



**RLS**

**TeraLoaders™**

Product Specification

501579 Rev. B



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# 1.

# Introduction

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## 1.1 Scope

This product specification describes the Qualstar RLS-4124, RLS-5116 and RLS-8116 tape TeraLoaders™, subsequently referred to in this specification as the TeraLoader or RLS. It also provides detailed specifications of the product and is intended for use by individuals evaluating, purchasing and/or integrating the RLS.

## 1.2 Supplemental Documentation

For information about the SCSI 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:

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<b>Subject</b>	<b>Document</b>	<b>Qualstar Document Number</b>
Installation & Operation	TeraLoader Installation and Operation Manual	501580
Quick Start Guide	RLS-4124 Quick Start Guide	501581
Quick Start Guide	RLS-5116 Quick Start Guide	501583
Quick Start Guide	RLS-8116 Quick Start Guide	501582
Service	RLS Technical Service Manual	501510
Supported Tape Drive	Product Information Note	PIN-014
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-2	ANSI X3.131-1994	N/A
SCSI SPI-2 Specification	ANSI X3.302-1998 SCSI Parallel Interface-2 (SPI-2)	N/A

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**Table 1-1 Applicable Documents**

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# 2.

# Product Description

## 2.1 General Description

The Qualstar TeraLoaders (models RLS-4124, RLS-5116 and RLS-8116) are automated rack-mountable tape autoloaders with a single tape drive. They are 5 rack-units tall (8.75-inches). The supported tape drives are listed in Product Information Note #014 available at Qualstar's Web Site: [www.qualstar.com](http://www.qualstar.com).

The TeraLoaders are single-drive versions of Qualstar's versatile RLS line of tape libraries. They may not have all the features found in the RLS tape libraries but they feature the same Ultra-160 compatible SCSI interface and have the storage capacities described below:

Model	Tape Technology	Cartridges	Native Capacity
RLS-4124	AIT-3	24	2.4 Terabytes
RLS-5116	SAIT	16	8.0 Terabytes
RLS-8116	LTO 2	16	3.2 Terabytes

Table 2-1 Storage Capacity

A robotic system moves cartridges between its carousel (with four removable magazines) and the tape drive. It operates on any internationally available AC power source.

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 to effect smooth and reliable operations. All digital, closed-loop servo systems using magnetic and optical position sensors assure fast and smooth cartridge handling. The servos automatically calibrate themselves, thus eliminating all electrical adjustments. Preventive maintenance is reduced to replacing the air filter and cleaning the gripping surfaces, when so prompted by the control panel display.

## 2.2 Standard Features

- Mean-Exchanges-Between-Failures (MEBF) exceeds 2,000,000 exchanges
- Maintenance-friendly by design – no adjustments
- Universal input power rating (100- to 240-VAC, 50/60 Hz)
- Random or Sequential operating modes
- Easy-to-use menu system for configuration, operation and maintenance
- Forced-air cooling with a front mounted, user replaceable air filter
- The key-lockable front panel with a large window for good visibility into the lighted interior

- 
- Control panel utilizes six pushbuttons and a white backlit 80-character display
  - Power Factor Corrected (PFC) power supply is very efficient and fully CE compliant
  - Q-Link web-based remote manager can control the RLS and automatically e-mail alarm messages to a contact list (operating firmware may be remotely updated)
  - Rack mount slide kit included
  - Plug-in Interface Personality Module (IPM) provides LVD/SE SCSI Interface
  - Operating firmware may be updated via the SCSI interface or Q-Link
  - Barcode scanning of data cartridge labels is optional

