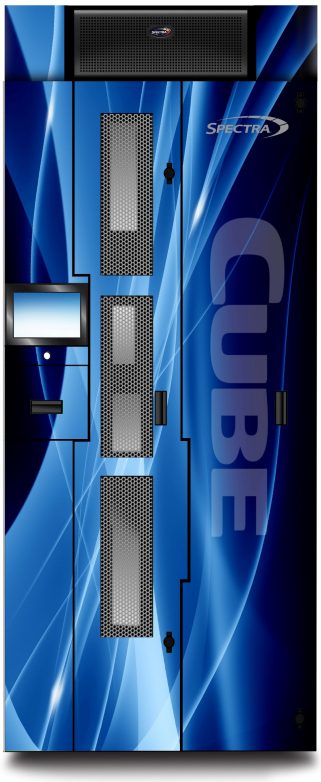
Spectra Cube Library User Guide



www.SpectraLogic.com

TABLE OF CONTENTS

Contacting Spectra Logic 8

About This Guide 13

Intended Audience 13

Product Status 13

Related Information 14

Chapter 1 - Library Overview 16

Library Features 17

LumOS software 17

Front Panel Components 20

Interior Components 22

Rear Components 24

Operator Panel Touch Screen 25

TeraPack Access Port (TAP) 26

Spectra Library Control Module 27

Exporting Controllers 29

Tape Drives 29

TeraPack Cartridge Handling 31

Overview of the LumOS User Interface 32

Access Options 32

LumOS Web Interface 32

User Interface Features 33

Logging in to the LumOS User Interface 35

Dashboard 36

Chapter 2 - Architecture Overview 38

Media Pools 39

Library Partitions 40

Storage Partitions 40

Cleaning Partitions and Auto Drive Clean 41

Component Identifiers 43

Drive Component Identifiers 44

Chamber Component Locators 44

Connectivity 46

TeraPorter Connectivity 46

Drive Connectivity 47
High-Availability Configurations 49
Redundant Connectivity 49
Redundant Power Supplies 50
Chapter 3 - Configuring The Library 51
Configuring Users 52
Creating and Editing Users 53
Editing the Current User Password 54
Configuring Settings 55
Basic Settings 56
Auto-Logout Settings 57
Authentication Settings 57
Network and Metric Settings 60
Startup Scan Settings 61
Partition Overview 62
Configuring and Using Cleaning Partitions and Auto Drive Clean 62
Configuring and Using Storage Partitions 63
Storage Partition Options 63
Creating A Partition 65
Overview 65
Partition Interface 65
Creating A New Cleaning Partition 66
Creating A New Storage Partition 67
Modifying An Existing Partition 72
Deleting A Partition 74
Chapter 4 - Encryption 75
BlueScale Encryption Key Management Overview 76
Understanding the Components 76
Standard Edition vs. Professional Edition 76
Configuring Encryption 78
Adding BlueScale Encryption 78
Exporting BlueScale Encryption Keys 81
Deleting BlueScale Encryption Keys 82
Authorization Settings 83
KMIP Encryption Key Management Overview 85

Adding KMIP Encryption 85
Chapter 5 - Using The Library 90
Controlling the Library Power 92
Power On the Library 92
Power Off the Library 92
Importing, Exporting, and Exchanging Magazines 93
Main TAP 93
Requirements 93
Restrictions 94
Performing an Import or Export 96
Importing Into a Storage or Cleaning Partition 96
Import Requirements 96
Prepare the Storage Partition or the Cleaning Partition 99
Import the Magazines 100
Exporting Magazines and Cartridges 102
Prepare for the Export 102
Export the Magazines or Cartridges in a Partition 103
Exchanging Magazines and Cartridges 104
Prepare for the Exchange 104
Exchange the Magazines or Cartridges in a Partition 104
Move Media 106
Moving Media 106
Media Lifecycle Management 107
Navigating the MLM Screen 108
Tape Details 109
Tape Mount History 110
Understanding Drive Lifecycle Management 111
Overview 111
Drive Health Reports 111
Drive Lifecycle Management 112
Navigating the DLM Screen 112
Drive Details 113
Drive Mount History 114
Licenses 115
Adding a License 115

Chapter 6 - Maintaining The Library 116
Updating, Servicing, or Moving the Library 117
Diagnostics 118
Alerts 127
Configuring Alert Settings 127
Adding or Editing Alert Subscribers 128
Log Gathering 130
Gathering Logs 130
Managing Backups 131
Package Update 133
Configuring a Package Update 133
Drive Firmware Update 134
Updating Drive Firmware in LumOS User Interface 134
Updating Drive Firmware Using ITDT 140
Robotics 143
Robot Details 143
Chapter 7 - Technical Support 144
Accessing the Technical Support Portal 145
Create an Account 145
Log Into the Portal 146
Opening a Support Ticket 147
Returns 152
Appendix A - Best Practices 153
MLM Best Practices 154
Implementation Guidelines 154
Usage Policy Guidelines 155
Using Cartridges 156
Labeling Cartridges 156
Handling Cartridges 157
Storing Cartridges 158
Using Cartridges in the Library 159
Cartridge Rotation 160
Appendix B - Specifications 164
Library Specifications 165

Data Storage Capacity 165
Size and Weight 166
Service Access Requirements 167
Shipping Size and Weight 167
Power Specifications 168
Environmental Specifications 171
Shock and Vibration Specifications 173
Interface Specifications 174
Component Interface Connectors 174
Network Interface Cable Requirements 174
Universal Serial Bus (USB) Support 176
NDMP Support 176
Tape Drive and Media Specifications 177
LTO Tape Drive Specifications 177
Drive-Based Encryption Highlights 180
Tape Media Specifications 180
Barcode Label Specifications 183
Interoperability and Software Compatibility 187
Appendix C - Regulatory & Safety Standards 188

COPYRIGHT

NOTICES

TRADEMARKS

DOCUMENT INFORMATION

Documentation part number:

- 93940000

Revision History:

- Revision A - June 2024, Initial Release.
- Revision B - August 2024, Updated for LumOS 1.4.

Contacting Spectra Logic

<table>
<tr><td colspan="2">To Obtain General Information - Spectra Logic Website: www.spectralogic.com</td></tr>
<tr><td>United States Headquarters</td><td>European Office</td></tr>
<tr><td>Spectra Logic Corporation
6285 Lookout Road
Boulder, CO 80301
USA</td><td>Spectra Logic Europe Ltd.
329 Doncastle Road
Bracknell
Berks, RG12 8PE
United Kingdom</td></tr>
<tr><td>Phone: 1.800.833.1132 or 1.303.449.6400
International: 1.303.449.6400
Fax: 1.303.939.8844</td><td>Phone: 44 (0) 870.112.2150
Fax: 44 (0) 870.112.2175</td></tr>
<tr><td colspan="2">Spectra Logic Technical Support Technical Support Portal: support.spectralogic.com</td></tr>
<tr><td>United States and Canada - Phone
Toll free US and Canada: 1.800.227.4637
International: 1.303.449.0160</td><td>Europe, Middle East, Africa
Phone: 44 (0) 870.112.2185
Deutsch Sprechende Kunden
Phone: 49 (0) 6028.9796.507
Email: spectralogic@stortrec.de</td></tr>
<tr><td colspan="2">Mexico, Central and South America, Asia, Australia, and New Zealand
Phone: 1.303.449.0160</td></tr>
<tr><td colspan="2">Spectra Logic Sales Website: shop.spectralogic.com</td></tr>
<tr><td>United States and Canada
Phone: 1.800.833.1132 or 1.303.449.6400
Fax: 1.303.939.8844
Email: sales@spectralogic.com</td><td>Europe
Phone: 44 (0) 870.112.2150
Fax: 44 (0) 870.112.2175
Email: eurosales@spectralogic.com</td></tr>
<tr><td colspan="2">To Obtain Documents - Spectra Logic Website: support.spectralogic.com/documentations/documentation</td></tr>
</table>

End User License Agreement

1. READ CAREFULLY

YOU SHOULD READ THE FOLLOWING TERMS AND CONDITIONS BEFORE ACCEPTING THIS END-USER LICENSE AGREEMENT ("EULA"). THIS EULA IS A LEGAL AGREEMENT BETWEEN YOUR ORGANIZATION, THE END USER, AND SPECTRA LOGIC CORPORATION ("SPECTRA") FOR THE SPECTRA SOFTWARE PRODUCT WHICH INCLUDES COMPUTER SOFTWARE AND MAY INCLUDE ASSOCIATED MEDIA, PRINTED MEDIA, AND "ONLINE" OR ELECTRONIC DOCUMENTATION (COLLECTIVELY, "SOFTWARE PRODUCT"). BY INSTALLING, COPYING, OR OTHERWISE USING THE SOFTWARE PRODUCT, YOU AGREE TO BE BOUND BY THE TERMS OF THIS EULA. IF YOU DO NOT AGREE TO THE TERMS OF THIS EULA, YOU MAY NOT INSTALL, COPY, DOWNLOAD OR USE THE SOFTWARE PRODUCT. YOU AGREE THAT YOUR USE OF THE SOFTWARE ACKNOWLEDGES THAT YOU HAVE READ THIS AGREEMENT, UNDERSTAND IT, AND AGREE TO BE BOUND BY ITS TERMS AND CONDITIONS.

2. OWNERSHIP

It is understood and agreed that Spectra Logic Corporation, a Delaware corporation with offices at 6285 Lookout Road, Boulder, CO 80301 ("Licensor") is the owner of all right, title and interest to the Software Product, regardless of the media or form of the original download, whether by the World Wide Web, disk or otherwise. You, as licensee ("Licensee") through your downloading, installing, copying or use of this product do not acquire any ownership rights to the Software Product.

3. GENERAL

The Software Product is licensed, not sold, to you by Spectra for use only under the terms of this EULA. The Software Product is protected by copyright laws and international copyright treaties, as well as other intellectual property laws and treaties. The rights granted herein are limited to Spectra's and its licensors' intellectual property rights in the Software Product and do not include any other patents or intellectual property rights. The terms of this EULA will govern any software upgrades provided by Spectra that replace and/or supplement the original Software Product, unless such upgrade is accompanied by a separate license in which case the terms of that license will govern.

4. SOFTWARE PRODUCT

The Software Product, as used in this EULA, means, collectively and/or as applicable:

- The Software Product package;
- Any and all contents, components, attachments, software, media, and code with which this Agreement is provided and delivered;
- Any and all images, photographs, art, art work, clip art, fonts or other artistic works (the "Art Work");
- Related explanatory written materials and instructions, and any other possible documentation related thereto ("Documentation"); and
- Upgrades, modified versions, updates, additions and copies of the Software Product (the "Upgrades"), if any, licensed to by Spectra under this EULA.

5. GRANT OF LICENSE AND RESTRICTIONS

A. Spectra grants you a non-exclusive, non-transferable End-User license right to install the Software Product solely for the purpose for which it was created.

B. Unless provided otherwise in the Documentation or by prior express written consent of Spectra, you shall not display, modify, reproduce and distribute any Art Work, or portion(s) thereof, included with or relating to the Software Product, if any. Any such authorized display, modification, reproduction and distribution shall be in full accord with this EULA. Under no circumstances will your use, display, modification, reproduction and distribution of the Art Work give you any Intellectual Property or Proprietary Rights of the Art Work. All rights, title, and interest belong solely to Spectra.

C. Except for the initial loading of the Software Product, you shall not, without Spectra's express written consent:

- Copy or reproduce the Software Product; or
- Modify, adapt, or create derivative works based on the Software Product or any accompanying materials.

6. DESCRIPTION OF OTHER RIGHTS AND LIMITATIONS

A. Spectra will provide you with support services related to the Software Product ("Support"). Such Support will be provided in accordance with the Spectra Master Support Agreement, available for download and viewing on the Spectra Corporate Web site. Use of Support is governed by this EULA and Spectra's Master Support Agreement.

B. Any supplemental software, code, content, or media provided to you in the course of Support shall be considered part of the Software Product and subject to the terms and conditions of this EULA.

C. Spectra retains all right, title, and interest in and to the Software Product, and any rights not granted to you herein are reserved by Spectra. You hereby expressly agree not to extract information, reverse engineer, disassemble, decompile, or translate the Software Product, or otherwise attempt to derive the source code of the Software, except to the extent allowed under any applicable law. In the event that such activities are permitted by applicable law, any information you, or your authorized agent, discover shall be promptly disclosed to Spectra and shall be deemed the confidential information of Spectra.

D. You shall not modify, sublicense, assign, or transfer the Software Product or any rights under this EULA, except as expressly provided in this EULA. Any attempt to sublicense, assign, or transfer any of the rights, duties, or obligations will be void.

E. You may permanently transfer all of your rights under this EULA, provided you retain no copies. The other party must agree to accept the terms and conditions of the EULA.

7. ALL RESERVED

All rights not expressly granted herein are reserved by Spectra.

8. TERM

A. This License is effective until terminated. Licensee may terminate it at any time by destroying the Software Product with all copies, full or partial, and removing all of its component parts.

B. Your rights under this EULA will terminate automatically without notice from Spectra if you fail to comply with any term(s) or condition(s) of this EULA. In such event, no notice shall be required by Spectra to effect such termination.

C. Upon termination of this EULA, you shall cease all use of the Software Product and destroy all copies, full or partial, together with all backup copies, modifications, printed or written materials, and merged portions in any form and remove all component parts of the Software Product.

9. INTELLECTUAL PROPERTY RIGHTS

A. Spectra shall retain all right, title, and interest in the Software Product and to any modifications or improvements made thereto, and any upgrades, updates or Documentation provided to End User. End User will not obtain any rights in the Software Product, its updates, upgrades, and Documentation, as a result of its responsibilities hereunder.

B. End User acknowledges Spectra's exclusive rights in the Software Product and that the Software Product is unique and original to Spectra and that Spectra is owner thereof. Unless otherwise permitted by law, End User shall not, at any time during or after the effective Term of the Agreement, dispute or contest, directly or indirectly, Spectra's exclusive right and title to the Software Product or the validity thereof.

10. U.S. GOVERNMENT END USERS

The Software Product and related documentation are "Commercial Items," as that term is defined at 48 C.F.R. §2.101, consisting of "Commercial Computer Software" and "Commercial Computer Software Documentation," as such terms are used in 48 C.F.R. §12.212 or 48 C.F.R. §§227.7202-1 through 227.7202-4, as applicable. The Commercial Computer Software and Commercial Computer Software Documentation are being licensed to U.S. Government end users (a) only as Commercial Items and (b) with only those rights as are granted to all other End Users pursuant to the terms and conditions herein. Unpublished rights reserved under the copyright laws of the United States.

11. EXPORT LAW ASSURANCES

You may not use or otherwise export or re-export the Software Product except as authorized by United States law and the laws of the jurisdiction in which the Software Product was obtained. In particular, but without limitation, the Software Product may not be exported or re-exported (a) into (or to a nation or resident of) any U.S. embargoed countries or (b) to anyone on the U.S. Treasury Department's list of Specially Designated Nationals or the U.S. Department of Commerce Denied Persons List or Entity List. By installing or using any component of the Software Product, you represent and warrant that you are not located in, under control of, or a national or resident of any such country or on any such list.

12. DISCLAIMER OF WARRANTIES

YOU EXPRESSLY ACKNOWLEDGE AND AGREE THAT USE OF THE SOFTWARE PRODUCT IS AT YOUR SOLE RISK AND THAT THE ENTIRE RISK AS TO SATISFACTORY QUALITY, PERFORMANCE, ACCURACY AND EFFORT IS WITH YOU. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, AND EXCEPT AS MAY BE STATED IN THE SPECTRA MASTER SERVICE AGREEMENT, THE SOFTWARE PRODUCT IS PROVIDED "AS IS," WITH ALL FAULTS AND WITHOUT WARRANTY OF ANY KIND, AND SPECTRA AND SPECTRA'S AFFILIATES (COLLECTIVELY REFERRED TO AS "SPECTRA" FOR THE PURPOSES OF SECTIONS 12 AND 13) HEREBY DISCLAIM ALL WARRANTIES AND CONDITIONS WITH RESPECT TO THE SOFTWARE PRODUCT, EITHER EXPRESS, IMPLIED OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES AND/OR CONDITIONS OF MERCHANTABILITY, OF SATISFACTORY QUALITY, OF FITNESS FOR A PARTICULAR PURPOSE, OF ACCURACY, OF QUIET ENJOYMENT, AND NON-INFRINGEMENT OF THIRD-PARTY RIGHTS. SPECTRA DOES NOT WARRANT AGAINST INTERFERENCE WITH YOUR ENJOYMENT OF THE SOFTWARE PRODUCT THAT THE FUNCTIONS CONTAINED IN THE SOFTWARE PRODUCT WILL MEET YOUR REQUIREMENTS, THAT THE OPERATION OF THE SOFTWARE PRODUCT WILL BE UNINTERRUPTED OR ERROR-FREE, OR THAT DEFECTS IN THE SOFTWARE PRODUCT WILL BE CORRECTED. NO ORAL OR WRITTEN INFORMATION OR ADVICE GIVEN BY SPECTRA OR A SPECTRA AUTHORIZED REPRESENTATIVE SHALL CREATE A WARRANTY. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OF IMPLIED WARRANTIES OR LIMITATION ON APPLICABLE STATUTORY RIGHTS OF A CONSUMER, SO THE ABOVE EXCLUSION AND LIMITATIONS MAY NOT APPLY TO YOU.

13. LIMITATION OF LIABILITY

TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL SPECTRA, ITS AFFILIATES OR LICENSEES, BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT, OR CONSEQUENTIAL DAMAGES WHATSOEVER (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION, LOSS OF BUSINESS INFORMATION, OR ANY OTHER PECUNIARY LOSS) ARISING OUT OF THE USE OF OR INABILITY TO USE THE SOFTWARE PRODUCT OR THE PROVISION OF OR FAILURE TO PROVIDE SUPPORT SERVICES, EVEN IF SPECTRA HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN ANY CASE, SPECTRA'S ENTIRE LIABILITY UNDER ANY PROVISION OF THIS EULA SHALL BE LIMITED TO THE AMOUNT ACTUALLY PAID BY YOU FOR THE SOFTWARE PRODUCT; PROVIDED HOWEVER, IF YOU HAVE ENTERED INTO A MASTER SUPPORT AGREEMENT, SPECTRA'S ENTIRE LIABILITY REGARDING SUPPORT SERVICES SHALL BE GOVERNED BY THE TERMS OF THAT AGREEMENT. BECAUSE SOME STATES AND JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF LIABILITY, THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

14. CONTROLLING LAW AND SEVERABILITY

This EULA will be governed by and construed in accordance with the laws of the State of Colorado, as applied to agreements entered into and to be performed entirely within Colorado between Colorado residents. This EULA shall not be governed by the United Nations Convention on Contracts for the International Sale of Goods, the application of which is expressly excluded. If for any reason a court of competent jurisdiction finds any provision, or portion thereof, to be unenforceable, the remainder of this EULA shall continue in full force and effect.

About This Guide

This guide describes how to configure, use, maintain, and troubleshoot the Spectra® Cube™ library. It also provides specifications for the library.

Intended Audience

This guide is intended for data center administrators and operators who maintain and operate backup systems. The information in this guide assumes a familiarity with SCSI and Fibre Channel command protocols, as well as with network connectivity protocols such as Fibre Channel, SAS, and Ethernet. It also assumes a knowledge of technical tasks such as configuring operating systems and installing drivers.

Product Status

The Spectra Logic® Technical Support portal provides information about which products are currently supported and which are considered discontinued. To view information about discontinued products, log into the portal (see Accessing the Technical Support Portal on page 145).

RELATED INFORMATION

This section contains information about this document and other documents related to the Spectra Cube library.

User Interface Screens

The interface changes as new features are added or other modifications are made between software revisions. Therefore, the screens on your library may differ from those shown in this document.

Additional Publications

For additional information about the Spectra Cube library and its drives, refer to the publications listed in this section.

Spectra Cube Tape Library

This guide and the following documents related to the Spectra Cube library are available as PDF files on the Spectra Logic website at *support.spectralogic.com/documentation.*

- The *Spectra Tape Libraries SCSI Developer's Guide* provides detailed information about the SCSI and Fibre Channel commands used in the library.
- The *Spectra Tape Libraries Warnings* document provides all of the warnings found in Spectra™ tape libraries documentation, in English and 27 other languages.

LTO Ultrium Tape Drives

The following documents provide information that is applicable to all IBM LTO tape drives.

- *IBM Tape Device Drivers Installation and User's Guide*

  Note: This guide also provides information about using the IBM Tape Diagnostic Tool (ITDT) to troubleshoot drive problems.

- *IBM TotalStorage LTO Ultrium Tape Drive: SCSI Reference*

For drive-specific information, search for the product name (for example, LTO 8) on the documentation page on the IBM website. You can also search the IBM Support Portal at: *ibm.com/support/knowledgecenter/*.

Typographical Conventions

This document uses the following conventions to highlight important information:

WARNING Read text marked by the "Warning" icon for information you must know to avoid personal injury.

CAUTION Read text marked by the "Caution" icon for information you must know to avoid damaging the library, the tape drives, or losing data.

IMPORTANT Read text marked by the "Important" icon for information that helps you complete a procedure or avoid extra steps.

Note: Read text marked with "Note" for additional information or suggestions about the current topic.

Chapter 1 - Library Overview

The Spectra Cube enterprise-class library is designed and built to meet the stringent requirements for data integrity, data security and high reliability in the enterprise environment.

This chapter provides an overview of the Cube library features and components.

Library Features 17
- LumOS software 17
- Front Panel Components 20
- Interior Components 22
- Rear Components 24
- Operator Panel Touch Screen 25
- TeraPack Access Port (TAP) 26
- Spectra Library Control Module 27
- Exporting Controllers 29
- Tape Drives 29

TeraPack Cartridge Handling 31

Overview of the LumOS User Interface 32
- Access Options 32
- LumOS Web Interface 32
- User Interface Features 33

Logging in to the LumOS User Interface 35
- Dashboard 36

LIBRARY FEATURES

This section provides an overview of the features that make the Spectra Cube library a highly versatile enterprise storage solution.

LumOS software

The library's LumOS software lets you set configuration options, view library and drive information and metrics, manage cartridges, and monitor library operations. You can access the LumOS interface using any of the following methods:

- The Cube operator panel interface — via the touch screen on the library's operator panel.
- The LumOS web interface — via the Remote Library Controller (RLC) using a standard web browser.
- The LumOS ReST API — via API Platform software or a custom program developed to use the LumOS ReST API.

See Overview of the LumOS User Interface on page 32, for detailed information about the features and controls provided by the LumOS user interface.

IMPORTANT

Many of the features described in this user guide require your library to be running the most current version of the LumOS software. Spectra Logic recommends that you keep your library's LumOS software and component firmware up-to-date at all times. If you are using a previously released LumOS package, upgrading to the current release is strongly recommended. See Maintaining The Library on page 116 for detailed information.

The LumOS software includes the following features (listed in alphabetical order).

API Command Interface

The API interface provides a set of commands for use in customer-generated programs used for controlling all library operations without using the LumOS user interface.

Auto Configuration Save

The Auto Configuration Save feature automatically generates a daily backup file on the LCM. The backup file contains the library configuration, partition configuration, move history, and the MLM and DLM databases, as well as the encryption configuration and any BlueScale™ encryption keys.

If desired, you can download the backup file after it is created. Having an external copy of the backup file ensures that you can recover the library configuration, as well as the MLM and DLM databases, in the event of a disaster and is highly recommended.

Auto Drive Clean

Auto Drive Clean provides library-based cleaning of drives without user intervention. Automated drive cleaning results in fewer failed tape read/write operations and is the recommended method for cleaning drives.

The Auto Drive Clean feature uses a dedicated cleaning partition for storing cleaning cartridges. The cleaning partition can be shared by multiple storage partitions and is used by the library to automatically clean drives whenever necessary.

Diagnostics and Utilities

Diagnostics and utilities are available through the LumOS interface. Selecting a diagnostic or utility displays additional information, including whether or not you can run the operation while the library is operating.

IMPORTANT In general, the library diagnostics and advanced utilities are only for use under the direction of Spectra Logic Technical Support.

Drive Lifecycle Management

Drive Lifecycle Management (DLM) helps you identify drives that are experiencing high error rates or other problems. See Understanding Drive Lifecycle Management on page 111 for detailed information.

Encryption Key Management

The Spectra Cube library can encrypt data and manage encryption keys using BlueScale key management. See Encryption on page 75 for detailed information.

Media Lifecycle Management

Media Lifecycle Management (MLM) helps you manage your tape media by giving you tools to proactively determine potential media errors before they happen. See Media Lifecycle Management on page 107 for detailed information about configuring and using the MLM features.

Shared Library Services (SLS) Partitioning

The library uses Shared Library Services (SLS) virtualization technology to partition the library into multiple virtual libraries. See Partition Overview on page 62 for detailed information about how partitions function in the library. See Creating A Partition on page 65 for detailed information about configuring and using partitions.

SlotIQ

SlotIQ optimizes robotics performance by allowing the library to virtualize slot locations and optimize the order of moves in a queue to reduce the amount of robotic movement required for any set of moves.

Soft Load

The Soft Load feature uses the drives soft load (or auto load) functionality to improve library performance. Soft Load requires that the library have a high performance transporter and that the partition use LTO-6 or later generation drives.

Spectra Swarm

The Spectra Swarm bridge is a high-performance storage controller that adds 40-Gigabit Ethernet connectivity to SAS tape drives. See the *Spectra Swarm Bridge Installation & Configuration Guide* for more information.

Front Panel Components

Figure 1 shows the front components of the library.

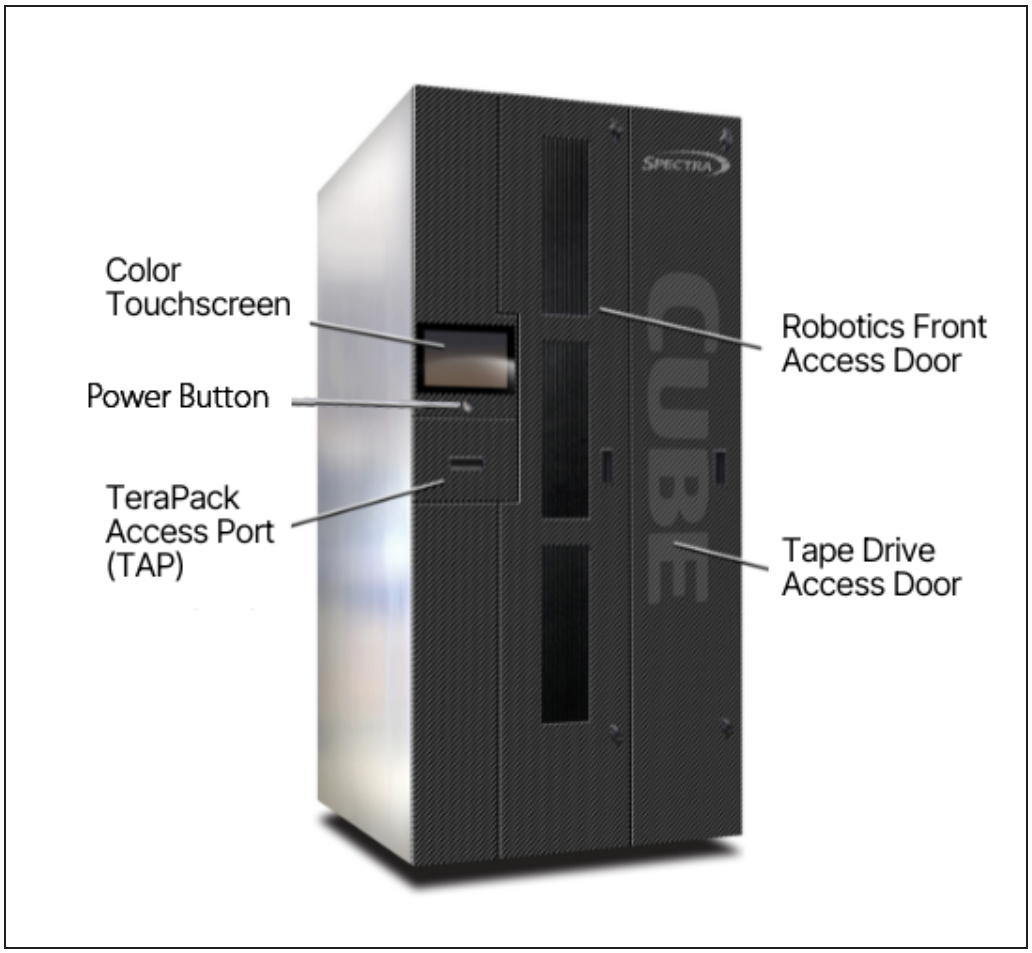


Figure 1 Front panel components.

The following table describes each of the components shown in Figure 1.

Component	Description
Touchscreen	The color touchscreen allows you to access the LumOS user interface which controls all aspects of the library.
Power Button	The power button controls library power. The button illuminates when the library is powered on.
TeraPack Access Port (TAP)	The TeraPack™ Access Port (TAP) acts as an entry/exit port that lets you import media into or remove media from the library. To learn more about the TAP, see TeraPack Access Port (TAP) on page 26.

Component	Description
Robotics Front Access Door	The robotics front access door, positioned in the center of the library frame, allows you to access the interior of the library for service. This door is closed during normal operation. See Interior Components on the next page for more information.
Tape Drive Access Door	The tape drive access door allows access to tape drives, the LCM, and Ethernet switches installed in the library. This door is closed during normal operation. See Interior Components on the next page for more information.

Interior Components

Figure 2 shows the interior components of the library.

Note: The interior components are shown for reference only. They are not accessible during normal operation.

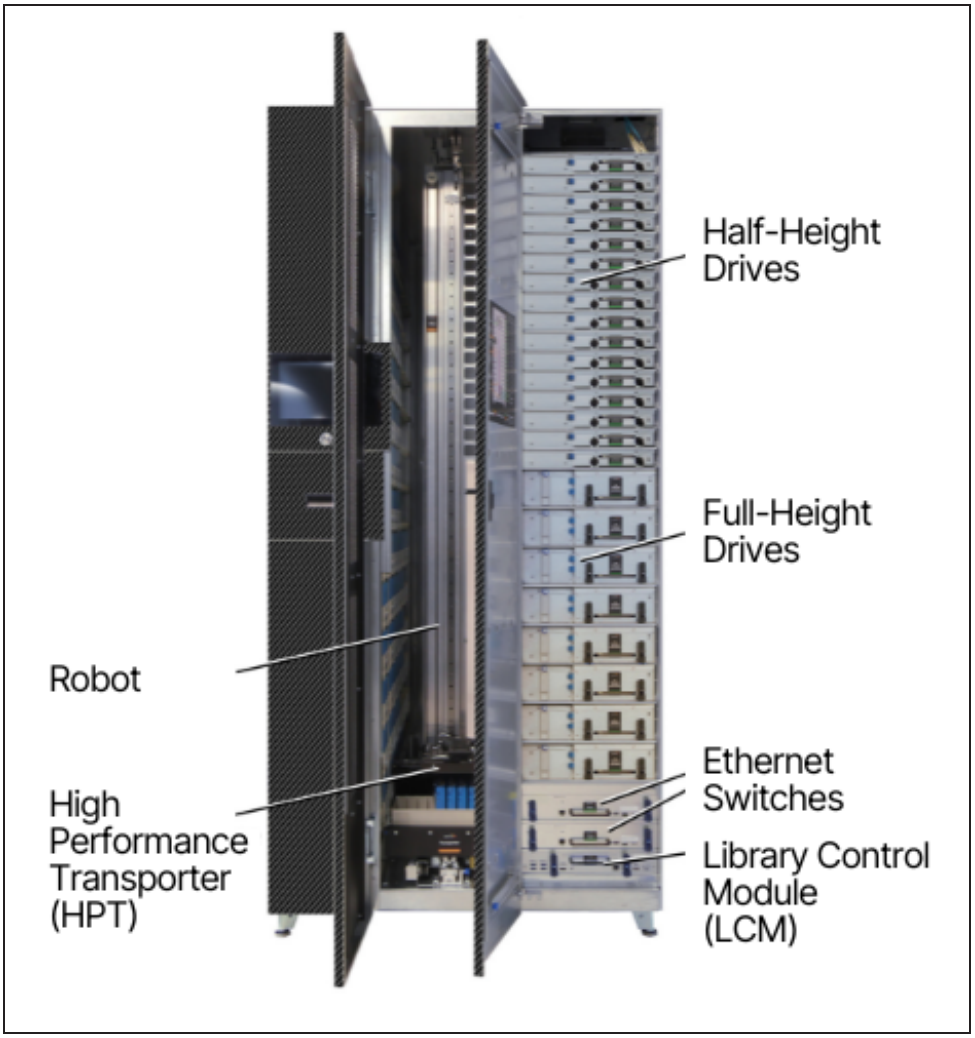


Figure 2 Library interior components (Robotics and Drive access doors opened).

The following table describes each of the components shown in Figure 2.

Component	Description
Robot	The **TeraPorter** and the **transporter** make up the robotic mechanism used to perform all media movement within the library. The TeraPorter moves along the **horizontal axis** (HAX) and the transporter moves up and down the **vertical axis** (VAX).

Component	Description
High Performance Transporter	The High Performance Transporter (HPT) is mounted on the TeraPorter. During normal operation, the HPT retrieves a magazine from a source chamber and holds it while the robotics move to the destination drive. The **cartridge picker** then removes the requested individual cartridge from the magazine and inserts it into a drive. When the drive is finished using the cartridge and ejects it, the cartridge picker retrieves the cartridge and returns it to a magazine. The robotics then move the transporter to return the magazine to a chamber. The **barcode reader**, mounted on the cartridge picker, reads the barcode labels on TeraPack magazines and individual cartridges. The library uses the barcode label information to maintain an inventory of the media currently stored inside the library.
Tape Drives (full-height or half-height)	The library accommodates multiple generations of high-performance, high-capacity, full-height and half-height LTO drives. The library supports up to 16 full-height drives, or up to 30 half-height drives. The two drive form factors can be mixed in the same library. Drives are hot-swappable to provide uninterrupted operation. **Note:** Any drive bays that do not have drives installed must have covers installed to maintain proper air circulation throughout the frame and to protect internal library components.
Ethernet Switches	One or more Ethernet switches are installed to provide internal communication between the LCM and tape drives. **Note:** The external Ethernet ports on the Ethernet switches are not used at this time.
Library Control Module (LCM)	A dedicated on-board library control module (LCM) runs the LumOS software that controls all aspects of library operation.
Media Storage (not shown)	All of the media in the library is stored in TeraPack magazines. Each magazine contains ten slots for LTO cartridges. The magazines are placed on shelves divided into chambers. Each chamber provides storage for one TeraPack magazine.
Interior Lights (not shown)	LEDs mounted to the top of the library interior provide illumination automatically when the Robotics Door is opened.
Weather Stations (not shown)	Sensors to monitor the library's internal temperature and humidity.

Rear Components

Figure 3 shows the rear panel components of the library frame.

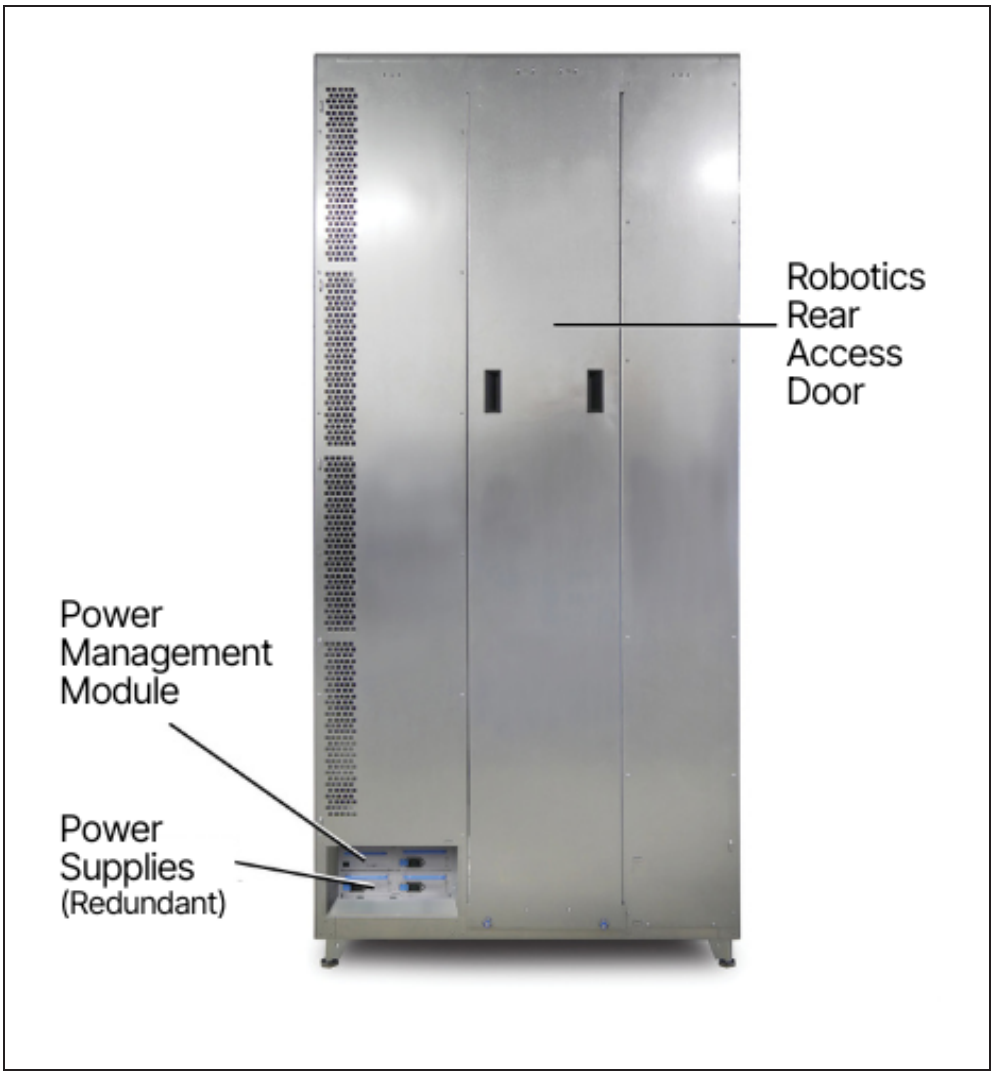


Figure 3 Library rear components.

The following table describes each of the components shown in Figure 3.

Component	Description
Power Management Module	The Power Management Module (PMM) controls all aspects of library power. The PMM interfaces with front-end AC-DC power supplies to control power to the system. The PMM generates power for robotics. The PMM also controls the safety disconnect circuit.
Power Supply Modules	The power supply modules convert AC input to provide power used by drives in the library. These power supplies also provide power to the LCM and the LCD operator panel.

Component	Description
	The number of supplies required by a library is calculated by Spectra Logic based on the number and type of drives in the library. Extra supplies provide redundancy and failover protection.

Operator Panel Touch Screen

The operator panel touch screen provides local access to the LumOS user interface through the Library Control Module (LCM). You can select options and enter information by touching the appropriate location on the screen. For detailed information about using the LumOS user interface through the touch screen, see Overview of the LumOS User Interface on page 32.

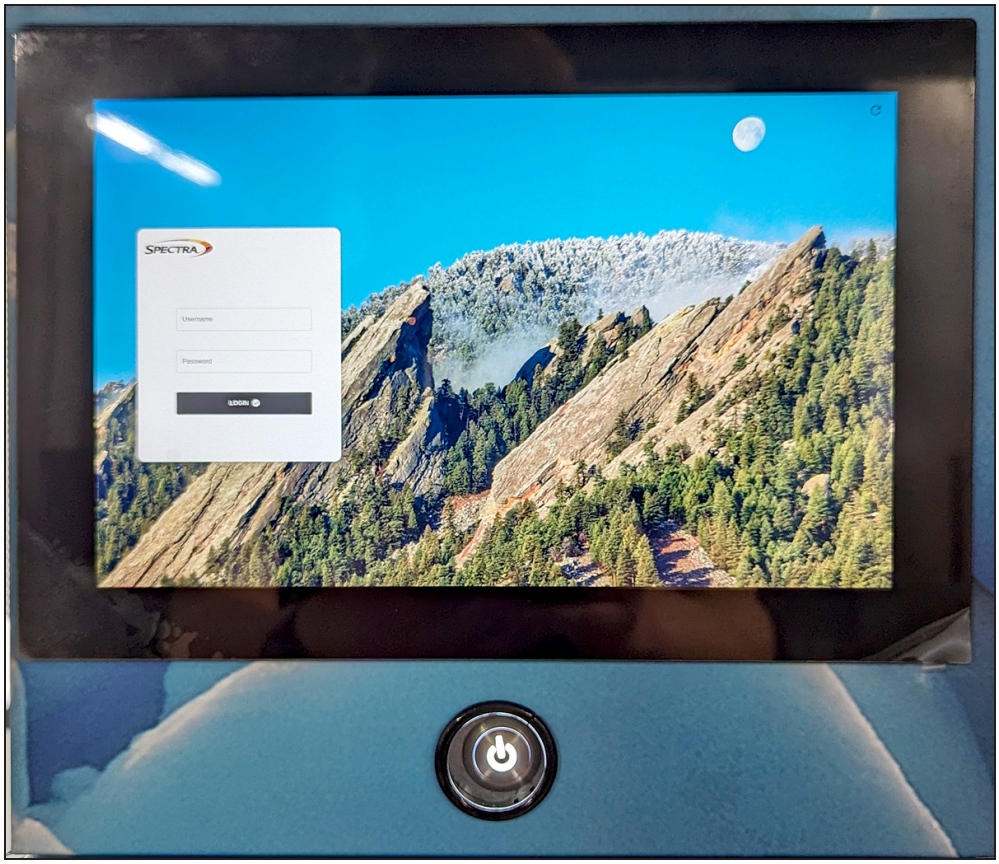


Figure 4 The library operator panel touch screen displaying the Dashboard of the LumOS user interface.

The operator panel includes the following features:

Component	Description
LCD touch screen	The LCD touch screen lets you monitor library operations and select configuration options using the LumOS user interface.

Component	Description
Power Button	The power button provides front panel on/off control of the library.

TeraPack Access Port (TAP)

The TeraPack Access Port (TAP) acts as entry/exit port that lets you import magazines into or export magazines from the library. A magazine can contain one or more cartridges or it can be empty.

Note: To import or export individual cartridges, they must be placed in a magazine.

Using the TAP to move cartridges into and out of the library provides these key advantages:

- **Data Security** — Media is never stored in the TAP. A newly inserted TeraPack magazine is automatically moved into the library and placed in a storage chamber. A magazine already in the library is only moved to the TAP when you request an export operation through the user interface. Data security and backup integrity are enhanced because the media stored in the library can only be physically accessed using the password-protected LumOS user interface or API.
- **Convenience** — Instead of individually importing or exporting single cartridges as you would with a traditional entry/exit port, using a TAP lets you handle multiple cartridges in a single operation, thus reducing the time spent on import and export tasks.

Figure 5 The TAP with a TeraPack magazine loaded.

Spectra Library Control Module

The library uses a control module called the Spectra Library Control Module (LCM). The dedicated computer runs the library's LumOS software, which controls and manages all aspects of the library operation.

Spectra LCM Overview

The LCM runs the LumOS software, which provides the LumOS user interface that is used to perform all configuration, import/export, and management functions for the library. The LumOS user interface is accessible locally through the library's touch screen and remotely using a standard web browser.

In addition to providing the user interface, the LumOS software running on the LCM generates and maintains the MLM database, BlueScale encryption keys, system logs, and other information related to the current system status. It also handles email operation.

The LCM also processes media changer commands from the hosts and storage management software to control the operation of the TeraPorter. The LCM stores all of the information about the location and status of each element in the library, as well as the raw media inventory in its nonvolatile memory.

Figure 6 shows the external components on a Spectra Library Control Module.

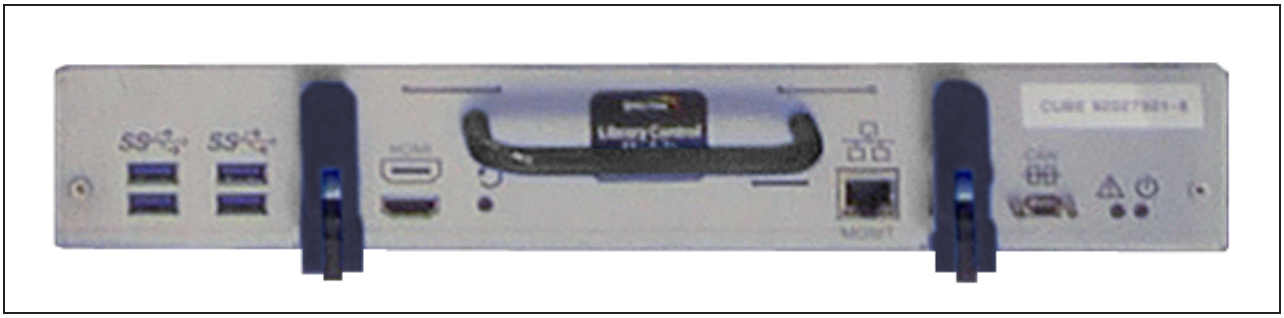


Figure 6 The connectors and components on a Spectra LCM.

The following table describes the components shown in Figure 6.

Component	Description
USB Ports (4)	The USB ports on the LCM can be used to connect a USB device for saving configurations and uploading LumOS software packages. You can also connect a USB keyboard and mouse to the USB ports on the LCM and use them when interacting with the LumOS user interface. This connection provides access to all of the options available from the library's front panel touch screen.

Component	Description
Monitor Connector	This connector is only used for troubleshooting by Spectra Logic service personnel.
Ethernet Ports	The two Ethernet ports on the LCM connect the library to an Ethernet network and is used to access the library through the LumOS web interface using the Remote Library Controller (RLC). The LumOS web interface provides access to all of the options available from the library's operator panel except those that require physical interaction with the library (for example, importing or exporting media). The Spectra LCM has a 10/100/1000BaseT connection.
Internal Drive	In the LCM, an internal NVMe drive stores the library's configuration information, activation keys, system settings, and partition settings. It also stores the MLM and DLM databases and information related to the current system status.
RS-232 and CAN Connectors	These connectors are only used for troubleshooting by Spectra Logic service personnel.
Status Lights	Two LEDs illuminate to show power to the LCM, and fault status when applicable. One LED illuminates green when power is applied. The second LED is off during normal operation, and illuminates red when a fault condition occurs.

Exporting Controllers

A direct-attached LTO-6 or later generation drive is required to provide the control path for the library's robotics. When configuring a storage partition, the drive you select to provide the robotic control path is referred to as the "exporting controller" for the partition.

The controller is the bridge between an external Fibre Channel or SAS connection from the host and the internal interface used by the library. It provides the control path for the media changer commands sent from the host to the library. The controller relays the commands to the LCM, which processes the commands and uses them to control the robotics in the library.

A minimum of one exporting controller is required to connect the library's robotics to the Fibre Channel or SAS network. The commands to control the motion of the robotics within the partition are sent from the host to the exporting drive's logical unit number 1 (LUN 1). The motion control commands are then routed to the robotics using the exporting drive's Automation/Drive Interface (ADI).

