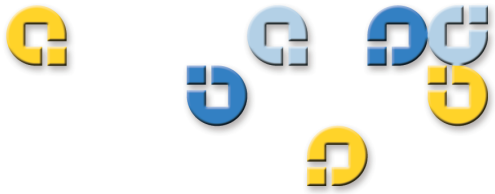
Quantum



User's Guide User's Guide User's Guide User's Guide User's Guide User's Guide

Quantum Key Manager

Quantum Tape Libraries

6-66531-01 A

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Preface

Audience

This book is intended for storage and security administrators responsible for security and backup of vital data, and anyone assisting in the setup and maintenance of Quantum Key Manager servers and software in the operating environment. It assumes the reader has a working knowledge of storage devices and networks.

Purpose

This book contains information to help you install, configure, and run your QKM system.

Document Organization

This document is organized as follows:

- Chapter 1, Overview, provides an overview of tape encryption and the Quantum Key Manager (QKM) components.
- Chapter 2, Safety, provides basic electrical and electrostatic safety information.
- Chapter 3, Planning Your QKM Environment, provides considerations for how to set up your QKM server environment.

- Chapter 4, Installation and Initial Configuration, provides instructions on how to set up the QKM server and configure the library to use QKM.
- Chapter 5, Using the QKM Server, provides instructions on using the QKM server hardware and general usage commands.
- Chapter 6, Using the Library to Initiate QKM Functions, provides information on how to use the library remote web client to generate, import, and export data encryption keys and encryption certificates, and how to share encrypted tapes offsite.
- Chapter 7, Logs, describes the various QKM logs and how to access them.
- Chapter 8, Troubleshooting, describes how to detect and resolve problems with the QKM server hardware or operation.
- Chapter 9, Hardware Replacement Procedures, describes how to replace a defective hard disk drive and how to replace a QKM server.
- Chapter 10, Updating and Rolling Back QKM Server Software, explains how to update and roll back QKM server software.
- Appendix A, Specifications,, provides hardware and operational specifications for the QKM server.

This document concludes with a glossary and an index.

Notational Conventions

This manual uses the following conventions:

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

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

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

Related Documents

The following publications provide information related to Quantum Key Manager. For the latest versions, visit www.quantum.com.

Document No.	Document Title
6-66532-xx	Quantum Key Manager Quick Start Guide
6-66533-xx	Quantum Key Manager Rack Installation
6-66572-xx	Quantum Key Manager Safety Information by IBM
6-66535-xx	Quantum Key Manager Open Source License Agreement
6-01210-xx	Scalar i500 User's Guide
6-00421-xx	Scalar i2000 User's Guide

Contacts

Quantum company contacts are listed below.

Quantum Corporate Headquarters

To order documentation on Quantum Key Manager or other products contact:

Quantum Corporation
P.O. Box 57100
Irvine, CA 92619-7100
(949) 856-7800
(800) 284-5101

Technical Publications

To comment on existing documentation send an e-mail to:

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Quantum Home Page

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Chapter 1
Overview

Data is one of the most highly valued resources in a competitive business environment. Protecting that data, controlling access to it, and verifying its authenticity while maintaining its availability are priorities in our security-conscious world. Data encryption is a tool that answers many of these needs.

The HP LTO-4 Fibre Channel or SAS tape drive is capable of encrypting data as it is written to any LTO-4 data cartridge. Encryption is performed at full line speed in the tape drive after compression. (Compression is more effectively done before encryption.) This new capability adds a strong measure of security to stored data without the processing overhead and performance degradation associated with encryption performed on the server or the expense of a dedicated data encryption appliance.

This chapter covers:

Library Managed Encryption

The library managed tape drive encryption solution is composed of three major elements:

- Encryption-Enabled Tape Drive
- Quantum Key Manager (QKM)
- Encryption-Enabled Tape Library

Encryption-Enabled Tape Drive

HP LTO-4 Fibre Channel and SAS tape drives are *encryption-capable*. This means that they are functionally capable of performing hardware encryption, but this capability has not yet been activated. In order to perform hardware encryption, the tape drives must be *encryption-enabled*. They can be encryption enabled via the tape library.

See Supported Backup Applications on page 81 for a list of which tape drives are supported by QKM on your library.

Quantum Key Manager (QKM)

Encryption involves the use of several kinds of keys, in successive layers. How these keys are generated, maintained, controlled, and transmitted depends upon the operating environment where the encrypting tape drive is installed. Some host applications are capable of performing key management. For environments without such applications or those where application agnostic encryption is desired, Quantum provides the Quantum Key Manager (QKM) solution to perform all necessary key management tasks. How QKM Key Management Works on page 3 describes these tasks in more detail.

Encryption-Enabled Tape Library

On an encryption-enabled library, tape encryption occurs automatically and transparently. The library communicates with the QKM server to obtain data encryption keys for the drives to read from or write to tapes.

Library managed encryption is provided for HP LTO-4 tape drives in a Quantum Scalar i500 or Scalar i2000 tape library. Key generation and management is performed by QKM. Data encryption keys pass from QKM to the drives via the library, making encryption transparent to applications.

How QKM Key Management Works

Quantum Key Manager (QKM) generates, protects, stores, and maintains data encryption keys that are used to encrypt information being written to, and decrypt information being read from, HP LTO-4 tape media (tape and cartridge formats).

QKM acts as a process awaiting key generation or key retrieval requests sent to it through a secure TCP/IP communication path between QKM and the tape library.

When a new data encryption key is needed, the tape drive requests a key, which the library forwards to the primary QKM server. The library requests a data encryption key from the primary QKM server first, unless the primary QKM server is down and failover to the secondary QKM server has occurred. If failover to the secondary QKM server occurred, then the library continues to request data encryption keys from the secondary QKM server until either the library is rebooted or the secondary server goes down and failover back to the primary occurs. After a library reboot, the library goes back to forwarding requests to the primary server.

Upon receipt of the request, QKM retrieves an existing data encryption key from the keystore and securely transfers it to the library, which then provides it to the tape drive where it is used to encrypt the data being written to tape. Once a data encryption key is assigned to a tape, it is never reused on another tape.

When an encrypted tape is read by an HP LTO-4 tape drive, the tape drive requests, via the library, the required data encryption key from the QKM server. QKM retrieves the required data encryption key from the keystore and securely transfers it to the library, which provides it to the tape drive. The HP LTO-4 tape drive uses the data encryption key to perform encryption or decryption.

No data encryption key is stored anywhere on the cartridge memory or the tape. Only the name of the data encryption key is stored on the tape, so that in the future the key can be requested for further read or write purposes. The first read/write operation on an encrypted tape requires the tape drive to request the data encryption key.

Encryption Keys

An encryption key is typically a random string of bits generated specifically to encrypt and decrypt data. Encryption keys are created using algorithms designed to ensure that each key is unique and unpredictable. The longer the length of key used, the harder it is to break the encryption code.

The HP LTO-4 method of encryption uses 256-bit AES algorithm to encrypt data. 256-bit AES is the encryption standard currently recognized and recommended by the US government, which allows three different key lengths. 256-bit keys are the longest allowed by AES.

QKM uses two types of encryption algorithms:

- Symmetric
- Asymmetric

Symmetric, or secret key encryption, uses a single key for both encryption and decryption. Symmetric key encryption is generally used for encrypting large amounts of data in an efficient manner. 256-bit AES encryption uses symmetric keys.

Asymmetric, or public/private encryption, uses a pair of keys. Data that is encrypted using one key can only be decrypted using the other key in the public/private key pair. When an asymmetric key pair is generated, the public key is typically used to encrypt, and the private key is typically used to decrypt.

QKM uses both symmetric and asymmetric keys—symmetric encryption for high-speed encryption of user or host data stored on tape, and asymmetric encryption (which is necessarily slower) for secure communication and protecting the symmetric keys while in transit.

Encryption Certificates

Each QKM server pair uses one unique encryption certificate. The encryption certificate contains the public key of the public/private key

pair that protects data encryption keys during transit to another site. The destination QKM server provides its public key to the source QKM server as part of its encryption certificate, which the source QKM server uses to wrap (encrypt) exported data encryption keys for transport. Upon arrival, the file containing the wrapped data encryption keys can only be unwrapped by the corresponding private key, which resides on the destination QKM server and is never shared.

For more information, see the following:

- Encryption Keys on page 4)
- Sharing Encrypted Tapes Offsite on page 53
- Importing and Exporting Data Encryption Keys on page 52
- Importing and Exporting Encryption Certificates on page 52

Keystore

The keystore contains:

- All of the data encryption keys generated by the QKM server on which it resides. These keys are used for encrypting and decrypting tapes.
- A copy of the data encryption keys generated by the other QKM server in the pair.
- Data encryption keys that you imported (for example, keys that other companies or individuals sent to you). These keys can be used to decrypt tapes provided by the other companies or individuals.
- Your QKM server pair's encryption certificate
- Encryption certificates that you imported (for example, that other companies or individuals sent to you). These are used to wrap your data encryption keys for transit to another party to use in decrypting tapes you may have provided to them.
- Public and private keys used for secure communication.
- Metadata (for example, which data encryption keys were used on which tapes).

Mirrored Hard Disk Drives

Each QKM server contains two hard disk drives in a RAID 1 (mirrored) configuration. The two hard disk drives are constantly being synchronized, so that each is an exact duplicate of the other. If one hard disk drive fails, the other one contains all the required information to allow the server to continue to work as normal. As soon as the failed hard disk drive is replaced, all the data on the working hard disk drive is duplicated onto the new hard disk drive.

Why You Need to Back Up Your QKM Servers

Quantum requires you to back up your QKM servers every time you generate data encryption keys (and before you start using these keys) in order to protect your keystore.

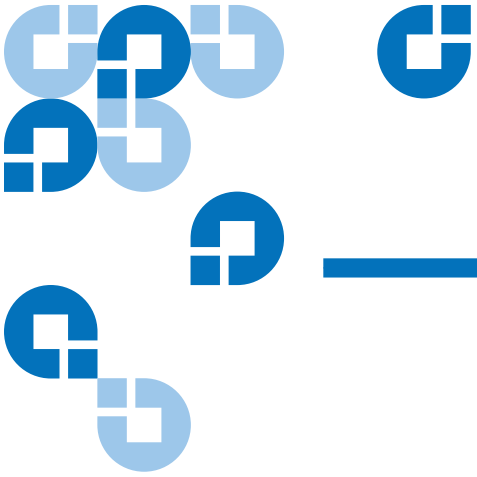
Although QKM contains features designed to protect your keystore in case of hard disk drive or server failure, these features do not cover every situation.

In the following cases, if you have no backup, there is no way to recover your keystores:

- If both QKM servers and all four hard disk drives were to suffer environmental damage causing them to become inoperable, the only way to recover your keystore is via the backup.
- If you forget your password, the only way to recover your data is to completely replace your server and its hard disk drives, and perform a restore from your backup.

Also, each QKM server generates its own unique data encryption keys, meaning that the keystore on each QKM server is different. This is why you need to back up each QKM server separately, every time that server generates data encryption keys.

For instructions on how to perform a backup, see Backing Up the Keystore on page 41.



Chapter 2
Safety

This chapter provides some important information for handling your server safely. Please also review the safety information in *Safety Information by IBM* located on the *Quantum Key Manager Documentation CD*.

This chapter covers:

- Electrical Safety
- Handling Static-Sensitive Devices

Electrical Safety

Warning: **DANGER:** Electrical current from power, telephone, and communication cables is hazardous. To avoid a shock hazard:

- Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.
- Connect all power cords to a properly wired and grounded electrical outlet.
- Connect to properly wired outlets any equipment that will be attached to this product.
- When possible, use one hand only to connect or disconnect signal cables.
- Never turn on any equipment when there is evidence of fire, water, or structural damage.
- Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.
- Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.

