

PS SERIES STORAGE ARRAYS QUICKSTART

PS50E to PS400E

PS Series Firmware Version 3.2



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PS Series Firmware Version 3.2

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Table of Contents

Preface	v
Introduction to PS Series Storage Arrays	1
Steps for Setting Up and Using an Array	2
Step 1. Set Up the Array Hardware Configuration	3
A. Unpack Shipping Box and Gather Required Hardware	3
B. Mount Array in a Rack	8
C. Install Disks or Blank Carriers	10
D. Connect Power Cables for Grounding	11
E. Connect Array to a Network Switch	12
F. Turn on Power to Array and Check LEDs	15
G. Connect Array to a Console Terminal	19
Step 2. Configure the Array and Create a Group	20
Step 3. Set the RAID Policy	23
Using the GUI to Set the RAID Policy	24
Using the CLI to Set the RAID Policy	27
Step 4. Create a Volume	28
Using the GUI to Create a Volume	30
Using the CLI to Create a Volume	34
Step 5. Connect to the Volume from a Host System	35
Advanced Operations and More Information	36
Index	39

Preface

This *QuickStart* describes how to set up EqualLogic PS Series model 50E to 400E storage array hardware and create a PS Series group—a self-managing, storage area network (SAN) that is affordable and easy to use, regardless of scale.

After setting up the group, see the PS Series *Group Administration* manual for information about managing the group.

Note: For model 50E to 400E storage arrays, PS Series Firmware Version 2.2 and higher firmware versions support the Type II control module, which can be identified by a blue face plate and single serial port. The figures in this *QuickStart* show arrays installed with the Type II control module.

However—unless otherwise noted—the information in this *QuickStart* also applies to the functionally equivalent Type I control module, which can be identified by a dark gray face plate and two serial ports.

Do *not* mix different control module types in an array. However, a PS Series group can include arrays with Type II control modules and arrays with Type I control modules, if all the arrays are running compatible firmware, as described in the PS Series *Release Notes*.

Audience

This *QuickStart* is designed for administrators responsible for setting up PS Series 50E to 400E storage array hardware and creating a group. Although administrators do not need extensive network or storage system experience, it may be useful to understand:

- Basic networking concepts
- Current network environment
- User disk storage requirements
- RAID configurations
- Disk storage management

Note: This *QuickStart* describes using PS Series arrays in some common network configurations. However, detailed information about setting up a network is beyond its scope.

Organization

This *QuickStart* is organized as follows:

- *Introduction to PS Series Storage Arrays*
- *Steps for Setting Up and Using an Array*
 - Step 1. Set Up the Array Hardware Configuration*
 - Step 2. Configure the Array and Create a Group*
 - Step 3. Set the RAID Policy*
 - Step 4. Create a Volume*
 - Step 5. Connect to the Volume from a Host System*
- *Advanced Operations and More Information*

EqualLogic Website

The EqualLogic website (www.equallogic.com) has the latest product firmware and documentation, in addition to warranty information.

Product Documentation and Technical Support

For detailed information about PS Series storage arrays, groups, and volumes, see the following documentation:

- *Release Notes*. Provides the latest information about PS Series storage arrays.
- *QuickStart*. Describes how to set up the storage array hardware and create a PS Series group. Be sure to use the manual for your array model.
- *Group Administration*. Describes how to use the Group Manager graphical user interface (GUI) to manage a PS Series group. This manual provides comprehensive information about product concepts and procedures.
- *CLI Reference*. Describes how to use the Group Manager command line interface (CLI) to manage a PS Series group and individual arrays.
- *Hardware Maintenance*. Provides information about maintaining the storage array hardware. Be sure to use the manual for your array model.
- *Online help*. In the GUI, expand **TOOLS** in the far left panel and then click **Online Help** for help on both the GUI and the CLI. See *Obtaining Online Help* on page 2-16.

The *QuickStart* and *Hardware Maintenance* manuals are printed and shipped with the product. They are also located on the PS Series documentation CD-ROM that is shipped with the product, along with the *Group Administration* and *CLI Reference* manuals and the Group Manager online help.

In addition, the Host Integration Tools for Microsoft® Windows® systems are available on the Host Integration Tools CD-ROM that is shipped with the product.

Technical support on EqualLogic products is available for customers with arrays under warranty and customers with a valid support contract. To obtain support:

- Visit the EqualLogic Customer Support website to download the latest documentation and firmware. Go to www.equallogic.com and log in to your support account. If you do not have an account, register for an account.
- From the Customer Support website, you can submit a service request.
- In the United States, call toll-free 877-887-7337. Outside the United States, call +00 1 919-767-5729. If the issue is urgent, ask to speak with a member of the EqualLogic Customer Support team.

Online Help

Click `Tools` in the bottom left corner of the Group Manager graphical user interface (GUI) to expand the menu. Then, click on `Online Help` for help on both the GUI and the CLI.

The Group Manager CLI provides help at the command line. In addition, the `setup` utility provides help for each prompt.

Warranty Information

The license agreement and warranty information are included in the PS Series array shipping box. To register your array, go to www.equallogic.com, click `Support`, and then click `warranty registration`.

Restricted Access Requirement

PS Series arrays must be installed in a restricted access location. A restricted access location is an area that is intended only for qualified or trained personnel.

Introduction to PS Series Storage Arrays

EqualLogic PS Series storage arrays deliver the benefits of consolidated storage in a storage area network (SAN) that is affordable and easy to use—regardless of its size. With intelligent, automated management and fast, flexible scalability, PS Series arrays greatly reduce storage acquisition and management costs.

By grouping together one or more PS Series arrays connected to an IP network, you can create a **PS Series group**—a highly-scalable iSCSI SAN with a shared pool of storage space. Integrated virtualization software makes a group easy to manage and provides automatic RAID configuration, data provisioning, and load balancing. To increase SAN capacity and performance, connect another array to the network and add it to the group—data remains online at all times.