To learn more about the role the controller plays in the library, see TeraPorter Connectivity.

Notes:
- A tape drive can only provide the control path for one partition.
- The library supports up to 30 drive exporters.

Tape Drives

The library supports LTO-6 and later generation Fibre Channel full-height drives, LTO-7 and later generation half-height Fibre Channel drives, and LTO-9 full-height SAS drives. The drives are mounted in drive sleds that lock in place when installed in the library. Drives are hot-swappable to provide uninterrupted operation.

Note: To prevent issues with transporter position calibration, do not put labels on the front face of drives.

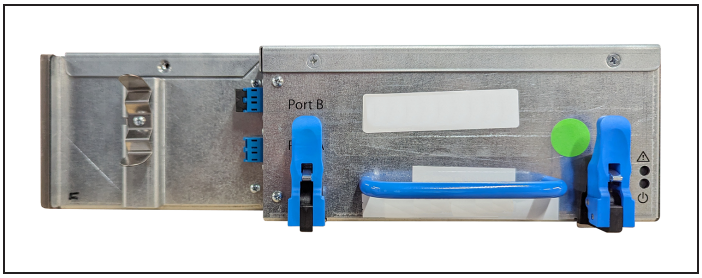


Figure 7 The LTO-6 and later full-height Fibre Channel drive sled.

Figure 8 The LTO-7 and later half-height Fibre Channel drive sled.

The following table describes the drive components.

Component	Description
Drive Sled	The drive sled provides the electrical and logical connections to the library, as well as the connections to the host Fibre Channel arbitrated loop or fabric or SAS network. The drive sled firmware assigns an identifier to the drive based on its location in the library (see Drive Component Identifiers on page 44). This identifier is used to identify the drives in the Cube and ReST API. See Drive Connectivity on page 47 for additional information about the connectivity provided by the drive sled.
Fibre Channel Connectors	Each Fibre Channel drive sled has two multi-mode optical SFP LC connectors (Port A and Port B) that are used to connect the drive directly to a Fibre Channel network. The two ports let you connect two separate fiber optic cables to each drive for failover redundancy. The two ports cannot be used simultaneously.
SAS Connectors	Each SAS drive sled has a two, unshielded, single-port SFF-8088 (LTO-6 through 8) or SFF-8644 (LTO-9) serial connector that provides the Serial Attached SCSI (SAS) connectivity for the drive.
Status LEDs	Two LEDs indicate power on and failure status. One LED illuminates green when power is applied. The second LED is off during normal operation, and illuminates red when a fault condition occurs.
Locking Levers (full height) **Locking Knobs** (half-height)	Drives sleds are locked into place by either locking levers or locking knobs, depending on drive form factor. The levers or knobs allow you to manually lock the drive sled in place. The levers are released, or roated open, to remove the drive sled from the library.

For more information about the drives in the library, see:

- LTO Ultrium Tape Drives on page 15 for a list of documents that provide information that is applicable to all IBM LTO tape drives.
- LTO Tape Drive Specifications on page 177 for information about the transfer rates and storage capacities of LTO drives.
- Component Interface Connectors on page 174 for cabling requirements for host connections to the drives.

TERAPACK CARTRIDGE HANDLING

The library optimizes space usage by storing media on horizontal shelves. This horizontal storage provides very high density by using space within the library instead of the limited space provided by the vertical library walls. Each horizontal shelf is divided into multiple equal-sized media storage chambers. Each chamber accommodates a single TeraPack magazine.

The library uses TeraPack magazines to import and export cartridges through the TAP and to store cartridges inside the library. Each magazine holds up to ten LTO cartridges. The magazine has guides along each side and grooves on the bottom to ensure proper alignment when it is inserted into the TAP.

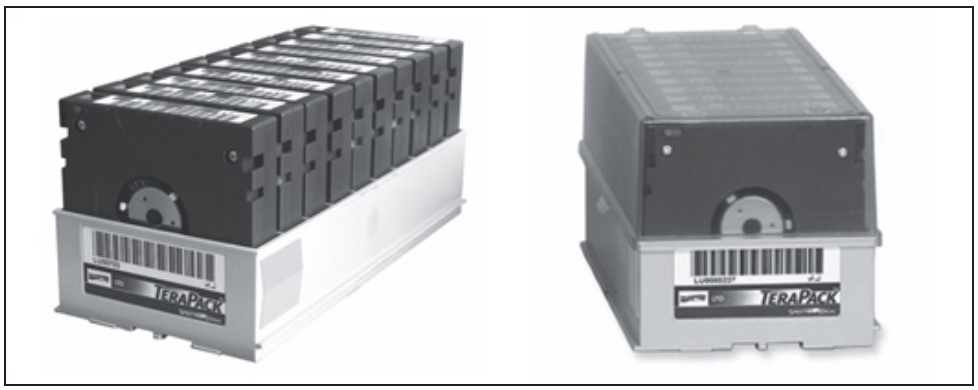


Figure 9 TeraPack magazine with barcode labeled cartridges and plastic dust cover.

Storing and handling cartridges in TeraPack magazines helps eliminate errors resulting from mishandling individual tapes, which is the leading cause of tape damage. When inside the library, TeraPack magazines are stored in semi-enclosed chambers. When not in the library, an optional clear plastic dust cover snaps onto the magazine to protect the cartridges. The cartridges are continually protected by the TeraPack magazine, both inside and outside of the library.

Using TeraPack magazines offers the following advantages:

- **Barcode labeling** All of the cartridges in a TeraPack magazine, as well as the magazine itself, are barcode labeled for easy identification.
- **Grouped media** The cartridges in a TeraPack magazine are treated as a single unit during import and export operations. This grouped media handling simplifies media management tasks by eliminating the need to import or export cartridges one by one.

Overview of the LumOS User Interface

The LumOS user interface lets you set configuration options, view library and drive information and metrics, manage media, monitor library operations, and perform maintenance operations.

Access Options

The LumOS user interface is accessed using either the touch screen on the library operator panel or through the LumOS web interface.

Operator Panel Touch Screen Interface

The touch screen on the operator panel is the library's local LumOS user interface. You select options and enter information by simply touching the appropriate location on the screen with a stylus or your finger. The touch screen interface includes a soft keyboard that you can use to enter characters into the text fields.

LumOS Web Interface

The LumOS web interface lets you use a standard web browser to access the library through the Remote Library Controller (RLC). Simply enter the library's IP address into a browser running on a computer, tablet, or phone that can access the Ethernet network connected to the library's LCM module.

The LumOS web interface provides access to the same features and functions that are available through the touch screen, excluding functions that involve physical interaction with the library.

Note: Users with sufficient permissions can manually override and remove the restrictions on functions that involve physical interaction.

When using the web interface, keep the following requirements in mind:

Supported Browsers

Remote access to the library through the web interface is only officially supported using the Google® Chrome™ browser.

Additional browsers have not been fully tested with the LumOS web interface. Using an unsupported browser may result in the LumOS web interface not displaying or operating as expected.

User Interface Features

The following sections describe the common LumOS user interface features.

Toolbars

The toolbar panel appears along the top edge of each screen and lets you navigate through the available toolbars to select options. Clicking on a toolbar expands it to display the available options.

Option Overview

The following table provides an overview of the options available under each toolbar.

Toolbar	Available Options
Status	The Status toolbar provides access to Status Messages, Drive Lifetime Management (DLM), Media Lifetime Management (MLM), Robotics, and Library Hardware screens. • Status Messages - Displays Info, Summary, Warning, Error, and Fatal Error messages. • DLM - Displays all present drives with access to their health status, mount history, and details. • MLM - Displays all present tapes with access to their health status, barcode, and details. • Robotics - Displays the status of the robot inside the library and its details. When accessed from the operator panel, users can send robots to service. • Library Hardware - Displays the health status and details of all hardware present in the library.
Configuration	The Configuration toolbar provides access to Partitions, Package Update, Drive Firmware Update, Settings, Licensing, User Management, and Encryption screens. • Partitions - Displays all Cleaning and Storage partitions. Users can use the Partitions screen to create, edit, and delete partitions. • Package Update - Displays the active package and allows users to upload, change, and delete packages. • Drive Firmware Update - Displays the Drive Firmware Update screen, which provides controls for staging and committing drive firmware updates. • Settings - Displays the Settings screen, which allows users to modify basic, authentication, network, and metric settings.

Toolbar	Available Options
	• Licensing - Displays the Licensing screen, which allows users to view existing licenses and add new license keys. • User Management - Displays the Users screen, which allows users to create, edit, or delete users. • Encryption - Displays the Encryption screen, which allows users to add, import, export, or delete a BlueScale encryption key, add a KMIP server, and change the encryption password.
Operations	The Operations toolbar provides access to the Move Media, Exchange Media, Import Media, and Export Media screens. • Move Media - Displays all Cleaning and Storage partitions and allows users to move media inside the library. • Exchange Media - Only accessible on the operator panel. Displays all pools and magazines and allows the user to import or export magazines through the TAP. • Import Media - Only accessible on the operator panel. Displays all available partitions and allows the user to import magazines into partitions using the TAP. • Export Media - Only accessible on the operator panel. Displays all available partitions and allows the user to export magazines from partitions using the TAP.
Tools	The Tools toolbar provides access to the Log Gather, Backup/Restore, Diagnostic, and Alerts screen. • Log Gather - Displays the Log Gather screen, which allows the user to select a log type and time range and initiate a log gather. • Backup/Restore - Displays the Backup/Restore screen, which allows the user to create, delete, upload, download, and restore from a backup file. • Diagnostics - Displays the Diagnostics screen, which allows the user to run diagnostics to troubleshoot the library. These tests should only be performed under guidance from Spectra Logic Technical Support. • Alerts - Displays the Alerts screen, which allows the user to configure automatic alerts and add subscribers to the alert mail list.

LOGGING IN TO THE LUMOS USER INTERFACE

To log in to the LumOS user interface, use the front panel. To access the web interface, use the front panel to determine the Cube library's IP address, then open a web browser on a computer on the same network and enter the IP address of the library. The login screen displays.

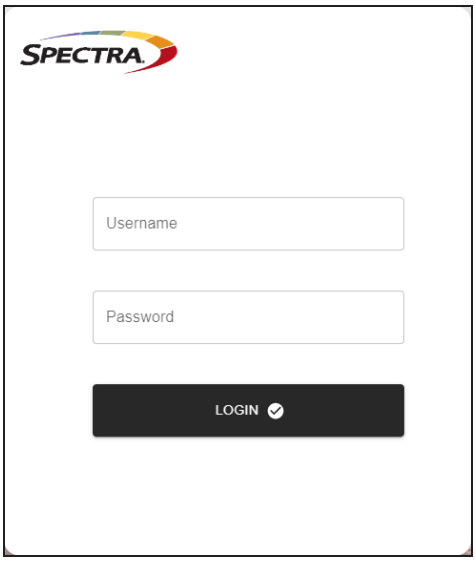


Figure 10 The Cube Login screen.

Enter in the **Username** and **Password** and click **Login** to log in.

- The default username is **su**.
- The default password is **spectra**.

Note: When logging into the LumOS interface, the web page defaults to **Operations > Move Media** page with the dashboard displayed.

The LumOS Web Interface

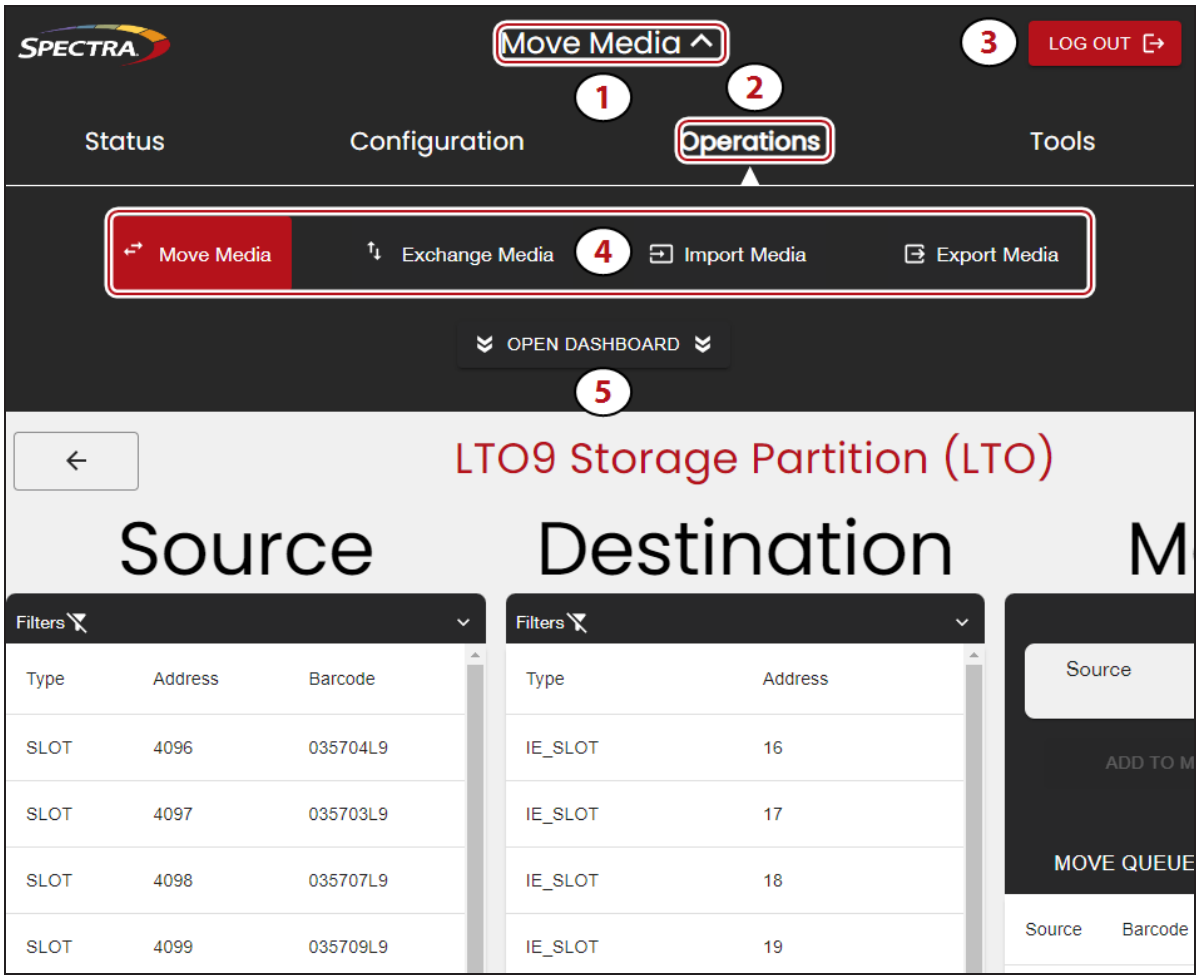


Figure 11 The LumOS web interface features.

1. The current selected screen.
2. The current selected toolbar.
3. The **Log Out** button.
4. All feature screens available under the current selected toolbar.
5. The **Open Dashboard** button expands the LumOS user interface dashboard. See Dashboard below for more detail.

Dashboard

The LumOS user interface dashboard provides an overview of the Cube library status. Expand the title bar and then select **Open Dashboard**. Use the figure below to help you navigate the dashboard.

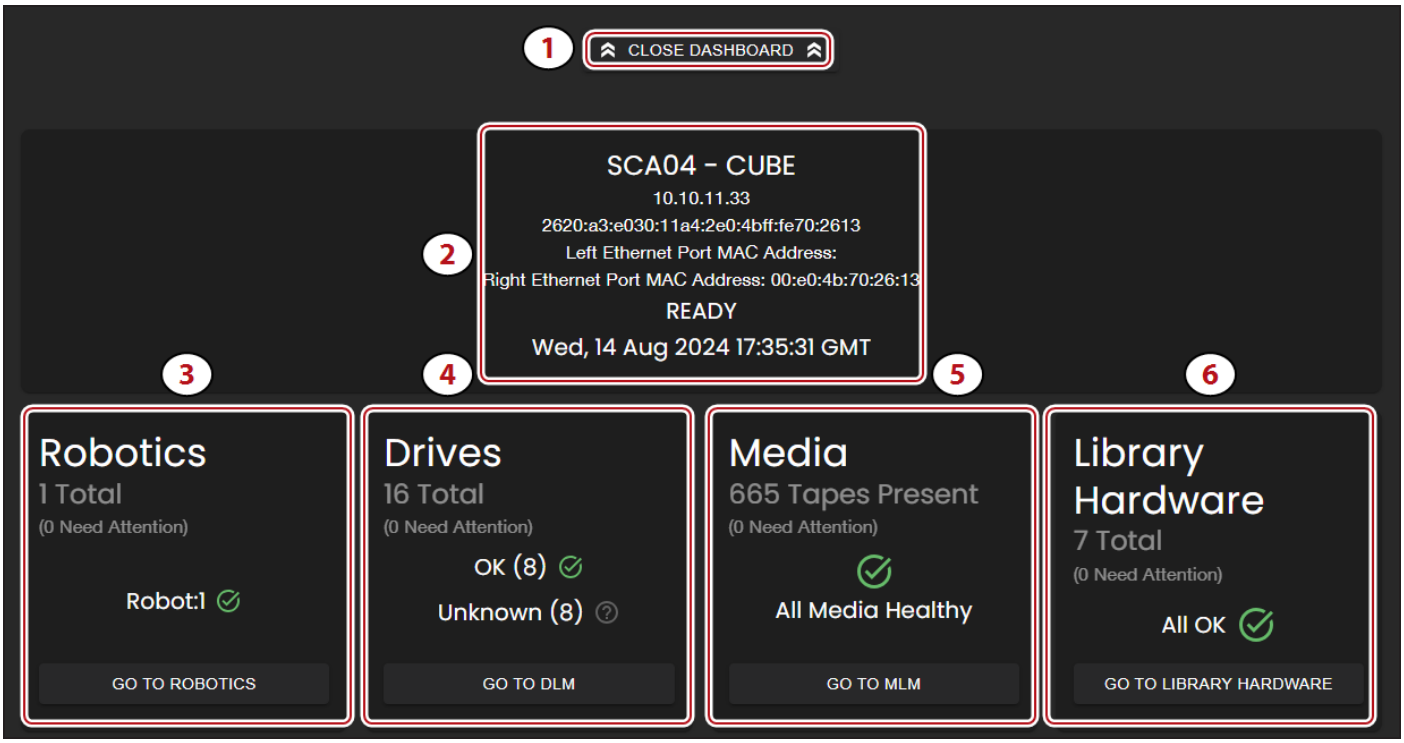


Figure 12 The Cube Dashboard.

Cube Dashboard

1. Click **Open Dashboard** to view the dashboard.
2. **System** information lists library name, IP address, MAC address, and GMT time.
3. **Robotics** information lists the number of robots and their health status. Click **Go To Robotics** to view the Robotics page.
4. **Drives** information lists the number of drives and their health status. Click **Go To DLM** to view the Drive Lifetime Management page.
5. **Media** information lists the number of tapes and their health status. Click **Go To MLM** to view the Media Lifetime Management page.
6. **Library Hardware** information lists all hardware elements in the Cube library and their health status. Click **Go To Library Hardware** to view the Library Hardware page.

Chapter 2 - Architecture Overview

The Spectra Cube library is designed to provide maximum flexibility and ease of use in an enterprise-class system.

Media Pools **39**

Library Partitions **40**

Storage Partitions 40

Cleaning Partitions and Auto Drive Clean 41

Component Identifiers **43**

Drive Component Identifiers 44

Chamber Component Locators 44

Connectivity **46**

TeraPorter Connectivity 46

Drive Connectivity 47

High-Availability Configurations **49**

Redundant Connectivity 49

Redundant Power Supplies 50

MEDIA POOLS

Inside the library, magazines and cartridges are logically grouped through the use of pools. These pools are made up of chambers, each of which accommodates a single magazine. The library has three different types of pools: storage pools, entry/exit pools, and the free pool.

Storage pool

The chambers in a storage partition's storage pool provide the cartridge storage for a partition. You specify the number of chambers assigned to a storage pool when you create a partition.

- Each storage partition has its own storage pool containing at least one chamber. The cartridges in the storage pool are available for use by the host storage management software that accesses the partition.
- A cleaning partition has at least one chamber in its storage pool and can be shared by multiple storage partitions. The cleaning cartridges stored in the cleaning partition are not accessible to the storage management software.

Entry/Exit pool

The chambers in an entry/exit pool provide an interim storage location for cartridges during import and export operations. You specify the number of entry/exit pool chambers when you create a storage partition. Cleaning partitions do not have an entry/exit pool.

IMPORTANT The host storage management software cannot use the cartridges in the entry/exit pool for backup jobs. However, the storage management software can access the cartridges stored in the entry/exit pool to move them into the storage pool.

A cartridge is in the entry/exit pool for one of the following reasons:

- It was ejected from the storage pool by the storage management software, or moved manually using the LumOS user interface.
- A magazine containing one or more cartridges was imported into the library. From the entry/exit pool, the cartridges can be imported into the storage partition's storage pool.
- A magazine containing one or more special-purpose cartridges was imported into the library using the TAP. These cartridges may be used for cleaning a drive.

Free pool

Chambers that are not assigned to a partition are in the free pool. These chambers can be assigned to a storage partition or a cleaning partition. The chambers in the free pool cannot be accessed through the user interface or the storage management software until they are added to a partition.

LIBRARY PARTITIONS

Partitions divide the library logically to appear as one or more physical libraries—one library per configured partition. Partitioning simplifies storage consolidation through the creation of virtual libraries, each with its own drives and media. Each partition:

- Has exclusive access to the tape drives and media storage assigned to it.
- Can control the TeraPorter(s) to move media within the partition.

The library supports two types of partitions, storage partitions and cleaning partitions. You can configure a maximum of 30 partitions using the maximum number of physical controllers. One or more cleaning partitions can be configured in a single library. A single cleaning partition can be associated with multiple storage partitions. Cleaning partitions do not count against the storage partition maximum.

Note: The more partitions in a library, the longer each move can take. You may need to increase the timeout setting in your storage management software.

Storage Partitions

Overview

The library requires, at a minimum, one storage partition. Each storage partition must have at least one drive and one chamber in its storage pool. Drives and chambers can only be assigned to one storage partition at a time.

In some environments, using multiple storage partitions is crucial to data center efficiency and growth. For example, multiple partitions are extremely useful in the following situations:

Multiple Storage Management Software Packages

If groups within your company use different storage management software packages, each software package requires its own dedicated library. Instead of maintaining multiple physical libraries — one per backup package — the data center can use a single Spectra Logic library with multiple partitions, in which each partition appears to the software as a dedicated library.

Encryption

If you want to encrypt some but not all of your backup data, you can partition the library into an encryption partition and non-encryption partition to segregate the two types of data.

Multiple Drive Generations

If your data center uses multiple generations of LTO drives, Spectra Logic strongly recommends configuring separate partitions for each generation to ensure read/write compatibility between the drives and cartridges.

Shared Resources

If each department in the company must keep their data segregated, partitioning the library supplies this segregation, as well as the subsequent integrity of the data set. Each partition can only access the drives and cartridge locations assigned to it. Data from other partitions cannot become intermixed with the data stored on the media in the partition's inventory.

Multiple Databases

If your company uses multiple databases, partitioning the library preserves the backup processes associated with each type of database.

Cleaning Partitions and Auto Drive Clean

Overview

The cleaning partition provides permanent storage for cleaning cartridges inside the library. This special-purpose partition does not have an entry/exit pool or any drives associated with it. A single cleaning partition can be shared by multiple storage partitions.

Auto Drive Clean uses the cleaning cartridges in the cleaning partition to provide library-based cleaning of drives, typically with no user intervention. Automated drive cleaning results in fewer failed tape read/write operations and is the preferred method for cleaning drives.

Drives in a partition with an associated storage partition are cleaned no more than once in any 12 hour period.

Note: Software-initiated drive cleaning operations cannot use the cleaning cartridges stored in a cleaning partition; the cartridges are not accessible to the storage management software.

Requirements

The Auto Drive Clean feature requires a cleaning partition to be associated with the storage partitions that contain the drives you want to clean.

Cleaning cartridges used in a cleaning partition must be stored in specially labeled Maintenance TeraPack magazines. The cartridges themselves must be identified with "CLN" at the beginning of the barcode on their labels. The library prevents you from importing cleaning cartridges and magazines that are not properly labeled into a cleaning partition.

Auto Drive Clean Operation

When a drive is unloaded in response to a host request and the data cartridge is moved to its storage location, the library queries the drive to determine if it needs cleaning. If cleaning is required, the library delays notifying the host that the SCSI move command for the unloaded data cartridge is complete while it performs an automatic drive cleaning.

During the delay, the library retrieves a cleaning cartridge from the cleaning partition and inserts it into the drive. When the cleaning is complete, the library returns the cleaning cartridge to the cleaning partition and notifies the host that the SCSI move command for the unloaded data cartridge is complete. The library then posts a system message that the cleaning was successful.

Expired Cleaning Cartridges

When an expired cleaning cartridge is loaded into a drive, it is immediately ejected without attempting the cleaning. The library flags the cleaning tape as expired in its inventory and does not attempt to use it for subsequent cleanings.

If the cleaning partition contains another valid cleaning cartridge, a cleaning that failed because of an expired cleaning cartridge is reattempted the next time the host unloads a data cartridge from the drive.

MLM Tracking of Cleaning Cartridges

When you use MLM-enabled cleaning cartridges, the library stores usage information in the MLM database, including the number of cleans remaining and the cartridge health - good, near expiration, or expired. This information is retained in the MLM database when a cleaning cartridge is exported from the library.

When a cartridge is nearing the end of its useful life, the library notifies you so that you can replace the cartridge. This early notification helps prevent failed cleanings resulting from using an expired cleaning cartridge.

The library does not store any information about non-MLM cleaning cartridges in the MLM database. However the library does mark an expired cleaning cartridge and does not attempt to use it again as long as it remains in the library. If an expired non-MLM cartridge is exported and then re-imported into the library, it is identified as expired the next time it is loaded into a drive.

Note: The expiration status of a cartridge is lost if the library or library controller is reset.

COMPONENT IDENTIFIERS

The library user interface and the API command interface use component identifiers for each drive. These identifiers also appear in system messages. The component identifier is based on the component's location in the library.

Figure 13 shows the component identifiers for each chamber and drive for full height drives. Figure 14 shows the component identifiers for each chamber and drive for half height drives.

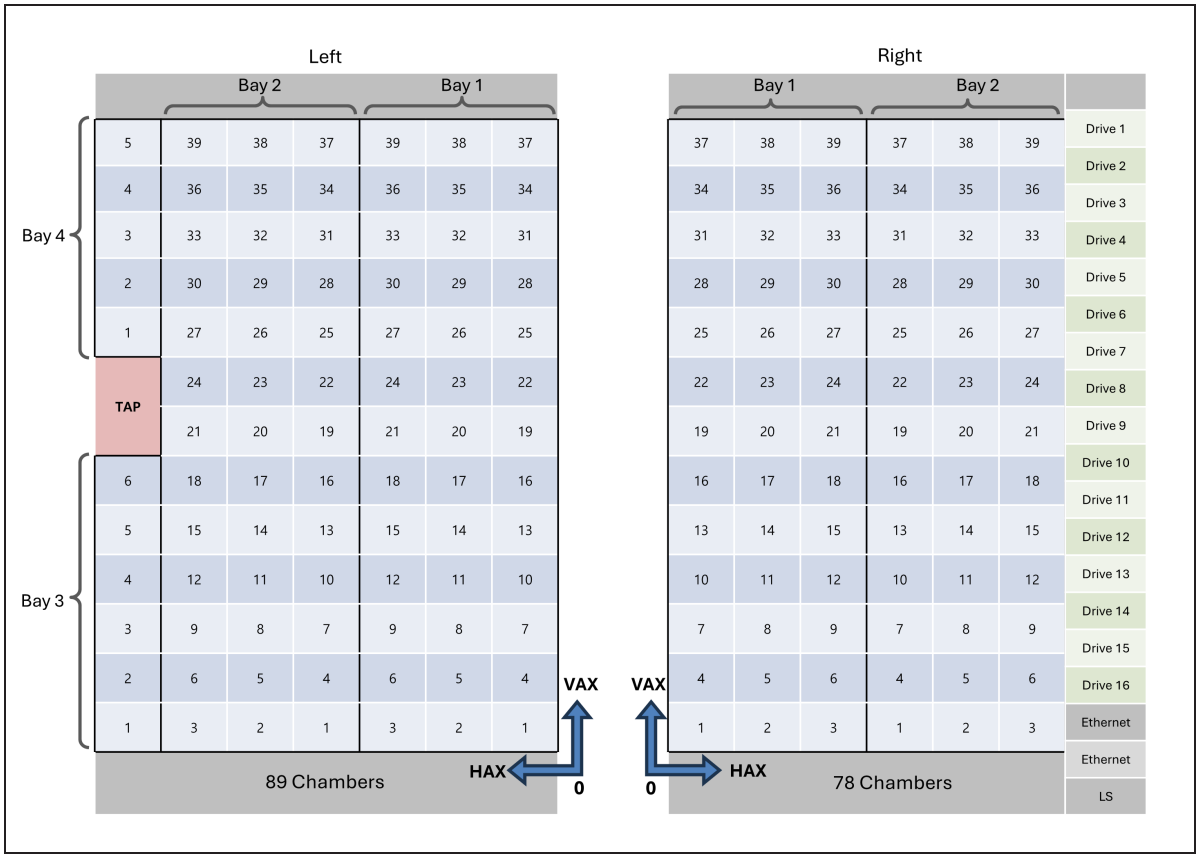


Figure 13 Chamber and drive locations - full height.

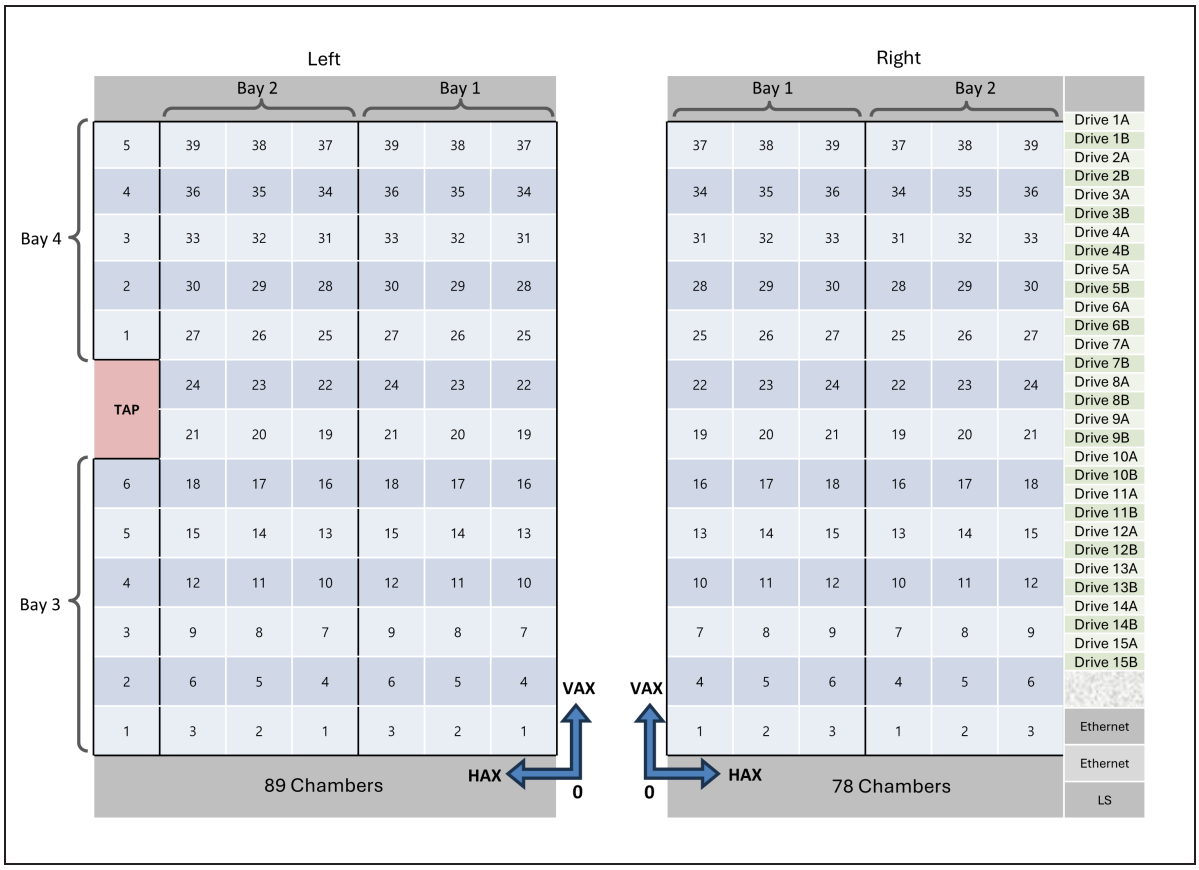


Figure 14 Chamber and drive locations - half height.

Drive Component Identifiers

The firmware in the drive sled that houses each drive assigns an identifier to the drive based on its location in the library. The identifier is also used to generate the World Wide Name (WWN) that the library reports for the drive (see World Wide Names for Drives on page 48). Because the identifier is location-based, it remains constant even if the physical drive is replaced by a new drive. The new drive assumes the location-based identifier.

Drive component locators use the format **Frame:DBA:Number**, where:

- **Frame** is the number of the frame. For the Cube library, this number is always 1.
- **DBA** is the number of the logical DBA containing the drive. Each DBA logically contains 4 drives. The DBAs are numbered from bottom to top of the library.
- **Number** is the number of the drive bay in the DBA.

Chamber Component Locators

Chamber component locators use the format **Frame:Side:Bay:Chamber**, where:

- **Frame** is the number of the frame. For the Cube library, this number is always 1.
- **Side** is the side where the chamber is located.

  - **l** indicates the left side of the library as you are facing the library.
  - **r** indicates the right side of the library as you are facing the library.
- **Bay** is the number of the shelving bay contining the chamber.
- **Chamber** is the number of the chamber in the shelving bay.

CONNECTIVITY

The library TeraPorter and the drives connect to the host system over a Fibre Channel arbitrated loop or fabric, or a SAS fabric. These connections carry two types of information:

- The commands from the storage management software that control the TeraPorter motion and the read/write operations of the drives.
- The data being transferred to and from a drive by the host.

TeraPorter Connectivity

The TeraPorter requires a drive to provide the robotic control path. When configuring a storage partition, the drive you select to provide the robotic control path is referred to as the "exporting controller" for the partition. The exporting controller makes the partition accessible to the hosts as a media changer (a library). It receives the media changer commands sent from the host to the library and relays them to the LCM, which in turn processes them into the motion commands used to control the robotics.

You can select multiple exporting controllers for a partition and use your host software to export the same changer interface over the controllers to provide redundancy.

Control Path Through a Direct-Attached Drive

In a direct-attached drive configuration, one or more drives in a storage partition are designated as the exporting drive (also know as the exporting controller). The commands from the host to control the motion of the robotics within the partition are routed to the exporting drive's logical unit number 1 (LUN 1). Commands to control the operation of the exporting drive are sent from the host to LUN 0 of the drive.

Notes:
- If you have multiple storage partitions, you must designate an exporting controller for each partition.
- A drive can only provide the robotic control path for the partition to which it is assigned.
- You can select multiple drives as controllers, and export the same changer interface over the drives to provide redundancy, as long as your storage management software can support this. These multiple paths cannot be used at the same time.

Figure 15 shows an example of a partition with two Fibre Channel drives providing the robotic control path. LUN 1 on the drives provides the robotic control path over which the commands to the robotics are received from the host.

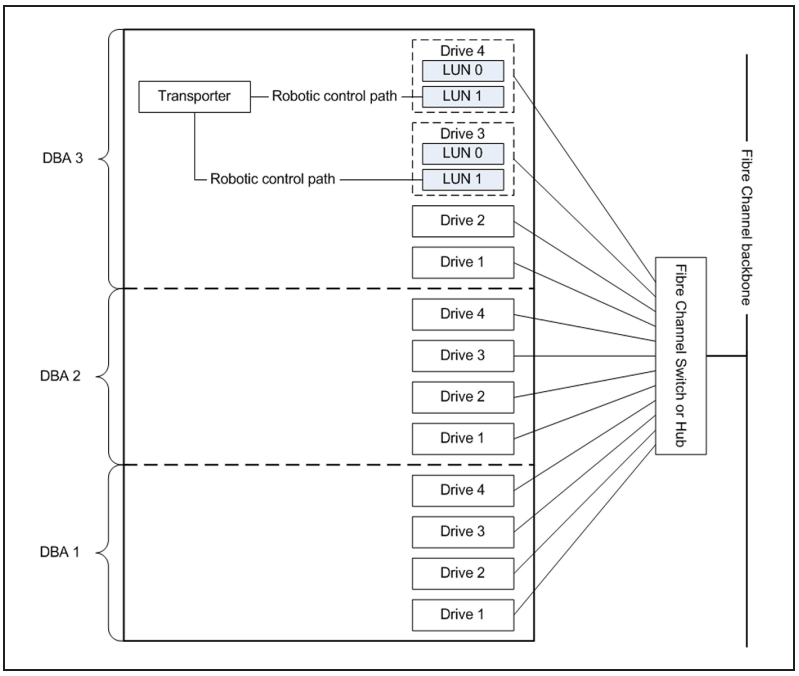


Figure 15 An example of a partition with two direct-attached Fibre Channel drives providing the robotic control path.

World Wide Names for Partitions

The partition WWN is the same as the WWN for the drive. The commands to control the motion of the robotics within the partition are sent from the host to the exporting drive's logical unit number 1 (LUN 1). Commands to control the operation of the exporting drive are sent from the host to LUN 0 of the drive.

See World Wide Names for Drives on the next page for more information about WWNs for drives.

Drive Connectivity

The drives in the library have either a Fibre Channel interface or a SAS interface.

- Serial Attached SCSI (SAS) drives connect to a SAS HBA or a Spectra Swarm bridge.
- Fibre Channel drives connect to the host using a Fibre Channel arbitrated loop, fabric, or switch.

Note: When connecting Fibre Channel drives to an arbitrated loop, keep in mind that all of the drives on an arbitrated loop must share the data transfer capacity (bandwidth) of the interface. Having multiple devices on the same loop can negatively impact the performance of all the devices.

World Wide Names for Drives

As part of providing network connectivity, the drive sled firmware assigns a location-based WWN for the drive it houses. This WWN is used by the host software to address the drive. Because this WWN is location-based, it remains constant even if a drive is replaced by a different one of the same type. The new drive assumes the location-based identifier and WWN.

Note: The WWN displayed on the Drive Details screen is actually the WWPN for port A on the drive sled. The WWPN for port B is the same as the one for port A except that the second digit from the left is **2** instead of **1**.

HIGH-AVAILABILITY CONFIGURATIONS

In high-availability enterprise environments, keeping the library operating even in the event of a network connection failure or component failure is extremely important.

Redundant Connectivity

In a high-availability environment, the ability to maintain communications between the host systems and the library and its drives in the event of a connection failure is essential.

- You can select multiple drvies as controllers and export the same changer interface over the drives to provide redundancy as long as your storage management software can support this. These multiple paths cannot be used as the same time.
- The servers and Fibre Channel switches used to access the direct-attached Fibre Channel drives in the library can use failover software to provide redundant connectivity through the two Fibre Channel ports on each full-height drive.

Drive Connectivity Failover

The drives used with the library are equipped with two Fibre Channel or SAS ports. The two ports cannot be used simultaneously to provide redundant data paths between the hosts and the drive. However, they can be used to provide failover capability in the event that communication to the port currently in use is interrupted. This failover can be accomplished several ways, including:

- Manually disconnect the cable from the failed port and connect it to the other port. You may need to reconfigure your host software to recognize the alternate port.
- Connect each port on the drive to a separate HBA port in the host. Configure one HBA port as the primary connection and the other HBA port as the failover connection. Install failover software on the host computer to control the transfer of I/O from one HBA to the other in case of a failure.

  Note: You may also need to configure your storage management software to correctly recognize both ports. Refer to your failover software, HBA, and storage management software documentation for instructions.

  Note: Tape drives sold by Spectra Logic do not support MPIO.

Redundant Power Supplies

The library uses power supply modules to convert AC input to power drives library. These power supply modules also provide power to the LCM and LCD operator panel. The number of power supply modules required by a library is calculated by Spectra Logic based on the number and type of drives in the library. Extra power supply modules provide redundancy and failover protection.

Chapter 3 - Configuring The Library

This chapter describes configuring the Spectra Cube library, including creating partitions.

Configuring Users **52**

Creating and Editing Users 53

Editing the Current User Password 54

Configuring Settings **55**

Basic Settings 56

Auto-Logout Settings 57

Authentication Settings 57

Network and Metric Settings 60

Startup Scan Settings 61

Partition Overview **62**

Configuring and Using Cleaning Partitions and Auto Drive Clean 62

Configuring and Using Storage Partitions 63

Storage Partition Options 63

Creating A Partition **65**

Overview 65

Partition Interface 65

Creating A New Cleaning Partition 66

Creating A New Storage Partition 67

Modifying An Existing Partition **72**

Deleting A Partition 74

CONFIGURING USERS

Overview

Each library user is assigned to one of three user groups, each with its own set of pre-defined library privileges.

Understanding User Groups and Security

The following table describes the three user groups and the privileges of each.

User Group Type	Description
Superuser	Controls all aspects of the library's configuration and operation, including defining other library users and assigning them to a user-privilege group. By default, the LumOS software has a superuser account named "su". **Notes:** • The library requires a minimum of one superuser. You cannot delete the last member of the superuser group. • Only a user with superuser privileges can add, modify, or delete users. • Only a user with superuser privileges can access and configure encryption features.
Administrator	Configures and uses the library. Users in the Administrator group have the same privileges as users in the superuser group with the exceptions of creating or modifying library users, accessing the encryption features, changing authenticators, restoring the library from a backup, or reading the security log.
Operator	Performs day-to-day operations. Users assigned to the Operator group can move media, and import and export media using the Entry/Exit pool, but cannot access the more sensitive library operations such as configuration, diagnostics, and security.

Creating and Editing Users

This section describes using the LumOS user interface to create and edit users. To begin, login to the LumOS user interface and navigate to **Configuration > Users**.

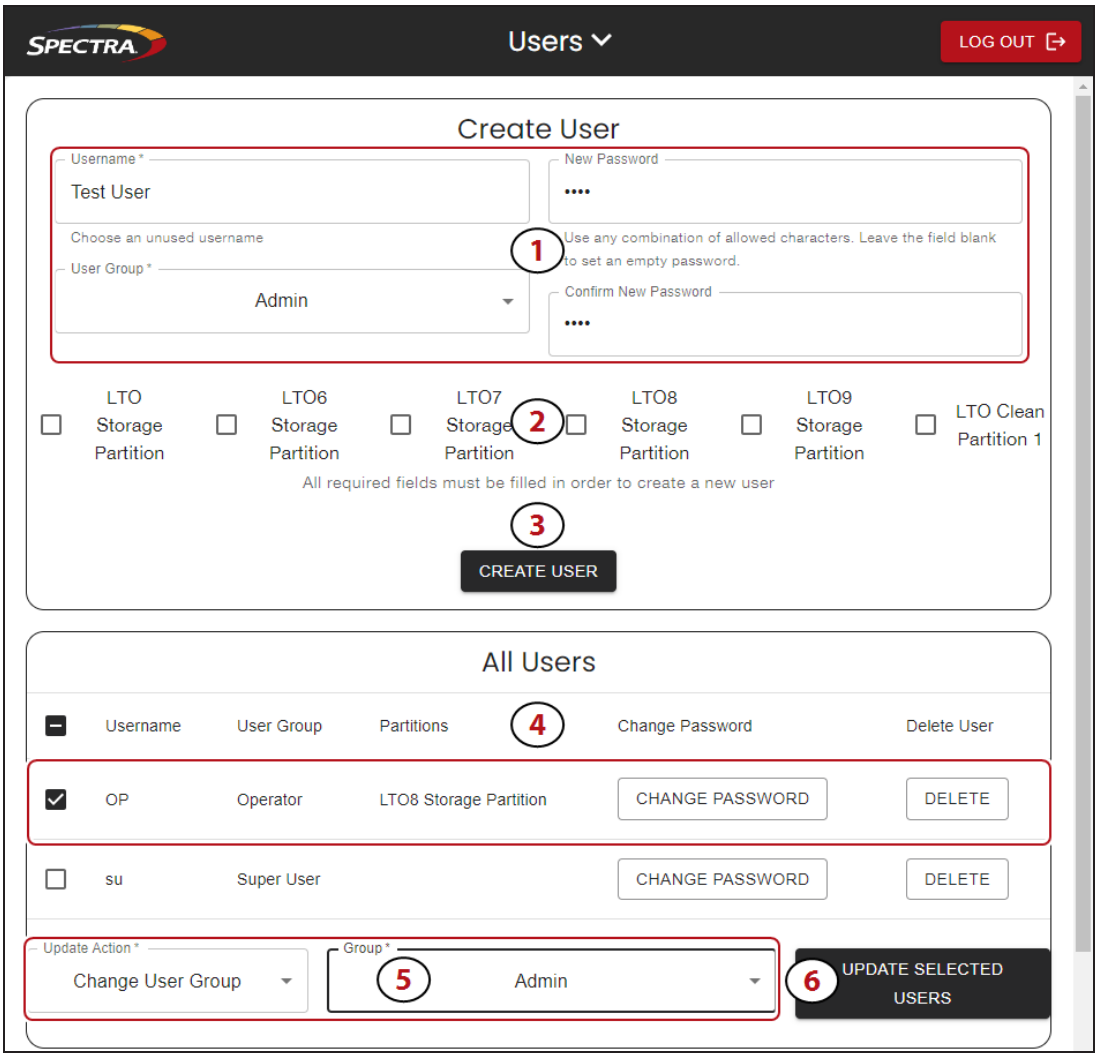


Figure 16 The LumOS Users screen.

Use Figure 16 above to help you create and edit users.

1. Enter the required information for **Username**, **User Group**, **Password**, and **Confirm Password**.

   Valid user groups are **Operator**, **Admin**, and **Superuser**.

   Note: Usernames are case sensitive.

2. Select the partition(s) you want to assign to the new user.

   Note: Users can only access the partition(s) assigned to them.

3. Click **Create User**. The new user displays below in the **All Users** section.

4. Click **Change Password** and enter and confirm a new password if desired.
5. To edit a user, select one or more users in the **All Users** section. Select the desired action from the **Update Action** drop-down menu and then an opton from the **Please Choose an Update Action First** drop down menu.

Note: Valid update actions include under **Update Action** are:

- **Add Partition Access**
- **Remove Partition Access**
- **Change User Group**

6. Click **Update Selected Users**.

Editing the Current User Password

This section describes using the LumOS user interface to edit the password for the user profile actively signed on to the library.

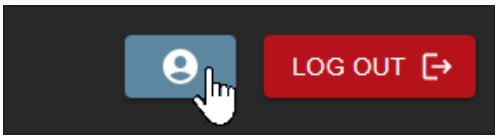


Figure 17 The LumOS Users screen.