To Connect:	**To Disconnect:**
1. Turn everything **OFF**.	1. Turn everything **OFF**.
2. First, attach all cables to devices.	2. First, remove power cords from outlet.
3. Attach signal cables to connectors.	3. Remove signal cables from connectors.
4. Attach power cords to outlet.	4. Remove all cables from devices.
5. Turn device **ON**	

Handling Static-Sensitive Devices

Caution: Static electricity can damage the server and other electronic devices. To avoid damage, keep static-sensitive devices in their static-protective packages until you are ready to install them. To reduce the possibility of damage from electrostatic discharge, observe the following precautions:

- Limit your movement. Movement can cause static electricity to build up around you.
- The use of a grounding system is recommended. For example, wear an electrostatic-discharge wrist strap, if one is available. Always use an electrostatic-discharge wrist strap or other grounding system when you work inside the server with the power on
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed circuitry.
- Do not leave the device where others can handle and damage it.
- While the device is still in its static-protective package, touch it to an unpainted metal surface on the outside of the server for at least 2 seconds. This drains static electricity from the package and from your body.
- Remove the device from its package and install it directly into the server without setting down the device. If it is necessary to set down the device, put it back into its static-protective package. Do not place the device on the server cover or on a metal surface.
- Take additional care when you handle devices during cold weather. Heating reduces indoor humidity and increases static electricity.

Chapter 3

Planning Your QKM Environment

Use the information in this chapter to determine the operating environment for your QKM system. This chapter includes:

QKM Server Requirements

Server Requirements

QKM comes standard with two key servers pre-loaded with software. One QKM server is to be used as the primary key server; the other one is to be used as a secondary server for failover purposes, in case the primary server stops working.

Caution: The server appliances are designed for one purpose only — to store and manage your encryption keys. Do not install additional hardware on the server. Never install any software, file, or operating system on the server unless it is an upgrade or patch supplied by Quantum. Doing so may make your server inoperable and will void your warranty.

- The QKM server must have IP connectivity through any firewalls to all Quantum libraries using the QKM server to obtain LTO-4 encryption keys.
- QKM uses TCP port 6000 for the QKM server, and secure sockets layer (SSL) is always enabled. These settings cannot be changed.
- Refer to the QKM Server Environmental Specifications on page 78 for temperature and humidity requirements.

Cooling and Airflow Requirements

To maintain proper airflow and system cooling, observe the following:

- Ensure there is adequate space around the server to allow the server cooling system to work properly. Leave approximately 2 inches (50 mm) of open space around the front and rear of the server.
- Do not place objects in front of the fans.
- Do not leave open space above or below an installed server in your rack cabinet. To help prevent damage to server components, always install a filler panel to cover the open space and to help ensure proper air circulation.

Caution: Do not operate the server for more than 10 minutes without a drive installed in each bay.

Caution: Do not open the server cover to adjust or fix internal components. If the server has a problem, contact Quantum Service & Support for a replacement.

Rack Considerations

If the QKM server is installed in a rack, consider the following:

Warning: Do not place any object weighing more than 110 lb. (50 kg) on top of rack-mounted devices.

- Install the server only in a rack cabinet that has perforated doors.
- Do not block any air vents. Usually 6 in. (15 cm) of air space provides proper airflow.
- Plan the device installation starting from the bottom of the rack cabinet.
- Install the heaviest device in the bottom of the rack cabinet.
- Do not leave open space above or below an installed server in your rack cabinet. To help prevent damage to server components, always install a filler panel to cover the open space and to help ensure proper air circulation.
- Do not extend more than one device out of the rack cabinet at the same time.
- Connect all power cords to properly wired and grounded electrical outlets.
- Do not overload the power outlet when installing multiple devices in the rack.

Multiple Libraries Accessing One QKM Server Pair

Multiple libraries may access and use the same QKM server pair. The only requirement is that they be available to the QKM servers through TCP/IP connectivity. If you want to connect more than one library to a QKM server pair, keep the following in mind:

- Each library must be licensed to use QKM. See Step 3: Installing the EKM License on the Library on page 21.
- Each library can only access one QKM server pair at a time.
- The first time you enable a QKM partition to use library managed encryption, the library triggers the QKM servers to create a unique set of encryption keys. When more libraries are connected to a QKM server, more initial data encryption keys will reside in the QKM server's keystore.
- Each library's set of unique data encryption keys is maintained separately on the QKM server. When you generate more keys for a particular library, this does not affect any of the other libraries and their sets of encryption keys. Each library only triggers creation of its own set of keys.

Disaster Recovery Planning

Quantum recommends that you plan for disaster recovery in the following ways:

- Maintain each of the two QKM servers in a different geographical location, preferably in a different city, state, or country, to mitigate the possibility of both servers being compromised in the event of natural disaster or theft.

- Back up the QKM server each time new keys are generated and store the backups in a safe location (see Backing Up the Keystore on page 41).

> **Caution:** **Do not use QKM to encrypt the sole copy of your QKM server keystore backup.** If both servers were to fail, you would not be able to recover the encrypted backup and would lose all data you had stored on all your encrypted tapes.

- Remember your password. If you lose your password, you lose login access to the QKM server, including backup and restore capability. If you lose your password, Quantum will not be able to recover it for you.
- Replace a failed hard disk drive immediately. Even though the second hard disk drive allows you to continue to operate, redundancy is removed and a second hard disk drive failure would cause the server to fail.
- Replace a failed server immediately. Even though the other QKM server allows you to continue to operate, you do not want to risk the second server failing as well.

Chapter 4

Installation and Initial Configuration

This chapter provides instructions for how to set up and configure the QKM server. Perform all of the steps, **in order,** before you begin encrypting tapes.

Caution: The server appliances are designed for one purpose only — to store and manage your encryption keys. Do not install additional hardware on the server. Never install any software, file, or operating system on the server unless it is an upgrade or patch supplied by Quantum. Doing so may make your server inoperable and will void your warranty.

Items Required

You need the following to install and configure each QKM server:

- QKM server (each comes with two hard disk drives installed).
- Power cord (supplied).
- Rackmount kit (supplied).
- Ethernet cable, crossover (for initial configuration, not supplied).
- Ethernet cable, standard (for standard operation, not supplied).
- Laptop or PC, to connect to each server to perform initial configuration.
- The most recent library firmware installed on your library. (Minimum versions required: **Scalar i500: 570G**; **Scalar i2000: 595A**.)
- For Microsoft ® Windows®, you may need to install a utility to use secure shell (SSH) and secure file transfer protocol (SFTP). Two such utilities are PuTTY, available at http://www.chiark.greenend.org.uk/~sgtatham/putty/ and WinSCP, available at http://winscp.net.

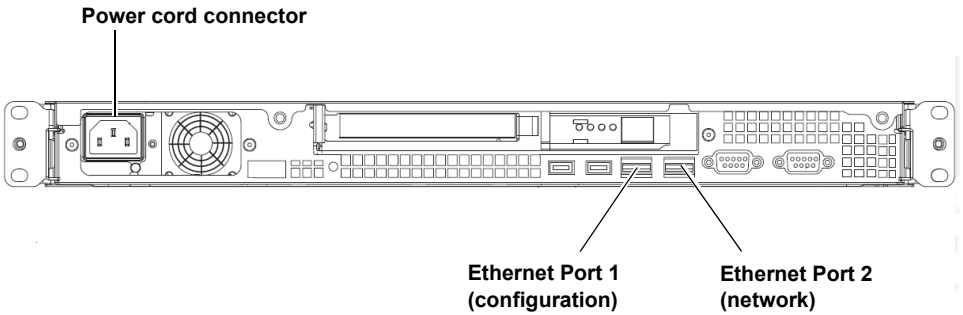
Step 1: Installing the QKM Servers

Follow the instructions below for **both QKM servers**.

> **Note:** Both QKM servers must be configured, operational, and connected to the network before any libraries can be set up to use them.

1. Determine the location for the servers. It is recommended that you place the two servers in different geographical locations for disaster recovery purposes. Ensure the air temperature is below 95 °F (35 °C).
2. Install the QKM server in a rack. Follow the *Rack Installation Instructions* (included with the rail kit and located on the *Quantum Key Manager Documentation CD*).
3. Connect the power cord into the rear of the QKM server (see Figure 1) and plug it into a grounded power outlet.

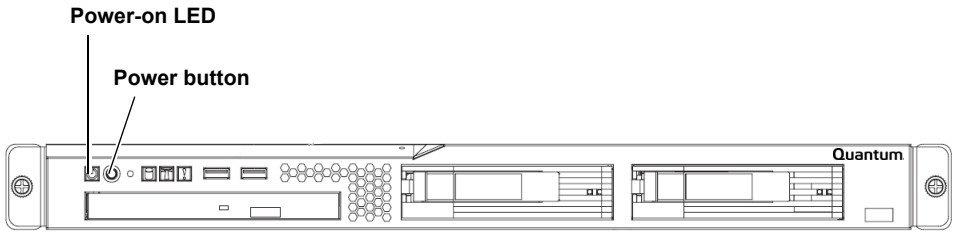
Figure 1 Rear Panel



4. Approximately 20 seconds after you connect the server to AC power, the power button becomes active, and one or more fans might start running loudly for about 20 seconds. Observe the Power-on LED on the front panel of the QKM server (see Figure 2). It should be flashing, indicating the server is turned off and connected to an AC power source. If the LED is not flashing, there could be a problem with the power supply or the LED. Check the power connection. If this LED still does not flash, contact Quantum Service & Support.

5 Turn on the QKM server by pressing the power button on the front of the server (see Figure 2).

Figure 2 Front Panel



6 Again observe the Power-on LED on the front panel of the QKM server. Wait until it is on but not flashing, indicating the server is turned on.

7 Wait about 3 minutes to allow the server to complete startup before you connect via SSH in the next step.

Step 2: Configuring the QKM Servers

Follow the instructions below for **both QKM servers**.

Note:	Both QKM servers must be configured, operational, and connected to the network before any libraries can be set up to use them.

The configuration process requires you to read and accept the end user license agreement, and then complete a setup wizard. The setup wizard helps you configure your password, IP address, netmask, gateway, time zone, date, and time. Before beginning, decide what you want each of these values to be. You can also change these values in the future.

Allow 30 minutes per server to complete the configuration.

1 Connect a crossover Ethernet cable from a laptop or PC to **Ethernet Port 1** on the rear of the QKM server (see Figure 1).

> **Note:** Ethernet Port 1 is used only for configuration. Once you perform the initial configuration, you will use Ethernet Port 2 for QKM server communication via your network.

2 Using SSH, connect to the server using the IP address **192.168.18.3**.

> **Note:** The IP address of Ethernet Port 1 is a static IP address that cannot be changed.

3 At the login prompt, enter the user login ID (which will never change):

akmadmin

4 At the password prompt, enter the default password:

password

5 At the command prompt, enter:

./qkmcmds

The End User License Agreement displays.

6 Read and accept the license agreement. Press **<Enter>** to scroll through the agreement, and at the end, enter **y** to accept.

7 Press **<Enter>** to begin the setup wizard.

8 At the password prompt, enter the default password again:

password

9 The first setup wizard task prompts you to change your password. There is only one password for QKM, which is required for all login and access to Admin commands, including backup and restore. **If you lose the password, there is no way to retrieve it.**

If you do not wish to change the password at this time, just press **<Enter>** and the default password (**password**) remains. You can change the password at any time later using the Admin commands menu.

EXTREMELY IMPORTANT:
Remember Your Password!

If you forget your password, there is no way to retrieve it!

Each QKM server has its own password. If you set them differently, you must remember both.

If you forget your password, you will lose login access to the QKM server, including backup and restore capability. Quantum will NOT be able to restore the password.

CAUTION! CAUTION! CAUTION! CAUTION!

10 Continue through the setup wizard to configure the rest of the settings: time zone, date and time, QKM server IP address, netmask, and gateway. If you press **<Enter>** without entering a value, the existing value remains.

> **Note:** The IP address you are configuring is for Ethernet Port 2, the port you will be using for QKM operations.
> **Ethernet Port 1 IP Address** (never changes): 192.168.18.3
> **Ethernet Port 2 Default IP Address**: 192.168.18.4

11 When the setup wizard is complete, press **<Enter>**.

The list of QKM Admin commands displays. If you made any mistakes during the setup wizard, you can go back and change them by entering the number corresponding to the item. To view the list at any time, enter **./qkmcmds** at the command prompt.

