QUALSTAR®

RLS-8350
Tape Library

Product Specification

511002 Rev 07-01-19

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Notices

For information about this product specification, please visit our website or call Qualstar at:

QUALSTAR CORPORATION

1267 Flynn Road
Camarillo, CA 93012

FAX: (805) 978-5984
Phone: (805) 583-7744

E-Mail: sales@qualstar.com
www.qualstar.com

Table of Contents

1.   Introduction

1.1   Scope

This product specification describes the Qualstar RLS-8350 tape library, subsequently referred to in this specification as the RLS or library. It also provides detailed specifications of the product and is intended for use by individuals evaluating, purchasing and/or integrating the RLS library products.

1.2 Supplemental Documentation

For information about the data interface, or other information outside the scope of this manual, please refer to the appropriate documents listed below. The following Qualstar and ANSI documents supplement this specification:

Subject	Document	Qualstar Document Number
Installation & Operation	RLS-8350/85XXX Series Installation and Operation Manual	511000
Service	RLS-8350/85XXX Series Technical Service Manual	511010
Approved Data Cartridges	Product Information Note	PIN-038
Barcode Label Specifications	Product Information Note	PIN-040
SCSI Command Information	RLS SCSI-2 Interface Manual	501551
SCSI-1	ANSI X3.131-1986	N/A
SCSI-2	ANSI X3.131-1994	N/A
SCSI Parallel Interface-2 Specification (SPI-2)	ANSI X3.302-1998	N/A
SCSI Architecture Model-2 (SAM-2)	ANSI INCITS 366-2003	N/A
SCSI-3 Primary Commands (SPC)	ANSI X3.301-1997	N/A
SCSI-3 Primary Commands - 2 (SPC-2)	ANSI INCITS 351-2001	N/A
SCSI-3 Primary Commands - 3 (SPC-3)	ANSI INCITS 408-2005	N/A
SCSI-3 Media Changer Commands (SMC)	ANSI INCITS 314-1998 [R2003]	N/A
Automation/Drive Interface - Transport Protocol (ADI)	ANSI INCITS 406-2005	N/A
Automation/Drive Interface - Commands (ADI)	ANSI INCITS 403-2005	N/A
Serial Attached SCSI - 1.1 (SAS-1.1)	ANSI INCITS 417-2006	N/A

Table 1-1   Applicable Documents

2.   Product Description

2.1 General Description

The RLS-8350 is a high density, automated rack mounted tape library. The library is 6 rack-units tall (6U = 10.50 inches). The RLS-8350 tape library utilizes LTO tape technology.

The library supports up to 50 cartridges and four tape drives. The entire system (drives and library) is under host control via the host interface. Fibre channel and SAS tape drive interfaces are supported, and the library uses the ADI facility of the tape drives for its interface.

The RLS-8350 library can be easily expanded by adding one to three RLS-8560 or RLS-85120 libraries, housing up to 410 tape cartridges and up to 19 tape drives in just 36U of rack space.

The library contains a robotics system for handling data cartridges, up to four LTO-6, LTO-7 or LTO-8 SAS or fibre channel tape drives and storage slots for data cartridges. The unit operates on internationally available AC power with active power factor correction.

The RLS is designed for maximum reliability. Only the highest quality components are used in a design that is inherently robust and simple. Brushless motors are used exclusively for smooth and reliable operations. All digital, closed-loop servo systems use magnetic and optical position sensors to assure fast, smooth, trouble-free cartridge handling. The servos automatically calibrate themselves, eliminating all electrical adjustments. Preventive maintenance consists of replacing the air filter and cleaning the gripper pads, when prompted by the control panel.

2.2 Standard Features Found in the RLS-8350 Library

- Library interface to the application is established via ADI, (Automation/Drive Interface) through the tape drive's interface

- Barcode scanning of data cartridge labels

- Q-Link web-based library manager can remotely control the RLS and automatically email alarm messages to a contact list

- Supports Internet Protocol Version 6 (IPv6)

- Supports library managed encryption, which allows tape drives to encrypt the data written on tape cartridges

- Rack mount kit

- Simultaneous random and multi-sequential operating modes with two or more tape drives

- Library resources may be partitioned

- Multiple initiators may simultaneously connect to a single partition

- The front panel has a window for visibility into the interior

- Interior illumination

- Color touch screen control panel

- Easy-to-use menu system for configuration, operation and maintenance

- Tape drives are in quick-change hot swappable carriers

- Programmable, automated tape drive cleaning

- Operating firmware may be updated via Q-Link Ethernet interface

- Maintenance-friendly by design: no adjustments, hot-swap drives, hot-swap power supply modules. All service can be performed without removing from the rack.

- Filtered, forced-air cooling of library and tape drives provided by front replaceable air filters

- Universal input power rating (100- to 240-VAC, 50/60 Hz)

- Power Factor Corrected (PFC) power system is efficient and fully CE compliant

2.3 Optional Features Available

- N+1, hot-swappable power supply modules (automatic e-mail alarm message sent via Q-Link when any power supply or fan fails)

- FastPass™ elevator expansion option, which allows one to four RLS-8560 or RLS-85120 libraries to be connected to form a single library.

