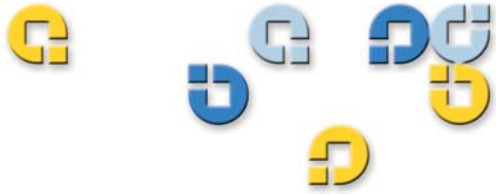
Quantum



Design and Integration Guide Design and Integration Guide Design and Integration Guide

Tape Drive

SDLT 600

81-81196-02 A01

SDLT 600 Design and Integration Guide, 81-81196-02 A01, December 2005, Made in USA.

COPYRIGHT STATEMENT

TRADEMARK STATEMENT

Contents

Figures

Tables

Preface

The Quantum SDLT 600 tape drive is a highly scalable tape drive designed for multiple product generations. This product is a follow-on to the SDLT 220 and SDLT 320 tape drives. The SDLT 600 tape drive system comprises both the tape drive and the data cartridge; the system is available in either a built-in (internal) model or a tabletop model. The tape drive provides 300 GB of storage capacity with a transfer speed of 36 Megabyte per second (MB/sec) native; 600 GB of storage capacity with a transfer speed of 72 MB/sec compressed.

Purpose and Scope

This design and integration guide provides detailed information that may be helpful to refer to as you integrate the SDLT 600 tape drive system into larger systems.

This guide is for customers integrating the SDLT 600 tape drive into their products. Technical knowledge on the part of the user is assumed.

Structure of this Manual

- Chapter 1, General Tape Drive Specifications provides a basic product description of the SDLT 600 tape drive system, and the tape drive specifications such as dimensions and tolerances, functional, physical vibration and shock, and environmental requirements.

- Chapter 2, Electrical Specifications lists the SDLT 600 tape drive system power consumption and its power supply requirements.
- Chapter 3, Thermal Specifications includes information about how to keep the temperature inside the tape drive within the operating limits.
- Chapter 4, Regulatory Requirements provides information about the various regulations to which the SDLT 600 tape drive system conforms.
- Chapter 5, Universal Interface Information provides information that applies to any tape drive interface specification—either Parallel SCSI (Ultra 160) or Fibre Channel. This chapter also provides information about the optional connection to a loader or library system.
- Chapter 6, Parallel SCSI Interface provides information about the Parallel SCSI (Ultra 160) interface specification.
- Chapter 7, Fibre Channel Interface provides information about the Fibre Channel interface specification.
- Chapter 8, Updating the Firmware describes the two processes for updating the firmware inside the tape drives.
- Chapter 9, Insertion and Extraction Guidelines includes the data cartridge insertion and ejection guidelines.

Notational Conventions

This document uses the following conventions:

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

Caution: Cautions indicate potential hazards to equipment and are included to prevent damage to equipment.

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

This document uses the following:

- Tape Drive System — Refers to the complete system including the cartridge.

- Tape Drive — Refers to just the tape drive and does not include the cartridge.
- Right side of the tape drive — Refers to the right side as you face the component being described.
- Left side of the tape drive — Refers to the left side as you face the component being described.
- Power cycle — Means to turn the tape drive or system on, then turn them off (or off, then on).
- Dimensions in figures — All dimensions are shown with no units specified (Inches understood unless otherwise specified).

Related Documents

The following documents are related to the SDLT 600 tape drive:

Document No.	Document Title	Document Description
81-81218-xx	SDLT 600 Product Specification	Provides hardware, performance, environment, shock and vibration, and regulatory specifications for the tape drive
81-81196-xx	SDLT 600 Design and Integration Guide	Provides information that helps you install the tape drive into a larger system
81-81283-xx	SDLT 600 Quick Start Guide	Provides "quick" instructions on how to install and run the tape drive
81-81297-xx	DLTSage and DLT*Ice* User's Guide	Provides information on DLTSage™ and DLT*Ice*™, a suite of preventative maintenance diagnostic software tools that enables users to more simply manage tape storage environments.

Document No.	Document Title	Document Description
81-81220-xx	SDLT 600 User Reference Guide	Provides instructions on how to install, run the tape drive, hardware, performance, environment, shock and vibration, and regulatory specifications for the tape drive
81-81305-xx	SDLT 600 Quick Start Guide	Provides brief instructions on how to install the tape drive
81-81202-xx	SDLT 600 Fibre Channel Interface Guide	Provides Fibre Channel command information specific to the tape drive.
81-81200-xx	SDLT 600 SCSI Interface Guide	Provides SCSI command information specific to the tape drive.
6464162-xx	SDLT DLTtape Interactive Library Interface Specification	Provides information specific to the library tape drive.
81-81252-xx	Bezel Replacement Guide	Provides instructions on how to replace the bezel on the tape drive

Current SCSI standards documents available from www.t10.org

- SCSI Architecture Model (SAM-3)
- SCSI Primary Commands (SPC-3)
- SCSI Parallel Interface (SPI-5)
- SCSI Stream Commands (SSC-3)
- Fibre Channel Protocol (FCP-2)
- Fibre Channel Framing and Signaling (FC-FS-2)
- Fibre Channel Arbitrated Loop (FC-AL-2)
- Fibre Channel General Services (FC-GS-5)

See the appropriate documentation for information on the tape drive and cartridges.

SCSI Standards

Copies of the approved version of the SCSI standards may be obtained from:

Global Engineering Documents
15 Inverness Way, East
Englewood, CO 80112
(800) 854-7179 or (303) 397-2740

For More Information

The Web site www.dlttape.com includes much valuable information about SDLT systems; or to locate very specific product-related information, visit 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.

Quantum Diagnostics Tools

Quantum frequently provides new and updated tools to use with its tape drives. For example, see entries in table 1

Table 1 Sample of Quantum Diagnostic Tools Available to the Web Site

qTalk - Firmware Update Utility for Super DLT tape drives	SCSI-based Windows application that allows users to upload new firmware to a DLT tape drive.
DLTSage iTalk Diagnostic Software for Super DLTtape drives	Diagnostic software that allows users to quickly test the integrity of a Super DLT tape drive.
Device Driver for Windows 2000, Windows XP, and Windows Server 2003 (32-Bit Edition) - Intel x86 Platform	Device Driver to allow use of all DLT, Super DLT, and Value DLT tape drives with Windows 2000, Windows XP, and Windows Server 2003 running on Intel x86 (32-bit) platforms.

DLTSage xTalk Diagnostic Software for Super DLT tape drives	xTalk will evaluate your tape drive's health and determine if it needs to be sent in for service.
And others—the list changes frequently.	

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

Contacts

Quantum company contacts are listed below.

Quantum Corporate Headquarters

To order documentation on this or other Quantum products, contact:

Quantum Corporation
141 Innovation Drive
Irvine, CA 92617
(949) 856-7800
(800) 284-5101

Technical Publications

To comment on existing documentation send e-mail to:

doc-comments@quantum.com

Quantum Home Page

Visit the Quantum home page at:

http://www.quantum.com

Customer Support

The Quantum Customer Support Department provides a 24-hour help desk that can be reached at:

North/South America:	(949) 725-2100 or (800) 284-5101
Asia/Pacific Rim:	(International Code) + 61 7 3839 0988
Europe/Middle East/Africa:	(International Code) + 44 (0) 1256 848748

Send faxes for the Customer Support Department to:

North/South America:	(949) 725-2176
Asia/Pacific Rim:	(International Code) + 61 7 3839 0955
Europe/Middle East/Africa:	(International Code) + 44 (0) 1256 848777

Send e-mail for the Customer Support Department to:

North/South America:	http://www.quantum.com/am/service_support/Index.aspx
Asia/Pacific Rim:	apachelp@quantum.com
Europe/Middle East/Africa:	eurohelp@quantum.com

Chapter 1

General Tape Drive Specifications

This chapter provides general tape drive specifications associated with the SDLT 600 tape drive, which include the following topics:

Product Description

The Quantum SDLT 600 tape drive system is a highly scalable tape drive designed for multiple product generations. It is a follow-on to the DLT product family. The SDLT 600 tape drive system comprises both the tape drive and the data cartridge. The system is available in three models: a

tabletop (or external) unit, an internal unit for server installation, and a library model for installing in tape automation systems.

Figure 1 shows pictures of the internal and tabletop models. The library model (not shown) is identical to the internal, but with a slightly different front bezel.

Figure 1 SDLT 600 Tape Drive System

Internal model

Tabletop model

SDLT 600 Tape Drive System Features

The SDLT 600 tape drive system offers the following product features:

- A streaming tape drive that uses half-inch wide Super Digital Linear Tape (Super DLTtape II) media.
- A standard 5.25-inch full-height form factor to simplify integration into system and tape library solutions.
- Backward read compatibility for SDLT 220 and SDLT 320 tape drive formats with the Super DLTtape I data cartridge type; and the DLT VS160 tape drive format with DLTtape™ VS1 data cartridge type.

- DLTSage iTalk (and Pocket DLTSage iTalk)—Infrared (wireless) interface that provides a remote testing base allowing customers and integrators to access system diagnostic information from the front of the SDLT 600 tape drive system.
- The SDLT 600 tape drive is available in either Ultra 160 or Fibre Channel interface versions.
- The tape drive system provides 300 Gigabyte (GB) of storage capacity with a transfer speed of 36 Megabyte per second (MB/sec) native; 600 GB of storage capacity with a transfer speed of 72 MB/sec compressed.

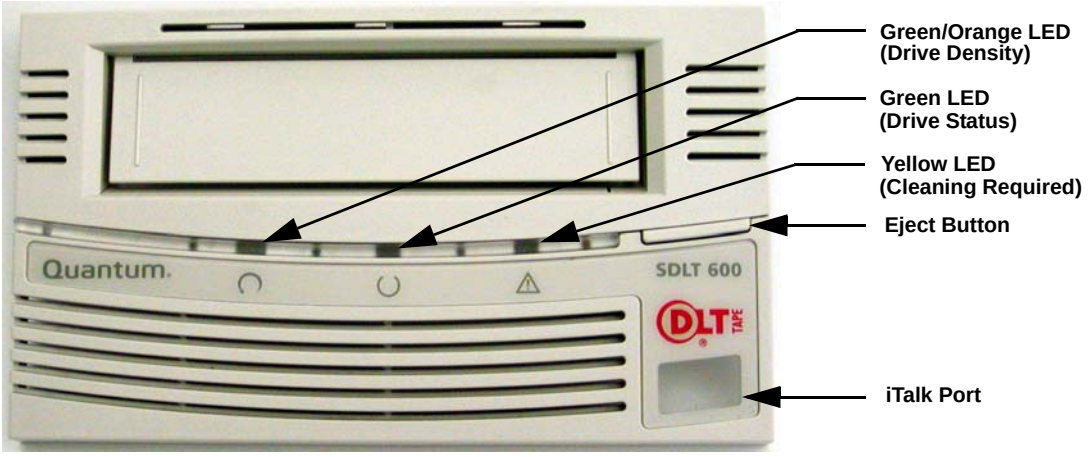
SDLT 600 Library Tape Drive Interface

The library tape drive interface for the SDLT 600 tape drive 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.

SDLT 600 Tape Drive Front Panel LEDs

All controls and LEDs are on the tape drive's front panel. See figure 2 for details. Use these controls and LEDs to operate the tape drive and monitor the SDLT 600 tape drive system's activities. For more detail about the controls and LED functionality, refer to *SDLT 600 Product Manual (81-81184-xx)*.