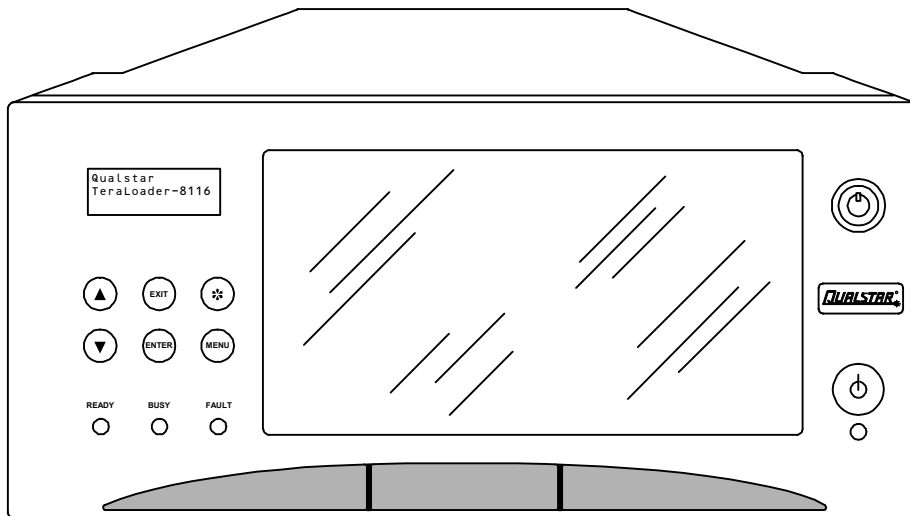


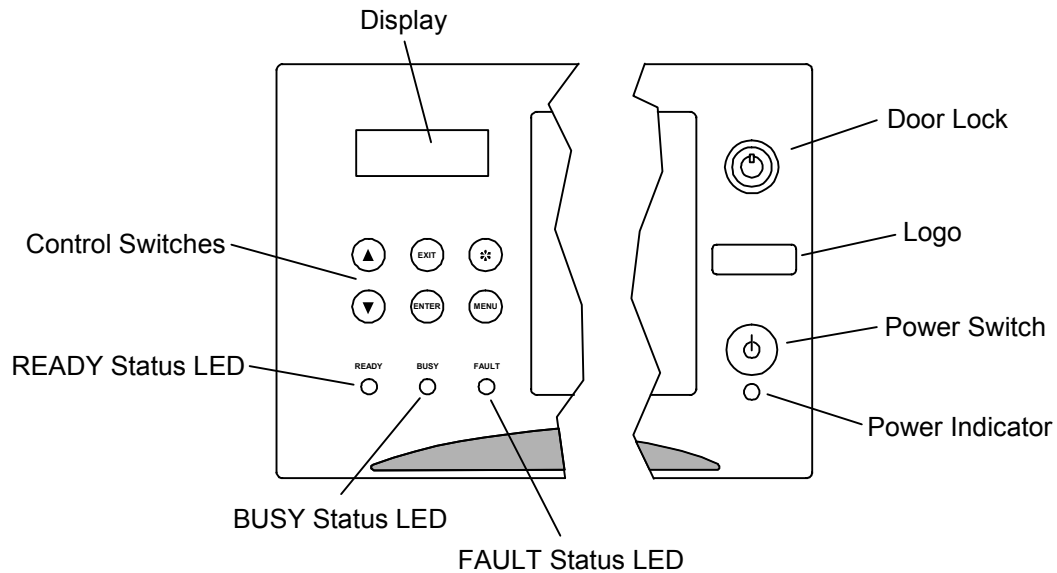
Figure 2-1 TeraLoader Front View

## 2.3 Major Features

### 2.3.1 Cabinet and Front Panel Components

The cabinet has a hinged top cover to provide easy access for field service. Both power and data connections are in the rear. Cooling air enters at the bottom of the front panel and is exhausted out the rear.

The entire front panel is actually a door that hinges down for access to the tape cartridges and the tape drive. A key-operated lock secures the door. Figure 2-2 shows the various features of the front panel. An interlock switch prevents robotic movement whenever the front door is opened.



**Figure 2-2 Front Panel Details**

### 2.3.1.1 Control Panel

The control panel has a four-line, 80-character, backlit display, six control keys, three color-coded status LEDs (READY, BUSY and FAULT) and an audible alarm. The operator uses the control keys and display to configure and operate the RLS and to observe its status. The following information can be displayed:

- Extensive menu system for configuration, maintenance and operation
- Operational status (indicates all active cartridge movements)
- SCSI command history log which stores the most recent commands and status
- All firmware revisions
- Error conditions

The six pushbutton switches are used to manually control the RLS by means of the menu system and are identified in Table 2-2.