12 Enter **q** at the command prompt to save your changes and restart the QKM key server process. This process takes a few seconds.

13 Disconnect the crossover Ethernet cable from **Ethernet Port 1**.

14 Connect a standard Ethernet cable from **Ethernet Port 2** on the back of the QKM server to your network (see Figure 1). You will connect to this port using the IP address assigned in step 10 above.

15 Repeat the above steps on the other server in the QKM server pair.

Step 3: Installing the EKM License on the Library

Make sure that you purchased enough license capacity to cover all the tape drives that you will be using for library-managed encryption. If you want more than one library to use QKM, you must install a separate license on each library.

If you purchased QKM at the same time as your library, then your Encryption Key Management (EKM) license may already be installed on the library. If it is, you can skip this step. You can check the **Licenses** page on the library remote web client to see if the EKM license is installed.

If you purchased QKM separately from the library, you will receive, separately, instructions on how to obtain your license key and install it on the library. Follow the instructions to install your license key. If you have any questions, contact Quantum Service & Support.

Step 4: Scheduling Sufficient Time for Configuring the Library and Generating Data Encryption Keys

All of the steps that follow deal with configuring your library for QKM and generating data encryption keys. Depending on your library type, it may take up to two hours to complete all of the following steps.

Caution: Do not perform any library or host-initiated operations on the partitions to be used for QKM until all of the following steps are complete.

Also, please note that you cannot perform the following configuration steps **until all previous steps have been completed.**

Step 5: Preparing QKM Partitions on the Library

1. Install HP LTO-4 tape drives in the library, if not already installed.
2. Ensure that the partitions you want to configure for QKM contain **only** HP LTO-4 tape drives.
3. On the HP LTO-4 tape drives, install the latest version of firmware that is qualified for the library firmware installed on your library. Refer to the library release notes for the correct version of tape drive firmware.

Step 6: Configuring the QKM Server IP Addresses on the Library

1. On the library's remote web client, navigate to the encryption server setup screen:
   - Scalar i500 menu path: **Setup > Encryption > System Configuration**
   - Scalar i2000 menu path: **Setup > Encryption > Server Configuration**
2. Select **QKM** from the **Key Server Type** drop-down list.
3. Enter the QKM primary and secondary server IP addresses or hostnames in the fields provided.

Refer to your library user's guide or online help for detailed instructions.

Step 7: Installing the QKM TLS Certificates

The transport layer security (TLS) certificates allow the library to securely communicate with the QKM servers.

> **Note:** The date on both QKM servers and the library must be set to the current date. Incorrect date settings may interfere with the TLS certificates and cause the library to stop communicating with the QKM servers.
>
> See Changing the Date and Time on page 41 for instructions on changing the date on the QKM server. See your library documentation for instructions on changing the date on your library.

Items Required

- A computer with a CD ROM drive and Internet access.
- The *Quantum Key Manager TLS Certificates CD* (shipped separately from the QKM servers). The CD contains one .tgz file. This .tgz file contains all the certificates that need to be loaded onto your library.

  > **Note:** You do not need to open or extract any of the files from the .tgz file.

Procedure

1. First check to see if the certificates are already installed on your library. From your library's remote web client, select **Tools > QKM Management > Encryption Certificate > Import.**

   On this screen, next to the **Import TLS Certificates** checkbox, there is a line of text stating whether the certificates are currently installed on the library. If the certificates are installed, then you do not need to install them again, and you can skip the rest of this section. If certificates are **not** installed, continue to the next step.
2. Insert the *Quantum Key Manager TLS Certificates CD* into the computer's CD ROM drive.
3. From the library screen that you accessed in step 1 above, select the **Import TLS Certificates** checkbox.

4 Browse to the .tgz file located on the CD. (If desired, you can copy the .tgz file to another location on your computer and browse to it there.)

5 Select the .tgz file and click **Open**.

6 Click **Apply** or **OK**.

7 When the operation completes, make sure the certificates were installed on the library by reading the text next to the **Import TLS Certificates** checkbox. The text should state that the certificates are installed on the library.

Step 8: Running QKM Path Diagnostics

This is an optional, but recommended, step.

QKM Path diagnostics checks to make sure the key servers are running and communicating with the library. If the library detects any communication issues, or if the TLS certificates are not installed, you receive an error message.

On the library's remote web client, access the diagnostics test as follows:

Scalar i500	**1.** From the menu, click **Setup > Encryption > System Configuration**. **2.** Click the **Click here to run EKM Path Diagnostics** link.
Scalar i2000	**1.** From the menu, click **Setup > Encryption > Server Configuration**. **2.** Click the EKM Path Diagnostics **Test** button.

Refer to your library documentation or online help for details about the diagnostics.

Step 9: Configuring the Partitions and Generating Data Encryption Keys

QKM is enabled at the partition level.

- You must enable library managed encryption on each partition separately.
- Partitions you want to configure for QKM must contain **only** HP LTO-4 tape drives.
- Both QKM servers must be fully configured and operational.

1. On the library's remote web client, navigate to the encryption partition configuration screen (click **Setup > Encryption > Partition Configuration**).
2. Select **Enable Library Managed** for each partition that will use QKM.

> **Note:** When you change the encryption method on a partition, the partition is taken offline. When the change completes, the partition is brought back online automatically.

> **Note:** If the library encounters any problems accessing the QKM servers, or if the TLS certificates are not installed, the library generates an error message. Correct the error and try again.

3. **Key generation begins.** When you enable library managed encryption on a partition in the library for the first time, the library automatically triggers each QKM server to generate a set of unique data encryption keys. This may take 15 minutes to an hour, depending on your library type. The library notifies you when the process is complete.
4. Wait for the process to complete before continuing to Step 10: Saving the Library Configuration.

Step 10: Saving the Library Configuration

Save the library configuration. See your library documentation for more details about saving the configuration.

- Scalar i500 menu path: **Tools > Save/Restore Configuration**
- Scalar i2000 menu path: **Tools > Save/Restore**

Step 11: Backing Up the Keystores

EXTREMELY IMPORTANT:
Back Up Your Keystores!

It is critical that you back up both keystores before using the data encryption keys to encrypt data.

The only way to read encrypted tapes is via the data encryption keys in the keystore. If your servers fail without a backup, you will permanently lose access to all your encrypted data.

The backup is required for server hardware replacement.

CAUTION! CAUTION! CAUTION! CAUTION! CAUTION!

Once the data encryption keys are generated on the primary and secondary key servers, you must back up each keystore separately because they contain different data. If a server fails and needs to be replaced, the backup is required to restore operation.

Note: **For multiple libraries accessing the same QKM server pair:** If you are configuring more than one library to use the same QKM servers, be aware that each library triggers the QKM servers to create a set of data encryption keys which are added to the keystore. You need to make sure all the data encryption keys are included in your backup before you start using those keys. If you are configuring several libraries at the same time, you can wait until all the data encryption keys are generated and then perform a single backup of each server, provided that you do not use the keys before you back them up. However, if there is a time delay between the key generation during which you intend to begin serving keys for encryption, you will need to perform multiple backups — one after each key generation session.

Perform the following steps for **each QKM server** separately.

1. Connect to the QKM server using SSH.
2. Log in using the password you created earlier.
3. At the command prompt, enter:

   ./qkmcmds

   A message displays alerting you that performing QKM Admin commands will stop the QKM key server process until you quit and exit Admin Commands.
4. Enter **y** to agree to stop the QKM key server process.

   A list of commands displays.
5. At the command prompt, enter the number or letter corresponding to **Back up keystore**.

   All the relevant files that you need to restore your keystore are gathered and placed into two .tgz files:

   - /home/akmadmin/QKMApp<SN><date><time>.tgz
   - /home/akmadmin/QKMData<SN><date><time>.tgz

6 Use SFTP to copy the backup files to a desired location.

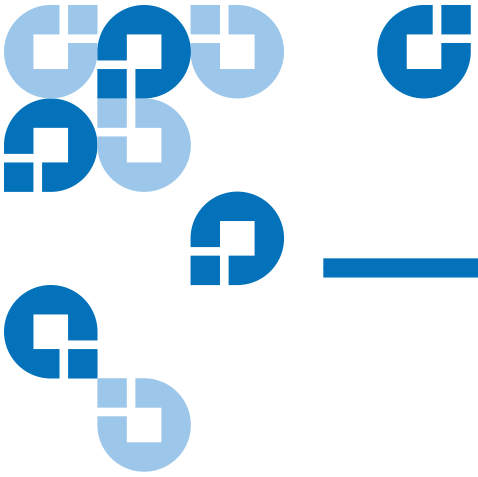
> **Caution:** You must copy these backup files to another location and not just leave them on the QKM server. Then, if the QKM server fails, you can restore the backup from the remote location onto the new server.

> **Caution:** **Do not use QKM to encrypt the sole copy of your QKM server keystore backup.** If both servers were to fail, you would not be able to recover the encrypted backup and would lose all data you had stored on all your encrypted tapes.

7 Press **<Enter>**.

8 Enter **q** to quit the Admin commands and restart the QKM key server process.

9 Repeat the above steps on the other server in the QKM server pair.



Chapter 5

Using the QKM Server

This chapter discusses the QKM server hardware and general operating instructions. Topics include:

Caution: Never install any software, file, or operating system on the server unless it is an upgrade or patch supplied by Quantum. Doing so may make your server inoperable and will void your warranty.

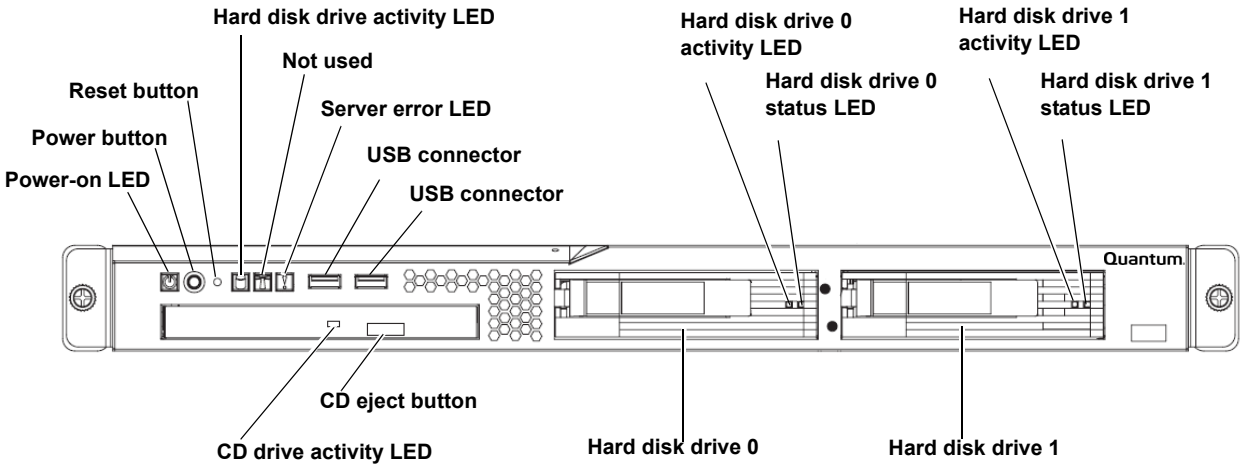
QKM Server Controls, LEDs, and Connectors

This section describes the controls, light-emitting diodes (LEDs), and connectors on the front and rear of the server.

Front Panel

Figure 3 shows the controls, light-emitting diodes (LEDs), and connectors on the front of the server.

Figure 3 Front Panel Controls, LEDs, and Connectors



Power-on LED: When this LED is lit and not blinking, it indicates that the server is turned on. When this LED is blinking, it indicates that the server is turned off and still connected to an AC power source. When this LED is off, it indicates that AC power is not present, or the power supply or the LED itself has failed.

> **Note:** If this LED is off, it does not mean that there is no electrical power in the server. The LED might be burned out. To remove all electrical power from the server, you must disconnect the power cord from the electrical outlet.

Power button: Press this button to turn the server on and off manually. You may need to use a pen to press the button. A power-control-button shield comes installed around the button to prevent the server from being turned off accidentally.