2.4 RLS-8350 Library Features and Options
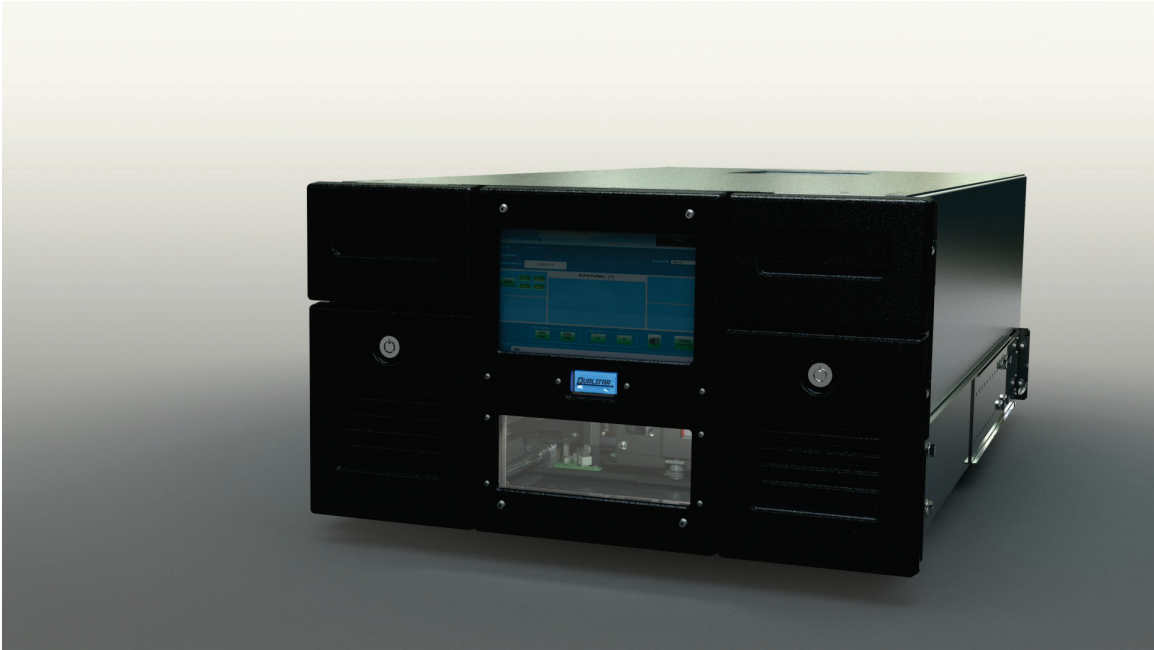
FEATURE	RLS-8350
Tape Technology	LTO
Maximum Number of Drives	4
Number of Slots	50
I/O Ports	1
Cartridges per I/O Port	4
Barcode Reader	Standard
Q-Link Remote Library Manager	Standard
Hot-swap Tape Drive Carriers	Standard
N+1, Hot-Swappable Power Supply Modules	Optional

Table 2-1   RLS-8350 Features and Options

2.5 Major Features

2.5.1 Cabinet

The cabinet provides easy access for upgrades and field service while the library is installed in a standard 19" equipment rack. Tape drives and power supply modules (PSMs) plug into the rear of the library, providing all power and data connections.

2.5.2 Front Panel Components

The library's functions can be controlled through the control panel. The I/O port is released by the robot and slides out from the front panel, and is electronically locked. Bulk loading can be accomplished by removing the right or left storage matrix. Figure 2-1 shows the various features of the front panel. The library may be configured to continue operation while the I/O port is extended.
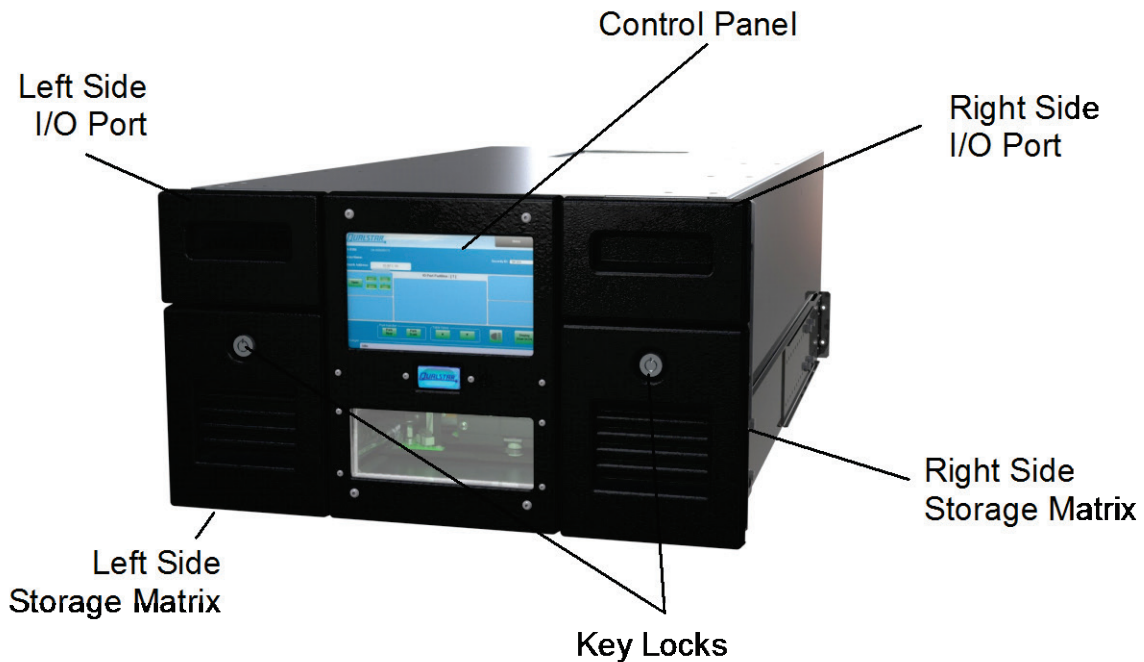
Figure 2-1   RLS-8350 Front Panel Details