To ensure high reliability, PS Series storage arrays include RAID-protected disks, automatic disk sparing, redundant fans and power supplies, and dual high-performance control modules, each with three Gigabit Ethernet interfaces and a battery-backed cache.

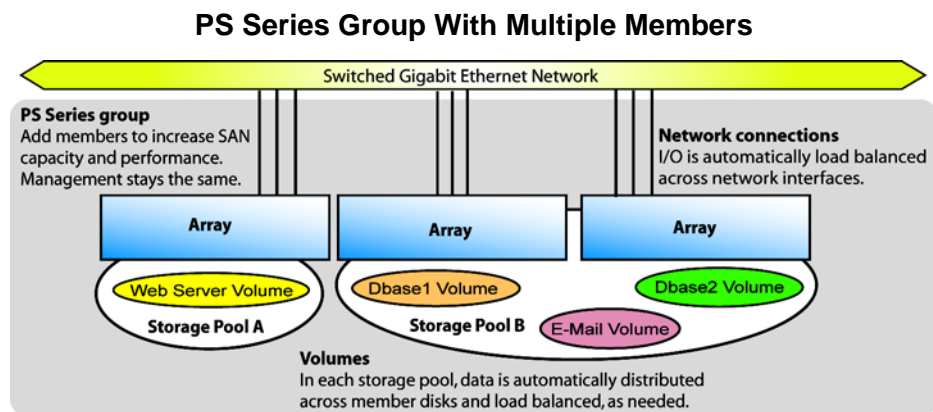
A simple setup utility lets you quickly configure an array as a **member** of a new or existing group. RAID configuration and load balancing (network and data) occur automatically. Both graphical and command line user interfaces are available for group management.

In a multi-member group, you can separate space into **storage pools**, which allow you to organize storage according to usage, providing more control over resource allocation, while maintaining a single system management view.

Using the Group Manager graphical or command line user interface, you create **volumes**, assigning to each volume a pool, size, access controls, and other attributes. A volume can be spread across multiple disks and group members and is seen on the network as an **iSCSI target**. Members and volumes can move between pools to meet business objectives.

To connect to a volume, a host needs only a standards-compliant **iSCSI initiator**. Volume access can be restricted through IP address, initiator name, or CHAP (Challenge Handshake Authentication Protocol) credentials. Once connected, the volume is seen by the host as a regular disk that can be formatted as usual.

At a minimum, a group consists of one array with one network connection, but you can configure three network interfaces for maximum array bandwidth. Data and network I/O are automatically load balanced across disks and interfaces—with no impact on data availability.



You can easily increase group capacity and bandwidth by adding arrays. When an array is added to a group, it obtains the group configuration from the existing members. Once you choose a RAID policy for the member, the pool is automatically expanded, and volume data and network I/O are load balanced across the pool members' disks and network connections. Volumes continue to be accessible through the same iSCSI targets, and no host modifications are necessary. Management overhead remains the same, regardless of the group size.

Steps for Setting Up and Using an Array

To start using your PS Series array:

- Step 1.** Set up the array hardware configuration.
- Step 2.** Configure the array on the network and create a group.
- Step 3.** Log in to the group and set the RAID policy for the array.
- Step 4.** Create a volume.
- Step 5.** Connect to the volume from a host system.

Step 1. Set Up the Array Hardware Configuration

A. Unpack Shipping Box and Gather Required Hardware

The order in which you unpack the shipping box is important for safety:

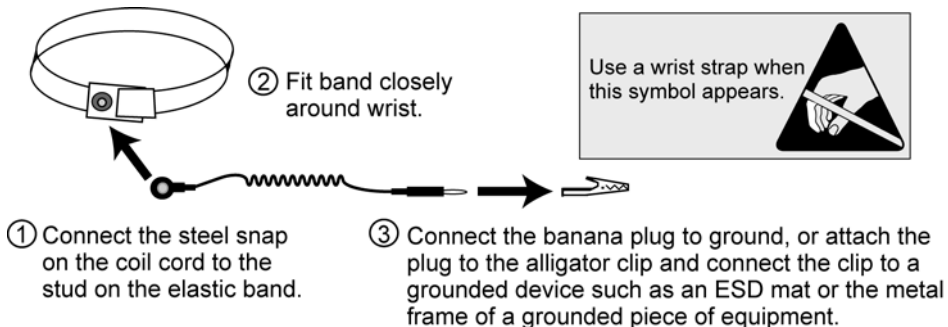
1. Open the outer shipping box, remove the inner carton containing the array chassis, and place it on a secure, stable surface.



The array chassis is *heavy*. Do not attempt to lift or install the array without assistance.

2. Remove the accessories, including the electrostatic wrist strap.
3. Attach the wrist strap to your wrist and a grounded device, as shown in the figure below, to protect the array from electrostatic discharge. Use the wrist strap when the ESD symbol appears in the documentation.

Using an Electrostatic Wrist Strap



4. Open the chassis carton and remove the foam caps.
5. Remove the shelf assembly kit rails. The rails are *not* connected to the chassis.
6. Remove the chassis from the carton when you are ready to install it in a rack.