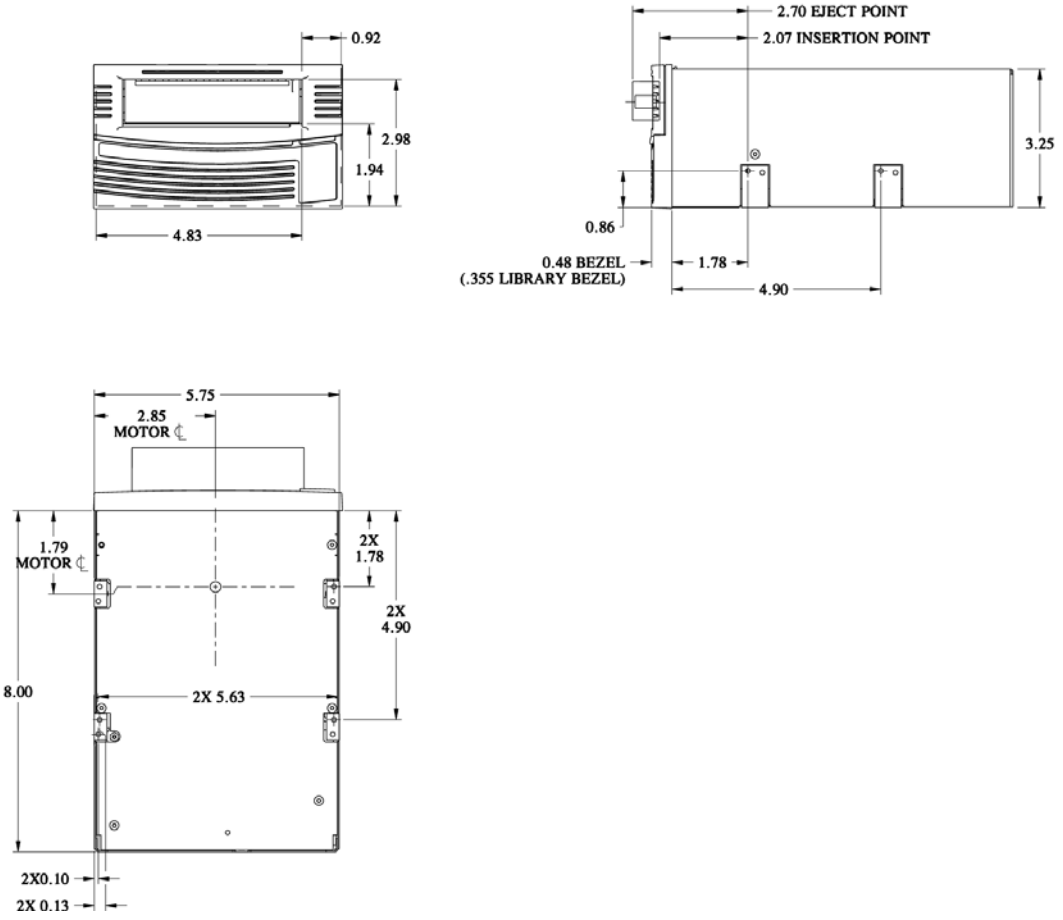
Figure 2 SDLT 600 Tape Drive Front Panel LEDs



Dimensions and Tolerances

The following figures show the physical specifications of the SDLT 600 tape drive.

Figure 3 Combination Front, Side, and Bottom View of SDLT 600 Tape Drive



Note: Data cartridge insertion and ejection distances are shown in figure 4.

Figure 4 Rear View Dimensions of the Internal SCSI Tape Drive (SCSI Connections)

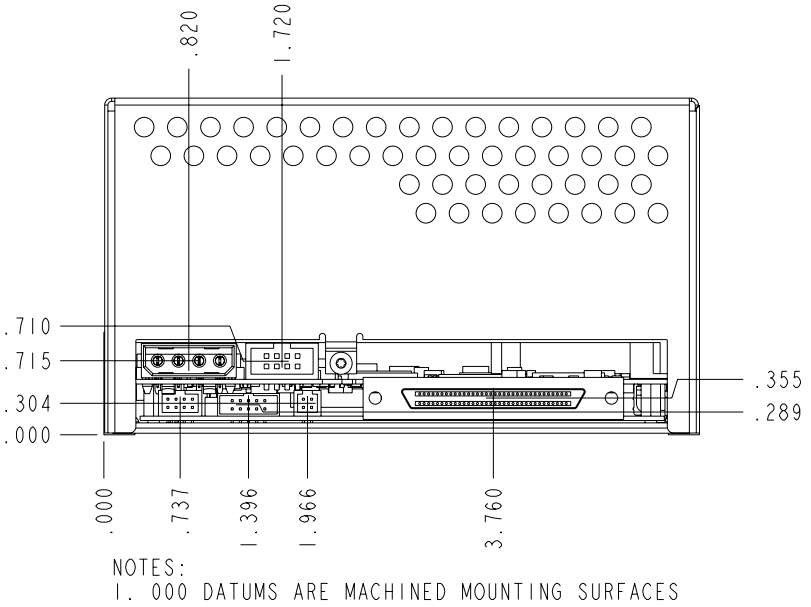


Figure 5 Rear View of the Internal SCSI Tape Drive Connectors (SCSI Configuration)

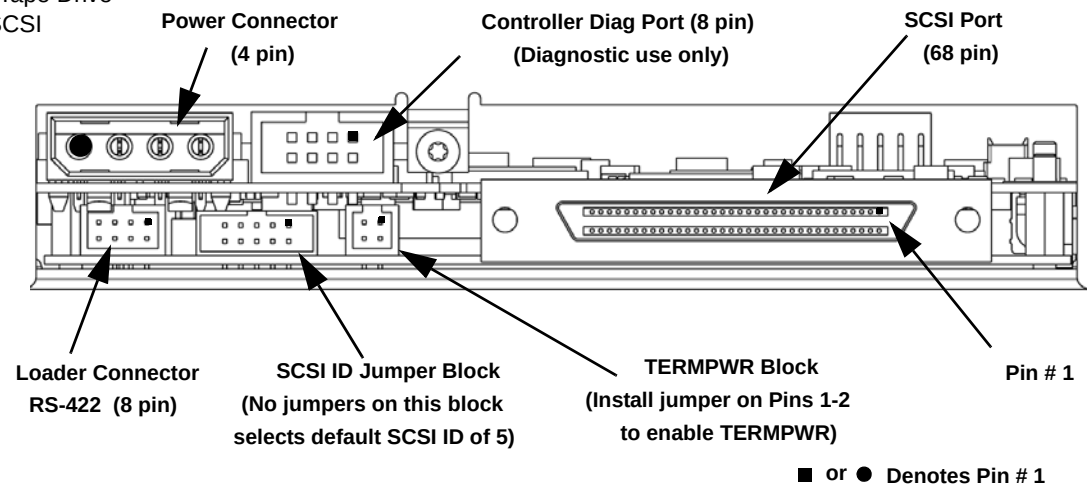


Figure 6 Rear View Dimensions of the Fire Channel Tape Drive (Fibre Channel Connections)

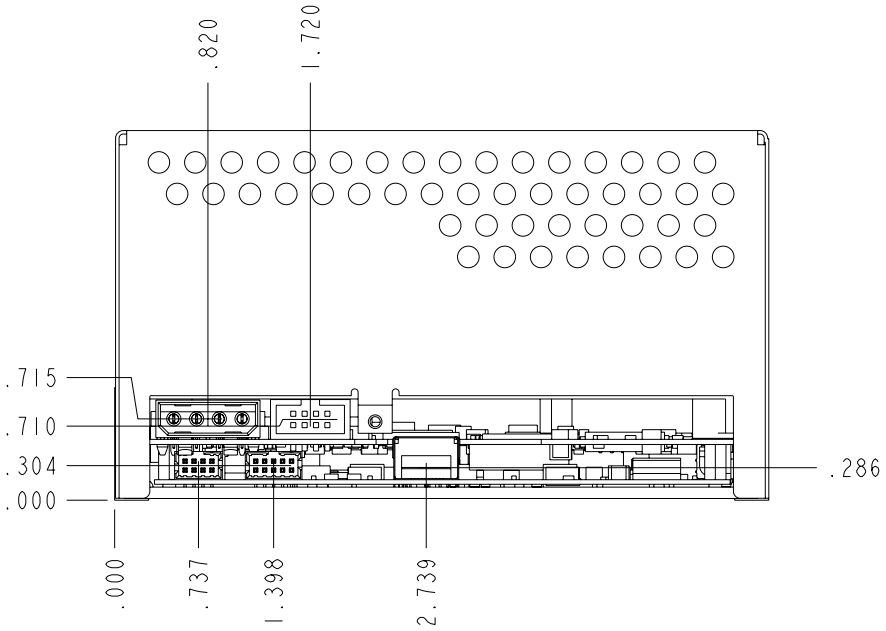


Figure 7 Rear View of the Fibre Channel Tape Drive Connectors (Fibre Channel Configuration)

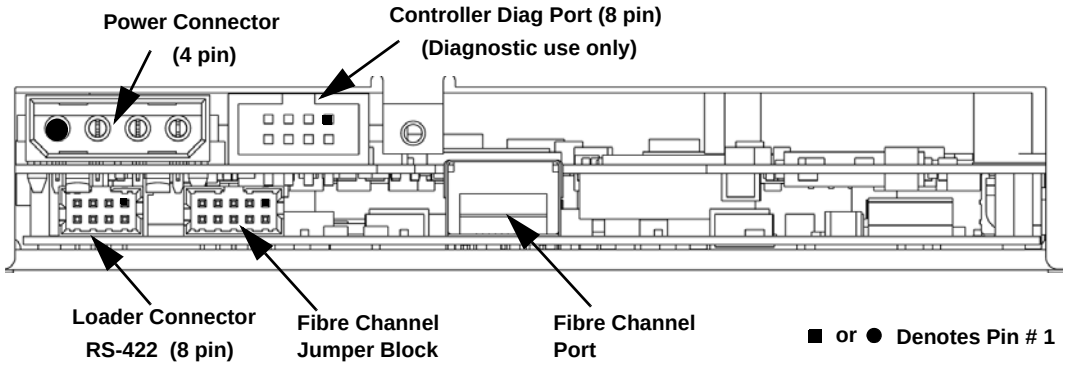
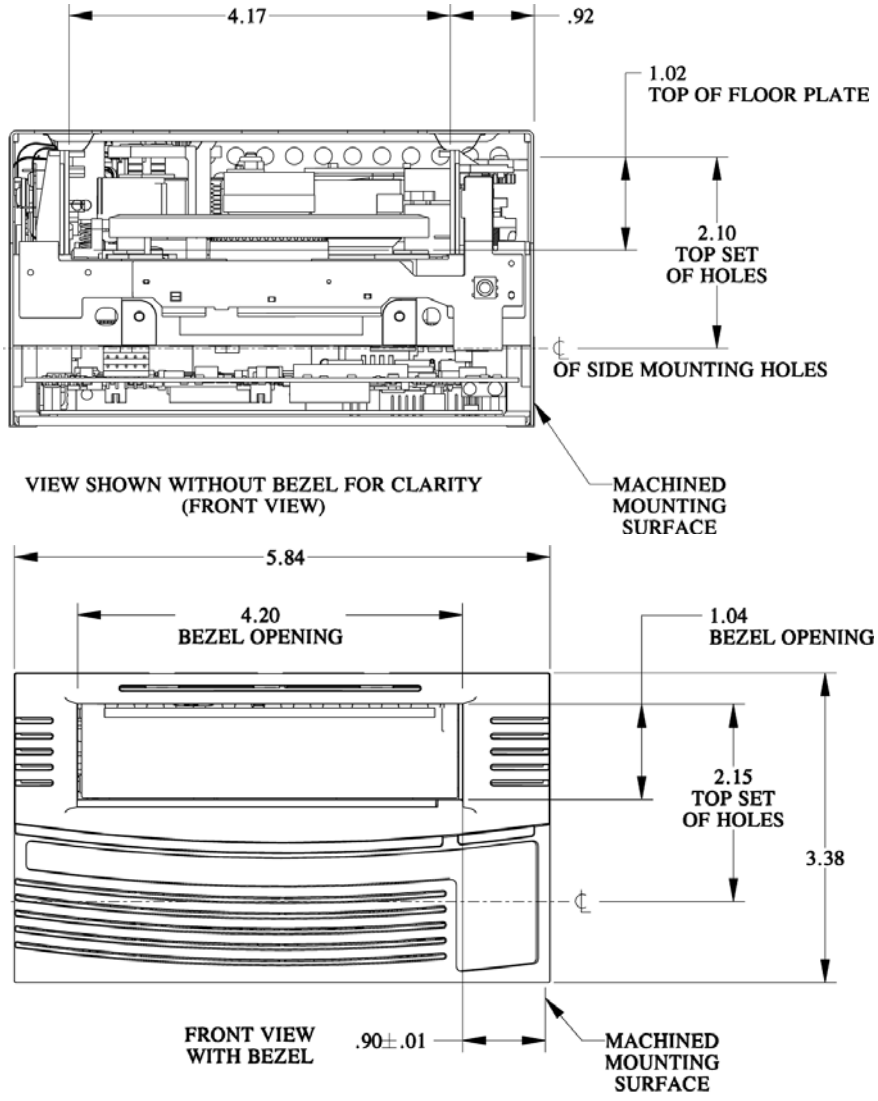


Figure 8 Front Views of the SDLT 600 Tape Drive



Physical Dimensions and Weights

Table 2 provides physical dimensions for the SDLT 600 tape drive system.