NAME	FUNCTION
▲	Scrolls up through menu items.
▼	Scrolls down through menu items.
ENTER	Accepts the currently displayed menu choice.
EXIT	Exits the present menu and returns to the previous menu level.
✱	Displays The Quick Operation menu
MENU	Always takes you to the Top Menu.

**Table 2-2 Control Panel Switches**

### 2.3.1.2 Door Lock

The front door contains dual interlocks. One interlock is key operated and one is under software/host control. If the host system has set the “Prevent Media Removal” state, the front door cannot be opened regardless of the key lock position. If the host system has set the “Allow Media Removal” state and the key is in the unlocked position, the door may be opened.

### 2.3.1.3 Power Switch and Indicator

A push-on/push-off switch controls primary power. A green LED Power Indicator illuminates when the power is on.

## 2.3.2 Rear Panel Components

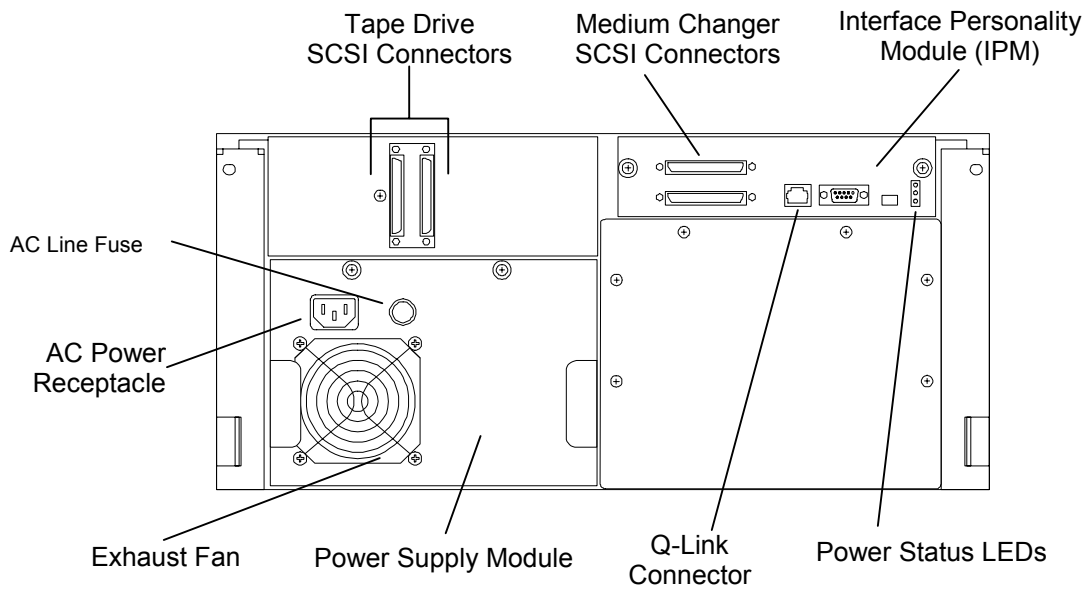


Figure 2-3 Rear Panel Details

### 2.3.2.1 Power Supply Module

The RLS uses an internal 24-VDC distributed power system for enhanced reliability. The 24-VDC power is supplied by a single high efficiency 125-watt, power-factor-corrected, AC-to-DC power supply. This supply operates from any AC power source available around the world and it meets all applicable international safety, radiation and efficiency standards.

### 2.3.2.2 Interface Personality Module (IPM)

The IPM is a plug-in module that can be changed when the RLS is powered-down. It always contains the LVD/SE (Multi-mode) SCSI connectors to the RLS medium changer and the Q-Link port provides a 10BaseT connection to LANs and the Internet for the remote manager.

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### 2.3.2.3 Tape Drive SCSI Interface Panel

The tape drive's SCSI connection appears on a pair of HD-68 SCSI connectors provided on the rear interface panel. When the tape drive is unplugged, the connection between the pair of drive connectors is broken. Thus, unplugging a tape drive on a live system will open the SCSI bus and disrupt data transfer.