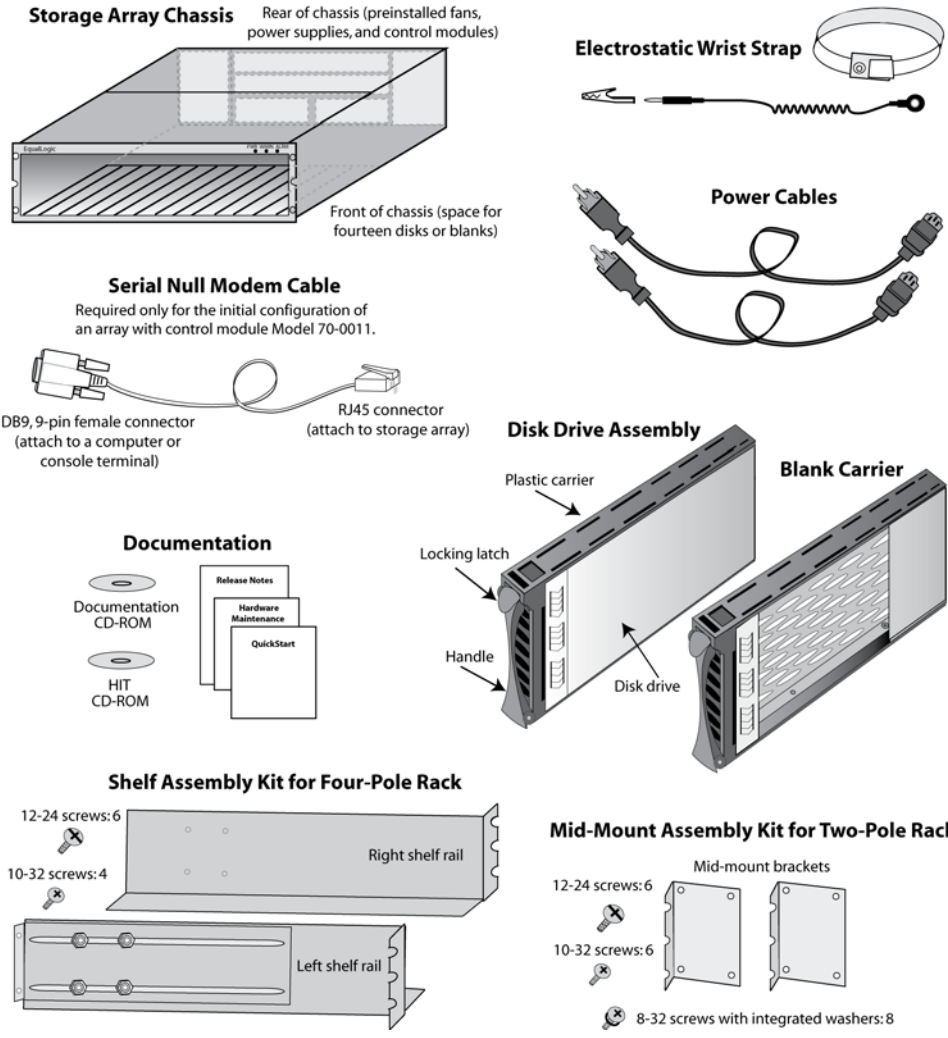
Notes: Disk drives are shipped in two cartons located under the chassis box. *Do not* remove a disk drive from its foam insert until the chassis is installed in a rack in its final location and you are ready to insert the disk.

Product returns will be accepted only in the original packaging or in authorized packaging obtained from your PS Series support provider.

Ensure that the shipping box includes all the components required for installation, as shown in the following figure and described in the table *Storage Array Shipping Box Contents*.

In addition, the array installation requires the hardware described in the table *Required Hardware – Not Supplied*. This hardware is not provided with the array.

Storage Array Shipping Box



Storage Array Shipping Box Contents

Component	Description
Storage array chassis	The 3U unit contains one or two control modules, two power supplies, two fan trays, and slots for up to 14 disks.
Seven or fourteen disk drives or blank carriers	A disk drive or blank carrier must be installed in each array disk slot. Only disks from EqualLogic are supported. The size of the smallest disk in the array limits the amount of space each disk contributes to the array. That is, if the smallest disk is 250 GB, only 250 GB of each disk is available for use.
Power cables	Connects an array to one or more power sources. The shipping box may contain multiple power cables to meet the electrical requirements of the country in which the array will reside. Caution: Be sure to use only these enclosed power cables with only this product.
Serial null modem cable	Creates a serial connection between an array with Type II control modules and a console or terminal emulator. A serial connection is used only to complete the initial member and group configuration or if there is no network connection to the array. The null modem cable has one RJ45 connector and one DB9, 9-pin, female connector. Note: Type I control modules require a Micro-D serial adapter cable and a null modem cable with two 9-pin female connectors for a serial connection. These cables are shipped with arrays installed with Type I control modules.
Mid-mount assembly kit	Enables you to install an array in a two-pole rack. Includes two mid-mount brackets and eight 8-32 screws with integrated washers to attach the brackets to the array. Also includes six 12-24 and six 10-32 screws to attach the array to the poles. Use the screw type that is right for your rack poles.
Shelf assembly kit	Enables you to install an array in a four-pole rack. Includes two shelf brackets (each with a slider attached with four lock nuts), four 10-32 screws to attach the array to the back poles, and six 12-24 screws to attach the array to the front poles.
Electrostatic wrist strap	Protects sensitive hardware from electrical discharge.

Storage Array Shipping Box Contents (Continued)

Component	Description
Documentation and CD-ROMs	<p>Printed documentation includes the PS Series <i>QuickStart</i>, <i>Hardware Maintenance</i>, <i>Release Notes</i>, and SAN setup poster.</p> <p>The <i>Group Administration</i> and <i>CLI Reference</i> manuals and the Group Manager online help are on the documentation CD-ROM, along with the <i>QuickStart</i> and <i>Hardware Maintenance</i> manuals.</p> <p>Host Integration Tools for Microsoft® Windows® systems and related documentation are on the HIT CD-ROM.</p> <p>License and warranty information is also included in the shipping box.</p>

Required Hardware – Not Supplied

Component	Description
Standard 19" two or four-pole rack	Provides easy access to storage arrays and other hardware in your computing environment.
One or more network cables	<p>Connects an array to a network switch. Only one network connection is required for operation, but as many as six connections are possible on a dual control module array. Four are recommended. You can use a combination of copper and optical network connections.</p> <p>For copper-based networks, use Category 5E or Category 6 cables with RJ45 connectors. You can also use Category 5 cables if they adhere to the TIA/EIA TSB95 standard.</p> <p>For fiber optic networks, use cables with LC connectors. Fiber optic networks also require small form factor pluggable (SFP) connectors, which can be obtained from EqualLogic.</p>
Network switch	Connects devices to a network. If possible, connect the array to different switches for high availability.
Computer or a console terminal	Enables you to perform the initial array and group configuration or manage the group when there is no active network connection. A computer must be running a terminal emulator.

