



Violin 6000 Series Memory Array Installation Guide For Release V6.0.0



Document Number: 535-0045-00 Rev 02
May 2013

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Preface

This preface outlines the organization of this book, describes document conventions, and provides information about additional resources.

- [Intended Audience](#) on page 1
- [Document Organization](#) on page 2
- [Reference Documents](#) on page 2
- [Document Conventions](#) on page 3
- [Contacting Violin Memory](#) on page 4

Intended Audience

This guide is intended for experienced systems administrators. Violin Memory assumes that you are experienced in installing and servicing high-performance storage systems.

Contact Violin Memory Customer Support for any assistance with installing and servicing this system. See [Contacting Violin Memory](#) on page 4 for contact information.

Document Organization

This guide is organized into the following sections:

- [Chapter 1, Memory Array Hardware Installation](#)—Describes how to install the Violin 6000 Series Memory Array.
- [Chapter 2, System Setup and Configuration](#)—Describes how to configure the Violin 6000 Series Memory Array for the first time.
- [Appendix A, InfiniBand Client Configuration](#)—Describes establishing InfiniBand initiators for use with the Memory Gateways internal to the Violin 6000 Series Memory Array.
- [Appendix B, Multipath Configuration](#)—Provides examples of client-side multipath setup for a Violin Memory Gateway.

Reference Documents

In addition to this guide, the following Violin Memory documents comprise the documentation suite that will assist you with setting up, using and servicing the Violin 6000 Series Memory Array. These guides are available for download from the Violin Memory Support site at <http://www.violin-memory.com/support/>

| This document... | Provides this information... |
|----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Release Notes | This document describes the new features, resolved issues, known limitations and software upgrade instructions for the current release. |
| <i>Violin 6000 Series Memory Array User's Guide</i> | This guide provides instructions for managing, monitoring, and maintaining the Violin 6000 Series Memory Array using the Violin Web interface and Command Line Interface (CLI). |
| <i>Violin 6000 Series Memory Array Slide Rail Installation Guide</i> | This guide provides instructions for installing the Violin 6000 Series Memory Array slide rails in an equipment rack. |
| <i>Violin 6000 Series Memory Array Cable Management Installation Guide</i> | This guide provides instructions for installing the cable management arm on a Violin 6000 Series Memory Array. It is included in the Violin 6000 Series Memory Array shipping box. |
| <i>Violin 6000 Series Memory Array Service Guide</i> | This guide describes how to safely replace the system components in a Violin 6000 Series Memory Array. |

Reference Documents

Document Conventions

Safety Icons

The table below summarizes warning, caution, and note icons used in this document and includes sample text.

Safety Icons

| Icon | Sample Text |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| WARNING! | WARNING! Only authorized, qualified, and trained personnel should attempt to work on this equipment. |
| Caution: | Caution: Follow the listed safety precautions when working on the Violin 6000 Series Memory Array. |
| Note: | Note: Read through this entire chapter and plan your installation according to your location before installing the equipment. The following procedures and the order in which they appear are general installation guidelines only. |

Typographical Conventions

The following typographic conventions are used in this guide:

| Format | Meaning |
|---------------------------|----------------------------------------------------------------------------------------|
| Bold | User Interface text. |
| <i>Italic</i> | Provides emphasis and identifies variables and document titles. |
| Courier | Command names, examples, and output. |
| Courier bold | Input you must type exactly as shown. |
| < <i>Courier italic</i> > | Information for which you must supply a value. |
| [] | Optional command parameters are enclosed within square brackets. |
| | Separates a set of command choices from which only one may be chosen. |
| { } | Required command parameters that must be specified are enclosed within curly brackets. |

Typographical Conventions

Security

Violin Memory, Inc., cannot be responsible for unauthorized use of equipment and will not make allowance or credit for unauthorized use or access.

Contacting Violin Memory

To obtain additional information or technical support for Violin Memory products, contact us at:

Phone: 1-855-VIOLIN-5 (1-855-846-5465)

International: +1 650-396-1500 Extension 3

Web site: <http://www.violin-memory.com>

Email: support@vmem.com

When contacting Violin Memory Customer Support, please have the following information available:

- Model and serial number of the system for which you are requesting support.
- Software version.
- A brief description of the problem.
- Command Line Interface or Web interface access to the affected system.

CHAPTER 1 Memory Array Hardware Installation

This chapter describes the hardware installation of a 6000 Series flash Memory Array in the following sections:

- [Installation and Configuration Overview](#) on page 5
- [Unpacking the Memory Array](#) on page 7
- [Standard System Configurations](#) on page 9
- [Installing the Memory Array](#) on page 14
- [Connecting the Memory Array to a Host or Network](#) on page 23
- [Connecting the ACMs for vMOS-6](#) on page 26
- [Connecting Management Cables](#) on page 27
- [Securing the Memory Array to the Equipment Rack](#) on page 29

See the *Violin 6000 Series Memory Array User's Guide* for software installation and upgrade instructions.

Installation and Configuration Overview

The Memory Array installation and configuration occurs in four distinct phases:

- Phase 1: Hardware Installation and Cabling
- Phase 2: First-time Memory Array Configuration
- Phase 3: Driver Installation and Configuration (if direct-attached connection is used)
- Phase 4: Create LUNs on the Memory Array

Note: Instructions for installing drivers and configuring the Memory Gateways to manage block storage are provided in the *Violin 6000 Series Memory Array User's Guide*.

This chapter describes the first phase of a Memory Array implementation: the installation of the Memory Array hardware and network cabling.

Hardware Installation is a five-step process consisting of the following procedures:

- **Unpacking the Memory Array:** In this step, unpack the Memory Array shipping box, inspect the Memory Array components, and verify that you have the tools required to install the Memory Array hardware.
- **Rack-mounting the Memory Array Chassis:** In this step, mount the Memory Array chassis in the equipment rack using the slide-out rails and ground the equipment racks.
- **Attaching the Cable Management Arm** (if used): In this step, attach the cable management arm to the Memory Array and the equipment rack.
- **Connecting Power:** In this step, connect the AC power cords to the Memory Array power supplies and connect to a power source.
- **Connecting the Interface Cables:** In this step, connect the interface cables (Fibre Channel, InfiniBand or 10GBe, PCIe) to the Memory Array chassis and to the client network.

The order of the procedures described in this chapter are offered as general guidelines only. Depending on your installation environment, you may find it easier to perform the procedures in a different order than they are presented here. For example, it may be easier to connect the network management cables to the Memory Array chassis before you install the chassis in the equipment rack.

Read through this entire chapter and plan your installation according to your location before installing the Memory Array hardware.

This chapter describes only the first phase of a Memory Array implementation. The remaining phases can be found in the following sections:

| Phase | Chapter |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2: First-time Memory Array Configuration | Chapter 2, System Setup and Configuration |
| 3: Driver Installation and Configuration | Appendix A, InfiniBand Client Configuration <hr/> Note: Violin Driver installation is covered in the <i>Violin 6000 Series Memory Array User's Guide</i> and is only necessary if you connect the Memory Array directly to a host machine using PCIe cables. <hr/> |

Table 1.1 Phase Task Map

Unpacking the Memory Array

The first step in the Memory Array hardware installation is to remove the Memory Array from the shipping box.

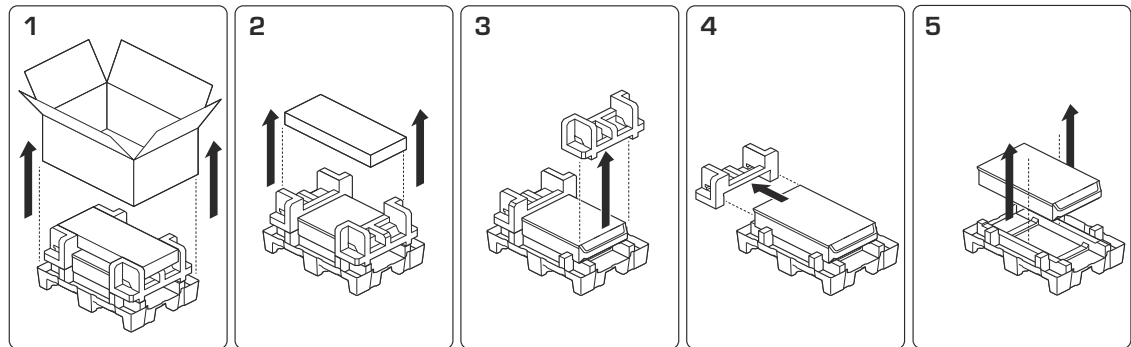


Figure 1.1 Unpacking Memory Array

Remove the Memory Array from the shipping packaging and remove all packing materials. Visually inspect the system for any damage. If any damage is detected, contact Violin Memory Customer Support. For more information, see [Contacting Violin Memory](#) on page 4.

Unpack the supplied kits and confirm that all parts and components have arrived in good order.

WARNING! Only authorized, qualified, and trained personnel should attempt to work on this equipment.

Caution: Because of the weight of the Violin 6000 Series Memory Array, two people are required to lift and place the system in an equipment rack.

Parts and Accessory List

The table below lists the parts that may be included in the Memory Array shipping package. Contents vary depending on the system ordered. Some optional accessories are not listed here.

| Item Number | Part Description | Quantity |
|-------------|---------------------------------------------------------------------------------------------------------------------|--------------|
| 1 | Memory Array | 1 |
| 2 | Flash VIMMs (preinstalled in Memory Array) | 24, 44 or 64 |
| 3 | C14-C19 Connector AC power supply cable, 6 ft, in Accessory Box; connects to C20 inlets on the rear of the chassis. | 2 |
| 4 | DB9 to RJ-45, 6 ft rollover console cable, in Accessory Box | 2 |
| 5 | Rail Mounting Kit, includes two flat head screws, cage nuts and screws | 1 |
| 6 | Rack ears | 2 |
| 7 | Host Bus Adapter (HBA) blanking panels (installed if direct-attached system) | 4 |
| 8 | PCIe card (if direct-attached system ordered) | 4 |
| 9 | PCIe cable, 3 m, in Accessory Box (if PCIe cards ordered) PCIe cable, 3 m (if a vMOS-6 system) | 4 1 |

Table 1.2 Parts List

Installation Tools and Equipment

The table below lists the tools and equipment used during the installation process:

| Item Number | Tool | Quantity |
|-------------|------------------------------------------------------------------------------------------------------------|----------|
| 1 | Phillips head screwdrivers, sizes 1 and 2 | 1 each |
| 2 | Computer system for direct connect configuration | 1 or 2 |
| 3 | CAT 5 Ethernet Cable with RJ-45 connectors, straight-through or cross-over, depending on your installation | 2 |

Table 1.3 Required Installation Tools

Standard System Configurations

This section shows diagrams of standard configurations supported by Memory Arrays. It includes the following configurations:

- [SAN-attached Storage Configurations](#) on page 9
- [Direct-attached Storage Configurations](#) on page 11

See [Connecting the Memory Array to a Host or Network](#) on page 23 for specific port-to-port cabling instructions.

SAN-attached Storage Configurations

In many applications, it is preferable for the Memory Array to be shared by many hosts, many of which may not be in the same rack as the Memory Array. In these scenarios, a storage area network (SAN) or local area network (LAN) connection is preferable. The Memory Array can connect to the SAN via Fibre Channel or InfiniBand, or the LAN via 10GbE iSCSI.

A Memory Gateway is used to provide the SAN/LAN block storage function. The Violin Memory software application installed on the Memory Gateways manages the network connectivity and provides storage virtualization services such as LUN provisioning, masking and exporting.

See the *Violin 6000 Series Memory Array User's Guide* for information on managing clusters and configuring the system.

Note: A mix of network interface cards (NICs) in one Memory Array system is not supported.

Fibre Channel and iSCSI ports on the Memory Gateway may be connected either directly to specific hosts or to switches. The switches may be standalone switches for use within a rack or networked switches that connect large numbers of hosts across the data center. The latter case is the most common.

Internal Memory Gateways

The Memory Array includes two internal Memory Gateways. Each internal Memory Gateway supports two network interface modules (shown in Figure 1.2), each of which can support the following:

- Four 8 Gbps Fibre Channel ports that auto-negotiate down to 4 Gbps
- Four InfiniBand ports operating at 4X Quad Data Rate (QDR)
- Four 10GbE iSCSI ports

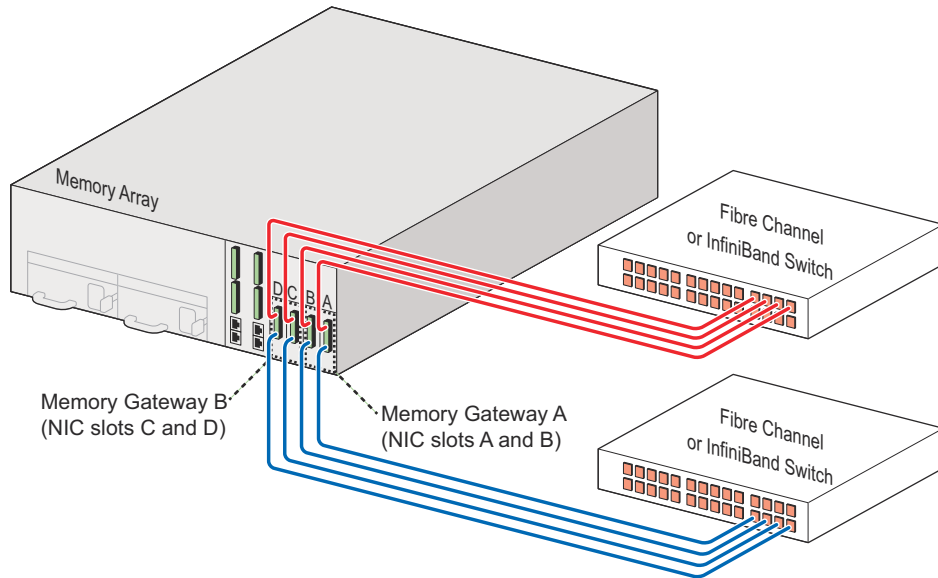


Figure 1.2 High-availability SAN-attached via Dual Internal Memory Gateways

Figure 1.2 shows the supported cable configuration when setting up a high-availability (HA) system. This is the only supported HA configuration for the 6000 Series Memory Array. Memory Gateway A manages connectivity through NIC slots A and B; Memory Gateway B manages connectivity through NIC slots C and D.

Memory Gateways can use up to eight ports of 8 Gbps FC or 10GbE to connect to network switches. InfiniBand ports on the Memory Array should be connected to InfiniBand switches in a high-availability configuration.

Understanding Port Numbering

When connecting the interface cables in a SAN-attached configuration, it is important to know the ports from which LUNs are exported from the Violin Web interface. Figure 1.3 shows the slot and port numbers for Fibre Channel cards installed in the system, along with the representative CLI values for each port. If there are more than two ports per card, the numbers increase from top to bottom on the card.