1. Click on the blue user icon in the top right to open the current user settings.

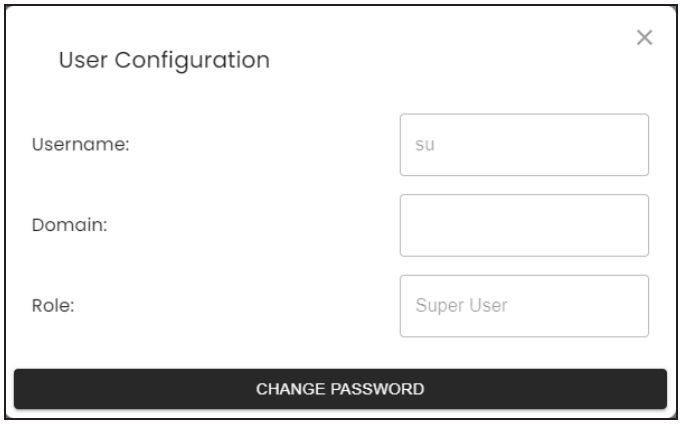


Figure 18 The LumOS User Configuration screen.

2. Click **Change Password**, then enter the current user password, the new desired password, and confirm the new desired password.
3. Click **Submit**.

CONFIGURING SETTINGS

You can use the LumOS user interface to configure settings for the Spectra Cube library. This section describes configuring all settings in the Settings screen in these sections:

- **Basic Settings on the next page**
- **Auto-Logout Settings on page 57**
- **Authentication Settings on page 57**
- **Network and Metric Settings on page 60**
- **Startup Scan Settings on page 61**

To begin, log in to the LumOS user interface and select **Configuration > Settings**.

Basic Settings

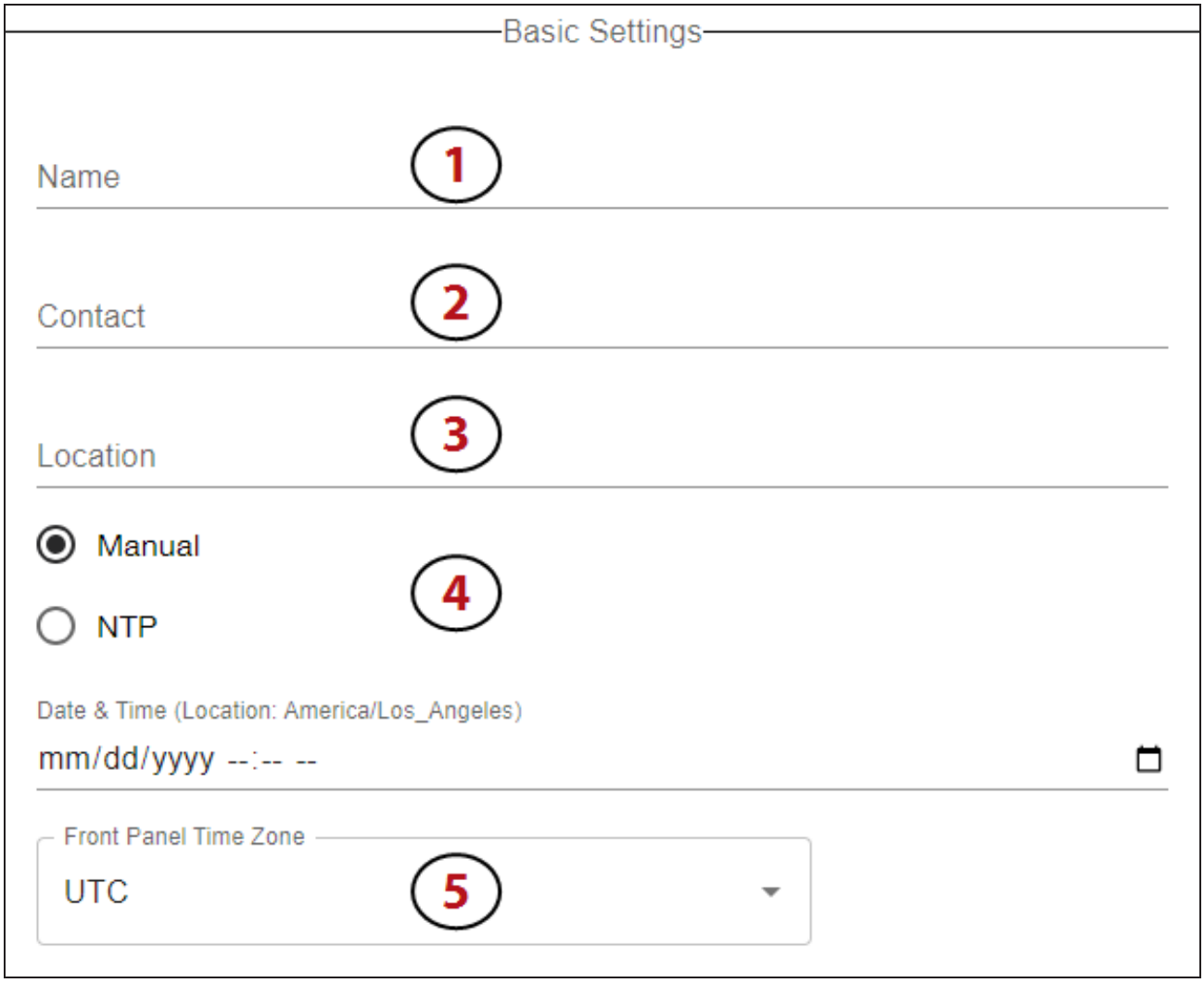


Figure 19 The Basic Settings section.

1. Enter a **Name** for the Cube library.
2. Enter **Contact** information for the library.
3. Enter **Location** information for the library.
4. Select between **Manual** or **NTP** for the time format on the library.
   - If you select **Manual**, enter the required time and date information or click the calendar icon on the right hand side to set the time.
   - If you select **NTP**, enter the required NTP server information for up to four NTP servers (not pictured).
5. Select the **Front Panel Time Zone** in the drop-down menu.
6. Click **Submit Changes** (not pictured).

Auto-Logout Settings

This section covers the available auto-logout settings for the LumOS user interface. All entry field text must be numerical.

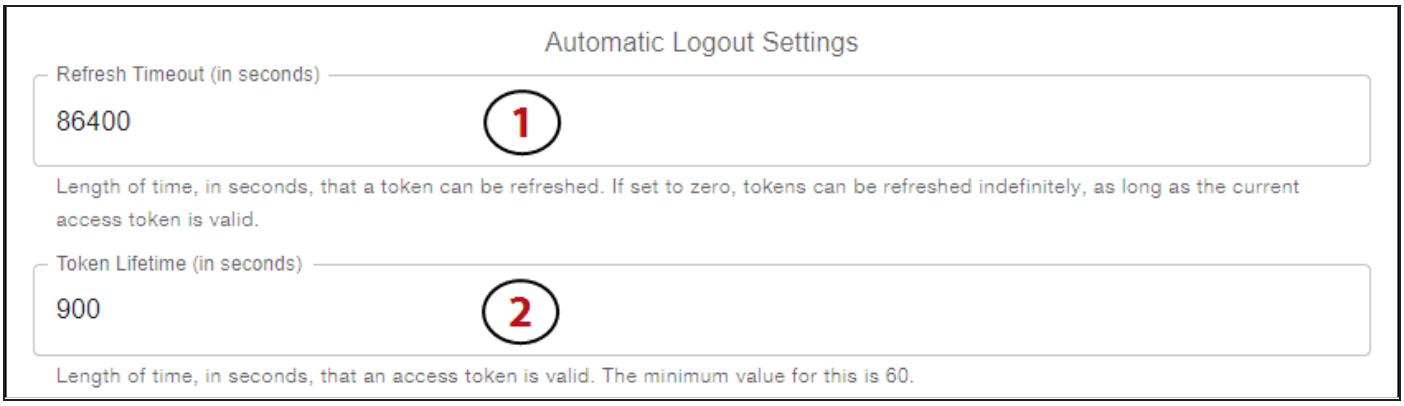


Figure 20 The Auto-Logout section.

1. Enter a value for the **Refresh Timeout**. This setting is the length of time in seconds that you can refresh a token. If set to zero, you can indefinitely refresh a token provided a valid and current access token.
2. Enter a value for the **Token Lifetime**.This setting is the length of time in seconds that an access token is valid. The minimum value is 60 seconds.

Authentication Settings

This section covers all the available authentication settings in the LumOS user interface.

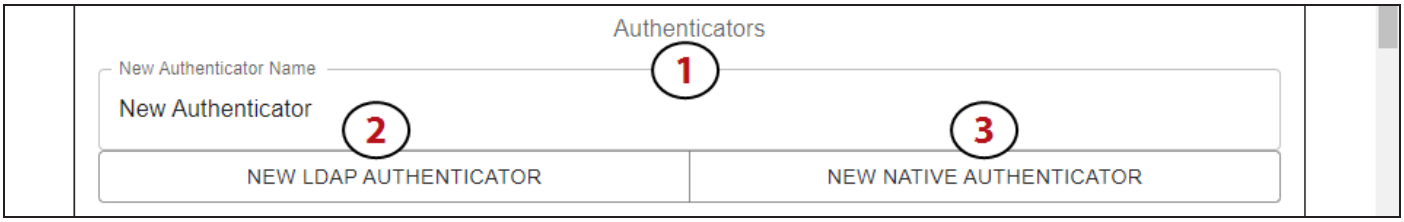


Figure 21 The Authenticator sections.

1. Enter a **New Authenticator Name**.
2. Click **New LDAP Authenticator** to create a new LDAP (Lightweight Directory Access Protocol) Authenticator. See the LDAP Authenticator subsection on the next page to learn how to configure a LDAP authenticator.
3. Click **New NATIVE Authenticator** to create a new NATIVE Authenticator. See the NATIVE Authenticator subsection on page 59 to learn how to configure a native authenticator.

LDAP Authenticator

This section covers the available LDAP authentication settings in the LumOS user interface.

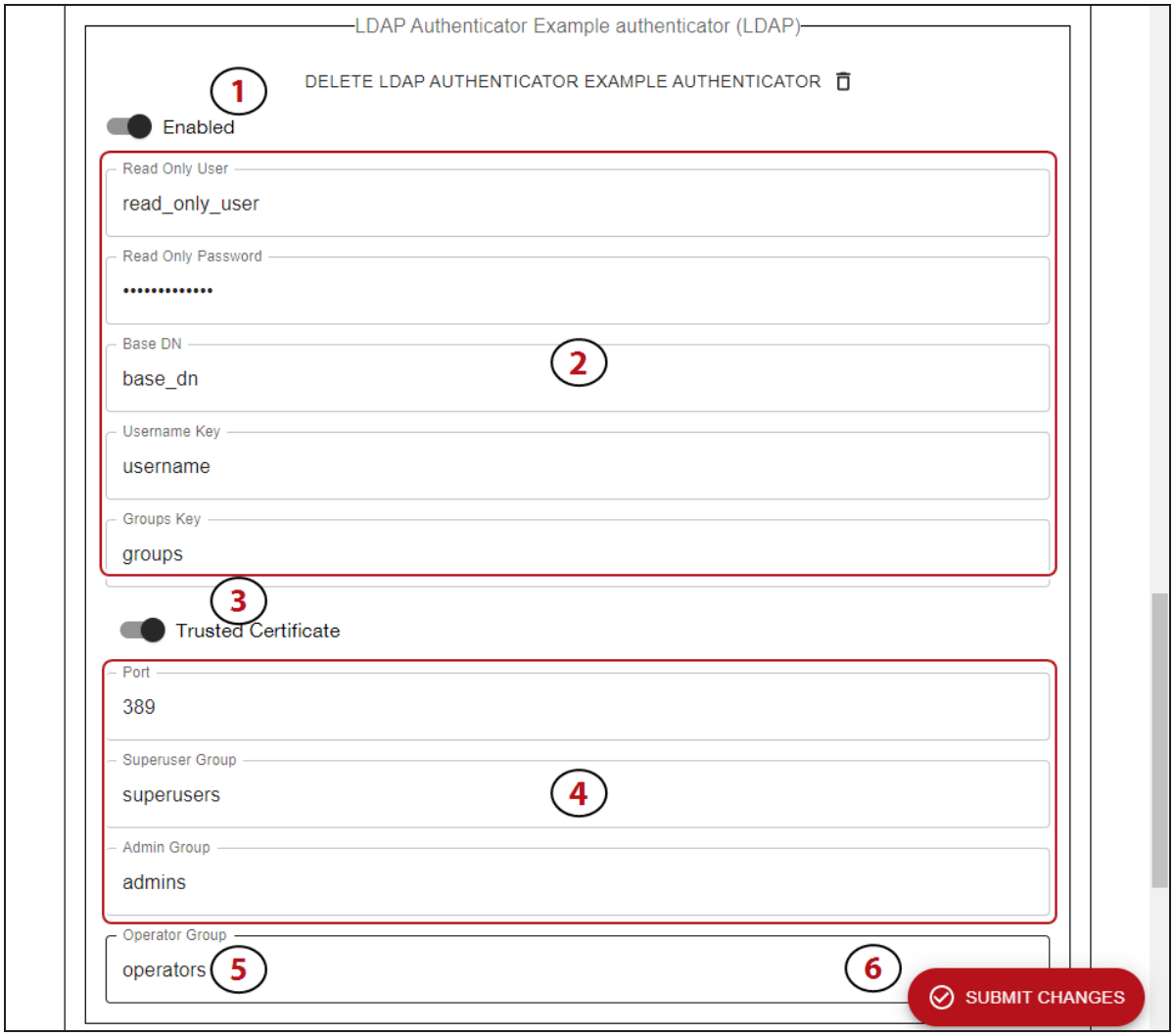


Figure 22 The LDAP Authenticator section.

1. Toggle the selector to enable the LDAP authenticator.
2. Enter the required information for the **Read Only User** username, **Read Only Password**, the **Base DN** (domain name) information, **Username Key**, and **Groups Key**.
3. Toggle the selector to enable **Trusted Certificate** if desired.
4. Enter information for the **Port**, **Superuser Group**, and **Admin Group**.
5. Enter information for the **Operator Group**.
6. Click **Submit Changes**.

NATIVE Authenticator

This section covers the available NATIVE authentication settings in the LumOS user interface.

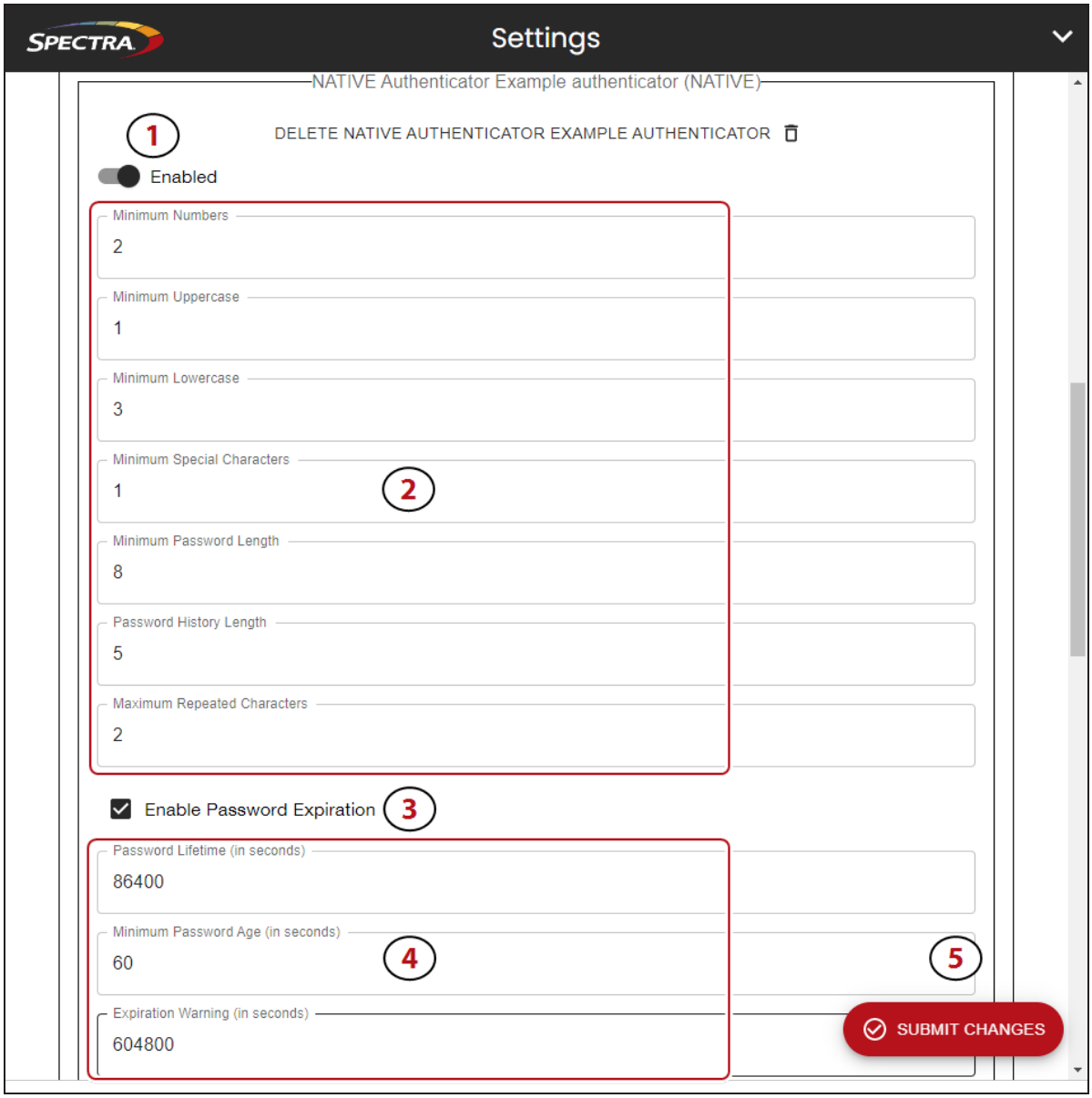


Figure 23 The NATIVE authenticator section.

1. Toggle the selector to enable the NATIVE authenticator.
2. Enter the desired password requirements in the entry fields.
3. Select **Enable Password Expiration** if desired.
4. Enter the desired password expiration settings in the entry fields.
5. Click **Submit Changes**.

Network and Metric Settings

This section covers configuring Network and Metric Settings.

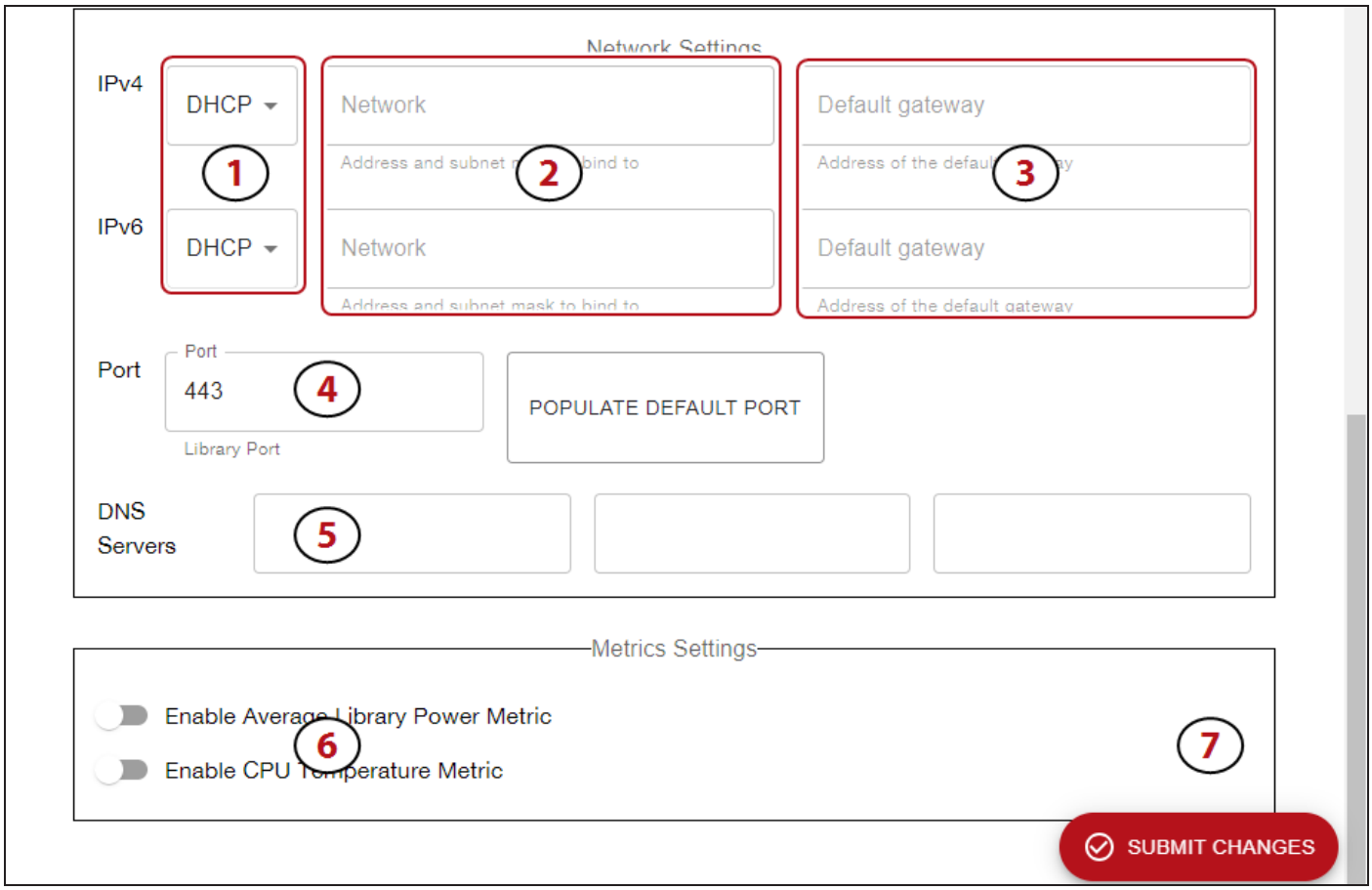


Figure 24 The Network and Metric Settings sections.

1. Toggle the drop-down menu between **DHCP** and **Static** as desired.
2. Enter information for the **Network** address.
3. Enter information for **Default gateway**.
4. Enter information for **Port**. Click **Populate Default Port** if desired.
5. Enter information for **DNS Servers** if desired. You may enter up to three DNS servers.
6. Toggle the selectors **Enable Average Library Power Metric** and **Enable CPU Temperature Metric** to enable gathering the metrics through the API. By default, these settings are disabled.
7. Click **Submit Changes**.

Startup Scan Settings

This section covers configuring the Starup Scan setting.

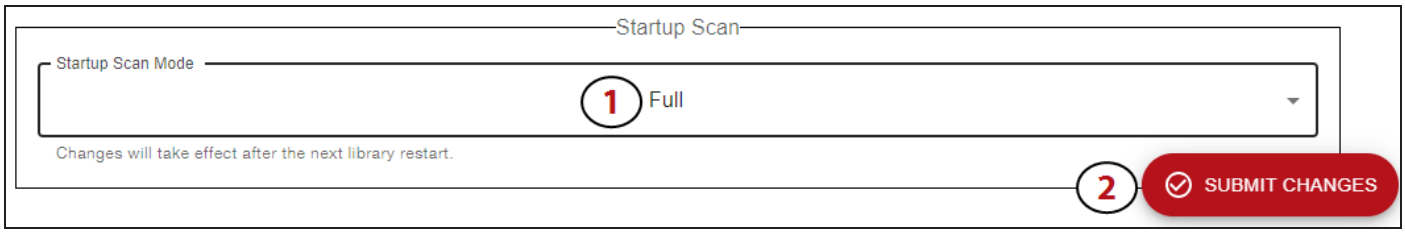


Figure 25 The Startup Scan section.

1. Select the **Startup Scan** option from the drop-down menu. The library initiates a startup scan when the library is started or when the access door is closed.

   A **Quick** scan verifies all magazine barcodes. A **Full** scan performs a full security audit of the library inventory.

2. Click **Submit Changes**.

PARTITION OVERVIEW

The library supports two types of partitions: storage partitions and cleaning partitions. When configuring partitions, keep in mind the requirements in the following sections.

Configuring and Using Cleaning Partitions and Auto Drive Clean

- Cleaning partitions do not count against the partition maximum.
- A cleaning partition can be shared by multiple storage partitions .
- Cleaning partitions use chambers that are not licensed with a Capacity On Demand (CoD) key. If all of the chambers are licensed, a cleaning partition uses any chambers that are not already assigned to another partition.
- Configuring a cleaning partition and assigning it to one or more storage partitions automatically enables the Auto Drive Clean feature for those storage partitions. The drives in the storage partitions with an associated cleaning partition are cleaned automatically when a drive indicates that it needs cleaning.
- The cleaning cartridges in the cleaning partition are inaccessible to the storage management software. If your storage management software supports automated drive cleaning and you plan to use this method to clean the drives, store a TeraPack magazine (not a Maintenance TeraPack magazine) containing one or more cleaning cartridges in the storage partition's storage pool. The storage management software can then access the cleaning cartridges when needed.

IMPORTANT

If you store cleaning cartridges in the storage partition, make sure that they are identified as required by your storage management software to prevent the storage management software from attempting to use the cartridges for writing or reading data.

- The cleaning cartridges used in a cleaning partition must be stored in specially labeled Maintenance TeraPack magazines.
- If you do not configure a cleaning partition and associate it with the storage partitions, you must use your storage management software to perform the cleaning or use the LumOS user interface to manually move a cleaning cartridge to the drive that needs cleaning.

Configuring and Using Storage Partitions

- You can configure storage partitions either before or after you configure cleaning partitions. If you want to use Auto Drive Clean with a storage partition, it is easier to configure the cleaning partition before you configure the storage partition. If you choose to create the storage partition before you create the cleaning partition, you need to modify the storage partition to assign the cleaning partition to it.
- The library requires, at a minimum, one storage partition to be configured before you can use the library. Each storage partition must have a minimum of one drive and one chamber assigned to the storage pool.
- When using both Fibre Channel and SAS drives in the library, the different drive interface types must be in separate partitions.
- Chamber Availability — The number of chambers available for a storage partition depends on how many chambers in the library are licensed and how many chambers are used by other partitions.

  Note: The more partitions in a library, the longer each move can take. If move requests can be sent to several partitions at once, you may need to increase the timeout setting in your storage management software.

Storage Partition Options

Before you begin configuring partitions, gather the information listed in the following table.

Option	Description
Soft Load	The Soft Load feature uses the drive's soft load (or auto load) functionality to improve library performance. Soft Load requires that the library have high performance transporters..

MLM Discovery	Choose the MLM discovery options for the partition.
	• **Disabled** - Prevent the partition from populating in the MLM database.
	• **Auto Discovery** - Automatically add newly imported cartridges to the MLM database.
	• **PreScan** - Automatically add newly importated cartridges to the MLM database. Additionally checks the cartridge to determine if it has any of the following characteristics:
	  • Non-MLM-enabled
	  • Broken or dislodged leader
	  • Write protected
	  • Encrypted tape with a moniker not currently stored in the library
	  • Red media health

Option	Description
Read Element Status	Read Element Status returns the status of elements in the partition. • **Standard** - The default setting. • **Tape Generation** - Adds Media Domain, Media Type, Drive Domain, and Drive Type to the SCSI command response.
SlotIQ	SlotIQ optimizes robotics performance by allowing the library to virtualize slot locations and optimize the order of moves in a queue to reduce the amount of robotic movement required for any set of moves.
Quick Postscan	Quick Postscan performs a readability verifiction test to verify data integrity for all of the cartridges in the partiton. Quick Postscan verifies all the data on a single wrap from the beginning of the tape (BOT) to the end of the wrap or end of recorded data (EOD), whichever comes first.
Barcode	Choose the barcode label options for the partition. Spectra Certified data cartridges with standard barcode labels use a barcode with eight human-readable characters followed by a checksum character that is not human-readable. Barcode options allow the user to set the checksum behavior, truncation side, and the number of characters to report. • **Checksum Behavior** - The library supports three different checksum behaviors. **Use Checksum** (default) verifies the barcode against the checksum during a read. **Ignore Checksum** does not verify the barcode against the checksum. If your labels do not include a checksum, use **No Checksum**. • **Truncation Side** - Truncates barcode characters in the library. The library supports **Left** and **Right** side truncation. • **Number of Characters to Report** - Select the number of barcode characters to report. If **Number of Charaters to Report** is set to a lower number than 16, the library truncates characters on the side configured by **Truncation Side**. **IMPORTANT** Be careful when specifying the number of characters to report. You may end up with duplicate barcodes reported. For example, 12345XXXL2 and 12345ABCL3 are both reported as 12345 with a right side truncation of 5 characters.

CREATING A PARTITION

Overview

The LumOS user interface allows the user to create a new partition on the Cube library. This section covers "Creating A New Storage Partition" on page 67 and "Creating A New Cleaning Partition" on the next page.

Partition Interface

Log into the LumOS user interface and select **Configuration** > **Partition**. The Partitions screens displays.

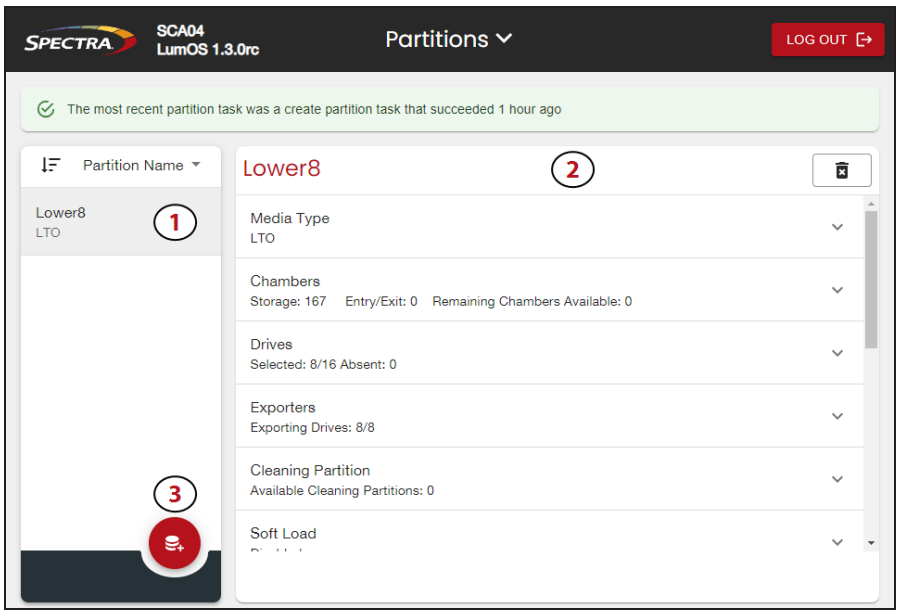


Figure 26 The LumOS partitions screen.

Features of the Partitions screen include:

- Partition Tab (**1**) - Displays all existing partitions. The filter sorts the list by Partition Name or Media Type.
- Partition Management Tab (**2**) - Displays the information about the selected partition.
- Create New Partition button (**3**) - Opens the wizard to create a new partition.

Creating A New Cleaning Partition

The following section describes the steps to create a new cleaning partition. The step numbers relate to the numbered locations on the figure below.

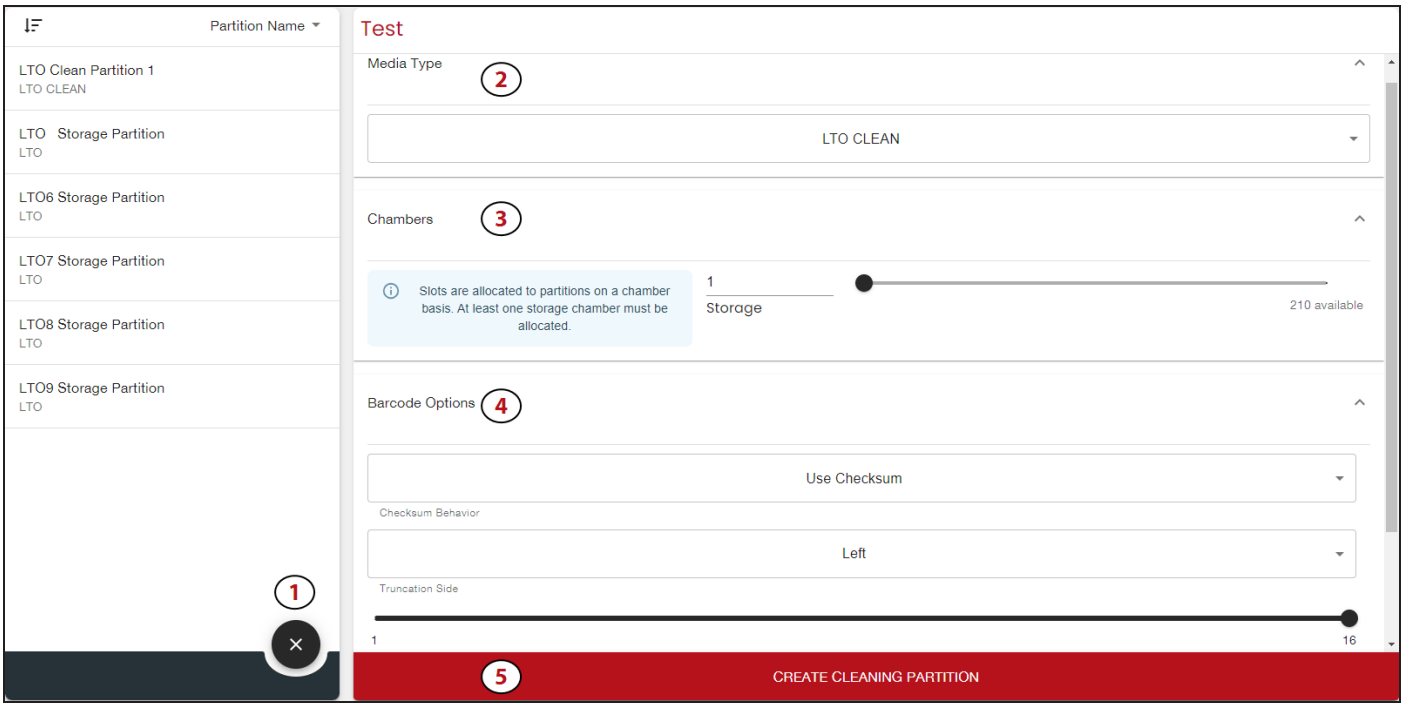


Figure 27 The LumOS cleaning partition creation screen.

1. Click the **New Partition** button. Enter the name for the new cleaning partition and click **Begin Cleaning Partition Creation**. The cleaning partition creation section displays.
2. Select the **Media Type** you want to use. Cleaning partition media type must match the storage partition media type.
3. Use the **Storage** entry field or slider to select the number of chambers for the partition.
4. Select the desired **Checksum Behavior** using the drop-down menu. You may specify the **Truncation Side** using the drop-down menu, and the number of characters using the slider.
5. Click **Create Cleaning Partition**.

Creating A New Storage Partition

The following section describes the steps to create a new storage partition. The step numbers correspond to the numbered locations on the figures below. Start by clicking the **New Partition** button and entering the name for the new storage partition. Click **Begin Storage Partition Creation**. The storage partition creation section displays.

Note: The Partition name cannot be edited in the future.

Figure 28 The LumOS storage partition creation screen - Media Type and Chambers.

1. Use the **Media Type** drop-down menu to select LTO.

Note: Media type cannot be changed after creation.

2. Use the entry fields or sliders to select the number of **Storage** chambers and **Entry/Exit** chambers for the partition.

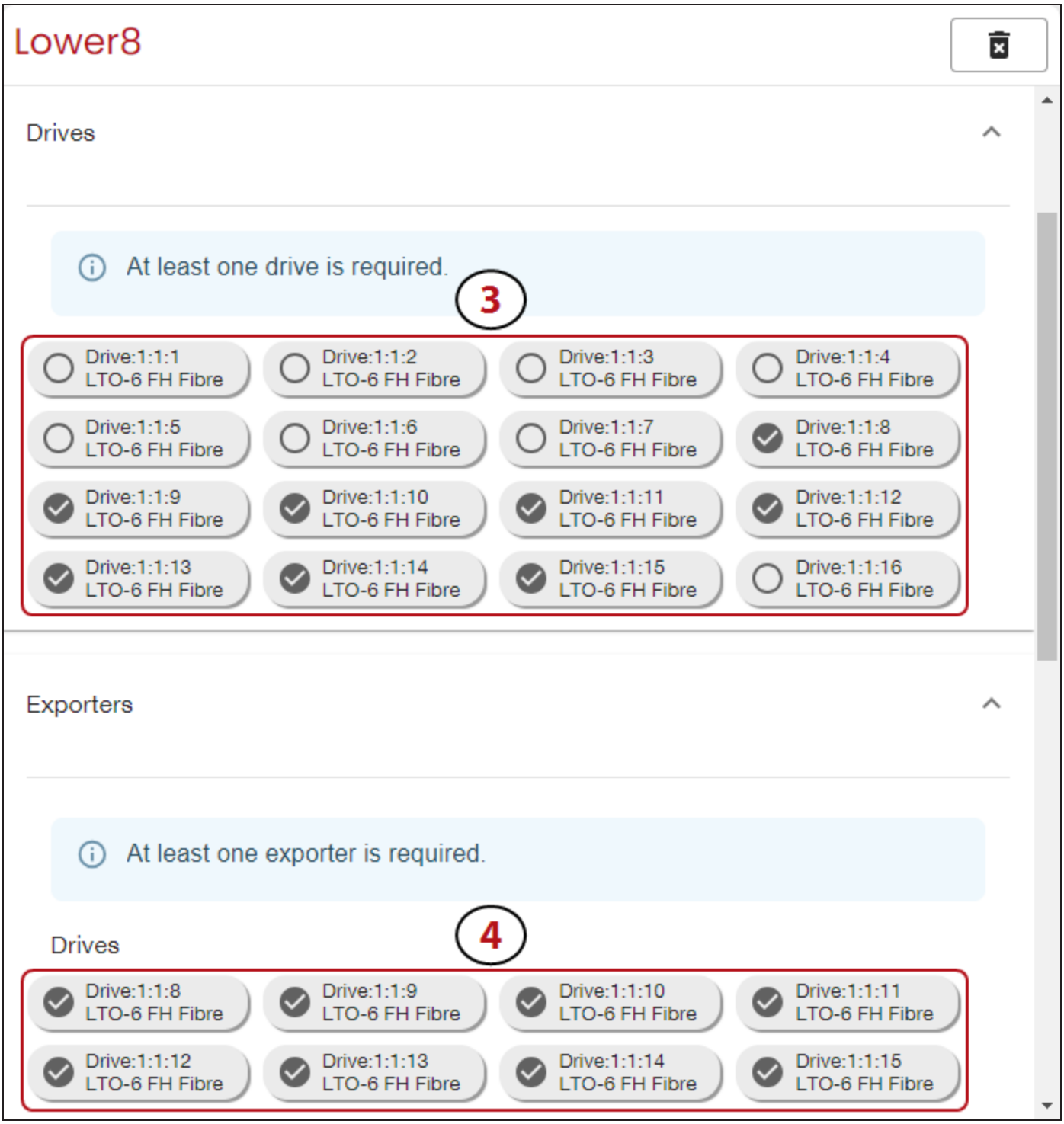


Figure 29 The LumOS storage partition creation screen - Drives and Exporters.

3. Select the **Drives** to include in the partition. At least one drive is required to create a partition.
4. Select any desired drives selected in Step 3 as an **Exporter**. At least one exporter is required to create a partition.

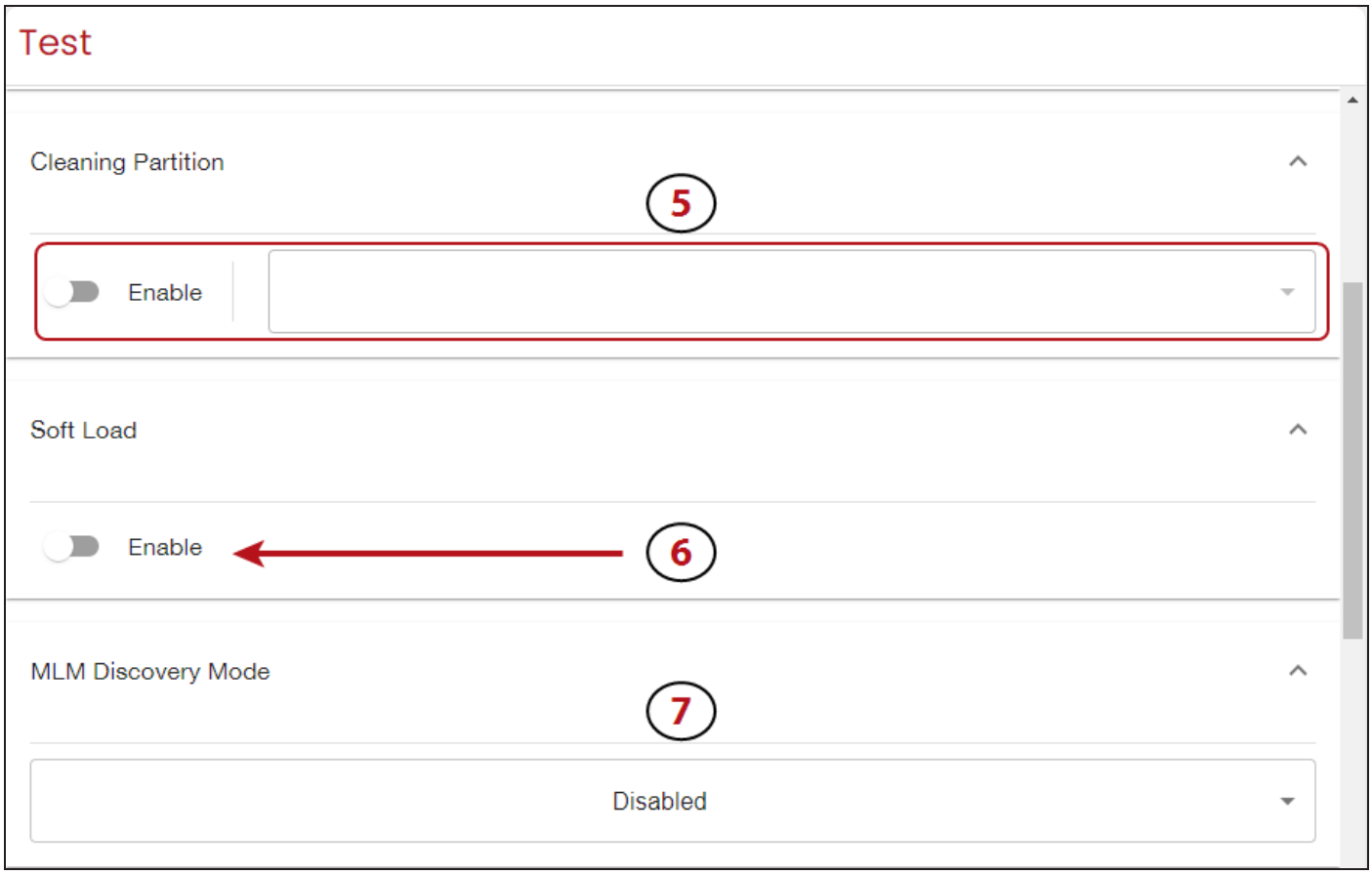


Figure 30 The LumOS storage partition creation screen - Cleaning Partition, Soft Load, and MLM Discovery Mode.

5. If desired, select a **Cleaning Partition**. Cleaning partitions must use the same media type as the storage partition.
6. Toggle **Soft Load** if desired.
7. Select **MLM Discovery Mode**. Available options are **Disabled**, **Auto Discovery**, **Prescan**, and **Passive**.
   - **Disabled** prevents the partition from populating to the MLM database.
   - **Auto Discovery** and **PreScan** discover newly imported cartridges and adds them to the MLM database. **PreScan** additionally runs a basic health and function test on the drives.

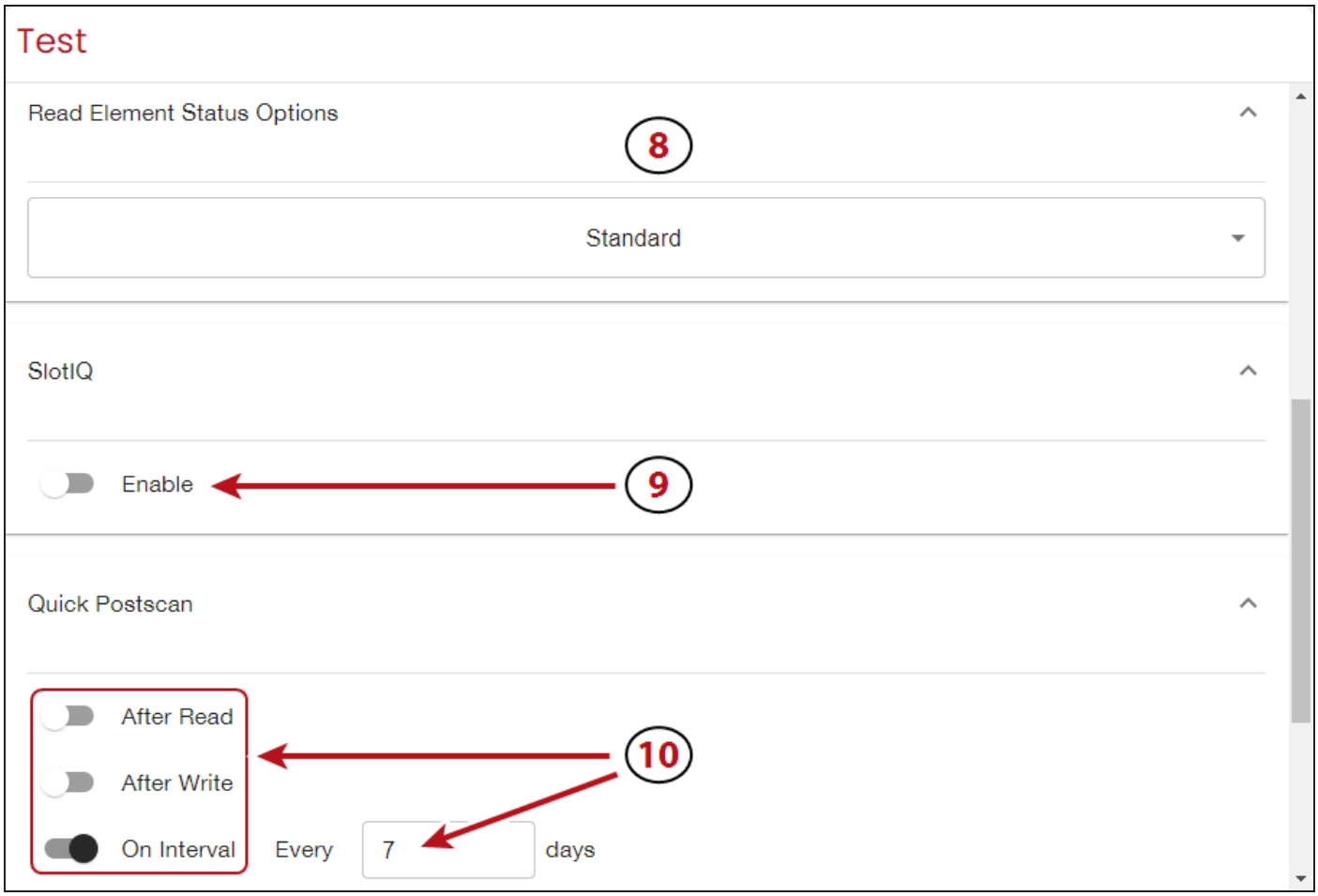


Figure 31 The LumOS storage partition creation screen - Read Element Status Options, SlotIQ, and Quick Postscan.