The following table describes the optional hardware that you can use in a storage array installation. This hardware is not provided with your array.

Optional Hardware – Not Supplied

Component	Description
One or two UPS systems	Provide a highly available source of power to an array. Each UPS system should be on a different circuit and must provide the correct type of voltage for an adequate amount of time.
Cage nuts	Enable you to mount an array in a rack with square holes.

The environmental, power, and physical requirements for PS Series 50E to 400E storage arrays are described in the following table.

Storage Array Requirements

Component	Requirement
Weight of fully-loaded array (14 disks and two control modules)	92 pounds or 41.82 kilograms
Operating temperature	41 to 104 degrees F / 5 to 40 degrees C
Storage temperature	-22 to 140 degrees F / -30 to 60 degrees C
Maximum altitude	10,000 feet
Operational relative humidity	8 to 90% non-condensing
Thermal output (fully-loaded array)	1500 BTU/hour, 450 watts
Shock	30 G for 2 ms
Vibration	.1 G @ 10 to 100 hertz
Input voltage	90 to 264 VAC (auto-sensing)
Input current	4.0 amperes (maximum, single power supply) @ 115 volts
Input frequency	50 to 60 hertz
Input power	450 VA
Power supplies	Dual, 400 watts DC output
Height/Width/Depth	5.25" x 17 5/8" x 25" 13.33 cm x 44.77 cm x 63.5 cm

B. Mount Array in a Rack

A PS Series array must be mounted in a two-pole or four-pole 19" rack. Be sure there is sufficient space for air flow in front of and behind the rack and the room has proper ventilation.

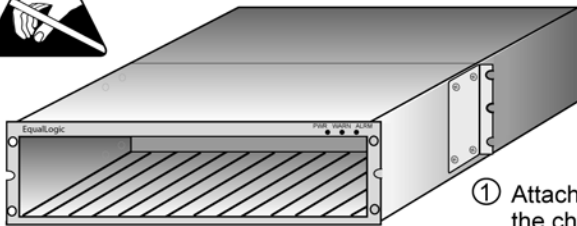
Attach an electrostatic wrist strap to your wrist and a grounded device before handling the array chassis.



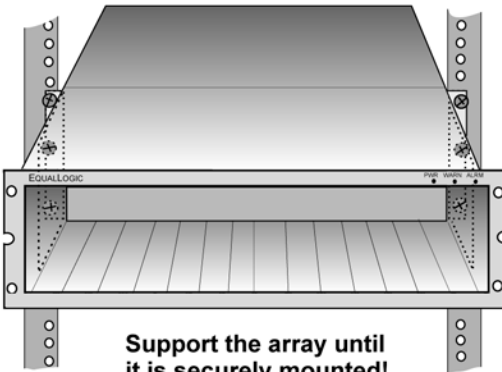
The storage array chassis is *heavy*. Do not attempt to lift or install the array without assistance.

To mount the array in a rack, refer to the steps in the figures shown next.

Mounting in a Two-Pole Rack



- ① Attach each mid-mount bracket to the chassis using four 8-32 screws with integrated washers.

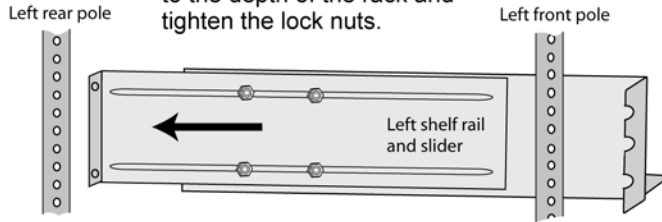


- ② Attach each mid-mount bracket to a center pole. Use three 12-24 screws or three 10-32 screws (depending on the type of rack).

Mounting in a Four-Pole Rack

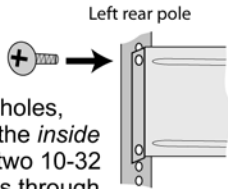


- ① For each rail, adjust the slider to the depth of the rack and tighten the lock nuts.

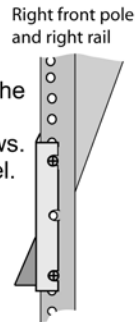


- ② For racks with round holes, attach each slider to the *inside* of a back pole using two 10-32 screws. Insert screws through the pole, then the slider.

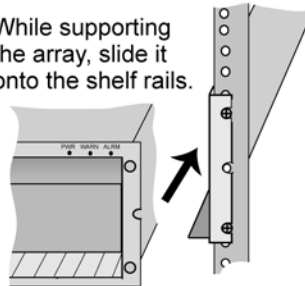
Racks with square holes require cage nuts, so attach the slider to the *outside* of the back pole.



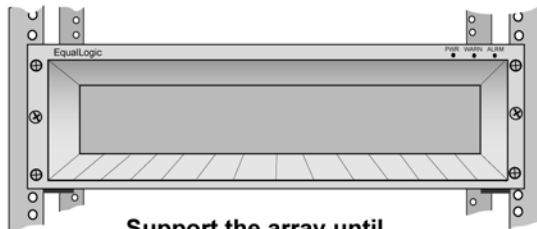
- ③ Attach each slider to the *outside* of a front pole using two 12-24 screws. Be sure the rail is level.



- ④ While supporting the array, slide it onto the shelf rails.



- ⑤ Use two 12-24 screws to attach the array to the *outside* of the shelf rails and front poles.