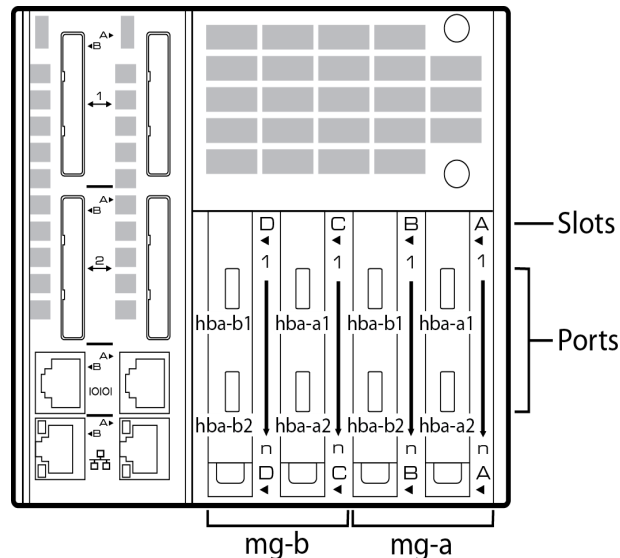


Figure 1.3 Memory Gateway NIC Slots and Fibre Channel Port Numbers

Note that the physical port numbers on the network interface cards (NICs) are not aligned with their corresponding port names in the CLI, as shown in Figure 1.3. For example, in a Fibre Channel environment, NIC port A1 is shown as “hba-a1” in the CLI, and NIC port C1 is *also* shown as “hba-a1” in the CLI. This is because the two Memory Gateways, shown with their CLI representations above (mg-a and mg-b), separately manage two NICs each.

InfiniBand and iSCSI cards are also supported. Their port numbers are represented in the CLI as follows:

- **InfiniBand:** hca-a1, hca-a2, etc.
- **iSCSI:** eth-a1, eth-b1, etc.

Note: To verify the actual port numbering shown in the CLI, log in to the Memory Gateway master and then run the “show targets” command.

Direct-attached Storage Configurations

PCI Express (PCIe) is the primary interconnect for direct-attached storage configurations. It is also possible to use Fibre Channel without a SAN or switch, but this is treated as a SAN-attached storage configuration. See [SAN-attached Storage Configurations](#) on page 9.

Note: vMOS-6 requires that the Array Controller Modules (ACMs) be externally connected to each other to interconnect the internal Memory Gateways. Data Management features available in vMOS-6, such as snapshots and thin provisioning, are not supported in PCIe direct-attached configurations. See [Connecting the ACMs for vMOS-6](#) on page 26 for details.

Each Array Controller Module (ACM) provides two PCIe x8 Gen2 ports, each of which has a 40 Gbps nominal bit rate. The Memory Array has two ACMs, with all four of the ports available to host computers.

Multiple direct-attached storage configurations are available depending on the number of hosts and whether the hosts require shared access to the volumes or LUNs within the Array. Typical configurations are:

- **Single Host:** single or dual PCIe x8 connections from the host to the Memory Array.
- **Two Hosts:** single or dual PCIe x8 connections from each host to the Memory Array. Each host has access to all volumes and flash on the Memory Array. Data may be shared.

Drivers for Direct-attached Configurations

A driver must be installed on the host machine if the Memory Array is directly attached to a Linux or Windows host. In a direct-attached configuration, the Violin Memory driver enables the host machine to access block storage on a Violin Memory Array.

See “Violin Drivers” in the *Violin 6000 Series Memory Array User’s Guide* for instructions on installing the Linux driver. When available, a driver for Windows and the installation instructions can be downloaded from the Violin Memory Customer Support site.

Direct Attached, Single Host

A direct-attached connection to a single host machine via dual PCIe x8 connections is supported. For a dual configuration, the second PCIe x8 connection is required. This configuration also increases system availability and bandwidth.

For improved High Availability (HA) protection, all four ports (two on each ACM) can be connected to a single host for redundancy, as shown in Figure 1.4. The second set of connections present another disk device with the same addressability as the first disk device. For a Linux system, the device is shown as `/dev/vtmsa.`

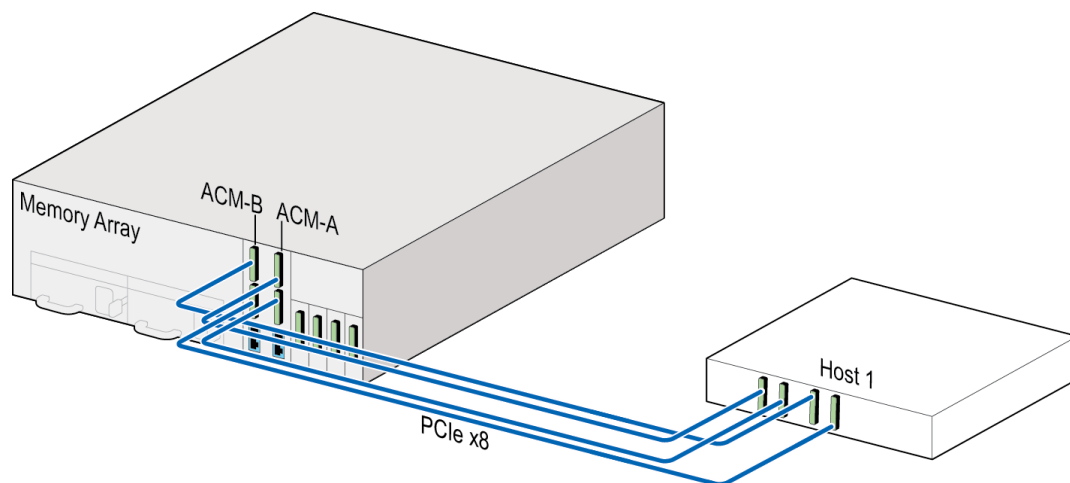


Figure 1.4 Direct-Attached to Single Host for Redundancy

Connect one PCIe cable to the top PCIe connector on one of the ACMs, and connect the other PCIe cable to the bottom of *the same* ACM. Repeat these connections for the other ACM.

Connect the other ends of the PCIe cables to the host machine.

Connecting two PCIe cables from one ACM to the host machine is also supported (as shown in Figure 1.5), however, utilizing both ACMs is recommended to take advantage of redundancy, as described above.

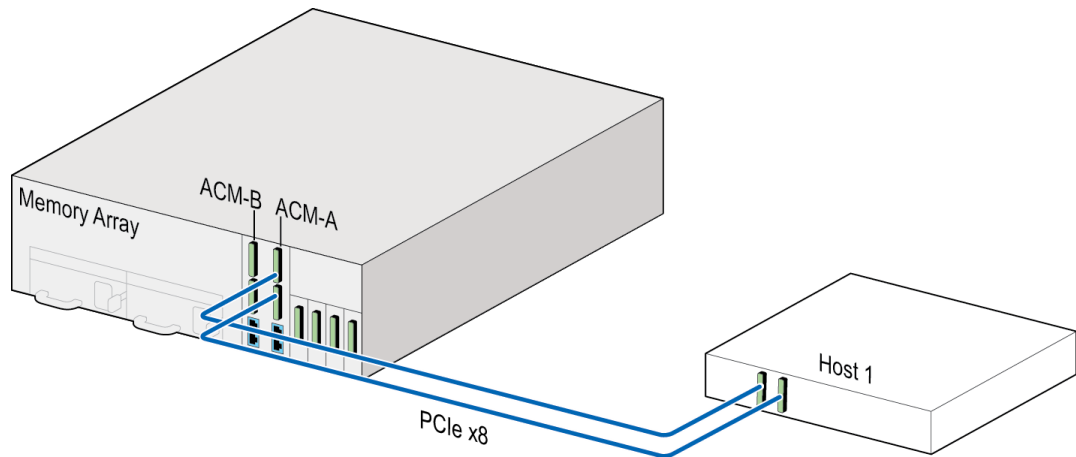


Figure 1.5 Direct-Attached to Single Host

For a dual PCIe x8 connection to the host machine, connect one PCIe cable to the top PCIe connector on one of the ACMs, and connect the other PCIe cable to the bottom of *the same* ACM.

Connect the other end of the PCIe cable to the host machine.

Direct Attached, Two Hosts

A direct-attached connection to two host machines is supported. Each host can be connected via single or dual PCIe x8 connections. In dual configuration, the second PCIe x8 connection can be used to increase bandwidth, redundancy and system availability.

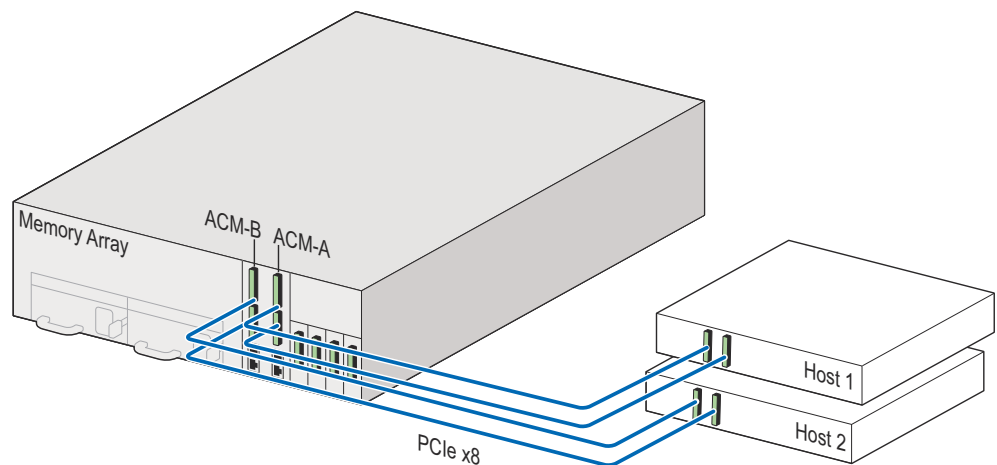


Figure 1.6 Direct-Attached to Two Hosts

For a dual PCIe x8 connection to two host computers, connect one PCIe cable to the top PCIe connector on one of the ACMs, and connect the other PCIe cable to the bottom of *the same* ACM. Connect the other end of the PCIe cable to the host machine. Connect the second host machine to the other ACM in the same manner.

Where hosts share the same volume, a mechanism is needed to ensure the two hosts share the volume productively and do not overwrite each other's data. This can be done via a clustered file system (e.g., GPFS, GFS, Veritas) or by partitioning the volume and explicitly assigning partitions to each host over PCIe.

Installing the Memory Array

Follow the steps in this section to install the Memory Array in an equipment rack and to connect the system directly to a host machine or to a network.

Managing Thermal Heat Impact Within the Equipment Rack

Follow these recommendations to minimize the heat impact within an equipment rack when deploying Memory Arrays in a high-density configuration:

- Equipment racks should be populated with the heaviest and most power-dense equipment at the bottom. Install the Memory Arrays from the bottom up, for the following reasons:
 - Weight: To maintain the lowest center of gravity.
 - Cooling: To give best access to cold air inlet coming from the floor.
 - Serviceability: To allow ease of access during service, as the system modules are accessible from the top.
- Check and install thermal barriers, special baffling or direct ducting if possible to prevent hot aisle air recirculating into the cold aisles, raising inlet temperatures and therefore, raising the temperature of Memory Arrays.
- To the greatest extent possible, remove airflow obstructions from the intake and exhaust openings of the Memory Arrays mounted in the rack. Thus, proper cable management technique is recommended. It is recommended that data and power cables be grouped when routing and tying.

Tying power cables at the bottom of the cable management arm and tying data cables at the top of the cable management arm help minimize airflow restriction.

- Chilled air is pulled through the front and exhausted through the rear by the fans in the Memory Arrays. Recirculation of hot air exiting the back of the rack into the front of the rack should be eliminated as much as possible.

Install blanking/filler plates to all empty “U” slots in the racks to prevent both cold air from bypassing server inlets and to avoid exhaust air from recirculating back to the inlets.

- The recommended operating temperature ranges for data centers—according to ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning)—is 64.4°F (18°C) for low-end and 80.6°F (27°C) for high-end. When deploying multiple Memory Arrays in the same rack, you should monitor ambient and inlet temperature rise and may wish to adjust AC settings in the data center to provide appropriate temperature levels. Violin Memory recommends that the ambient temperature be maintained at around 25°C.
- As an optional but not necessary practice, you could consider racking Memory Arrays with 1U separation to reduce exhaust airflow restrictions and to enable ease of cable management.

- To reduce heat build-up inside high-density racks, top exhaust fans or door exhaust fans can be installed.

Installing the Slide Rails

This section describes attaching the inner slide rails to the Memory Array chassis and mounting the slide rails and Memory Array chassis to an equipment rack. If you are installing the Memory Array in a square-hole equipment rack, the slide rails contain front and rear toolless mounting brackets that click and lock into place.

The slide rail kit should include the following:

- Two slide rails
- Two flat head screws for mounting the rails to the Memory Array chassis

Caution: Improperly mounted rack-mounting brackets and slide rails can cause the product to fall.

Caution: Because of the weight of the Violin 6000 Memory Array, two people are required to lift and place the system in an equipment rack.

Note: You must be able to access the rear of the Memory Array and the equipment rack during installation.

To install the slide rails:

1. Locate the left and right slide rails. The left slide rail is labeled “LEFT FRONT” on the outside front of the rail; the right slide rail is labeled “RIGHT FRONT.”

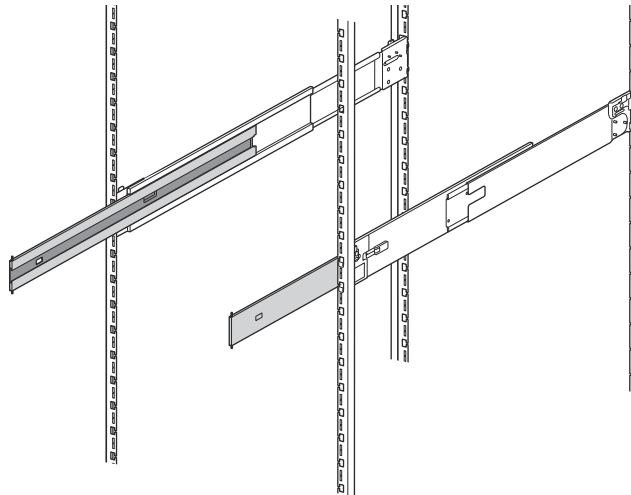


Figure 1.7 Slide Rails in Equipment Rack

Note: The Memory Array is a 3U storage system. When identifying the location of the slide rails, make sure to allow for enough space above and below the Memory Array to accommodate other devices in the equipment rack. The bottom of the Memory Array chassis rests .125 inches below the bottom of the slide rails; the lid is 2 inches above the top of the slide rails.

2. Install the slide rails at the appropriate height in the equipment rack. Orient the slide rails so they slide out to the front of the equipment rack.

Removing the Inner Slide Rail Sections

Fully extend the slide rails from the equipment rack until the rails click into place.

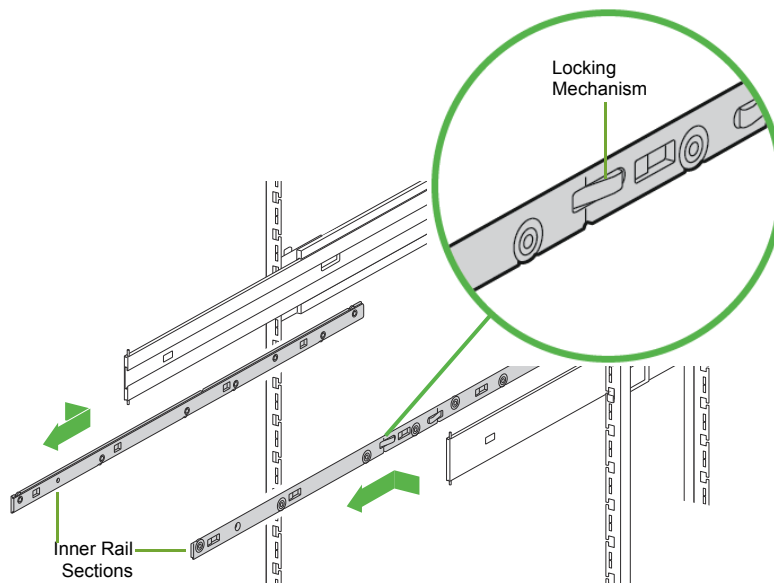


Figure 1.8 Removing the Inner Slide Rail Sections

3. Press the spring-loaded locking mechanisms on the outside of both inner rail sections and then pull out and remove the inner slide rail sections from the left and right slide rails.