Table 2 SDLT 600 Tape Drive Physical Dimensions

	Internal Version	Library Version	Tabletop Version
Height	82.55 mm (3.25 in.) without front bezel 85.73 mm (3.38 in.) with front bezel	82.55 mm (3.25 in.) without front bezel 85.73 mm (3.38 in.) with front bezel	164.46 mm (6.48 in.)
Width	146.05 mm (5.75 in.) behind front bezel 148.59 mm (5.85 in.) with front bezel	146.05 mm (5.75 in.) behind front bezel 148.59 mm (5.85 in.) with front bezel	174.75 mm (6.88 in.)
Depth	203.20 mm (8.00 in.) from back of front bezel 215.40 mm (8.48 in.) including front bezel	203.20 mm (8.00 in.) from back of front bezel 212.22 mm (8.36 in.) including front bezel	320.04 mm (12.60 in.)

Note: Mounting hole pattern for the bottom and sides of the system is industry standard.

Table 3 shows the weights of the SDLT 600 tape drive.

Table 3 SDLT 600 Tape Drive Shipping Weight

	Internal Version	Tabletop Version
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 used may change the shipping weight.

Reliability

Quantum and its employees and suppliers are committed to providing quality products. The SDLT 600 tape drive system is a very reliable electromechanical device.

Head Life and MTBF

The projected mean time between failures (MTBF) for the overall SDLT 600 tape drive system is 250,000 hours, not including the heads. Head life is a minimum of 30,000 tape motion hours and an average of 50,000 media motion hours.

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.

Media Durability

Table 4 shows the number of media passes and full media uses to expect from a Super DLTtape II data cartridge.

Table 4 Super DLTtape II Data Cartridge Media Durability

	Media Durability
Media passes*	1,000,000
Full media uses**	250

*A media pass occurs with any movement (in either direction) of the surface of the media over the tape head.
**A full media use is an operation that reads or writes (with verify off) the full capacity of the data cartridge.

Data Cartridge Life Expectancy

Table 5 shows the number of load and unload cycles you can expect before the data cartridges need replaced.

Table 5 Loading and Unloading the Data Cartridge (Maximum)

	Super DLTtape II Data Cartridge
Data cartridge load/unload cycles*	5,000
Media insertions**	20,000

*A load/unload cycle is when a data cartridge is inserted into the receiver, loaded to BOT, calibrated, and then unloaded.
**An insertion is when a data cartridge is inserted into the receiver and then unloaded.

Data Integrity

SDLT 600 tape drive data transfer errors are extremely rare; table 6 shows data integrity for the overall SDLT 600 tape drive system.

Table 6 Data Transfer Error Rates

Error Type	Frequency
Detected, Recoverable (ECC) 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 of Data	< 1 per 10^6 bytes written

Functional Specifications

The following subsections contain full functional specifications for the Quantum SDLT 600 tape drive.

Performance Data

Table 7 provides performance data for the SDLT 600 tape drive system. For a comparison of SDLT 600 tape drive storage capacities, see Storage Capacity on page 17.

Table 7 SDLT 600 Tape Drive Performance Data

Feature	SDLT 600 Tape Drive
Drive Read/Write Transfer Rate*	36 MB/second, native 72 MB/second, compressed
Tracks	40 logical tracks 640 physical tracks
Track Density	1502 tracks per inch (tpi)
Linear Bit Density	233 Kbits per inch (Kbpi)
Read/Write Tape Speed	108 inches per second (ips)
Rewind Tape Speed	160 ips
Linear Search Tape Speed	160 ips
Average Rewind Time**	77 seconds
Maximum Rewind Time**	156 seconds
Average Access Time** (from BOT)	79 seconds
Maximum Access Time** (from BOT)	190 seconds
Load to BOT**	18 seconds (typical) 63 seconds (unformatted tape)
Unload from BOT**	19 seconds

Feature	SDLT 600 Tape Drive
Nominal Tape Tension	Stationary: 3.0 ± 0.5 oz Operating Speed: 3.5 ± 0.5 oz

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

Backward-Read Compatibility Transfer Rates

The SDLT 600 tape drive system features a backward-read compatibility (BRC) mode. When in BRC mode, the SDLT 600 tape drive is capable of reading SDLT 220 and SDLT 320 tape formats in a Super DLTtape I data cartridge, as well as the DLT VS160 tape format in the DLTtape VS1 data cartridge.

Table 8 lists the BRC transfer rates for the SDLT 600 tape drive.

Table 8 SDLT 600 Tape Drive Backward-Read Compatibility (BRC) Transfer Rates

Format	Data Cartridge Type	Native Capacity	BRC Transfer Rate (80% of Native Read Transfer Rate)*
SDLT 320 Tape Drive	Super DLTtape I	160 GB	12.8 MB/sec**
SDLT 220 Tape Drive	Super DLTtape I	110 GB	8.8 MB/sec**
DLT VS160 Tape Drive	DLTtape VS1	80 GB	6.4 MB/sec**

*Quantum strives to operate BRC transfer rate at 100% of native read transfer rate, but guarantees 80%.
**Transfer rates shown are nominal based on 80% of actual native read transfer rate of uncompressed data.

Note: SDLT 600 tape drive will eject a data cartridge written in DLT formats other than DLT VS160.

Maximum Data Transfer Rate

Table 9 shows the maximum sustained (and burst) data transfer rates for the SDLT 600 tape drive.

Table 9 Maximum Data Transfer Rates

Configuration	Native	Compressed*	Burst Max**
SCSI Ultra 160 (MSE LVD mode)	36 MB/sec	72 MB/sec	160 MB/sec
SCSI Ultra 160 (SE mode)	36 MB/sec	40 MB/sec	40 MB/sec
Fibre Channel (1 Gbps)	36 MB/sec	72 MB/sec	100 MB/sec
Fibre Channel (2 Gbps)	36 MB/sec	72 MB/sec	200 MB/sec

*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. For non-compressible (expanding) data, this results in a reduction in capacity and transfer rate for the data. Fully random data is the worst case for compressibility.
**The SCSI bus limits burst speeds, not the design of SDLT 600 tape drive or Super DLTtape II media.

Note: Cable lengths and cable type can limit attainable transfer rate; for details, see SCSI Stub and Cable Lengths on page 61.

Storage Capacity

Table 10 provides native and compressed capacity ranges for the Super DLTtape II data cartridge:

Table 10 Super DLTtape II Data Cartridge Storage Capacity

Mode (Compressed/ Uncompressed)	Capacity
Native Storage Capacity	300 GB
Compressed Storage Capacity	600 GB (2:1 compression ratio)*

*In accordance with industry practice, a typical compression ratio of 2:1 is quoted. Actual compression ratios achieved depend on the redundancy and type of data files being written.

Recording Media Specifications

Super DLTtape II media differs slightly from previous generations of Super DLTtape media. Table 11 shows overall specifications for Super DLTtape II media

Table 11 Super DLTtape II Media and Data Cartridge Specifications

Characteristic	Specification
Overall media thickness	8.0 µm
Media length, total	2066 feet
Media length, usable	1957 feet
Width	0.5 in.
Coercivity	2600 Oe
Data cartridge dimensions	4.1 in. x 4.1 in. x 1.0 in.
Shelf life	30 years min. @ 20 °C and 40% RH (non-condensing)
Usage	1,000,000 passes (typical office/ computer environment)
Data cartridge case color	Blue

Shipping, operating, and storage, environment limits for the Super DLTtape II data cartridges are shown in table 12, table 13, and table 14

Media Shipping, Operating, and Storage Specifications

Table 12 describes the optimum media shipping conditions.

Table 12 Super DLTtape II Media Shipping Limits

Shipping Conditions	
Temperature	–18 °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)

Table 13 describes the optimum media operation conditions.

Table 13 Super DLTtape II Media Operating Limits

Operating Conditions	
Temperature	10 ° to 40 °C (50 ° to 104 °F)
Relative Humidity	20% to 80% (non-condensing)

Table 14 describes the optimum media storage conditions.

Table 14 Super DLTtape II Media Storage Limits

Storage Conditions	Archival	Non Archival
Temperature	18 ° to 28 °C (64 ° to 82 °F)	16 ° to 32 °C (60° to 90 °F)
Relative Humidity	40% to 60% (non-condensing)	20% to 80% (non-condensing)

Environmental Requirements

The SDLT 600 tape drive system operates in environments that include general offices and work spaces with systems capable of maintaining standard comfort levels.

The following subsections provide the environmental specifications for the SDLT 600 tape drive systems (both the internal and the tabletop configurations). For long-term trouble-free operation, Quantum strongly recommended that SDLT 600 tape drives be used in a clean, smoke-free environment.

Air Flow Requirements

The internal tape drive requires adequate air flow to dissipate the heat resulting from continuous drive operation. Specifically, the air flow must be sufficient to keep the tape path temperature below 50 °C.

To allow enough air into the tape drive to keep the tape path below this temperature, it is important to keep the cooling holes in the rear and the grill in the front of the tape drive clear of any obstructions that may hinder the air flow. For more details about air flow, see Air Flow on page 37.

> **Note:** It is also important to operate the tape drive within an ambient air temperature no greater than 40 °C.

Temperature and Humidity

The ambient operating environment for the tape drive may not exceed the limits shown in table 15. (The specifications shown in the table are valid for both the internal and tabletop tape drives.)

Table 15 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

Storage and Shipment

The ambient storage and shipment environment for the tape drive may not exceed the limits shown in table 16. (The specifications shown in the table are valid for both the internal and tabletop tape drives.)

Table 16 Tape Drive Storage and Shipment Specifications

Specification*	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 17.

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 19.

The SDLT 600 tape drive will operate to 30,000 feet for temperatures within 15 ± 5 °C.

Shock and Vibration Specifications

The following tables provide non-operating and operating shock and vibration specifications for the SDLT 600 tape drive system.

Table 17 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 18 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 19 Non-Operating Vibration Specifications (Unpackaged)

Vibration (Unpackaged)		
Type	**Sine**	**Sweep**
Frequency Range	5 to 500 to 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 to 500 Hz	
Acceleration Level	2.0 G	
PSD Envelope	0.008 G^2/Hz	
Application	X,Y,Z axes	Sweep rate = 60 minutes/axis

Table 20 Non-Operating Vibration Specifications (Packaged)

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 to 150 to 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 21 Operating Specifications Shock

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)

Table 22 Operating Vibration Specifications

Vibration		
Type	**Sine**	**Sweep**
Frequency Range	5 to 500 to 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

Occasional Cleaning of Tape Head

SDLT 600 tape drives occasionally require preventive cleaning. The amount of ambient pollution and particulates in the environment, to a large degree, dictates the cleaning frequency.

Clean your tape drive only when cleaning is necessary. Your backup software or the yellow alert LED located on the front bezel of the tape drive notify you if you need to clean the tape drive; the location of this LED (and other front bezel LEDs) is shown in figure 2 on page 4.

Clean the SDLT 600 tape drive with the SDLT CleaningTape, which is also used to clean the SDLT 220 and SDLT 320 tape drives.

Caution: Use ONLY the SDLT CleaningTape. Other cleaning tapes, such as CleaningTape III or DLT VS CleaningTape, are incompatible with the SDLT 600 tape drive heads.

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 cartridge): 4 min., 30 sec.

On the last pass, the cleaning process stops, the cleaning tape is rewound, but the cleaning cartridge is not ejected. If the cleaning 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 cleaning cartridge does not eject.

Error Reporting (for Cleaning)

Use the SDLT Cleaning Cartridge if cleaning is indicated through your backup software or when the yellow alert light is on. Do not clean the tape drive unless the tape drive specifically indicates cleaning is necessary.