### 2.3.3 Medium Changer Components

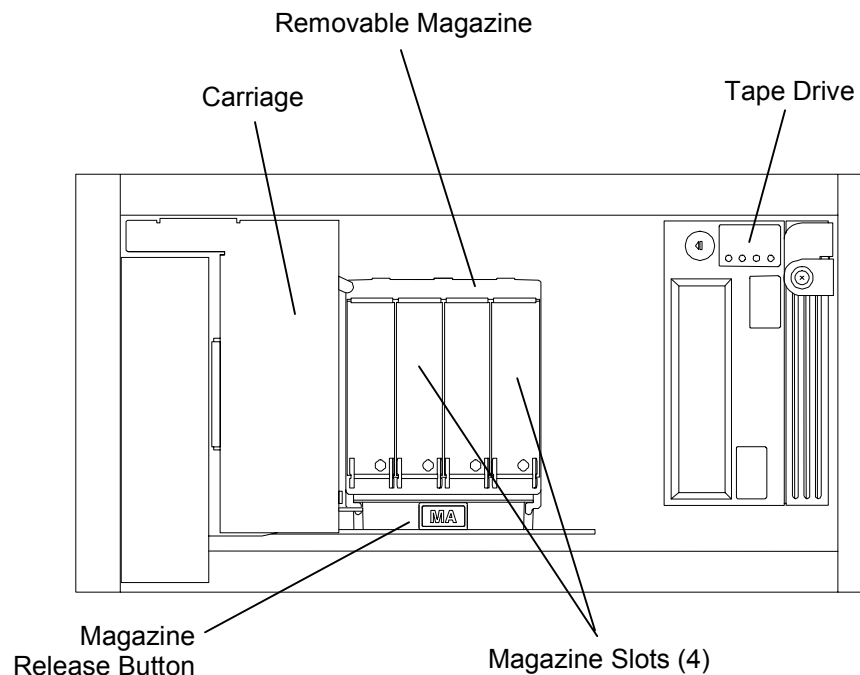


Figure 2-4 RLS-5116 / 8116 Functional Components

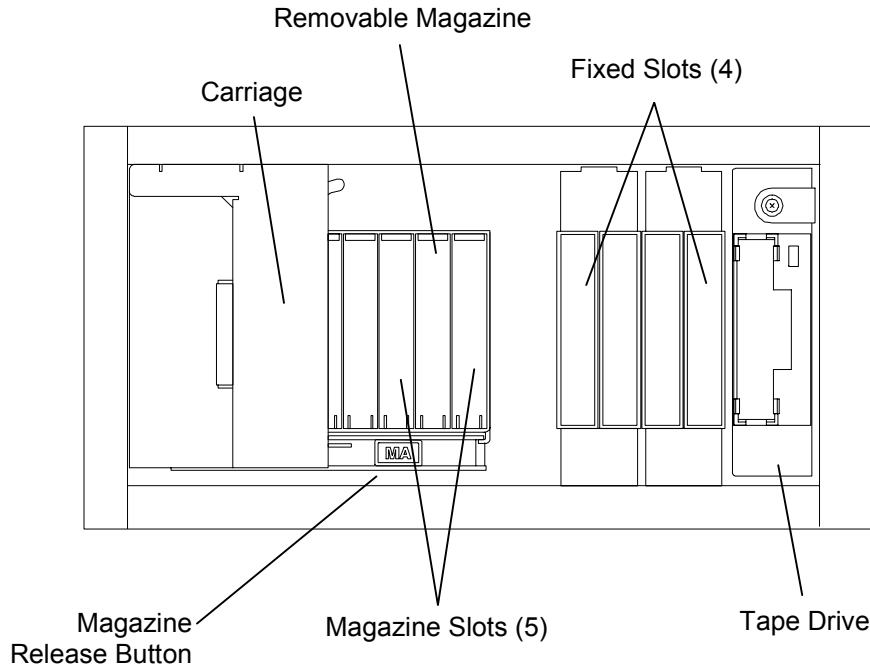
#### 2.3.3.1 Magazines and Carousel

All TeraLoaders have four detachable magazines mounted on a four-sided carousel. In the RLS-4124, each magazine holds five tape cartridges while in the RLS-5116 and RLS-8116, each magazine holds four tape cartridges. The carousel rotates in 90-degree increments to present one magazine to the robotic handler. The carousel can rotate in either direction to minimize the access time to a magazine.