Note: Keep track of the left and right inner slide rail sections. The left must attach to the left of the chassis; the right must attach to the right of the chassis.

Attaching the Inner Slide Rail Sections to the Memory Array Chassis

1. Locate the four rectangular cutouts on the side of the inner rail section.

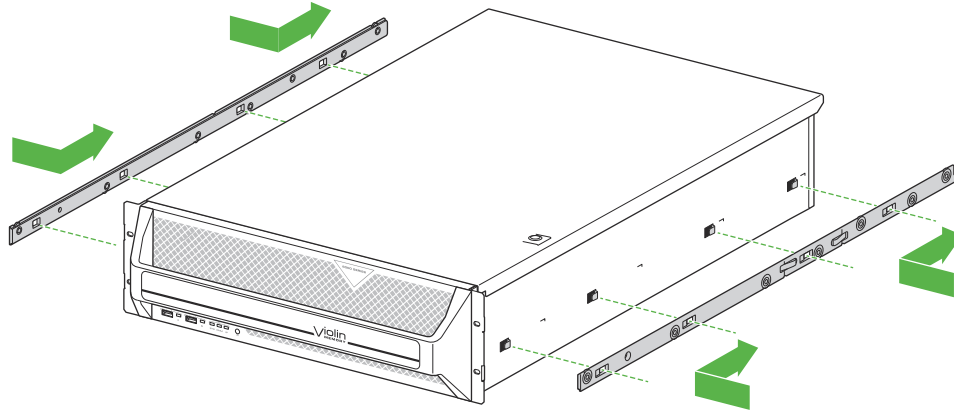


Figure 1.9 Attaching the Inner Rail Sections to the Memory Array

Note: Make sure to attach the left and right inner slide rail sections to the correct sides of the chassis. The inner slide rail sections are marked as follows: “B-L” on the left section and “B-R” on the right section.

2. Align the four cutouts over the four hooks on the outside of the Memory Array chassis and then slide the inner rail section toward the rear of the Memory Array chassis until it is securely in place.

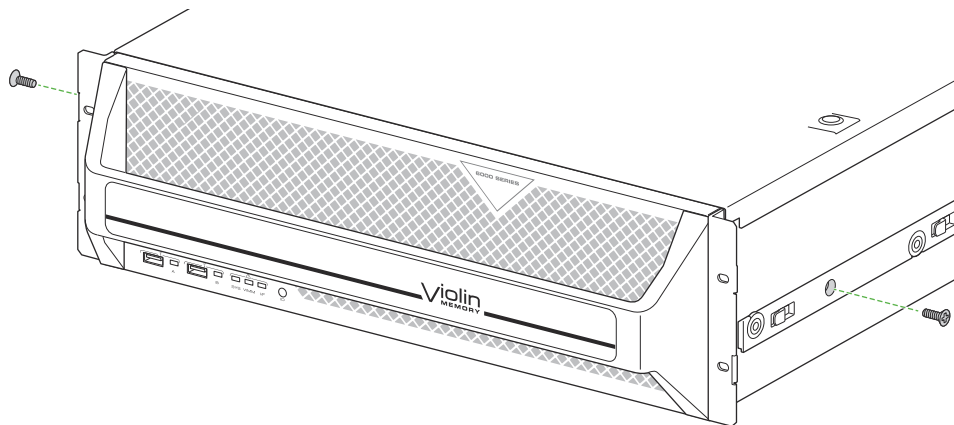


Figure 1.10 Securing the Inner Rail Sections to the Memory Array

3. Using the two flat head screws from the slide rail kit, secure the inner rail sections to the Memory Array chassis.

Installing the Cage Nuts

Cage nuts and screws are included in the accessory kit to secure the Memory Array to the *top hole* on the rack ears and the equipment rack. Use either the supplied cage nuts or the screws, depending on the style of your equipment rack.

Note: If the equipment rack in which the Memory Array will be installed is a square-hole rack, it is recommended that you install the cage nuts before mounting the Memory Array.

Use the cage nuts for square-holed equipment racks. If the equipment rack has threaded holes, you can secure the Memory Array to the equipment rack *after* the Memory Array is installed.

To install the cage nuts:

1. Identify the location in the equipment rack where the cage nut will reside. The cage nut will align with the top hole on the rack ear, which is two holes above the top clip on the slide rail.
2. Remove the screw from the cage nut and set it aside for later use.
3. Insert the cage nut into the equipment rack at the identified location.
4. Using a flat-blade screwdriver, from the inside of the equipment rack, compress the cage nut clip until the cage nut locks into place.
5. Repeat step 4 using another cage nut on the other side of the equipment rack.

Attaching the Rack Ears (Optional)

Note: Optional rack ears are included in the Memory Array shipping box if you do not want to secure the Memory Array chassis to the equipment rack using the front bezel. Securing the Memory Array to the equipment rack is covered on page 29.

Attach the rack ears to the two front corners of the Memory Array chassis to assist with sliding the system in and out of the equipment rack.

1. Remove the rack ears and six flathead screws from the accessory kit.

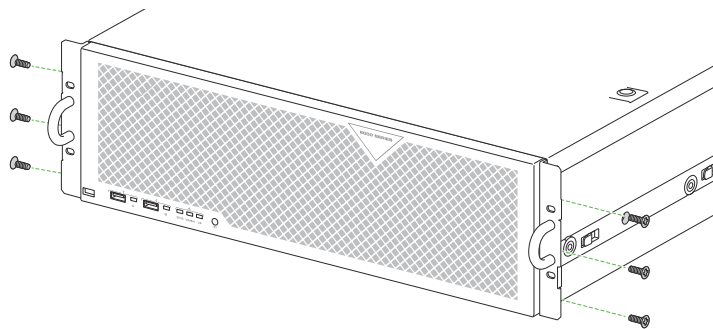


Figure 1.11 Attaching the Left Cable Management Bracket and Routing the Cables

2. Using a #1 Phillips screwdriver, attach the rack ears to both sides of the chassis.

Note: Do not secure the rack ears to the equipment rack until all of the cables are connected to the Memory Array.

Mounting the Memory Array in the Equipment Rack

1. With another person, lift the Memory Array and then align the left and right inner rail sections that you mounted on the Memory Array chassis with their original channels located on the inside of the slide rails.

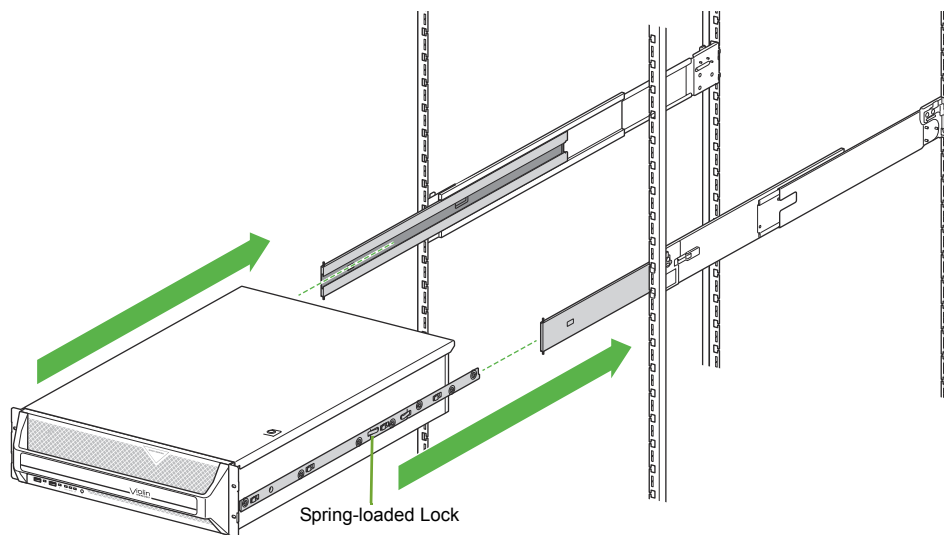


Figure 1.12 Mounting the Memory Array on the Equipment Rack

2. Carefully push the Memory Array into the slide rails until the inner rail sections lock into place, making sure that the Memory Array remains level throughout.
3. Press in the spring-loaded locking mechanism on the outside of both inner rail sections and then push the whole assembly back into the equipment rack.

Connecting the Cable Management Arm

See the *Violin 6000 Series Memory Array Cable Management Installation Guide* included in the Memory Array shipping box for instructions on installing the cable management arm.

Skip to [Grounding the Memory Array](#) on page 20 if you are not using the Violin cable management arm.

Grounding the Memory Array

This procedure describes the connection of the equipment ground from the equipment rack to the Memory Array chassis.

Note: Maintain reliable earthing of rack-mounted equipment. Supply extra connections, other than the direct connections to the branch circuit, such as using power strips.

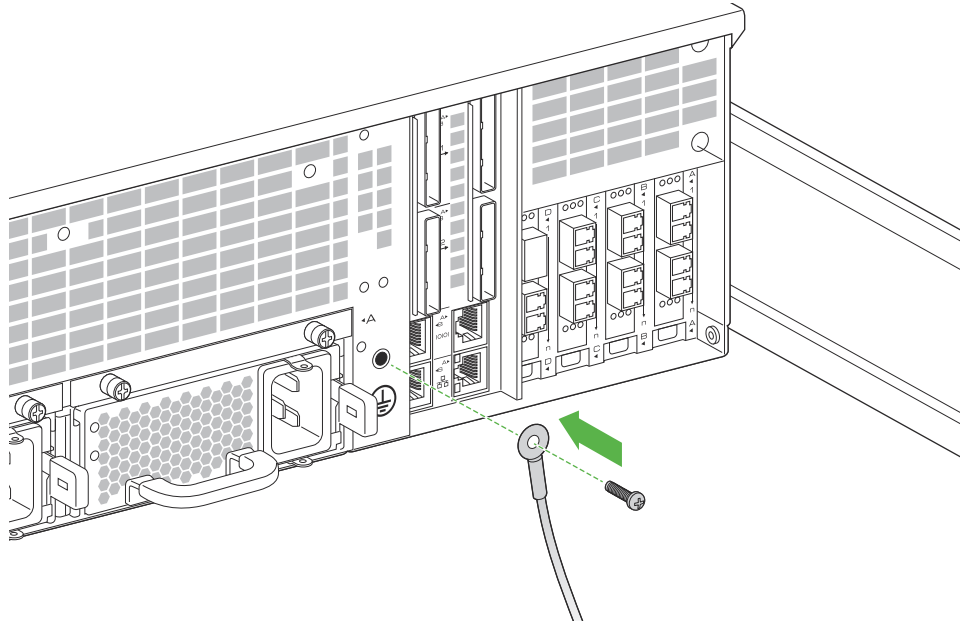


Figure 1.13 Securing an Equipment Ground Wire

To connect an equipment ground wire to the Memory Array:

1. Cut an appropriate length of wire for the equipment ground wire for your location and strip 1/2" of insulation from both ends of the wire. Use appropriately sized wire for your equipment application. Minimum acceptable wire gauge is 8 AWG.
2. Using a size 10-32x1/2" (maximum length) screw (not included), secure the equipment ground wire to the equipment ground connection on the rear of the chassis.

Note: A UL listed ground lug must be used. Check your local code requirements or contact a licensed electrician.

3. Secure the other end of the equipment ground wire to the equipment rack using an appropriately sized screw for the equipment rack. If the equipment rack has a designated ground location, secure the ground wire to this location.

Connecting AC Power Cords to the System

The Memory Array requires 200-264 volts, 47-63 Hz, single phase, 15 A circuits. The power requirements are for the entire chassis.

The power cords have IEC 320 C19 plugs for the Memory Array, and C14 plugs to the data center power strip.

The Memory Array has the following power requirements. See [Memory Array System Specifications](#) on page 62 for more information.

| Item | Requirement |
|---------------------------|----------------------------------|
| Voltage Input Range | 200-264 V AC 50/60 Hz (15 A Max) |
| Supported Operating Range | 180-264 V AC |
| Supported Frequency Range | 47-63 Hz |

Table 1.4 Power Requirements

The Memory Array chassis has the AC power supplies installed prior to shipping. For redundancy purposes, connect the AC power cords to both power receptacles on the Memory Array, and then to different power circuits (if possible).

Caution: Consider the equipment connection to the supply circuit and the effect that overloading the circuits might have on overcurrent protection and supply wiring. Also consider the appropriate equipment nameplate ratings when addressing this concern.

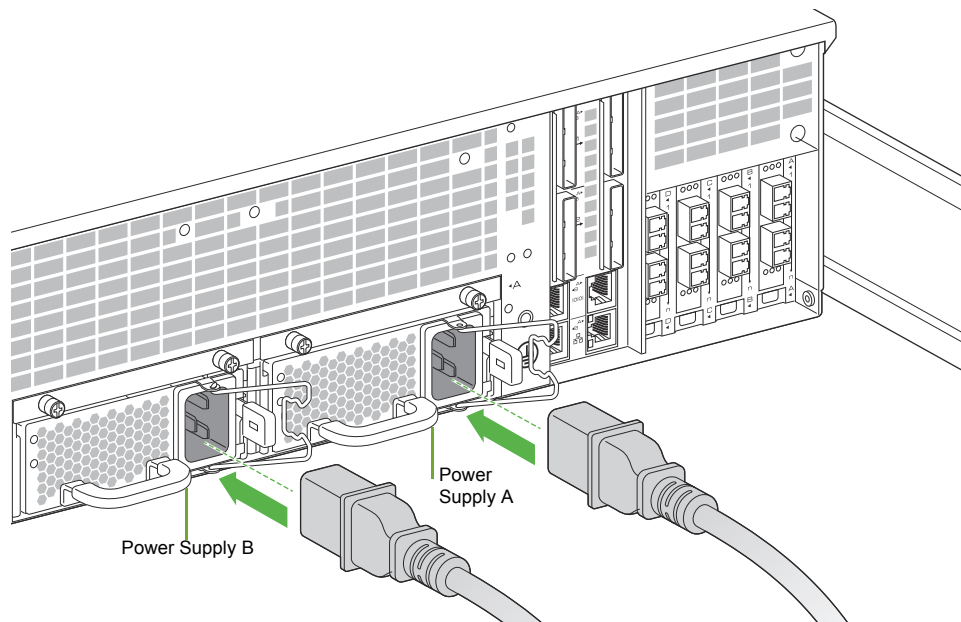


Figure 1.14 Connecting the AC Power Cords

Note: The Violin 6000 Memory Array AC power cords are not a standard configuration. Use only the AC power cords supplied with your system.

To connect the AC power cords to the Memory Array chassis:

1. Locate the AC power receptacles at the rear of the Memory Array chassis.
2. Insert the power connector into the mating power receptacle on the rear of the Memory Array.