How the Tape Drive Returns Cleaning Status

The General Status Packet, accessible through the RS-422 serial interface, contains three unique bits that communicate cleaning information for the tape drive. See the *Super DLTtape Interactive Library Interface Specification (6464162-xx)*, for details. They are:

- **Cleaning Requested**
  When this bit is set, it indicates that it is necessary 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 indicates that it is necessary to cycle a cleaning cartridge through the tape drive before attempting any further data reading operation.
- **Cleaning Cartridge Expired**
  When this bit is set, it indicates that the current cleaning cartridge has exceeded its use count. This bit is valid only in the following context:
  - After attempting a cleaning application.
  - Until the next cleaning cartridge 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 tape 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

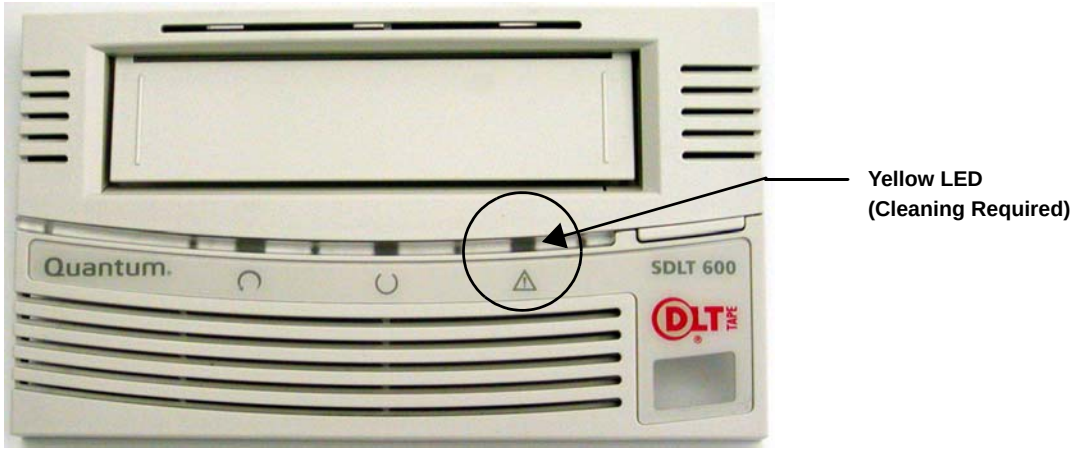
For HWE (Hard Write Error)/HRE (Hard Read Error) that are not related to servo problems, the **Cleaning Requested** ASC/ASCQ (00/17) status is reported using the same criteria as setting the TapeAlert **Clean Now** flag. The Sense Key is Medium Error (03h). The **Cleaning Requested** ASC/ASCQ replaces 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. For more details, see the *SDLT 600 SCSI Interface Guide (81-81200-xx).*

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 9.

Figure 9 SDLT 600 Tape Drive Front Panel Cleaning LED



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

- When a HWE (Hard Write Error)/HRE (Hard Read Error) is encountered
- More than 100 hours of tape motion have occurred since the last cleaning.

Once illuminated, the yellow LED remains illuminated until one of the following occurs:

1. Tape drive is cleaned successfully;
2. The tape drive is reset due to a firmware failure or firmware update, or
3. Power is cycled off and on.

Chapter 2

Electrical Specifications

This chapter provides the electrical specifications associated with the SDLT 600 tape drive, which includes the following two topics:

- Current and Power Requirements
- Power Supply Tolerances

Current and Power Requirements

Table 23 lists the current and power requirements for the two versions of the SDLT 600 tape drive system (internal and tabletop) configured with the parallel SCSI interface. Table 24 on page 31 lists the current and power requirements for the internal version of the SDLT 600 tape drive system configured with the Fibre Channel interface. The library version of the SDLT 600 tape drive uses the same amount of power as the internal version with both the SCSI and Fibre Channel interfaces. The tabletop version requires AC power.

The tape drive draws the highest current (and power) during the native write modes. *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.)

> **Note:** In table 23 and table 24, the current and DC power values pertain to the internal tape drive, while the AC power values apply to the tabletop tape drive.

Table 23 Current and Power Requirements (SCSI Interface)

Mode	5 V Current (A) MaxPk[1] MaxMean[2] Typ[3]			12 V Current (A) MaxPk[1] MaxMean[2] Typ[3]			DC Power (W) Max[4] Typ[5]		AC Power (W) Max[6] Typ[7]	
Standby/Idle	2.6	2.6	2.4	0.2	0.1	0.1	14	14	47	45
Media Loading/ Unloading	6.2	5.3	3.4	2.7	0.9	0.7	30	26	64	56
600 Write– Motor Start[8]	4.3	4.0	3.7	1.3	0.3	0.3	23	22	51	48
600 Write– Streaming	5.4	5.1	4.9	0.7	0.5	0.4	30	30	65	63
Max for SDLT 600 tape drive Modes[9]	n/a	5.3	n/a	n/a	0.9	n/a	30	n/a	70	n/a

Mode	5 V Current (A) MaxPk[1] MaxMean[2] Typ[3]	12 V Current (A) MaxPk[1] MaxMean[2] Typ[3]	DC Power (W) Max[4] Typ[5]	AC Power (W) Max[6] Typ[7]

1. The Max-Peak value represents short current spikes drawn for durations of < 50ms. 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 nominal DC voltage.
2. The Max-Mean 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 tape drives + 3 sigma.
7. The Typical AC power is calculated from the average of AC power drawn in tabletop tape drives.
8. 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-Mean values, since the peak values are of very short duration.

(**Common Notes**)

1. Voltage tolerance: 5V ±5%, 12V ±5%; Room temperature 24 °C. AC power measured at 117 V, 60 Hz.
2. DC Current, MaxMean, and DC/AC Power Max refer to the statistically calculated maximum average requirement based on a sample population of tape drives. These values do not reflect the peak current or power requirement; this amount is given by the DC MaxPk current.

Table 24 Current and Power Requirements (Fibre Channel Interface)

Mode	5 V Current (A) MaxPk[1] MaxMean[2] Typ[3]			12 V Current (A) MaxPk[1] MaxMean[2] Typ[3]			DC Power (W) Max[4] Typ[5]		AC Power (W) Max[6] Typ[7]	
Standby/Idle	3.5	3.5	3.1	0.2	0.1	0.1	18	17	n/a	n/a
Media Loading/ Unloading	5.4	4.4	4.4	2.7	0.7	0.7	30	30	n/a	n/a
600 Write– Motor Start[8]	4.6	4.3	4.2	1.3	0.3	0.3	25	25	n/a	n/a
600 Write– Streaming	5.9	5.6	5.5	0.7	0.5	0.4	33	33	n/a	n/a
Max for SDLT 600 tape drive Modes[9]	n/a	5.6	n/a	n/a	0.7	n/a	33	n/a	n/a	n/a

Mode	5 V Current (A) MaxPk[1] MaxMean[2] Typ[3]	12 V Current (A) MaxPk[1] MaxMean[2] Typ[3]	DC Power (W) Max[4] Typ[5]	AC Power (W) Max[6] Typ[7]

1. The Max-Peak value represents short current spikes drawn for durations of < 50ms. 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 nominal DC voltage.
2. The Max-Mean 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 tape drives + 3 sigma.
7. The Typical AC power is calculated from the average of AC power drawn in tabletop tape drives.
8. 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-Mean values, since the peak values are of very short duration.

(**Common Notes**)

1. Voltage tolerance: 5V ±5%, 12V ±5%; Room temperature 24 °C. AC power measured at 117 V, 60 Hz.
2. DC Current, MaxMean, and DC/AC Power Max refer to the statistically calculated maximum average requirement based on a sample population of tape drives. These values do not reflect the peak current or power requirement; this amount is given by the DC MaxPk current.

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.

Voltage Tolerances

Voltage tolerances are:

- 5 VDC ± 5%
- 12 VDC ± 5%

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 25 DC Voltage Monitoring

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

Power Cycle Time

Test results show that an SDLT 600 tape drive is able to power on and perform reliably with up to 11 seconds of delay time between the 5V and the 12V source. The tape drive is also able to power on and perform successfully with rise times of up to 11 seconds on either the 5V and the 12V supply (while the other is stable).

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 3

Thermal Specifications

This chapter presents the results of extensive experimentation and measurements of tape drive temperatures, and the resultant impact on SDLT 600 tape drive performance. Find the following topics discussed in this chapter:

LOG SENSing of Temperature

The SDLT 600 tape drive provides detailed status and diagnostic information through the Temperature (0Dh) and TapeAlert (2Eh) pages of the LOG SENSE (4Dh) command.

The Temperature page reports the operating temperature in degrees Celsius of the tape drive in real time—the very moment the tape drive receives the LOG SENSE command. Use the Temperature page to ensure that the tape drive is operating within the specified operational temperature range. Requesting the Temperature page on a regular basis can help prevent data problems that may result from operating the tape drive outside its specified temperature range.

The TapeAlert page reports the current status of the tape drive's internal self-diagnostic monitoring activity. The tape drive sets and clears the various flags as operating conditions change. The host should typically request the TapeAlert page as follows:

- Before any Read or Write operation.
- Following any Read or Write error the tape drive reports.
- When the tape drive reaches the end of the tape in a data cartridge and continued Read or Write activity on a spanned cartridge is required.
- Immediately following any Read or Write operation.

Requesting the TapeAlert page at regular intervals helps ensure the highest possible data integrity and tape drive reliability.

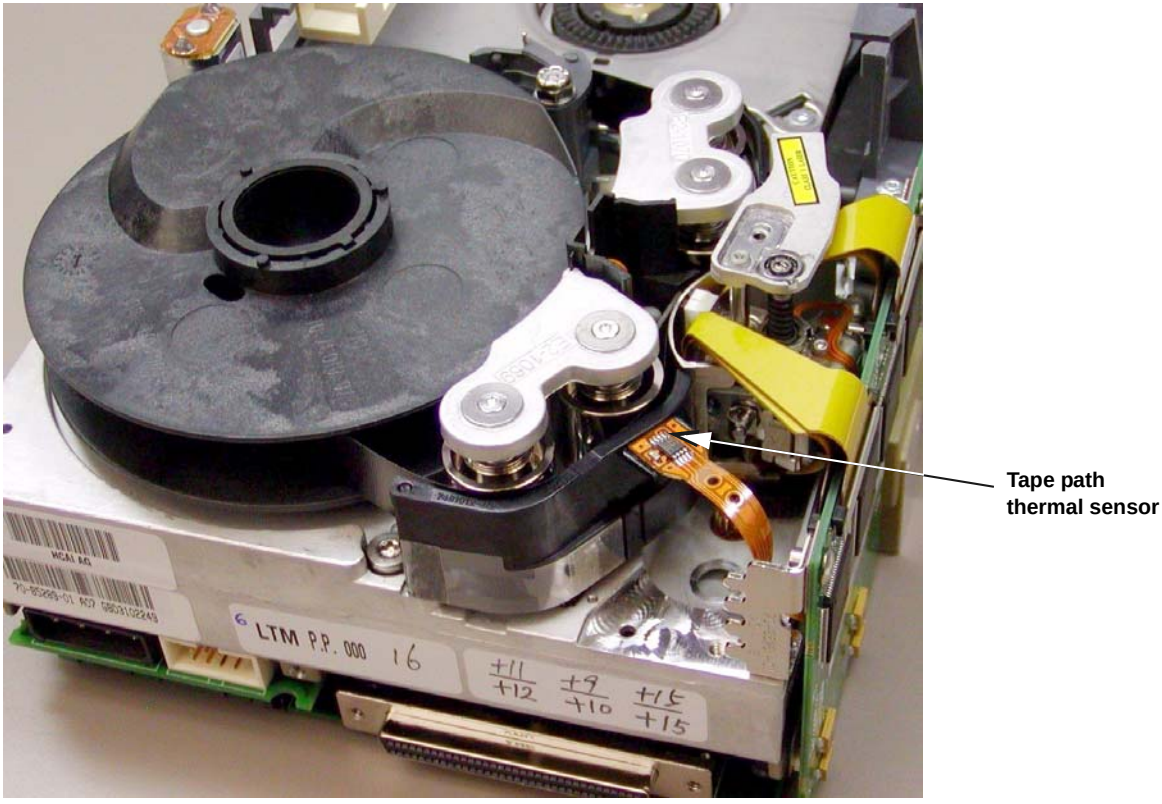
The TapeAlert page communicates tape drive status through the **Value of TapeAlert Flag** parameter. If the tape drive's operating temperature exceeds the maximum allowable, the TapeAlert page reports Flag 36. Take steps immediately to reduce the operating temperature of the tape drive.

See the *SDLT 600 Fibre Channel Interface Guide (81-81202-xx)* or the *SDLT 600 SCSI Interface Guide (81-81200-xx)* for additional information about using the LOG SENSE command.

Over Temperature Condition

The SDLT 600 tape drive has a thermal sensor located in the tape path that accurately monitors the air temperature in the tape path. The exact location of the tape path thermal sensor is shown in figure 10.

Figure 10 SDLT 600 Tape Path Thermal Sensor



This thermal sensor triggers the tape drive to issue a TapeAlert warning at 50 °C that the temperature inside the tape drive has reached the maximum allowable.

If you receive this TapeAlert warning, you must immediately stop your current data cartridge operation, rewind the media, and eject the data cartridge from the tape drive.

You should investigate the possible causes for the over temperature condition, such as restricted air flow or increased operating environment temperature, and correct the situation before continuing to operate the tape drive.

If the tape path temperature continues to increase beyond 50 °C, and you have not stopped the tape drive operation, a second TapeAlert warning is generated and forces any current data cartridge operation to abort. The

media then rewinds, unloads, and ejects. (If the tape drive is in an automated tape library, the data cartridge unloads, but does not eject). SCSI status then indicates that the tape drive is in the over temperature condition.