8. Use the **Read Element Status Options** drop-down menu to select between **Standard** and **Tape Generation** options.
9. Use the selector to toggle **SlotIQ** if desired.
10. Use the selectors to configure the **Quick Postscan** frequency. If you select **On Interval**, enter a value in the entry field to indicate the number of days between scans.

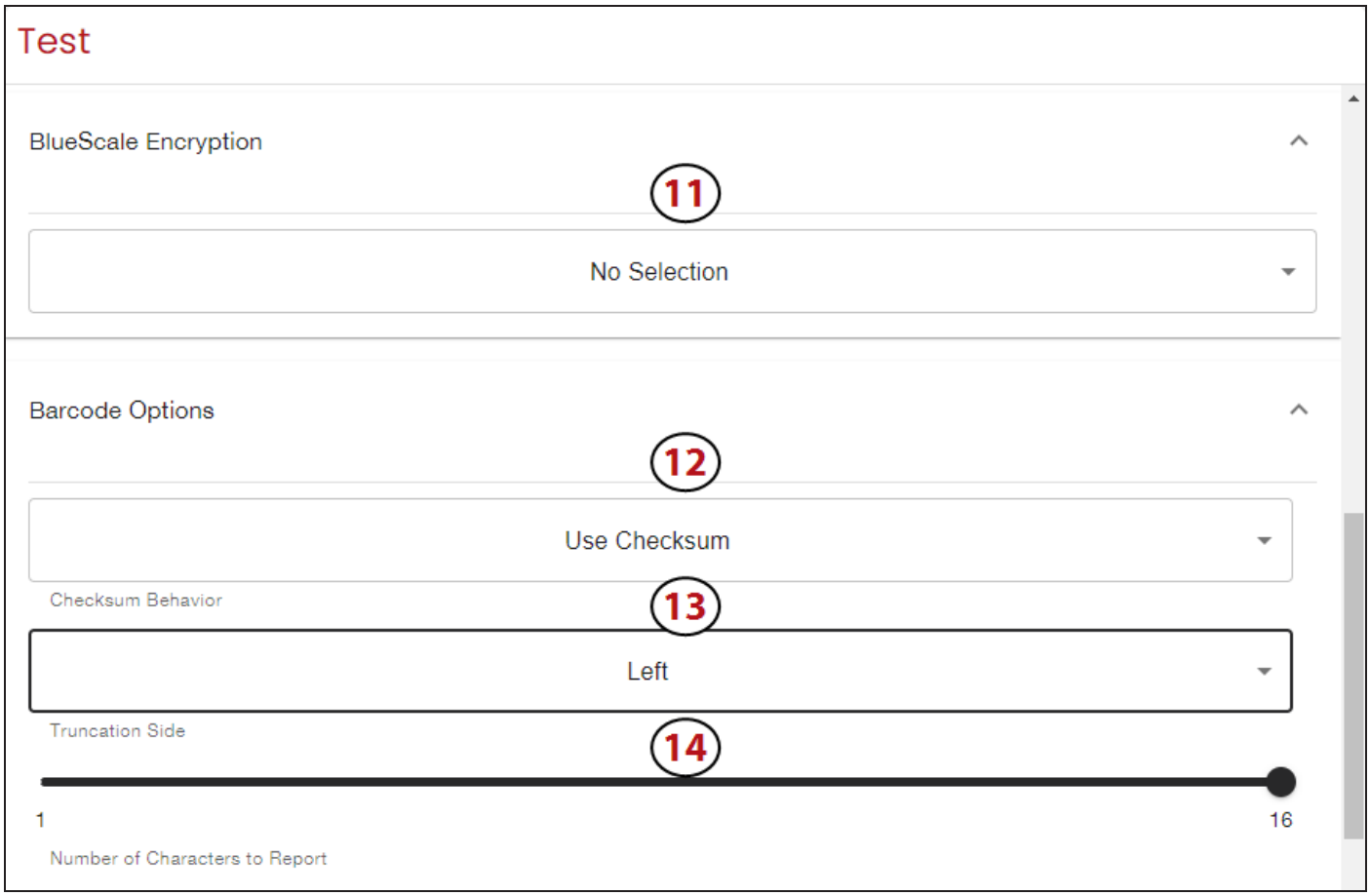


Figure 32 The LumOS storage partition creation screen - BlueScale Encryption and Barcode Options.

11. Use the drop-down menu to select from existing **BlueScale Encryption** keys. For more information on how to add an encryption key, see Configuring Encryption on page 78.
12. For Barcode Options, use the **Checksum Behavior** drop-down menu to select between **Use Checksum**, **No Checksum**, or **Ignore Checksum**.
13. Use the drop-down menu to select the **Truncation Side**.
14. Use the slider to modify the **Number of Characters to Report**.
15. Click **Create Partition** (not shown).

MODIFYING AN EXISTING PARTITION

This section describes how to edit or modify an existing partition.

CAUTION Use your storage management software to empty all drives and discontinue host operations before modifying an existing partition.

Preparation

Before making changes to an existing partition, review the information in the Partition Overview on page 62 to ensure that you address any requirements. In addition, consider the following recommendations and requirements:

- Spectra Logic strongly recommends backing up the library configuration, either to a USB device or as an attachment to an email before you make changes.
- When reducing the number of chambers assigned to a partition, physically export any magazines in those chambers before you remove chambers from the partition.

IMPORTANT By default, the library deletes empty chambers from a partition first. However, if all chambers are full, the library is forced to delete populated chambers. When this happens, the magazines in the deleted chambers are no longer accessible through the LumOS user interface. You must add these chambers to either a new or existing partition before the magazines are accessible again.

Modify a Partition

Log into the library as a user with superuser or administrator privileges, then navigate to **Configuration > Partitions**. Use the following figure and corresponding steps to modify an existing partition.

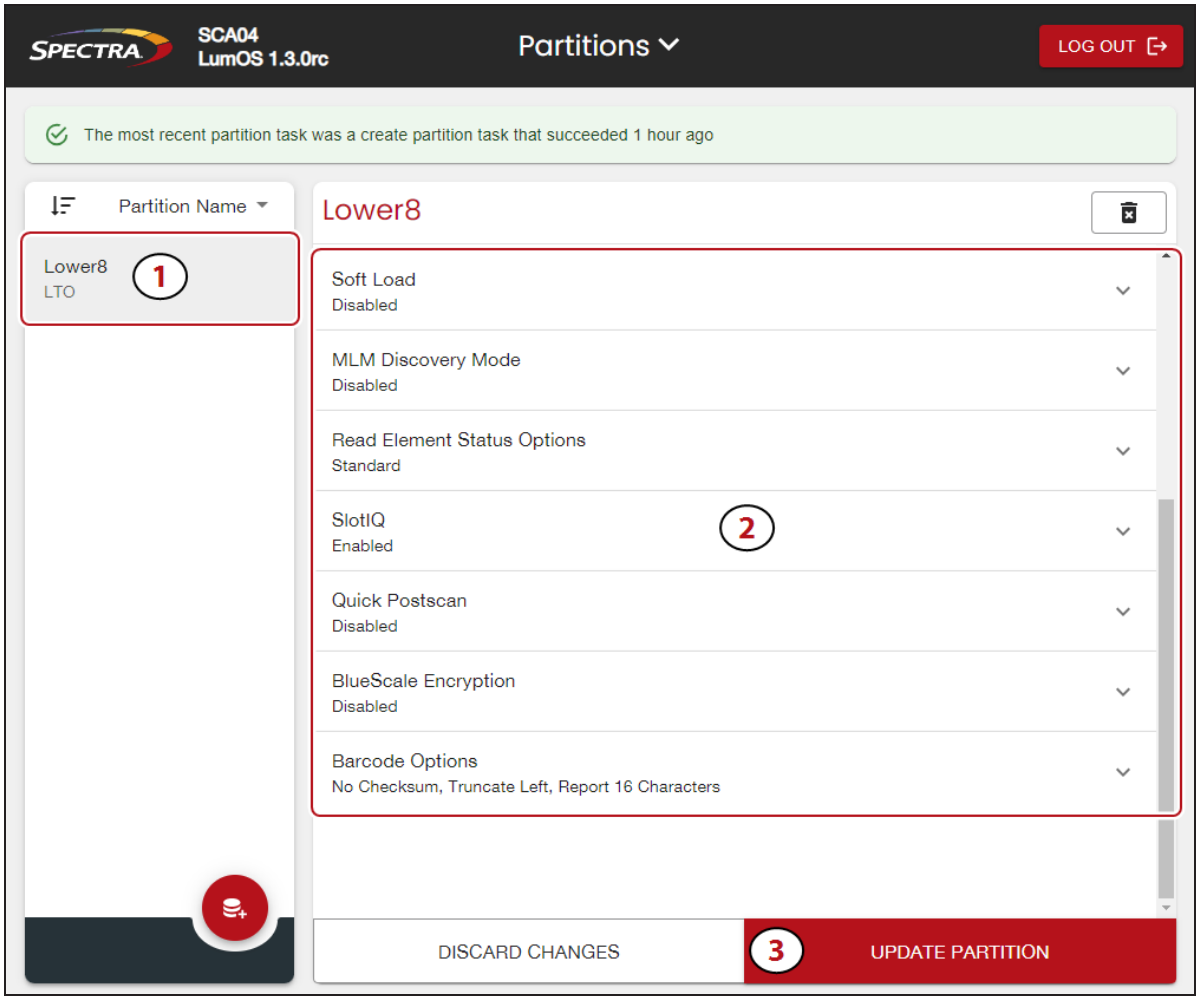


Figure 33 The Partitions screen.

1. Select the partition you want to modify.
2. On the Partition Management Tab, expand the sections you want to modify and make your desired changes. See Storage Partition Options on page 63 for information about each setting.
3. Click **Update Partition**.

Deleting A Partition

When you delete a partition, the drives and chambers previously assigned to that partition are available to be assigned to a new or existing partition.

Preparation

Before deleting an existing partition, make sure you address the following:

- Spectra Logic strongly recommends backing up the library configuration before you delete a partition.
- Empty all drives in the partition.
- To ensure that you do not inadvertently mix cartridges from one storage partition with that from another, use your storage management software to eject all cartridges from the storage partition's storage pool.

IMPORTANT After the partition is deleted, any magazines in the chambers that were assigned to the partition's storage and entry/exit pools are not accessible until the chambers are assigned to another partition.

- If the storage partition is configured to use encryption, make sure that you export the encryption key for any cartridges that were in the partition.
- If you plan to delete a cleaning partition, remove the cleaning partition from any existing storage partitions, otherwise the delete fails.

Auto Configuration Save

When you delete a partition, the library automatically generates a configuration backup file and saves it to the memory card in the LCM. If you configured the email option, an email with the backup file as an attachment is sent to the specified recipient.

Delete A Partition

Use the following steps to delete an existing partition:

1. Log in as a user with superuser or administrator privileges and navigate to **Configuration > Partitions**.
2. Select the partition you want to delete.
3. Click the trashcan icon in the top right of the Partition Management Tab.
4. Click **Confirm** on the confirmation screen.

CHAPTER 4 - ENCRYPTION

This chapter describes supported encryption methods and how to configure encryption on your Cube library.

BlueScale Encryption Key Management Overview **76**
Understanding the Components 76
Standard Edition vs. Professional Edition 76
Configuring Encryption **78**
Adding BlueScale Encryption 78
Exporting BlueScale Encryption Keys 81
Deleting BlueScale Encryption Keys 82
Authorization Settings 83
KMIP Encryption Key Management Overview **85**
Adding KMIP Encryption 85

BlueScale Encryption Key Management Overview

BlueScale Encryption key management is tightly integrated into your Cube library. BlueScale Encryption key management is provided through the library's user interface.

Understanding the Components

The BlueScale Encryption key management system contains two major components:

- **The BlueScale Encryption Key management Software** — The key management feature is accessed through the library's user interface, either using the operator panel or a remote connection through the LumOS web interface. Spectra BlueScale encryption key management is available in Standard and Professional Editions to meet your site security requirements.
- **The Encryption Chip in the LTO-6 or Later Generation Drives** — Using encryption-enabled hardware makes encryption extremely fast and places no burden on your network. After encryption is enabled, data is automatically encrypted as it is written to tape.

  Note: Encryption-enabled LTO drives use the same encryption algorithm, ensuring that tapes encrypted by one LTO drive generation can be read by another generation of drive as long as the tape itself is compatible with the drive.

Standard Edition vs. Professional Edition

To determine a BlueScale Encryption key management strategy appropriate for your site and your data, decide on the security level required for your site, and the amount and kinds of data to encrypt. After you decide on the appropriate security level and whether data sets need to be isolated, you can decide which edition of BlueScale Encryption meets your needs.

BlueScale Encryption Standard Edition

Standard Edition is included as a standard feature on the library. It is suitable for sites with a primary goal of securing data while it is transported to a remote location and stored there for long-term archival.

BlueScale Encryption Professional Edition

Professional Edition provides additional choices for defining the level of security you implement in your data center. It is suitable for sites that want the added security of multi-password access to the encryption configuration controls and for importing and exporting encryption keys, and the added flexibility of storing up to 30 encryption keys on the library.

The following table compares the major differences between the Standard and Professional Editions.

Note: Subsequent releases will add additional features to Bluescale Encryption Professional Edition.

Feature	Standard Edition	Professional Edition
Availability	Included as a standard feature on the library.	Requires a purchased option key to activate.
Encryption Login Passwords	Single encryption password accesses all encryption features.	Single encryption password accesses all encryption features.
Keys (Data Set Isolation)	• Single encryption key stored on the library at a time. • The same key is used for all partitions configured to use encryption.	• Up to 30 encryption keys stored on the library. • A single encryption key can be assigned to each storage partition.
Key Export and Import	A single password is used when exporting and importing the encryption key. The encryption key is exported in a single file.	A single password is used when exporting and importing the encryption key. The encryption key is exported in a single file.
Compression	Drive-based compression only.	Drive-based compression only.
Compatibility between Software Editions	Data encrypted using either software edition (Standard or Professional) can be decrypted by a library running the other edition as long as the key used to encrypt the data is present on the library attempting to decrypt the data.	

CONFIGURING ENCRYPTION

You can use the LumOS user interface to configure BlueScale and KMIP Encryption for the Spectra Cube library. This section describes adding, importing, and exporting BlueScale Encryption, adding a KMIP server and CSR, and how to configure authorization settings.

To begin, log in to the LumOS user interface and select **Configuration > Encryption**.

Adding BlueScale Encryption

Use the figures below to add or import an encryption key.

Figure 34 The Encryption screen.

1. Click **Create Key** or **Import Key**.
   - For **Create Key**, follow Step 2 on page 79.
   - For **Import Key**, follow Step 4 on page 79.

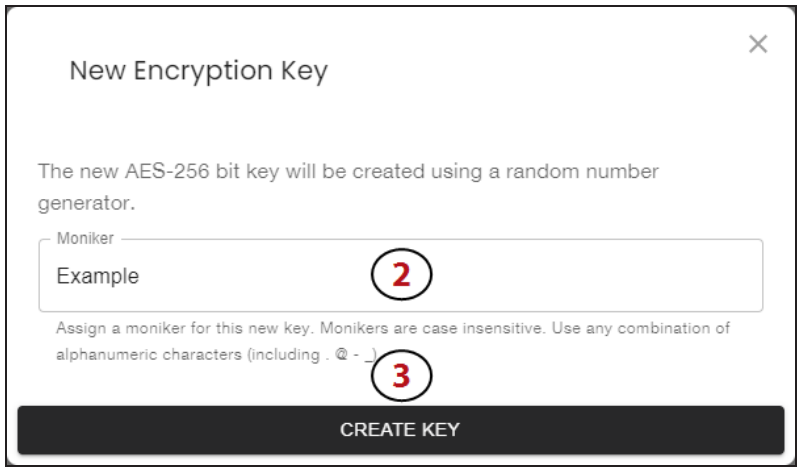


Figure 35 The New Encryption Key screen.

2. To create a new encryption key, enter a **Moniker** in the text field.
3. Click **Create Key**.

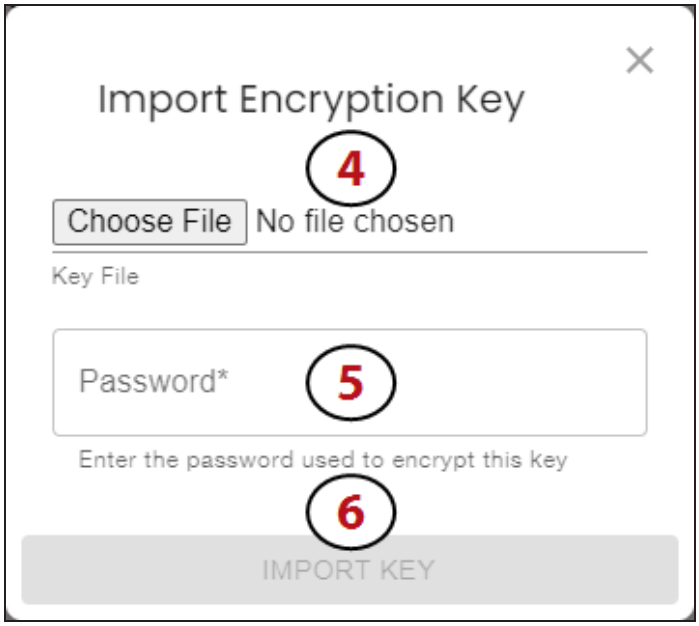


Figure 36 The Encryption screen.

4. To import an existing encryption key, click **Choose File** and use file explorer to locate the desired encryption key file.
5. Enter the **Password** for the selected key into the text field.
6. Click **Import Key**.

Figure 37 The Encryption screen.

7. If you have a BlueScale Encryption Professional license, you can repeat the above steps to create and to import additional encryption keys.

Note: To add an encryption key to a partition, see Creating A New Storage Partition on page 67.

Exporting BlueScale Encryption Keys

Use the figures below to export an existing BlueScale encryption key.

Figure 38 The Encryption screen.

1. Click the **Export** button next to the desired encryption key.

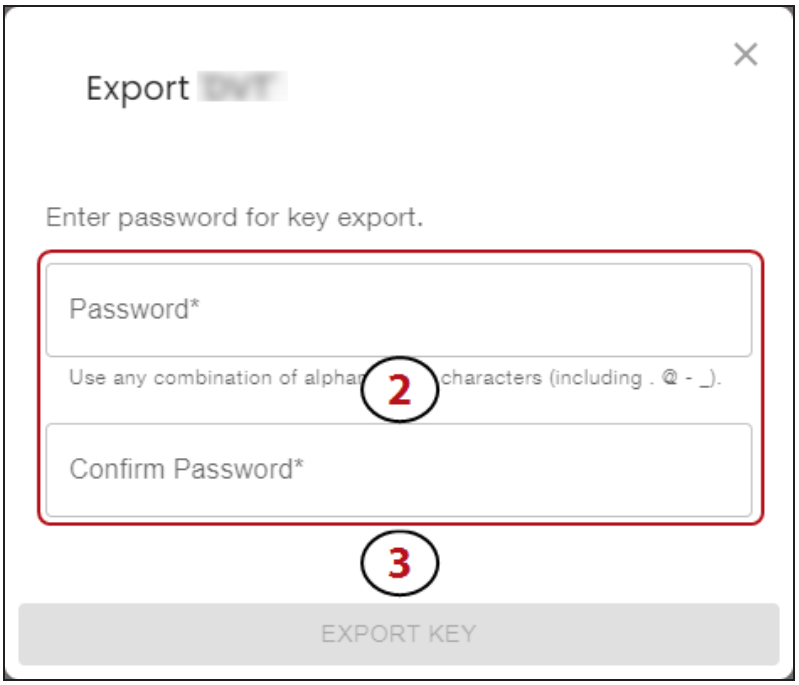


Figure 39 The Export screen.

2. Enter and confirm the **Password** for the selected key. The password is required when you import the key.
3. Click **Export Key**.

Deleting BlueScale Encryption Keys

Use the figures below to delete an existing BlueScale encryption key. Deleting an encryption key does not remove the encryption from any assigned partitions. Be sure to clear the encryption setting from existing partitions and to export a copy of the encryption key prior to deletion.

CAUTION Make sure that you export a copy of the existing key before you delete it. You need a copy of the exported key and its password to import the key back into the library and restore data that was encrypted with the key.

1. Export at least one copy of the encryption key and store it in a safe location (see Exporting BlueScale Encryption Keys on the previous page).
2. If the encryption key you plan to delete is assigned to a partition, edit the partition to disable encryption (see Modifying An Existing Partition on page 72).

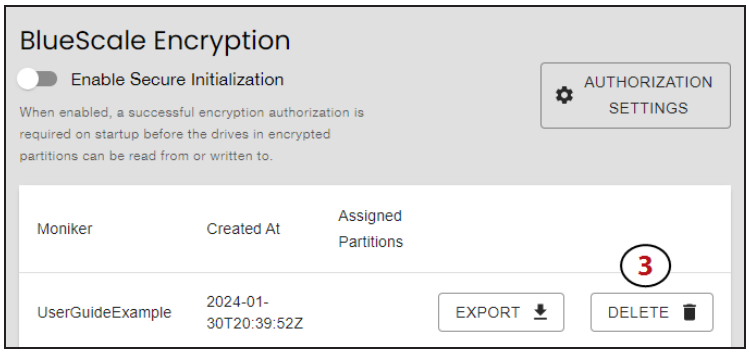


Figure 40 The Encryption screen.

3. From the Encryption screen, **click** the trashcan icon on the key you wish to delete.

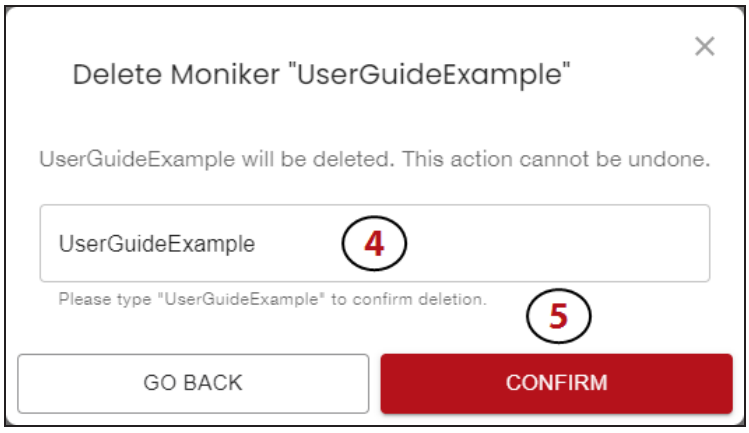


Figure 41 The Delete Moniker screen.

4. In the confirmation window, enter the **Moniker** into the text field.
5. Click **Confirm** to delete the encryption key.

Authorization Settings

The section below provides an overview of the authorization settings in the LumOS user interface.

Figure 42 The Encryption screen.

1. Toggle the selector for **Enable Secure Initialization** if desired. Secure initialization requires encryption authorization on library initialization for drives in encrypted partitions before read and write actions can occur.
2. Click **Authorization Settings** button to open the Authorization Settings window.

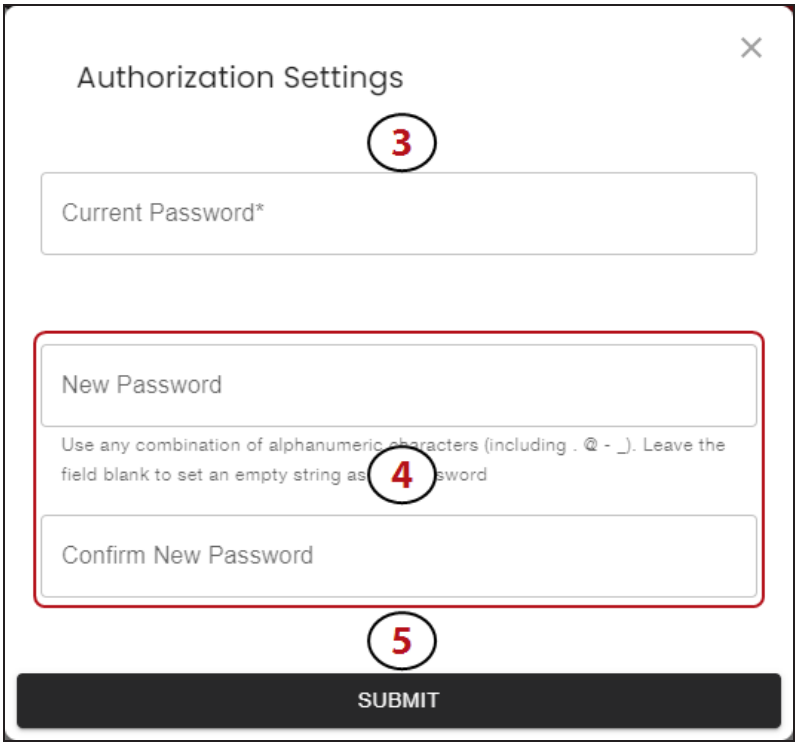


Figure 43 The Authorization Settings screen.

3. In the **Current Password** text field, enter the current encryption password.
4. Enter and confirm the **New Password** in the text fields.
5. Click **Submit**.

Note: To reset an expired password, you must use the LumOS API commands.

KMIP Encryption Key Management Overview

The Key Management Interoperability Protocol (KMIP) is a centralized management system that allows you to manage the life cycle of the encryption keys and security certificates for your library. The LumOS user interface allows users to generate, store, and retrieve security keys used by tape drives for data encryption.

Before you configure your library to implement KMIP key management, install and configure KMIP on your server.

Notes:
- KMIP encryption key management is not compatible with BlueScale encryption key management because they cannot share encryption keys. Data encrypted using on type of encryption key management cannot be decrypted using a different type of encryption key management.
- KMIP encryption is not compatible with PostScan. In the Partition Creation wizard, if PostScan is enable, KMIP Encryption is not selectable on the Encryption screen.

Adding KMIP Encryption

Use the steps and figure below to configure KMIP encryption. To begin, log in to the LumOS user interface and select **Configuration > Encryption**.

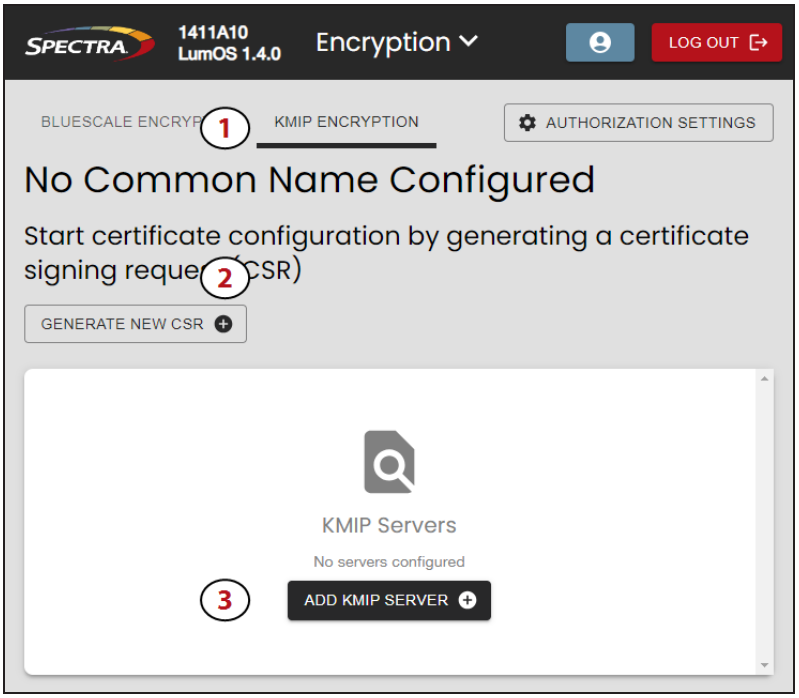


Figure 44 The KMIP Encryption screen.

1. Select **KMIP Encryption** at the top of the Encryption screen.

2. Click **Generate New CSR** to generate a certificate signing request. See Generating Certificate Signing Requests below for more details.
3. Click **Add KMIP Server** to add a KMIP server. See Adding KMIP Servers on page 88 for more details.

Generating Certificate Signing Requests

Use the steps and figure below to generate a new certificate signing request.

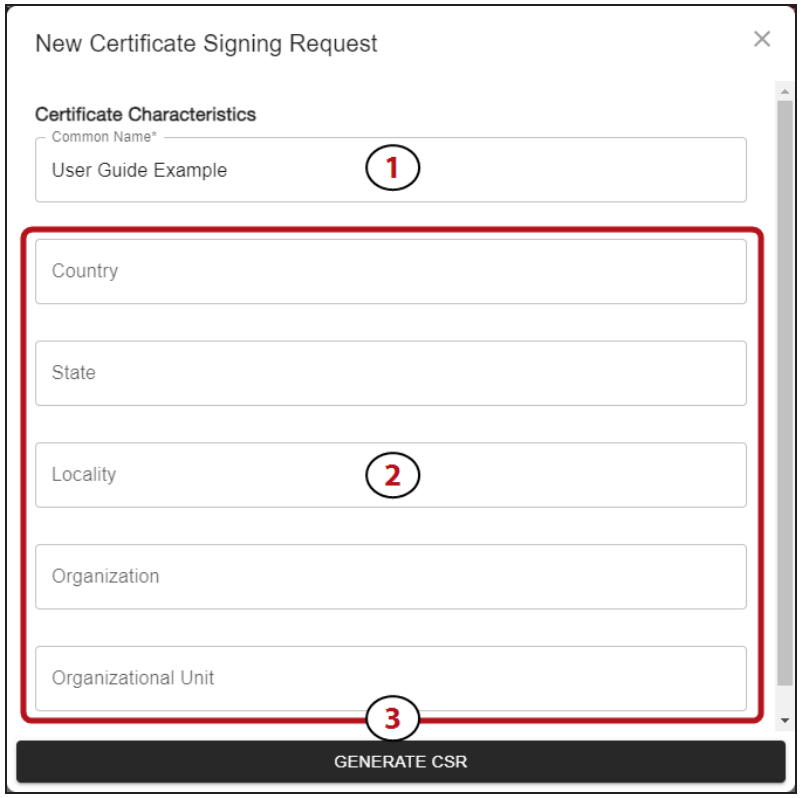


Figure 45 The New Certificate Signing Request screen.

1. In the **Common Name** text field, enter a common name.
2. Optionally, fill out the **Country**, **State**, **Locality**, **Organization**, and **Organization Unit** text fields.
3. Click **Generate CSR**.

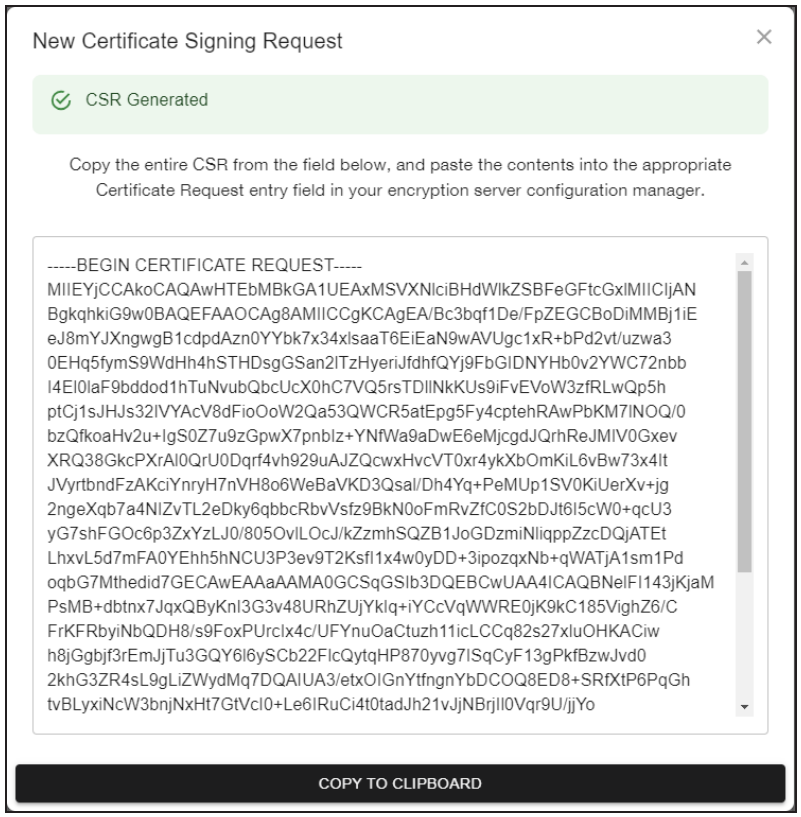


Figure 46 The New Certification Signing Request screen.

4. Click **Copy To Clipboard** to copy the new CSR.
5. Using your encryption server configuration manager, paste the copied CSR in the appropriate Certificate Request entry field.

Adding KMIP Servers

Use the steps and figure below to add a KMIP server.

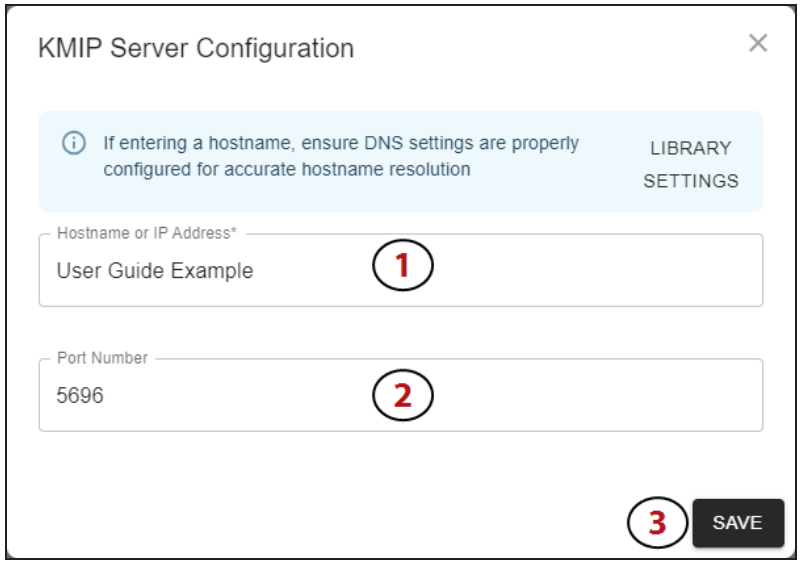


Figure 47 The KMIP Server Configuration screen.

1. In the **Hostname or IP Address** text field, enter the KMIP server hostname or IP address.
2. Optionally, enter the KMIP server port number in the **Port Number** text field.
3. Click **Save**.

Editing KMIP Servers

Use the steps below to edit a previously configured KMIP server. To begin, click **Edit Server** on the configured KMIP server you wish to edit.

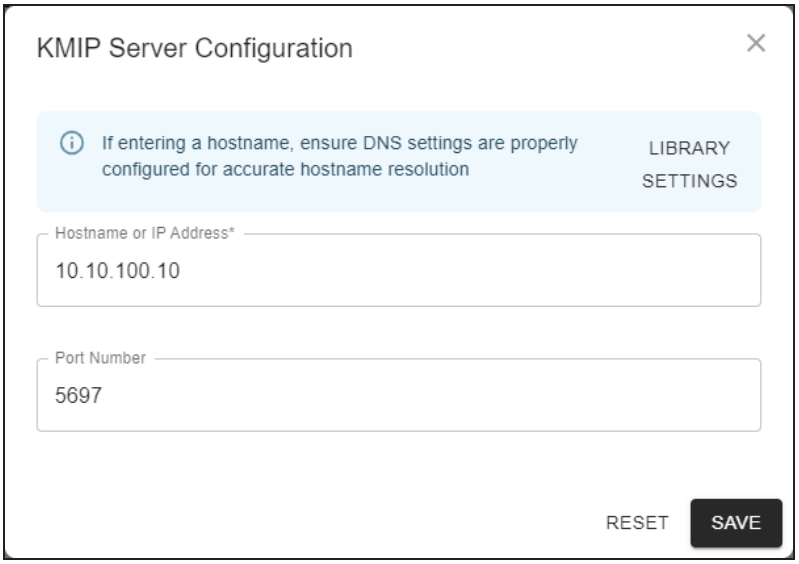


Figure 48 The KMIP Server Configuration screen.

1. Edit the **Hostname or IP Address** and **Port Number** text fields.
2. Click **Save**.

Deleting KMIP Servers

Use the steps below to delete a previously configured KMIP server. To begin, click **Delete Server** on the configured KMIP server you wish to delete.

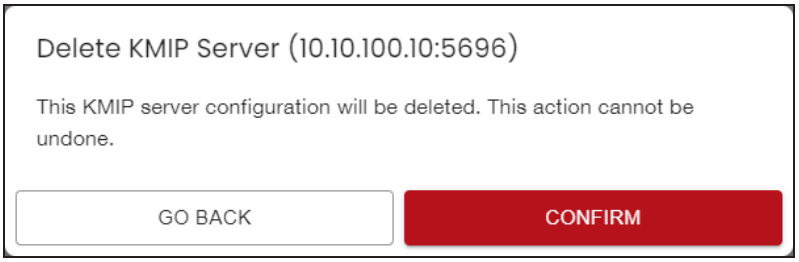


Figure 49 The Delete KMIP Server screen.

1. Click **Confirm** to delete the server.

Chapter 5 - Using The Library

This chapter describes using the Spectra Cube library, including moving, importing, and exporting media.

Controlling the Library Power **92**
- Power On the Library 92
- Power Off the Library 92

Importing, Exporting, and Exchanging Magazines **93**
- Main TAP 93
- Requirements 93
- Restrictions 94
- Performing an Import or Export 96

Importing Into a Storage or Cleaning Partition **96**
- Import Requirements 96
- Prepare the Storage Partition or the Cleaning Partition 99
- Import the Magazines 100

Exporting Magazines and Cartridges **102**
- Prepare for the Export 102
- Export the Magazines or Cartridges in a Partition 103

Exchanging Magazines and Cartridges **104**
- Prepare for the Exchange 104
- Exchange the Magazines or Cartridges in a Partition 104

Move Media **106**
- Moving Media 106

Media Lifecycle Management **107**
- Navigating the MLM Screen 108
- Tape Details 109
- Tape Mount History 110

Understanding Drive Lifecycle Management **111**
- Overview 111
- Drive Health Reports 111

Drive Lifecycle Management **112**
- Navigating the DLM Screen 112

Drive Details 113
Drive Mount History 114
Licenses 115
Adding a License 115

CONTROLLING THE LIBRARY POWER

The library power is controlled using the front panel power button.

Power On the Library

Before powering on the library, make sure that all of the library's power cables are plugged into AC outlets.

Use the Front Panel Power Button

1. Press and hold the front panel power button until the button's LED illuminates and the LCD operator panel turns on.

Figure 50 The front panel power button.

2. After initialization is complete, the LumOS login screen displays (see Logging in to the LumOS User Interface on page 35).

Note: If the library cannot complete the initialization process, it generates system messages and enters maintenance mode. Contact Spectra Logic Technical Support for assistance (see Contacting Spectra Logic on page 8).

Power Off the Library

Before powering off the library, use the following steps to prepare for shut-down.

1. Use your storage management software to stop any backups running to the library.
2. Move any media loaded in tape drives to storage locations.
3. Power off the library by pressing and holding the front panel power button for approximately 5 seconds (the button's LED starts flashing). The library begins its power-off sequence, which allows the LumOS software and components to shut down gracefully.

IMPORTING, EXPORTING, AND EXCHANGING MAGAZINES

You can use the LumOS user interface to import, export, and exchange cartridges on the Spectra Cube library. You must be physically present at the library to perform these tasks, but the import and export process can be controlled remotely if desired.

Main TAP

For day-to-day operations involving a small number of magazines, you can import or export one at a time using the main TAP.

Requirements

User Privilege Requirement

Any user with operator privileges who is assigned to the partition and all users with superuser or administrator privileges can perform import or export operations. See Configuring Users on page 52 for information about assigning user to a partition.

Note: Operators assigned to the partition can only import and export to and from the Entry/Exit pool.

Cartridge and Magazine Labeling

Make sure that each cartridge and magazine is labeled with a unique barcode. The barcode labels on Spectra Certified Media contain information about the media type. To ensure that the correct type of cartridges are stored in a partition, the library prevents you from importing the wrong cartridge type into a partition.

TeraPack Magazines

Cartridges are always imported and exported using a TeraPack magazine (or a maintenance magazine for cleaning partitions), regardless of whether you have an individual cartridge or a group of cartridges.

- When you want to import a single cartridge, you must first put the prepared cartridge in a magazine, then import the magazine.
- When you want to export a single cartridge, you must export the magazine containing the cartridge and remove the desired cartridge from the magazine. You can then re-import the magazine if desired.

Restrictions

Using the LumOS Web Interface

Import, Export, and Exchange operations are normally performed using the operator panel on the front of the library; however, you can override this restriction and initiate the import, export, and exchange processes remotely using the LumOS user interface or API commands. See Operator Panel Override below for more information.

Background Operations

You cannot import, export, or exchange cartridges or magazines if the library is actively running a background operation such as Media Auto Discovery, PreScan, or PostScan.

Media Auto Discovery and PreScan are background operations that use the drives in a partition to discover newly imported cartridges and add them to the MLM database. The discovery process cannot begin while the hosts are actively loading cartridges into or unloading cartridges from the drives. If you import cartridges during this time, the library posts a failure message stating that no drives are available to perform the discovery process.

Operator Panel Override

You can override the operator panel restriction on Import, Export, and Exchange operations to initialize the operations using the LumOS web interface. To override the restriction using the LumOS web interface, navigate to **Operations** toolbar and select the desired operation screen and follow the steps below.

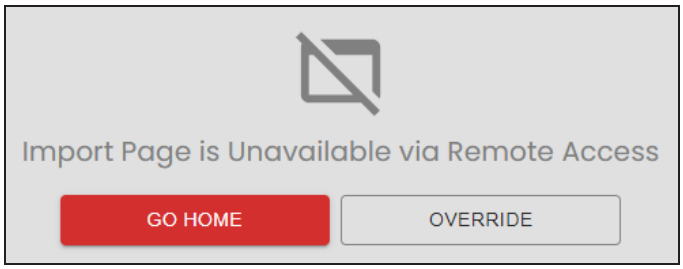


Figure 51 The Override button.

1. Click **Override**.

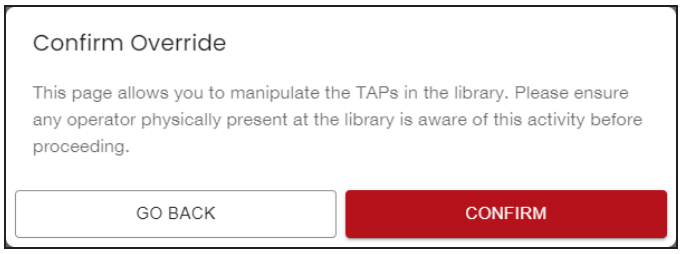


Figure 52 The Confirm Override screen.

2. Click **Confirm**.

Note: Overriding the operator panel only allows users to initialize operations and manipulate the TAP remotely. An operator must be physically present at the library to insert or remove magazines.

Performing an Import or Export

Use the links below to navigate to the corresponding sections:

- **Importing Into a Storage or Cleaning Partition below**
- **Export the Magazines or Cartridges in a Partition on page 103**
- **Exchanging Magazines and Cartridges on page 104**

Note: Importing and exporting requires you to manage the TeraPack Access Port (TAP) on the library. You can manage the TAP using the buttons in the LumOS user interface. For an example, Figure 53 shows the Main TAP and Open TAP buttons.

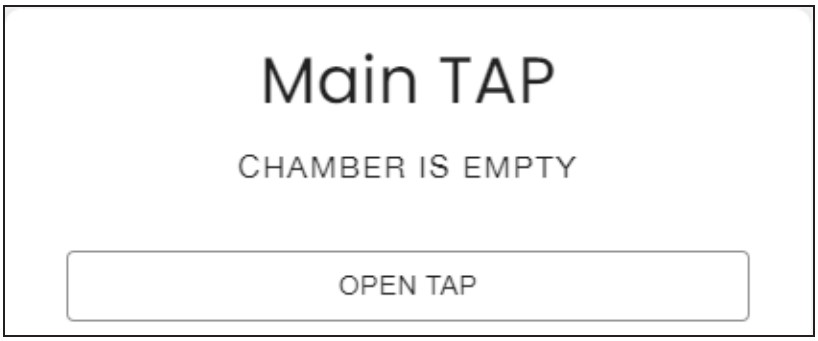


Figure 53 The LumOS Main TAP interface.

Importing Into a Storage or Cleaning Partition

During normal operations, magazines containing data cartridges are typically imported to a storage partition's entry/exit pool and then moved to the storage pool using **Move Media** in the LumOS user interface. This process ensures that the media inventory maintained by the storage management software is accurate.

An exception is the first time that cartridges are loaded into a storage partition. Importing magazines directly into a storage partition's storage pool simplifies loading a storage partition for the first time. After the cartridges are imported into the storage pool, they are available for immediate use by the storage management software.

Import Requirements

Partitions

You must have one or more partitions defined before you can import magazines into the library. See Partition Overview on page 62 for information about partitions and pools. Creating A Partition on page 65 provides detailed instructions for creating partitions.

Cartridges and Magazines

All cartridges are imported into the library using magazines. Before beginning, have on hand the cartridges that you want to import into the partition.

If you are importing magazines into the storage partition's storage pool for the first time, the maximum number of magazines equals the number of chambers assigned to the storage pool for the partition. You do not need to fill all slots in the magazines or all of the chambers in the partition; however, any empty chambers are inaccessible to the storage management software.

Entry/Exit Pool

For daily operations, TeraPack magazines containing data cartridges are typically imported or exported using a storage partition's entry/exit pool. When using the entry/exit pool for importing/exporting, the following must be true:

- The entry/exit pool must have sufficient empty chambers available for importing new magazines. If you need to import new magazines and all of the chambers in the entry/exit pool are full, you must export one or more magazines to make space for the new magazines.
- The entry/exit pool must have sufficient empty slots available to accommodate any cartridges that the storage management software ejects from the partition. If all of the slots in the entry/exit pool are full, either move newly imported cartridges to the partition's storage pool, leaving empty slots in the entry/exit pool, or export one or more full magazines and replace them with magazines that have empty slots.

IMPORTANT Make sure that the magazines you export are not filled with cartridges that you just imported but did not yet move to the storage pool using the LumOS user interface.

- You can import a magazine containing a cleaning cartridge into the partition's entry/exit pool and then use the Inventory screen to move the cartridge to a drive for cleaning. When the cleaning is complete, move the cleaning cartridge back to the entry/exit pool and export the magazine from the entry/exit pool.

Storage Pool

A storage partition's storage pool contains all of the cartridges that can be accessed by the storage management software for the purpose of writing or reading data.