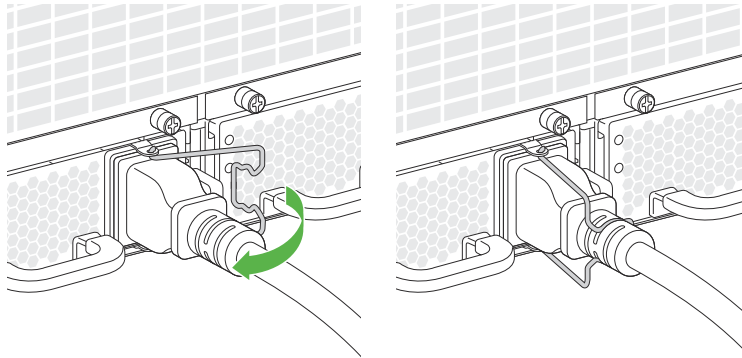


Figure 1.15 Securing the Power Cord Clips

3. Move the clip to the right and then secure it over the power cord.
4. Repeat steps 2-3 for the second AC power supply.

Powering up the Memory Array

Note: Always power on the Memory Array before the host computer to ensure PCIe communication; PCIe hotplug is not supported. An alternate method is to reboot the host computer after powering on the Memory Array to ensure that the host computer recognizes the system.

To complete the power on sequence:

1. Plug each AC power cord from the chassis into an AC outlet.

During the boot up process, the green Status LEDs will flash. The Memory Array is fully booted when the Status LED is continuously lit.

Note: If the top LED on the power supply continues to blink green after the boot up process, the power controller associated with the power supply is either missing, improperly seated or must be replaced. Contact Violin Memory Customer Support for assistance.

2. If connected to a host computer, power on the host computer and log in as `root` on a Linux system, or as an “administrator” on a Windows system to install the device driver. See “Violin Drivers” in the *Violin 6000 Series Memory Array User’s Guide* for more information.

See the *Violin 6000 Series Memory Array User's Guide* for information about rebooting and shutting down the Memory Array and the internal modules.

Connecting the Memory Array to a Host or Network

This section describes the steps required to connect the various types of interface cables from the Memory Array to a host or storage area network (SAN). See [Standard System Configurations](#) on page 9 for general guidelines for all supported configurations.

Connecting PCIe Cables to the Memory Array

This section describes the steps required to connect a single Memory Array to a single host. Several different direct-attached storage configurations are possible depending on the number of hosts and whether those hosts require shared access to the volumes or LUNs within the Memory Array. See [Direct-attached Storage Configurations](#) on page 11 for information on other direct-attached configurations.

The Memory Array communicates with the direct-attached host computer using a PCI Express (PCIe) connection. There are two Array Controller Modules (ACMs) in the system. Each Array Controller provides two PCIe x8 Gen2 ports, making four PCIe ports available to two hosts. Only two external hosts are supported. Two PCIe cables must be used when connecting the Memory Array to an external host.

To connect the PCIe cables to the Memory Array:

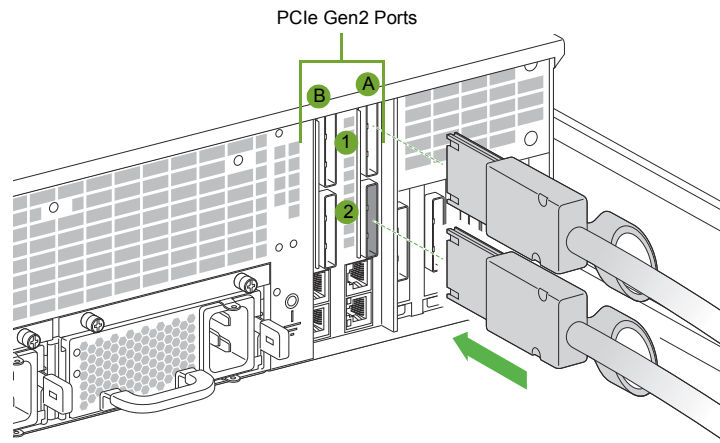


Figure 1.16 Connecting the PCIe Cables to the Memory Array

1. Align the connectors of the PCIe cables with the appropriate PCIe connectors at the rear of the Memory Array chassis. Note the arrangement of the ACMs: ACM A is on the right and ACM B is on the left. PCIe port 1 is on the top and port 2 is on the bottom.
2. Securely plug the PCIe cables into the PCIe connectors of the appropriate PCIe ports.

Note: Ensure that the bend radius of the PCIe cable is greater than 1.9".

To connect the PCIe cables to a host computer:

1. Install a PCIe Host Bus Adapter (HBA) card into the available PCIe slot in the host computer, ensuring that it is securely seated into the PCIe slot. See the documentation that came with the PCIe card for installation instructions.
2. Orient the unconnected end of the PCIe cables so that they align with the PCIe connectors on the back of the host computer.
3. Securely plug the cables into the PCIe connectors.

Connecting Network Interface Cables to the Memory Array

This section describes the steps required to connect the network interface cables from the Memory Array to a storage area network (SAN) via Fibre Channel, InfiniBand or a Local Area Network (LAN) via 10GbE iSCSI. See [SAN-attached Storage Configurations](#) on page 9 for instructions on the ports to use on the Memory Array for the supported configurations, including a high-availability installation.

Note: When connecting the interface cables in a SAN-attached configuration, it is important to know the ports from which LUNs are exported from the Web interface. See [Understanding Port Numbering](#) on page 10 for more information on the port numbering of the support cards.

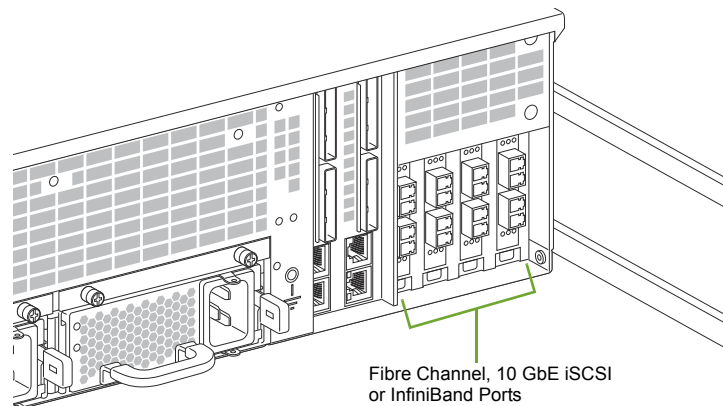


Figure 1.17 Connecting Interface Cables to the Memory Array

Connecting Fibre Channel Cables

The dual 8Gbps ports on the Fibre Channel HBA are SFP+ with LC-style connectors. See [Fibre Channel Adapter Card Specifications](#) on page 63 for more information.

1. Align one connector of the Fibre Channel cable with the appropriate Fibre Channel connector at the rear of the Memory Array chassis.
2. Securely plug the Fibre Channel cable into the Fibre Channel connector of the appropriate Fibre Channel port.
3. Connect the other end of the Fibre Channel cable to a host computer or Fibre Channel switch.

Connecting iSCSI Cables

The 10 GbE NIC ports are SFP+ LC connectors. [Ethernet/iSCSI Adapter Card Specifications](#) on page 65 for more information.

1. Align one connector of the iSCSI cable with the appropriate iSCSI connector at the rear of the Memory Array chassis.
2. Securely plug the iSCSI cable into the iSCSI connector of the appropriate iSCSI port.
3. Connect the other end of the iSCSI cable to an iSCSI switch.

Connecting InfiniBand Cables

The InfiniBand adapter card uses QSFP 40Gb/s connectors. See [InfiniBand Adapter Card Specifications](#) on page 64 for more information.

1. Align one connector of the InfiniBand cable with the appropriate InfiniBand connector at the rear of the Memory Array chassis.
2. Securely plug the InfiniBand cable into the InfiniBand connector of the appropriate InfiniBand port.
3. Connect the other end of the InfiniBand cable to an InfiniBand switch.

See [InfiniBand Client Configuration](#) on page 51 for an overview of InfiniBand driver installation and client setup.

Connecting the ACMs for vMOS-6

Note: This cable connection is only required for vMOS-6.

vMOS-6 requires that the ACMs be externally connected to each other to interconnect the internal Memory Gateways. This cable connection enables a Non-Transparent Bridge (NTB), which allows for high-bandwidth, low latency inter-cluster coordination between the two Memory Gateways for effective management of thin provisioned LUNs and snapshots.

There are two Array Controller Modules (ACMs) in the system. Each Array Controller provides two PCIe x8 Gen2 ports. The ACMs communicate with each other using a PCI Express (PCIe) connection. This section describes the steps required to connect the ACMs to each other.

To connect the PCIe cable:

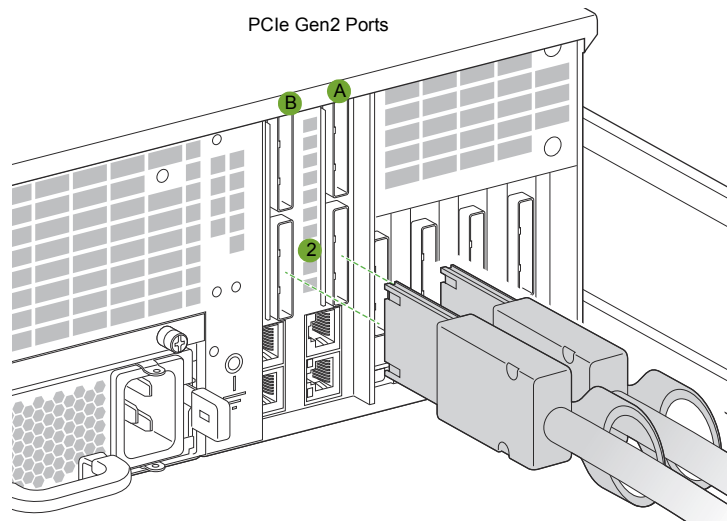


Figure 1.18 Connecting the PCIe Cables to the ACMs

1. Using the supplied PCIe cable, align the connectors of both ends of the PCIe cable with the bottom ports on the ACMs: ACM A port 2 and ACM B port 2, as shown in Figure 1.18.

WARNING! You *must* use the bottom PCIe ports on the ACMs for this connection. The top PCIe ports must remain unused in this configuration.

2. Securely plug the PCIe cables into the PCIe connectors of the bottom PCIe ports.

There is no configuration required to enable this ACM-to-ACM connection. You can, however, verify that NTB is configured and to view its status by using the “`show ntb`” commands. See [Verifying NTB Link \(vMOS-6 Only\)](#) on page 45 for more information.

Note: If you are using the cable management arm, route this cable in the arm along with the other cables. Ensure that the bend radius of the PCIe cable is greater than 1.9”.

Connecting Management Cables

Configuring the Memory Array and gathering status about the system can be completed by connecting to the console or Ethernet ports on the back of the chassis. Each method is described in the following sections:

- [Connecting the Console Cable](#) on page 27
- [Connecting the Ethernet Cable](#) on page 28

Connecting the Console Cable

Use the serial console cable to connect a computer to the Memory Array for configuration operations and retrieval of system status using the command-line interface (CLI).

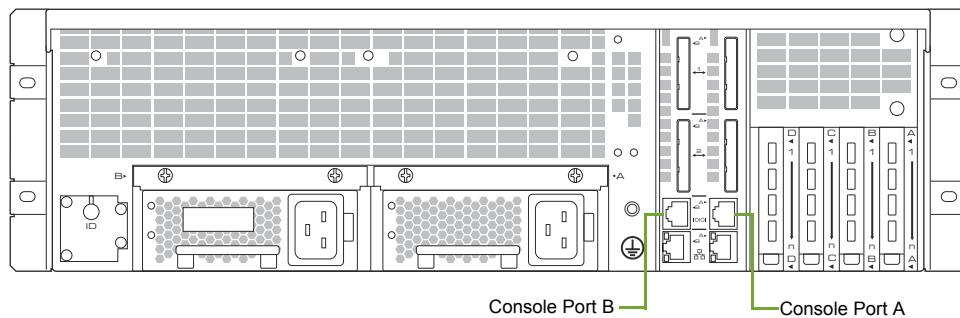


Figure 1.19 Connecting the Console Cable to the Memory Array

To connect the console cable to the Memory Array and a computer:

1. Connect one end of the console cable to a serial console port A on the rear of the Memory Array.
2. Connect the other end of the cable to a computer.
3. When you are ready to connect to the CLI, launch a terminal window, and then use the following console settings:
 - Bits per second: 115200
 - Data bits: 8
 - Parity: None
 - Stop bits: 1

See [System Setup and Configuration](#) on page 31 for more information.

Connecting the Ethernet Cable

The RJ-45 10/100/1000 Ethernet cable connects the host computer to the command-line interface (CLI) for configuration operations and retrieves system status.

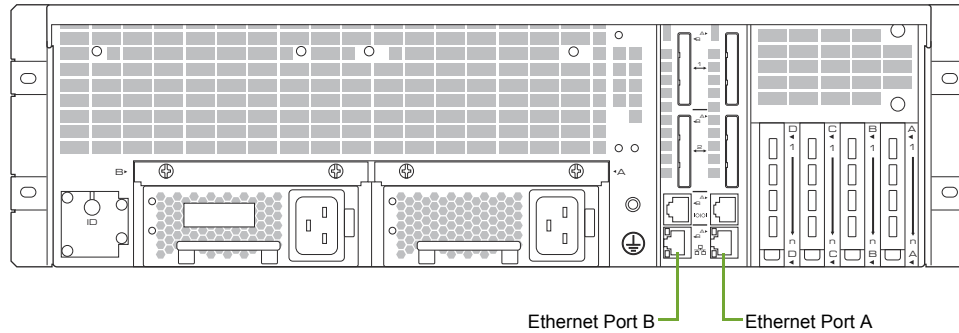


Figure 1.20 Connecting the Ethernet Cable to the Memory Array

For a direct host-to-system Ethernet connection, use a straight-through or cross-over RJ-45 to RJ-45 CAT5 Ethernet cable.

You can also use a straight-through or cross-over cable to connect the Memory Array to a switch, hub or other network equipment, provided that the host and the system can communicate with each other.

To connect the Ethernet cable to the Memory Array and the host computer:

1. Connect one end of the Ethernet cable to one of the bottom Ethernet connectors on the rear of the Memory Array.
2. Connect the other end of the Ethernet cable:
 - If directly connecting to the host machine, plug the cable into the Ethernet connector on the host.
 - If connecting to customer network equipment, plug the cable into the customer network equipment, such as a network switch. Use a second Ethernet cable to connect the host computer to the customer network equipment.

Securing the Memory Array to the Equipment Rack

Follow these steps to secure the front bezel on the Memory Array to a square-hole equipment rack using either the previously-installed cage nuts, or to a threaded equipment rack using the screws included in the accessory kit.

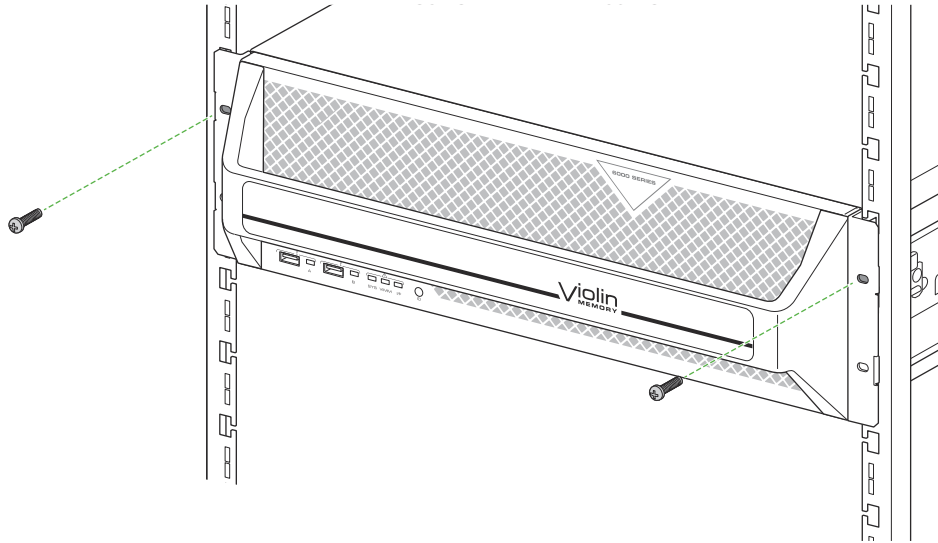


Figure 1.21 Securing the Memory Array to the Equipment Rack

Use either the supplied cage nuts or the screws, depending on the style of your equipment rack. See [Installing the Cage Nuts](#) on page 18 if you have not installed the cage nuts for a square-hole equipment rack.