A magazine and its cartridges can be removed from the RLS as a unit. A dust cover is provided for storage. Magazines self-lock on their mounts and are easily removed by pressing a release button. Additionally, each cartridge is individually retained within the magazine to prevent mishandling or damage.

#### 2.3.3.2 Fixed Slots

The RLS-4124 contains four fixed cartridge storage slots (identified as F1 through F4) that may be accessed when the front panel/door is opened. The fixed slots can hold data or cleaning cartridges.



**Figure 2-5 RLS-4124 Functional Components**

### 2.3.3.3 Tape Drive

The RLS accommodates a single tape drive. A microprocessor 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 RLS executive processor and is available to the host computer. The drive's SCSI ID is set to the RLS menu values as soon as power is applied.

### 2.3.3.4 Robotics

The RLS utilizes a simple two-axis robotic cartridge handling mechanism that moves cartridges between the magazine slots and the tape drive. All motion is powered by brushless DC motors. Magnetic sensors provide position and velocity feedback while optical sensors provide absolute positional information. This unique design produces optimum positioning accuracy, reliability and long life. The servo systems are all-digital and do not require adjustments.

### 2.3.3.5 Cooling System

A rear mounted axial fan draws outside air into the cabinet through a front-mounted replaceable air filter. The air is exhausted out the rear of the unit. Temperature sensors monitor internal temperatures and sound an audible alarm and display an alarm message when the RLS operating temperature limits are exceeded. A temperature alarm message can also be sent to a list of e-mail recipients via the Q-Link remote manager. The RLS periodically prompts the user to replace the air filter. This message can also be e-mailed via Q-Link.

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### 2.3.3.6 Barcode Reader (Optional)

The barcode reader consists of a charge-coupled sensor and associated electronics. The barcode reader can scan all cartridges in the RLS (except those within the tape drive). Barcode data is stored internally in the RLS's non-volatile RAM (the internal inventory database) and is available to the host computer upon request.

### 2.3.3.7 Inventory Sentry

The Inventory Sentry utilizes infrared beam that passes in front of the tape drive and all storage locations immediately available to the robotic handler. If the front door is opened and the inventory is not disturbed, closing the door immediately returns the RLS to operational status.

If the Inventory Sentry beam is broken while the door is open, the inventory status is invalidated. When the door is subsequently closed, the RLS will automatically rescan the entire cartridge inventory (and barcode labels if present) and update its internal inventory database before becoming operational.

## 2.4 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](http://www.qualstar.com) (click on Support tab) for more information.

By default, the TLS expects a modulus 43 check character at the end of each label. The use of a check character helps assure that labels are read error-free. The TLS configuration must be changed before using barcode labels without a check character. All of the labels within the TLS must match the check character configuration: either all with or all without a check character.

## 2.5 The SCSI Interface

For the sake of clarity and compliance with the SCSI specifications, the functional portion of the RLS is defined as a "Medium-changer". The standard SCSI control interface to the medium-changer is both Low-Voltage Differential (LVD) and Single-Ended (SE) capable. This is defined by ANSI as Multi-Mode Low Voltage Differential or MLVD and is also called LVD/SE. All of the supported tape drives have MLVD interfaces. When LVD and SE devices are mixed on the same SCSI bus, the bus will only operate in the single-ended mode. Wide (16-bit) and narrow (8-bit) devices may always be combined on the same bus.

There is a pair of 68-conductor SCSI connectors on the rear of the RLS for the medium-changer and the tape drive. A bridge cable is used to place both devices on the same SCSI bus.

The user can change the SCSI ID of the medium-changer and the tape drive from the control panel or via Q-Link as described in the Installation and Operation Manual or

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Quick Start Guides (see Table 1-1). The complete SCSI-2 interface protocol is described in Qualstar's SCSI Interface Manual, Document No. 501551.

### **2.5.1 SCSI Connectors**

The standard RLS SCSI interface utilizes two sets (medium changer and tape drive) of dual-stacked HD68 (SPI-2) connectors (AMP P/N 787679-1 or equivalent). The mating connector is an AMP 750752-1 or equivalent with jackscrew locking hardware.

### **2.5.2 SCSI Terminators**

The SCSI bus must be properly terminated at each of its ends. The host adapter board is usually one terminus and is normally terminated. The other end usually appears at the RLS and requires the installation of the supplied LVD/SE SCSI terminator (Qualstar P/N 117-0011-9).