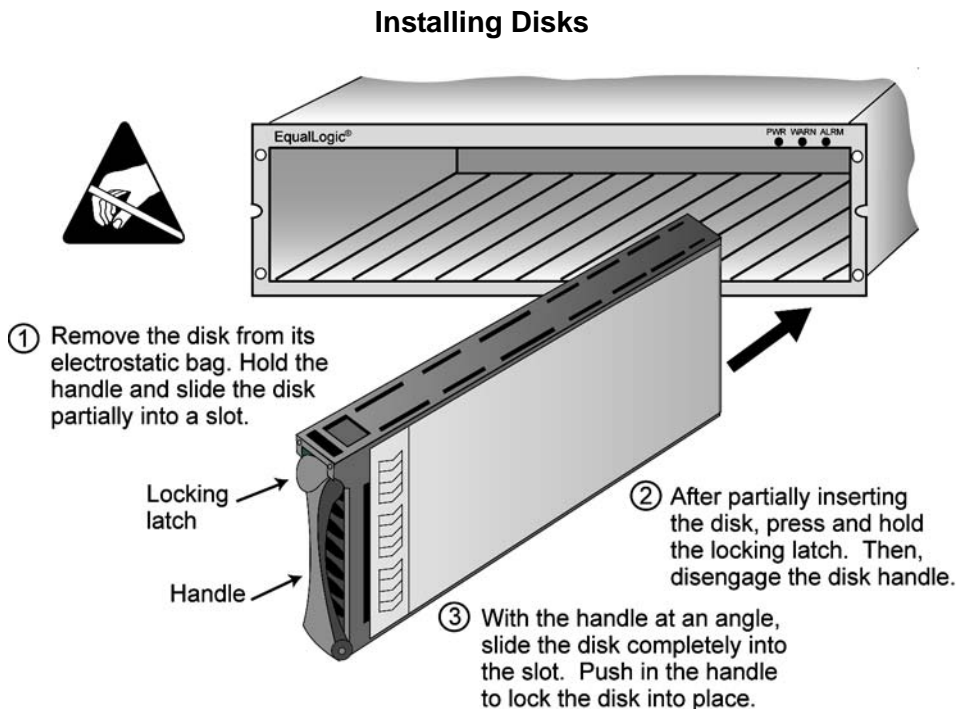
Support the array until it is securely mounted!

C. Install Disks or Blank Carriers

Follow these rules for handling PS Series array disks:

- Do not remove a disk from its plastic carrier or you will void your warranty and support contract.
- Do not leave a disk slot empty or you will void your warranty and support contract. Each slot must have a disk drive assembly or blank carrier installed.
- Allow disks to warm to room temperature before installation.
- Attach an electrostatic wrist strap to your wrist and a grounded device before handling a disk, unless the disk is in an electrostatic bag.
- Handle a disk only by the handle or the sides of the plastic carrier.
- Do not drop or jolt a disk or force a disk into a disk slot.

To install a disk, refer to the steps in the figure shown next.



D. Connect Power Cables for Grounding

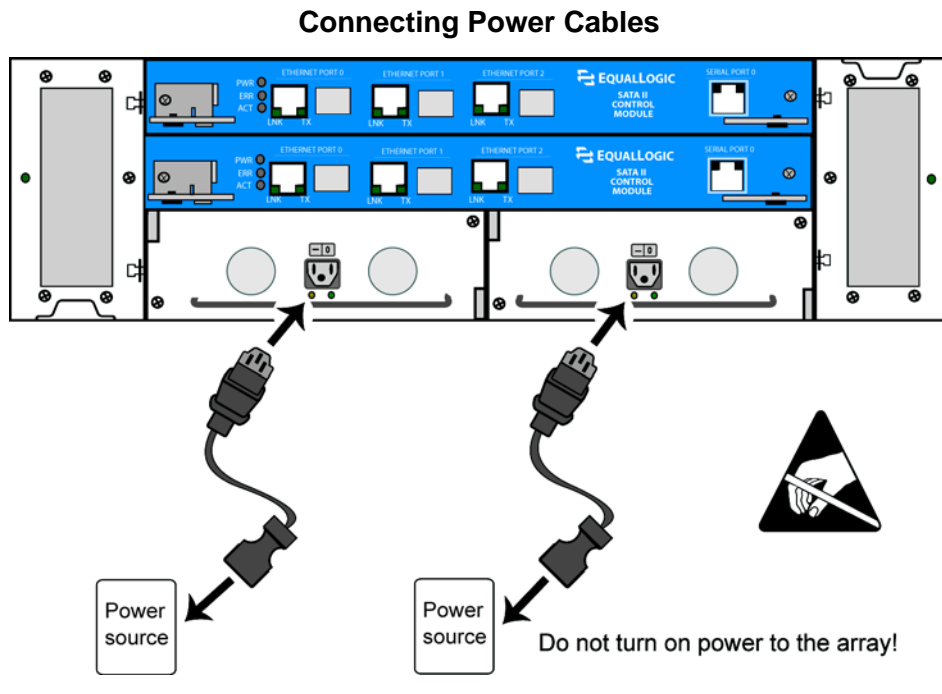
A PS Series array includes two power supplies. It is recommended that you connect both power supplies to different power sources, preferably on separate circuits.

For a highly-available power configuration, connect one power supply to an uninterruptible power supply (UPS) system, and connect the other power supply to a different source of power. See the table *Storage Array Requirements* on page 7 for information about UPS requirements.

Attach an electrostatic wrist strap to your wrist and a grounded device before connecting power cables.

Note: *Do not* turn on power to the array. At this time, the power cables are only for grounding purposes.

To connect power cables to an array, refer to the figure shown next.



E. Connect Array to a Network Switch

A PS Series array includes one or two control modules and can have one to three network connections. Only one control module is active (actively serving I/O) at one time. The secondary (redundant) control module mirrors cache data from the active control module. If the active control module fails, the secondary will take over network operations.

Each control module has three Ethernet interface ports, labeled PORT 0, PORT 1, and PORT 2. A dual control module array provides three pairs of network interfaces. For example, PORT 0 on CM0 (installed in the top slot) and PORT 0 on CM1 (installed in the bottom slot) are a pair.

It is important to properly connect network cables. In a dual control module array, PORT 0 and PORT 1 are redundant interfaces. For example, if you connect a cable to PORT 0 or PORT 1 on the secondary control module, the active control module can access the cable connection. The PORT 2 network interface is *not* redundant; therefore, the active control module must have a direct cable connection.

In addition to the requirements and recommendations described in the following tables, all the usual rules for proper network configuration apply to the group members. General network configuration is beyond the scope of this document.