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

Note: The thermal sensor shown in figure 11 is the only temperature sensing built into an SDLT 600 tape drive.

Air Flow

The SDLT 600 tape drive requires adequate air flow to allow the internal tape drive to dissipate the heat resulting from continuous tape drive operation. Specifically, the air flow must be sufficient to keep the tape path temperature below 50 °C.

The mass of air flowing through the tape drive affects the heat dissipation from the tape drive. Altitude (i.e., air density) determines the mass flow rate and resistance to air flow. Measuring pressure drop determines the resultant air flow impedance.

The graphs in figure 11 and figure 12 show the minimum volumetric air flow needed at various altitudes to achieve the required mass flow rate to keep the tape path temperature below 50 °C.

Figure 11 Volumetric Air Flow Required at Various Altitudes—Embedded Bezel

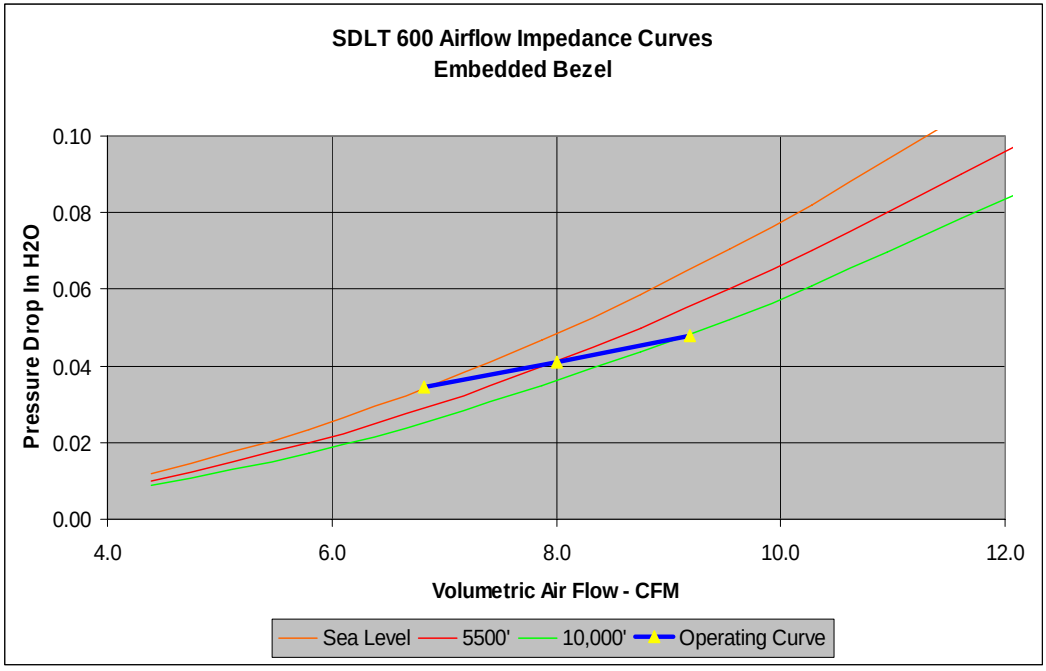
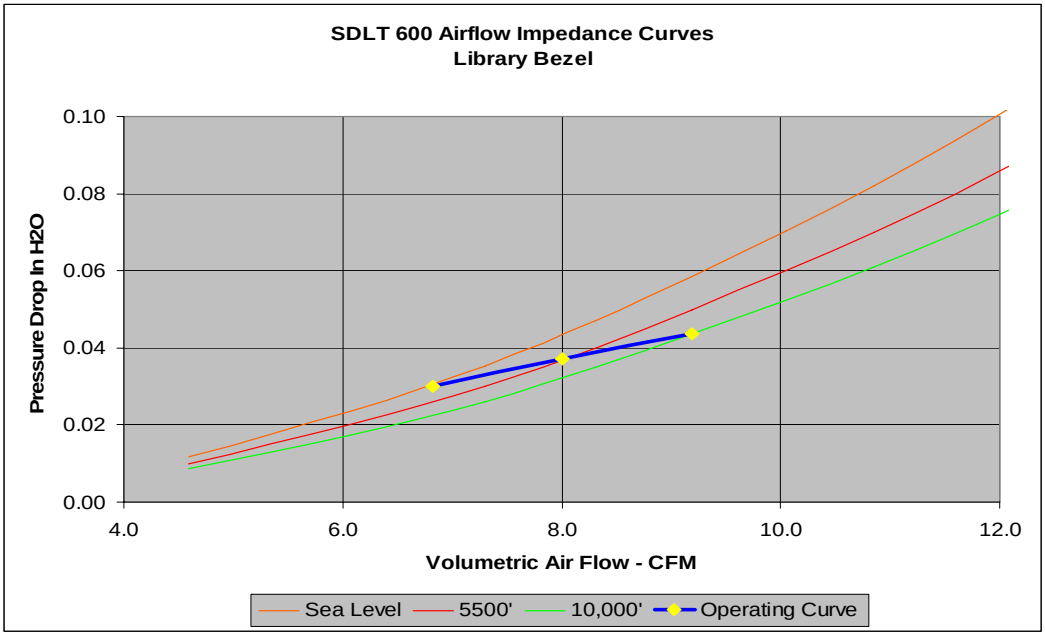


Figure 12 Volumetric Air Flow Required at Various Altitudes—Library Bezel



Chapter 4

Regulatory Requirements

This chapter describes various regulations that apply to the SDLT 600 tape drive:

Safety Regulations

This section lists the safety regulations that the SDLT 600 tape drive meets or exceeds.

Safety Certifications

The SDLT 600 tape drive meets or exceeds the following safely requirements:

- UL 60950: Information Technology Including Electrical Business Equipment (USA)
- EN60950/IEC 950: Information Technology Including Electrical Business Equipment (Europe)
    - EN60825-1 Information Technology Equipment

The SDLT 600 tape drive is also certified to bear the GS mark.

The SDLT 600 tape drive is a Class I laser product that complies with 21 CFR 1040.10 as applicable on the date of manufacture.

Electromagnetic Field Specifications

SDLT 600 tape drives are electrical devices; as such, this equipment generates, uses, and may emit radio frequency energy. The tape drives may emit energy in other frequencies, as well, as discussed in the following subsections.

Electromagnetic Emissions

The internal version of the SDLT 600 tape drive system complies with FCC Class A in a standard enclosure; the tabletop version complies with FCC Class B limits.

Electromagnetic Interference Susceptibility

Table 26 provides regulations and certifications held by the SDLT 600 tape drive for Electromagnetic Interference (EMI).

Table 26 EMI Regulations and Certifications

Type	Regulation/Certification
EEC Directive 89/336 CE	EN55022 (EU) EN55024 (EU)
CFR 47, 1995	FCC Rules Part 15B Class B
IECS-003	Canada
V-3/97.04	VCCI Class B (Japan)

Type	Regulation/Certification
CNS 13438	BSMI Class A (Taiwan)
AS/NZS 3548	Australia/New Zealand

Immunity and ESD Limits

Table 27 lists the immunity and ESD failure level limits to which the SDLT 600 tape drive has been tested.

Test Name	Test Specification	Required Performance
EN55022: 1998 Radiated and Conducted Emissions		
Radiated Electromagnetic Emissions	EN55022: 1998	Class B
Conducted Electromagnetic Emissions		
Current Harmonics and Flicker Emissions Tests		
AC Power Supply Harmonic Emissions	EN61000-3-2	As per the standard
AC Power Supply Voltage Flicker	EN61000-3-3	As per the standard
EN55024: 1998 Immunity Tests		
Electrostatic Discharge Immunity	EN61000-4-2	Criteria A
Radiated Electromagnetic Immunity	EN61000-4-3	Criteria A
Electrical Fast Transient / Burst Immunity	EN61000-4-4	Criteria B
Electrical Surge Immunity	EN61000-4-5	Criteria B
Conducted Electromagnetic Immunity	EN61000-4-6	Criteria A
Power Frequency Magnetic Field Immunity	EN61000-4-8	Criteria A

Test Name	Test Specification	Required Performance
AC Voltage Dips and Interrupts Immunity	EN61000-4-11	Criteria B

Acoustic Noise Emissions

Table 27 lists acoustic noise emission levels, both as noise power and sound pressure, for the SDLT 600 tape drive. The table provides the preliminary declared values per ISO 9296 and ISO 7779/EN27779.

Table 27 Acoustic Noise Emissions, Nominal

Mode	Noise Power Emission Level (LNPEc)		Sound Pressure Level (LPAc)*	
	Internal	Tabletop	Internal	Tabletop
Idle	Not applicable	5.4 Bel	Not applicable	42 dB
Streaming	5.9 Bel	5.9 Bel	47 dB	53 dB

* Sound pressure level measured at front of tape drive.

Class A Statements (Internal Tape Drive)

FCC Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the

instruction manual, may cause harmful interference to radio communications.

Any changes or modifications made to this equipment may void the user's authority to operate this equipment.

Operation of this equipment in a residential area may cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

> **Note:** Additional information on the need to interconnect the device with shielded (data) cables or the need for special devices, such as ferrite beads on cables, is required if such means of interference suppression was used in the qualification test for the device. This information will vary from device to device and needs to be obtained from the EMC (Electromagnetic Compatibility) group or product manager.

Canada (Digital Apparatus)

Reference: *Interference-Causing Equipment Standard*, ICES-003, Issue 2

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

CISPR-22 Warning!

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Achtung!

Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten, in

welchen Fällen der Benutzer für entsprechende Gegenmaßnahmen verantwortlich ist.

Attention!

Ceci est un produit de Classe A. Dans un environnement domestique, ce produit risque de créer des interférences radioélectriques, il appartiendra alors à l'utilisateur de prendre les mesures spécifiques appropriées.

Taiwan (BSMI) Statement

警告使用者:

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

Japan (VCCI) Statement

この装置は、クラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。 VCCI－ A

DEN-AN Notice (Japan)

すべての電源コードが同じ定格電流を使用するとは限りません。同封されている電源コードを他の製品と一緒に使用しないでください。また、家庭用の延長コードをQuantum製品と一緒に使用しないでください。複数の電源コードを必要とする製品の電源を完全に切るには、システムに接続しているすべての電源コードを外してください。

Class B Statements (Tabletop Tape Drive)

FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or TV technician for help.

Any changes or modifications made to this equipment may void the user's authority to operate this equipment.

Operation of this equipment in a residential area may cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

> **Note:** Additional information on the need to interconnect the device with shielded (data) cables or the need for special devices, such as ferrite beads on cables, is required if such means of interference suppression was used in the qualification test for the device. This information will vary from device to device and needs to be obtained from the EMC (Electromagnetic Compatibility) group or product manager.

Canada (Digital Apparatus)

Reference: *Interference-Causing Equipment Standard*, ICES-003, Issue 2

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Taiwan (BSMI) Statement

警告使用者:

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

Japan (VCCI) Statement

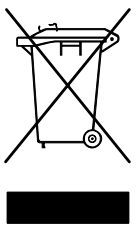
Environmental Compliance

Quantum is committed to providing quality products in an environmentally sound manner and to comply with all applicable environmental laws, rules and regulations.

This product was designed, manufactured and made available with consideration to worldwide laws, rules and regulations applicable to the product and the electronics industry including the European Union Directives 2002/95/EC & 2002/96/EC (RoHS and WEEE).

For further information on Quantum's Environmental Compliance and Global Citizenship, please consult the following Web site at http://qcare.quantum.com.

Disposal of Electrical and Electronic Equipment



This symbol on the product or on its packaging indicates that this product should not be disposed of with your other waste. Instead, it should be handed over to a designated collection point for the recycling of electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please visit the Quantum Web site at http://qcare.quantum.com or contact your local government authority, your household waste disposal service or the business from which you purchased the product.

Chapter 5

Universal Interface Information

This chapter provides interface specifications that apply to all variations of the SDLT 600 tape drive, which include the following topics:

Interface Types

The Ultra 160 SCSI and Fibre Channel interfaces are available on both the internal and tabletop models. These versions provide two possible parallel SCSI interface types and one Fibre Channel interface type. For details, see table 13, which provides speeds and options for the various SDLT 600 tape drive models.