- Using the screws removed from the cage nuts, or the separate screws for a threaded equipment rack, insert the screws into the top holes on the front bezel and then tighten the screws.

CHAPTER 2 System Setup and Configuration

When a new Violin 6000 Memory Array is powered on for the first time, all configuration settings remain at their default values. You must change the default settings to communicate with the Memory Array over your network(s).

This chapter explains how to update and set up the system settings on a new Violin 6000 system using the configuration wizard in the following sections:

- [Completing the Configuration Wizard](#) on page 32
- [System Verification and Management](#) on page 37
- [Troubleshooting](#) on page 47

Note: If you connected the Memory Array directly to a host machine using PCIe cables, you must install a driver to enable the host machine to access block storage on the Array. See “Violin Drivers” in the *Violin 6000 Series Memory Array User’s Guide* after completing the configuration steps in this chapter.

Completing the Configuration Wizard

When a new Violin 6000 Memory Array is powered on for the first time, all configuration settings remain at their default values. Follow the steps in this section to configure the Memory Array for the first time.

Default System Settings

The Memory Array's default settings are listed in Table 2.1. Change these settings using the CLI over a SSH session or using a serial port connected to the Memory Array.

| Setting Name | Default Value |
|----------------------|--------------------------------------------------------------------------------------|
| Cluster Name | vmem-array |
| Host Name | vmem-array-acma vmem-array-acmb |
| IP Addresses | 192.168.1.10 (ACMa, static) |
| | 192.168.1.11 (ACMb) |
| | 192.168.1.12 (ACM Management IP address) also known as a VIP (Virtual IP address) |
| IP Netmask | 255.255.255.0 |
| IP Default Route | 192.168.1.1 |
| Clock Source | NTP |
| Shell Connectivity | Serial, SSH (port 22) |
| Serial Port Settings | 9600 Baud, No Parity, 8 bits, 1 stop |
| User Name | "admin" |
| Password | blank |
| Flash VIMM Format | 65% for SLC 84% for MLC |

Table 2.1 Memory Array System Default Settings

Configuration Checklist

Before you begin configuring the Memory Array and the Memory Gateways, make sure that you gather the following information from the network administrator. These items must be available to complete the initial configuration.

| Information | Notes |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| A host name to be used for the system | |
| Four host IP addresses within the same subnet: <ul style="list-style-type: none"> • Array Controller Module A (acm-a) host IP address • Array Controller Module B (acm-b) host IP address • Memory Gateway A (mg-a) host IP address • Memory Gateway B (mg-b) host IP address | |
| Two management IP addresses: <ul style="list-style-type: none"> • ACM management IP address • Memory Gateway management IP address | |
| ACM management IP Netmask | |
| Memory Gateway management IP Netmask | |
| Netmask | |
| DNS server IP address | |
| Domain name | |
| Default Gateway IP address | |
| NTP server IP address and time zone | |
| E-mail hub and port for auto support feature (if callhome.vmem.com cannot be reached over TCP port 25 due to corporate firewall restrictions) | |

Table 2.2 Initial System Configuration Checklist

Completing the Configuration Wizard for a New System

This section describes initial (first time) configuration of the Memory Array. Configuration is completed by connecting a serial console cable to the Memory Array and then using the Command Line Interface (CLI) to configure the system.

1. Connect a serial cable from your computer to console port A on the back of the Memory Array. (Port A is the right console port on the back of the chassis.)
2. Start a terminal window, and then use the following console settings:
 - Bits per second: 115200
 - Data bits: 8
 - Parity: None
 - Stop bits: 1
3. Log in to the system as “admin”. A password is not required.

The command displays text similar to the following:

```
Violin Memory Array Configuration Wizard

This wizard will prompt you for the following items. Make sure you have
all of the following information below before starting:

    Hostname
    * Four host IP addresses (within the same subnet)
    * Two management IP addresses (with netmask - if different from above)
    * DNS server IP address and domain name
    * Default Gateway
    NTP server and time zone
    Email hub and port for auto support feature (if callhome.vmem.com
cannot be directly reached)

    * = not required if using DHCP.

Press '?' for help, Ctrl+B to go back to the previous step.
Default value is in square brackets: press Enter to accept it.
Press Ctrl+R to clear default to enter empty string.
Press Ctrl+C to jump to the end of the wizard at any time. █
```

All of the wizard steps are shown below, with the valid responses explained. Default values are shown in brackets.

```
Step 1: Hostname? [hostname of machine] █
```

- At the command prompt, type the host name that will be used for the system.

```
Step 2: Admin password (Enter to leave unchanged)? █
```

- Press Enter to leave the administrator password empty or type a password to be used.

```
Step 3: Use DHCP for all eth1 public interfaces? [no] █
```

- Type “no” to use a static IP address, which is recommended. Type “yes” to use DHCP to configure the public interfaces on this system. If you type “yes”, the system will attempt to contact a DHCP server to obtain an IP address, default route, DNS servers and domain name.

```
Step 4: Netmask? [255.255.255.0] █
```

- Type the Netmask value for the public interface provided by the network administrator. You can also enter the value as a mask length after a slash, for example, “/24”.

```
Step 5: Default gateway? [0.0.0.0] █
```

- Type the Default Gateway IP address for the local subnet obtained from the network administrator.

Step 6: Primary DNS server? [0.0.0.0]

- Type the IP address of the DNS server (that the system should use to resolve hostnames into IP addresses) obtained from the network administrator.

Step 7: Domain name? []

- Type the DNS domain name in which the system resides (obtained from the network administrator). For example, if the fully qualified host name is system1.example.com, you would enter "example.com".

Step 8: Memory Gateway (MG) management IP address? [0.0.0.0]

- Type the IP address to be used for the Memory Gateway management IP address (obtained from the network administrator).

Step 9: Memory Gateway (MG) management IP netmask? [0.0.0.0]

- Type the IP address to be used for the Memory Gateway management netmask (obtained from the network administrator).

Step 10: ACM management IP address? [0.0.0.0]

- Type the IP address to be used for the ACM management IP address (obtained from the network administrator).

Step 11: ACM management IP netmask? [0.0.0.0]

- Type the IP address to be used for the ACM management netmask (obtained from the network administrator).

Step 12: Memory Gateway A (mg-a) host IP? [0.0.0.0]

- Type the IP address to be used for Memory Gateway A (mg-a) (obtained from the network administrator).

Step 13: Memory Gateway B (mg-b) host IP? [0.0.0.0]

- Type the IP address to be used for Memory Gateway B (mg-b) (obtained from the network administrator).

Step 14: Array Controller Module A (acm-a) host IP? [0.0.0.0]

- Type the IP address to be used for Array Controller Module A (acm-a) (obtained from the network administrator).

Step 15: Array Controller Module B (acm-b) host IP? [0.0.0.0]

- Type the IP address to be used for Array Controller Module B (acm-b) (obtained from the network administrator).

```
Step 16: Set clock timezone? [yes]
```

- Press Enter to start setting the time zone, or type “no” to use an NTP server (Step 17). If you choose “yes”, enter the Country, Zone and Sub-zones to use. If you are unsure of the proper responses, type “?” to display a list of choices.

```
Step 17: NTP server name(s)? []
```

- Type the IP address(es) of the NTP server(s) to use (separated by commas if more than one is used).

```
Step 18: E-mail notification recipient(s)? [callhome@vmem.com]
```

- Type the e-mail addresses of those who should receive an e-mail when an alert message is sent from the Memory Array. Separate multiple e-mail addresses with a comma.

```
Step 19: E-mail mailhub? [callhome.vmem.com]
```

- Press Enter to use the default mailhub for the Call Home feature (notifications and autosupport e-mails).

```
Step 20: E-mail mailhub port? [25]
```

- Press Enter to use the default mailhub port.

```
Step 21: Enable Violin support? [yes]
```

- Press Enter to enable autosupport e-mails and log uploads to be delivered to Violin Memory. Type “no” to disable delivery.

Note: It is highly recommended that you enable this feature so that Violin Memory Customer Support is aware of any issues that arise and can promptly assist with a resolution.

Once you have entered the necessary information, all of the values that will be used are displayed for confirmation. It is recommended that you review each answer to ensure that you entered all of the appropriate values accurately, and then make changes if necessary.

To change an answer, type the step number and then change the information. Once the answers are finished, press Enter to save the settings and exit the initial configuration.

System Verification and Management

Following first-time configuration of a Violin 6000 Series Memory Array, it is recommended that you verify that the system is set up as desired and running properly. This section provides those system verification steps to complete.

Utilities commands are also available to monitor the performance of Memory Array systems in a direct-attached configuration. Using Violin utilities, you may retrieve detailed information about the Memory Array and data transfer counts that enable you to configure the system for optimal performance. See the *Violin 6000 Series Memory Array User's Guide* for information on using Violin utilities.

The following verification steps are covered in this section:

- *Cluster Management* below
- [Configuring the PCIe Connection](#) on page 39
- [Verifying ACM PCIe Settings](#) on page 41
- [Verifying the Memory Gateway Network Setup](#) on page 42
- [Verifying the Memory Gateway Power State](#) on page 43
- [Verifying Memory Gateway Addresses and Licenses](#) on page 44
- [Verifying NTB Link \(vMOS-6 Only\)](#) on page 45
- [Initializing the Violin Memory Array](#) on page 45
- [Troubleshooting](#) on page 47

Cluster Management

The Array Controllers (ACMs) and the Memory Gateways inside the Violin 6000 Series Memory Array operate as separate clusters. One of the ACMs is designated as the master node and the other designated as the standby to the master. The same roles apply to the Memory Gateways: one is the master and one is the standby Memory Gateway. The Memory Gateways manage connectivity to SAN systems as well as LUN management.

- The first node configured at installation becomes the *master*, and the second one configured becomes the *standby*.
- The standby is an active node that performs services like the other nodes in the cluster.

Management activities include monitoring nodes in the system, stopping or rebooting nodes, and upgrading the software running on the system.

Note: Management tasks can be performed using either the Violin Web interface or the Command Line Interface (CLI). This section explains the tasks with CLI examples, and gives references to the Web Interface screens where you can perform the same tasks.

This section is organized into the following sections:

- [ACM Management IP Address](#) on page 38
- [Monitoring the Cluster](#) on page 38

ACM Management IP Address

The ACM management IP address is set during the initial configuration of Array Controller Module A. This address is assigned to the master node of the cluster; if that node fails the ACM management IP address is redirected to the standby node, which becomes the new master.

Tip: By using the ACM management IP address, you can ensure a direct and reliable connection to the current master node for all management activities.

Monitoring the Cluster

To monitor the cluster nodes, you can use the `show cluster` set of commands in the CLI or the ACM List screen in the Array Admin section of the Violin Web interface. See “CLI Reference” in the *Violin 6000 Series Memory Array User’s Guide* for descriptions of the `show cluster` commands and other cluster management commands.

The ACM List screen shows the ACMs that are currently part of the Memory Array cluster with their status and role (master or standby). You can also view additional information about an ACM from this screen. See the *Violin 6000 Series Memory Array User’s Guide* for information about the ACM List screen.

The most useful of the `show cluster` commands is `show cluster global brief`. This command can be used on any node in the cluster in Config or Enable mode (but not in Standard mode). Command modes are explained in the *Violin 6000 Series Memory Array User’s Guide*.

The `show cluster global brief` command displays the cluster ID and name, the management IP address and netmask, the cluster master interface, and the number of Gateways (nodes) in the cluster. For each node, the display gives its role (master or standby), host ID, external IP address, and internal IP address.

An asterisk after a node’s ID number designates the local node, from where you issued the command. Below is an example of the `show cluster global brief` command on the master node:

```
violin-acma [violin: master] (config) # show cluster global brief

Global cluster state summary
=====
Cluster ID: 15000-0000-0016
Cluster name: violin
Management IP: 0.0.0.0/0
Cluster master IF: eth1
Cluster node count:  2

ID      Role      State   Host           External Addr  Internal Addr
-----
1*     master   online  violin-acma    10.1.14.209    169.254.1.10
2      standby  online  violin-acmb    10.1.14.208    169.254.1.11
violin-acma [violin: master] #
```

Without the `brief` option, the `show cluster global` command displays additional information about each node in the cluster. Instead of using an asterisk to designate the local node ID, this display uses the label `<---` (local node).

Example of `show cluster global`:

```
violin-acma [violin: master] (config) # show cluster global
Cluster ID:          15000-0000-0016
Cluster name:        violin
Management IP:       10.1.2.345/22
Cluster master IF:   eth1
Cluster node count:  2

Node Status:
  Node ID: 1 <--- (local node)
  Host ID: 219dc7a368b5
  Hostname: violin-acma-acm-a
  Node Role: master
  Node State: online
  Node internal address: 169.254.1.10, port: 60102
  Node external address: 10.1.10.57
  Recv. Heartbeats from: 2
  Send Heartbeats to: 2

Node Status:
  Node ID: 2
  Host ID: e18b8f130daf
  Hostname: violin-acmb
  Node Role: standby
  Node State: online
  Node internal address: 169.254.1.11, port: 57575
  Node external address: 10.1.9.208
  Recv. Heartbeats from: 1
  Send Heartbeats to: 1

violin-acma-acm-a [violin: master] (config) #
```

Configuring the PCIe Connection

If the Violin 6000 Memory Array is set up in a direct-attached configuration using PCIe cables, you must configure the PCIe connection using the CLI. Use the `show pcie` command to display the PCIe connection information.

Note: It is unnecessary to modify the PCIe configuration for Memory Arrays with internal Memory Gateways. The PCIe configuration is already set at the factory.

Follow these steps to access the `pcie` command and configure the PCIe connection.

1. Start a terminal application and enter the host name of the Memory Array or the ACM Management IP address (assigned during initial configuration).

2. If you are using a serial connection, use the following console settings:

- Bits per second: 115200
- Data bits: 8
- Parity: None
- Stop bits: 1

3. At the CLI command prompt, log in as “admin.”

4. At the command prompt, type `enable` and then `configure terminal`:

```
violin-acma [violin: master] > enable
violin-acma [violin: master] # configure terminal
```

5. Enter the `show pcie` command to display the PCIe connection information. Below is an example of the command and output for a system named “violin” with 4 VCMs. The output shows the two possible configurations: `direct-attach` and `mg`.

```
violin-acma [violin: master] (config) # show pcie
Current PCI-E config: direct-attach
  Constant Frequency enabled
Config direct-attach
Config mg

Ports acm-a (violin-acma-acm-a):
  external-a: optimal
    vcm-a: optimal
    vcm-b: optimal
  external-b: optimal
    clustering: optimal
    vcm-c: optimal
    vcm-d: optimal

Ports acm-b (violin-acma-acm-b):
  external-a: optimal
    vcm-a: optimal
    vcm-b: optimal
  external-b: optimal
    clustering: optimal
    vcm-c: optimal
    vcm-d: optimal
violin-acma [violin: master] (config) #
```

The first section, called the Switch configuration section, displays the current routing mode, which in this case is set to the default “direct-attach” mode. This mode is four (4) PCIe direct connections, with two (2) on each ACM. The four (4) PCIe ports run at gen 2 speed with a PCIe lane width of x8 lanes per port, as shown in the Port configuration section.