Reset button: Press this button to reset the server and run the power-on self-test (POST). You might need to use a pen or the end of a straightened paper clip to press the button.

Hard disk drive activity LED: When this LED is blinking, it indicates that a hard disk drive is in use. It blinks at the same time as one or both of the hard disk drive activity LEDs on the hard disk drives.

Server error LED: This amber LED has an exclamation point in it. When this LED is illuminated, it indicates that a server error has occurred (including when a hard disk drive is not in a slot; for example, when you replace a damaged hard disk drive).

USB connectors: You may connect a USB device to either of these connectors. The only reason you might use a USB device is to connect directly to the command line interface without using an SSH connection.

CD-eject button: Press this button to release a CD from the CD drive.

CD drive activity LED: When this LED is lit, it indicates that the CD drive is in use.

Hard disk drive 0 and 1 activity LEDs: These green LEDs blink once every 16 seconds during normal activity. When the hard disk drive is being accessed, the LED blinks at a faster rate. During RAID rebuild (which occurs when a hard disk drive is replaced), the LED flickers very fast so that it may appear to be on solid.

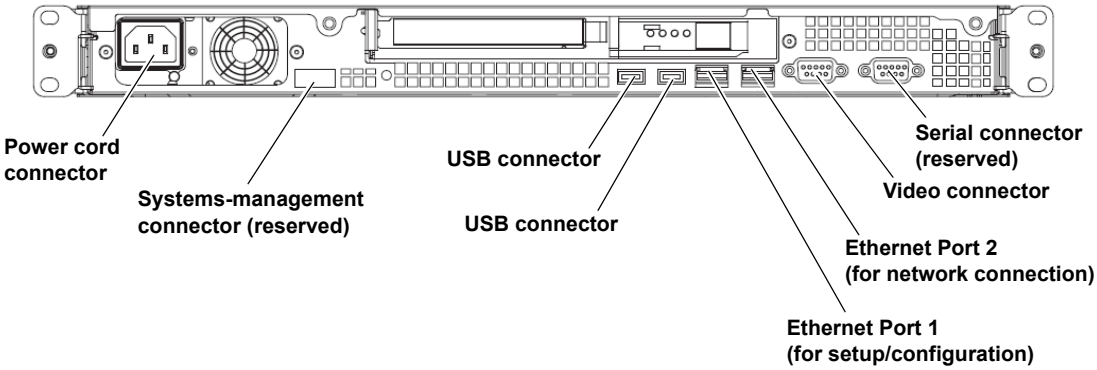
Hard disk drive 0 and 1 status LEDs: These amber LEDs will be on solid to indicate a problem with the hard disk drive. During RAID rebuild (which

occurs when a hard disk drive is replaced), the LED of the hard disk drive that is updating will blink.

Rear Panel

Figure 4 shows the connectors on the rear of the server. Figure 5 shows the LEDs on the rear of the server.

Figure 4 Rear Panel Connectors



Power-cord connector: Connect the power cord to this connector.

Serial connector: Reserved.

Video connector: Connect a monitor to this connector. The only reason you might connect a monitor is to connect directly to the command line interface without using an SSH connection.

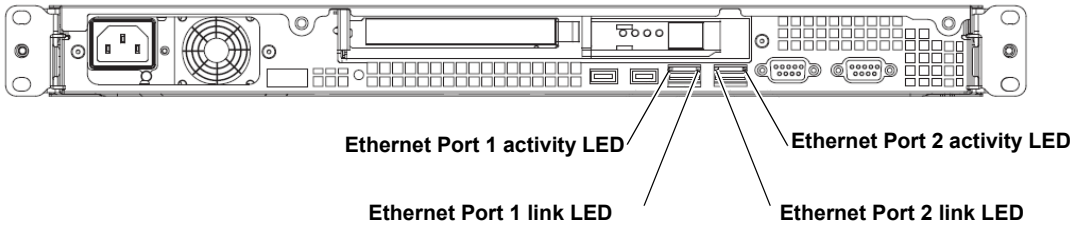
Ethernet Port 1: Use this port for setup and initial configuration with a local SSH connection only. You might also use this port if you forget the IP address of Port 2 need reconfigure the QKM server. to reconfigure Port 2. Do not connect this port to your network. The IP address of Port 1 is static and cannot be changed. The IP address is **192.168.18.3**.

Ethernet Port 2: Use this port to connect the QKM server to your network. The default IP address for this port is **192.168.18.4**. You will change the IP address during initial setup.

USB connector: You may connect a USB device to either of these connectors. The only reason you might use a USB device is to connect directly to the command line interface without using an SSH connection.

Systems-management connector: Reserved.

Figure 5 Rear Panel LEDs



Ethernet activity LED: This LED is on each Ethernet connector. When this LED is on, it indicates that there is activity between the server and the network.

Ethernet link LED: This LED is on each Ethernet connector. When this LED is on, it indicates that the Ethernet controller is connected to the network.

Turning On the QKM Server

You can turn on the server and start the operating system by pressing the power button. Approximately 20 seconds after the server is connected to AC power, the power button becomes active, and one or more fans might start running to provide cooling while the server is connected to power. It is normal for the fan to start up loudly at first, for about 20 seconds, then become quiet.

Note: If a power failure occurs while the server is turned on, the server will restart automatically when power is restored.

Turning Off the QKM Server

You can press the power-control button to start an orderly shutdown of the operating system and turn off the server. While the server remains connected to AC power, one or more fans might continue to run. To remove all power from the server, you must disconnect it from the power source.

Caution: The power button on the server does not turn off the electrical current supplied to the device. To remove all electrical current from the device, ensure that the power cord is disconnected from the power source.

Logging in to the QKM Server

While most encryption operations will occur automatically and transparently, you will need to access the QKM server on occasion to perform certain functions, which are described in this chapter.

To access the QKM server command line at any time after initial setup:

1. Connect to the QKM server via SSH, using the IP address assigned to Ethernet Port 2. Remember that there are two QKM servers with different IP addresses. Make sure that you are accessing the correct server.

   Note: If you are using Microsoft ® Windows®, you may need to install a utility to use SSH. Two such utilities are PuTTY, available at http://www.chiark.greenend.org.uk/~sgtatham/putty/ and WinSCP, available at http://winscp.net.

2. At the login prompt, enter the login ID:

   akmadmin

3. At the password prompt, enter your password.

Accessing QKM Admin Commands

1. Log in to the QKM server (see Logging in to the QKM Server on page 34).
2. At the command prompt, enter the following command to retrieve the list of QKM commands:

   ./qkmcmds
3. Enter your password.

   A message displays alerting you that performing QKM Admin commands will stop the QKM key server process.
4. Enter **y** to agree to stop the QKM key server process and continue.

   A message appears stating the QKM key server process is being stopped.
5. Press **<Enter>** to continue.

   The list of QKM Admin commands displays (see Figure 6 for an example).

Figure 6 QKM Admin Commands (Example)

Notes on Using QKM Command Line Interface and Admin Commands

Take note of the following points about using the QKM command line interface and QKM Admin commands.

- When changing the settings, you can just press **<Enter>** to leave the current setting unchanged.
- **Login ID:** There is only one login ID, **akmadmin**. This login ID cannot be changed.
- **Password:** There is one user account password. The password can be different on each server. You need to enter the password frequently to gain access to certain functions. You can change this password at any time, but be careful. It is critical that you do not lose your

password, because if you do there is no way to recover it. Without the password, you lose login access to the QKM server, including backup and restore capability. The default password is **password**. You can change the password using the Setup Wizard or by selecting it from the Admin commands list.

- You can make as many changes in a row as you wish, but in order to save your changes, you must enter **q** to quit Admin commands. Quitting Admin commands saves any changes you requested and restarts the QKM server process. If your session terminates before you enter **q**, any changes you made will not be saved. You should always quit Admin commands to terminate your session before closing the command line window or ending your SSH session.
- Only one user can use QKM Admin Commands at a time. If you try to log in and another user is logged in, you will receive a message that the system is already running and you will not be able to log in.
- You may log in to the QKM server directly (without using SSH) by connecting a monitor and keyboard directly to the QKM server.

Running the Setup Wizard

You should not need to run the entire Setup Wizard after initial setup, but if you wish to, do so as follows:

1. Log in to the QKM server (see Logging in to the QKM Server on page 34).
2. Display the list of Admin commands (see Accessing QKM Admin Commands on page 35).
3. Enter the number or letter corresponding to launching the Setup Wizard.
4. Complete the Setup Wizard.
5. Enter **q** to quit Admin commands, apply your changes, and restart the QKM key server process.

Changing the Password

There is only one password for a QKM server, which is required for all login and access to Admin commands, including backup and restore. Each QKM server has a password, and the passwords may be different on the two QKM servers in the pair.

If you lose the password, there is no way to retrieve it. The only way to recover from such a situation is to completely replace the QKM server (see Replacing a QKM Server and Both Hard Disk Drives on page 69).

EXTREMELY IMPORTANT:
Remember Your Password!

If you forget your password, there is no way to retrieve it!

If you forget your password, you will lose login access to the QKM server, including backup and restore capability. Quantum will NOT be able to restore the password.

CAUTION! CAUTION! CAUTION! CAUTION! CAUTION!

1. Log in to the QKM server (see Logging in to the QKM Server on page 34).
2. Display the list of Admin commands (see Accessing QKM Admin Commands on page 35).
3. Enter the number or letter corresponding to changing the password.

   Follow the prompts to change your password.
4. Enter **q** to quit the Admin commands, apply your changes, and restart the QKM key server process.

Changing the IP Address

When you first install your QKM server and run the setup wizard, you set the IP address (see Step 2: Configuring the QKM Servers on page 18). At any time after that, you can change the IP address as follows.

Caution: Changing the IP address should not be taken lightly. Remember that if you change the IP address on your server, you must also change it in the library remote web client of each library that is attached to the QKM server pair or the libraries will not be able to communicate with the QKM server. This requires a number of coordinated steps that are detailed below.

1. Log in to the QKM server (see **Logging in to the QKM Server** on page 34).
2. Display the list of Admin commands (see **Accessing QKM Admin Commands** on page 35).
3. Enter the number or letter corresponding to setting the server IP address.
4. Follow the prompts to change your IP address.
5. Enter **q** to quit the Admin commands, apply your changes, and restart the QKM key server process.
6. Update the IP address on each library that uses this QKM server, as follows:
   a. Make sure that no tape cartridges are mounted in any of the tape drives in any of the QKM partitions on the library.
   b. Access the library's remote Web client.
   c. Navigate to the encryption partition configuration page (**Setup > Encryption > Partition Configuration**).
   d. Change the encryption method on all QKM partitions from **Enable Library Managed** to **Allow Application Managed**.

e Navigate to the encryption key server setup screen:

- Scalar i500: **Setup > Encryption > System Configuration**
- Scalar i2000: **Setup > Encryption > Server Configuration**

f Update the IP address of the QKM server.

> **Caution:** Be sure to update the correct IP address (primary vs. secondary).

g Navigate back to the encryption partition configuration screen and change the encryption method on all QKM partitions from **Allow Application Managed** to **Enable Library Managed**.

Changing the Time Zone

To change the time zone at any time after initial configuration:

1. Log in to the QKM server (see Logging in to the QKM Server on page 34).
2. Display the list of Admin commands (see Accessing QKM Admin Commands on page 35).
3. Enter the number or letter corresponding to setting the time zone.
4. Follow the prompts to set the time zone.
5. Enter **q** to quit the Admin commands, apply your changes, and restart the QKM key server process.

Changing the Date and Time

To change the date and time at any time after initial configuration:

1. Log in to the QKM server (see Logging in to the QKM Server on page 34).
2. Display the list of Admin commands (see Accessing QKM Admin Commands on page 35).
3. Enter the number or letter corresponding to setting the date and time.
4. Follow the prompts to set the date and time.
5. Enter **q** to quit the Admin commands, apply your changes, and restart the QKM key server process.

Backing Up the Keystore

For an explanation of why you need to back up your QKM servers, see Why You Need to Back Up Your QKM Servers on page 6.

You must a perform a backup on a QKM server every time you generate data encryption keys on that server (and before you start using those keys for encryption).