Figure 13 SDLT 600 Tape Drive Interface Versions Speeds and Options

Interface Versions	Speeds	Protocol Options
Fibre Channel *	• 100 MB/second • 200 MB/second	• Class 3 • Connect to N_port, NL_port, FL_port, F_port • FC-MI • FC-AL-2 • FC-FS • SCSI-3 (SAM-2, SPC-2, FCP-2, or SSC)
Ultra 160	• 160 MB/second maximum burst speed **	• Multi-mode Single-Ended (MSE) provides one of two differential senses: • - Low Voltage Differential (LVD) running up to 160 MB/second, or • - Single Ended (SE) running up to 40 MB/second • Ultra 160 2/FAST-20/Asynchronous • SCSI-3 (SAM-2, SPC-2, SPI, and SSC) • Supports up to 15 hosts

*Fibre Channel interface not available in the tabletop model.
**The SCSI bus itself limits this speed, not the design of SDLT 600 tape drive or Super DLTtape II media.

LVD/MSE interface type automatically switches between the LVD and the single-ended mode. When a single-ended device is connected to a multimode LVD/MSE bus, the entire bus switches to the single-ended mode. Otherwise, LVD/MSE devices operate in the LVD mode.

Power-On Self-Test

When the tape system is powered on, the system performs a Power-On Self-Test (POST). POST normally completes in 10 to 15 seconds. However, if a data cartridge is inside the tape drive when powered on, POST duration is somewhat longer, depending on how much tape in the data cartridge may be loaded in the tape drive.

Table 28 provides the sequence of operation to expect when power is turned on. See figure 2 on page 4 to help familiarize yourself with the LEDs on the front panel.

Table 28 SDLT 600 Tape Drive LED Lighting Pattern During Power-On Self-Test (POST)

Stage	What You Observe
1 (Power On)	All LEDs illuminate for approximately one second.
2	The LEDs flash on, then off in a progressing pattern from left to right. Stages 1 and 2 generally complete within approximately five seconds.
3	The right LED remain off, the left LED illuminates steadily, and the middle LED flashes until POST completes. This stage typically lasts for 5 to 10 seconds.
4	When POST is complete, the middle LED stops flashing and remains illuminated; the left LED turns off, and right LED remains off.
POST Failure	If POST fails, the middle and right LEDs illuminate steadily and the left LED flashes.

Note: If a data cartridge is in place when the tape drive is powered on, it may take a considerably longer time for stage 3 to complete due to tape rewind and searching operations that occur during that stage. And, at stage 4, the left LED remains on.

SCSI Command Timeout

Table 29 shows the length of time the SCSI command initiator waits for a response before it times out.

Table 29 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
PERSISTENT RESERVE IN	500 milliseconds
PERSISTENT RESERVE OUT	500 milliseconds
PREVENT/ALLOW MEDIA REMOVAL	500 milliseconds
READ	1 hour
READ ATTRIBUTE	500 milliseconds
READ BLOCK LIMITS	500 milliseconds
READ BUFFER	3 minutes
READ POSITION	500 milliseconds
RECEIVE DIAGNOSTIC RESULTS	500 milliseconds
RELEASE (10)	500 milliseconds

Command	Timeout
RELEASE UNIT	500 milliseconds
REPORT DENSITY SUPPORT	500 milliseconds
REPORT DEVICE IDENTIFIER	500 milliseconds
REPORT LUNS	500 milliseconds
REPORT SUPPORTED OPERATION CODES	500 milliseconds
REQUEST SENSE	500 milliseconds
RESERVE (10)	500 milliseconds
RESERVE UNIT	500 milliseconds
REWIND	4 minutes
SEND DIAGNOSTIC	20 minutes
SET DEVICE IDENTIFIER	500 milliseconds
SPACE	6 hours (directory may need rebuilding)
TEST UNIT READY	500 milliseconds
VERIFY	1 hour
WRITE	1 hour
WRITE ATTRIBUTE	500 milliseconds
WRITE BUFFER (UPDATE MICROCODE)	10 minutes
WRITE FILEMARKS	1 hour

Connecting the Tape Drive

This section describes how to use the back panel connectors that are use by all models of the tape drive. The arrangement of these connectors is shown in figure 16 on page 60 for SCSI, and in figure 18 on page 69 for Fibre Channel.

Power

Pin assignments for the 4-pin power connector are listed in table 30. You can ascertain which pin is Pin 1 by referring to either of the figures called out in Connecting the Tape Drive.

Table 30 4-Pin Power Connector Pin Assignments

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

Loader/Library Controller Interface

The loader connector (for the 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 600 tape 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 14 shows a schematic representation of the connector; pin assignments for the loader connector are listed in table 31.

Figure 14 Loader Connector (Internal Version)

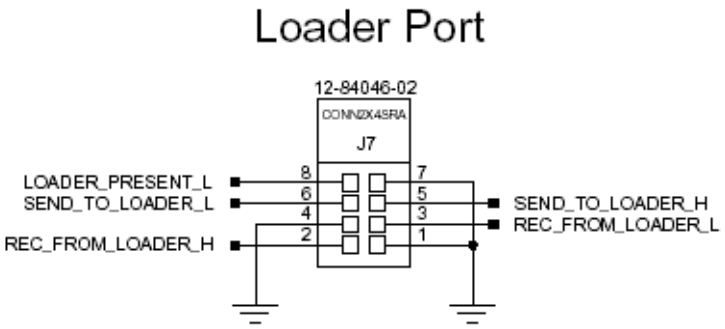


Table 31 8-Pin Loader Connector Pin Assignments

Signal Name	Pin	Pin	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

Chapter 6

Parallel SCSI Interface

This chapter provides SCSI interface specifications associated with the SDLT 600 tape drive, which include the following topics:

SCSI Interface Type

The SDLT 600 tape drive conforms to the Ultra 160 SCSI standard. Ultra 160 SCSI provides these three data transfer rates:

- Low Voltage Differential (LVD) running up to 160 MB/second
- MSE/LVD running up to 160 MB/second
- Single Ended (SE) running up to 40 MB/second

LVD/MSE interface type automatically switches between the LVD and the single-ended mode. When a single-ended device is connected to a

multimode LVD/MSE bus, the entire bus switches to the single-ended mode. Otherwise, LVD/MSE devices operate in the LVD mode.

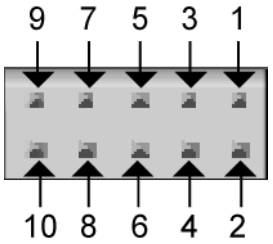
Setting the SCSI ID

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 your system or SCSI controller documentation.

The SCSI ID is set using jumpers on a set of pins at the rear of the tape drive. This section discusses setting the SCSI ID on the internal tape drive via the jumper block. Table 32 and table 33 both show the SCSI ID address and jumper settings.

Figure 15 shows the empty jumper block that you use to set the SCSI ID. If you decide it is necessary to change the tape drive's SCSI ID, use your fingers to move the jumpers to the pattern corresponding to the ID you want (see figure 15 and the related table of SCSI jumper settings in table 32 and table 33).

Figure 15 Detail of the Empty SCSI ID Jumper Block



Internal tape 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 tape drive (figure 16), 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 uses the default setting of 5.

Table 32 SCSI ID Address Selections (Graphical Format)

SCSI ID	**0**	**1**	**2**	**3**
Jumper Block				
SCSI ID	**4**	**5 (default)**	**6**	**7**
Jumper Block				
SCSI ID	**8**	**9**	**10**	**11**
Jumper Block				
SCSI ID	**12**	**13**	**14**	**15**
Jumper Block				

Note: The computer system and the tape drive SCSI IDs are only checked at power on. To change the SCSI ID after installation, power off both the system and the tape drive, change the tape drive's SCSI ID, power on the tape drive, and then power on the system.

Table 33 SCSI ID Address Selections (Tabular Format)

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 tape drive to ignore the firmware value and read the value jumpered on the block.

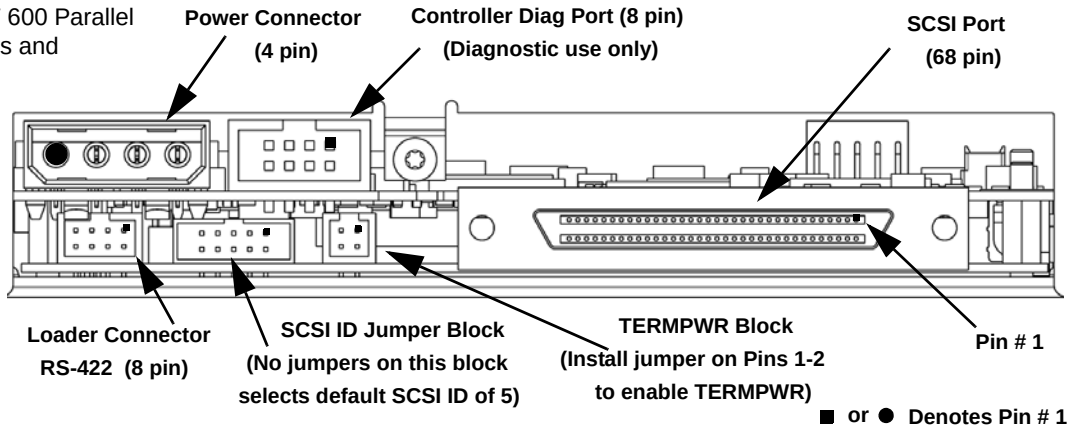
Power-On Self-Test

While POST is running, the tape system responds BUSY to SCSI commands. The tape system also responds to various SCSI messages during POST.

Hardware Connectors

The SCSI interface resides on the Host Interface Module (HIM) and is made available via the back panel of the tape drive, as shown in figure 16.

Figure 16 SDLT 600 Parallel SCSI Connectors and Jumpers



SCSI Stub and Cable Lengths

The longest stub length on the HIM PCBA card is 1.543 inches.

The recommended maximum SCSI cable length is 25 meters for LVD, and 6 meters for MSE. For best results, ensure that your SCSI cables and terminators are SPI-3 (or SPI-4) compatible.

Configuring the Tape Drive

This section describes how to use the connectors that are provided on the back of the SDLT 600 tape drive. The arrangement of these connectors is shown in figure 16.

Parallel SCSI

Pin assignments for the two possible SCSI connectors are listed in table 34 and table 35.

1. Before connecting the SDLT 600 tape drive to the host computer, be certain the tape drive and computer are powered off.
2. If you are connecting several devices to the SCSI bus, connect only the tape drive to the host computer at this time. Confirm that the host computer and tape drive are communicating correctly before adding additional devices.
3. The SCSI bus must be terminated at each end. You may need to terminate this tape drive if one of the following conditions exist:
   - The SDLT 600 tape drive is the only device connected to the SCSI bus.
   - The SDLT 600 tape drive is one of several devices connected to the SCSI bus, and it is the last device connected to the SCSI bus.

4 If either condition exists in step 3, attach a **Y** adaptor cable to the tape 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.

> **Note:** You must supply the **Y** adaptor cable to connect both the SCSI connector and the terminator to the tape drive.

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

Table 34 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

Signal Name	Pin Number	Pin Number	Signal Name
TERMPWR	17	51	TERMPWR
TERMPWR	18	52	TERMPWR
Reserved	19	53	Reserved
Ground	20	54	Ground
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 35 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

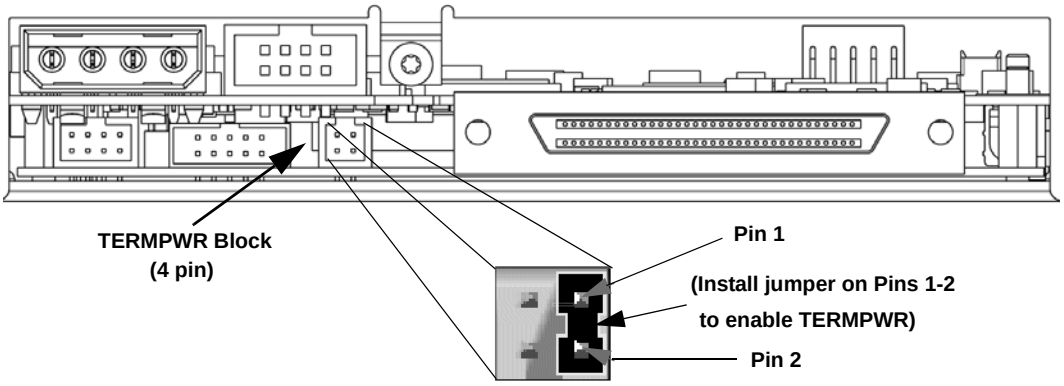
Signal Name	Pin Number	Pin Number	Signal Name
+RST	25	59	-RST
+MSG	26	60	-MSG
+SEL	27	61	-SEL
+C/D	28	62	-C/D
+REQ	29	63	-REQ
+I/O	30	64	-I/O
+DB(8)	31	65	-DB(8)
+DB(9)	32	66	-DB(9)
+DB(10)	33	67	-DB(10)
+DB(11)	34	68	-DB(11)

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 (see figure 17) on the TERMPWR jumper block. Remove the jumper to disable TERMPWR. Pins 3 and 4 on this block are reserved and require no jumper.