Network Requirements

Requirement	Description
Cables for your type of network	See the <i>Optional Hardware – Not Supplied</i> on page 7 table for cable requirements for different types of networks.
At least one network connection	An array must have at least one functioning network interface connected to a network (through a network switch, if possible). When you run the <code>setup</code> utility, you will assign an IP address and netmask to this interface.

Network Recommendations

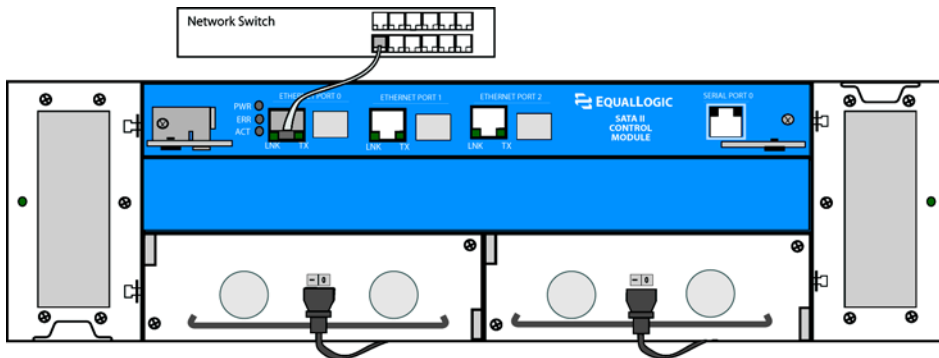
Recommendation	Description
Switched Gigabit Ethernet network	Connect arrays and hosts to a switched network and ensure that all network connections between hosts and arrays are Gigabit Ethernet. An array can operate at 10 and 100 Mbits, but performance will be significantly degraded.
Access to the group IP address	In a multi-subnet group, each configured network interface should have access to the subnet on which the group IP address resides.
Multiple network connections	Connect multiple network interfaces on an array (to different switches, if possible). You can configure the interfaces (assign an IP address and netmask) after adding the array to the group.
Redundant network paths	Using a multipathing solution helps to ensure that no single point of failure exists between hosts and arrays.
For replication, a reliable, adequately sized network link	For effective and predictable replication, be sure that the network link between the primary and secondary groups is reliable and provides sufficient bandwidth for copying data.
No STP functionality on switch ports that connect end nodes	<p>Do not use Spanning-Tree (STP) on switch ports that connect end nodes (iSCSI initiators or storage array network interfaces). However, if you want to use STP or RSTP (preferable to STP), you should enable the port settings available on some switches that let the port immediately transition into STP forwarding state upon link up. This functionality can reduce network interruptions that occur when devices restart, and should only be enabled on switch ports that connect end nodes.</p> <p>Note: The use of Spanning-Tree for a single-cable connection between switches is encouraged, as is the use of trunking for multi-cable connections between switches.</p>
Flow Control enabled on switches and NICs	Enable Flow Control on each switch port and NIC that handles iSCSI traffic. PS Series arrays will correctly respond to Flow Control.
Unicast storm control disabled on switches	Disable unicast storm control on each switch that handles iSCSI traffic, if the switch provides this feature. However, the use of broadcast and multicast storm control is encouraged on switches.
Jumbo Frames enabled on switches and NICs	Enable Jumbo Frames on each switch and NIC that handles iSCSI traffic to obtain any performance benefit and ensure consistent behavior.
VLANs	Configure switches to use VLANs in order to separate iSCSI SAN traffic from other network traffic.

Recommendations for connecting network cables are as follows:

- Connect Ethernet interfaces in the following order: PORT 0, PORT 1, and PORT 2.
- Distribute network connections across control modules and network switches.
- To ensure connectivity to the non-redundant port (PORT 2), connect cables to PORT 2 on both control modules.
- To enable failover across the redundant ports (PORT 0 and PORT 1), connect cables to the ports on both control modules.

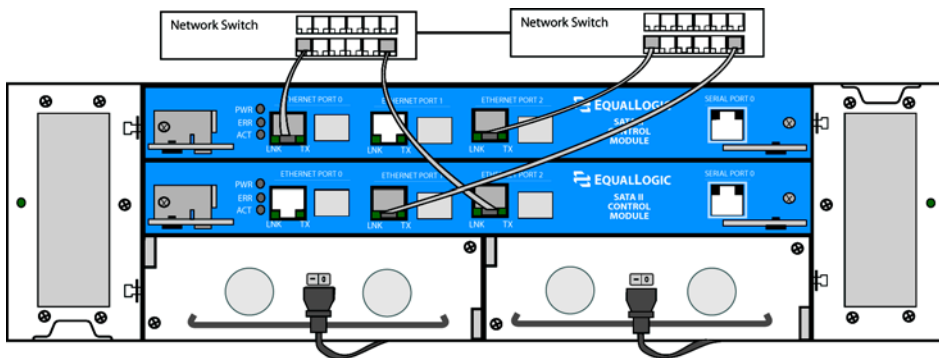
The figure below shows a minimum network configuration. Although functional, the single control module and network connection are possible points of failure.

Minimum Network Configuration



The following figure shows the recommended network configuration with multiple connections distributed across redundant control modules and switches.