The backup contains your keystore database, which includes the data encryption keys generated on the QKM server, the copies of the data encryption keys generated on the other QKM server in the pair, and the metadata (which data encryption keys were used on which tapes). The backup does not contain information that is not related to keys; for example, your password, server IP addresses, and so on.

You can perform a backup as often as you like. It is often not practical to back up the servers every time there is a change to the metadata (in other words, every time a data encryption key is used on a tape drive). Every time you serve a new data encryption key after you take the backup, the metadata will be out of synch with what is stored in your backup. This means that if you ever needed to restore from your backup, it might not contain the complete metadata that was on the server. However, the

metadata is "nice to have" but not required. The backup will contain the crucial data, which is your keystore.

- The library keeps track of the name of the last data encryption key issued for encryption purposes. If your server crashes and you perform a restore, the next time the library requests a data encryption key, it will ask for the next key. Even if you lose your metadata, data encryption keys will not be duplicated on tape cartridges.
- The metadata keeps track of which data encryption keys were used on which tape cartridges. The name of the data encryption key (not the key itself) is stored on the cartridge. If an encrypted tape needs to be appended to or read from, the tape drive requests the data encryption key from the server. As long as the server has the required key, you will be able to obtain the correct key.

When you perform a backup, all of the files you would need to resume normal operation upon restore are pulled and placed into two .tgz files.

Caution: **Do not use QKM to encrypt the sole copy of your QKM server keystore backup.** If both servers were to fail, you would not be able to recover the encrypted backup and would lose all data you had stored on all your encrypted tapes.

1. Log in to the QKM server (see Logging in to the QKM Server on page 34).
2. Display the list of Admin commands (see Accessing QKM Admin Commands on page 35).
3. Enter the number or letter corresponding to backing up the server.

   All the relevant files that you need to restore your server are gathered and placed in two files. The names and paths (also displayed on the command line interface) are:

   /home/akmadmin/QKMApp<SN><date><time>.tgz

   /home/akmadmin/QKMData<SN><date><time>.tgz

4 Use the secure file transfer protocol (SFTP) to copy the files to a known location.

> **Caution:** You must copy these backup files to another location and not just leave them on the QKM server. Then, if the QKM server fails, you can restore the backup from the remote location onto the new server.

> **Note:** If you are using Microsoft Windows, you may need to install a program to use SFTP. Two such utilities are PuTTY, available at http://www.chiark.greenend.org.uk/~sgtatham/putty/ and WinSCP, available at http://winscp.net.

5 Press **<Enter>**.

The list of QKM Admin commands displays.

6 Enter **q** to quit the Admin commands and restart the QKM key server process.

> **Caution:** **Do not use QKM to encrypt the sole copy of your QKM server keystore backup.** If both servers were to fail, you would not be able to recover the encrypted backup and would lose all data you had stored on all your encrypted tapes.

Restoring the Keystore

The only time you should need to restore the keystore is when you replace a QKM server and both of its hard disk drives. You perform the restore procedure as part of the server replacement procedure. See Replacing a QKM Server and Both Hard Disk Drives on page 69.

The restore procedure places all of the information contained in your backup onto a QKM server. The backup contains your keystore database, which includes:

- the data encryption keys generated on the QKM server,
- the copies of the data encryption keys generated on the other server in the QKM server pair, and
- any metadata for data encryption keys used up until the time the backup was performed.

The backup does not include metadata for data encryption keys used after the backup was performed.

1 Get the backup files you wish to restore and place them in a location you can access via your network.

> **Caution:** Make sure you use the backup for the failed server, not the working server. The backups are not the same. The filenames of the backup files contain the serial number of the server.

2 Log in to the QKM server (see Logging in to the QKM Server on page 34).

3 Display the list of Admin commands (see Accessing QKM Admin Commands on page 35).

4 Enter the number or letter corresponding to restoring the keystore.

A message displays instructing you to copy the following two files to the **/home/akmadmin** folder using SFTP:

- QKMApp<serialnumber><lastbackupdate>.tgz
- QKMData<serialnumber><lastbackupdate>.tgz

5 Use the secure file transfer protocol (SFTP) to move the files from your known location to the **/home/akmadmin** folder on the QKM server.

> **Note:** If you are using Microsoft Windows, you may need to install a program to use SFTP. Two such utilities are PuTTY, available at http://www.chiark.greenend.org.uk/~sgtatham/putty/ and WinSCP, available at http://winscp.net.

6 When finished copying the files, press **<Enter>**.

A message appears telling you the configuration was restored and reminding you to quit Admin commands and then synchronize the server with its attached libraries.

7 Press **<Enter>** again.

The list of Admin commands displays.

8 Enter **q** to quit the Admin commands and restart the QKM key server process.

The files are loaded onto the QKM server's hard disk drives and the QKM key server process restarts.

9 As soon as possible, synchronize the restored QKM server with each library that accesses it, as follows:

> **Note:** The library cannot use the restored key server to serve new data encryption keys until you synchronize. Each library keeps track of the last data encryption key served by the key server. Synchronization resets the restored key server so that it does not serve previously used data encryption keys.

a Access the library's remote web client.

b Navigate to the partition encryption screen (**Setup > Encryption > Partition Configuration**) and change one QKM partition from **Enable Library Managed** to **Allow Application Managed**. Make sure to apply the change. On some libraries, you click **Apply**. On others, you may need to go through several screens before finishing.

c Wait 3 minutes to allow the changes to complete.

d Change the QKM partition back to **Enable Library Managed**.

e Check to see if any RAS tickets were generated. If not, the synchronization succeeded.

f Repeat the above steps on each library that accesses the QKM server.

Setting the QKM Server Hostname

The QKM server's default hostname is **qkmserver**. You can change the hostname during initial configuration using the Setup Wizard, or any time thereafter using the Admin command.

1. Log in to the QKM server (see Logging in to the QKM Server on page 34).
2. Display the list of Admin commands (see Accessing QKM Admin Commands on page 35).
3. Enter the number or letter corresponding to setting the hostname.

   The command prompt displays the current hostname in brackets.
4. Enter a new hostname.
5. Press **<Enter>**.
6. Enter **q** to quit the Admin commands, apply your changes, and restart the QKM key server process.

Accessing QKM Server Information

You can access information about the QKM server itself. The information you can obtain is:

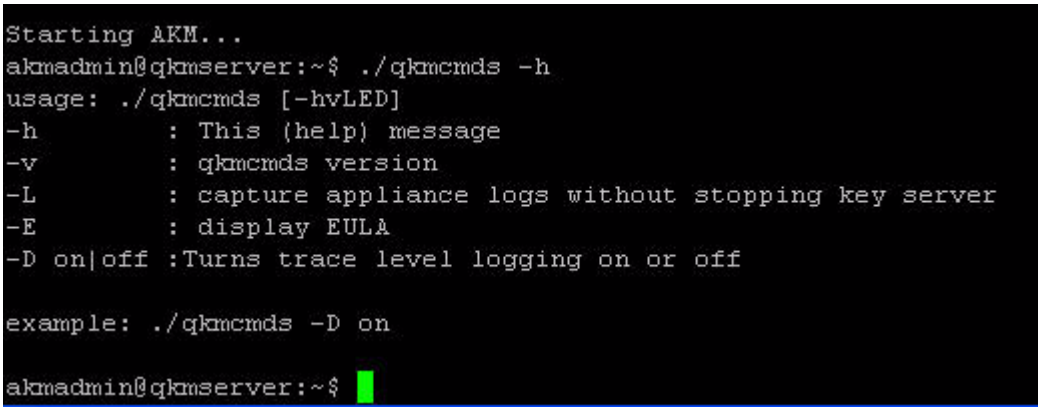
- Displaying the Help Menu
- Displaying the QKM Server Software Version
- Capturing QKM Server Logs Without Stopping the Key Server
- Displaying the End User License Agreement
- Turning Trace Level Logging On and Off

Displaying the Help Menu

1. Log in to the QKM server (see Logging in to the QKM Server on page 34).
2. At the command prompt, enter the following command to display the list of commands (see Figure 7):

   ./qkmcmds -h

Figure 7 Help Menu



Displaying the QKM Server Software Version

1. Log in to the QKM server (see Logging in to the QKM Server on page 34).
2. At the command prompt, enter the following command:

   ./qkmcmds -v

Capturing QKM Server Logs Without Stopping the Key Server

This feature is explained in Capturing QKM Server Logs Via the Server Without Stopping the Key Server Process on page 57.

Displaying the End User License Agreement

The End User License Agreement (EULA) is displayed during initial configuration of the QKM server. You were required to accept the terms

of the agreement before configuring the server. If you want to read the license agreement at any time after initial setup, do the following:

1. Log in to the QKM server (see Logging in to the QKM Server on page 34).
2. At the command prompt, enter the following command:

   ./qkmcmds -E

   The first few paragraphs of the license display.
3. Press **<Enter>** to scroll through the license agreement one line at a time. Type **end** to advance one paragraph (or several lines) at a time.

At the end of the license agreement, the date of acceptance displays.

4. Press **<Enter>**.

Turning Trace Level Logging On and Off

QKM server software logging can get very verbose, so this option is turned off by default. If you turn it on, the key server software generates more logging, which may be useful for troubleshooting purposes. You should keep this turned **OFF** unless Quantum Service & Support directs otherwise.

1. Log in to the QKM server (see Logging in to the QKM Server on page 34).
2. At the command prompt, enter one of the following commands:

   ./qkmcmds -D on *or*

   ./qkmcmds -D off

Chapter 6

Using the Library to Initiate QKM Functions

There are certain operations and functions that you can access and use via the Scalar i500 and Scalar i2000 Web library remote web clients. These operations include:

- Generating Data Encryption Keys
- Importing and Exporting Data Encryption Keys
- Importing and Exporting Encryption Certificates
- Sharing Encrypted Tapes Offsite

Generating Data Encryption Keys

Data encryption keys are generated in sets of a specified quantity (see Number of Data Encryption Keys Generated on page 79). You can generate data encryption keys at the following times:

- Generating Data Encryption Keys at Initial Setup
- Generating Data Encryption Keys When the Set is Depleted

The library tracks data encryption key usage and reminds you to generate more keys when needed. If you try to generate data encryption keys on a QKM server that already has sufficient unused data encryption keys, then

it will not create more. You will receive a message to that effect on the library remote web client.

> **Note:** Each library that you connect to a QKM server requires its own set of data encryption keys. Each library only pulls data encryption keys from the set that "belongs" to it. This means that a QKM server may contain several distinct sets of data encryption keys. When the data encryption keys for one library have all been used, then you need to generate more.

Generating Data Encryption Keys at Initial Setup

At initial setup, when you configure the first partition for library managed encryption, the library triggers each QKM server to generate a set of data encryption keys. The process is described in Step 9: Configuring the Partitions and Generating Data Encryption Keys on page 25.

Generating Data Encryption Keys When the Set is Depleted

When a QKM server has used 80 percent of the data encryption keys assigned to a particular library, that library generates a RAS ticket to let you know. You should schedule a time to generate more data encryption keys and back up the server. On the Scalar i2000, if you do not generate more data encryption keys, the library generates another reminder RAS ticket when 95 percent of the data encryption keys are used up.

If a QKM server completely runs out of data encryption keys for a particular library, that library generates a second, different, RAS ticket, stating that you have run out of data encryption keys and that the library attempted to failover to the other QKM server. If this happens, it is imperative that you generate a new set of data encryption keys immediately and then back up the server.

The data encryption key generation process can take 15 minutes to an hour, depending on the library type. During key generation and backup, the QKM server will not be able to process any library requests for data encryption keys. You should not run any library or host-initiated operations on QKM partitions during key generation and backup.

To generate data encryption keys, you need to temporarily disable library managed encryption on a partition, and then enable it again. Enabling library managed encryption on a partition triggers the library to check both QKM servers to see if new data encryption keys are needed. If so, it creates the keys.