Figure 17 TERMPWR Jumper Block on Rear of Tape Drive



Chapter 7

Fibre Channel Interface

This chapter provides Fibre Channel interface specifications associated with the SDLT 600 tape drive, which include the following topics:

Background Information About Fibre Channel

Fibre Channel is a high-speed serial architecture that allows either optical or electrical connections at data rates of 1 Gb/second or 2 Gb/second. Fibre Channel supports point-to-point, fabric, and arbitrated loop topologies. Implementation of the Fibre Channel Protocol (FCP) standard enables the transmission of SCSI commands, data, and parameters, and the receipt of SCSI status and sense information across the Fibre Channel connection.

For more information about the Fibre Channel interface, see the *SDLT 600 Fibre Channel Interface Guide (81-81202-xx).*

Fibre Channel Interface Type

The SDLT 600 fibre channel tape drive supports the following features:

- Automatic speed negotiation, with transfer rates of:
  - 100 megabytes per second (1 Gb/second)
  - 200 megabytes per second (2 Gb/second)
- Automatic topology negotiation (the drive operates as an NL_Port or N_Port):
  - Arbitrated Loop: private loop, NL_Port to NL_Ports(s)
  - Arbitrated Loop: public loop, NL_Port to NL_Ports(s) and one FL_Port.
  - Fabric attachment: N_Port to F_Port
  - Point-to-Point attachment: N_Port to N_Port
- FCP (SCSI-3 command set) for tape devices
- Class 3 level of service
- Basic and extended link services
- Hard assigned port address, when attached to a library. The library has the ability to assign a hard address to the drive. If no hard address is assigned to the drive, then a soft address is taken initially.

Relationship Between Fibre Channel and SCSI

Small Computer System Interface (SCSI) is one of the industry's most widely adopted I/O interfaces; it is widely used in computing platforms from personal computers to mainframes to peripheral devices of all types. Transmitting SCSI command-set information across a Fibre Channel connection makes the large body of SCSI application and tape driver software available for use in the high-performance Fibre Channel environment.

> **Note:** Complete FCP and SCSI standards documents are available at www.t10.org.

SDLT 600 tape drives conform to the FCP-2 standard, therefore commands are transported as specified in this standard. This document assumes you are familiar with the SCSI-3, FCP, SAM, SPC, FC-FS, and SSC standards.

Selecting Speed and Topology

The Fibre Channel interface resides on the Host Interface Module (HIM) and is made available via the back panel of the tape drive, as shown in figure 18.

Although Fibre Channel SDLT 600 tape drives will auto-negotiate the speed and topology, you may override the automatic selections by placing jumpers on the Fibre Channel jumper block at the rear of the tape drive. Figure 18 shows the Fibre Channel jumper block location, table 37 and table 38 show the various jumper setting combinations.

Figure 18 Internal Fibre Channel Connectors and Jumpers

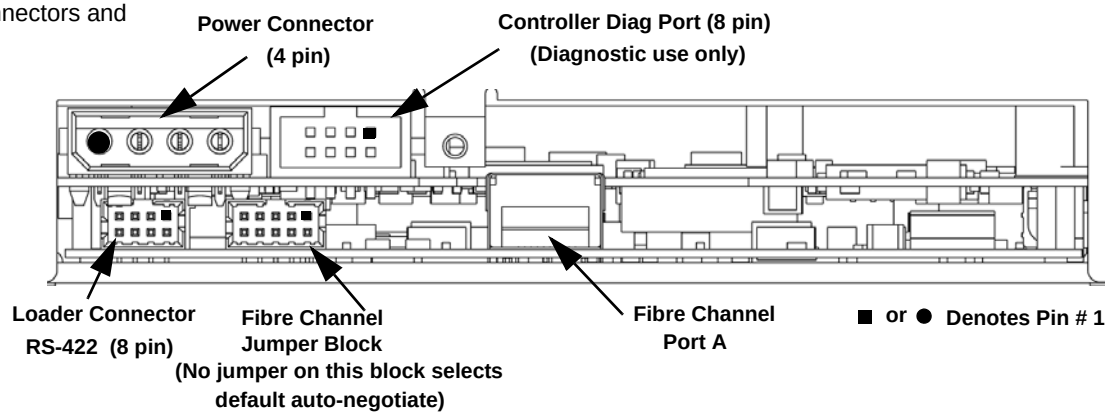


Table 36 shows the empty jumper block that you use to set the speed and topology. (Using this jumper block is optional.) If you decide it is necessary to change the tape drive's speed or topology, use your fingers to move the jumpers to the pattern corresponding to the speed or topology you want (see the related jumper settings in table 37) and table 38.

Table 36 Detail of the Empty Fibre Channel Speed and Topology Jumper Block

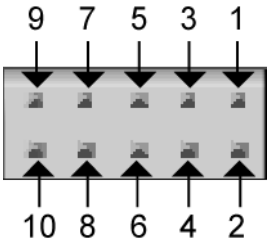


Table 37 SDLT 600 Fibre Channel Speed Configuration Jumper Block Settings

To Select This Speed	Put Jumper on These Pins	Resulting Configuration
1 Gb/sec	**5 and 6**	Tape drive attempts to synchronize the link at 1 Gb/second only.
2 Gb/sec	**3 and 4**	Tape drive attempts to synchronize the link at 2 Gb/second only.
Auto-negotiate	**No jumpers**	Auto Speed Negotiate: Tape drive attempts to synchronize first at 2 Gb/second, then at 1 Gb/second.
	5 and 6 AND 3 and 4	Auto Speed Negotiate: Tape drive attempts to synchronize first at 2 Gb/second, then at 1 Gb/second.

Note: Pins 1 and 2 are spare pins that are not used; no effect if jumpered or not jumpered.

Table 38 Fibre Channel Topology Configuration Jumper Block Settings

To Select This Topology	Put Jumper on These Pins	Resulting Configuration
Loop	**9 and 10**	Tape drive attempts to initialize the link in Arbitrated Loop topology only.
Point-to-Point	**7 and 8**	Tape drive attempts to initialize the link in Point-to-Point topology only.
Auto-negotiate	**No jumpers**	Auto Topology: Tape drive attempts to first initialize in Arbitrated Loop topology first, Point-to-Point topology next.
	9 and 10 AND 7 and 8	Auto Topology: Tape drive attempts to first initialize in Arbitrated Loop topology first, Point-to-Point topology next.

Note: Pins 1 and 2 are spare pins that are not used; no effect if jumpered or not jumpered.

Note: The tape drive only checks the jumpers at power on. To change the speed or topology configurations after installation, power off the tape drive, move the jumpers as needed, and then power on the tape drive.

The Tape Drive Fibre Channel Interface

The Fibre Channel interface runs at a speed of 1 Gb/second or 2 Gb/second. The tape drive supports auto-negotiation of the speeds, unless you force it to one speed or the other. See Selecting Speed and Topology for more information.

Practical Considerations

Fibre Channel can support up to 126 devices in a loop configuration. Longwave transceivers (with fiber optic cable) support distances up to 10 kilometers; shortwave transceivers (with fiber optic cable) support distances up to 500 meters.

SDLT 600 Fibre Channel tape drives use slightly more power than SCSI-configured tape drives. See the electrical specification tables in chapter 2, for additional information.

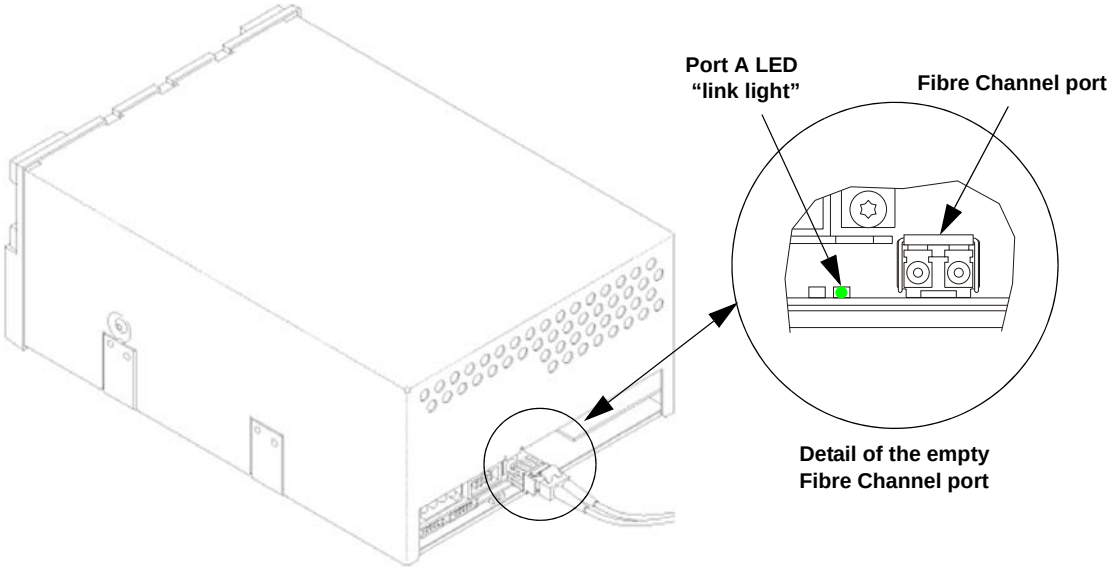
Fibre Channel Port A is where you connect your Fibre Channel cable to the tape drive. Figure 19 shows the location of this port, as well as several other components on the rear of the SDLT 600 tape drive.

Fibre Channel cables are "hot-swappable"—meaning you may connect and disconnect them with unit power on. Therefore, unlike other systems, the tape drive and computer may remain powered on while you connect the SDLT 600 tape drive to the host computer.

Verifying the Connection for an Internal Fibre Channel Tape Drive

Figure 19 shows the fiber optic cable connected to an internal Fibre Channel tape drive and a detail of the Fibre Channel Port A area, including the Port A LED (the "link light") associated with the port.

Figure 19 Connecting the Fiber Optic Cable to an Internal Fibre Channel Tape Drive

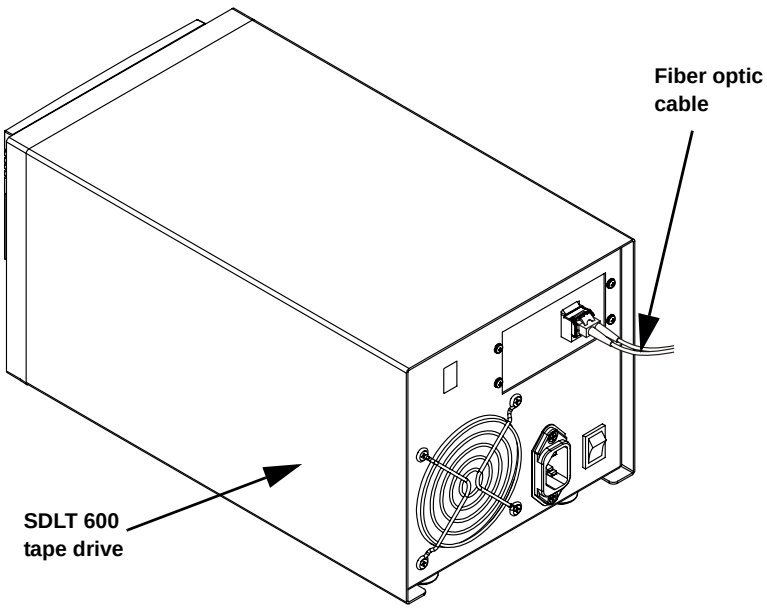


Insert a fiber optic cable into the Fibre Channel port on the back of the tape drive (see figure 19 if needed). The connector is fully seated when it snaps into the port.

The “link light” LED illuminates at the beginning of Fibre Channel POST and extinguishes at the completion of Fibre Channel POST (this verifies that the LED works). The LED also illuminates when Fibre Channel link initialization is achieved, indicating the Fibre Channel link is up and working as expected. The LED does not illuminate when there is no Fibre Channel link established.

Note: You can connect a Fibre Channel connector while the tape drive is still powered on; this capability is known as “hot-swappable” or hot-pluggable.”
When connecting to the Fibre Channel port, make sure to use a 50µM Fiber core fiber optic cable with an LC, Duplex connector.

Figure 20 Connecting the Fiber Optic Cable to a Tabletop Fibre Channel Tape Drive



World-wide Names

Each SDLT 600 tape drive contains two unique, 64-bit world-wide names: a node name for the tape drive, and one for the tape drive's Fibre Channel port. The tape drive reports the world-wide names to the host through the INQUIRY Command (12h). See the *SDLT 600 Fibre Channel Interface Guide (81-81202-xx)* for more information.