- If you are importing magazines into the entry/exit pool and using your storage management software to move the cartridges to the storage pool, the storage pool must have sufficient empty slots to accommodate each cartridge imported into the entry/exit pool.
- If you are importing directly into the storage pool, the storage pool must have sufficient empty chambers to accommodate the magazines you plan to import.
- Any chambers in the storage pool that do not contain magazines are inaccessible to the storage management software. You can, however, import magazines into the empty chambers using the library's LumOS user interface.

Cleaning Partition

When importing cleaning cartridges into a cleaning partition, keep the following in mind:

- Cleaning cartridges must be identified with "CLN" at the beginning of the barcode sequence on their labels. This requirement applies to both standard and custom barcode labels.
- Cleaning cartridges used in a cleaning partition must be in Maintenance TeraPack magazines, which are identified by Spectra-unique labels. The library automatically prevents importing cleaning cartridges and magazines that are not properly labeled into a cleaning partition.

  Note: Maintenance TeraPack magazines filled with appropriately labeled cleaning cartridges are available from Spectra Logic.
- Make sure that the Maintenance TeraPack magazine does not contain any data cartridges. The library will not import a Maintenance TeraPack magazine that contains cartridges that are not identified with “CLN” at the beginning of the barcode sequence on their labels.
- The cleaning cartridges in a cleaning partition can only be used for drives in storage partitions configured to use that cleaning partition. Associating a cleaning partition with drives in a storage partition automatically enables the Auto Drive Clean feature for that partition.
- The cleaning cartridges in the cleaning partition are inaccessible to the application software running on the host. Make sure you disable any software-based drive cleaning to prevent repeated requests to import a cleaning cartridge.
- If your storage management software supports automated drive cleaning and you plan to use this method to clean the drives instead of the library’s Auto Drive Clean feature, refer to your software documentation for instructions. You must import the properly labeled cleaning cartridges into the storage partition using a TeraPack magazine (not a Maintenance TeraPack magazine).

Prepare the Storage Partition or the Cleaning Partition

Before importing magazines into a storage partition or a cleaning partition, make sure that the partition has sufficient empty slots or chambers available to accommodate the cartridges or magazines you plan to import.

- If you plan to import cartridges into the storage partition's entry/exit pool, and then use your storage management software to move the cartridges to the storage pool, check the Inventory screen for the partition to make sure that the storage pool has an empty slot available to accommodate each imported cartridge. If there are insufficient empty slots available in the storage pool, do one of the following to prepare the storage pool to receive the imported cartridges:
  - If the partition's storage pool has empty chambers, import one or more TeraPack magazines with empty slots into the storage pool.
  - If the partition's storage pool does not have any magazines with empty slots, use your storage management software to eject cartridges from the library. The library moves the ejected cartridges from the partition's storage pool to magazines in its entry/exit pool. You can then export the magazines from the library. The resulting empty slots in the storage pool are now available for newly imported cartridges.
  - Exchange a full magazine in the storage pool for one containing empty slots.
- If you plan to import cartridges directly into the partition's storage pool, make sure that the storage pool has an empty chamber for each magazine you plan to import. The partition's Import/Export screen shows the number of empty chambers available in the partition's storage pool. If there are no empty chambers available in the storage pool, export one or more magazines from the storage pool.
- If you plan to import cleaning cartridges into a cleaning partition, make sure that there is an empty chamber for each maintenance magazine you plan to import. If there are no empty chambers available in the cleaning partition, export one or more magazines. Alternatively, you can exchange expired cleaning cartridges for new ones in the magazines already present in the cleaning partition without having to import additional magazines.

Import the Magazines

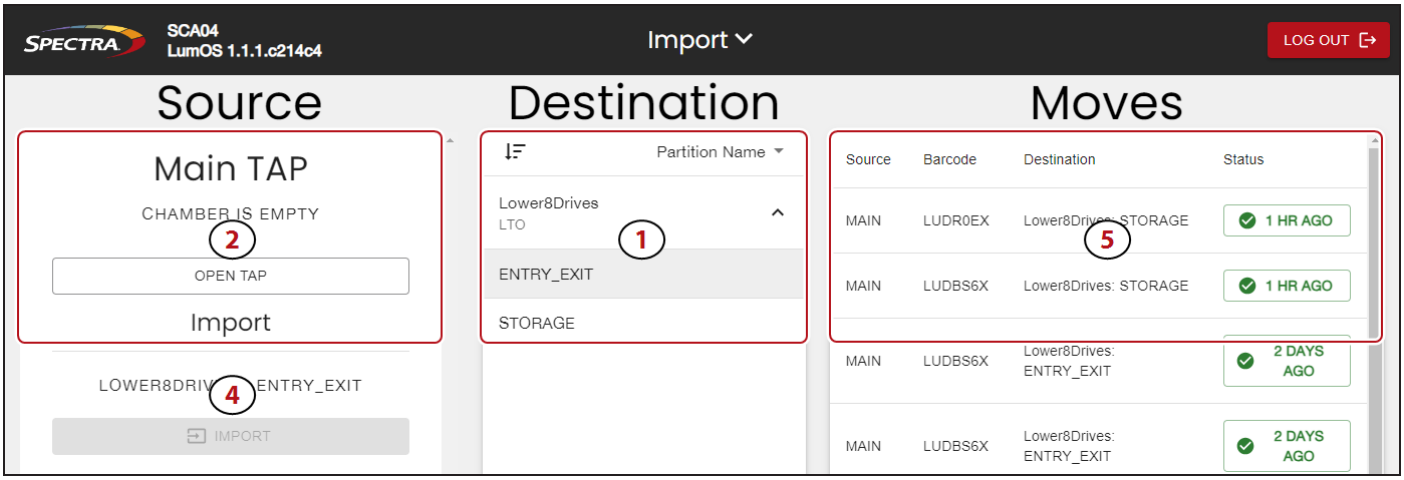


Figure 54 The LumOS Import screen.

To import a magazine, log into the library as a user with the appropriate privileges and select **Operations > Import Media** in the LumOS user interface. Use Figure 54 on page 100 above to help you import media:

1. Select the desired **Destination** partition and pool type from the list.

   Note: Cleaning partitions can only select the **Storage** pool. Storage partitions can select either the **Storage** or **Entry/Exit** pools.

2. Click **Open TAP**.

3. Insert the magazine into the tray on the open TAP with the smooth surface side toward the outside of the library, as shown in Figure 55 on page 101.

Figure 55 Insert a magazine into the TAP, making sure that it is correctly oriented.

4. Click **Close TAP** to close the TAP door.
5. Click **Import** to start the import.
6. Review the **Moves** column for your import history.

EXPORTING MAGAZINES AND CARTRIDGES

The export process uses the main TAP to physically remove all of the magazines (and any cartridges they contain) from the selected location (a cleaning partition or storage partition's entry/exit pool or storage pool). The exported magazines are not replaced by new magazines.

Prepare for the Export

- If you want to export cartridges from a storage partition, use the your storage management software to eject the desired cartridges from the partition's storage pool. You can then export the cartridges from the entry/exit pool. Using this method to export cartridges from a storage partition ensures that the media inventory maintained by the storage management software remains accurate.

  The following steps describe the process for ejecting cartridges from a storage partition using the entry/exit pool.

  1. Use your storage management software to eject the cartridges from the library.
  2. The library moves each cartridge out of the partition's storage pool and into an empty slot in a TeraPack magazine already stored in the entry/exit pool.
  3. When all of the requested cartridges are in the entry/exit pool, the library reports to the software that the export request is complete.
  4. At your convenience, you can then export the magazines in the entry/exit pool from the library using controls on the Export screen of the user interface and the main TAP.

IMPORTANT When exporting tape cartridges from a partition with SlotIQ enabled, Spectra Logic recommends that you use your host software to move the cartridges to the Entry/Exit pool before exporting.

- Exporting a magazine directly from the storage pool is not recommended unless you are exporting all of the magazines from a partition. This process is often referred to as a "bulk export."

  If you choose to export magazines directly from the storage partition's storage pool, be sure to use your storage management software to update its media inventory after completing the export.

Export the Magazines or Cartridges in a Partition

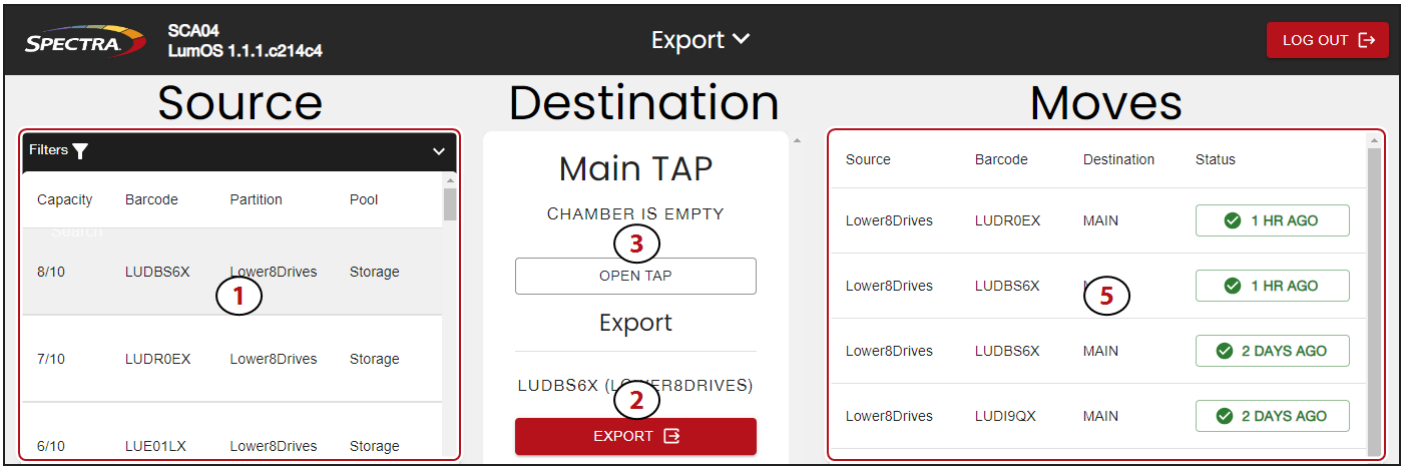


Figure 56 The LumOS Export screen.

To export a magazine or cartridge, log into the library with the appropriate privileges and select **Operations > Export Media** in the LumOS user interface. Use Figure 56 above to help you export media:

1. Select the desired **Magazine** in the **Source** column.
2. Click **Export**.
3. Click **Open TAP** to access the exported magazine. Remove the magazine or desired cartridges from the magazine.
4. Click **Close TAP** to close the TAP door.
5. Review the **Moves** column for your export history.

EXCHANGING MAGAZINES AND CARTRIDGES

The exchange process moves each of the magazines in the selected location to the TAP so that you can exchange the magazines for others of the same type.

You can also remove or exchange one or more individual cartridge(s) in a magazine while leaving the other cartridges in place. Exchanging cartridges in a magazine is especially useful when you need to temporarily import a cleaning cartridge into the storage pool as part of drive maintenance.

Prepare for the Exchange

Be sure to have the prepared cartridges and labeled magazines on hand before beginning the exchange.

Exchange the Magazines or Cartridges in a Partition

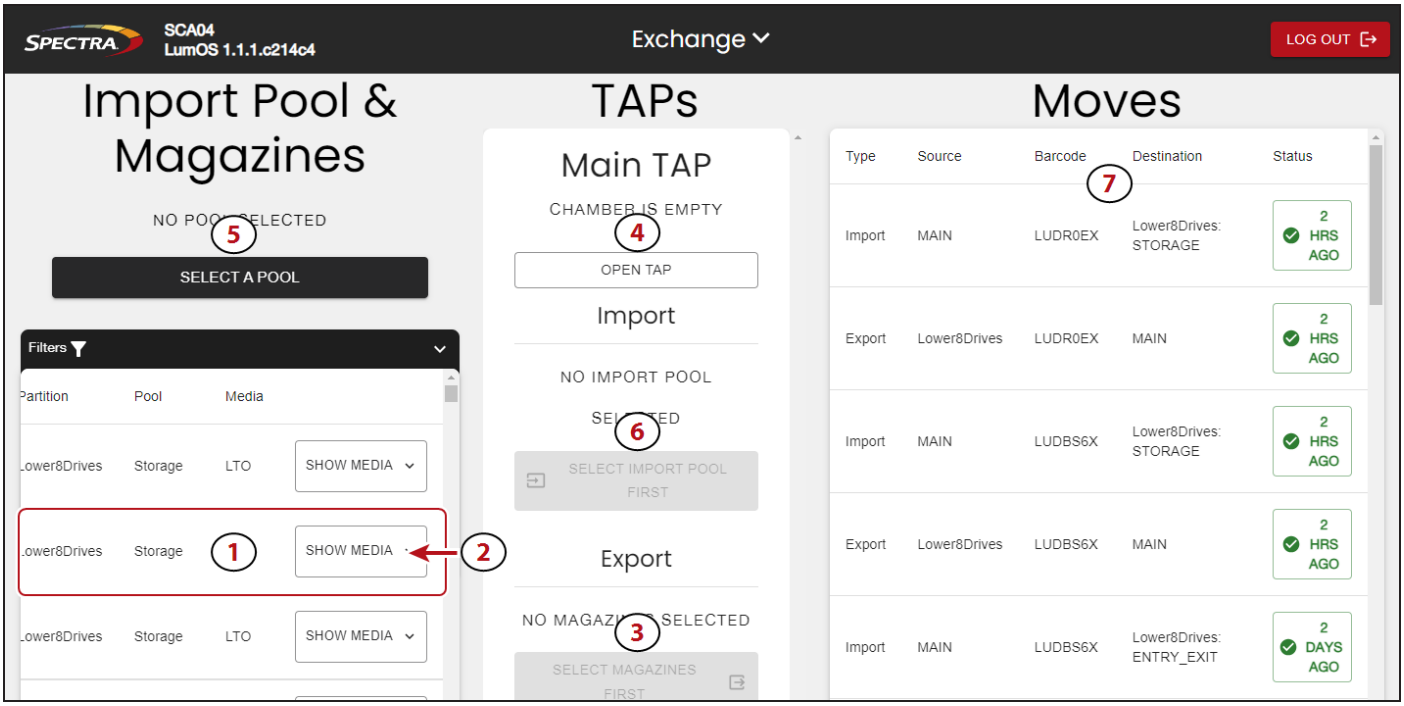


Figure 57 The LumOS Exchange screen.

To exchange a magazine or cartridge, log into the library with the appropriate privileges and select **Operations > Exchange Media**. Use Figure 57 above to help you exchange media.

1. Select a magazine to export from the magazine list.
2. If desired, click **Show Media** to display the cartridge ID and barcodes contained in the magazine.
3. Click **Export** on the TAP to export the selected magazine.

4. Click **Open TAP** to access the exported magazine. Exchange the magazine or any desired media in the TAP then click **Close TAP**.
5. Click **Select A Pool** to select the pool to which you want to exchange media.
6. Click **Import** to import the new media to the selected pool.
7. Review the **Moves** column for your import and export history.

Move Media

Overview

During normal operations, you typically use your storage management software to move cartridges from one location to another within the library. However, you may occasionally need to create and process a move queue to direct the library to move cartridges manually. This can be done using the library's LumOS user interface or REST API to locate and move individual cartridges (for example, to move a cleaning cartridge stored in the storage partition to a drive if you are not using the Auto Drive Clean option). Use the instructions below to manually direct cartridge moves using the LumOS user interface.

User Privilege Requirements

The user privilege requirements when moving cartridges in a storage partition depend on how the library is being accessed. Operator users can only move cartridges within their assigned partitions. Superuser or administrator users can move cartridges within any partition.

Moving Media

To move media in the library, log in and select **Operations > Move Media**, then **Select** the partition for which you want to move media. The user interface refreshes to display the inventory of the selected partition.

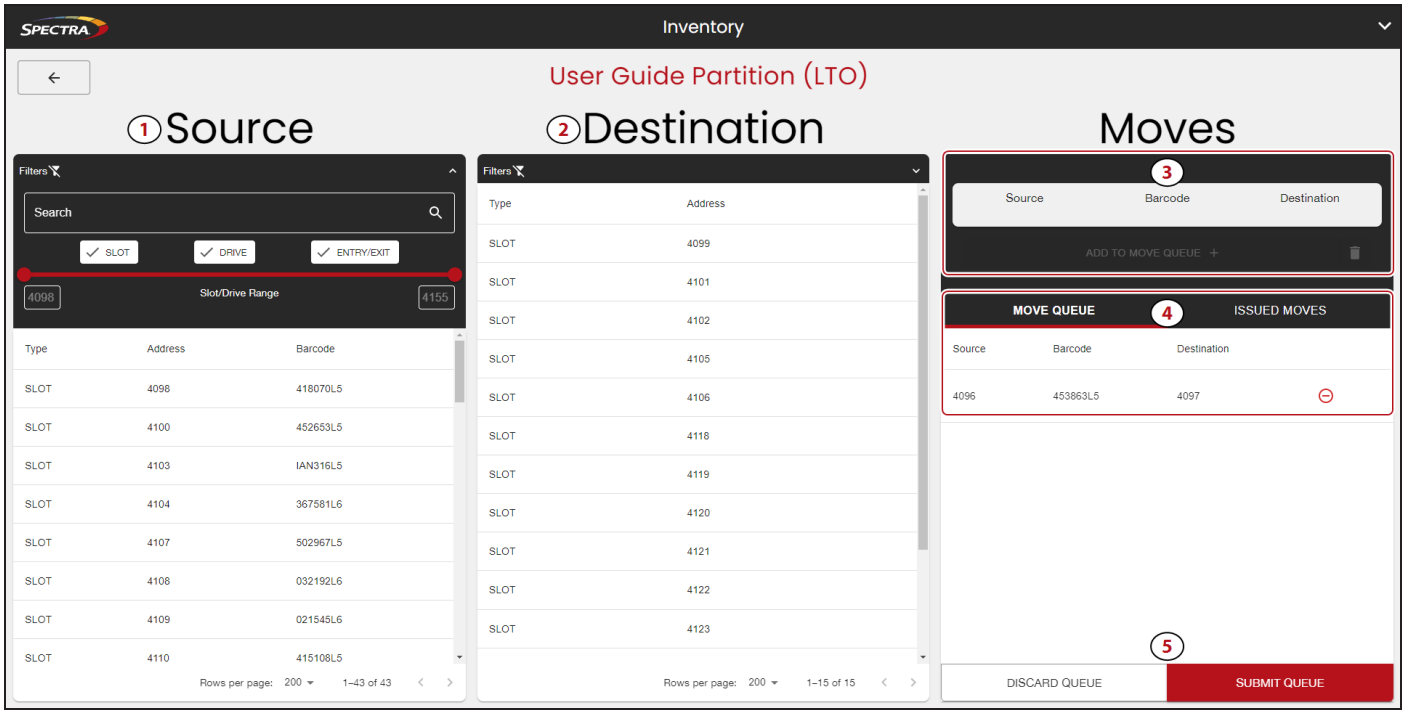


Figure 58 The LumOS Inventory screen.

Use Figure 58 to help you move media:

1. Select the desired **Source** slot from the list.
2. Select the desired **Destination** slot from the list.

   Note: You can filter **Source** and **Destination** by **Slot**, **Drive**, or **Entry/Exit** port. Additionally you can directly **Search** or limit the displayed range.

3. Verify the information displayed in the **Moves** column matches the desired **Source**, **Barcode**, and **Destination**. Click **Add To Move Queue** if the information is correct. Repeat as necessary to add additional moves to the **Move Queue**.
4. Confirm that the **Move Queue** lists all desired moves. Click the minus icon to remove a specific move from the queue, if necessary.

   Note: Clicking the **Issued Moves** tab displays the partition move history.

5. Click **Submit Queue** to issue the move commands.

MEDIA LIFECYCLE MANAGEMENT

This section describes how to use Media Lifecycle Management to proactively monitor and report on the health of cartridges in your library. To view Cube library Media Lifecycle Management (MLM) information, log in and navigate to **Status > MLM**.

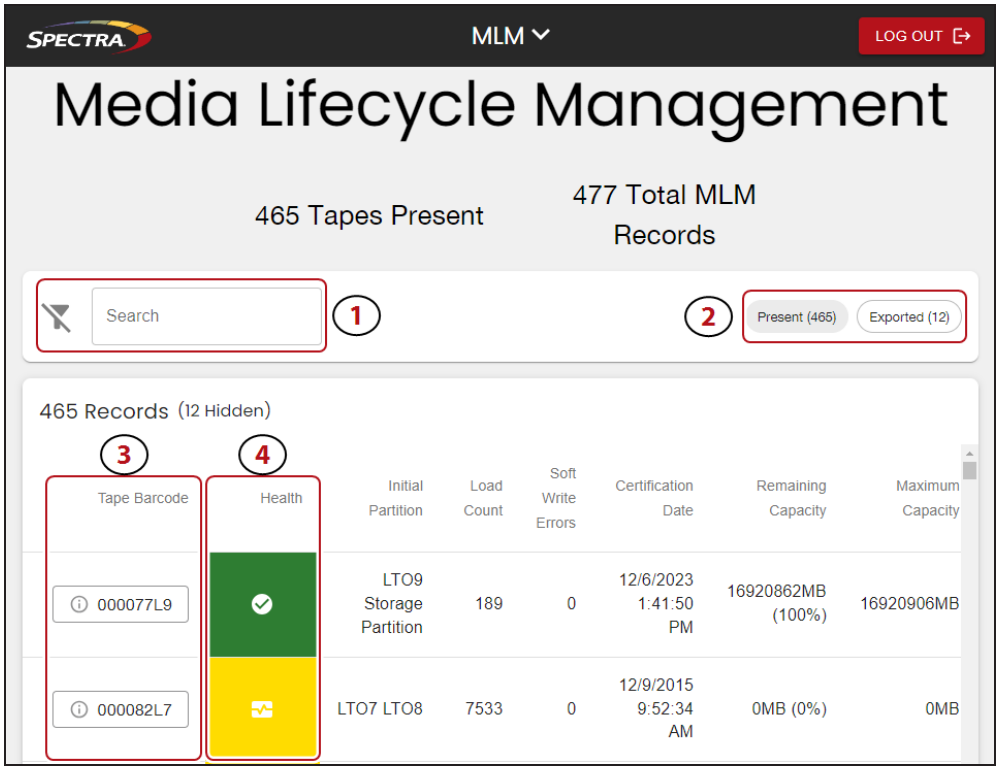


Figure 59 The LumOS MLM screen.

Navigating the MLM Screen

Use Figure 59 to help you navigate the features of the MLM screen.

1. Use the **Search** feature to filter the records by tape barcode or partition name displayed on the MLM screen.
2. Press the **Present** or **Exported** button to display records for tapes currently in the library or tapes exported from the library.
3. Click the **Tape Barcode** buttons to view expanded tape information. See Tape Details on the next page.
4. The **Health** column displays the tape cartridge health in a color code: Green is good health, orange is average health, and red is poor health.

Tape Details

Click a **Tape Barcode** button pictured in Figure 59 to view the tape details screen.

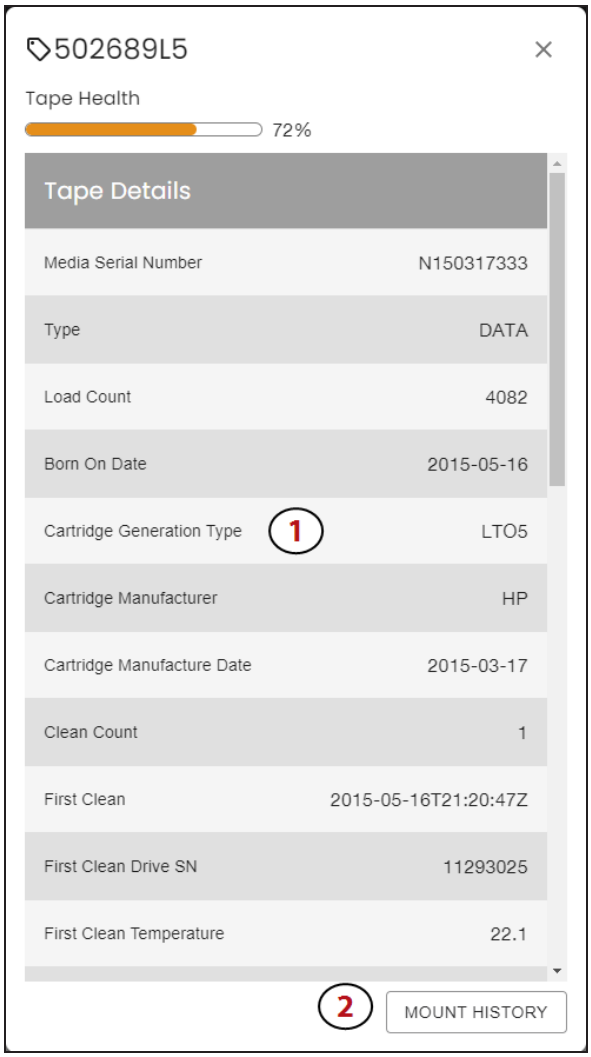


Figure 60 The LumOS Tape Details screen.

1. The **Tape Details** screen displays all tracked metrics for the tape.
2. Click **Mount History** to display the Mount History screen for the selected tape. See Tape Mount History on the next page.

Tape Mount History

Use Figure 61 to help you navigate the mount history screen.

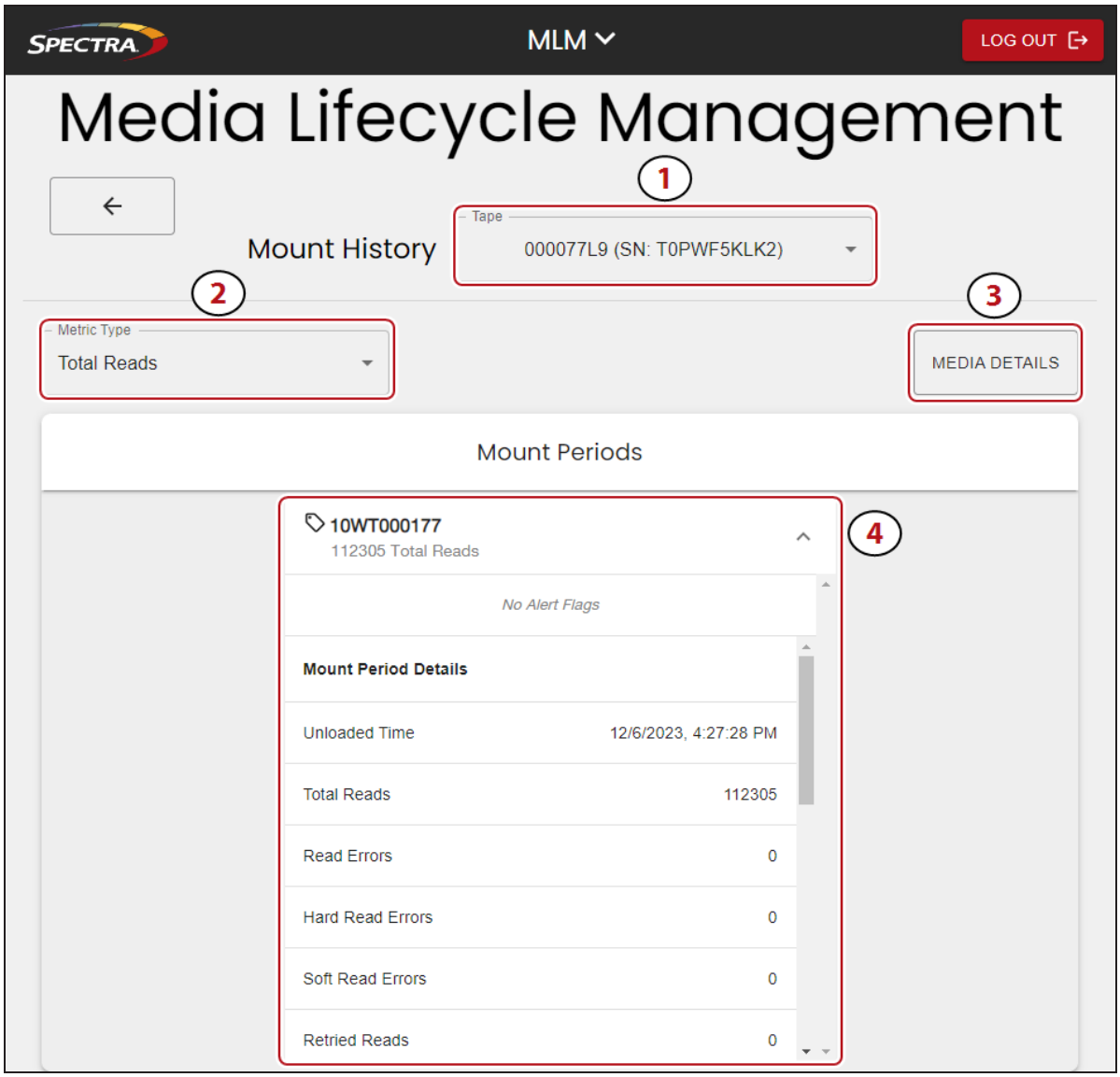


Figure 61 The LumOS Mount History screen.

1. Use the **Tape** drop-down menu to select the tape for which you want to view mount history information.
2. Use the **Metric Type** drop-down menu to select the metric you want to view on all mount periods.
3. Click **Media Details** to view the media details for the tape. See Tape Details on the previous page for more information.
4. Click on a mount history entry to expand and view all mount period details.

Understanding Drive Lifecycle Management

Overview

Drive Lifecycle Management works in conjunction with Media Lifecycle Management to help you identify drives that experience a high number of errors or other problems during operation.

Each time a cartridge is unloaded from a drive, the library collects media health data from the drive. This data includes read/write errors, tape alerts, and flags generated during the time the most recent cartridge was loaded in the drive. It also includes the current value for the drive's single character display (SCD) and any errors detected at the time the cartridge is unloaded. All of this data, plus the MLM data for the 50 most recently loaded cartridges, is stored in the DLM database. This data is used to generate an overall drive health status for the library, as well as health reports for each individual drive.

Drive Health Reports

A health icon next to each drive indicates the overall health of the drive. Detailed reports provide information about the cartridges that have been loaded into the drive and any errors reported. The DLM database containing the health information for every drive in the library is backed up whenever the library is backed up.

DRIVE LIFECYCLE MANAGEMENT

The LumOS user interface allows you to monitor the drives in the Cube library. To view the Drive Lifecycle Management (DLM) screen, log in and navigate to **Status > DLM**.

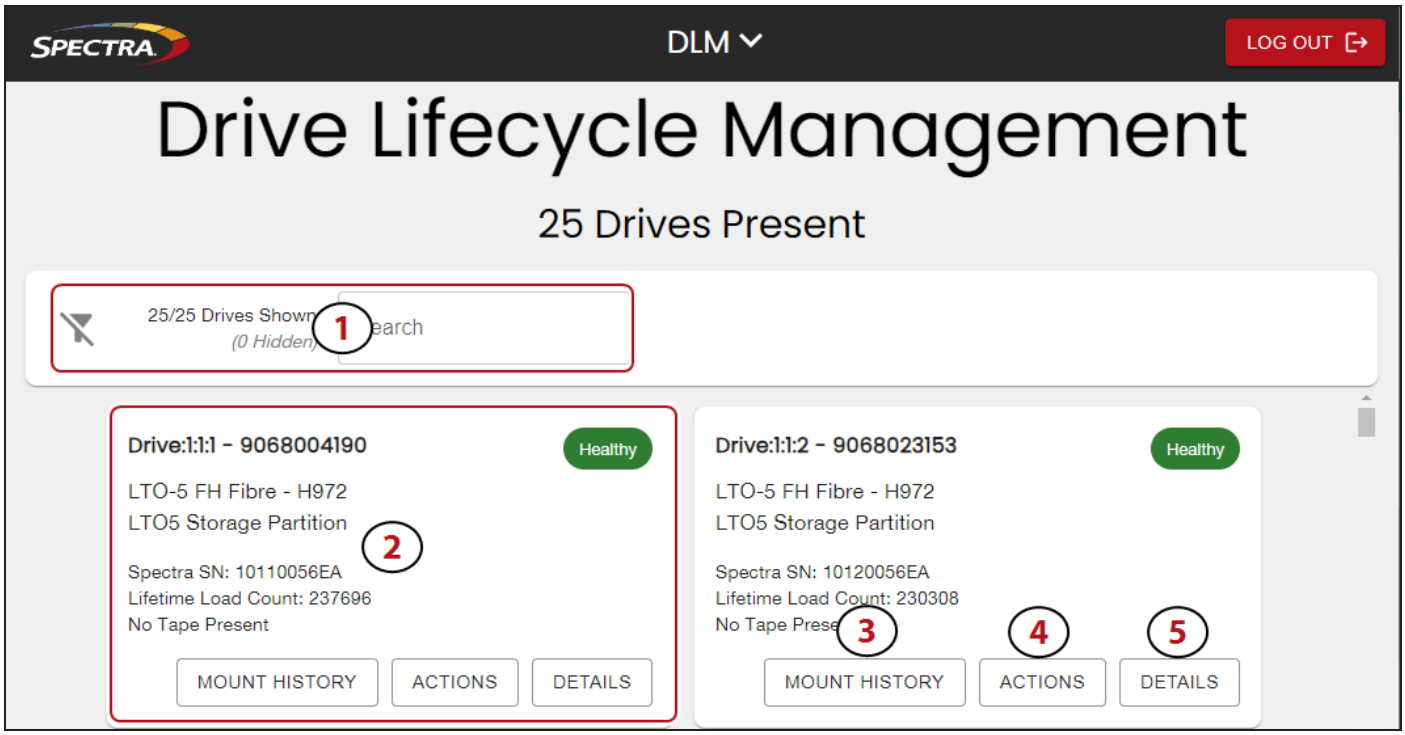


Figure 62 The LumOS DLM screen.

Navigating the DLM Screen

Use Figure 62 to help you navigate the features of the DLM screen.

1. Use the **Search** entry field to search for drives by serial number.
2. Each drive pane displays basic information about the drive.
3. Click **Mount History** to display the mount history for the drive. See Drive Mount History on page 114 for more information.
4. Click **Actions** to display the action history for the drive and to access the **Reset Drive** button.
5. Click **Details** to display the drive details screen. See Drive Details on the next page for more information.

Drive Details

Use Figure 63 on page 113 to help you navigate the Drive Details screen.

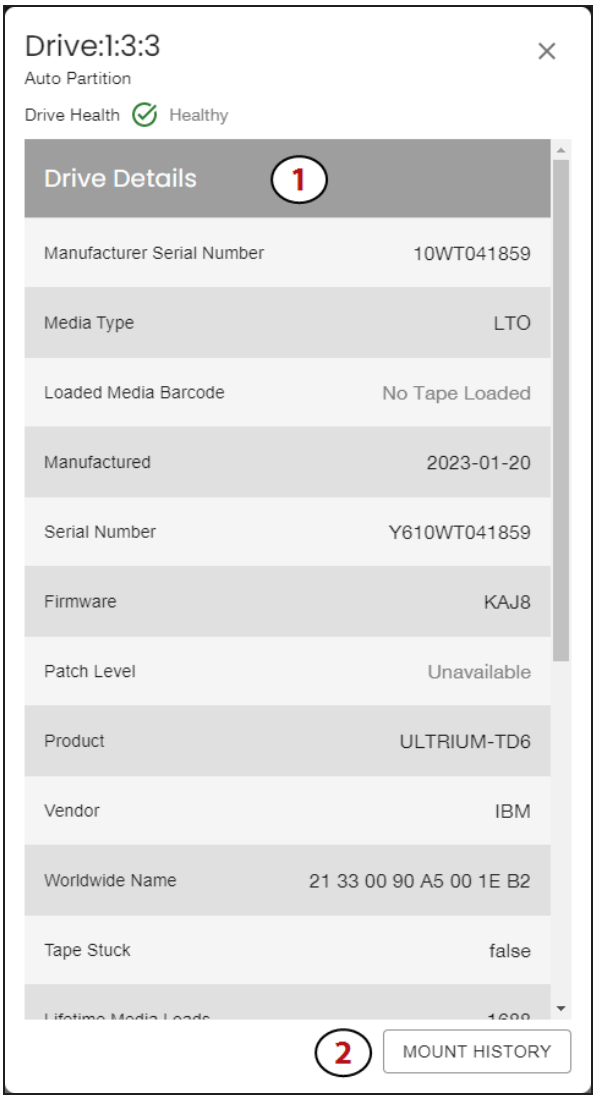


Figure 63 The LumOS Drive Details screen.

1. The Drive Details screen lists the metrics for the drive.
2. Click **Mount History** to display the Drive Mount History screen. See Drive Mount History on the next page for more information.

Drive Mount History

Use Figure 64 to help you navigate the Drive Mount History screen.

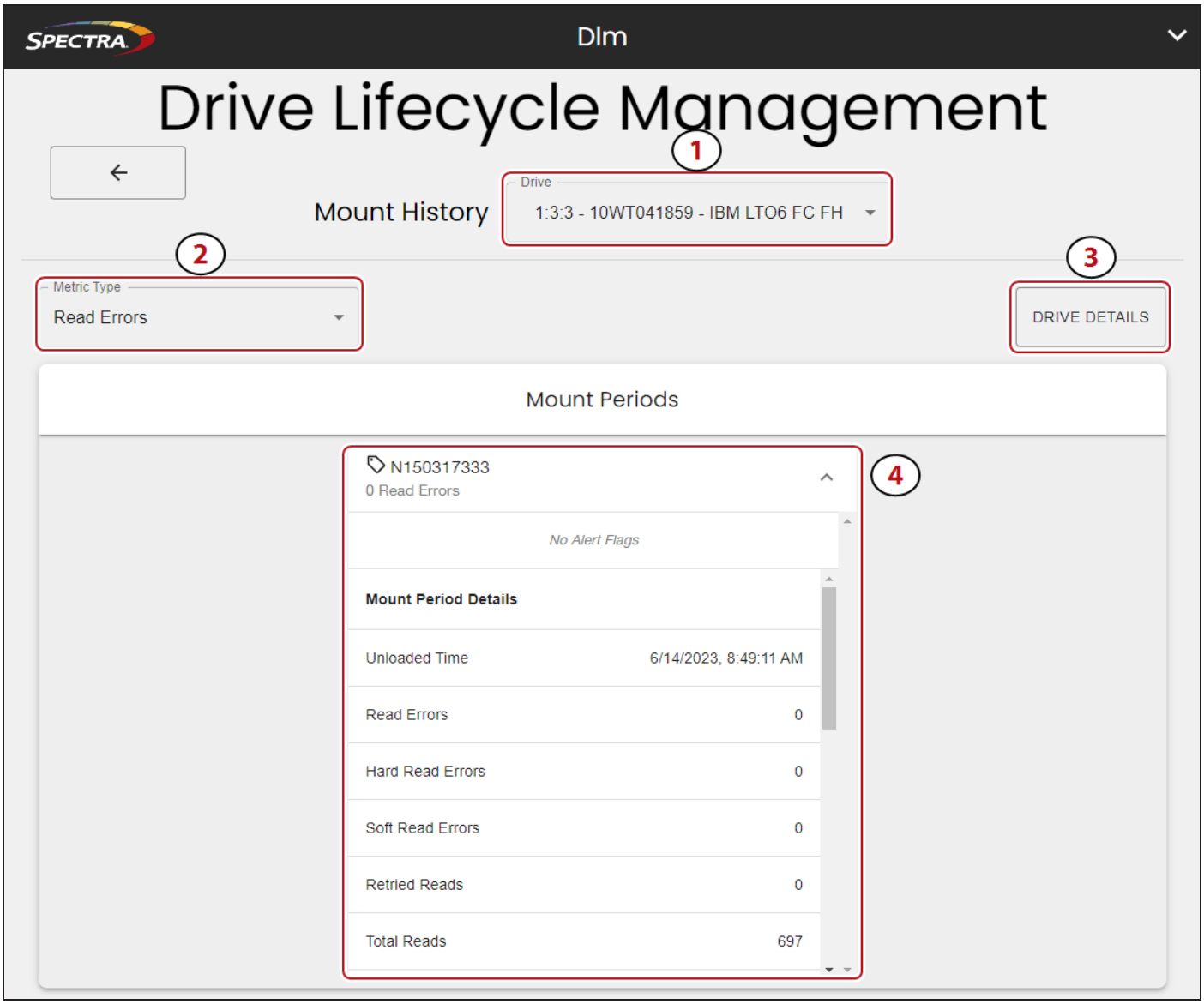


Figure 64 The LumOS Mount History screen.

1. Use the **Drive** drop-down menu to select the drive for which you want to view details.
2. Use the **Metric Type** drop-down menu to select the metric you want to view on all mount periods.
3. Click **Drive Details** to display drive details for the drive. See Drive Details on the previous page for more information.
4. Click on a mount history entry to expand and view all mount period details.

LICENSES

The LumOS user interface allows you to add and monitor licenses. To add a new license to the Cube library, log in and navigate to **Configuration > Licensing**.

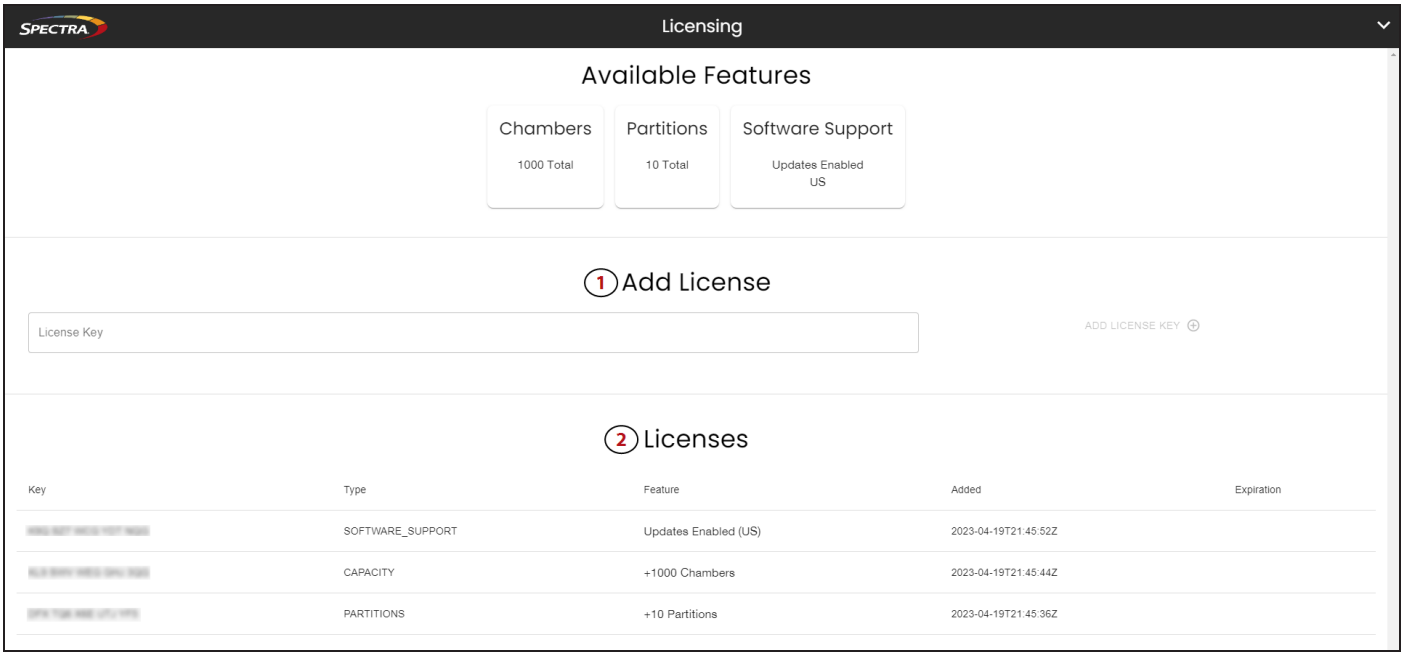


Figure 65 The LumOS Licensing screen.

Adding a License

To add a license:

1. Enter the **License Key** in the entry field and click **Add License Key**.
2. Confirm the new license displays in the **Licenses** pane.

Chapter 6 - Maintaining The Library

This chapter describes maintaining the Spectra Cube library, including updating library software, managing library backups, running diagnostics, and generating log files for use in troubleshooting.

Updating, Servicing, or Moving the Library **117**
Diagnostics **118**
Alerts **127**
Configuring Alert Settings 127
Adding or Editing Alert Subscribers 128
Log Gathering **130**
Gathering Logs 130
Managing Backups **131**
Package Update **133**
Configuring a Package Update 133
Drive Firmware Update **134**
Updating Drive Firmware in LumOS User Interface 134
Updating Drive Firmware Using ITDT 140
Robotics **143**
Robot Details 143

UPDATING, SERVICING, OR MOVING THE LIBRARY

Contact Spectra Logic Technical Support before making any changes to your library hardware or performing any service operations.

Servicing the Library

In the event that it is necessary to replace a component, make sure that you have instructions for performing the procedure *and* you either:

Are instructed to do so by Spectra Logic Technical Support,

—OR—

Have a support contract such as Assisted Self-Maintenance (ASM).

Moving the Library

The library hardware is configured to ensure proper thermal control, air flow, and dust filtering. After the library is installed, do not move the library.

IMPORTANT

Moving the library without assistance from a Spectra Certified Field Engineer voids your service contract. Contact Spectra Logic Technical Support for assistance if you need to relocate your library (see Contacting Spectra Logic on page 8).

DIAGNOSTICS

The LumOS user interface allows you to run library diagnostics remotely. To run a diagnostic, log in and navigate to **Tools > Diagnostics**. You can run the following diagnostic tests:

- **Column Calibration Test on the next page**
- **Robotics Positioning Test on page 120**
- **Move to Chambers on page 121**
- **Move to Drives on page 122**
- **HPT Self Test on page 123**
- **Security Audit on page 124**
- **Unload Drives on page 125**
- **Resolve SlotIQ on page 126**

Column Calibration Test

The **Column Calibration Test** diagnostic tests for VAX column calibration issues. Use the figure below to help you with the diagnostic.