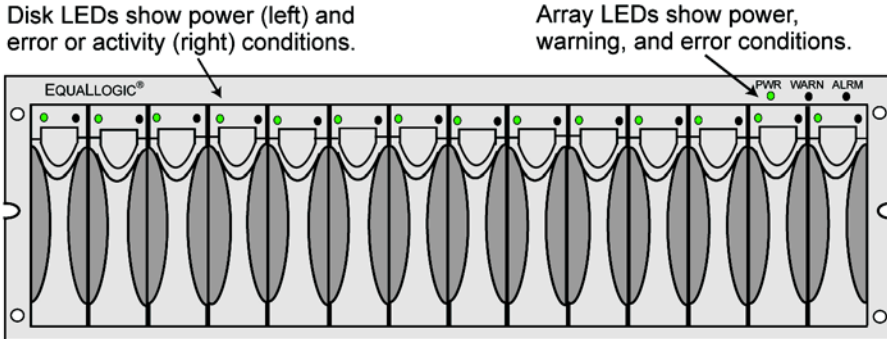
High-Performance, High-Availability Network Configuration



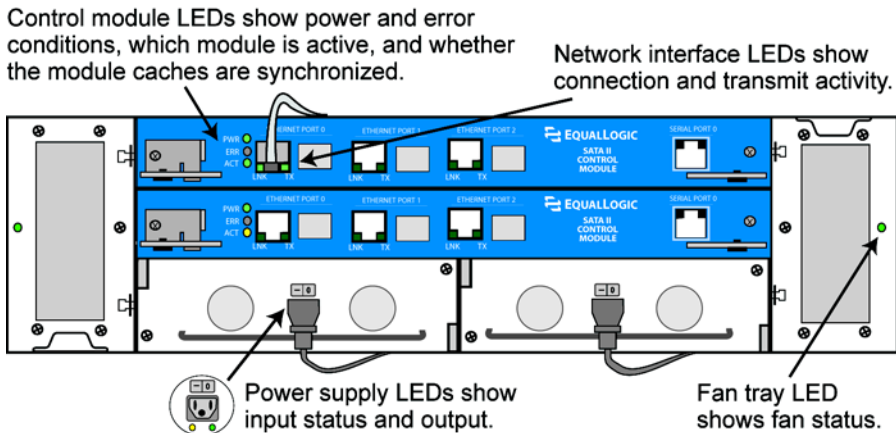
F. Turn on Power to Array and Check LEDs

Before turning on power, *be sure* the array is at room temperature. If an error message or LED indicates a problem, contact the support provider for your PS Series array.

Front Panel LEDs



Back Panel LEDs



Front Panel LED Descriptions

Array LEDs	Color	Description
PWR	Off	No power.
	Green	Power.

Front Panel LED Descriptions (Continued)

Array LEDs	Color	Description
WARN	Off	No power or normal condition.
	Red	One or more of the following has occurred: <ul style="list-style-type: none"> • RAID set is degraded but still functioning. • RAID set (volume-level) has lost blocks. • Component temperature is near upper or lower limit. • Fan RPMs exceed upper or lower limit. • Power supply fan has failed. • Power supply is not installed or has no power. • Only one control module installed or control module has failed over. • Control module has insufficient RAM. • Lock on secondary control module is open. • Active control module syncing with secondary. • No communication between control modules. • Installed spare disk does not have enough capacity to replace a disk in a RAID set. • A non-critical hardware component has failed. • Real-time clock battery is low.
ALRM	Off	No power or normal condition.
	Red	One or more of the following has occurred: <ul style="list-style-type: none"> • RAID set is not functioning. • Lost block table is full. • Array temperature exceeds upper or lower limit. • Control module cache has lost data. • One or both fan trays are not installed. • Both fans on a fan tray have failed. • Cache battery has less than 72 hours of charge • NVRAM coin cell battery has failed. • Cache contains data that does not belong to any of the installed disks. • More than one valid RAID set exists in the array. • Control modules are different models. • A critical hardware component has failed.

Disk LED Descriptions

Disk LEDs	Color	Description
Left	Off	No power or error condition
	Green	Power.
Right	Off	No power or normal condition.
	Red	Error condition.
	Flashing green	Disk activity.

Control Module LED Descriptions

Control Module LEDs	Color	Description
PWR	Off	No power.
	Green	Power.
ERR	Off	No power or no error condition.
	Red	Array is starting up or error condition.
ACT	Off	No power, secondary control module, secondary control module not synchronized with active control module, or error condition (only Type II).
	Green	Active control module (serving network I/O).
	Orange	Secondary control module synchronized with active control module.

Network Interface LED Descriptions

Network Interface LEDs	Color	Description
LNK	Off	No power or not connected to network.
	Green	Connected to network switch.
TX	Off	No power or not transmitting.
	Green	Transmitting.

Power Supply LED Descriptions

Power Supply LEDs	Color	Description
Left (location may differ on some power supplies)	Off	No power or error condition.
	Orange	Input power good (AC).
Right (location may differ on some power supplies)	Off	No power or error condition.
	Green	Output power good (DC).

Fan Tray LED Descriptions

Fan Tray LED	Color	Description
Outside edge of fan tray	Off	No power.
	Green	Environmental Management Module (EMM) and fans on the fan tray are functioning.
	Red	EMM or a fan on the fan tray has failed. LED will be temporarily red when the array is first powered on or when the fan tray is installed.
	Red flash	Fan RPMs exceed upper or lower limit.

G. Connect Array to a Console Terminal

Set up a serial connection between the array and a console terminal (or a computer running a terminal emulator) to run the `setup` utility and add the array to a group. After setting up the array, the serial connection is no longer required.

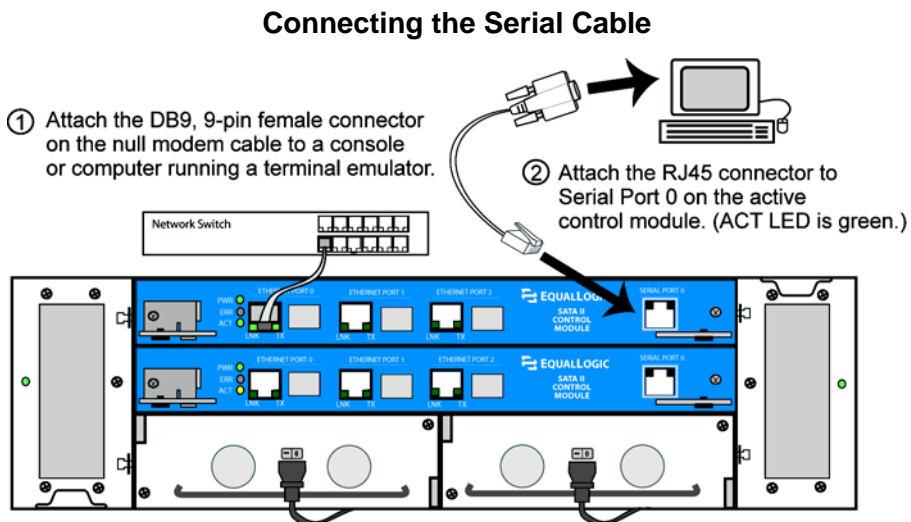
Note: Type II control modules (blue face plate and single serial port) require a null modem cable with one RJ45 connector and one DB9, 9-pin, female connector for a serial connection, as shown in the figure below.