2.5.2.1 Control Panel

The control panel is a color LCD with touch screen. The operator may use the control panel menus to configure and operate the RLS and monitor its status. The following information can be displayed:

- Model number and all firmware revisions

- Extensive menu system for configuration, maintenance and operation

- Operational status (indicates all active cartridge movements)

- History log which stores the most recent commands and status

- Error conditions and diagnostic messages

- Library partition information

- Inventory information

2.5.2.2 I/O Port

The operator gains access to the media by unlocking the I/O port through either the control panel or Q-Link and then manually extending the I/O port. When closed, the I/O port is locked electronically. Once extended, four cartridges may be removed or inserted. The library status may be configured to be "not ready" when the I/O port is extended. Under this configuration, while the port is open, the RLS can respond to a host interface command with a busy status, a not ready status or it can accept the command and wait for port closure to complete the command.
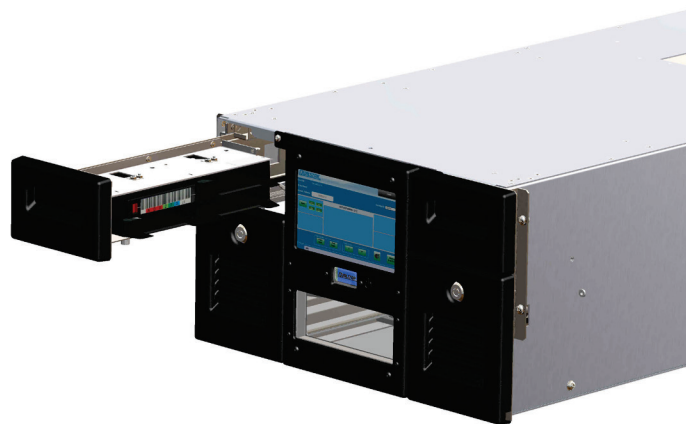
Figure 2-2   The Four Slot I/O Port Extended

2.5.2.3 Security

The storage matrix must be secured with a key operated lock for the library to operate.

2.5.2.4 Power Switch and Indicator

The library's power status is indicated by a blue LED Power Indicator button on the front of the library that illuminates when the power is applied. Standby/Soft-power is controlled by a switch located inside the LED Power Indicator button. During standby mode the center of the button flashes blue at the rate of one blink approximately every two seconds. During power on mode the button is fully illuminated.

The primary power for the library is controlled by a rocker switch located on the rear panel.