The process for generating data encryption keys is as follows:

1. From the library's remote Web client, access the encryption partition modification screen. From the menu bar, click **Setup > Encryption > Partition Configuration.**
2. Select a partition configured for library managed encryption, and temporarily disable library managed encryption by changing the encryption method from **Enable Library Managed** to **Allow Application Managed**. *Remember which partition it is*, because you will be changing it back in a few minutes. Make sure to apply the change. On some libraries, you click **Apply**. On others, you may need to go through several screens before finishing.

   Note: When you change the partition's encryption method to **Allow Application Managed**, the data that was written to the tapes while the partition was configured for **Enable Library Managed** can no longer be read, until you change the partition back to **Enable Library Managed**. You will only be disabling for a short time, and then changing back to **Enable Library Managed** (just to trigger the key generation process) so this should have little effect, unless you forget to turn it back to **Enable Library Managed**.

3. Wait 3 minutes to allow the changes to complete.
4. Go back to the partition modification screen and change the partition back to **Enable Library Managed**. Again, make sure to save the changes.
5. Wait for the process to complete before resuming library operations.
6. Back up the QKM keystore. You must back up the keystore every time you generate new data encryption keys to protect against catastrophic server failure. See Backing Up the Keystore on page 41.

Importing and Exporting Data Encryption Keys

When you want to share encrypted tape cartridges with another site, or to read tapes encrypted by another site, you need to import and export data encryption keys via the library remote web client. See Sharing Encrypted Tapes Offsite on page 53 for information and instructions on this process.

Both QKM servers must be connected and operational in order to import or export data encryption keys.

The menu paths to import and export data encryption keys from the library remote web client:

- **Tools > QKM Management > Encryption Key > Import**
- **Tools > QKM Management > Encryption Key > Export**

If errors occur during a data encryption key import operation, you receive an error message and a RAS ticket. See QKM Encryption Key Import Warning Log on page 55 for more information.

Importing and Exporting Encryption Certificates

You need to import and export encryption certificates as part of sharing encrypted tapes with other organizations. See Encryption Certificates on page 4 and Sharing Encrypted Tapes Offsite on page 53 for information and instructions on this process.

Both QKM servers must be connected and operational in order to import and export encryption certificates.

The menu paths to import and export encryption certificates from the library remote web client:

- **Tools > QKM Management > Encryption Certificate > Import**
- **Tools > QKM Management > Encryption Certificate > Export**

Sharing Encrypted Tapes Offsite

It is common practice to share tapes with other organizations for data transfer, joint development, contracting services, or other purposes. If you are using QKM, you can share encrypted tapes with other companies and individuals who also use QKM.

QKM creates unique key aliases across all QKM installations worldwide. This ensures that you can safely share QKM-encrypted tapes with other sites or companies.

In order to share encrypted data on an HP LTO-4 tape, a copy of the symmetric key used to encrypt the data on the tape must be made available to the other organization to enable them to read the tape.

In order for the symmetric key to be shared, the other organization must share their public key with you. This public key will be used to wrap the symmetric key when it is exported from the QKM keystore.

When the other organization imports the symmetric key into their QKM keystore, it will be unwrapped using their corresponding private key. This ensures that the symmetric key will be safe in transit since only the holder of the private key will be able to unwrap the symmetric key.

With the symmetric key that was used to encrypt the data in their QKM keystore, the other organization will then be able to read the data on the tape.

The general process for sharing a tape from an originating (i.e., source) organization to a receiving (i.e., destination) organization is as follows.

1. The destination administrator navigates to the **Export Encryption Certificate** screen on the library remote web client (**Tools > QKM Management > Encryption Certificate > Export**), exports the encryption certificate that belongs to the destination QKM server, and saves the file to a known location on a computer.
2. The destination administrator e-mails the encryption certificate file to the source administrator.
3. The source administrator saves the encryption certificate file to a known location on a computer.

4 The source administrator navigates to the **Import Encryption Certificate** screen on the library remote web client (**Tools > QKM Management > Encryption Certificate > Import**) and imports the encryption certificate onto the source QKM server.

5 The source administrator navigates to the **Export Encryption Keys** screen on the library remote web client (**Tools > QKM Management > Encryption Key > Export**) and exports the data encryption key(s) used to encrypt the shared tape(s), assigning the same encryption certificate noted above to wrap the data encryption keys. The source administrator saves the file containing the wrapped data encryption keys to a known location on a computer.

6 The source administrator e-mails the file containing the wrapped data encryption keys to the destination administrator.

7 The destination administrator saves the file containing the wrapped data encryption keys to a known location on a computer.

8 The destination administrator navigates to the **Import Encryption Keys** screen on the library remote web client (**Tools > QKM Management > Encryption Key > Import**) and imports the data encryption keys onto the destination QKM server.

9 The destination library can now read the encrypted tapes.

Chapter 7

Logs

The QKM server collects data about its activities that you may need to access, mostly for troubleshooting purposes. The logs are:

- QKM Encryption Key Import Warning Log — Lists any data encryption keys that did not get imported during a standard key import operation.
- QKM Server Logs — Several logs that are useful to Quantum Service & Support when troubleshooting.

QKM Encryption Key Import Warning Log

During a key import operation, if at least one data encryption key in the file of exported keys is successfully imported but at least one data encryption key is not successfully imported, the library generates an "import warning" message as well as a RAS ticket. The RAS ticket directs you to view the Import Warning Log, which contains a list of the data encryption keys that were not imported.

When this error occurs, it may mean that the file containing the data encryption keys is corrupted. Obtain a new copy of the file and try the key import operation again.

The library remote web client menu paths to access this log are:

- Scalar i500: **Reports > Log Viewer**
- Scalar i2000: **Tools > QKM > Management > Retrieve QKM Logs**

QKM Server Logs

The QKM server logs contain information about all activities performed by the QKM server. Quantum Service & Support may request that you retrieve the logs using one or more methods described below. You should not need to retrieve these logs unless directed to do so by Quantum Service & Support.

The three methods of retrieving the logs are:

- Retrieving QKM Server Logs Via the Library
- Capturing QKM Server Logs Via the Server Without Stopping the Key Server Process
- Capturing QKM Server Logs Via the Server While Stopping the Key Server Process

The logs collected via the library are a smaller subset of the logs collected via the server. Logs collected via the library include the QKM server error log, audit log, and systems log. Logs pulled from the server include the preceding plus operating system and configuration logs.

As the log files are collected on the server, when they reach maximum size, old information is deleted as new information is added.

Retrieving QKM Server Logs Via the Library

1. From the library remote web client, access the Retrieve QKM Logs page. The menu path is: **Tools > QKM Management > Retrieve QKM Logs**
2. Choose the server from which you want to pull the logs (primary or secondary).

   The library pulls the logs from the QKM server and places them in a single .tgz file that you can download or e-mail to a recipient.

Capturing QKM Server Logs Via the Server Without Stopping the Key Server Process

The most efficient way to collect the logs from the QKM server is to do so without stopping the QKM key server process.

1. Log in to the QKM server (see Logging in to the QKM Server on page 34).
2. Display the list of Admin commands (see Accessing QKM Admin Commands on page 35).
3. At the command prompt, enter the following command:

   ./qkmcmds -L

   The logs are gathered and consolidated into a single .tgz file. The file is named **qkm_logcapture_<SN><date>.tgz** and is stored in the QKM server directory **/home/akmadmin/**.
4. Use a secure file transfer protocol (SFTP) to copy the backup file to a desired location.

   > **Note:** If you are using Microsoft Windows, you may need to install a utility to use SFTP. Two such utilities are PuTTY, available at http://www.chiark.greenend.org.uk/~sgtatham/putty/ and WinSCP, available at http://winscp.net.

5. Press **<Enter>**.

Capturing QKM Server Logs Via the Server While Stopping the Key Server Process

An alternative method of collecting the QKM server logs is via the QKM Admin commands. This method stops the QKM key server process. Normally you would not choose this method, but if the key server process is stopped anyway and you want to capture the logs at the same time, you can do so.

1. Log in to the QKM server (see Logging in to the QKM Server on page 34).
2. Display the list of Admin commands (see Accessing QKM Admin Commands on page 35).

3 Enter the number or letter corresponding to capturing the QKM server logs.

The logs are gathered and consolidated into a single .tgz file. The file is named **qkm_logcapture_SN_<date>.tgz** and is stored in the QKM server directory **/home/akmadmin/**.

4 Use the secure file transfer protocol (SFTP) to copy the backup file to a desired location.

> **Note:** If you are using Microsoft Windows, you may need to install a utility to use SFTP. Two such utilities are PuTTY, available at http://www.chiark.greenend.org.uk/~sgtatham/putty/ and WinSCP, available at http://winscp.net.

5 Enter **q** to quit the Admin commands and restart the QKM key server process.

Chapter 8

Troubleshooting

This chapter discusses the following error scenarios and resolutions:

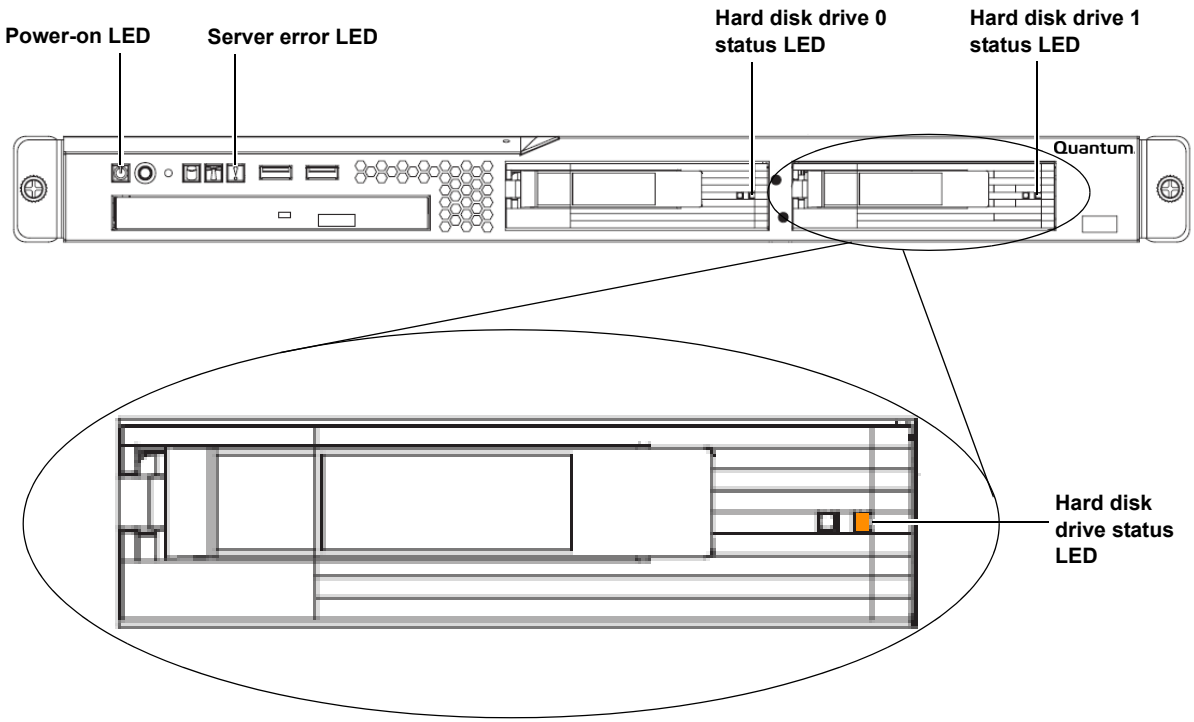
Library RAS Tickets

The library will generate Reliability, Availability, and Serviceability (RAS) tickets for certain QKM server conditions and library-initiated QKM operations. Some RAS tickets are for information only. Others alert you to problems that need to be fixed. Follow the resolution instructions in the ticket to help clear or diagnose problems. Contact Quantum Service & Support if you cannot resolve the problem yourself.

QKM Server LED Error Indicators

The LEDs on the front of the QKM server can signal problems with the server. This section describes LED activity and the errors to which they point. For an explanation of all the LEDs and their function, see QKM Server Controls, LEDs, and Connectors on page 30.