### **2.5.3 SCSI Termination Power**

The RLS medium changer and the tape drive carrier can both supply up to 2-amps of termination power. Current-limited solid-state switches that are under menu control supply all RLS termination power.

## **2.6 Q-Link Remote Manager**

Q-Link, consisting of hardware and additional firmware, provides remote web accessed management capability. It allows a user/supervisor to observe, configure, control and trouble-shoot any RLS remotely over the Internet or a LAN using Internet Explorer V6.0 or Netscape V6.2 browsers. Q-Link communicates to the outside world via a standard 10BaseT interface and provides the following features:

- Display Inventory and General Status
- Configure the RLS including the Drive, SCSI and Logical Libraries
- Dump diagnostic logs
- Upload new RLS and Q-Link firmware
- Move inventory
- Clean or unload tape drives

Additionally, Q-Link can be configured to e-mail event or fault messages to a list of support staff when a name server and SMTP server are available.

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## 2.7 RLS Operation

### 2.7.1 Medium Changer Control System

There are several microprocessors utilized throughout the RLS to form an efficient distributed control system under the supervision of the Executive Processor. 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. This code load can be accomplished via the SCSI or Q-Link interfaces.

### 2.7.2 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 (the address where the cartridge came from – its source). The Inventory Database is maintained in non-volatile RAM and is always available to the host application.

### 2.7.3 Random or Sequential Operation

The RLS may be configured through the menu system or the Q-Link remote manager for Random or Sequential operation. In the Random mode, a host computer must move each tape cartridge to and from the tape drive. In the Sequential mode, no host computer is required as tape cartridges are automatically moved in sequence to and from the tape drive.

There are two variations of Sequential Operation: Sequential and Recycle. Both modes load every tape cartridge into the tape drive and replace each cartridge back to its original location after it is ejected by the drive. The Sequential mode will stop after all cartridges have been loaded once where the Recycle mode will repeat the sequence indefinitely.

### 2.7.4 Manual Operation

The menu system provides a means of manually moving cartridges to or from all available locations by using the control keys or 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).

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# 3. Physical Specifications