2.5.3 Rear Panel Components
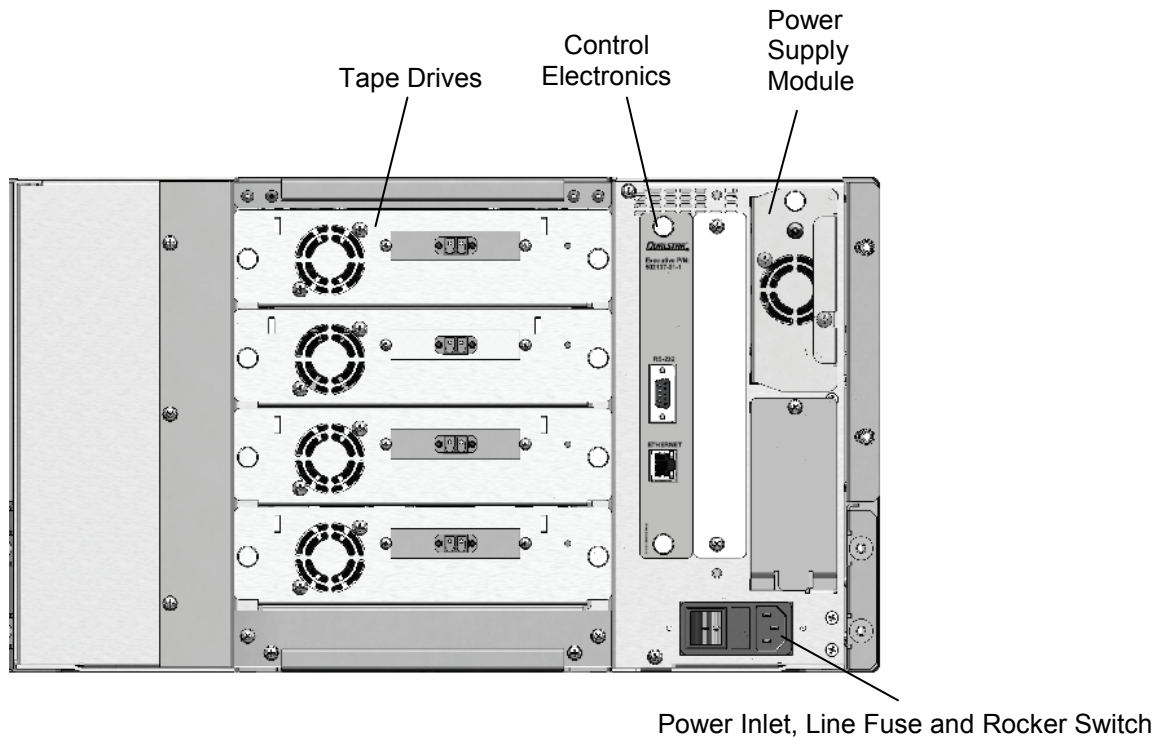
Figure 2-3 Rear Panel Details

2.5.3.1 N+1 Power Option

The RLS-8350 has a distributed power system. One or two power supply modules (PSM) can be accommodated. One power supply module is standard, the second power supply module provides N+1 capability, ensuring system redundancy.

The PSMs operate in parallel, sharing the load. This reduces the stress on the individual power supplies and extends their service life. When the N+1 option is

installed, the library will continue to operate if one module fails. The remaining PSM will power the RLS-8350 indefinitely. The library and tape drives will continue to function, uninterrupted by the failure and subsequent replacement of the failed PSM. A green "power good" LED indicates that a PSM is operating properly. A failed PSM causes an alarm condition that will result in e-mail notification by the Q-Link remote library manager.

All PSMs supply regulated 24-volts DC to the RLS-8350. The unit is powered from AC mains of 100- to 240-volts, 50 or 60 Hertz.

Figure 2-4   The Power Supply Module (PSM)

2.5.3.1 FastPass Elevator Expansion Option

RLS-8350 rack mounted tape libraries easily expand capacity and data delivery performance to keep pace with rapidly growing data protection and data archiving requirements. Each library can be equipped to pass tapes vertically from one unit to the next when installed in an industry standard 19-inch EIA equipment rack.

The FastPass elevator expansion option passes tapes from unit to unit. The mechanism installs from the rear of the rack and fits entirely within the form factor of the libraries.

The FastPass option can be installed by an end user, and the system is completely self-calibrating. The elevator option requires no additional power or cooling, and does not reduce the number of tape drives housed in each library module. The fast pass modules use a tape drive slot, reducing the possible number of tape drives by two for each pair of libraries that are connected.

Each RLS-8350 library can be expanded by adding one to three RLS-8560 or RLS-85120 libraries below it, enabling the total configuration to support up to 19 tape drives and up to 410 tape cartridges.

Figure 2-5   Two Libraries Connected with the FastPass Elevator Expansion Option

Upper elevator
expansion
module

Lower elevator
expansion
module
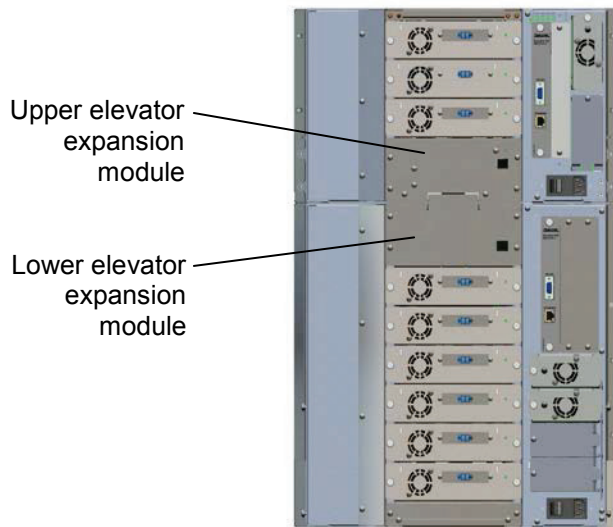
Figure 2-6   Rear view of two libraries with the FastPass Elevator Expansion Option

2.5.4   Medium Changer Components

I/O Port

Robotics

Tape Drives
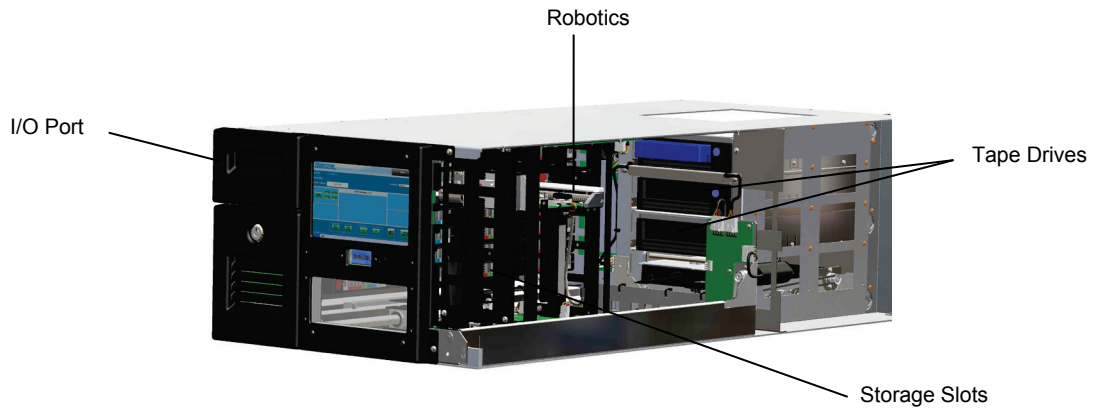
Storage Slots

Figure 2-7   RLS Components

2.5.4.1   Storage Slots

Each RLS-8350 model utilizes a left and right fixed matrix of storage slots (28 slots on the right side and 22 on the left). The storage matrices may be removed from the unit for bulk loading or removal of cartridges.