Figure 8 LED Locations on Front of Server



LED	Color	Error Code	What it means and what to do
Power-on LED	Green	blinking	Server is turned off but is still connected to an AC power source. Turn the server **ON** by pressing the power button on the front panel.
		Off	AC power is not present, or LED is burned out. Check to see if the server is connected to a working AC power source. If it is, the LED may be burned out. Contact Quantum Service & Support for a replacement server.
Server error LED	Amber (with exclama-tion point)	On solid	This LED illuminates during hard disk drive replacement when a hard disk drive is missing from its slot. It should go off again when the hard disk drive is replaced. If this LED is illuminated and both hard disk drives are properly installed, there is a problem with the server. Contact Quantum Service & Support.
Hard disk drive status LED	Amber	On solid	The hard disk drive is faulty and must be replaced. Contact Quantum Service & Support.
		Blinking	Indicates that a RAID rebuild is taking place.

POST Beep Codes

The power-on self-test (POST) beep codes can help you identify whether the server is working or not:

Beep Code	Indicates
One beep	Successful completion of POST with no errors.

Beep Code	Indicates
More than one beep; any sequence of beeps.	POST detected a problem with the server. Contact Quantum Service & Support.

Common Problems

Symptom	Action
A problem occurs only occasionally and is difficult to diagnose.	Make sure that all cables and cords are connected securely to the rear of the server and attached devices.
The power-control button does not work, and the reset button does work (the server does not start). **Note:** The power-control button will not function until 20 seconds after the server has been connected to AC power.	Make sure that the power-control button is working correctly: **1.** Disconnect the server power cords. **2.** Reconnect the power cords. **3.** Press the power button. **4.** If the server does not start, replace the server.
The QKM server unexpectedly shuts down, and the LEDs on the front panel are not on.	**1.** Make sure the power cord is connected to the server and plugged in to a working power source. **2.** Check the airflow from the fan. When the server is turned on, air is flowing from the fan grille. If there is no airflow, the fan is not working. This can cause the server to overheat and shut down. **3.** Contact Quantum Service & Support for QKM server replacement.
The fan is not working.	Contact Quantum Service & Support.
The fan is very noisy.	It is normal for the fan to be noisy upon startup for about 20 seconds, after which the fan should become quieter. If the fan does not quiet down after about 20 seconds, contact Quantum Service & Support.

Symptom	Action
The library cannot communicate with the QKM server.	Check all of the following. If you have tried all of these items and the problem still exists, contact Quantum Service & Support. • Verify IP address on the QKM server and make sure it is configured correctly on the library. • Ensure the QKM server Ethernet cables and power cords are attached. • Ensure that the QKM server is turned on and is running. • Check the LEDs on the QKM server and hard disk drives to make sure that none indicate errors (see QKM Server LED Error Indicators on page 60). • Make sure the date on both QKM servers and the library is set to the current date. Incorrect date settings may interfere with the TLS certificates and cause the library to stop communicating with the QKM servers. • Ensure that the QKM TLS certificates are installed on the library. Go to the **Import Encryption Certificates** screen on the library remote web client (**Tools > QKM Management > Encryption Certificate > Import**). Next to the **Import TLS Certificates** checkbox is a statement telling you whether the certificates are installed on the library. If they are not installed, install them (see Step 7: Installing the QKM TLS Certificates on page 23). • Check to see if there are any RAS tickets on the library relating to QKM. If so, follow any instructions listed in them. • Ensure that at least one library QKM partition is configured for library managed encryption.

Symptom	Action
You forgot the QKM Admin password.	There is no way to retrieve or reset a forgotten password. The only way to recover from this situation is to completely replace your QKM server and both hard disk drives: **1.** Contact Quantum Service & Support for a replacement server. **Note:** Charges may apply. **2.** Replace the server and both hard disk drives (see Replacing a QKM Server and Both Hard Disk Drives on page 69). This process includes setting a new password on the replacement server.
You don't remember the QKM server IP address and you can no longer connect to the QKM server via SSH.	**1.** Connect a crossover Ethernet cable directly to the QKM server's Ethernet Port 1. **2.** Connect to the server via SSH using the IP address for Port 1: **192.168.18.3**. **3.** Log in to the QKM server using the login ID **akmadmin** and your password. **4.** Display the list of Admin commands (see Accessing QKM Admin Commands on page 35). **5.** Enter the number or letter corresponding to setting the server IP address. The QKM server's current IP address appears on the command line with the option for you to change it. **6.** Make a note of the IP address, then press **<Enter>** to scroll through the IP address, netmask, and gateway address settings without changing them. **7.** Enter **q** to exit Admin commands.

Chapter 9

Hardware Replacement Procedures

There are only two possible hardware replacement scenarios for the QKM server:

Procedure	When to perform
Replacing a Hard Disk Drive	When a single hard disk drive fails.
Replacing a QKM Server and Both Hard Disk Drives	When any of the following occurs: • The QKM server fails but both hard disk drives remain intact. • Both hard disk drives fail. • When a QKM server and both its hard disk drives are not operational.

Replacing a Hard Disk Drive

The QKM server comes with two 3.5-inch, hot-swappable, SAS hard disk drives. The hard disk drives are configured as RAID 1, in which the data on both hard disk drives is continuously being mirrored, so if you lose one, your data is preserved.

If a single hard disk drive fails, your QKM system will failover to the remaining hard disk drive. The remaining hard disk drive will continue to handle operations on that QKM server, but without the security of a redundant hard disk drive. To restore redundancy and protect against server failure in case the other hard disk drive fails, you should replace the failed hard disk drive as soon as possible.

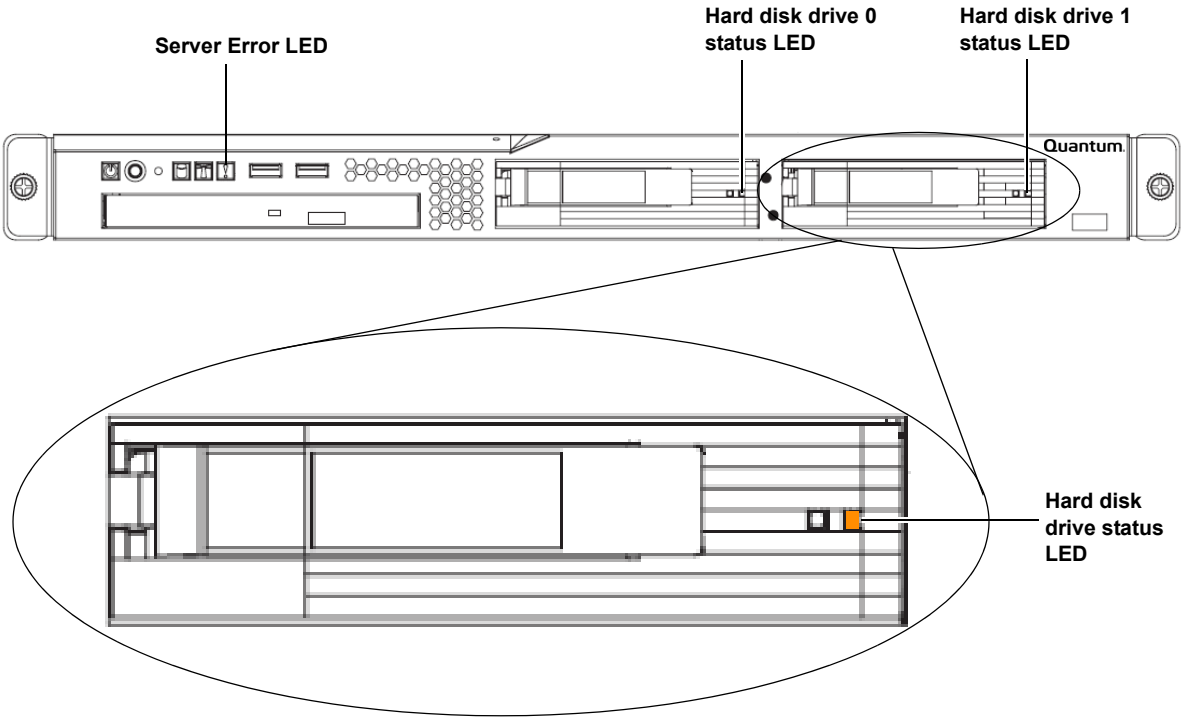
Since the hard disk drives are hot swappable, you do not need to turn off the server in order to replace a single hard disk drive. During the replacement process, normal library and QKM server functions can continue.

Caution: Never remove more than one hard disk drive while the system is powered up.

Caution: To maintain proper system cooling, do not operate the server for more than 10 minutes without a hard disk drive installed in each bay.

1. Read the safety information in Chapter 2, Safety.
2. Locate the failed hard disk drive. The amber hard disk drive status LED will be solidly illuminated on the failed hard disk drive. See Figure 9 for location of LED.

Figure 9 LED Locations on Front of Server



3 Pull open the drive handle on the failed hard disk drive and remove the hard disk drive from the bay (see Figure 10).

The amber Server Error LED illuminates, indicating a server fault due to a missing hard disk drive.

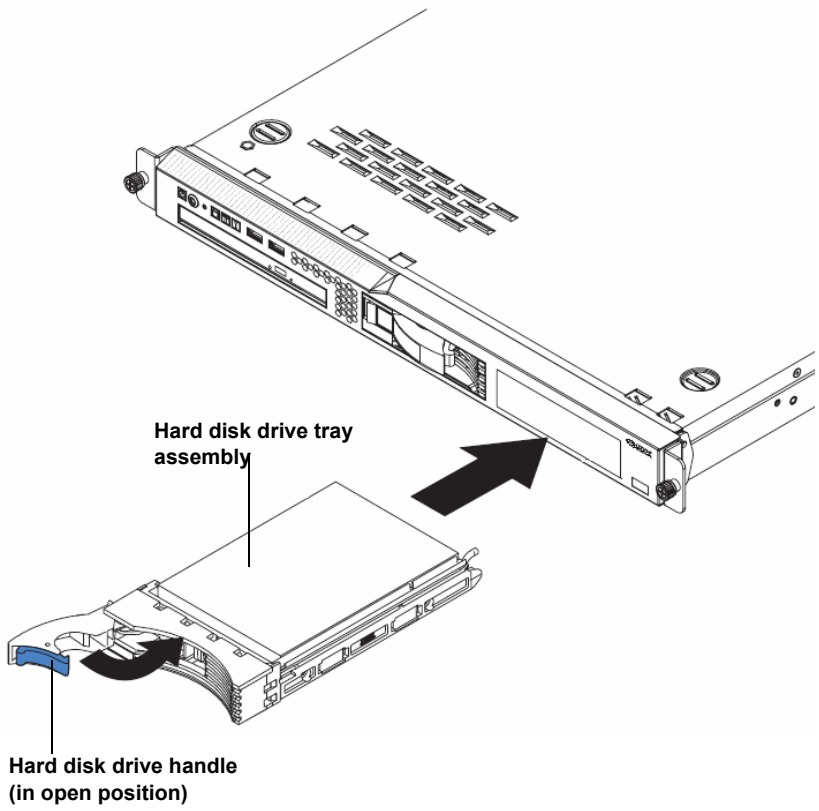
4 Open the drive tray handle of the replacement hard disk drive so that the handle is perpendicular to the front of the drive (see Figure 10).

5 Align the drive assembly with the guide rails in the bay.

6 Gently push the drive assembly into the bay until the drive stops (see Figure 10).

Caution: To prevent damage to the drive tray, do not force the drive into the bay at an angle. Make sure that you carefully insert the hard disk drive straight into the drive bay as shown in Figure 10.

Figure 10 Replacing a Hard Disk Drive



7 Push the tray handle to the closed (locked) position.

The RAID rebuild process begins. The following sequence of LEDs indicates the stages of the rebuild.