## 3.1 Dimensions

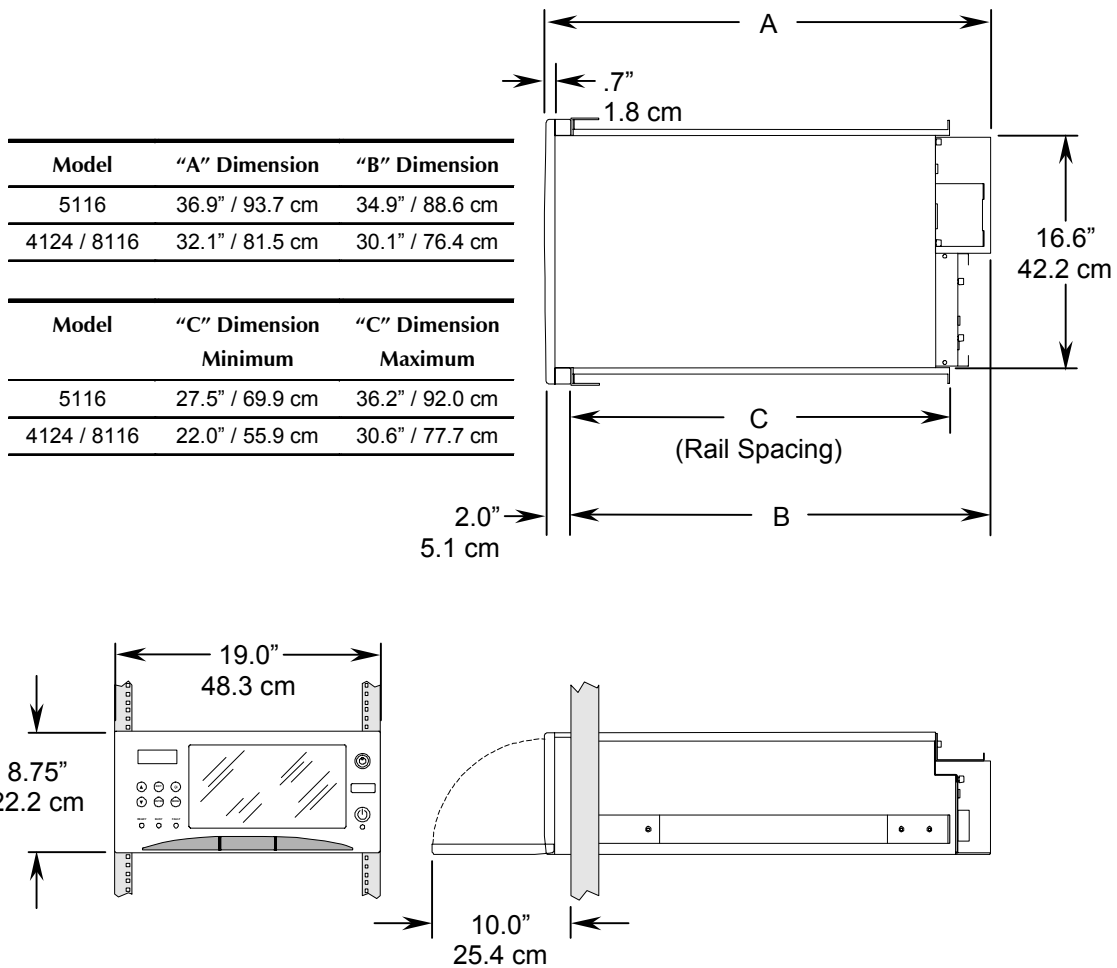


Figure 3-1 RLS External Dimensions

### 3.2 Shipping Carton

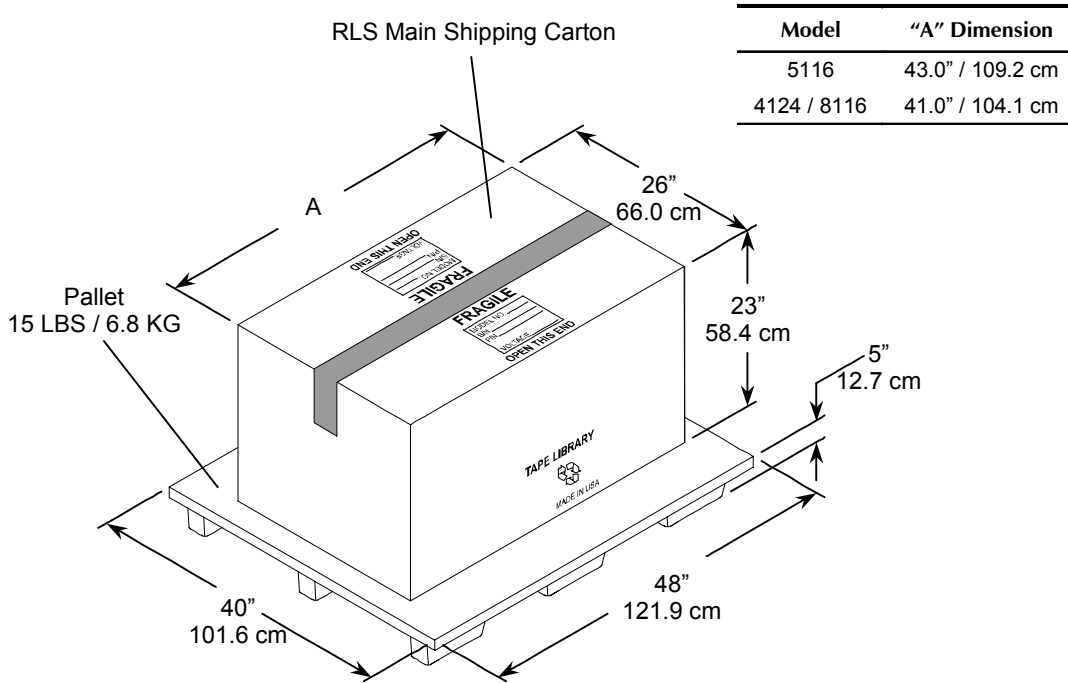


Figure 3-2 RLS Shipping Carton

Note: All tapes and magazines must be removed from inside the RLS before shipping. An accessory carton within the shipping box is provided for their storage.