Figure 2-8   Left Storage Matrix Extended

2.5.4.2 Tape Drives

The RLS-8350 library accommodates up to four tape drives. The drives are housed in plug-in drive carriers that may be installed or removed while the other drives within the unit are operating. A microprocessor in the drive carrier communicates with the tape drive via its supervisory port to ascertain its model, serial number and operational status. This information is immediately uploaded to the executive processor and is available to the host computer whenever a new drive is plugged-in. The drive's world-wide name is set to the RLS menu values as soon as power is applied. Any tape drive may be inserted or removed while the others are running. A drive can be changed within a minute and no tools are required. Blank filler panels must be installed at each vacant tape drive location.
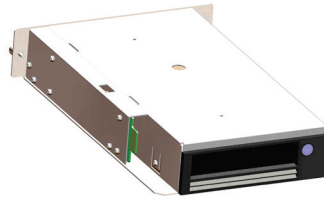
Figure 2-9   Tape Drive Assembly

2.5.4.3 Robotics

The RLS-8350 utilizes a four-axis robotic cartridge handling system that moves cartridges between the storage slots and the tape drives. All axes are driven by vector drive brushless DC motors. The motors move the linear axes with precision lead screws. Feedback is provided by hall effect sensors with optical end-of-travel sensing. Cartridge gripping is accomplished using a solenoid for simplicity and dependability. The linear axes are riding on linear bearings, and the rotating axis is supported on ball bearings. This results in high reliability, long life, and nearly zero maintenance for the robotics. The entire robotic handler is a removable as a single unit through the front with only 7 screws, without removing the library from the equipment rack.
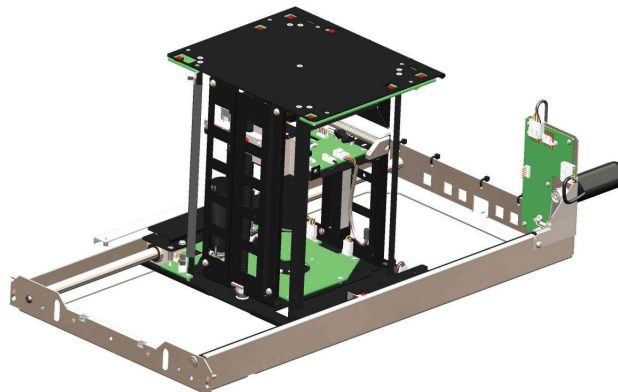
Figure 2-10   The Robotics

2.5.4.4 Cooling System

The library is cooled by fresh air that is drawn into the cabinet through filters in the front panel. The air is exhausted out the rear of the library. Each tape drive and power supply module has a fan.

2.5.4.5 Barcode Reader

A barcode reader is included with all RLS models. The barcode reader can scan all cartridges in the RLS (except those within tape drives), as well as cartridges introduced into the I/O port. Barcode Labels

Pre-printed barcode labels, which are both human and machine-readable, are available from a number of sources, including Qualstar.

Barcode labels must conform to ANSI/AIM BCI-1995, Uniform Symbology Specification Code 39. Please refer to PIN-040 at www.qualstar.com for more information.

By default, the RLS expects no modulus 43 check characters at the end of each label, but can be configured to expect the check character. All of the labels within the RLS must match the check character configuration. If the RLS is configured to expect a check character and the labels do not have a check character, then most barcodes will not read, and if they do read, then they will miss the last character. If the RLS is configured for no check character, and labels with check characters are used, then all of the labels will show an extra character.

2.6 RLS Operation

2.6.1 Medium Changer Control System

There are several microprocessors utilized throughout the RLS to form an efficient distributed control system. All of the microprocessors utilize FLASH memory for storing their operating firmware. In addition to its own needs, the executive processor firmware contains the firmware images for all of the other microprocessors in the RLS. Thus all of the RLS operating firmware gets updated with a single code load to the executive processor. The code load is accomplished over the Ethernet interface using an Internet browser. The updates are matched to the revisions of all the circuit boards to insure compatibility. Power loss during uploading or re-programming will not cause any harm.

2.6.2 Inventory Database

The medium changer maintains an Inventory Database that contains data associated with each storage location. The database contains such information as cartridge presence, barcode label data and cartridge source element address. In addition, the library collects the Memory-In-Cartridge data from each tape cartridge that is inserted into a tape drive. This information is available using the Control Panel or the Q-Link remote management facility. A subset of this is available to the host using the SCSI command set.

2.6.3 Library and Multi-Sequential (Multiple Stacker) Operation

Each tape drive and cartridge storage location in the RLS may be configured through the menu system for Library or Sequential operation. If a tape drive is configured for the Library mode, it becomes a resource controlled by the application operating the library. If a drive is configured for Sequential mode operation, it is referred to as a sequential drive and is not included in the list of resources reported.

For Sequential or Recycle operation, a set of cartridge locations is assigned to each sequential drive for its exclusive use. In these modes, each tape cartridge is returned to its original storage location after it is ejected from the tape drive.