Caution: Do not interfere with or remove a hard disk drive during the RAID rebuild.

a The replacement hard disk drive's green activity LED blinks rapidly for 5 seconds as the hard disk drive registers with the system.

b The amber hard disk drive status LED illuminates. (This LED indicates the hard disk drive is "defective" because it is not mirrored yet, and it should turn off once the RAID rebuild is complete.)

c The green activity LED on the existing good hard disk drive blinks, indicating it is being accessed.

d After about 5 seconds, the RAID rebuild begins, during which the green activity LEDs on both hard disk drives blink very fast so that they may appear to be on solid, and the replacement hard disk drive's amber status LED blinks. The RAID rebuild process may take up to 45 minutes.

e The amber server error LED turns off as soon as the RAID rebuild process starts.

f When the RAID rebuild is complete, the green activity LEDs on both hard disk drives blink in unison once every 16 seconds. The amber status LED on the replacement hard disk drive turns off. When the RAID rebuild is complete, check the hard disk drive LEDs to make sure that the hard disk drive is operating correctly.

8 The RAID rebuild is complete. The amber hard disk drive status LED should be **OFF**. If it is still on, the drive is faulty, and you should contact Quantum Service & Support.

9 Properly dispose of the failed hard disk drive. Quantum requests that you do not return your hard disk drive because it may still contain your data encryption keys.

> **Caution:** Do not use the failed hard disk drive in any other QKM server.

Replacing a QKM Server and Both Hard Disk Drives

You will replace the entire QKM server and its two hard disk drives for a number of different reasons, including:

- The QKM server fails but both hard disk drives remain intact.
- Both hard disk drives fail.
- When a QKM server and both its hard disk drives are not operational.

The replacement procedure includes configuring the replacement QKM server and restoring your last saved backup onto the replacement server. The entire process takes about one hour.

Caution: Do not remove the hard disk drives from the replacement server. You will replace the entire unit, including the hard disk drives.

Terminology

For ease of communication, we will use the following terminology:

- **Failed Server** — The QKM server, with its two hard disk drives installed, that you are removing and replacing. We will call it "failed server" even if it did not technically fail (for example, both hard disk drives failed but the server itself is working).
- **Replacement Server** — The replacement QKM server, with its own two hard disk drives installed.

Required Items

- Replacement QKM server with two installed hard disk drives.
- Crossover Ethernet cable for initial configuration (not supplied).
- Laptop or PC to connect to the replacement server for initial configuration.
- The latest saved backup taken from the failed server, placed in a retrievable location (see Restoring the Keystore on page 43).
- Remote access to your library.

Procedure

1. If not already turned off, turn **OFF** the failed server by pressing the power button on the front panel.
2. Unplug the power cord and Ethernet cable from the back of the server.
3. Remove the server from the rack.
4. Install the replacement server following the instructions in Step 1: Installing the QKM Servers on page 17.
5. Configure the replacement server following the instructions in Step 2: Configuring the QKM Servers on page 18. (Only configure the replacement server; leave the currently working QKM server as is.)

Caution: It is highly recommended that you configure the replacement server with the same settings as the failed server, and that you do not change the IP address. Changing the IP address requires you to perform a number of lengthy steps on each library that uses the QKM server (see Changing the IP Address on page 39).

6. If you changed the IP address of the replacement server from what it was on the failed server, update it on each library that is attached to the QKM server pair (for instructions, see Step 6 in Changing the IP Address on page 39).
7. Restore your last saved backup of the failed server following the instructions in Restoring the Keystore on page 43.
8. Run the QKM path diagnostics to ensure the library can communicate with the replacement server (see Step 8: Running QKM Path Diagnostics on page 24).

   Note: If the server you are replacing is the primary server, you will need to reboot the library in order for the library to start requesting keys from the primary server again. Once failover to the secondary server has occurred, the library continues to request keys from the secondary server until either the library is rebooted or the secondary server goes down and failover to the primary server occurs.

9. Remove the hard disk drives from the failed server and properly dispose of them. Quantum requests that you do not return your hard disk drives because they may still contain your data encryption keys.

   Caution: Do not use the failed hard disk drives in any other QKM server.

10. Return the failed server to Quantum.

Chapter 10

Updating and Rolling Back QKM Server Software

Periodically Quantum may issue updates or patches to the QKM firmware/software. These updates will include any needed operating system (Ubuntu) updates.

Caution: Never install any software or operating system onto your QKM server unless it is an upgrade or patch supplied by Quantum. Doing so may make your server inoperable and will void your warranty.

There is no automatic notification to alert you when new firmware/software is released. You must go to the Quantum Web site to check for updates, then install them according to the procedures in this section.

Caution: If you update or roll back the software on one server in a QKM server pair, remember to also update/rollback the other one. The servers do not automatically sync or check to see whether they are both running the same version.

Viewing the Currently Installed Version of QKM Server Software

To view the version of QKM server software installed on your server, type **./qkmcmds -v** at the command prompt after you log in.

Updating QKM Server Software

Equipment Required

To perform this procedure, you need:

- Remote access to your library.
- Physical access to your QKM servers.
- A blank, writable CD.
- The ability to download an ISO image from the Quantum Web site and burn it to a CD which you will place in the QKM server's CD ROM drive.

Procedure

1. Go to the Quantum Web site:

   http://www.quantum.com/ServiceandSupport/SoftwareandDocumentationDownloads/QKM/Index.aspx

2. Download the ISO image containing the latest version of software (the filename contains the version).
3. Burn the ISO image onto a CD.
4. Take **offline** all QKM partitions in all libraries attached to the QKM server pair that are set to use library managed encryption.
5. Log in to the QKM server (see Logging in to the QKM Server on page 34).

6 Display the list of Admin commands (see Accessing QKM Admin Commands on page 35).

7 Enter the number or letter corresponding to updating QKM server software.

8 Load the CD containing the ISO image into the a QKM server's CD ROM drive and press **<Enter>**.

The upgrade process executes.

9 When the upgrade process completes, press **<Enter>** to return to the Admin commands.

> **Note:** If no CD is loaded, you are again requested for the CD. Load the CD and press **<Enter>**, or enter **q** to quit and return to the Admin commands.

10 At the command prompt, enter **q** to quit Admin commands.

11 Execute **./qkmcmds -v** to see that the new version is loaded.

12 Remove the CD from the CD ROM drive.

13 Repeat the above steps on the other QKM server.

14 Bring back **online** all the QKM partitions in all libraries attached to the QKM server pair that are set to use library managed encryption.

15 Save the CD in case you need to perform a rollback in the future.

Rolling Back QKM Server Software

You can only roll back to the last previously installed version of software on the server.

Equipment Required

To perform this procedure, you need:

- Remote access to your library.
- Physical access to your QKM servers.
- The CD used to load the current version of software (see Updating QKM Server Software on page 73). If you no longer have the CD, note which version of software is currently installed on the server, then download that version from the Quantum Web site and burn it to a new CD. The Web site URL is:

  http://www.quantum.com/ServiceandSupport/SoftwareandDocumentationDownloads/QKM/Index.aspx

  The software version on the CD must match the version currently installed on the QKM server. If it does not, you will not be able to perform the rollback. To see what version is currently installed on your server, see Viewing the Currently Installed Version of QKM Server Software on page 73.

Procedure

1. Obtain the CD containing the currently installed version of software.
2. Take **offline** all QKM partitions in all libraries attached to the QKM server pair that are set to use library managed encryption.
3. Log in to the QKM server (see Logging in to the QKM Server on page 34).
4. Display the list of Admin commands (see Accessing QKM Admin Commands on page 35).
5. Enter the number or letter corresponding to rolling back QKM server software.

6. Insert the CD into the QKM server's CD ROM drive and press **<Enter>**.

   The rollback process executes.

7. When the rollback completes, press **<Enter>** to return to the Admin commands.

   - If the wrong upgrade CD is loaded, the rollback stops and you receive an error message. Press **<Enter>** to return to the Admin commands menu.
   - If no CD is loaded, you are again requested for the CD. Load the CD and press **<Enter>**, or enter **q** to quit and return to the Admin commands.

8. At the command prompt, enter **q** to quit Admin commands.
9. Execute **./qkmcmds -v** to see that the rollback version is loaded.
10. Remove the CD from the CD ROM drive.
11. Repeat the above steps on the other QKM server.
12. Bring back **online** all the QKM partitions in all libraries attached to the QKM server pair that are set to use library managed encryption.

Appendix A

Specifications

QKM Server Physical Specifications

Height: 1.75 in. (43 mm), 1U

Width: 17.32 in. (440 mm)

Depth: 22 in. (559 mm)

Weight: 24.3 lb. (11 kg)

Power Supply: 351 watt (110 or 220 V AC auto-sensing)

Power Cords: The Quantum Key Management Server includes the following power cords:

- IBM P/N 39M5081 - North American
- IBM P/N39M5377- Rack cord

QKM Server Environmental Specifications

Air Temperature

Server on: 50.0° to 95.0°F (10° to 35°C); altitude: 0 to 3000 ft (914.4 m)

Server on: 50.0° to 89.6°F (10° to 32°C); altitude: 3000 ft (914.4 m) to 7000 ft (2133.6 m)

Server off: 50.0° to 109.4°F (10° to 43°C); maximum altitude: 7000 ft (2133.6 m)

Shipping: -40° to 140°F (-40° to 60°C)

Humidity

Server on: 8% to 80%

Server off: 8% to 80%

QKM Server Acoustical Noise Emissions

Sound power, idling: 6.5 bel maximum

Sound power, operating: 6.5 bel maximum

QKM Server Heat Output

Approximate heat output in British thermal units (BTU) per hour:

341 BTU per hour (100 watts)

QKM Server Electrical Input

Sine-wave input (50 - 60 Hz) required

Input voltage low range:

- Minimum: 100 V AC
- Maximum: 127 V AC

Input voltage high range:

- Minimum: 200 V AC
- Maximum: 240 V AC

Approximate input kilovolt-amperes (kVA):

- Minimum: 0.102 kVA
- Maximum: 0.55 kVA

Number of Data Encryption Keys Generated

Each time the QKM server generates data encryption keys in response to a library request, the number of keys generated is:

- **Scalar i500**: 1024 data encryption keys
- **Scalar i2000**: 4096 data encryption keys

Supported Quantum Libraries

The following libraries support library-managed encryption via QKM:

- Scalar i500
- Scalar i2000

Supported Tape Drives

QKM supports the following tape drives:

Scalar i500 tape library	HP LTO-4 Fibre-Channel HP LTO-4 SAS
Scalar i2000 tape library	HP LTO-4 Fibre-Channel

Supported Media

QKM supports LTO-4 media.

Firmware Requirements

Library Firmware Requirements

You should always download the latest released version of firmware in order to take advantage of new features and improvements. The following table lists the minimum library firmware requirements needed to run QKM:

Scalar i500 tape library	570G
Scalar i2000 tape library	595A

Tape Drive Firmware Requirements

On the HP LTO-4 tape drives, install the latest version of tape drive firmware that is qualified for the library firmware installed on your library. Refer to the library release notes for the correct version of tape drive firmware.

Supported Backup Applications

QKM supports the following backup applications:

- Symantec NetBackup
- Symantec Backup Exec
- EMC NetWorker
- CA ARCserv
- CommVault Galaxy
- IBM Tivoli
- HP Data Protector

Glossary

This glossary defines the special terms, abbreviations, and acronyms used in this document.

C

certificate A digital document that binds a public key to the identity of the certificate owner, thereby enabling the certificate owner to be authenticated.

D

data encryption key An alphanumeric string used to encrypt data.

E

encryption The conversion of data into a cipher. A key is required to encrypt and decrypt the data. Encryption provides protection from persons or software that attempt to access the data without the key.

H

HDD Hard disk drive.

I

IP Internet Protocol. The method or protocol by which data is transmitted from one computer (or host) to another over the Internet using a system of addresses and gateways.

K

keystore A database that contains the data encryption keys and their associated metadata.

M

metadata Data about data; in the case of QKM, it means information about the data in the keystore database.

P

private key One key in an asymmetric key pair, typically used for decryption.

public key One key in an asymmetric key pair, typically used for encryption.

Q

QKM Quantum Key Manager. An application that manages data encryption keys and metadata via Quantum's tape libraries.

S

SFTP Secure File Transfer Protocol; a secure version of FTP.

SSH **S**ecure **SH**ell (or secure socket shell). A security protocol for logging into a remote server. SSH provides an encrypted session for transferring files and executing server programs.

T

TCP Transmission Control Protocol. Works in conjunction with IP to ensure that packets reach their intended destinations.

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