Drive States

Power On

When the tape drive completes the power-on process (including POST) and the port is initialized, the Fibre Channel port is enabled and will attempt to initialize on the attached Fibre Channel topology.

When the tape drive completes the power-on process, including POST, the device is on-line and capable of tape drive operations. See Power-On Self-Test on page 51 for detailed information about POST.

Failure to Obtain a Loop Address

If an SDLT 600 tape drive is unable to obtain an address (fabric assigned, previously assigned, hard assigned, or soft assigned), it goes into a non-participating mode and immediately implicitly logs out all logged in ports.

If an SDLT 600 tape drive experiences a power-on reset, or recognizes a LIP(AL_PD,AL_PS), it does not retain a previously acquired address to use during the next loop initialization.

Chapter 8

Updating the Firmware

The following sections of this chapter contain the information required for updating the firmware associated with the SDLT 600 tape drive:

- Updating the Firmware
- Code Update Using the Library Tape Drive Interface
- Firmware (Code) Update Troubleshooting

Updating the Firmware

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

- By directly using the SCSI bus
- By creating a firmware image data cartridge (CUP/FUP) to use in either a manual firmware update or in a library setting.

DLTSage provides the tool that allows you to update the tape drive's firmware using the SCSI bus, or to create a CUP/FUP data cartridge for an SDLT 600 tape drive. DLTSage is available on the Quantum Web site, www.quantum.com.

The following subsections briefly describe both methods of updating the tape drive firmware.

Update the Firmware Using the SCSI Bus

Quantum provides upgrades for product software and firmware that may be newly developed. These updates are available on the Quantum Web site.

> **Note:** These tools are only available to registered Quantum customers.

Refer to the following procedure to access and download these updates.

1. Go to the Quantum Web site: www.quantum.com.
2. Click **Service and Support** in the upper menu bar. This opens the **Service and Support** window.
3. Explore the various pages that comprise **Service and Support** until you find the update you need.
4. Download the **DLTSage** package and refer to that tool's built-in online help for detailed instructions to use while updating the firmware.

Create a CUP/FUP Data Cartridge

To update your tape drive firmware you may create a CUP/FUP data cartridge from the update information found on the Quantum Web site.

> **Note:** These tools are only available to registered Quantum customers.

Refer to the following procedure to access these updates for creating a CUP/FUP data cartridge.

1. Go to the Quantum Web site: www.quantum.com.
2. Click **Service and Support** in the upper menu bar. This opens the Service and Support window.
3. Explore the various pages that comprise Service and Support until you find the update you need.
4. Download the DLTSage package and refer to that tool's built-in online help for detailed instructions about how to create the data cartridge.

Using a CUP/FUP Data Cartridge

Follow these steps to use a CUP/FUP data cartridge:

1. Verify that the tape drive is powered on, and the middle (Drive Status) LED on the front panel of the tape drive is on, but not flashing.
2. Verify that the tape drive's cartridge opening is empty. (In other words, if any other cartridge is in the tape drive, unload and eject it.)
3. Press and hold the Eject button for six seconds; after six seconds, the left (Drive Density) LED begins to flash.
4. Release the Eject button, then quickly press and release the Eject button again. At this point, the left (Drive Density) and middle (Drive Status) LEDs start flashing synchronously in a regular, rhythmic pattern. The tape drive is now in Firmware Upgrade mode.

   You now have a **window** of one minute to insert the CUP/FUP data cartridge. If you do *not* insert a CUP/FUP data cartridge and the one minute time window expires, both LEDs stop flashing, although the middle (Drive Status) LED remains on (steadily illuminated). The tape drive is now out of Firmware Upgrade mode and can be used in a normal manner (once you insert a data cartridge). To put the tape drive back in Firmware Upgrade mode, repeat the previous steps 2, 3, and 4.
5. Insert the CUP/FUP data cartridge.
6. After you insert the CUP/FUP data cartridge, the left (Drive Density) and middle (Drive Status) LEDs change their pattern and start flashing in an alternating pattern. The tape drive is now performing the firmware upgrade.

   Note: The firmware upgrade fails the microcode update process if the firmware personalities do not match; the history log records this information, as well as the reason for the failure.
7. Wait several minutes for the update process to complete. The left (Drive Density) and middle (Drive Status) LEDs flash the entire time that memory is being updated.

8 When the update is complete, the tape drive resets itself and goes through POST. The tape drive rewinds the CUP/FUP data cartridge, unloads it, and ejects it. SCSI status indicates that microcode has been updated (06h, 3F, 01).

> **Note:** If the tape drive is mounted in a tape automation library, the CUP/FUP data cartridge rewinds to BOT and unbuckles in preparation for unloading, but does not automatically eject.

Code Update Using the Library Tape Drive Interface

The library tape drive interface (for SDLT 600 tape drive) 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 tape drive contains no data 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 data cartridge containing the new firmware into the tape drive.

5 Send the library ATTENTION command, then check the Tape Motion Status field of the returned General Status Packet to verify the data 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 data 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 data cartridge and remove it from the tape 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.

Firmware (Code) Update Troubleshooting

Try these remedial actions if the tape drive's code update fails:

- Updating the same revision—If you request a code update that is the same as the code revision already on the tape drive, the system updates the controller code but not the servo-specific code. The steps for this type of update are the same as for a normal update.
- Updating fails, which causes the tape drive to be reset; the problem can result from any of the following circumstances:
  - Data Cartridge contains incompatible update image.
  - Data Cartridge does not contain an update image.
  - No data cartridge in the tape drive.

Chapter 9

Insertion and Extraction Guidelines

This chapter provides media insertion and extraction guidelines for the SDLT 600 tape drive, which include the following topics:

Applicable Library Commands

This section discusses the commands and status bits that customers using a tape library interface need to be familiar with to communicate with the tape drive.

The tape library system uses commands to get information from the tape drive or to initiate tape drive action. The only time the tape drive accepts a command other than the ATTENTION or data request command is *after* it receives a valid ATTENTION command or data request command. At any other time, it discards any data it does not recognize as an ATTENTION or data request command.

The drive responds to an ATTENTION command (0x00) from a tape library controller with a General Status packet. General Status contains several bits that reflect the tape drive's loader status and its ability to accept new commands. It is intended that controller applications use OK

to Load as the primary indicator that a data cartridge can be inserted into the tape drive, and OK to Eject as the primary indicator that the tape drive has a data cartridge waiting to be ejected. Load Complete indicates tape is loaded and the read / write hardware is functional. However, the tape drive does not come ready on the SCSI bus until it finishes calibration and various read directory operations.

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

Table 39 General Status Packet Returned by ATTENTION Command

Bit / Byte	7	6	5	4	3	2	1	0
0	Product Type							
1	Servo Firmware Version							
2	Policy Firmware Version							
3	No ID	In Flux	Cartridge Present	Hardware Error	Cleaning Requested	Compress Enabled	Write Protect	OK to Eject
4	SCSI ID							
5	Current Tape Format							
6	OK to Load	TapeAlert Capable	Reserved (prior use)	Tape Motion Status				
7	Load Complete	Cleaning Cartridge Expired	Cleaning Required	Ex Status Changed	Prevent Removal	Reserved	Reserved (prior use)	Reserved (prior use)

Table 40 General Status Bits that Reflect Normal Load and Unload Capabilities

Status	Description
OK to Load	Tape drive is ready and a data cartridge can be inserted.
Cartridge Present	Tape drive has detected a data cartridge.
Load Complete	Tape drive has finished loading a data cartridge.
OK to Eject	Media is rewound and data cartridge can be ejected.

Loading a Tape

These commands pertain to loading the data cartridge:

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

For detailed information about these commands, and for more information about the General Status Packet shown in table 39, see the *Super DLTtape™ Interactive Library Interface Specification* (6464162-xx) document.

Realistic Expectations

The SDLT 600 tape drive should typically complete the reset and recovery process in less than one minute, although it is possible that heroic (extensive) data recovery retries—in some cases—can take longer. A tape drive that does not recover within several minutes requires manual intervention. Several causes, including a defective data cartridge, may be causing the failure to load event. The data cartridge should be inspected after a failure to load or unload event.

Exception Conditions

The tape drive sets the Hardware Error bit in the event of hardware failure. Status Byte 3 will post a Hardware Error and Cartridge Present if there is a detected tape load or unload failure. The tape drive always attempts to recover from a hardware problem by resetting the servo processor. The Hardware Error bit will be cleared if recovery was successful.

Unloading a Tape

These commands pertain to unloading the data 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.

For detailed information about these commands, and for more information about the General Status Packet shown in table 39, see the *Super DLTtape Interactive Library Interface Specification* (6464162-xx) document.

Realistic Expectations

The SDLT 600 tape drive should typically complete the reset and recovery process in less than 3 minutes, although it is possible that heroic (extensive) data recovery retries—in some cases—can take longer. The servo processor can be reset three times during error recovery, with each reset lasting approximately one minute. The amount of tape that has to be rewound into the data cartridge affects recovery time, but a tape drive that has not successfully recovered from its error state in several minutes requires manual intervention. The data cartridge should be inspected after a failure to load or unload event.

Loading a Data Cartridge

Complete this subsection to load a data cartridge into the front of the tape drive. Because these steps refer to some of the front panel LEDs and controls, they describe the process for *manually* loading a data cartridge.

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

Load Forces, Placement, and Timing

In automated tape library application, the mechanics of the loading process—including tight tolerances—are important and cannot be ignored.

Insertion Depth

When loading the data cartridge into the tape drive, the distance the picker is expected to move is important, as shown in figure 21 on page 88.

Cartridge Insertion Force

When loading the data cartridge into the tape 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: $0 < velocity \leq 1.5$ inch/sec.

Hold Time for Loading

When loading the data cartridge into the tape drive, the maximum time that the picker should hold the cartridge is 250 ms (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 600 tape drive to come ready after data cartridge load; the time necessary for the tape 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 data cartridge is inserted into the SDLT 600 tape drive, the tape drive completes its algorithms for cartridge load within 1 ½ minutes. **Worst case** time for a blank media data cartridge 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 data cartridge is inserted into the SDLT 600 tape drive, the tape drive completes its algorithms for cartridge load within 15 seconds.

Unloading a Data Cartridge

Complete this subsection to unload a data 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 data cartridge.

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

1. Press the **Eject** button, or issue an appropriate system software command. The tape drive completes any active writing of data to the media. The Drive Status LED flashes as the media rewinds.
2. When the media is finished rewinding, the tape drive ejects the data cartridge and the Drive Status LED lights steadily.

   Do not rush removal of the data cartridge. Wait until the tape drive ejects the data cartridge and the Drive Status LED lights steadily before removing the data cartridge.
3. Remove the data cartridge from the tape drive and return the data cartridge to its plastic case to protect the data cartridge from damage.

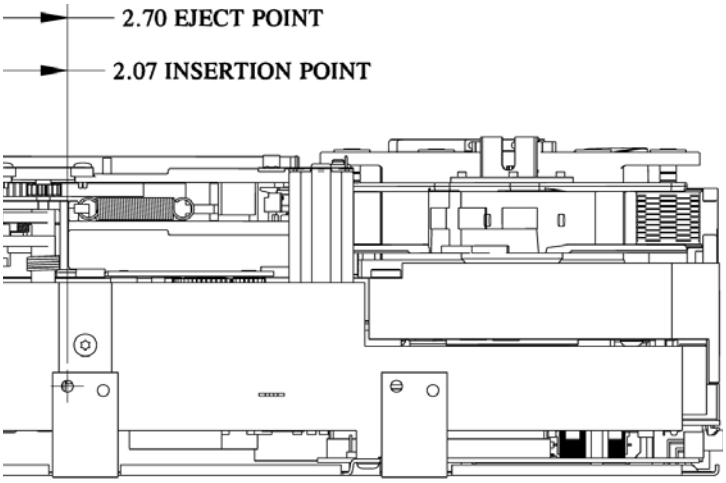
Unload Forces, Placement, and Timing

In automated tape library application, the mechanics of the unloading process—including tight tolerances—are as important as those of the loading process, and cannot be ignored.

Eject Distance

When ejecting a data cartridge from the tape drive, the distance the data cartridge can be expected to move is important; this distance is shown in figure 21.

Figure 21 Tolerances for Cartridge Insertion and Extraction



Data 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: $0 < velocity \leq 1.5$ inch/sec.

Quantum

141 Innovation Drive
Irvine, CA 92617
(949) 856-7800
(800) 284-5101
December 2005
81-81196-02

81-81196-02 REV A01