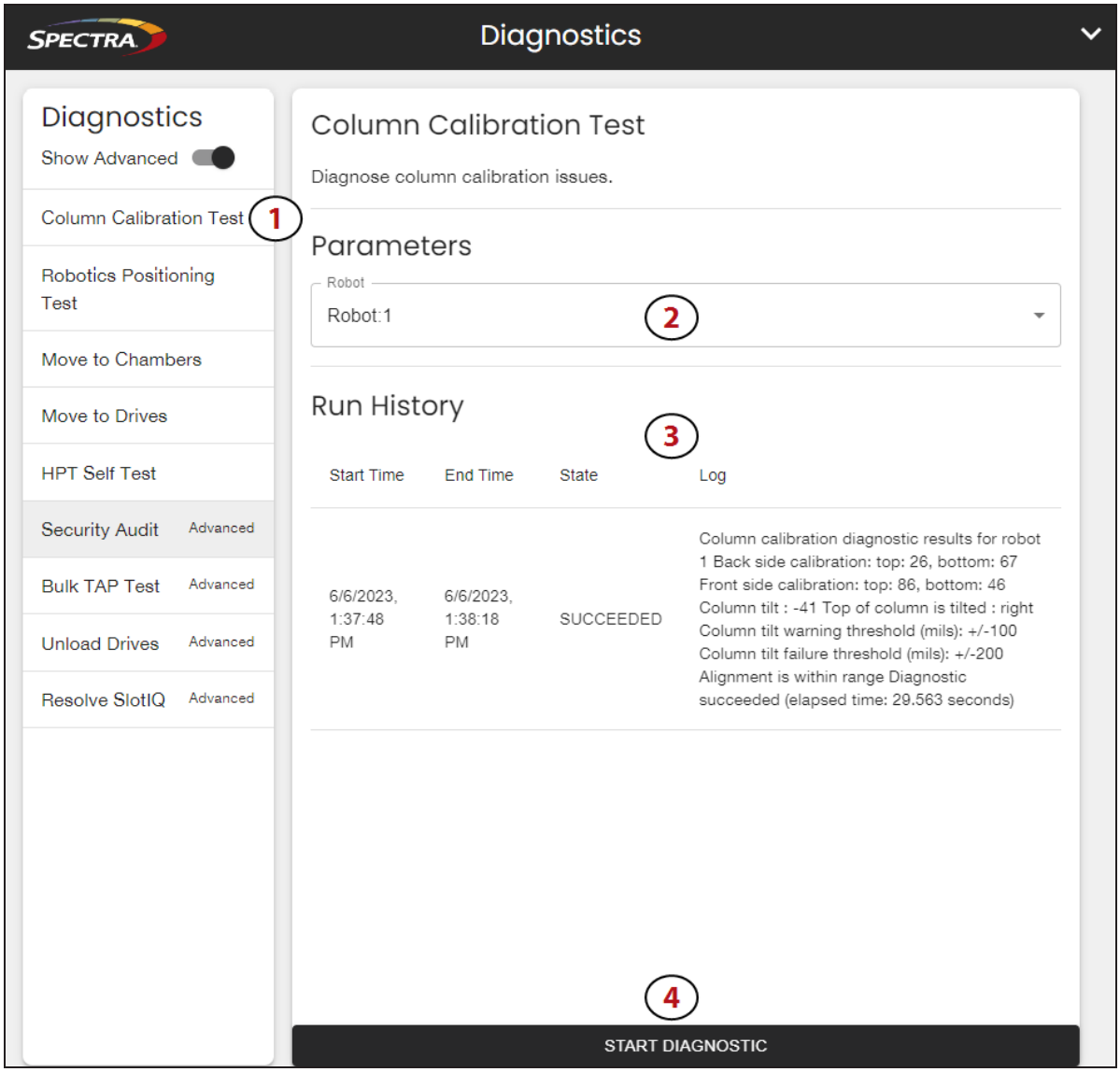


Figure 66 The LumOS Column Calibration Diagnostic screen.

1. From the diagnostics list, select **Column Calibration Test**.
2. Use the **Parameters** drop-down menu to select the robot to test.
3. Use the **Run History** panel to review previous column calibration test results.
4. Click **Start Diagnostic** to run a column calibration test on the selected robot.

Robotics Positioning Test

The **Robotics Positioning Test** diagnostic tests for robot positioning issues. Use the figure below to help you with the diagnostic.

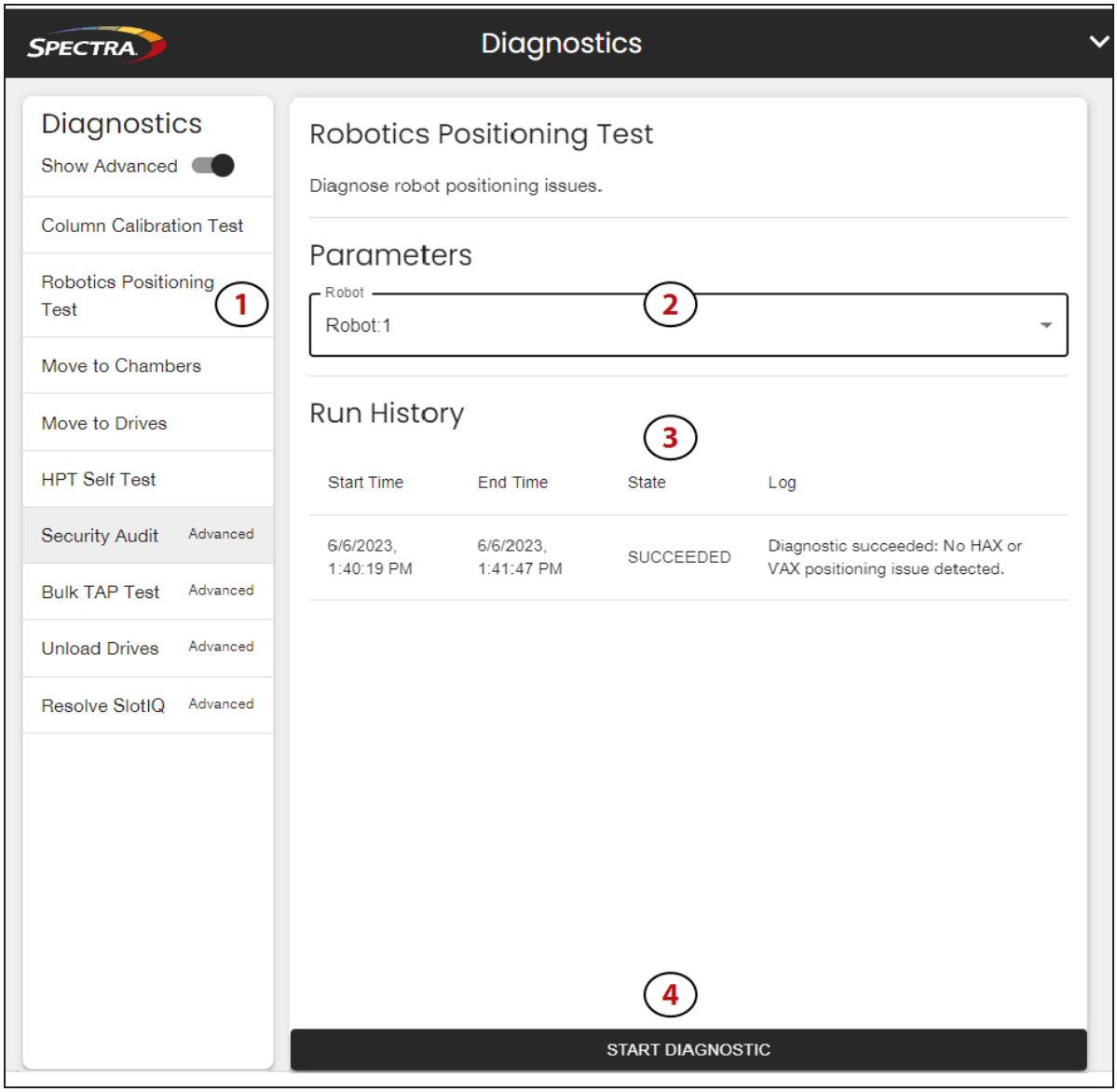


Figure 67 The LumOS Robotics Positioning Diagnostic screen.

1. From the diagnostics list, select **Robotics Positioning Test**.
2. Use the **Parameters** drop-down menu to select the robot to test.
3. Use the **Run History** panel to review previous robotics positioning test results.
4. Click **Start Diagnostic** to run a robotics positioning test on the selected robot.

Move to Chambers

The **Move to Chambers** diagnostic moves magazines to and from specified chambers to confirm access to magazines in the specified chambers. Use the figure below to help you with the diagnostic.

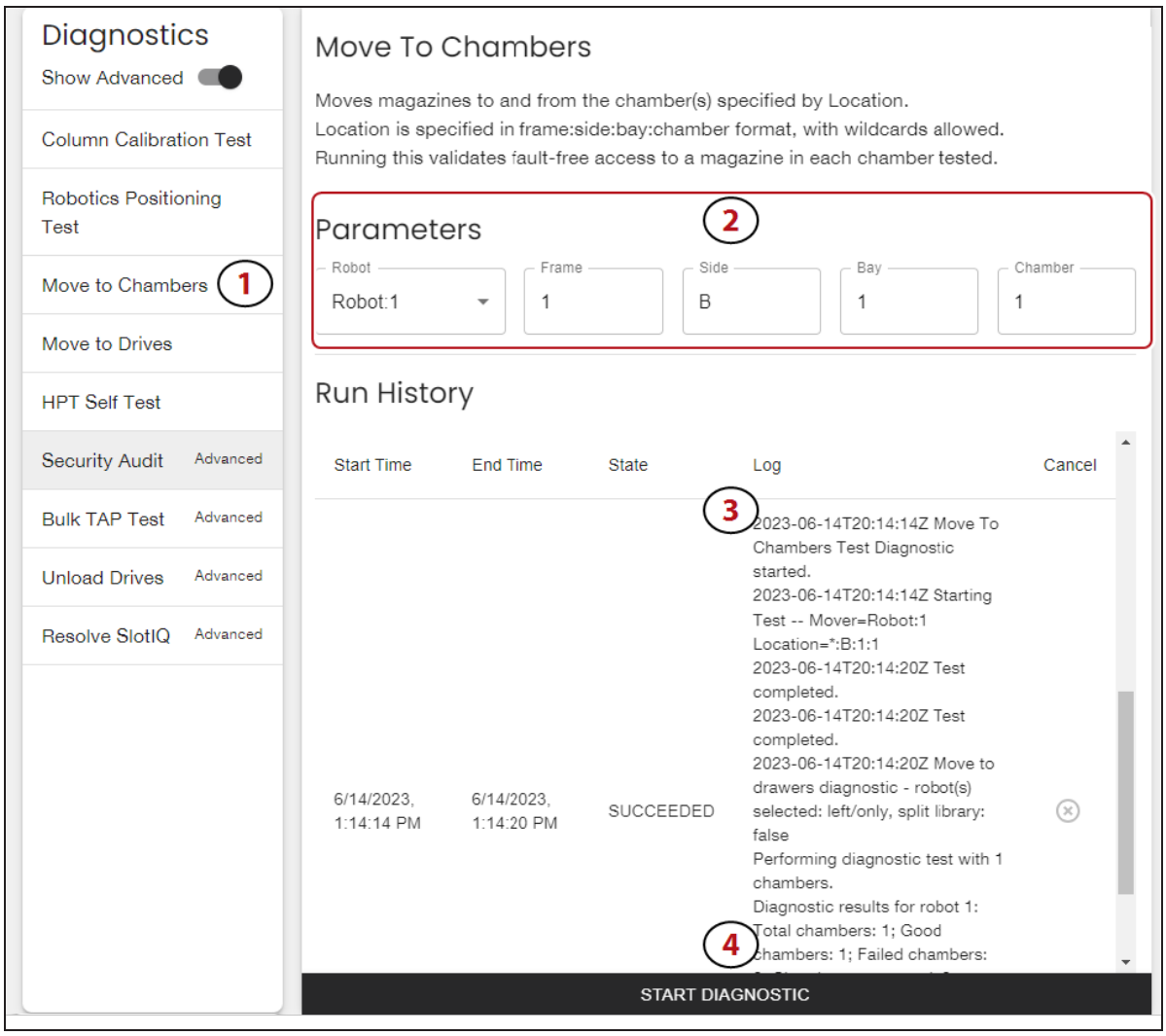


Figure 68 The LumOS Move to Chambers Diagnostic screen.

1. From the diagnostics list, select **Move to Chambers**.
2. Use the **Parameters** drop-down menu to select the robot to test. Enter information for **Side**, **Bay**, and **Chamber** if desired. If you leave a parameter blank, the test runs for all valid values of each parameter.

Note: Side only accepts **L** (left) and **R** (right) as parameters.

3. Use the **Run History** panel to review previous move to chambers test results.
4. Click **Start Diagnostic** to run a move to chambers test using the specified parameters.

Move to Drives

The **Move to Drives** diagnostic moves tape cartridges to and from specified drives to confirm the robotics can access the drives. Use the figure below to help you with the diagnostic.

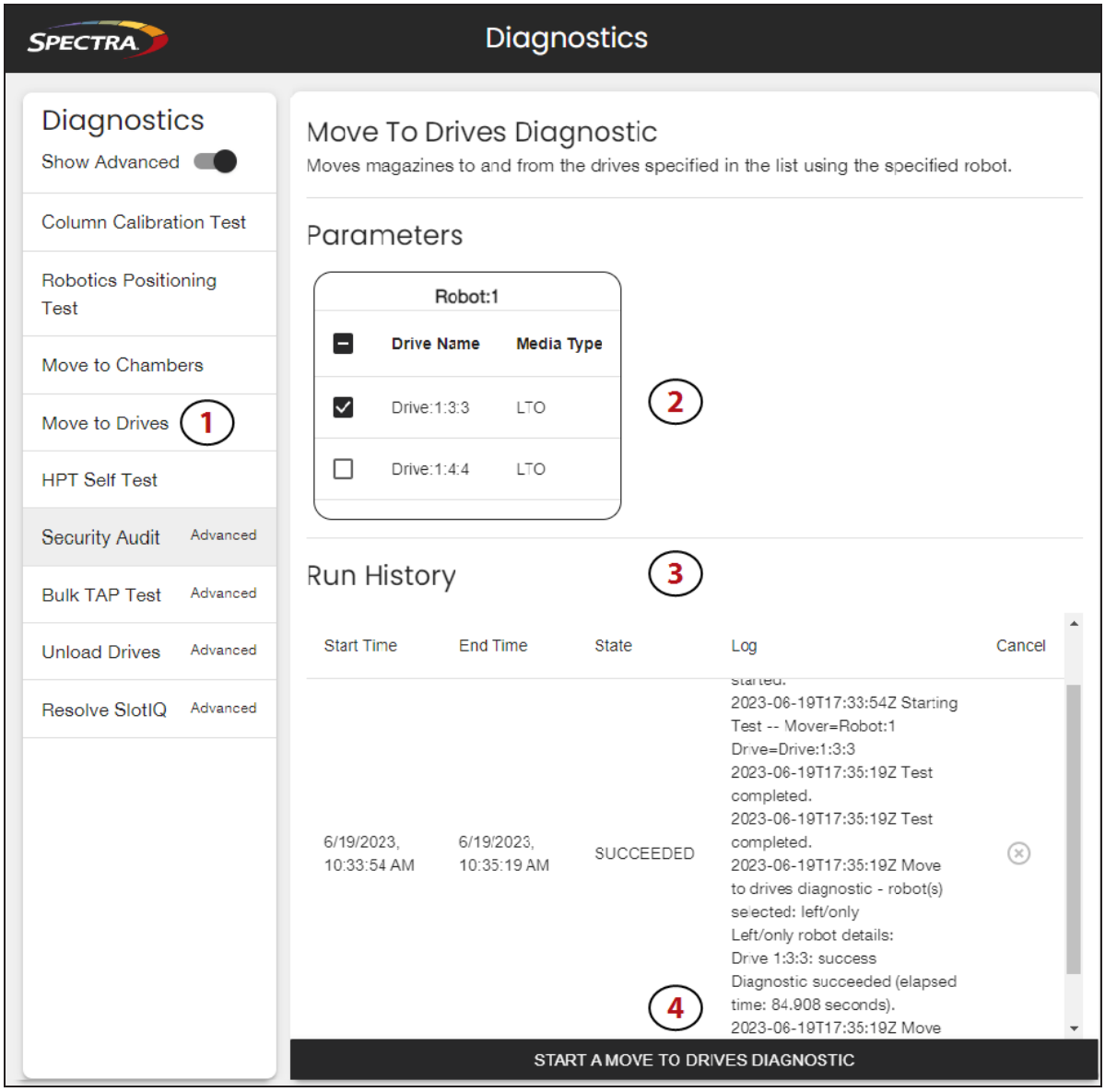


Figure 69 The LumOS Move to Drives Diagnostic screen.

1. From the diagnostics list select **Move to Drives**.
2. Use the **Parameters** menu to select the drives to test.
3. Use the **Run History** panel to review previous move to drives test results.
4. Click **Start Diagnostic** to run the test on the selected drive(s).

HPT Self Test

The **HPT Self Test** diagnostic tests for issues with the High Performance Transporter. Use the figure below to help you with the diagnostic.

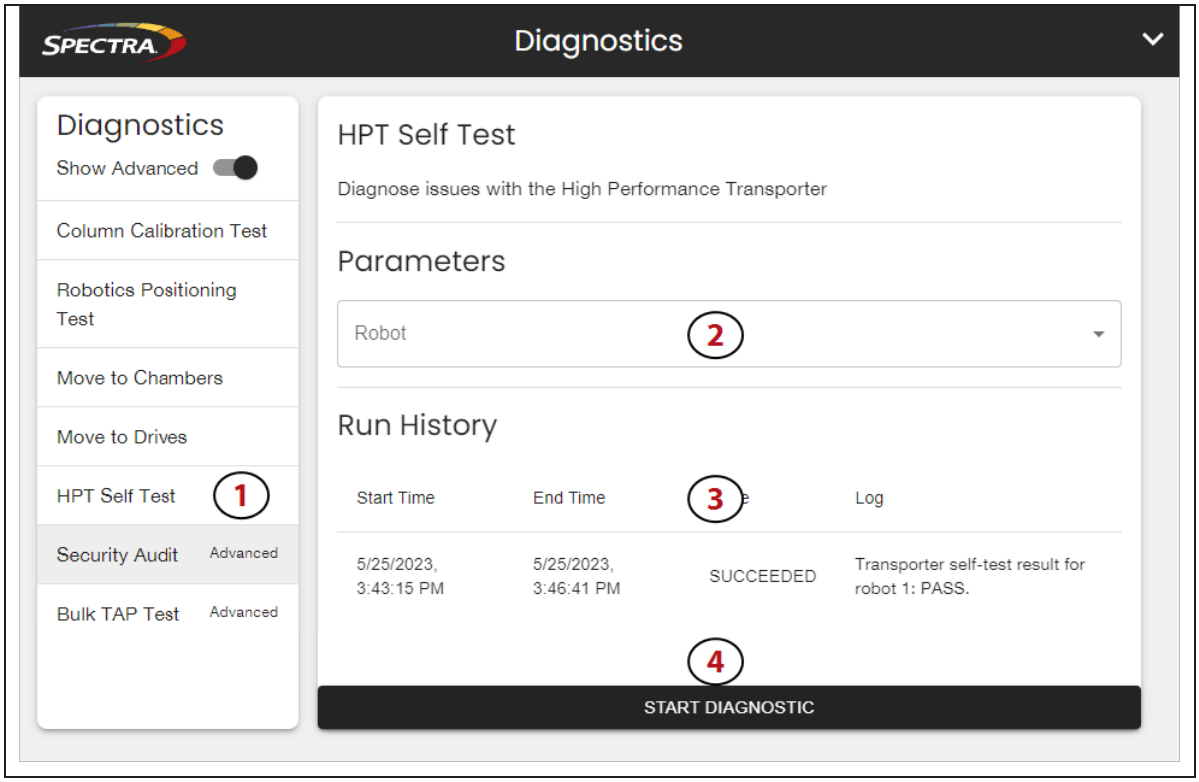


Figure 70 The LumOS HPT Self Test screen.

1. From the diagnostics list select **HPT Self Test**.
2. Using the **Parameters** drop-down menu select the robot to test.
3. Use the **Run History** panel to review previous HPT self test results.
4. Click **Start Diagnostic** to run a HPT self test.

Security Audit

The **Security Audit** diagnostic verifies the barcode and position of each TeraPack magazine and tape cartridge in the library. Use the figure below to help you with the diagnostic.

Note: Security Audit is an advanced diagnostic. Advanced diagnostics can significantly impact normal library operation.

IMPORTANT The Security Audit diagnostic takes longer the more magazines and tape cartridges are present in the library.

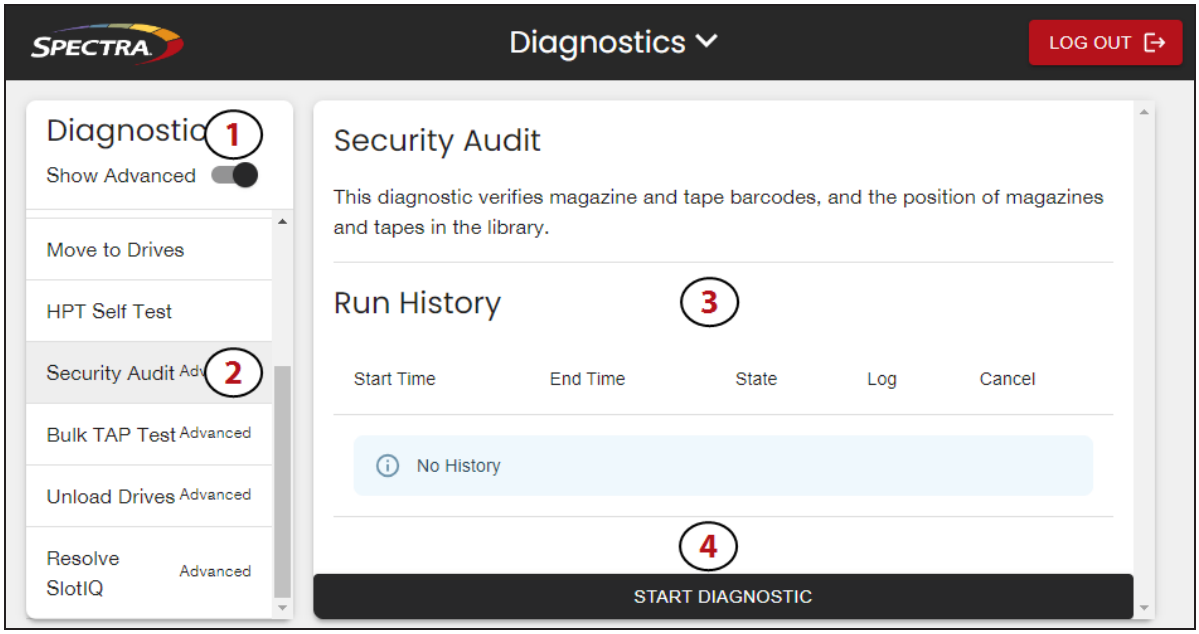


Figure 71 The LumOS Security Audit Diagnostic screen.

1. Toggle **Show Advanced** and read the Show Advanced Diagnostics dialog (not pictured). Click **Confirm**.
2. From the diagnostics list, select **Security Audit**.
3. Use the **Run History** panel to review previous security audit results.
4. Click **Start Diagnostic** to begin the security audit. The duration of this diagnostic depends on the number of TeraPack magazines installed in the library.

Unload Drives

The Unload Drives diagnostic allows users to unload all drives in the library or in a specific partition. Use the figure below to help you with the diagnostic.

Note: Unload Drives is an advanced diagnostic. Advanced diagnostics can significantly impact normal library operation.

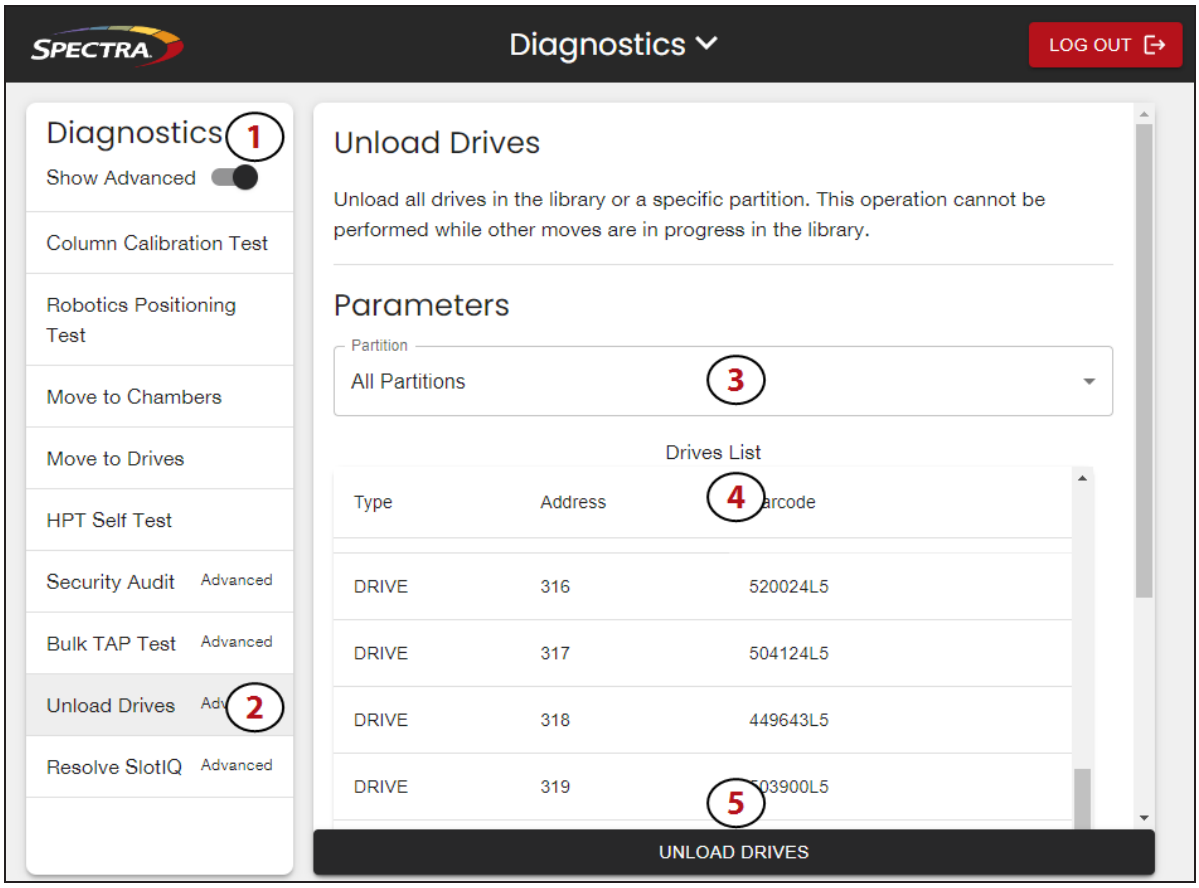


Figure 72 The LumOS Unload Drives screen.

1. Toggle **Show Advanced** and read the Show Advanced Diagnostics dialog (not pictured). Click **Confirm**.
2. From the diagnostics list, select **Unload Drives**.
3. Use the **Parameters** drop-down menu to select the desired partition, or select **All Partitions**.
4. Use the **Drives List** panel to review all selected drives.
5. Click **Unload Drives**.

Resolve SlotIQ

The Resolve SlotIQ diagnostic completes all outstanding virtual moves. Use the figure below to help you with the diagnostic.

Note: Resolve SlotIQ is an advanced diagnostic. Advanced diagnostics can significantly impact normal library operation.

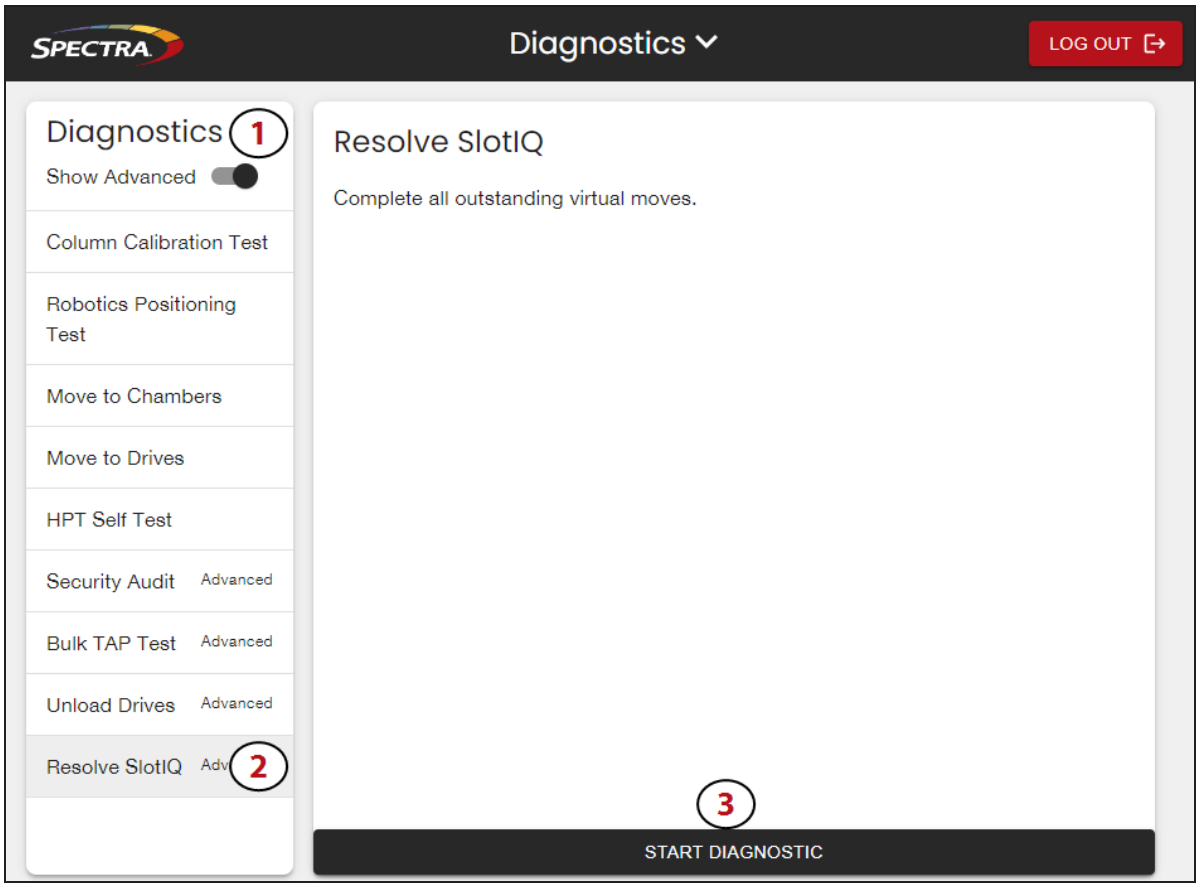


Figure 73 The LumOS Resolve SlotIQ screen.

1. Toggle **Show Advanced** and read the Show Advanced Diagnostics dialog (not pictured). Click **Confirm**.
2. From the diagnostics list, select **Resolve SlotIQ**.
3. Click **Start Diagnostic**.

ALERTS

Overview

This section describes enabling email alerts for drive failure notifications using the LumOS user interface. Log into the LumOS user interface and select **Tools > Alerts**.

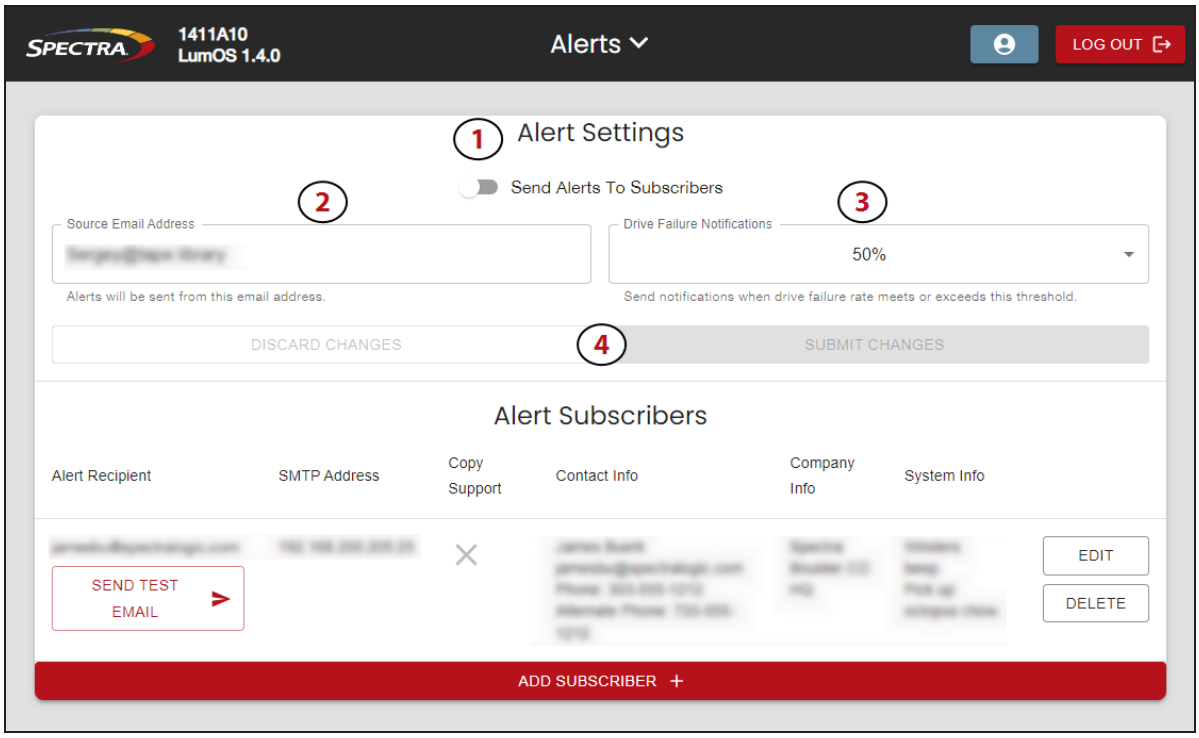


Figure 74 The LumOS Alerts screen.

Configuring Alert Settings

The following section describes the steps to enable and configure alerts. Use Figure 74 to help you complete the steps below.

1. Toggle **Send Alters To Subscribes** if desired.
2. Enter a **Source Email Address** to send auto alerts.

   Note: spectra@tape.library is a placeholder address that must be overwritten with a valid email address.

3. Use the **Drive Failure Notifications** drop-down menu to select a Drive Health threshold to send an alert. The Drive Health threshold is defined as the percentage of drives from all partitions reporting failures.
4. Click **Submit Changes** to apply.

Adding or Editing Alert Subscribers

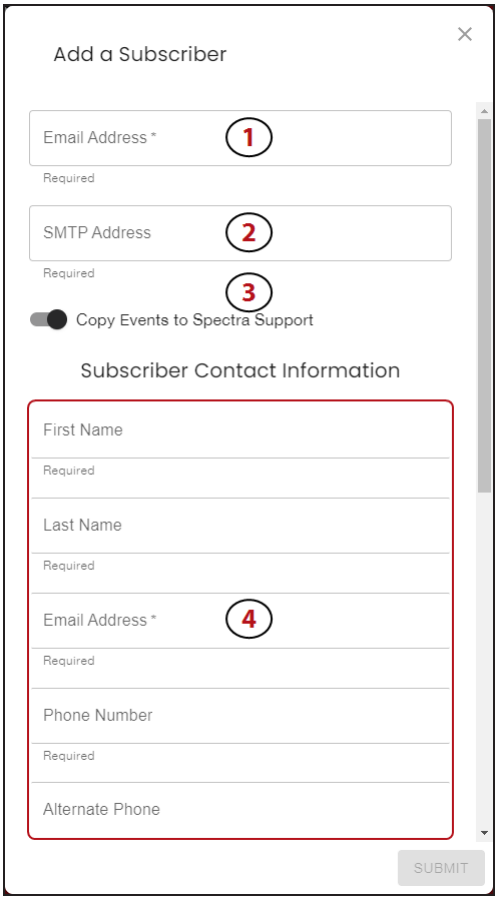


Figure 75 The LumOS Add Subscriber screen.

The following section describes the steps to add alert subscribers or to edit an existing alert subscriber. Click **Add A Subscriber +** to begin adding a new alert subscriber, or click **Edit** next to an existing alert subscriber then use Figure 75 to help you complete the steps below.

1. Enter an **Email Address**.
2. Enter a **SMTP Address**.

   Note: SMTP currently only supports port 25.
3. Toggle **Copy Events to Spectra Support** if desired to include Spectra Support on event alerts.
4. Enter the required **Subscriber Contact Information**. Optionally, enter information in the **Alternate Phone** field.

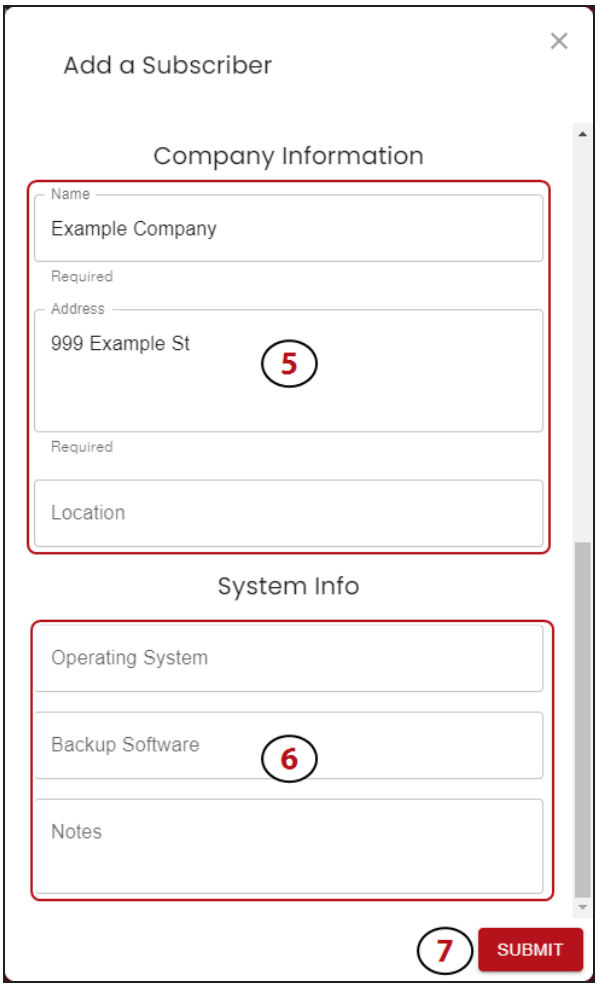


Figure 76 The LumOS Add Subscriber screen.

5. Enter the required **Company Information**. Optionally, enter information in the **Location** field.
6. If desired, fill out the **System Info** fields.
7. When all required fields are filled out, click **Submit**.

LOG GATHERING

The LumOS user interface allows you to gather logs from the Cube library. To gather a log, log in to the library and navigate to **Tools** > **Log Gather**.

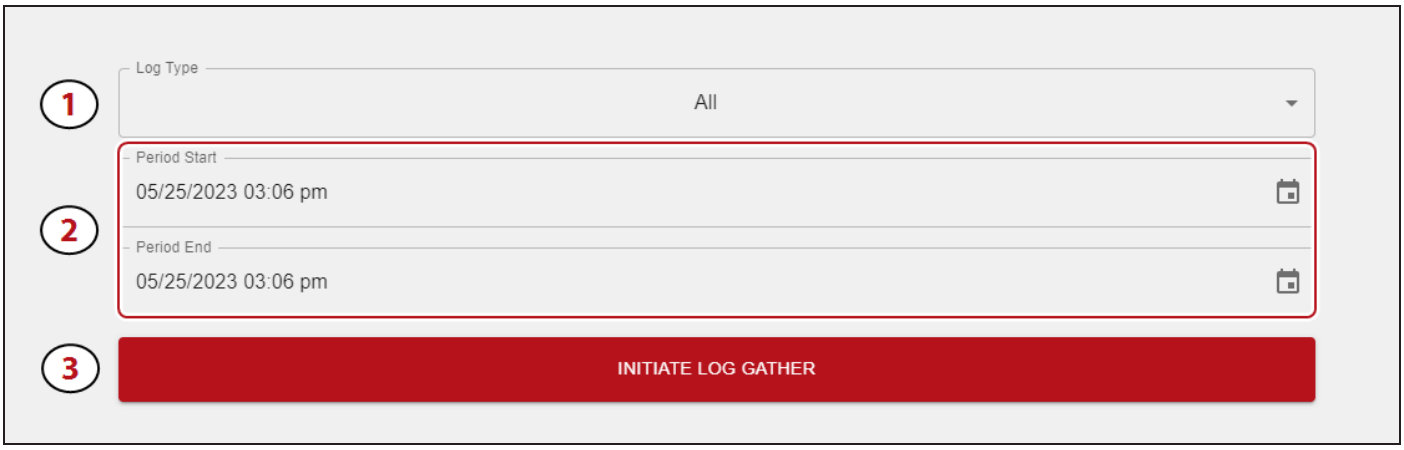


Figure 77 The LumOS Log Gather screen.

Gathering Logs

To gather logs:

1. Select the desired **Log Type** from the drop-down menu to gather. Supported log types include:
   - All
   - CAN
   - Dip E
   - Drive
   - Loglib
   - LumOS
   - Motion
   - MySQL
   - OS
2. Click the calendar icon to select the **Period Start** and **Period End** range.
3. Click **Initiate Log Gather**.

MANAGING BACKUPS

Overview

Keeping valid backup copies of your library's configuration ensures that you can easily restore the library in the event of a disaster. Library backups are extremely useful if problems require you to replace the LCM by allowing you to restore the library settings, including partitions, instead of having to manually re-enter all of the information.

Create and Download Backup

The LumOS user interface allows you to create and download backups on your Cube library or local machine. Log in and navigate to **Tools > Backup Restore**.

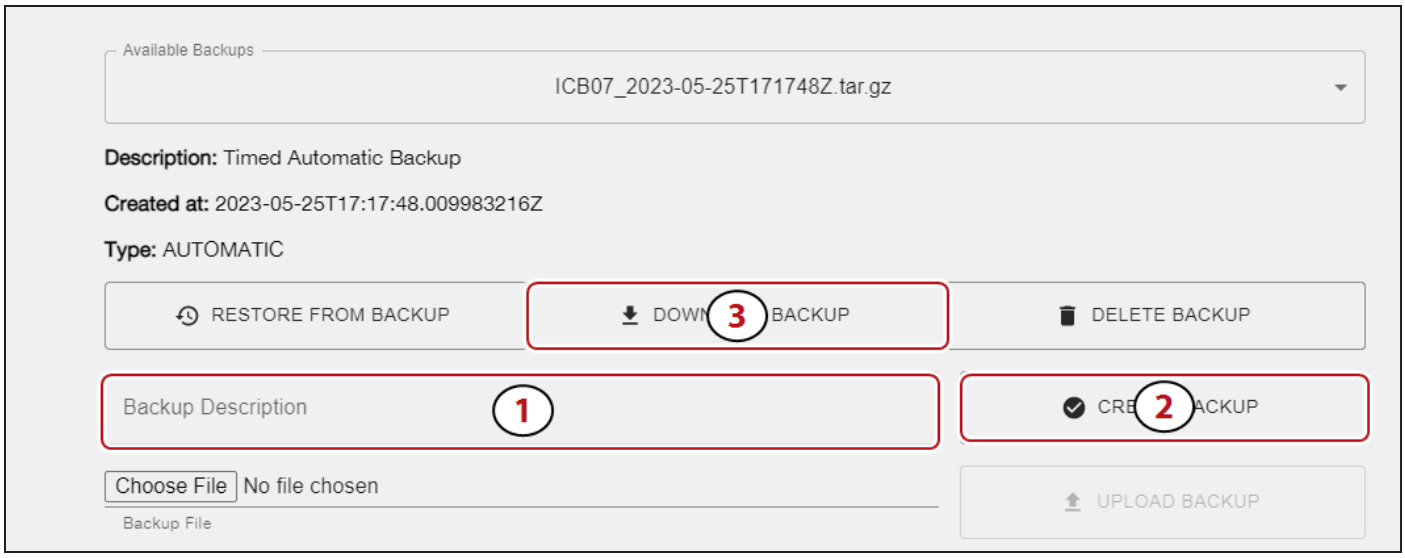


Figure 78 The LumOS Backup Restore screen.

Use the numbers in the figure above to help you with the following steps:

1. To create a new backup, enter information into the **Backup Description** field.
2. Click **Create Backup** to create the backup.
3. Click **Download Backup**.

Upload and Restore Backup

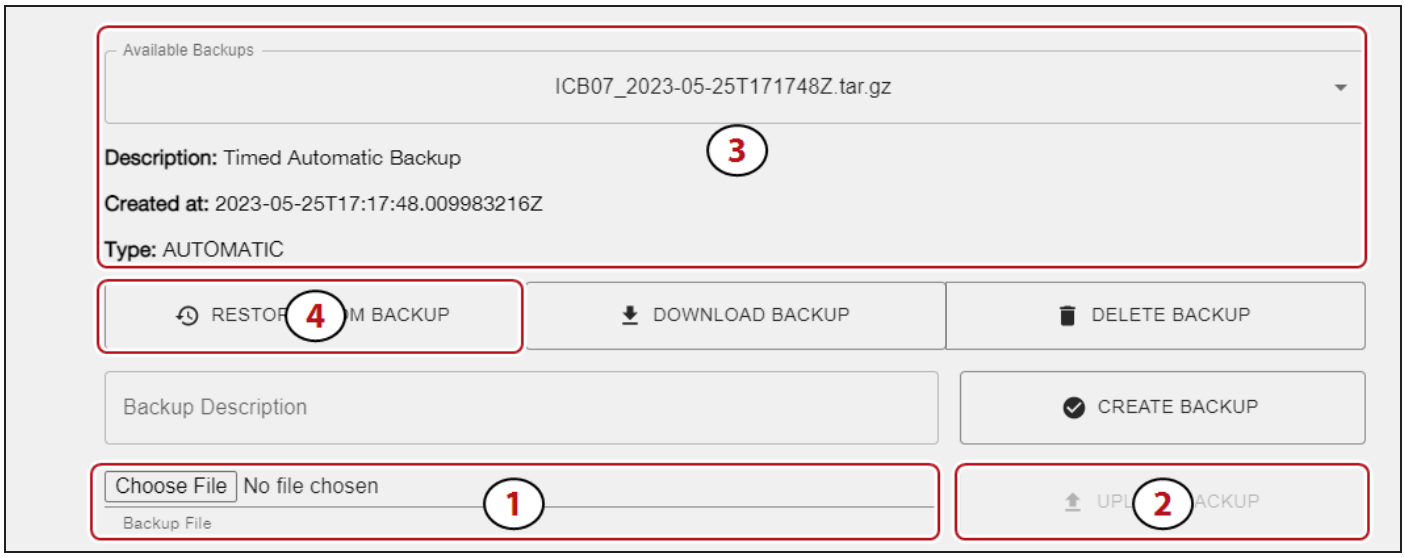


Figure 79 The LumOS Backup Restore screen.

Use the numbers in the figure above to help you with the following steps:

1. If necessary, click **Choose File** and select the desired file.
2. Click **Upload Backup** to upload the chosen file.
3. Using the **Available Backup** drop-down menu, select the desired backup.
4. Click **Restore From Backup**.

Note: You may also delete the selected backup by clicking **Delete Backup**.

PACKAGE UPDATE

Overview

This section describes updating the LumOS software using the LumOS user interface. Log into the LumOS user interface and select **Configuration > Package Update**.