For Dual Bin operation, two separate sets of cartridge locations are assigned to each sequential drive for its exclusive use. The input set of locations is where the changer gets cartridges to be placed in the sequential drive. The output set is where those cartridges are returned after the drive has ejected them.

Cartridge storage locations assigned to sequential operations are not included in the list of resources reported to host computers. Empty slots in a Sequential, Recycle or Dual Bin drive's storage location set will not adversely affect operation.

When a Sequential or Recycle operation is initiated the changer places the first cartridge, found at (or after) the initial specified storage location into the drive. When the drive ejects the cartridge, the changer automatically returns the cartridge to its original location. The changer then places the next cartridge found in sequence within the drive's storage set into the drive. This process is repeated until the last specified cartridge in the sequence is ejected and returned to storage. This sequence may be initiated at any location within a Sequential drive's storage set but will always end at the last storage location in the sequence. In Recycle operations, the handler will return to the starting position and repeat the cartridge movement cycle indefinitely.

When a Dual Bin operation is interactively started, the changer moves the cartridge found at (or after) its first input set location into the drive. When the drive ejects the cartridge, the changer automatically places it in the first empty cartridge location in the drive's output set. This process is repeated, until the last specified cartridge in the input set has been ejected from the drive and placed into the output set.

The computer communicating with the sequential drive only communicates with the drive and not the changer. This allows the use of applications lacking library-specific, cartridge-movement, operating software.

Multiple tape drives can be configured for concurrent Sequential, Recycle or Dual Bin operation. All Library drives, and all cartridge locations not assigned to sequential drives, are still available for simultaneous random mode operations.

This flexible design allows the user to partition the library's resources to best meet overall system needs.

2.6.4 Manual Operation

The menu system provides a means of manually moving cartridges to or from all available locations (drives, magazine slots and I/O port). The menu system is accessed

using the touch screen on the front panel, or via the Q-Link interface. If the host makes a request to the RLS during a manual operation, the RLS indicates it is busy until the manual operation is completed (usually within a few seconds).

2.6.5 Library Partitions

When shipped from the factory, all RLS units are configured as a single library with all tape drives and storage slots dedicated to random operation. This is generally the correct configuration for a single system running a library-aware backup application.

However, when multiple hosts are present and each needs to run a library specific backup application, then the RLS can be sub-divided into smaller *library partitions*. Each partition requires at least one dedicated tape drive. Note that when tape drives are dedicated to sequential operation (sequential, recycle or dual bin) only one tape drive is allowed to be assigned to each library partition.

The RLS can have multiple physical partitions, which allows separate hosts and thus separate host applications to have fully separate sub-libraries under their exclusive control. A partition must have one or more drive slots, and one or more cartridge slots assigned. Thus, the maximum number of partitions is a function of the resources assigned to the various partitions, up to the total number of drive slots and the number of cartridge slots in the Library. Note that a drive slot can be assigned but is not active unless a drive is installed. Drives, drive slots, and cartridge slots cannot be shared between partitions.

An individual I/O port slot can only be assigned to one partition. A unit with two (2) I/O ports doubles the number of I/O port slots that can be assigned to partitions. As with drives, drive slots, and cartridge slots, I/O port slots that are assigned to one partition may not be shared with a different partition.

Multiple hosts can communicate with the same partition, via the same physical port and LUN. Should a host need a separate physical connection to the partition, an additional drive can be configured for each physical host interface needed.

2.6.6 Encryption Key Management

The RLS-8350 Series enables use of the powerful data encryption capability built into every LTO tape drive. Simple, easy-to-use, library-based key management allows Administrators to assign a separate key to each partition. The data on all tapes within a partition are encrypted and decrypted with the user-supplied key.

