distance the cartridge can be expected to move is important; this distance is shown in Figure 8-1.

Cartridge Extraction Force

Limit the extraction force (applied by the picker) to 4.5 lbs (maximum). More than that will bend the pin on the takeup leader (if the leaders fail to unbuckle).

Extraction Velocity

The extraction velocity must be in the range: 1.5 inch/sec ≤ *velocity* < 0.

Quantum
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86-80002-01 B

86-80002-01 REV B