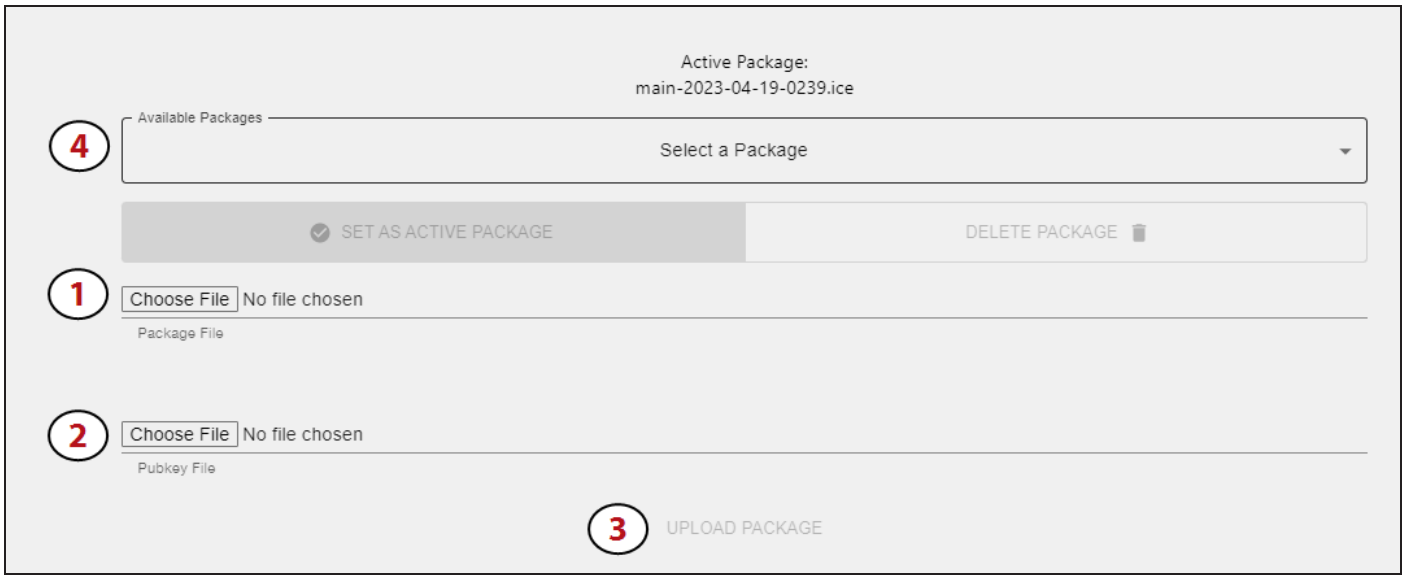


Figure 80 The LumOS Package Update screen.

Configuring a Package Update

The following section describes the steps to select and upload a package. Use Figure 80 to help you complete the steps below.

1. Click **Choose File** and navigate to select your desired Package File. Click **Open**.
2. Click **Choose File** and navigate the file browser to select your desired Pubkey file. Click **Open**.
3. Click **Upload Package**. New packages display in the **Available Packages** drop-down menu.
4. Select a package from the **Available Packages** drop-down menu, then click **Set As Active Package** to update the library software.

Note: The **Available Packages** drop-down menu only contains packages that were previously uploaded.

DRIVE FIRMWARE UPDATE

Overview

Whenever you update your library software, confirm that your drives are using the latest firmware version. Drive firmware updates are occasionally require to resolve drive issues.

The method you use to update the drives depends on the type of drives you are updating and your operating environment. This guide covers using the LumOS user interface and IBM Tape Diagnostic Tool (ITDT) to update drive firmware.

Note: You must discontinue backup operations and empty the tape drives before you can update drive firmware.

Updating Drive Firmware in LumOS User Interface

This section describes upgrading drive firmware using the LumOS user interface which is the recommended method to update drive firmware. Log into the LumOS user interface and select **Configuration > Drive Firmware Update**.

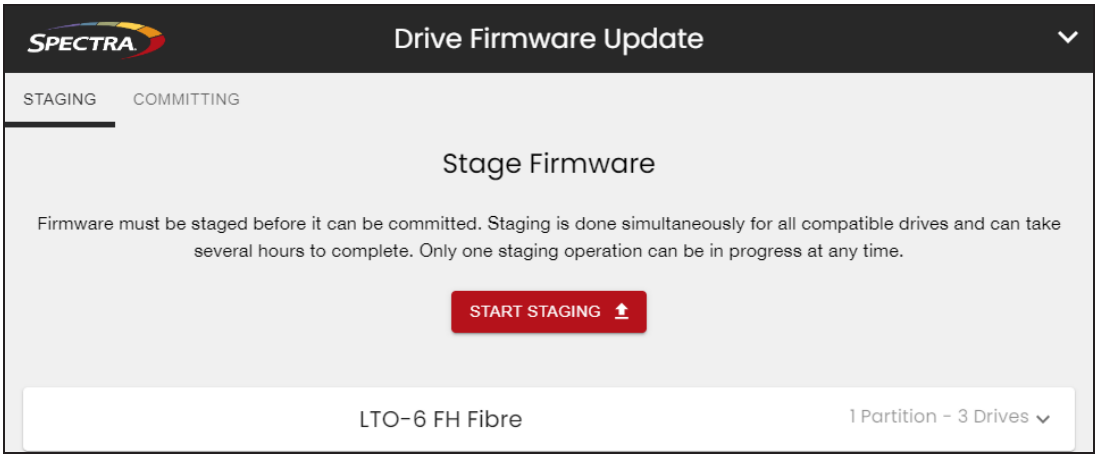


Figure 81 The LumOS Drive Firmware Update Staging screen.

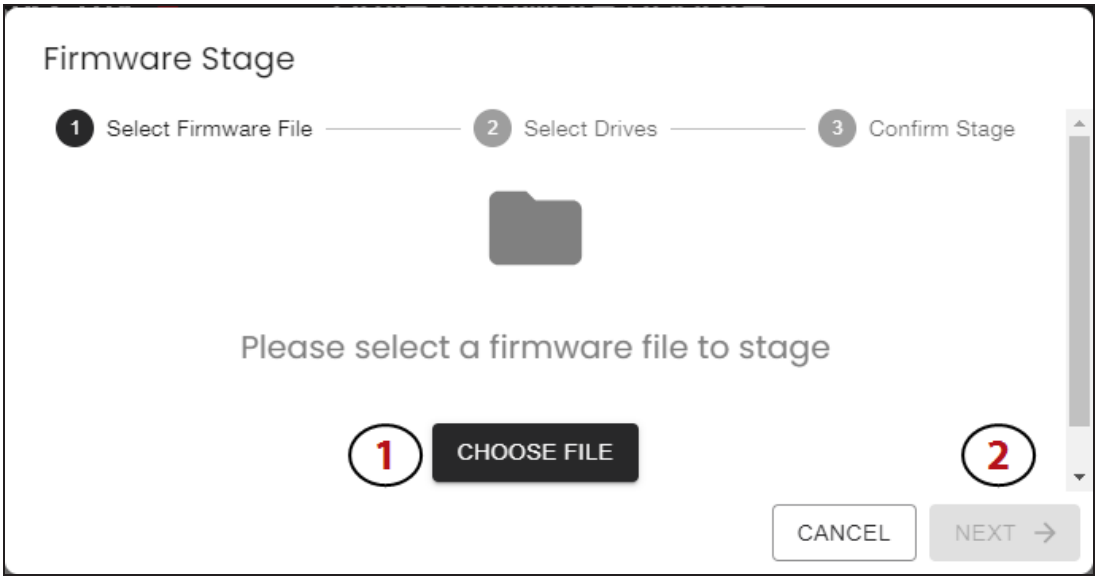


Figure 82 The LumOS Drive Firmware Stage Select Firmware File screen.

Click **Start Staging**, then use the steps below.

Note: Only one staging operation can be in progress at any time.

1. Click **Choose File** to open a file browser then select the desired firmware file.
2. Confirm the displayed firmware code and compatible drives information is correct and then click **Next**.

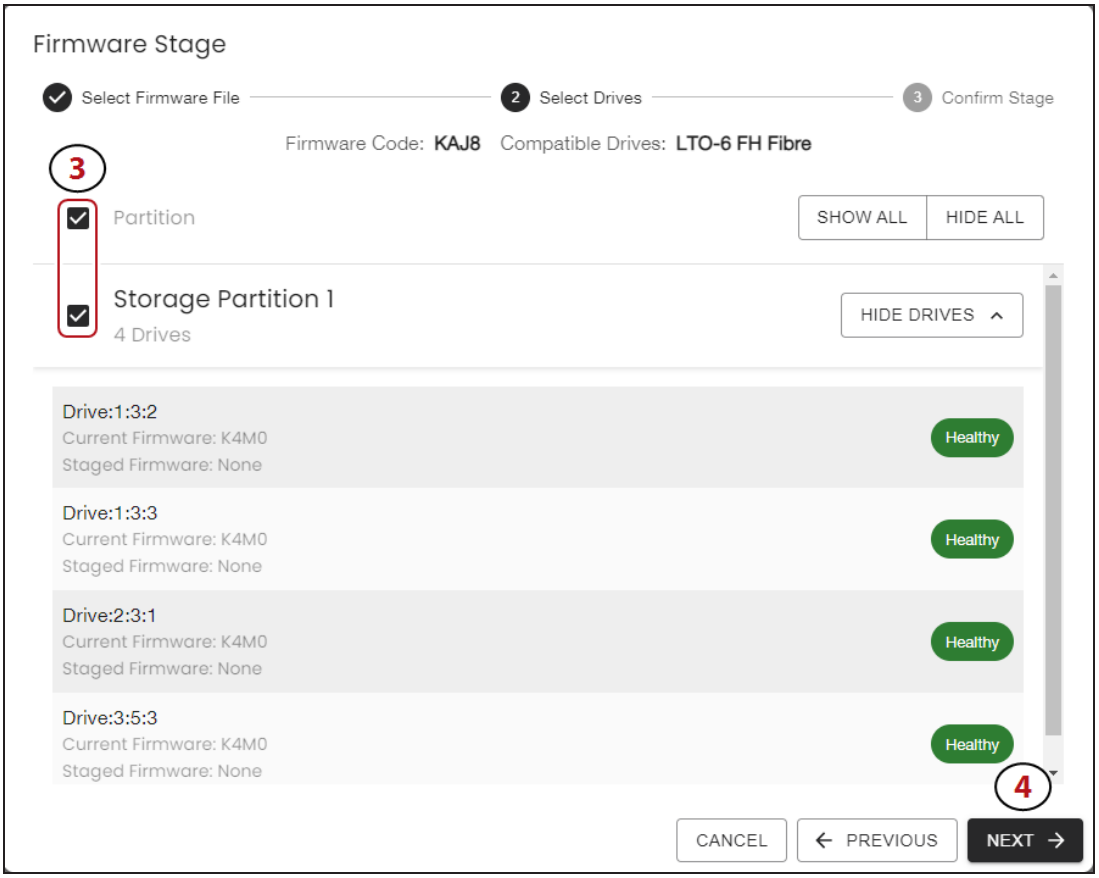


Figure 83 The LumOS Drive Firmware Stage Select Drives screen.

3. Select the partition to upgrade using the check box. To update all valid drives across all partitions, select the **Partition** check box.
4. Click **Next**.

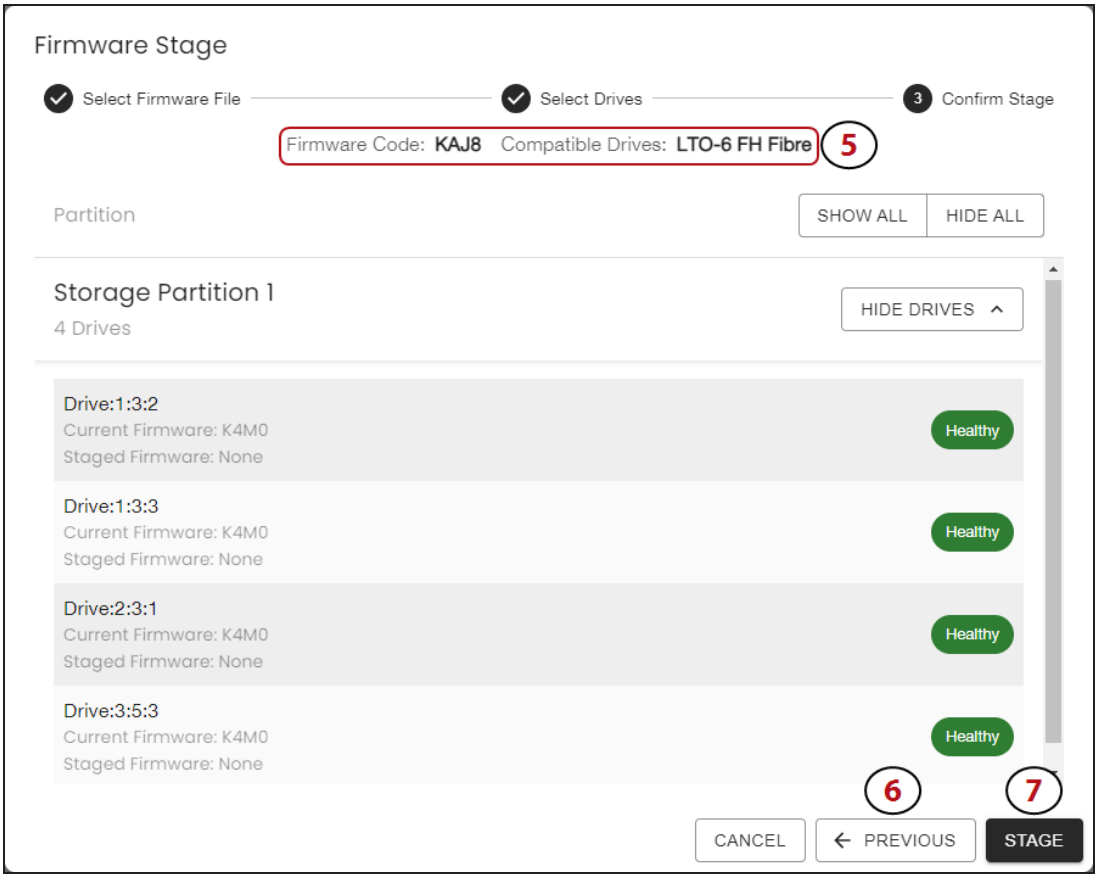


Figure 84 The LumOS Drive Firmware Stage Confirm Stage screen.

5. Confirm the **Firmware Code**, **Compatible Drives**, and selected drives are correct.
6. To make a correction, click **Previous** to return to previous pages.
7. Click **Stage**. The Staging screen displays the current operation progress and operation details.

Note: Staging may take several hours to complete. During the staging operation, you can continue normal backup operations.

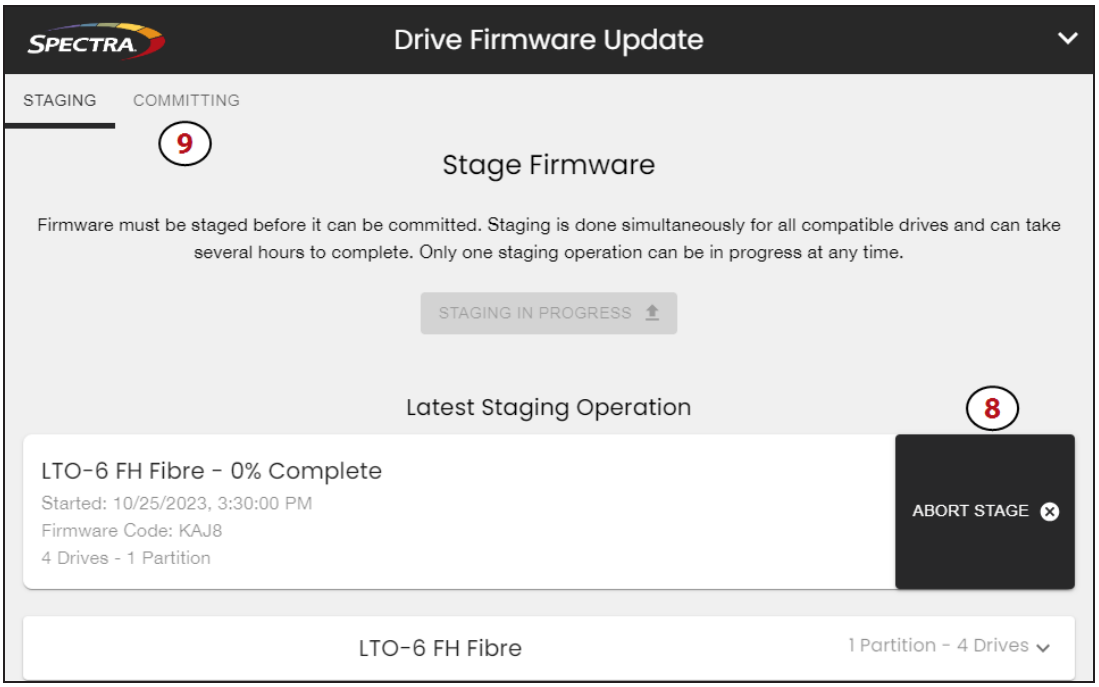


Figure 85 The LumOS Drive Firmware Update Staging screen.

8. If desired, click **Abort Stage** to cancel the operation.
9. After staging is complete, discontinue all backup operations and remove any cartridges from the drives.

CAUTION

Attempting to update the firmware while the library is busy or when the drives contain tapes may result in the update failing, failed backup jobs, or permanent damage to the drives. If you did not already do so, stop all backup operations and remove all tapes from the drives you are updating. If the library has SlotIQ enabled, run the Advanced Diagnostic **Unload Drives** followed by **Resolve SlotIQ**.

Once you have discontinued backups and emptied all drives, click **Committing** to view the Firmware Commit screen.

10. Select the desired **Drive Type** or **Partition**.

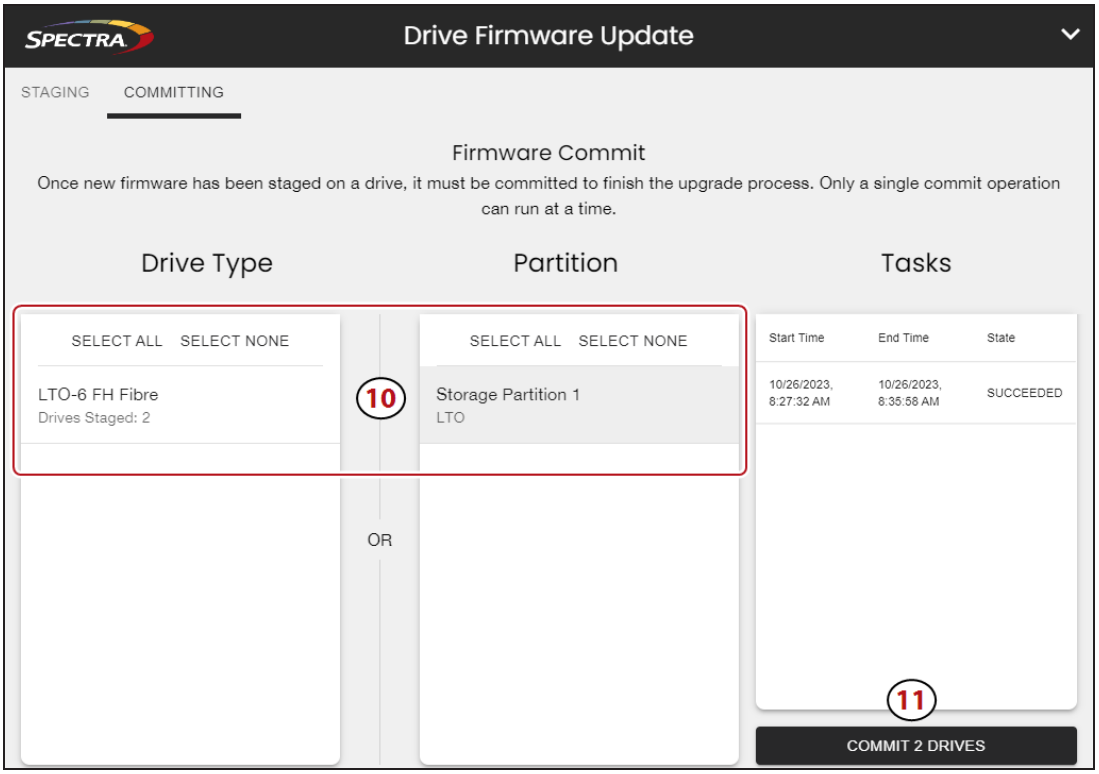


Figure 86 The LumOS Drive Firmware Update Firmware Commit screen.

11. Click **Commit Drives** to finish the upgrade process.

Note: Only a single commit operation can run at a time.

Updating Drive Firmware Using ITDT

Spectra Logic recommends using the LumOS interface to update drive firmware. If necessary, you can also update your LTO tape drive firmware with the IBM Tape Diagnostic Tool (ITDT).

Note: If your operating system is not supported by ITDT, or you cannot use ITDT in your environment, contact Spectra Logic Technical Support.

Download and Install ITDT

Download ITDT and its related documentation directly from IBM's Fix Central website.

Use the following steps to download and install ITDT on a computer that is connected to the same SAS or Fibre Channel arbitrated loop or fabric as the drives in the library.

1. Log into IBM's website (*ibm.com/support/fixcentral/*), using your individual IBM ID.
2. Select the **Select product tab**.
3. Select the following options:
   - **Product Group** = System Storage
   - **Select from System Storage** = Tape systems
   - **Select from Tape Systems** = Tape drivers and software
   - **Select from Tape drivers and software** = IBM Tape Diagnostic Tool (ITDT)
   - **Platform** = Select your operation system from the drop-down list and click **Continue**.
4. On the next page, select the version of ITDT that you want to download. If desired, you can select multiple versions.

   Note: If you are unsure which version to select, click **Show Fix Details** to see additional information.
5. Click Continue. If you have not logged into the website yet, it will prompt you to do so now.
6. Choose one of the following methods to download the selected ITDT installation files:
   - Download using your browser (HTTP)
   - Download using bulk FTP
   - Download using Download Director
7. Refer to the ITDT documentation for information about using ITDT. Contact Spectra Logic Technical Support if you need assistance (see Technical Support on page 144).

Download the Drive Firmware

1. After installing ITDT, launch the program so that it creates the **Input** and **Output** folders required during the firmware update process.
2. Log into your account on the Spectra Logic Technical Support portal at *support.spectralogic.com*.
3. Select **Downloads > Tape Drive Firmware**.
4. On the Tape Drive Firmware page, locate the appropriate drive firmware with respect to drive type (LTO), generation (for example, LTO-5), interface type (for example, SAS or Fibre Channel), and form factor (full-height or half-height).
5. Click the firmware version name in the column labeled **Current Firmware Version**.

IMPORTANT The link in the column labeled **Package File (For Staging)** is for using Drive Firmware Update feature in the LumOS user interface. Do not select this file if you are updating drive firmware using ITDT.

6. Use your web browser to save the file to the ITDT **Input** folder on the computer where ITDT is installed.

Discontinue Background Operations

You cannot update drive firmware if the library is actively running any background operations, including Media Auto Discovery, PreScan, and PostScan.

If you do not want to wait for a Media Auto Discovery, PreScan, or PostScan operation to complete, you can stop the Media Auto Discovery or PreScan operation, or pause the PostScan operation. For other background operations, you must wait for the process to complete.

Discontinue Backups and Empty the Drives

Before beginning the drive firmware update process, discontinue all backup operations and remove any cartridges from the drives.

CAUTION Attempting to update the firmware while the library is busy or when the drives contain tapes may result in the update failing, failed backup jobs, or permanent damage to the drives. If you did not already do so, stop all backup operations and remove all tapes from the drives you are updating. If the library has SlotIQ enabled, run the Advanced Diagnostic **Unload Drives** followed by **Resolve SlotIQ**.

1. If possible, use your storage management software to move any cartridges that are currently in drives back to their storage locations.
2. If you cannot use your storage management software, then move the cartridges as described in Move Media on page 106.

Update Drives Using ITDT

1. Follow the instructions in the ITDT documentation to update the drive firmware.
2. Reset the updated drives to restore their configuration settings.
3. After the update is complete, use your storage management software to restart any backup processes.

ROBOTICS

The LumOS user interface allows you to monitor the health of the robots inside the Cube library. To view the status of the robots, log in to the library and navigate to **Status > Robotics**.

Robot Details

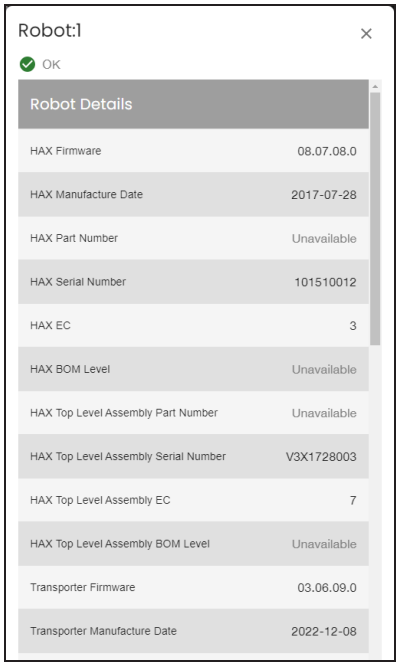


Figure 87 The LumOS Robot Details screen

To view robot details, click **Details** under the robot desired. The **Robot Details** screen displays the following information for HAX, Transporter, and VAX components:

- Firmware version
- Manufacture Date
- Part Number
- Serial Number
- EC
- BOM Level
- Top Level Assembly Part Number
- Top Level Assembly Serial Number
- Top Level Assembly EC
- Top Level Assembly BOM Level

CHAPTER 7 - TECHNICAL SUPPORT

Spectra Logic Technical Support provides a worldwide service and maintenance structure, refined over many years to provide timely, professional service.

IMPORTANT A valid LumOS software Support key is required in order to obtain technical support.

Accessing the Technical Support Portal **145**

Create an Account 145

Log Into the Portal 146

Opening a Support Ticket **147**

Returns **152**

ACCESSING THE TECHNICAL SUPPORT PORTAL

The Spectra Logic Technical Support portal provides access to the Knowledge Base, the current version of LumOS software for the library, drive firmware, drive device drivers, and additional service and support tools. You can also open or update a support incident and upload ASL files.

Create an Account

Access to *User Guides* and compatibility matrices does not require you to create an account. You must create a user account and log in to access *Release Notes* or repair documents, to download the latest version of LumOS software, or to open a support incident.

Note: If you have multiple Spectra Logic products, the serial numbers for all products will be associated with your account. If you do not see the serial numbers for all of your products when you log in, contact Technical Support (see Contacting Spectra Logic on page 8).

1. Access the Technical Support portal at *support.spectralogic.com*.
2. On the home page, click **Register Now**.

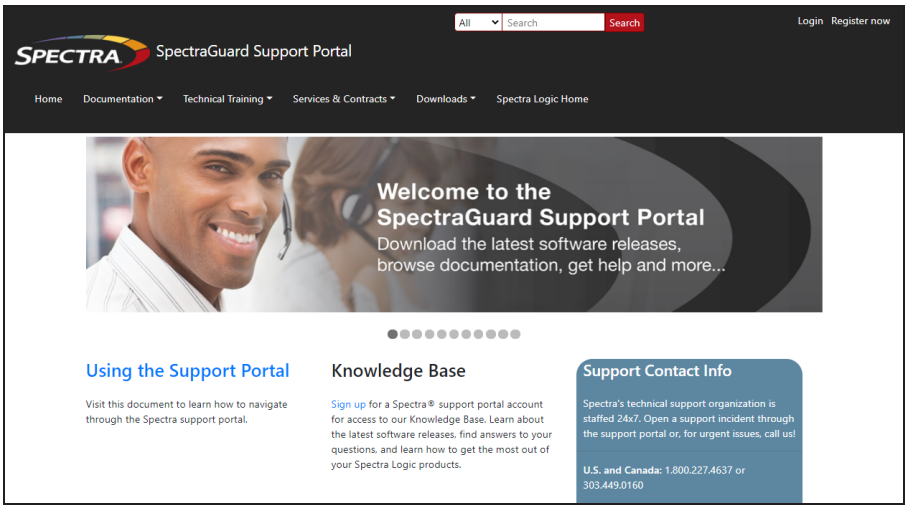


Figure 88 The Spectra Logic Technical Support portal home page.

3. Enter your registration information. Your account is automatically associated with the serial numbers of all Spectra Logic products owned by your site.

- If you have an invitation, follow the link and enter the invitation code.

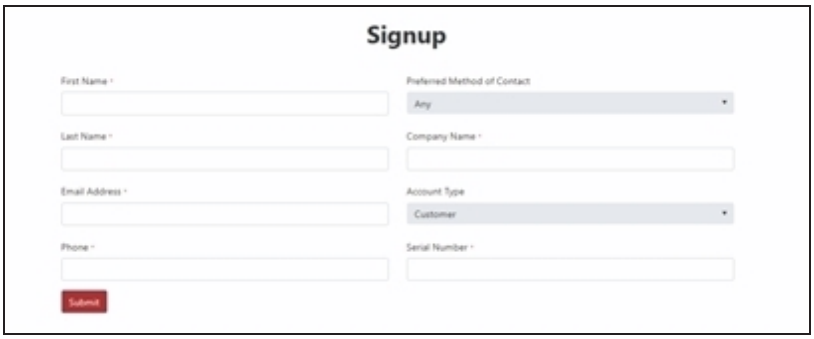


Figure 89 The Sign-up screen.

- If you do not have an invitation, enter the requested information to create your account. When you are finished, click **Submit**.

When the account is approved, you receive an email with an initial password. Use your email address and the password provided in the email to log in to your account. After you log in, you can change your password if desired.

Log Into the Portal

Use your email address and password to log into the Technical Support Portal.

OPENING A SUPPORT TICKET

You can open a support incident using the Spectra Logic Technical Support portal or telephone.

- Use the following instructions to open a support incident through the portal:

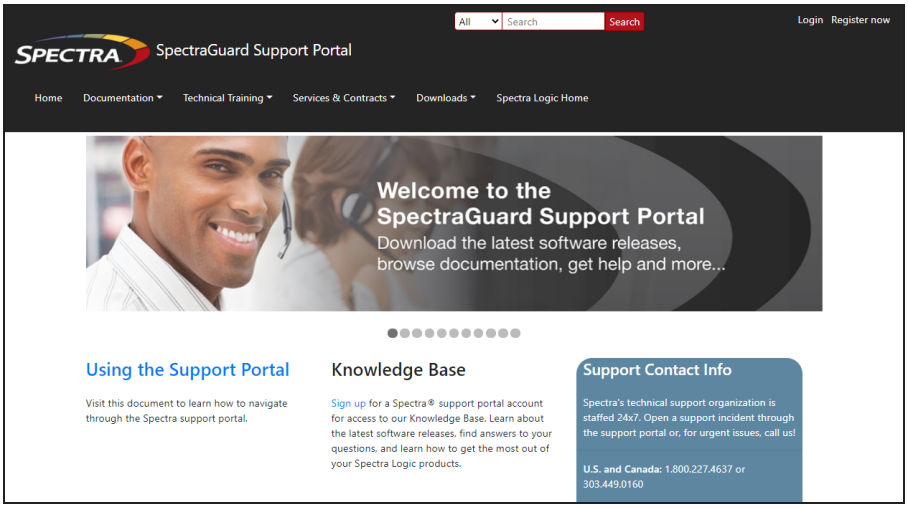


Figure 90 The Spectra Logic Technical Support portal home page.

1. Make notes about the problem, including what happened just before the problem occurred.
2. Gather the following information:
   - Your Spectra Logic customer number
   - Company name, contact name, phone number, and email address
   - The library serial number (see Determine the Library Serial Number)
   - Type of host system being used
   - Type and version of host operating system being used
   - Type and version of host storage management software being used
3. If necessary, log in to the Support Portal by clicking **Login**, enter your **email address** and **password**, and click **Log in**.

Note: See Accessing the Technical Support Portal on page 145 if you have not previously created an account on the Technical Support portal.

4. Submit a support incident.

- Use the following instructions to search for help before submitting a ticket, or skip to Submit an Incident Directly on the next page.

i. From any page, select **Incident>Incidents & Inventory**.

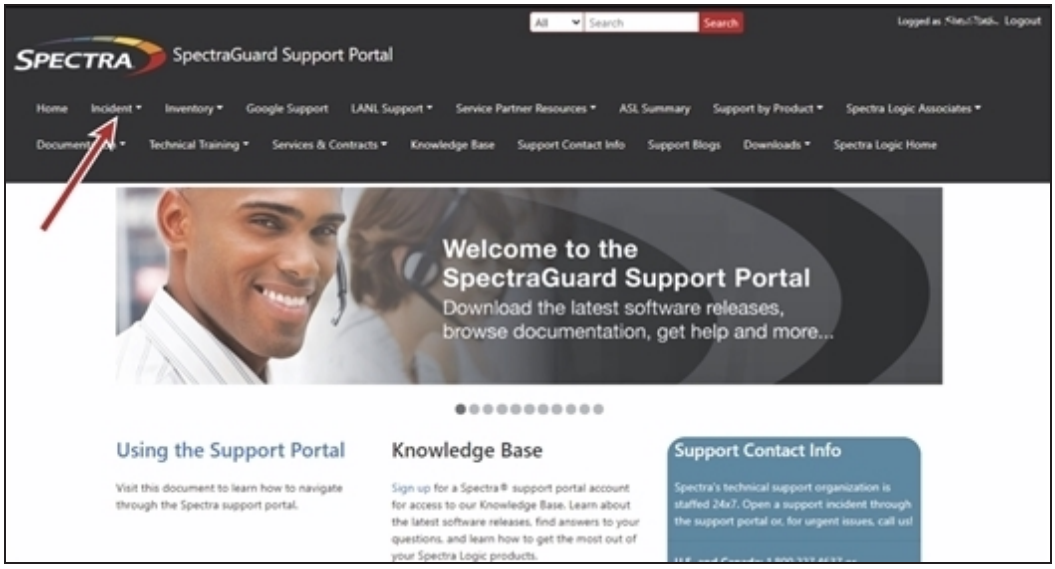


Figure 91 Select **Incidents>Incidents & Inventory**.

ii. Select **Open or View Incidents**.

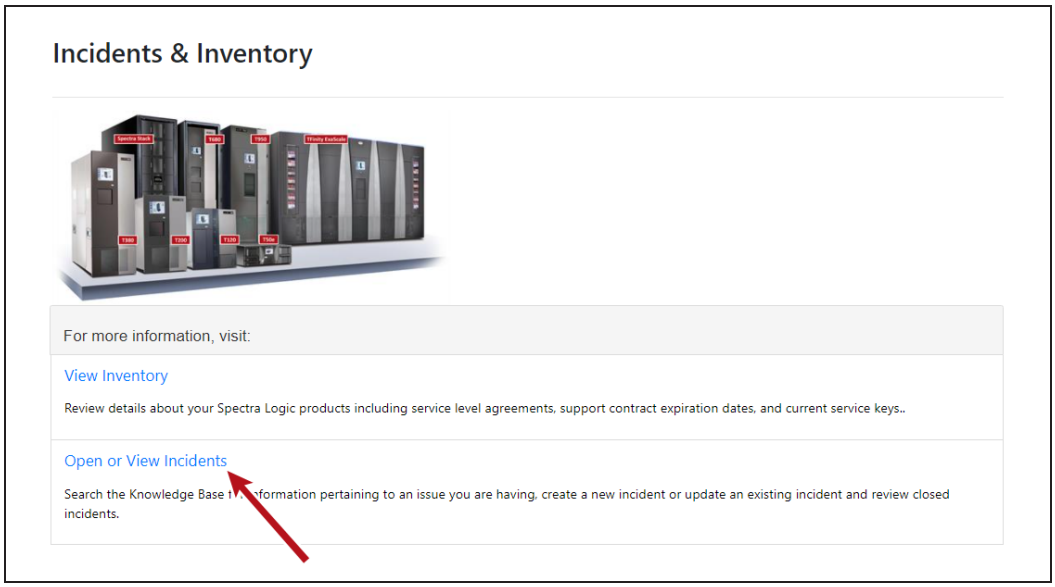


Figure 92 Select **Open or View Incidents**.

iii. In the Search dialog box, enter a term or phrase about your problem (**1**) and click **Search** (**2**).

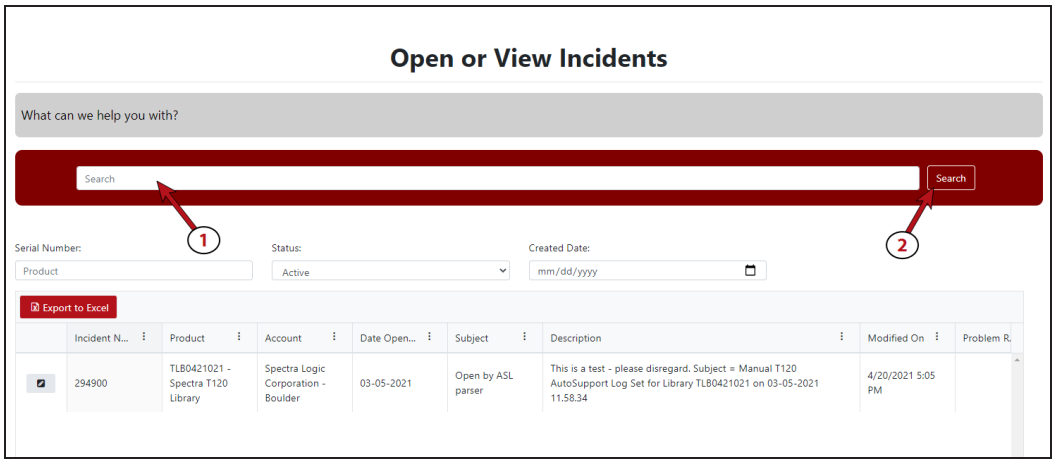


Figure 93 Enter a search phrase and click **Search**.

iv. If the search does not provide an answer, click **Open a New Incident**.

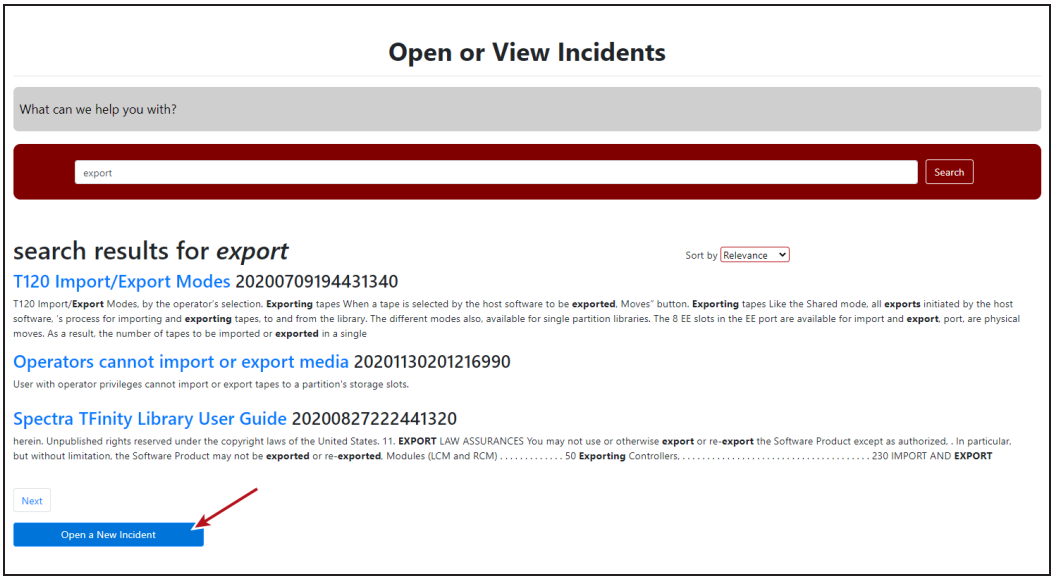


Figure 94 Click **Open a New Incident**.

v. Continue with Step 5 on page 150.

- Submit an Incident Directly

  i. From any page, select **Inventory>My Inventory**.

  ii. Locate the row of the product for which you want to submit an incident and click **Create Incident**.

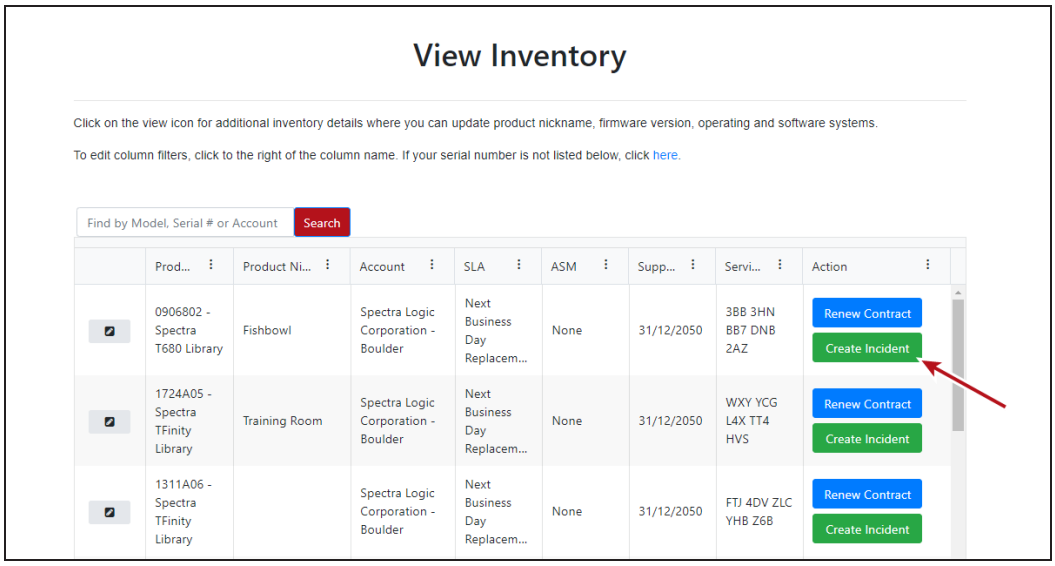


Figure 95 Click **Create Incident**.

iii. Continue with Step 5.

5. On the Create Incident page, enter the requested information providing as much detail as possible. When you are finished, click **Submit**.

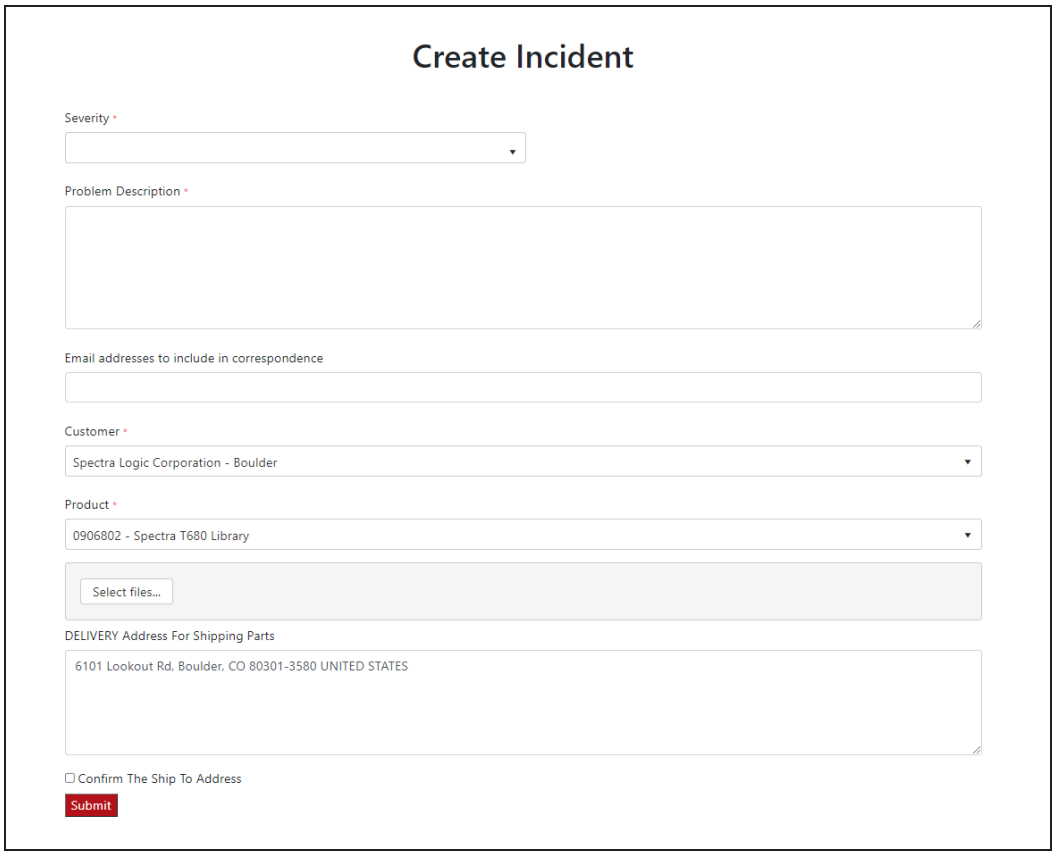


Figure 96 Enter information about your incident and click **Submit**.

Notes:
- If you have multiple libraries and need to determine the serial number of the affected library, see Determine the Library Serial Number.
- If the serial number of the affected library is not listed, contact Technical Support (see Contacting Spectra Logic on page 8).

- Contact Spectra Logic Technical Support by Phone

  To contact Spectra Logic Technical Support by telephone, see Contacting Spectra Logic on page 8.

RETURNS

Your Technical Support representative may ask you to return a problem component to Spectra Logic for analysis and servicing. After you complete a replacement procedure, return the defective part using ALL of the packaging that the replacement part arrived in (including any anti-static bags or foam inserts).

CAUTION Severe damage can occur if the component is not packaged correctly. You may be invoiced if it is damaged due to improper or insufficient packaging.

Use the return label and instructions that were included with the replacement part when preparing to ship the component you are returning. If you cannot locate these, contact Spectra Logic for another copy (see Contacting Spectra Logic on page 8). The return label and Return Merchandise Authorization (RMA) printed on it are used to associate the returned component with your account. To avoid being invoiced for failure to return the component, do not ship the component back to Spectra Logic without the RMA return label.

Appendix A - Best Practices

This appendix reviews best practices for using Media Lifecycle Management, protecting library configuration data, and working with media.

MLM Best Practices **154**
Implementation Guidelines 154
Usage Policy Guidelines 155
Using Cartridges **156**
Labeling Cartridges 156
Handling Cartridges 157
Storing Cartridges 158
Using Cartridges in the Library 159
Cartridge Rotation 160

MLM Best Practices

To effectively use MLM and ensure MLM and DLM data protection, plan a strategy based on your data center needs and develop policies and procedures to support that strategy. Having sound management policies and procedures for media rotation and management is essential for consistent, effective implementation.

Implementation Guidelines

Consider the following best practice guidelines as you prepare to implement MLM in your environment.

Guideline	Description
Identify the people responsible for backing up data	The people who perform data backup at your site are typically the ones who will be responsible for implementing and following MLM backup procedures.
Identify the users who will have responsibilities that involve MLM	It may be wise to have more than a single user familiar with policies, depending on the size of your organization, so that if one person is not available, another can take over.
Be consistent with partition names	Using consistent naming simplifies identifying a specific partition. Spectra's suggested naming practice is to list the location, followed by the library name, followed by the storage management software. For example, Dallas Cube library NetBackup.
On an organizational level, determine the level of management your media requires	The level of media management depends on the requirements for your environment. For example, you may choose to use Spectra's guidelines for retirement for all media, or you may choose to retire tapes that hold financial or legal data sooner than recommended.

Usage Policy Guidelines

Consider the following guidelines when establishing your Media Lifecycle Management policies.