The Port configuration section is broken into two parts, one for the ACM in slot “a” and the other for the ACM in slot “b”. The PCIe ports are labeled external “a” and “b” below. The display will show “optimal” for a port that is configured at its highest speed, “degraded” if it is at a lower speed, and “no link” if it can’t detect a connection.

6. Enable the direct-attached PCIe connection, or change the configuration using the following command:

```
violin-acma [violin: master] (config) # pcie connect < direct-attach | mg >
```

Where:

| | |
|------------------------------------|---------------------------------------------------------------------------------------|
| <code><direct-attach></code> | Specifies the default mode, which is four PCIe direct connections with 2 on each ACM. |
| <code><mg></code> | Basic configuration for 4VCMs off MG link ports, with external access through HBA. |

7. Save any changes using the following command:

```
violin-acma [violin: master] (config) # write memory
```

Note: For Windows, the SSC (Spread Spectrum Clocking) setting on the Windows server must match the SSC setting on the Memory Array. Use the `[no] pcie ssc enable` command. See the *Violin Array Controller Driver for Windows Installation Guide* for more information. This guide is available from the Violin Memory Customer Support site.

Verifying ACM PCIe Settings

1. If the Memory Array is used in a direct-attached configuration and has PCIe connections to an external host, disconnect the PCIe cables before continuing.
2. Log in to the Master ACM and then run the following commands to verify the system is running in mg mode, and that the vRAID Controller Module (VCM) links to the internal Memory Gateways are in an optimal state.

```
violin-acma [vmem-array: master] # show pcie
Current PCI-E config: mg
Config direct-attach
Config mg

Ports acm-a (lab-stein12-acma):
  mg_out: optimal
    hba-a: optimal
    hba-b: optimal
  mg_in: optimal
    vcm-a: optimal
    vcm-b: optimal
    vcm-c: optimal
    vcm-d: optimal

Ports acm-b (lab-stein12-acmb):
  mg_out: optimal
    hba-c: optimal
    hba-d: optimal
  mg_in: optimal
    vcm-a: optimal
    vcm-b: optimal
    vcm-c: optimal
    vcm-d: optimal
```

Note: The output of hba-a, hba-b, hba-c and hba-d is dependent on the presence of a PCIe card in the rear HBA slots. If one or more links are not optimal, try powering off the Violin Memory Gateway(s) and then on again, as described in [Verifying the Memory Gateway Power State](#) on page 43.

3. If the system is not in mg mode, run the following command (in Config mode):
`pcie connect mg`
4. Verify that the links are shown in optimal condition. If they are not, see [Troubleshooting](#) on page 47.
5. Continue to [Verifying the Memory Gateway Network Setup](#) on this page.

Verifying the Memory Gateway Network Setup

The internal Memory Gateways shipped from the factory in a Violin 6000 Series flash Memory Array (i.e., not replacement Memory Gateways), should have host definitions for “mg-a” and “mg-b”.

To verify the Violin Memory Gateway network setup, do the following:

1. Verify the Memory Gateway host definitions using the `show hosts` command, as shown in the following example.

```
violin-acm-b [23109R00000014: standby] # show hosts
Hostname: violin
Name server: 10.1.8.5 (configured)
Domain name: company.storage.int (configured)
IP 127.0.0.1 maps to hostname localhost
IP 169.254.1.1 maps to hostname master
IP 169.254.1.10 maps to hostname acm-a
IP 169.254.1.100 maps to hostname mg-master
IP 169.254.1.101 maps to hostname mg-a
IP 169.254.1.102 maps to hostname mg-b
IP 169.254.1.11 maps to hostname acm-b
IP 169.254.1.20 maps to hostname vcm-a
IP 169.254.1.20 maps to hostname vcm-a0
IP 169.254.1.21 maps to hostname vcm-a1
IP 169.254.1.30 maps to hostname vcm-b
IP 169.254.1.30 maps to hostname vcm-b0
IP 169.254.1.31 maps to hostname vcm-b1
IP 169.254.1.40 maps to hostname vcm-c
IP 169.254.1.40 maps to hostname vcm-c0
IP 169.254.1.41 maps to hostname vcm-c1
IP 169.254.1.50 maps to hostname vcm-d
IP 169.254.1.50 maps to hostname vcm-d0
IP 169.254.1.51 maps to hostname vcm-d1
Automatically map hostname to loopback address: yes
```

2. If there is no host IP address defined for both mg-a and mg-b, see [Determining IP Addresses of Internal Memory Gateways \(Both Unknown\)](#) on page 48 for instructions.
3. Continue to [Verifying the Memory Gateway Power State](#) on page 43.

Verifying the Memory Gateway Power State

1. Check the power status of the Memory Gateways by running the `show array modules type mg detail` command, as shown in the following example.

```
violin-acmb [violin: master] # show array modules type mg detail
mg-a:
  Present           : yes
  Running           : yes
  Mfg serial        : 47201T00126
  Mfg model         : 410-0156-00_R02
  Mfg version       : 02
  Mfg date          : 02242012
  Power             : yes
  Current (mA)      : 5521.61
  Overcurrent       :
  Internal switch port: 6
  IP address        : 169.254.1.101
  HW address        : 00:10:6F:16:07:31
mg-b:
  Present           : yes
  Running           : yes
  Mfg serial        : 47201T00135
  Mfg model         : 410-0156-00_R02
  Mfg version       : 02
  Mfg date          : 02242012
  Power             : yes
  Current (mA)      : 6590.08
  Overcurrent       :
  Internal switch port: 4
  IP address        : 169.254.1.102
  HW address        : 00:10:6F:22:06:F4
```

2. Verify that the “Power” field for both is set to “yes” and that the current draw measured is greater than 0.
3. If one or both Memory Gateways fail to meet these criteria, power on a Memory Gateway by running the following commands. Where <ID> is either mg-a or mg-b, depending on which system is not powered on:
`no array modules id <ID> enable`
`array modules id <ID> enable`
4. Wait about 5 seconds after issuing the second command, and then run the `show array modules type mg detail` command again. If both Memory Gateways are not reporting as they should, see [Troubleshooting](#) on page 47.

Verifying Memory Gateway Addresses and Licenses

This section covers the tasks for verifying the public IP addresses on the internal Memory Gateways and the vSHARE feature license. Complete both tasks.

To verify public IP addresses on the internal Memory Gateways, do the following:

1. From a system on the network other than the Memory Array being configured, verify that all three configured public addresses (one each per Memory Gateway and their shared management VIP) respond to pings.
2. Using SSH, verify that the CLI is accessible on the public gateway VIP by connecting to the management VIP address as user `admin`.
3. Verify that the Web interface is accessible on the public gateway VIP by opening a supported Web browser and entering the management VIP address. When prompted, log in as user `admin`.

To verify the vSHARE feature license, do the following:

1. Log in to the CLI of the master Memory Gateway. This can be either the externally accessible management VIP or the internal IP address of the gateway that is the master.
2. In enable mode, run the `show licenses` command to display the currently installed licenses. You should see output similar to the following example:

```
violin-vmga [violin-vmg: master] # show licenses
License 1: LK2-RESTRICTED_CMDS-7X77-4GKJ-E9T8-8A48-9JQ1-X4J7
  Feature:          RESTRICTED_CMDS
  Valid:            yes
  Tied to cluster ID: 99999 (ok)
  Active:           yes

License 2: LK2-VMOS6-7X87-4VKJ-
  Feature:          VMOS6
  Valid:            no
  Active:           no

License 3: LK2-VMOS6-7X87-4VKJ-E9R8-8A1L-48H4-9EGQ
  Feature:          VMOS6
  Valid:            yes
  Tied to cluster ID: 99999 (ok)
  Active:           yes
```

3. If there is not a license for a feature and/or the feature is not active, install the correct license for the given cluster ID using the following command:
`license install <license key>` Where `<license key>` is the key printed on the side of the Memory Array.
4. Continue to [Initializing the Violin Memory Array](#) on page 45.

Verifying NTB Link (vMOS-6 Only)

The Non-Transparent Bridge (NTB) is automatically enabled during installation. If this system is running vMOS-6, you can use the commands below to show that NTB is enabled and to show the status of the NTB link.

To show that NTB is configured:

1. Log in to the CLI of either Memory Gateway (master or standby).
2. In enable mode, run the `show ntb configured` command. If NTB is configured, you should see output similar to the following:

```
violin-vmga [violin-vmg: master] # show ntb configured
vntb0 :
  Enabled: yes
      MTU: 16320
Mask Len: 30
  mg-a IP: 169.254.2.1
  mg-b IP: 169.254.2.2
```

To show that the NTB link is up on both Memory Gateways:

1. Log in to the CLI of either Memory Gateway (master or standby).
2. In enable mode, run the `show ntb status` command to display the NTB link status. If the link is up on both Memory Gateways, you should see output similar to the following:

```
violin-vmga [violin-vmg: master] # show ntb status
vntb0 link status :
Link          Local  Remote
-----
PCI (local):  Up    Up
PCI (peer) :  Up    Up
   NTB :      Up    Up
   Network :  Up    Up
```

The network interfaces are communicating if the Network status is “Up” for both Local and Remote links.

3. If the status is not “Up” for the Local and Remote links, double-check the PCIe cable connection between the two ACMs, making sure the cable is securely attached to both ports.

Initializing the Violin Memory Array

To configure a Violin Memory Array to support block storage, you must first initialize the Violin Memory Array using the `media init` command.

1. Start a terminal application and open a connection to the Memory Gateway Master using its management IP address or hostname, which were set up during initial configuration of the Memory Array.
2. Log in to the Memory Gateway as “admin.”

3. At the command prompt, type `enable` and then `configure terminal`:

```
violin-mg-a [violin: master] > enable
violin-mg-a [violin: master] # configure terminal
```

4. Verify that the Array is visible to the Gateways by running the following command:

```
violin-mg-a [violin-vmg: master] (config) # show media all
Location      Media ID      Model                               Size      Status
-----
Boot Disk     ---          ---                                74.53G   online
PCI 1         ---          ---                                8016.00G unknown
PCI 2         ---          ---                                ---      ---
PCI 3         ---          ---                                ---      ---
PCI 4         41312F00917  VIOLIN_MEMORY_ARRAY              1024.00M unknown
```

5. Initialize the Memory Array (i.e., create a container) by running the following command:

```
media init device <device> type block
```

Where `<device>` can be determined by pressing the Tab key to auto-complete based on available devices. It should be something of the form:

```
ata-VIOLIN_MEMORY_ARRAY_*
```

You can also create a custom name for the container as part of the `media init` command by providing the option `name <custom name>`.

6. Enable the Memory Array using the following command: `media block id all enable`
7. Verify that the Memory Array is shown as enabled and recognized by running the `show media all` command.

You should see both a Media ID and a Model entry for the Memory Array. Additionally, the size should indicate the size of the array (~8TB in this example) and the status should be `online`, as shown in this example.

```
violin-mg-a [violin-vmg: master] (config) # show media all
Location      Media ID      Model                               Size      Status
-----
Boot Disk     ---          ---                                74.53G   online
PCI 1         41148F00119  VIOLIN_MEMORY_ARRAY              8016.00G online
PCI 2         ---          ---                                ---      ---
PCI 3         ---          ---                                ---      ---
PCI 4         41312F00917  VIOLIN_MEMORY_ARRAY              1024.00M unknown
```

8. Save the modified configuration using the `write mem` command.

Troubleshooting

This section provides troubleshooting tips, should you have problems configuring or accessing a Memory Gateway. The following topics are covered:

- [Determining IP Addresses of Internal Memory Gateways \(One Known, One Unknown\)](#) on page 47
- [Determining IP Addresses of Internal Memory Gateways \(Both Unknown\)](#) on page 48
- [Error Messages When Logging in to Memory Gateways](#) on page 49

Determining IP Addresses of Internal Memory Gateways (One Known, One Unknown)

If the IP address for one internal Memory Gateway is known (and verified via a direct ping) and the other Gateway's address is unknown, you can use the following procedure to determine the unknown IP address.

1. Verify each Memory Gateway is powered and drawing current by examining the output of the `show array modules type mg detail` command.
2. Perform a broadcast ping to 169.254.255.255 from the ACM CLI, similar to this example:

```
violin-acma [violin: master] # ping -b -w1 169.254.255.255
WARNING: pinging broadcast address
PING 169.254.255.255 (169.254.255.255) 56(84) bytes of data.
64 bytes from 169.254.1.10: icmp_seq=1 ttl=64 time=0.061 ms
64 bytes from 169.254.1.11: icmp_seq=1 ttl=64 time=0.102 ms (DUP!)
64 bytes from 169.254.42.198: icmp_seq=1 ttl=64 time=0.115 ms (DUP!)
64 bytes from 169.254.87.114: icmp_seq=1 ttl=64 time=0.115 ms (DUP!)
64 bytes from 169.254.1.10: icmp_seq=2 ttl=64 time=0.036 ms

64 bytes from 169.254.1.11: icmp_seq=2 ttl=64 time=0.058 ms (DUP!)
64 bytes from 169.254.42.198: icmp_seq=2 ttl=64 time=0.099 ms (DUP!)
64 bytes from 169.254.87.114: icmp_seq=1 ttl=64 time=0.115 ms (DUP!)
```

3. Examine the output of the above command and determine the IP address that is not 169.254.1.10 (acm-a), 169.254.1.11 (acm-b) or the known IP address of the other Memory Gateway. The remaining IP address is the Memory Gateway's unknown IP address.
4. Set up the host definition for the appropriate Memory Gateway ("mg-a" or "mg-b") and the newly discovered IP address using the following commands:

```
no ip host <mg-a|mg-b> <tab>

ip host <mg-a|mg-b> <ip address>
```

Note: Pressing the Tab key after the first command auto completes the command with any existing IP address assigned to that host. If none is present, the first command is unnecessary.

5. Verify the host definition by pinging the Memory Gateway directly using its hostname:

```
ping mg-a or ping mg-b
```

6. If the Memory Gateway responds properly, save the host settings using the `write mem` command.

Determining IP Addresses of Internal Memory Gateways (Both Unknown)

If both Memory Gateway IP addresses are unknown, it is necessary to power down one Memory Gateway to properly identify which Memory Gateway is which. The following procedure powers down mg-b.