### 3.3 Weights

MODEL	NET WEIGHT FULLY LOADED <sup>①</sup> (LBS / KG)	SHIPPING WEIGHT <sup>②</sup> (LBS / KG)
RLS-4124	61 / 28	96 / 44
RLS-5116	108 / 49	153 / 69
RLS-8116	69 / 31	112 / 51

① Includes rack slides and a full complement of magazines and tape cartridges

② Attached to pallet and not including tape cartridges

Table 3-1 RLS Weights

### 3.4 Color

The exterior color is black.

# 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	4 AMPS	254 VAC	90 VAC	48–62 Hz

Table 4-1 RLS Mains 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.

Power consumption varies with the particular operation being performed. The RLS utilizes a Power Factor Corrected (PFC) power supply and therefore the power factor is greater than 0.95 which meets with CE requirement EN61000-3-2.

MODEL	IDLE	PEAK
RLS-4124	63 watts 216 BTUs/hr	93 watts 318 BTUs/hr
RLS-5116	71 watts 291 BTUs/hr	105 watts 530 BTUs/hr
RLS-8116	75 watts 291 BTUs/hr	120 watts 530 BTUs/hr

Table 4-2 RLS Power Consumption

The idle power figure indicates the power consumed when the changer and tape drive are idle. The peak power figure indicates the peak power consumed when the carriage accelerates and the tape drive is active. The peak power level is 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 indicated 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 RLS be powered from an Uninterruptible Power Source (UPS). The UPS should be rated to handle the maximum wattage.

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### 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 RLS from noise on the power lines.

### 4.1.3 Power Cord

The supplied detachable power cord complies with the following specifications:

- **100-120 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.

# 5.

# Agency Compliance

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## 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

## 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

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# 6. Performance Specifications

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## 6.1 Data Cartridge Handling Times

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

MODEL	AVERAGE TIME
RLS-4124	15 seconds
RLS-5116	16 seconds
RLS-8116	16 seconds

Table 6-1 Cartridge Handling Times

## 6.2 Scan All Barcodes

In Table 6-2, the Typical Time value is the times required to scan a full complement of data cartridges. This assumes all cartridges are barcoded and that no retries are needed. Scanning of barcode labels will not commence for 12-seconds after power is turned on.

MODEL	TYPICAL TIME
RLS-4124	33 seconds
RLS-5116	62 seconds
RLS-8116	62 seconds

Table 6-2 Barcode Scanning Times

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# 7. Environmental Specifications

## 7.1 Temperature, Humidity and Altitude

PARAMETER	OPERATING	NON-OPERATING <sup>①</sup>
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 drive

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, shall not exceed:

- With only the tape drive operating: ≤ 55 dBA
- With the tape drive plus robotic handler operating: ≤ 60 dBA

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# 8. Reliability Specifications

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## 8.1 Mean Exchanges Between Failures

The Mean Exchanges Between Failures (MEBF) rating exceeds 2,000,000 exchange cycles. The MEBF rating excludes tape drives, which are rated separately by their manufacturers. An exchange cycle consists of the following actions:

1. Pick a data cartridge from a storage location.
2. Place the cartridge into the tape drive.
3. Remove a cartridge from the drive.
4. Return the cartridge to a storage location.

Qualstar Corporation does not warrant either the MEBF or the historical failure rate to be representative of any particular unit installed for customer use. Failure rates are derived from a large database of test samples. The individual failure rate will vary from unit to unit.

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# 9.

# Maintainability

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## 9.1 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.

## 9.2 Preventive Maintenance

The only routine preventive maintenance required by the RLS consists of periodically cleaning and replacing the air filter, which is located on the front panel. 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.

The gripping surfaces must be cleaned periodically. Again, the RLS keeps track of the number of cartridge moves and periodically reminds the user to perform the cleaning.

## 9.3 Automated Tape Drive Cleaning

The user can specify a location where a cleaning cartridge can be stored. A menu command allows the user initiate a clean drive sequence. If the drive is empty, the RLS will move the predetermined cleaning cartridge to the drive. When the drive ejects the cartridge, the RLS will return it to its original location.

## 9.4 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.

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