3.   Physical Specifications

3.1   Dimensions
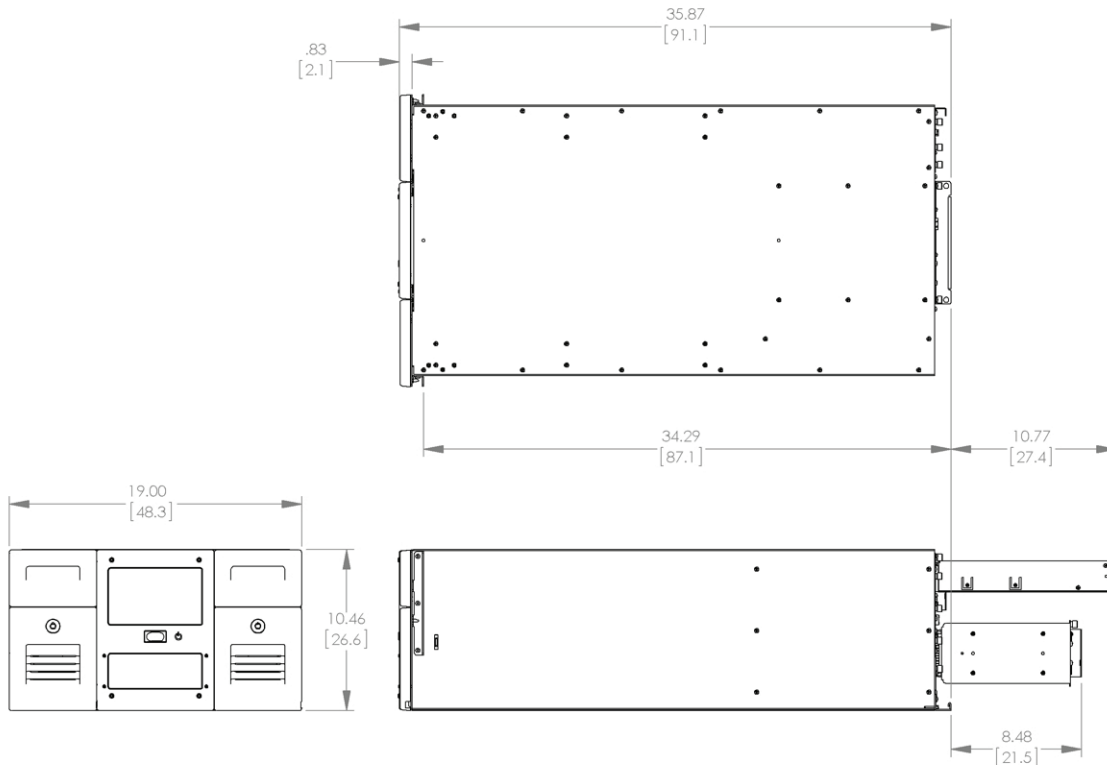
Figure 3-1   RLS External Dimensions

> Note: 12 additional inches (30.5 cm) of depth are required to remove and install tape
> drives and power supplies.

3.2   Color

The exterior color is black/aluminum.

3.3 Weights

MODEL	WEIGHT FULLY LOADED [1] (LBS / KG)	EMPTY WEIGHT [2] (LBS / KG)
RLS-8350	138 LBS / 63 KG	50 LBS / 23 KG

[1] Includes rack mount kit and a full complement of tape drives and tape cartridges
[2] Not including magazines, tape cartridges or drives

Table 3-1   RLS Weight

4.   Electrical Specifications

4.1 Standard AC Power Requirements and Consumption

The RLS operates with the following alternating current power sources (Mains):

Rated Line Voltage	Rated Line Current	Maximum Operating Line Voltage	Minimum Operating Line Voltage	Line Frequency Range
100–240 VAC	5 AMPS	254 VAC	100 VAC	50-60 Hz

Table 4-1   Power Requirements

Other than selecting the appropriate AC power cord for connection to the mains, the RLS requires no changes (switches, etc.) to operate from any input voltage within the rated line voltage range.

Power consumption varies with the number of tape drives installed and the particular operation being performed. All AC powered PSMs utilize Power Factor Corrected (PFC) power supplies and thus the RLS' power factor is greater than 0.95 which complies with CE requirement EN61000-3-2.

MODEL	TWO DRIVES INSTALLED		FOUR DRIVES INSTALLED	
	IDLE	PEAK	IDLE	PEAK
RLS-8350	44 watts 150 BTUs/hr	126 watts 430 BTUs/hr	68 watts 232 BTUs/hr	180 watts 614 BTUs/hr

Table 4-2   Power Consumption

The idle power figures indicate the power consumed when the changer and tape drives are idle. The peak power figures indicate the peak power consumed when the carriage accelerates and the tape drives are active. The peak power levels are not expected to last for more than two seconds at a time. The current drawn from the power line (mains) is equal to the watts indicted in Table 4-2 divided by the AC voltage.

4.1.1 Power Source Disturbances

The RLS will continue to operate uninterrupted and without damage over a one-cycle line dropout. It is recommended that the unit be powered from an Uninterruptible Power Source (UPS). The UPS should be rated to handle the maximum wattage.

4.1.2 Power Entry

The RLS has a line fuse and I.E.C. power receptacle mounted on the rear panel. An internal AC line filter reduces EMI conducted emissions and protects the library and tape drives from noise on the power lines.

4.1.3 Power Cord

The supplied detachable power cord complies with the following specifications:

- **100-125 volt applications**   UL listed and CSA certified three-conductor 18 AWG SJT vinyl-jacketed cord. One end is terminated with an IEC 320 C13 style connector. The other end is terminated with a NEMA 5-15P type plug.

- **200-240 volt applications**   Harmonized three-conductor HO5VV F3G 1.0mm vinyl-jacketed cord. One end is terminated with an IEC 320 C13 style connector. The other end is terminated with the European CEE7 Standard VII type plug.

RLS models equipped with two power supply modules come supplied with two power cords to allow the library to be connected to independent power sources.

5. Agency Compliance

5.1 EEC Directive Compliance (European Economic Community)

The RLS meets or exceeds the requirements of the CE Mark as set forth by:

- Electromagnetic Compatibility Directive 89/336/EEC

- Low Voltage Directive 73/23/EEC

5.2 Emissions/Immunity Standards Compliance

The RLS meets or exceeds the standards set forth by:

- FCC Rules, Part 15, Subpart B, Class A Computing Devices

- CE per EN55022 (1998) Class A and EN55024 (1998) including:
  EN61000-3-2, -3-3, -4-2, -4-3, -4-4, -4-5, -4-6, -4-8 and –4-11

- ACMA C-Tick N 23156

- KC Korean Certification MSIP-REM-QS7-RLS-8500

5.3 Safety Standards Compliance

The RLS meets or exceeds the standards set forth by:

- ANSI/UL60950 Third Edition – Certified by ITS – usETL

- CAN/CSA-C22.2 No. 60950-00 Third Edition – Certified by ITS – cETL

- CE per EN 60950 – ITS CB Certificate & Report US/995/ITS

5.4 European Directive on Waste Electrical and Electronic Equipment (WEEE)

Qualstar encourages its customers to use current recycling practices in order to reduce the burden that waste electronic products place on the environment.