1. Make sure mg-a is powered on and mg-b is powered off by running the following commands on the ACM master node:

```
array module id mg-a enable  
  
no array module id mg-b enable
```

2. Issue the following command and then verify that mg-a is drawing current (>0) and mg-b is not:

```
show array module type mg detail
```

3. Perform a broadcast ping to 169.254.255.255 from the ACM CLI, for example:

```
violin-acma [violin: master] # ping -b -w1 169.254.255.255  
WARNING: pinging broadcast address  
PING 169.254.255.255 (169.254.255.255) 56(84) bytes of data.  
64 bytes from 169.254.1.10: icmp_seq=1 ttl=64 time=0.061 ms  
64 bytes from 169.254.1.11: icmp_seq=1 ttl=64 time=0.102 ms (DUP!)  
64 bytes from 169.254.42.198: icmp_seq=1 ttl=64 time=0.115 ms (DUP!)  
64 bytes from 169.254.1.10: icmp_seq=2 ttl=64 time=0.036 ms  
64 bytes from 169.254.1.11: icmp_seq=2 ttl=64 time=0.058 ms (DUP!)  
64 bytes from 169.254.42.198: icmp_seq=2 ttl=64 time=0.099 ms (DUP!)
```

4. Examine the output of the above command and determine the IP address that is neither 169.254.1.10 (acm-a) nor 169.254.1.11. The remaining IP address is the address for mg-a.
5. Set up the host definition for mg-a using the following commands:

```
no ip host mg-a <tab>  
  
ip host mg-a <ip address>
```

Note: Pressing the Tab key after the first command will auto-complete the command with any existing IP address assigned to that host. If none is present, the first command is unnecessary.

6. Verify the host definition by pinging mg-a directly using its hostname:

```
ping mg-a
```

7. Power on mg-b as follows:

```
array module id mg-b enable
```

8. Wait 1-2 minutes for mg-b to boot up completely. Once booted, repeat steps 2-5 above to determine the IP address of mg-b. In this case, when looking at the output of the ping command, mg-b's address will be the address that is not 169.254.1.10, 169.254.1.11 or the previously-discovered mg-a address.
9. Save the host definitions by running the `write mem` command.

Error Messages When Logging in to Memory Gateways

Complete the steps below if the following warning messages display:

- "WARNING: POSSIBLE DNS SPOOFING DETECTED!"
or
- "WARNING: REMOTE HOST IDENTIFICATION HAS CHANGED!"

These steps allow you to log in to the Memory Gateways from either ACM.

1. Log in to the ACM Master.
2. Type the following at the command prompt to access the CLI's configuration mode:

```
violin-acma [violin: master] > enable
violin-acma [violin: master] # configure terminal
```

3. Type the following commands:

```
(config) # ssh client user admin known-host mg-a remove
(config) # ssh client user admin known-host mg-b remove
(config) # ssh client user admin known-host 169.254.1.101 remove
(config) # ssh client user admin known-host 169.254.1.102 remove
```

Next Steps

Depending on how you connected the Memory Array, see the following sections to complete the system configuration:

- See "vSHARE Management" in the *Violin 6000 Series Memory Array User's Guide* to configure the Memory Array to support block storage.
- See "Violin Drivers" in the *Violin 6000 Series Memory Array User's Guide* if you connected the Memory Array directly to a host machine using PCIe cables. You must install a driver to enable a host machine to access block storage on the Memory Array.
- See [InfiniBand Client Configuration](#) on page 51 if the Memory Array is connected to the client network using InfiniBand cables.
- See [Multipath Configuration](#) on page 55 for examples of client-side multipath configurations.

APPENDIX A InfiniBand Client Configuration

This appendix covers the following topics:

- [Process Overview](#) on page 51
 - [HCA Drivers](#) on page 52
 - [InfiniBand Client Setup](#) on page 52
 - [InfiniBand Gateway Setup](#) on page 54
-

Note: The examples in this appendix are guidelines only. Consult your operating system (OS) environment user manuals for explicit instructions regarding the discovery of IB target LUNs.

See [InfiniBand Adapter Card Specifications](#) on page 64 for information about the InfiniBand card installed in the Violin Memory Array. Consult the documentation that is provided for the card for the most up-to-date information about the procedures described in this appendix.

Process Overview

Establishing InfiniBand initiators for use with the Violin Memory Gateway follows this process:

1. Download the HCA driver suitable for your installation.
2. Install the driver and discover the target, as described in [InfiniBand Client Setup](#) on page 52.
3. Verify the link status of the IB ports for the Violin Memory Gateway, as described in [InfiniBand Gateway Setup](#) on page 54.

HCA Drivers

Mellanox and Qlogic offer a full set of protocol software and drivers for major all operating systems and vendors.

The examples in this appendix utilize the Mellanox driver for Linux. You should follow similar steps when installing Qlogic HCAs.

For Mellanox drivers, you can go to the company Web site and download the driver suitable for your installation: <http://www.mellanox.com>.

InfiniBand Client Setup

This section covers client setup for Linux and covers the following topics:

- [Client Initiator Support](#) on page 52
- [Installing the ISO Image](#) on page 52
- [Using ibstat](#) on page 53
- [Manually Discovering an SRP Target](#) on page 53

Client Initiator Support

While this appendix focuses on Linux examples, the following is a complete list of supported client initiators in this release:

- Linux: SLES, RHEL with stock kernel InfiniBand support and/or OFED release from Open Fabrics Alliances
- VMware: ESXi 4/4.1 SRP initiator support for HCA vendor, e.g. Mellanox
- Windows: Support is provide by WinOFED from Open Fabrics Alliances

Installing the ISO Image

Mellanox provides prebuilt binaries for all recent Linux client distributions. Mellanox OpenFabrics Enterprise Distribution (OFED) is delivered as an ISO image.

Note: Even though a Mellanox HCA is used in this example, Qlogic HCAs are also supported.

The ISO image contains both source code and binary RPMs for selected Linux distributions, as well as the installation script: `mlnxofedinstall`.

Mount the iso image file and execute `./mlnxofedinstall`.

For example:

```
mount -o rw,loop/work/MLNX_OFED_LINUX-1.4-sles10_sp1_sp2.iso /mnt
cd /mnt
./mlnxofedinstall
```


Using ibstat

After the system boots up, use the `ibstat` command to make sure the following are loaded: `mlx4_core`, `mlx4_ib`, `ib_core`, `ib_cm`, `ib_sa`, and `ib_srp`.

The `ibstat` command displays basic information obtained from the local IB driver. Normal output includes Firmware version, GUIDS, LID, SMLID, port state, link width active, and port physical state. The command has options to list CAs and/or Ports.

The following example shows output from the `ibstat` command.

```
[root@lab-ib-cn5 ~]# lsmod | grep mlx
mlx4_ib                110140  0
ib_mad                 72100   4 ib_cm,ib_sa,ib_umad,mlx4_ib
ib_core               109440  12
rdma_ucm,ib_srp,ib_sdp,rdma_cm,iw_cm,ib_ipoib,ib_cm,ib_sa,ib_uverbs,ib_umad,mlx4_ib,ib_m
ad
mlx4_en               113164  0
mlx4_core             150600  2 mlx4_ib,mlx4_en

[root@lab-ib-cn5 ~]# ibstat
CA 'mlx4_0'
  CA type: MT26428
  Number of ports: 2
  Firmware version: 2.9.1000
  Hardware version: b0
  Node GUID: 0x0002c903004e759c
  System image GUID: 0x0002c903004e759f
  Port 1:
    State: Active      <===== IB link is up
    Physical state: LinkUp
    Rate: 40
    Base lid: 13
    LMC: 0
    SM lid: 2
    Capability mask: 0x02590868
    Port GUID: 0x0002c903004e759d
    Link layer: InfiniBand
  Port 2:
    State: Active      <===== IB link is up
    Physical state: LinkUp
    Rate: 40
    Base lid: 14
    LMC: 0
    SM lid: 2
    Capability mask: 0x02590868
    Port GUID: 0x0002c903004e759e
    Link layer: InfiniBand
```

Manually Discovering an SRP Target

To discover the SRP target manually, log in to the client and enter the following command:

```
ibsrpdm -c
```

The output is line item of each target port of SRP target. Pick the line with the dgid matching your target GUID and then echo it to the `/sys/class/infiniband_srp/srp-mlx4_0-1/add_target`.

InfiniBand Gateway Setup

You can verify the link status of the IB ports for the Violin Memory Gateway. To do so, open a Linux shell window and enter the `ibstatus` command, as shown in the following example.

```
my-ib-srv2 [my-ib-cluster1: master] (config) # ibstatus

Infiniband device 'mlx4_0' port 1 status:
  default gid: fe80:0000:0000:0000:0002:c903:004e:6ddd
  base lid: 0x6
  sm lid:      0x2
  state:       4: ACTIVE
  phys state:  5: LinkUp
  rate:        40 Gb/sec (4X QDR)
  link_layer:  InfiniBand

Infiniband device 'mlx4_0' port 2 status:
  default gid: fe80:0000:0000:0000:0002:c903:004e:6dde
  base lid: 0x0
  sm lid:      0x0
  state:       1: DOWN
  phys state:  2: Polling
  rate:        70 Gb/sec (4X)
  link_layer:  InfiniBand

Infiniband device 'mlx4_1' port 1 status:
  default gid: fe80:0000:0000:0000:0002:c903:004e:719d
  base lid: 0x5
  sm lid:      0x2
  state:       4: ACTIVE
  phys state:  5: LinkUp
  rate:        40 Gb/sec (4X QDR)
  link_layer:  InfiniBand

Infiniband device 'mlx4_1' port 2 status:
  default gid: fe80:0000:0000:0000:0002:c903:004e:719e
  base lid: 0x0
  sm lid:      0x0
  state:       1: DOWN
  phys state:  2: Polling
  rate:        70 Gb/sec (4X)
  link_layer:  InfiniBand
```

APPENDIX B Multipath Configuration

This appendix provides examples of client-side multipath setup for a Violin Memory Gateway. The following topics are covered:

- [Multipath Overview](#) on page 55
- [Multipath Setup](#) on page 56

Note: The examples in this appendix are guidelines for (client-side) Red Hat Enterprise Linux 6 DM Multipath. For more information, see to the Red Hat Web site.

Multipath Overview

Multipath I/O is commonly used when there is more than one physical path between the system CPU and the storage devices. The redundant paths are leveraged to increase performance and fault-tolerance.

Device Mapper Multipath (DM Multipath, Red Hat Enterprise Linux) is the multipathing utility used in the example presented in this appendix. DM Multipath is a generic framework that maps each physical path to a SCSI device represented as a separate `/dev` entry in a form of a block device. DM Multipath provides means of combining multiple such block devices into a single block device. DM Multipath uses Device Mapper kernel framework for mapping IOs between individual paths and user-space daemon `multipathd` for providing configuration and policy for the mapped device.

To determine which devices (and paths) correspond to a particular LUN, DM Multipath initiates a query. The response to the query returns the LUN serial number (among other information). The serial number for a LUN remains the same, regardless of the number paths that are associated with the LUN. Using the LUN serial number, DM Multipath can determine how many paths are associated with that particular LUN. The mechanism for getting the serial number is controlled by the `getuid_callout` parameter, described in the next section.

Multipath Setup

This section covers setting up and configuring DM Multipath on the client side for use with Violin Memory Gateway provided LUNs.

Prerequisites

Before you begin setting up DM Multipath, do the following:

1. Verify that the `device-mapper-multipath` rpm is installed, as shown in the following example.

```
[root@redhat123 ~]# rpm -qa | grep multipath
device-mapper-multipath-0.4.7-23.el5_3.1
```

Note: The name of the package and the version shown may vary depending on your Linux distribution and version.

2. Make a copy of the original `multipath.conf` file. This ensures that you have the original file as backup, should an unexpected problem arise.

```
cp multipath.conf multipath.conf.bak
```

Note: The multipath package includes a file showing the default values that you can also use as a customization template, as well as a couple of other helpful files. Go to the `/usr/share/doc/device-mapper-multipath-0.4.7/` directory to access these files:

- `multipath.conf.defaults`
- `multipath.conf.annotated`
- `multipath.conf.synthetic`

Also see the man page for details on the available `multipath.conf` options.

```
man multipath.conf
```

Setting Up DM Multipath

This section shows you how to edit the `multipath.conf` file (the configuration file for `multipathd`) then configure the multipath daemon to start when the system boots up. DM Multipath default settings are suitable for common multipath configurations.

Setting up DM Multipath includes the following tasks:

1. [Editing the multipath.conf File](#) on page 57
2. [Configuring the Multipath Daemon](#) on page 59

Editing the multipath.conf File

This section presents the recommended configuration file for `multipathd` for use with a Violin Memory Gateway. The following is an example `multipath.conf` file for CentOS/RHEL 6.x for both ALUA and non-ALUA LUNs. Contact Violin Memory Customer Support for assistance with other supported distributions.

1. Edit the `multipath.conf` file, uncommenting entries, similar to the following example. The `devnode_blacklist` includes devices for which you do not want multipathing enabled.

```

# Blacklist all devices by default. Remove this to enable multipathing
# on the default devices.
blacklist {
    devnode "*"
}

blacklist_exceptions {
    devnode "sd*"
}

# Use user friendly names, instead of using WWIDs as names.
defaults {
    user_friendly_names yes
}

devices {
    device {
        vendor                "VIOLIN"
        product                "SAN ARRAY ALUA"
        path_grouping_policy   group_by_prio
        getuid_callout         "/sbin/scsi_id --whitelisted --replace-
whitespace --page=0x80 --device=/dev/%n"
        prio                   alua
        path_checker           tur
        path_selector          "round-robin 0"
        hardware_handler       "1 alua"
        failback               immediate
        rr_weight              uniform
        no_path_retry          fail
        rr_min_io_rq           4
    }

    device {
        vendor                "VIOLIN"
        product                "SAN ARRAY"
        path_grouping_policy   group_by_serial
        getuid_callout         "/sbin/scsi_id --whitelisted --replace-whitespace
--page=0x83 --device=/dev/%n"
        path_checker           tur
        path_selector          "round-robin 0"
        hardware_handler       "0"
        failback               immediate
        rr_weight              uniform
        no_path_retry          fail
        rr_min_io_rq           4
    }
}

```

In the above example, support for Violin SAN Array devices was added. When configuring this file, pay particular attention to the following for a non-ALUA LUN:

- `path_grouping_policy` should be set to `group_by_serial`
- `getuid_callout` should be set
- `path_checker` should be `tur (TEST_UNIT_READY)`
- `failback` should be `immediate`
- `rr_weight` should be `uniform` since weights are not assigned to the individual paths
- `no_path_retry` should be set `failt` to immediately bring path back online
- `rr_min_io` should be set to 4, but can be subject to change depending on the environment and workload.

For ALUA LUNs, pay particular attention to the following:

- `path_grouping_policy` should be set to `group_by_prio`
 - `prio` should be set to `alua`
 - `hardware_handler` should be set to `1 alua`
2. Save the `multipath.conf` file and proceed with [Configuring the Multipath Daemon](#) on page 59.

Configuring the Multipath Daemon

This section demonstrates how to configure the multipath daemon (`multipathd`) so that it starts when the system boots up.

1. Use the `chkconfig` command to add (-a) to the multipath daemon (`multipathd`) as a service.
2. Restart the multipath service, using the `service restart` command.
3. Verify that the multipath service is running, using the `multipath -ll` command.