Guideline	Description
Choose a retirement guideline	When implementing MLM, decide at the beginning on the criteria to be used when determining when to retire a cartridge. Spectra suggests using the Media Lifecycle Management health icon for each tape to assess the overall health of individual tapes.
Only use MLM-enabled media and cleaning cartridges in MLM-compatible libraries and drives	For the most accurate tracking, do not import your MLM-enabled media into non-Spectra Logic libraries or drive generations earlier than LTO-4. The cartridge MAM will not be updated with information about usage in those locations. As a result, the information about usage in those locations will not be recorded in the MLM database when the cartridge is returned to your library.
Use only Spectra Certified Media with MLM support (both data and cleaning cartridges) in the library	To ensure the best possible performance, use Spectra Certified Media. Check the *Spectra Logic website* for the most up-to-date media availability. Do not use any media that has not been approved by Spectra Logic for use in the library. The library uses information in the MLM database to monitor the health of the media in the library. For MLM-enabled media, the detailed health reports let you determine whether a particular data cartridge is past its useful threshold or determine whether a particular cartridge is experiencing high errors rates or retries. For MLM-enabled cleaning cartridges, you are notified when a cartridge is approaching the end of its useful life. Although MLM tracks the general health of media that is not MLM-enabled, detailed health information is not available for this media.

USING CARTRIDGES

The following sections describe best practices for using cartridges and for managing your media inventory. All library user groups have privileges that allow them to use the library's user interface to perform the cartridge handling and media management operations described in this appendix. Because handling cartridges requires physical interaction with the library, much of the information in this appendix is not applicable when you are accessing the library using the LumOS web interface.

Note: See MLM Best Practices on page 154 for additional guidance when using Spectra Certified Media with MLM support.

Labeling Cartridges

If you are not using pre-labeled Spectra Certified Media (both data and cleaning cartridges), be sure to label all cartridges with the appropriate barcode labels. Position each label in the indented area on the cartridge, as illustrated in Figure 97. See Barcode Label Specifications for detailed information about preparing and using barcode labels.

CAUTION Do not place labels on any surface of the cartridge except the area shown in Figure 97. A loose label can become dislodged and damage the drive.

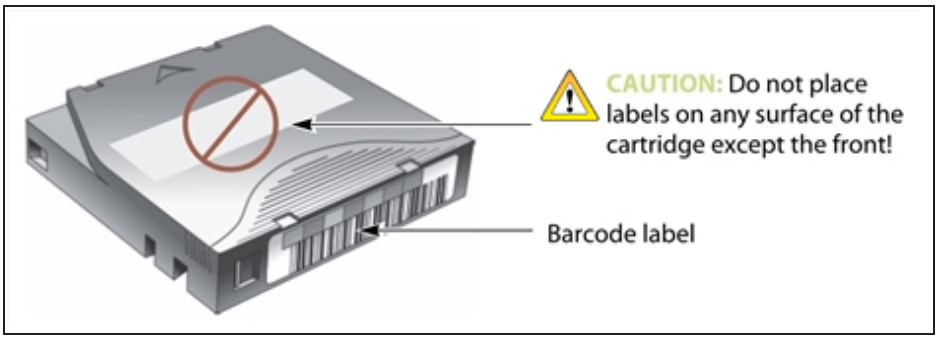


Figure 97 Properly barcode label all cartridges (LTO cartridge shown).

Handling Cartridges

Incorrect handling or an incorrect environment can damage the LTO cartridge or the magnetic tape inside it. To avoid damage to your cartridges and to ensure the continued high reliability of your drives, use the following guidelines:

- Do not drop the cartridge. If the cartridge drops, slide the cartridge door back and ensure that the leader pin is properly seated in the pin-retaining spring clips. Inspect the rear of the cartridge (the part that you load into the tape drive first) and ensure that there are no gaps in the seam of the cartridge case.
- Do not open any part of the cartridge other than the cartridge door. Do not open any other part of the cartridge case. The upper and lower parts of the case are held together with screws; separating them destroys the usefulness of the cartridge.
- Do not handle tape that is outside of the cartridge. Handling the tape can damage the tape's surface or edges, which may interfere with read or write reliability. Pulling on tape that is outside of the cartridge can damage the tape and the brake mechanism in the cartridge.
- If tape is outside of the cartridge, slide the cartridge door back and turn the hub to gently spool the tape back into the cartridge. Test the tape by using your storage management software to write to the tape, and then run a PostScan.
- Before you use a cartridge, let it acclimate for at least 24 hours to the normal operating environment.
- Ensure that all surfaces of a cartridge are dry before inserting it into a magazine.
- Do not stack more than six cartridges.
- Do not expose the tape cartridge to moisture or direct sunlight.
- Do not degauss a tape cartridge that you intend to use/reuse. Degaussing makes the tape unusable.
- Do not expose recorded or blank tape cartridges to stray magnetic fields (such as terminals, motors, video equipment, X-ray equipment, or high-current cables or power supplies). Such exposure can cause the loss of recorded data or make the blank cartridge unusable.
- Maintain the environmental conditions specified in Tape Media Specifications.

Storing Cartridges

While in use, cartridges are stored in TeraPack magazines inside the library. When the cartridges are *outside* of the library, Spectra Logic recommends storing them in magazines with dust covers.

Figure 98 TeraPack magazines with barcode labeled cartridges and plastic dust cover (LTO magazines shown).

Storing and handling cartridges in magazines helps to eliminate errors resulting from mishandling individual cartridges, which is the leading cause of cartridge damage. An optional clear plastic dust cover snaps onto the magazine to protect the cartridges.

Whenever you remove cartridges from your library, be sure to store them properly to maximize archival life and ensure data integrity. Follow these guidelines for proper cartridge storage:

- Store cartridges in a suitable environment (see Tape Media Specifications).
- Keep the storage location as free of airborne particulates as possible. To eliminate obvious sources of particulates, do not permit anyone to smoke, eat, or drink near the storage area, and do not store cartridges near a copier or printer that may emit toner and paper dust.
- Store cartridges with the write-protect switch in the protected position (see Preparing Cartridges for Use).
- Store cartridges as soon as possible after you remove them from the library. Immediate storage helps avoid many of the conditions that can damage tapes, such as temperature and humidity fluctuations, particulate contamination, and excessive handling.
- If you plan to ship a TeraPack magazine, make sure that you have a proper shipping container and that you use adequate packing material. The TeraPack carrying cases available from Spectra Logic are designed for safely transporting TeraPack magazines off site and are compatible with Iron Mountain.

Using Cartridges in the Library

This section describes the best practices for using cartridges in the library.

- Use only cartridges from approved vendors in the library. See Media and Media Accessories for more information about Spectra Certified Media.
- Make sure that the entry/exit pool contains one or more empty TeraPack magazines. This is particularly important when your storage management software ejects tape cartridges from a partition.

  If the entry/exit pool does not have any empty slots available for the ejected media, then the storage management software must wait until empty slots become available. The simplest way to avoid this delay is to import one or more empty TeraPack magazines after you export media from the library.

  Alternatively, always make sure that you import full TeraPack magazines into the library, then use your storage management software to move (import) all of the new media into the storage pool for the partition. After all of the media is moved to the storage pool, you will end up with one or more empty magazines in the entry/exit pool.
- Make the entry/exit pool large enough to accommodate all of the cartridges typically imported or exported during a single operation. For example, if you run a nightly backup that uses 48 cartridges which are then exported each morning, create an entry/exit pool of 50 LTO slots (5 chambers).
- After your library has been in use for a period of time, and at least one set of cartridges has completed a round trip (exported from the library, stored off site, then re-imported), the following rule of thumb applies: if you remove a TeraPack magazine from the entry/exit pool, replace it with either an empty magazine to accommodate future eject operations or a full magazine whose cartridges are then imported into the storage pool using your storage management software.
- During an import or export operation, do not leave the library unattended for more than a few minutes. If you do, the import or export operation times out so that the library can continue automated backup tasks. To continue, restart the operation when you are ready.
- Enable Auto Drive Clean and configure a cleaning partition to clean drives whenever required to help ensure optimal performance. If you do not use the Auto Drive Clean feature, periodically check the Drives screen to determine whether the drives require cleaning (see Cleaning a Drive).
- Confirm the quality of your media and verify data integrity by occasionally running restores using different drives.
- Confirm the quality of both media and drives by running periodic disaster recovery drills. These drills test the overall ability to recover all of your data using your backups.

Cartridge Rotation

During normal backup operations, tapes are rotated into and out of the library. This section provides a simple example of the library's media life cycle functionality to manage tape rotation. Using a backup plan similar to the one described in the following example for a period of time establishes a media rotation schedule for the library. The example assumes the following:

- The library has a total of 17 licensed chambers and uses LTO media.
  - 2 chambers are assigned to the entry/exit pool (20 slots, or 2 TeraPack magazines).
  - 15 chambers are assigned to the storage pool (150 slots, or 15 TeraPack magazines).
- The library contains 15 full TeraPack magazines and two empty TeraPack magazines.
- Two magazines containing 20 cartridges worth of backup data are sent off site every Friday.
- After the data has aged two weeks, the media is returned to the library and re-used.
- The site adheres to the following best practices:
  - Whenever a TeraPack magazine is exported, another magazine (either full or empty) is imported.
  - The library has enough empty TeraPack magazines to fill the entry/exit pool.

This example shows that, by Week 3, the backup plan results in a full media rotation in which the operator has done the following:

1. Removed and stored two full TeraPack magazines of media. Full magazines were exported from the entry/exit pool and removed through the TAP, resulting in an empty entry/exit pool.
2. Imported two full TeraPack magazines into the entry/exit pool through the TAP and then used the storage management software to move the media in the entry/exit pool into the storage pool.

   Moving the media to the storage pool leaves two empty magazines in the entry/exit pools, ready to accept media as the storage management software identifies media as ready to be ejected from the library.

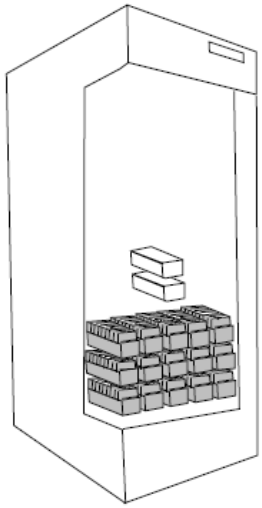
The following sections describe and illustrate the rotation process .

Initial Installation of Cartridges

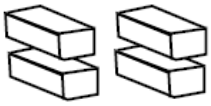
The library is configured with a single partition and has a total of 17 licensed chambers assigned to either the entry/exit pool or storage pool. When the library is initially installed, chambers are filled with TeraPack magazines as described in the following illustration.

Library:

- **Entry/Exit pool:** 2 chambers contain empty TeraPack magazines.
- **Storage pool:** 15 chambers contain full TeraPack magazines.



Data center:
4 empty TeraPack magazines available.

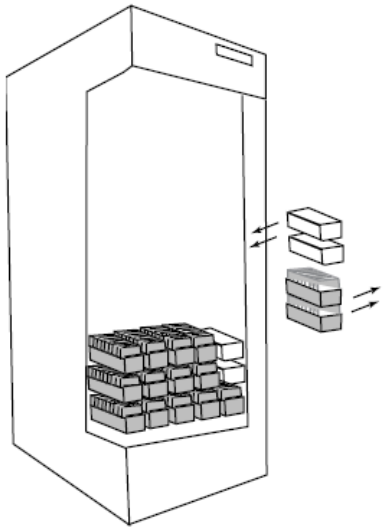


End of Week 1

The storage management software ejects cartridges from the storage pool. The library moves the cartridges to empty magazine slots in the entry/exit pool, making them ready to be removed from the library and stored off site.

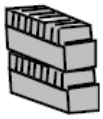
Operator tasks:

- Export 2 full TeraPack magazines from the entry/exit pool.
- Import 2 empty TeraPack magazines into the entry/exit pool.



Results of operator tasks:

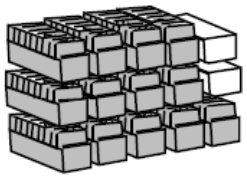
Off-site storage:
2 full TeraPack magazines.



Entry/Exit pool:
2 chambers, each contains an empty TeraPack magazine.

Storage pool:

- 13 chambers contain full TeraPack magazines.
- 2 chambers contain empty TeraPack magazines.



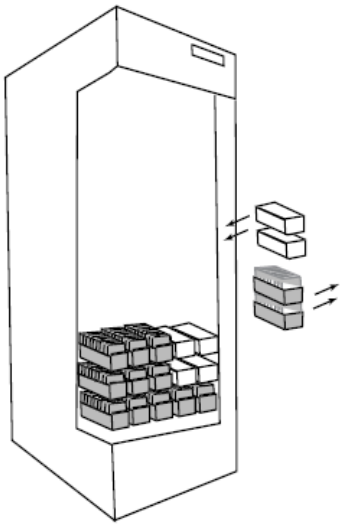
Data Center:
2 empty TeraPack magazines.

End of Week 2

The storage management software ejects cartridges from the storage pool. The library moves the cartridges to empty magazine slots in the entry/exit pool, making them ready to be removed from the library and stored off site.

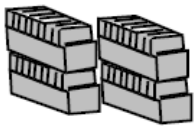
Operator tasks:

- Export the 2 full TeraPack magazines from the entry/exit pool.
- Import 2 empty TeraPack magazines into the entry/exit pool.



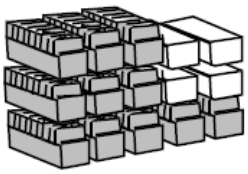
Results of operator tasks:

Off-site storage:
4 full TeraPack magazines



Entry/Exit pool:
2 chambers, each contains an empty TeraPack magazine.

- **Storage pool:**
  11 chambers contain full magazines
- 4 chambers contain empty TeraPack magazines.



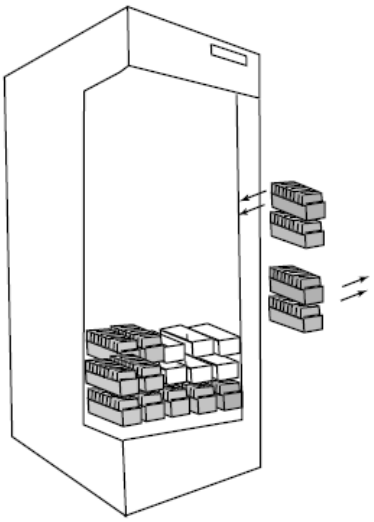
Data Center: No reserved media or magazines.

End of Week 3

The storage management software ejects cartridges from the storage pool. The library moves the cartridges to empty magazine slots in the entry/exit pool, making them ready to be removed from the library and stored off site. The two full magazines stored off site in Week 1 are ready for re-use. After importing the full magazines into the entry/exit pool, the storage management software is used to move the cartridges to the storage pool, leaving two empty magazines in the entry/exit pool.

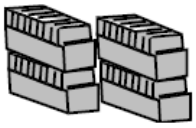
Operator tasks:

- Export the 2 full TeraPack magazines from the entry/exit pool.
- Import 2 full TeraPack magazines into the entry/exit pool.
- Use storage management software to move cartridges to the storage pool.



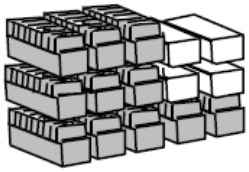
Results of operator tasks:

Off-site storage:
4 full TeraPack magazines



Entry/Exit pool:
2 chambers, each contains an empty TeraPack magazine.

- **Storage pool:**
  11 chambers contain full magazines
- 4 chambers contain empty magazines



Data Center: No reserved media or magazines.

APPENDIX B - SPECIFICATIONS

This appendix provides specifications for the Spectra Cube library, as well as the drives and media used in the library:

Library Specifications **165**

Data Storage Capacity 165

Size and Weight 166

Service Access Requirements 167

Shipping Size and Weight 167

Power Specifications 168

Environmental Specifications 171

Shock and Vibration Specifications 173

Interface Specifications **174**

Component Interface Connectors 174

Network Interface Cable Requirements 174

Universal Serial Bus (USB) Support 176

NDMP Support 176

Tape Drive and Media Specifications **177**

LTO Tape Drive Specifications 177

Drive-Based Encryption Highlights 180

Tape Media Specifications 180

Barcode Label Specifications 183

Interoperability and Software Compatibility **187**

Note: The specifications in this chapter are subject to change without notice.

LIBRARY SPECIFICATIONS

The following sections provide detailed specifications for the library including data storage capacity, library size and weight, space requirements, power specifications, environmental specifications, and shock and vibration specifications.

Data Storage Capacity

The Cube library provides flexible storage capacity that expands from a minimum of one storage chamber up to the maximum storage capacity of the library. The capacity specifications in this section assume that only one type of drive is installed in the library. When using mixed drives and media, the library's capacity depends on the number of drives and slots, and the type(s) of drives and media used.

Drive Type	Slots	Native Capacity	Compressed Capacity
LTO-6	1670	4,175 TB	10,437 TB
LTO-7	1670	10,020 TB	25,050 TB
LTO-7 Type M	1670	15,030 TB	37,575 TB
LTO-8	1670	20,040 TB	50,100 TB
LTO-9	1670	30,060 TB	75,150 TB

Size and Weight

The following table shows the size and weight specifications for the library frame and other components.

Notes:
- All dimensions and weights are approximate.
- To calculate the approximate weight of a loaded library, use the weight of the library frame and then add the weight for each drive, power supply, library module, and the weight of each TeraPack magazine full of cartridges.
- When calculating space requirements, include the service access requirements described in Service Access Requirements on the next page.

Parameter	Specification
Height [a]	79.4 in. (201.7 cm)
Width	35.9 in. (91.2 cm)
Depth	45.4 in. (115.3 cm)
Weight [b]	885 lb (401.4 kg)
Each drive (in drive sled)	• LTO-6: 11.0 lbs (5.0 kg) approximately. • LTO-7: 11.0 lbs (5.0 kg) approximately. • LTO-8: 11.0 lbs (5.0 kg) approximately. • LTO-9: 11.0 lbs (5.0 kg) approximately. • Contact Spectra Logic Professional Support for exact numbers.
Each TeraPack magazine	With ten LTO cartridges: 5.1 lb (2.3 kg)
Each Module (LCM, Power Management Module, Ethernet Switch)	• LCM: 7.3 lbs (3.3 kg) • Ethernet Switch: 5.2 lbs (2.4 kg) • Power Management Module: 4.5 lbs (2 kg)
Each power supply	7.9 lbs (3.6 kg) estimated. Contact Spectra Logic for an exact weight.

[a] The height of the library can be adjusted to allow for leveling on uneven floors.

[b] Weight with no drives or media installed.

Service Access Requirements

Side Access Requirement

There is no side access requirement and other equipment can be located directly on both sides of the Cube library.

Minimum Front and Back Access Requirements

A minimum of 2 feet (0.6 m) of clearance at the front and back of the library frame is required for airflow and service and operator access.

The library depth is 3.8 feet (1.2 m). The depth for the library frame plus the 2 feet (0.6 m) of required access space front and back is 7.8 feet (2.4 m).

IMPORTANT A minimum of 2 feet (0.6 m) of clearance at the front and back of the library frame is required for airflow and accessibility.

Recommended Front and Back Access Requirements

Spectra Logic recommends providing 3 feet (0.9 m) of clearance at the front and back of the library frame.

The library depth is 3.8 feet (1.2 m). The depth for the library frame plus the 3 feet (0.9 m) of recommended access space front and back is 9.8 feet (3.0 m).

Shipping Size and Weight

The following table provides the approximate dimensions and weights of the pallet and boxes used to ship the library.

	Height	Width	Depth	Weight
Crated Frame [a]		3.5 ft (1.1 m)	4.95 ft (1.5 m)	

a Each frame is shipped in a separate crate. The accessory box might ship with the main frame.

	Height	Width	Depth	Weight
Component Pallet [a], [b]				

Power Specifications

This section describes the power specifications for the library.

Input Power Requirements

The library frame includes two or three AC power modules in a redundant power configuration. With drive quantity 0 - X there are two power supplies and with drives x - 30 there are three power supplies.

For additional protection, connect the input on each power module to a separate branch circuit, which allows for failover in the event of a power failure in one of the circuits.

Power Rating

The Cube library frame is rated at 100-130 VAC or 200-240 VAC at xx amps. The power rating required depends on the number and type of drives installed. A fully loaded library requires 200-240 VAC.

Power Cord Specifications

The power cords included with the library are considered part of the library and are not intended for use with any other equipment. See Supply-End Connector Types on page 170 for the different types of cords available from Spectra Logic.

Notes:
- The supply-end connector is considered the disconnect for the unit. Make sure that the socket-outlet for the AC connection is in an accessible location near the library.
- The power cord must meet the specifications for the country where the library is installed.

a Assumes multiple components are shipped together on a single pallet. Components may also be shipped individually.

b The size and weight of the component pallet depends on the number and type of components shipped. To calculate the approximate weight of all the components, add 12 lb (5.4 kg) for each drive, 5 lb (2.3 kg) for each TeraPack magazine full of media, and 4 lb (1.8 kg) for each power supply.

North America and Korea 200–240 VAC Power Cord

The criteria for a 200-volt to 240-volt AC power cord in North America and Korea are as follows:

Parameter	Specification
Power cordage	SJT type, three-conductor, 14 AWG minimum [a]
Power input connectors	• **Male:** Connector must be of the proper type, rating, and safety approval (see Supply-End Connector Types on the next page). • **Female:** IEC 60320 C19

International 200–240 VAC Power Cord

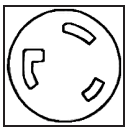
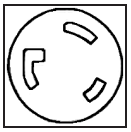
The criteria for an international 200-volt to 240-volt AC power cord are as follows:

Parameter	Specification
Power cordage	Flexible, HAR (harmonized) type H05VV-F, three conductor, cord with minimum conductor size of 1.7 square millimeters (0.0026350 square inches).
Power input connectors	• **Male:** Connector must be of the proper type, rating, and safety approval for the intended country (see Supply-End Connector Types on the next page). • **Female:** IEC 60320 C19

a Power cord must comply with local electrical code.

Supply-End Connector Types

The supply-end connector on the cord depends on the country where the library will be installed. The following table shows the supply-end connector types used in each country.

Part Number	Country of Use	Plug Style	Length	Appearance	
9594	North America, Korea	NEMA L6-20P	14.8 ft (4.5 m)		
7029	North America, Korea	NEMA L6-30P	14.8 ft (4.5 m)		
6807	Japan	NEMA L6-20P	13.9 ft (4.24 m)		
8665	United Kingdom, Continental Europe	IEC 60309	15 ft (4.6 m)		

Power Consumption and Cooling Requirements

The power and cooling requirements for the library depend on the number and type of drives installed. The following table provides the maximum power consumption and heat load for the base library frame and for each additional component added to the base library frame. Use this information to calculate the total maximum power consumption and heat load values, which can be used to build a power budget for the library.

All values are measured at the AC input and include power supply efficiency. The values are averages of observed hardware. In general, the lighter the load on the power supplies, the less efficient they are. The power supply efficiency in turn affects the power draw of all components.

Component	Power Consumption (watts)	Heat Load, Continuous (BTU/hour)
Library frame [a]	478	1630
LCM	40	136
Ethernet Switch	25	85
LTO-9 Fibre Channel or SAS Full-Height	• **Read/write:** 35	**Read/write:** 119
LTO-9 Fibre Channel or SAS Half-Height	• **Read/write:** 35	**Read/write:** 119
LTO-8 Fibre Channel Full-Height	• **Read/write:** 40 • **Idle:** 15 [b]	**Read/write:** 136
LTO-8 Fibre Channel or SAS Half-Height	• **Read/write:** 43 • **Idle:** 14 [b]	**Read/write:** 146
LTO-7 Fibre Channel Full-Height	• **Read/write:** 31 • **Idle:** 20 [b]	**Read/write:** 106
LTO-7 Fibre Channel or SAS Half-Height	• **Read/write:** 31 • **Idle:** 20 [c]	**Read/write:** 106
LTO-6 Fibre Channel Full Height	• **Read/write:** 28 • **Idle:** 8 [b]	**Read/write:** 95

Environmental Specifications

This section describes environmental specifications for the library. Do not place the library on a carpeted floor or anywhere else that poses risk for static discharge that could damage the library and its drives.

CAUTION The library must be installed on a level, hard-surfaced floor such as cement or tile. Never install it on carpeted flooring.

The library is equipped with internal fans. The fans keep the library's internal temperature within specifications as long as the data center environment is within specifications.

[a] No drives or components installed. Includes internal fans, robotics, and electronic boards.

[b] No cartridge loaded.

CAUTION When the library is moved from a cold environment to a warm environment, it should not be powered on for at least 24 hours. This adjustment period prevents condensation damage.

The following tables list the general environmental specifications for the library.

Allowable Operating Environmental Specification [a]	
Ambient temperature	60° F to 90° F (16° C to 32° C)
Humidity	20% to 80% (non-condensing) 71.6° F (22° C) dew point maximum
Maximum humidity change rate	5% per hour with no condensation
Maximum temperature change rate	9° F per hour (5° C per hour), (non-condensing)
Altitude	Sea level to 10,000 ft (3,048 m)

Recommended Operating Environmental Specification [b]	
Ambient temperature	60° F to 77° F (16° C to 25° C)
Humidity	20% to 50% (non-condensing) 71.6° F (22° C) dew point maximum
Maximum humidity change rate	5% per hour with no condensation
Maximum temperature change rate	9° F per hour (5° C per hour), (non-condensing)
Altitude	Sea level to 10,000 ft (3,048 m)

Storing [c] and Shipping (Non-Operating) Environment Specification	
Humidity	10% to 95% (non-condensing)

[a] The temperature and humidity must be allowed to stabilize in the specified ambient environment for 24 hours.

[b] The temperature and humidity must be allowed to stabilize in the specified ambient environment for 24 hours.

[c] The library is in its original packaging. The packaging is designed to protect the library from condensation caused by extreme temperature variations of 27° F (15° C) or more. When the library is moved from a cold storage environment to a warm operating environment, it must be acclimated in its packaging for at least 24 hours before opening to prevent serious condensation damage from occurring.

Storing [a] and Shipping (Non-Operating) Environment Specification	
Temperature	–40° F to 149° F (–40° C to 65° C)
Altitude	Sea level to 40,000 ft (12,192 m)

Shock and Vibration Specifications

The library will operate normally after experiencing shock loads as specified in the following table. The operating shock levels indicate how much shock the library can withstand while the enclosed drives are reading and writing data. The non-operating and storage shock levels indicate how much shock the library can withstand when it is not operating. After experiencing this amount of shock, the library will operate normally.

Specification	Operating	Storing and Shipping (Non-Operating Environment) [b]
Shock	2 g pk ½ sine wave for 10 msec (3 axes, 2 shocks per axis, minimum)	2 g pk ½ sine wave for 10 msec (3 axes, 2 shocks per axis, minimum)
Vibration (Swept Sine)	5 Hz – 500 Hz – 5 Hz 5 – 22 Hz, 0.01-inch DA displacement 22 – 500 Hz, 0.25G pk @ ½ octave (minimum three axes)	5 Hz – 500 Hz – 5 Hz 5 – 31 Hz, 0.02-inch DA displacement 31 – 500 Hz, 1G pk @ ½ octave (minimum three axes)
Vibration (Random)	0.5 Grms, 0 – 3000 Hz (single axis)	1 – 200 Hz @ 1.156 Grms. Bottom face only for 60 minutes.

aThe library is in its original packaging. The packaging is designed to protect the library from condensation caused by extreme temperature variations of 27° F (15° C) or more. When the library is moved from a cold storage environment to a warm operating environment, it must be acclimated in its packaging for at least 24 hours before opening to prevent serious condensation damage from occurring.

b Specifications are for the library in its original packaging.

INTERFACE SPECIFICATIONS

This section provides information about the interfaces used to connect the library and tape drives to the host systems. It also provides information about the Ethernet interface used to access the library's LumOS web interface.

Direct-attached tape drives have a native Fibre Channel or SAS interface; direct-attached SCSI drives are not supported.

For information about how IBM drives support SAS communications, refer to the tape drive documentation, available from IBM at *ibm.com/support/knowledgecenter/*.

Component Interface Connectors

Component	Physical Interface
Drive, direct-attached Fibre Channel	Two dual port multimode optical LC connectors [a]
Drive, direct-attached SAS - LTO-6 through LTO-8	Two SFF-8088 connector
Drive, direct-attached SAS - LTO-9	Two SFF-8644 connector

Network Interface Cable Requirements

The type of cables required to connect the library and its drives to the network depend on the type of interface being used.

Library Access

Provide a Category 5 (10/100/1000 Base-T connection) data-grade Ethernet cable that is compliant with EIA/TIA 568 from an active Ethernet network to be connected to an Ethernet port on the LCM (each Ethernet port is a pin-through-hole RJ-45 shielded connector) to support remote access to the library's LumOS user interface and to allow the library to automatically email notifications to users.

CAUTION Some port scanning software can interfere with remote library sessions.

a Only one port at a time can be used to connect the drive to a Fibre Channel network. If desired, the two ports can be used to create a failover configuration.

Tape Drive Access

- **Fibre Channel**

  Provide one optical fiber cable from the arbitrated loop or switched fabric, to a Fibre Channel port on each drive, to provide the hosts with access to the partitions. Depending on the wavelength, the cables must comply with the following specifications in the Fibre Channel standard (FC-PI-2):

  - **50-micron**—400-M5-SN-I classification
  - **62.5 micron**—400-M6-SN-I classification (not supported for LTO-6 or later generation drives)

  Use the following table to determine the maximum length for an M5 cable.

Data Rate / Link Speed	M5 (OM2) cable	M5E (OM3) cable	M5F (OM4) cable
1 Gbps	1640 ft (500 m)	Not Specified	Not Specified
2 Gbps	984 ft (300 m)	Not Specified	Not Specified
4 Gbps	492 ft (150 m)	1247 ft (380 m)	1312 ft (400 m)
8 Gbps	164 ft (50 m)	492 ft (150 m)	623 ft (190 m)

- **Serial Attached SCSI (SAS)**

  SAS tape drives support the point-to-point Serial Attached SCSI protocol.

  - **LTO-7 and LTO-8** - Connecting these drives to the host network requires an SFF-8088 SAS cable rated for 6 Gb/second that does not exceed 13 feet (4 m).
  - **LTO-9** - Connecting these drives to the host network requires an SFF-8644 SAS cable rated for 12 Gb/second that does not exceed 13 feet (4 m).

Universal Serial Bus (USB) Support

Spectra Logic supports using the USB ports on the LCM for the following:

- USB mass storage devices (for example, flash drives)
- Keyboards
- Pointer devices (for example, a computer mouse)
- External Drives (HD, CD, DVD, and Flash) with a USB interface

IMPORTANT The library only recognizes FAT-formatted, not NTFS-formatted, USB devices.

NDMP Support

Spectra Logic tape libraries are compatible with local, remote, and three-way NDMP (Network Data Management Protocol) topologies, where the tape library is connected to the NDMP data mover host over Fibre Channel.

TAPE DRIVE AND MEDIA SPECIFICATIONS

This section provides the basic specifications for the tape drives and media supported by the library.

Notes:
- The specifications in this section are provided for convenience only. Refer to the tape drive documentation for the most current specifications (see LTO Ultrium Tape Drives on page 15).
- The specifications in this section are subject to change without notice.

LTO Tape Drive Specifications

This section provides specifications for the LTO drives supported by the library. See Tape Media Specifications on page 180 for information about the media used in the library.

Note: LTO drives and media are also referred to as Ultrium or LTO Ultrium drives and media.

LTO-9 Drive

When connecting to a Fibre Channel network, LTO-9 Fibre Channel drives will attempt to connect at 8 Gb/second, but will auto-negotiate down to 4 Gb/second, or 2 Gb/second, depending on the requirements of the port to which the drive is connected.

LTO-9 SAS drives attempt to connect at 12 Gb/second, but auto-negotiate down to 6 Gb/second or 3 Gb/second, depending on the requirements of the port to which the drive is connected.

Parameter	Specification
Maximum sustained transfer rate [a, b]	400 MB/second, native 900 MB/second, compressed SAS 700 MB/second, compressed Fibre
Speed matching range	177 MB/second to 400 MB/second
Average space record time	TBD
Encryption capability	AES 256-GCM
WORM capability	Yes

a Assuming a 2.5:1 compression ratio. Compression throughput depends on the type of data.

b This is a per-drive value. Total sustained transfer rate for the library depends on the number of drives installed in the library.

Parameter	Specification
MTBF	250,000 hours at 100% duty cycle
Uncorrected error rate, calculated	1 x 10^{-20} bits
Power consumption	Read/write: 34 watts typical Idle: TBD

LTO-8 Drive

When connecting to a Fibre Channel network, LTO-8 Fibre Channel drives will attempt to connect at 8 Gb/second, but will auto-negotiate down to 4 Gb/second, or 2 Gb/second, depending on the requirements of the port to which the drive is connected.

LTO-8 SAS drives attempt to connect at 6 Gb/second, but auto-negotiate down to 3 Gb/second or 1.5 Gb/second, depending on the requirements of the port to which the drive is connected.

Parameter	Specification
Maximum sustained transfer rate [a, b]	360 MB/second, native 750 MB/second, compressed
Speed matching range	112 MB/second to 360 MB/second
Average space record time	59 seconds
Encryption capability	AES 256-GCM
WORM capability	Yes
MTBF	250,000 hours at 100% duty cycle
Uncorrected error rate, calculated	1 x 10^{-19} bits
Power consumption	Read/write: 40 watts typical Idle: 15 watts

LTO-7 Drive

When connecting to a Fibre Channel network, LTO-7 Fibre Channel drives will attempt to connect at 8 Gb/second, but will auto-negotiate down to 4 Gb/second, or 2 Gb/second, depending on the requirements of the port to which the drive is connected.

a Assuming a 2.5:1 compression ratio. Compression throughput depends on the type of data.

b This is a per-drive value. Total sustained transfer rate for the library depends on the number of drives installed in the library.

LTO-7 SAS drives attempt to connect at 6 Gb/second, but auto-negotiate down to 3 Gb/second or 1.5 Gb/second, depending on the requirements of the port to which the drive is connected

Parameter	Specification
Maximum sustained transfer rate [a, b]	300 MB/second, native 750 MB/second, compressed
Speed matching range	100 MB/second to 300 MB/second
Average space record time	56 seconds
Encryption capability	AES 256-GCM
WORM capability	Yes
MTBF	250,000 hours at 100% duty cycle
Uncorrected error rate, calculated	1×10^{-19} bits
Power consumption	Read/write: 31 watts typical Idle: 20 watts

LTO-6 Drive

When connecting to a Fibre Channel network, LTO-6 Fibre Channel drives will attempt to connect at 8 Gb/second, but will auto-negotiate down to 4 Gb/second, 2 Gb/second, or 1 Gb/second, depending on the requirements of the port to which the drive is connected.

Parameter	Specification
Maximum sustained transfer rate [c, d]	160 MB/second, native [e] 400 MB/second, compressed
Speed matching range	40 MB/second to 160 MB/second
Average space record time	77 seconds
Encryption capability	AES 256-bit

a Assuming a 2.5:1 compression ratio. Compression throughput depends on the type of data.

b This is a per-drive value. Total sustained transfer rate for the library depends on the number of drives installed in the library.

c Assuming a 2.5:1 compression ratio. Compression throughput depends on the type of data.

d This is a per-drive value. Total sustained transfer rate for the library depends on the number of drives installed in the library.

e A 1 Gb interface speed will not stream an LTO-6 drive at 160 MB/second.

Parameter	Specification
WORM capability	Yes
MTBF	250,000 hours at 100% duty cycle
Uncorrected error rate	1 x 10^{-17} bits
Power consumption	Read/write: 28 watts typical Idle: 8 watts

Drive-Based Encryption Highlights

Key

AES-256 data encryption with a secret 256-bit encryption key is used to encrypt and decrypt data. The key is not retrievable from the encryption core and is automatically erased during the unload process; software is required to extract the key, keep it secure, and provide management tools to track, store, use, and delete keys as appropriate.

Note: Spectra SKLM key management is not compatible with BlueScale Encryption key management, because they cannot share encryption keys. Data encrypted using Spectra SKLM key management cannot be decrypted using BlueScale Encryption key management, and vice versa.

For more information about encryption, see the *Spectra Tape Libraries Encryption User Guide*.

Tape Media Specifications

This section provides specifications for the tape media supported by the library.

Environmental Requirements

The following table lists the specifications for storage temperature and other environmental requirements for tape media. Do not allow the temperature and humidity in the storage environment to fluctuate.

Specification	Recommended Operating	LTO-9 Allowable Operating [a]	LTO-8 and Lower Allowable Operating [a]	Shipping [b]
Temperature	59° F to 77° F (15° C to 25° C)	59° F to 95° F (15° C to 35° C)	50° F to 113° F (10° C to 45° C)	–9° F to 120° F (–23° C to 49° C)
Relative humidity	20% to 50%	10% to 80%	10% to 80%	5% to 80%
Max dew point	72° F (22° C)	71.6° F (22° C)	79° F (26° C)	79° F (26° C)
Maximum humidity rate change	5% / hour with no condensation	5% / hour with no condensation	5% / hour with no condensation	
Maximum Altitude	10,000 ft 3048 m	10,000 ft 3048 m	10,000 ft 3048 m	40,000 ft 12192 m

LTO Media Specifications

The following table shows the capacities of the different generations of LTO Ultrium data cartridges.

LTO Media Generation	Native Capacity (Compressed Capacity)
LTO-6 and LTO-6 WORM	2.5 TB (6.25 TB [c])
LTO-7 and LTO-7 WORM	6 TB (15 TB [b])
LTO-7 Type M	9 TB (22.5 TB [b])
LTO-8 and LTO-8 WORM	12 TB (30 TB [b])
LTO-9 and LTO-9 WORM	18 TB (45 TB [b])

a The upper limit applies to the media, not the library. Be sure there is adequate air flow around the library at all times.

b When media is moved from a cold shipping/storage environment to a warm operating environment, it must be acclimated in its packaging for at least 24 hours before opening to prevent condensation damage from occurring.

c Assuming a 2.5:1 compression ratio. The compressed capacity depends on the type of data.

LTO Read/Write Compatibility

The following table shows the media read/write compatibility for each LTO drive generation supported by the library.

Drive Gen	LTO-4 Media	LTO-5 Media	LTO-6 Media	LTO-7 Media	M8 Media	LTO-8 Media	LTO-9 Media
LTO-6	*Read only*	**Read/write**	**Read/write**	Not supported	Not supported	Not supported	Not supported
LTO-7	Not supported	*Read only*	**Read/write**	**Read/write**	Not supported	Not supported	Not supported
LTO-8	Not supported	Not supported	Not supported	**Read/write**	**Read/write**	**Read/write**	Not supported
LTO-9	Not supported	Not supported	Not supported	Not supported	Not supported	**Read/write**	**Read/write**

WORM Media

Certain records retention and data security applications require a Write Once, Read Many (WORM) method for storing data on tape. LTO-6 and later generation drives enable WORM support when a WORM tape cartridge is loaded into the drive.

WORM Media Requirements

Because standard read/write media are incompatible with the WORM feature, a specially formatted WORM tape cartridge is required. Each WORM cartridge has a unique, worldwide cartridge identifier (WWCID), which comprises the unique CM chip serial number and the unique tape media serial number.

Data Security on WORM Media

Certain built-in security measures help ensure that the data written on a WORM cartridge does not become compromised, for example:

- The format of a WORM tape cartridge is unlike that of standard read/write media. This unique format prevents a drive that lacks WORM-capable firmware from writing on a WORM tape cartridge.
- When the drive senses a WORM cartridge, the firmware prohibits the changing or altering of user data already written on the tape. The firmware keeps track of the last appendable point on the tape.

Cleaning Cartridges

Cleaning cartridges are valid for 50 uses. Do not rewind and reuse the material in a cleaning cartridge. Reusing the material may redistribute contaminants previously removed from the tape path. If all of the cleaning material has been used, discard the cartridge and use a new cleaning cartridge.

Barcode Label Specifications

Symbology

The barcode labeling scheme used on Spectra Logic certified media uses the barcode symbology of USS-39. You can obtain a complete description and definition of this symbology from the *Automatic Identification Manufacturers (AIM)* specification, the *Uniform Symbol Specification (USS-39)*, and the *ANSI MH10.8M-1993 ANSI Barcode* specification.

Application and Orientation

The barcode label must be applied to the cartridge so that it fits within the label recess on the edge of the cartridge without curling up on the sides or ends. The label must be oriented so that the barcode characters are along the edge closest to the hub side of the cartridge.

Printed Characters

The label can have human-readable alphanumeric characters printed along the top or bottom edge of the label provided there is no conflict or interference with the automation code. This text must include the barcode data, but can also include additional text. The format and colors of the human readable characters is up to the customer and label vendor. For location restrictions, see Detailed Specifications for LTO Cartridge Barcodes on page 185 .

Note: When using barcode labels with alphanumeric characters along the bottom edge, the label must be positioned so that barcode is at least 13.72 mm below the top edge of the cartridge to ensure that the barcode reader can read the label.

Barcode Data

The library supports barcode data strings consisting of from 1 to 16 characters, including an optional checksum character. Quiet zones precede and follow the start and stop characters.

The barcode data string on standard Spectra Logic barcode labels consists of a start character, eight alphanumeric characters, a checksum character, and the stop character. Quiet zones precede and follow the start and stop characters.

- The first six (6) characters following the start character can be any combination of upper case A-Z or 0-9 (for example, ABC123) to identify the cartridge Volume Serial Number. The use of “CLN” and “DG{space}” at the beginning of the volume identifier is reserved.

  - The volume identifier "CLN*vnn*" is reserved for cleaning cartridges. When a drive requires cleaning, it requests a specific type of cleaning cartridge.
    - The "*v*" field is an alphanumeric field to identify cleaning cartridge applications, "U" for Universal Cleaning Cartridges or a drive unique identifier.
    - The "*nn*" alphanumeric field is used to track individual cleaning cartridge activity (that is, usage and life).
    - The volume identifier "`DG{space}vnn`" is reserved for diagnostic and service cartridges.
- The last two (2) characters are the media identifier and indicate the cartridge Media Type (for example, "L" for LTO and "6" for an LTO-6 cartridge). In IBM LTO tape drives, the value of the media identifier on cleaning cartridges is ignored, although a valid value must be present.
- The barcode string can be printed in either direction on the label and must begin and end with a valid start/stop character (*).
- The label must be printed so that barcode data is positioned along the edge of the label that will be closest to the hub side of the cartridge.

The *AIM Uniform Symbol USS-39* specification provides detailed information about the format of the start character, the series of characters that make up the barcode data, the optional checksum character, and the stop character.

Detailed Specifications for LTO Cartridge Barcodes

Figure 99 shows the dimensional specifications for LTO labels with the alphanumeric characters above the barcode.

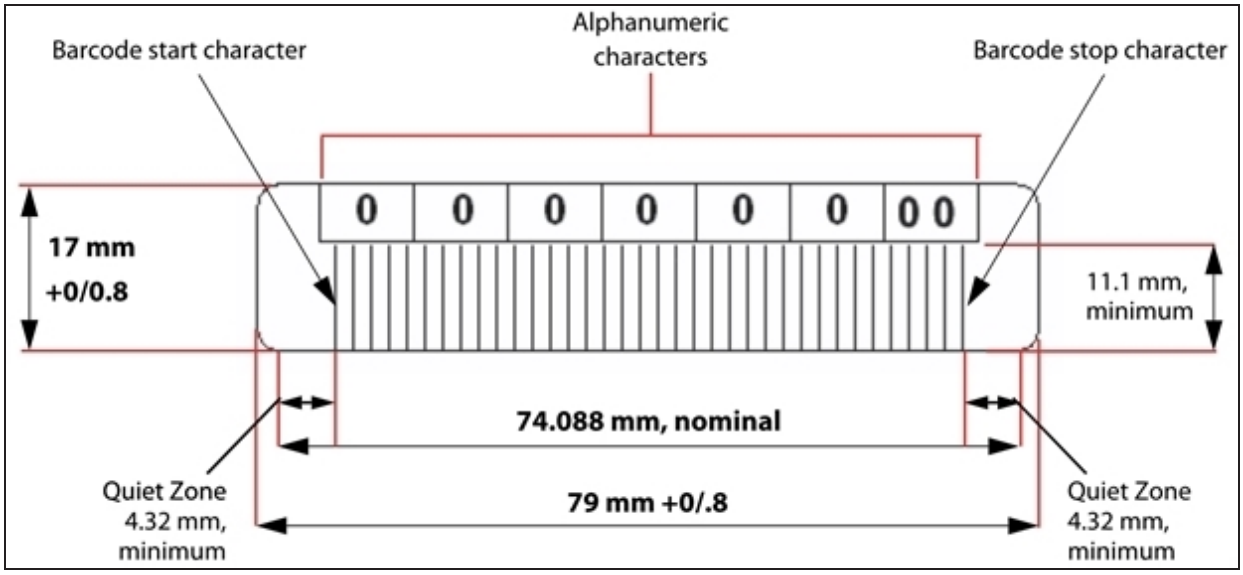


Figure 99 Barcode specifications for LTO media; alphanumeric characters on top.

Note: When using barcode labels with alphanumeric characters along the bottom edge, the label must be positioned so that barcode is at least 13.72 mm below the top edge of the cartridge to ensure that the barcode reader can read the label.

LTO Barcode Element Specifications

For the official IBM barcode label specification, see *ibm.com/support/pages/node/651699*. Unless otherwise specified, tolerances are X.XXX ± 0.127 mm, X.XXX ± 0.762 mm.

- Minimum symbol height is 11.1 mm, measured to the inside of the label's edge.
- The wide-to-narrow ratio is 2.75.
- The narrow element width is 0.432 mm +0.03 mm or –0.076 mm.
- The nominal width of the wide spaces and bars is 1.188 mm.
- The inter-character gap is 0.432 mm +0.03/–0.076 mm.
- The minimum quiet zone at the beginning and end of a printed barcode string is 4.32 mm (10 times the narrow element width).
- The total nominal barcode string length (including quiet zones) is 74.088 mm.
- The edge of the barcode is the edge of the printed area associated with the bar. The edge roughness is the transition encountered as a horizontal line is moved vertically from all black to all white. The edge roughness maximum is 0.038 mm.
- Variation between all bars, white and black, must be less than ±0.0381 mm.

LTO Physical Label Specifications

- Label stock must fit within the label recess on the face of the cartridge without curling up on the sides or ends (79 mm X 17 mm +0/–0.8).
- Minimum length sufficient for the quiet zones, start-stop, and data characters (nominal 74.088 mm).
- Minimum width no less than 1.5 mm narrower than the cartridge label recess width. Corners are cut with a 1.5 mm radius.
- Maximum label thickness, including the RFID tag, if present, together with any associated layers and adhesives cannot exceed 0.40 mm.
- The label and adhesive must have an environmental performance to match or exceed the environmental specifications of the cartridge to which it is applied.

INTEROPERABILITY AND SOFTWARE COMPATIBILITY

You can find complete interoperability listings, as well as a list of the types of software that have been tested and proven compatible with the library on the Spectra Logic website at *spectralogic.com/compatibility*.

APPENDIX C - REGULATORY & SAFETY STANDARDS

Contact Spectra Logic for regulatory and safety standard information.