If you are retiring a fully functional tape library, you are encouraged to transfer the functional unit to a new user, thereby extending the useful life of the tape library. The

manufacture of all products requires the consumption of energy. By extending the life of the tape library, energy is conserved.

In accordance with environmental directives that are being implemented in many countries (refer to the European Directive on Waste Electrical and Electronic Equipment - WEEE) Qualstar provides customers with "End of Life Instructions" that identify the process for recycling the materials and components that make up a Qualstar tape library.

5.4.1 End of Life Instructions

Tools required

- P1 and P2 Phillips head screwdrivers
- T20 Torx head screwdriver
- Hex head (Allen) wrench/driver set
- 1/4-inch hex nut driver

Disassembly procedure

1. Remove magazine.

2. Remove center panel.

3. Remove rear panels and PCBA's.

4. Remove internal subassemblies.

Items recyclable using conventional methods

- Aluminum: Robotics, exterior panels, some frames
- Stainless steel: Robot guide shafts, lead screws, bearings
- Steel: Magazine structure, some frames, fasteners
- Plastic: Window, cartridge magazines, tape cassettes, exterior front
- Copper: Internal wiring, motors
- Paper: Documents

Items that may have salvage or resale value

- Tape drives
- EMI line power filter

5.5 Reduction of Hazardous Substances (RoHS)

Qualstar is committed to the implementation of RoHS (Restriction of the use of certain hazardous substances in electrical and electronic equipment) in accordance with the European Directive.

Qualstar tape libraries are classified as "Information Technology Storage Array Systems" for which the RoHS Directive provides an exemption for lead solder. Affected subassemblies must be disposed of appropriately.

6. Performance Specifications

6.1 Data Cartridge Handling Times

Table 6-1 lists the Average Time to pick a cartridge from its storage location and place it in a drive, or pick a cartridge from a drive and return it to its storage location.

MODEL	AVERAGE TIME
RLS-8350	7.0 seconds

Table 6-1   Cartridge Handling Times

6.2 Scan All Barcodes

In Table 6-2, the Typical Time values are the times required to scan a full complement of data cartridges. This assumes all cartridges are bar-coded and that no retries are needed. Scanning of barcode labels will not commence for about 15 seconds after power is turned on.

MODEL	TYPICAL TIME
RLS-8350	112 seconds

Table 6-2   Barcode Scanning Times

7. Environmental Specifications

These tape libraries are designed for use in an office environment and may not be subjected to external vibrations during operation.

7.1 Temperature, Humidity and Altitude

PARAMETER	OPERATING	NON-OPERATING [1]
Ambient temperature	+5°C to +32°C (+41°F to +90°F)	-20°C to +60°C (-4°F to +140°F)
Temperature gradient (maximum)	1°C/minute, 10°C/hour (2°F/minute, 18°F/hour)	1°C/minute, 20°C/hour (2°F/minute to +36°F/hour)
Relative humidity (non-condensing)	20% to 80%	10% to 90%
Wet bulb temperature	26°C (79°F) maximum	29°C (84°F) maximum
Altitude	-1000 to +10,000 feet -304.8 to +3,048 meters	-1000 to + 40,000 feet -304.8 to +12,192 meters

[1] Includes tape drives

Table 7-1   Environmental Specifications

NOTE

Rapid changes in temperature which produce condensation must never be allowed since the condensed liquid may contaminate bearing lubricants and possibly shorten the expected Mean Time Between Failures.

7.2 Acoustical Noise

Overall noise level at one meter from the front of the RLS and the unit installed in a typical equipment rack, shall not exceed:

- With all tape drives operating: ≤ 54 dBA

- All tape drives plus robotic handler operating: ≤ 59 dBA

8.   Maintainability

8.1 Mean Time to Repair

The Mean Time To Repair (MTTR) shall not exceed 30 minutes. The MTTR is the average time for an adequately trained and equipped technician to diagnose and correct a malfunction while following the service procedures in the Technical Service Manual. Servicing will be limited to replacing major subassemblies and printed circuit board assemblies (PCBAs). Repair time does not include system retest time. All repair procedures may be performed while the RLS remains installed in a standard 19" equipment rack with adequate front and rear access.

8.2 Preventive Maintenance

Preventive maintenance required by the RLS consists of periodically cleaning or replacing the air filter, which is located in each storage matrix. The RLS keeps track of its power-on hours in order to periodically remind the user to replace the filter. The replacement interval can be changed to match the local environmental conditions.

Gripper pads must be cleaned periodically as needed.

8.3 Automated Tape Drive Cleaning

The user can specify a location where a cleaning cartridge can be stored for each tape drive. Any number of cleaning cartridge locations from none up to the number of drives may be specified, but each drive can have only one location.

A menu command allows the user to specify a drive to be cleaned. If the drive is empty, the RLS will move the predetermined cleaning cartridge to the drive. When the drive ejects the cartridge, the unit will return it to its original location.

8.4 Adjustments

The RLS does not require electrical or mechanical adjustments after any field replaceable unit (FRU) or tape drive is replaced. All adjustments, alignments and calibrations are performed automatically.