The following example demonstrates these steps for a single ALUA LUN that is accessible through two Fibre Channel (FC) ports that are multipathed into a single multipath device (`/dev/mapper/mpath1`).

```
# chkconfig -a multipathd
# service multipathd restart
# multipath -ll
mpathav (SVIOLIN_SAN_ARRAY_ALUA_5EA81A7F53121185) dm-11 VIOLIN,SAN
ARRAY ALUA
size=1000G features='0' hwhandler='1 alua' wp=rw
| +- policy='round-robin 0' prio=50 status=active
|  ~ 5:0:0:9 sds 65:32 active ready running
~ +- policy='round-robin 0' prio=10 status=enabled
   ~ 7:0:0:9 sdt 65:48 active ready running
```


System Specifications

This section contains specifications for the following:

- [Memory Array System Specifications](#) on page 62
- [Fibre Channel Adapter Card Specifications](#) on page 63
- [InfiniBand Adapter Card Specifications](#) on page 64
- [PCIe Host Adapter Card Specifications](#) on page 64
- [Ethernet/iSCSI Adapter Card Specifications](#) on page 65

Memory Array System Specifications

The table below lists the system specifications for all Violin 6000 Series Memory Array models. See <http://www.violin-memory.com> for the most up-to-date specifications.

| Series | 6600 | | | 6200 | | |
|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------|--------------|-------------|--------------|
| Model | 6606 | 6611 | 6616 | 6212 | 6222 | 6232 |
| Flash Type | SLC | | | MLC | | |
| Raw Capacity (GiB/GB) | 6TB/6.6TB | 11TB/12.1TB | 16TB/17.6TB | 12TB/13.2TB | 22TB/24.2TB | 32TB/35.2TB |
| VIMM Count (Data + Hot Spare) | 20 + 4 | 40 + 4 | 60 + 4 | 20 + 4 | 40.4 | 60 + 4 |
| Reliability/Resiliency | System Level Hardware Based vRAID 4 vRAID Controller Modules 2 Array Controller Modules 2 Memory Gateways Automated Failover & Failback | | | | | |
| Connectivity Options | 8x 4/8Gb/s Fibre Channel 8x 10GbE iSCSI 8x 40Gb/s QDR InfiniBand 4x PCIe Gen2 x8 | | | | | |
| Dimensions Height: Width: Depth: Cable Management: | 5.25" (3RU/134 mm) 17.5" / 420 mm 27" / 700 mm 6" / 153 mm | | | | | |
| Minimum Rear Clearance | 7" (178 mm) | | | | | |
| Weight | 76lbs/34.5kg | | 89lbs/40.4kg | 76lbs/34.5kg | | 89lbs/40.4kg |
| Power* | 1119W | | 1693W | 1355W | | 1723W |
| Cooling | 3822 BTU/hr | | 5780 BTU/hr | 4626 BTU/hr | | 5884 BTU/hr |
| Environmental Inlet Temp: Humidity: Altitude: | 0°C to 40°C 5-95% (non condensing) 10,000 feet (Derate temperature) | | | | | |
| Electrical Input Power Voltage: Operating Range: Current Rating: | 200-240 VAC 180-264 VAC 15 A maximum 2100VA max. | | | | | |
| Interfaces | RJ-45 Serial Console (2) RJ-45 10/100/1000 Ethernet (2) | | | | | |
| Management (CLI) | Serial, SSH, SNMP, Web/HTTP | | | | | |

Table G.1 Memory Array System Specifications

*Nominal power measurements for Fibre Channel configuration.

Fibre Channel Adapter Card Specifications

The following table provides basic information for the QLogic QLE2562 Host Bus Adapter. See the QLogic Web site (<http://www.qlogic.com>) for the most complete and up-to-date information.

| | |
|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fibre Channel Specifications Negotiation: IOPS: Class of service: Topology: Protocols: | 8/4/2Gbps auto-negotiation 200,000 initiator and target IOPS per port 2 and 3 FC-AL, FC-AL2, point-to-point, switched fabric FCP-3-SCSI FC-Tape (FCP-2) |
| PCIe Express Interface Compliance: Physical and Electrical: | PCIe Express Base Specification rev. 2.0 PCIe Express Card Electromechanical Specification rev. 2.0 PCIe Bus Power Management Interface Specification rev. 1.2 PCI Hot Plug Specification rev. 1.0 PCIe x8 physical connector StarPoint link training: - Maximum x4 lanes for Gen2 rate - Maximum x8 lanes for Gen1 rate |
| Connectivity Ports: | Dual 8Gbps Fibre Channel SFP+ with LC-style connector |
| HBA Specifications Airflow: Power consumption: Form factor: Temperature: Relative Humidity: RoHS compliance: | No airflow required 6.2 Watts (typical) Low-profile PCI Express card (6.6 in. x 2.54 in.) 0 to 55°C (operating) -40 to 70°C (non-operating) 10% to 90% (operating, non-condensing) 5% to 93% (non-operating, non-condensing) RoHS 6 |

Table G.2 Fibre Channel HBA Specifications

The following table is a description of the LED states of the QLogic QLE2562 Host Bus Adapter. See the QLogic Web site (<http://www.qlogic.com>) for the most complete and up-to-date information.

| Yellow (8Gbps) | Green (4Gbps) | Orange (2Gbps) | Description |
|------------------------------------------------|---------------|----------------|-------------------------------------------|
| Off | Off | Off | Power off |
| On | On | On | Power on (before firmware initialization) |
| Flashing | Flashing | Flashing | Power on (after firmware initialization) |
| Yellow, Green and Amber flashing alternatively | | | Firmware error |
| Off | Off | On/Flashing | Online, 2Gbps link/I/O activity |
| Off | On/Flashing | Off | Online, 4Gbps link/I/O activity |
| On/Flashing | Off | Off | Online, 8Gbps link/I/O activity |

Table G.3 LED Descriptions

InfiniBand Adapter Card Specifications

The following table provides basic information for the Mellanox ConnectX®-2 VPI Single and Dual Port QSFP InfiniBand and Ethernet Adapter Card. See the Mellanox Web site (<http://www.mellanox.com>) for the most complete and up-to-date information.

| | |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| QSFP 40Gb/s Connector: | InfiniBand (Copper and optical) Max power per port 2.0 W. Cable power budget class 2. |
| Protocol Support InfiniBand: | IBTA v1.2.1, Auto-Negotiation (40Gb/s, 10Gb/s per lane), (20Gb/s, 5Gb/s per lane) or (10Gb/s, 2.5Gb/s per lane) |
| QoS: | 8 InfiniBand Virtual Lanes for each port |
| Data rate: | QDR: InfiniBand |
| Connectivity: | <ul style="list-style-type: none"> - Interoperable with IB or 10GigE switches - microGiGaCN or QSFP connectors - Passive Copper cables (Direct Attach) - External optical media adapter and active cable support - QSFP to SFP+ connectivity through QSA |

Table G.4 InfiniBand Adapter Card Specifications

PCIe Host Adapter Card Specifications

The following table provides basic information for the Dolphin Express IXH610 Adapter. See the Dolphin Web site (<http://www.dolphinics.com>) for the most complete and up-to-date information.

| | |
|---------------------------------|-----------------------------------------------------------------------------|
| Link Speeds: | 40 Gbits/s |
| Application Performance: | 0.81 microsecond latency (application to application) |
| Active Components: | IDT PES24NT6AG2 x8 Gen 2 PCI Express Chip |
| Topologies: | Point to point, Switched |
| Cable Connections: | One x8 Standard PCI Express Copper Cables |
| Power Consumption: | 7 watts |
| Mechanical Dimensions: | PCI Express Card Electromechanical Specification 2.0 |
| Operating Environment: | Operating Temperature: 0°C-55°C Relative Humidity: 5%-95% non-condensing |

Table G.5 PCI Express Gen2 Host Adapter Specifications

Ethernet/iSCSI Adapter Card Specifications

The following table provides basic information for the Intel Ethernet X520 Adapter. See the Intel Web site (<http://www.intel.com>) for the most complete and up-to-date information.

| | |
|--------------------------------------|-------------------------------------------------------------------|
| Data rate supported per port: | Optical: 1 GbE/10 GbE Direct Attach: 10 GbE |
| Bus type: | PCI Express 2.0 (5 GT/s) |
| Bus width: | 4-lane PCI Express and 8-lane PCI Express |
| Interrupt levels: | INTA, MSI, MSI-X |
| Operating temperature: | 0°C-55°C (32°F-131°F) |
| Connectors: | One or two LC fiber-optic connectors SFP+ direct attach cables |
| Physical dimensions: | Low-profile PCI Express: 5.73 inches long (without PCI bracket) |

Table G.6 iSCSI Adapter Specifications

Compliance Information

This section contains the following compliance information for the Violin 6000 Series Memory Array.

- [FCC Class A Compliance](#) on page 68
- [Regulatory Model Number](#) on page 68
- [Electrostatic Discharge \(ESD\) Precautions](#) on page 69
- [Lithium Battery Caution](#) on page 69
- [Cabinet Safety Precautions](#) on page 69
- [Disposal of Waste Equipment by Users in Private Households in the European Union](#) on page 70
- [Perchlorate Material - Special Handling May Apply](#) on page 70
- [European Union RFI Statement](#) on page 70
- [USA Radio Frequency Interference FCC Notice](#) on page 70
- [Japan Radio Frequency Interference VCCI](#) on page 71
- [Korea RFI Statement](#) on page 71
- [Canada RFI Statement](#) on page 71
- [CISPR 22](#) on page 71
- [Australia C-Tick Label](#) on page 71
- [Taiwan BSMI Statement](#) on page 71
- [Four-in-One Recycling Symbol](#) on page 72
- [Product Information for People's Republic of China](#) on page 72

FCC Class A Compliance

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case, you are required to correct the interference at your own expense.

Regulatory Information

For your protection, this product has been tested for conformance to various national and international regulations and standards. The scope of this regulatory testing includes electrical and mechanical safety, electromagnetic emissions, immunity, acoustics and hazardous materials.

Regulatory Model Number

For the purpose of regulatory compliance certifications and identification, this product is assigned a Violin Memory regulatory model number. This number can be found on the product label, along with the required approval markings and information. When requesting certification information for this product, always refer to this regulatory model number.

Note: Do not confuse the regulatory model number with the marketing or model number.

Installation Conditions

See installation instructions before connecting this equipment to the input supply.

WARNING! The equipment must be provided with a proper AC protective earth (PE) ground connection.

Network Connected Equipment

WARNING! The installation must provide a ground connection for the network equipment.

Electrostatic Discharge (ESD) Precautions

When handling any electronic component or assembly, you must observe the following antistatic precautions to prevent damage. An ESD kit (P/N A3024-80004) is available (or supplied with memory additions). This kit contains one wrist strap, one conductive sheet, and one antistatic foam pad.

- Always disconnect power from the server and wear a grounded wrist strap when working around the server.
- Always wear a grounded wrist strap when handling printed circuit boards.
- Treat all assemblies, components and interface connections as static-sensitive.
- Avoid working in carpeted areas, and keep body movement to a minimum while removing or installing boards, to minimize buildup of static charge.

Lithium Battery Caution

WARNING! Observe the correct polarity when changing the lithium battery. There is a danger of explosion if battery is installed incorrectly.

Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions and local disposal requirements.

Note: Switzerland: Annex 4.10 of SR 814.013 applies to batteries.

Cabinet Safety Precautions

WARNING! Cabinets are heavy even when empty. Exercise caution when moving cabinets whether equipment is installed in the cabinet or not. Avoid rolling cabinets on rough or uneven surfaces or inclines greater than 10 degrees. Unloading cabinets from the pallet and movement of cabinets should be performed by at least two people.

Slidable products are not to be extended from the cabinet while the equipment is on the shipping pallet. The cabinet must be unloaded from the pallet and all anti-tip devices properly installed prior to extending any slidable product.

Once installed, all anti-tip devices must remain in place to maintain stability. Only one slidable product must be extended at a time.

Failure to follow these precautions can result in damage to equipment or injury to personnel.

Disposal of Waste Equipment by Users in Private Households in the European Union



This symbol on the product or on its packaging indicates that this product must not be disposed of with your other household waste. Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or the shop where you purchased the product.

Perchlorate Material - Special Handling May Apply

See <http://www.dtsc.ca.gov/hazardouswaste/perchlorate>.

This product may include a real-time clock battery or coin cell battery that may contain perchlorate and may require special handling when recycled or disposed of in California. Refer to the product user documentation to determine if this product contains batteries, and if so, the battery type(s) that are used.

European Union RFI Statement

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

USA Radio Frequency Interference FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

The user is cautioned that changes or modifications not expressly approved by Violin Memory could result in the equipment being noncompliant with FCC Class A requirements and void the user's authority to operate the equipment.

Japan Radio Frequency Interference VCCI

VCCI クラス A EMI コンプライアンス宣言

これは、自主規制協議会の干渉を情報技術機器 (VCCI) 基準クラス A の製品です。
この機器は、国内の環境で使用される場合は、無線障害の原因があります。
そのようなトラブルが発生した場合は、ユーザーは是正措置をする必要があります

Korea RFI Statement

A급 기기 이 기기는 업무용으로 전자파 적합 등록을 한 기기이
오니 판매자 또는 사용자는 이 점을 주의하시기 바라며 만약
잘못 판매 또는 구입하였을 때에는 가정용으로 교환하시기 바랍니다.

Canada RFI Statement

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

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

CISPR 22

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

Australia C-Tick Label



N136

Taiwan BSMI Statement

警告使用者：

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

Four-in-One Recycling Symbol



Product Information for People’s Republic of China

V-6000 Series

Violin Memory 针对中国市场的产品信息

Violin Memory Product Information for People’s Republic of China

该文件按照中国电子工业标准 SF/T11364-2006，“电子信息产品所产生污染物的标识控制”

This document provides product information as required by the People’s Republic of China Electronic Industry Standard SF/T11364-2006, *Marking for Control of Pollution Caused by Electronic Information Products*.

表格-1 列出了根据 SJ/T11363-2006 标准，Violin Memory 电子信息产品（EIPs）及其零部件所含有毒有害物质

Table 1 lists toxic or hazardous substances or elements contained in Violin Memory electronic information products (EIPs), including subassemblies, that exceed limits specified in SJ/T11363-2006.

| 部件名 Component Name | 有毒有害物质或元素 Toxic or Hazardous Substances or Elements | | | | | |
|-----------------------------------------------|--------------------------------------------------------|--------------|--------------|-----------------------------------------|--------------------------------|---------------------------------------|
| | Lead (Pb) | Mercury (Hg) | Cadmium (Cd) | Hexavalent Chromium (Cr ⁶⁺) | Polybrominated Biphenyls (PBB) | Polybrominated Diphenyl Ethers (PBDE) |
| 电子印制电路板组合 Printed Circuit Board Assemblies | O | O | O | O | O | O |
| 金属外壳 Metal Enclosure | X | O | O | O | O | O |
| 电源 Power Supply | O | O | O | O | O | O |
| 装固所用配件 Mounting Hardware | O | O | O | O | O | O |
| 电缆 Cables | O | O | O | O | O | O |
| 加紧所用配件 Fasteners | O | O | O | O | O | O |
| 電池 Battery | O | O | O | O | O | O |

O：表示该配件所含有毒有害物低于国标 SJ/11363-2006 所限标准
 O: Indicates that the toxic or hazardous substance contained in all of the homogeneous materials for this component is below the limit requirement in SJ/11363-2006
 X：表示该配件所含有毒有害物高于国标 SJ/11363-2006 所限标准
 X: Indicates that the toxic or hazardous substance contained in at least one of the homogeneous materials used for this component is above the limit requirements in SJ/T11363-2006

环保安全使用期:

Environment Friendly Use Period

以下标识数字 20 是指从生产日期开始 20 年内，在 Violin Memory 用户指南所描述的正常使用条件下，本产品所含表内列出的有毒有害物不会泄露，不会造成环境污染或人身财物损失。

The number in the marking, shown as 20 in the illustration below, refers to the EIP's environment friendly use period (EFUP). The EFUP is the number of years from the date of manufacture that toxic or hazardous substances or elements contained in EIPs will not leak or mutate under the normal operating conditions described in Violin Memory user documentation, resulting in any environmental pollution, bodily injury, or damage to assets.



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