If you have a Microsoft® Windows® system, you can use the EqualLogic Remote Setup Wizard to configure an array and create a group instead of using the `setup` utility. The wizard does not require the serial cable.

A serial connection is always to Serial Port 0 on the active control module. (ACT LED will be green.) It must have the following characteristics:

- 9600 baud
- One STOP bit
- No parity
- 8 data bits
- No hardware flow control

To set up a serial connection, refer to the next figure.



Step 2. Configure the Array and Create a Group

The `setup` utility enables you to configure a storage array on the network and create a PS Series group with the array as the first member. The utility prompts for the array's network configuration and the group configuration, including the group IP address.

Note: See the tables *Network Requirements* on page 12 and *Network Recommendations* on page 13 for additional network information.

After the `setup` utility completes, the group is available on the network. Next, log in to the group using the Group Manager GUI or CLI and set the RAID policy for the first member.

- A. Before running the `setup` utility, gather the information described in the tables *Member Configuration* and *Group Configuration*. Obtain IP addresses from your network administrator, as needed.

Member Configuration

Prompt	Description
Member name	Unique, descriptive name (up to 64 alphanumeric characters; no spaces). First character must be a letter or number. Used to identify and administer the array.
Network interface	Name of a network interface (either <code>eth0</code> , <code>eth1</code> , or <code>eth2</code>) that is connected to a functioning port on a network switch.
IP address	Network address for the named network interface. Note: Each member must have at least one network interface on the same subnet as the group IP address.
Netmask	Combines with the IP address to identify the subnet on which the named network interface resides (default is 255.255.255.0).
Default gateway (optional)	Network address for the device used to connect subnets and forward network traffic beyond the local network. A default gateway is needed only if you want the named network interface to communicate outside the local network (for example, to allow access to volumes from hosts outside the local network). Note: The default gateway must be on the same subnet as the named network interface.

Group Configuration

Prompt	Description
Group name	Name of the group (up to 54 characters). Valid characters include letters, number, and dashes. The first character must be a letter or number. Identifies the group for the purposes of adding new members or setting up replication.
Group IP address	Network address for the group. The group IP address is used for group administration and host access to data stored in the group.
Password for managing group membership	Password required when adding members to the group. The password must have 3 to 16 alphanumeric characters and is case-sensitive.
Password for the default group administration account	Password that will override the factory-set password (<code>grpadmin</code>) for the default <code>grpadmin</code> account. The password must have 3 to 16 alphanumeric characters and is case-sensitive.

- B. Using the serial connection you established in *Step 1-G* on page 19, press the **Enter** key. At the login prompt, enter the `grpadmin` account name and the factory-set password, which is also `grpadmin`. Note that passwords are not echoed on the screen.

```
Login: grpadmin
Password: grpadmin
```

```
Welcome to Group Manager
Copyright 2001-2007 EqualLogic, Inc.
```

```
It appears that the storage array has not been configured.
Would you like to configure the array now? (y/n) [n] y
```

- C. If you respond by typing `y` and pressing the **Enter** key, the following dialog appears. You can also enter `n` and, at a later time, type `setup` at the console prompt (`>`). The utility prompts for the member and group configuration. Press the **Enter** key to accept a default value. Enter `?` to obtain help.

An example of running the setup utility is shown next. There may be a short delay after entering the group IP address as the array searches the network.

Example of Configuring an Array and Creating a Group

```
Group Manager Setup Utility

The setup utility establishes the initial network and storage
configuration for a storage array and then configures the array
as a member or a new or existing group of arrays.

For help, enter a question mark (?) at a prompt.

Do you want to proceed (yes | no) [no]? yes

Initializing. This may take several minutes to complete.
Enter the network configuration for the array:

Member name []: member01
Network interface [eth0]: eth0
IP address for network interface []: 192.17.2.41
Netmask [255.255.255.0]: Enter
Default gateway [192.17.2.1]: Enter

Enter the name and IP address of the group that the array will join.

Group name []: group01
Group IP address []: 192.17.2.40

Searching to see if the group exists. This may take a few minutes.

The group does not exist or currently cannot be reached. Make sure
you have entered the correct group IP address and group name.

Do you want to create a new group (yes | no) [yes]? yes

Group Configuration

Group Name:                group01
Group IP address:          192.17.2.40

Do you want to use the group settings shown above (yes | no) [yes]: yes

Password for managing group membership:
Retype password for verification:

Password for the default group administration account:
Retype password for verification:

Saving the configuration ...

Waiting for configuration to become active.....Done

Group member member01 now active in the group.

Group group01 has been created with one member.

Use the Group manager GUI or CLI to set the RAID policy for the member.
You can then create a volume which a host can connect to using an iSCSI
initiator.
```

Step 3. Set the RAID Policy

After you create the group, use the Group Manager GUI or CLI to set the RAID policy for the member. This will automatically configure the disks according to the RAID policy, with the appropriate number of spare disks.

A member can be configured with one of the following RAID policies:

- RAID-10 – Striping on top of multiple RAID 1 (mirrored) sets, with one or two spare disks. RAID-10 provides good performance for random writes, in addition to the highest availability. However, since the disks are mirrored, RAID 10 provides the least capacity.
- RAID-50 – Striping on top of two RAID 5 (distributed-parity) sets, with one or two spare disks. RAID-50 provides a good balance of performance (especially for sequential writes), availability, and capacity.
- RAID-5 – One RAID 5 set, with one spare disk. RAID-5 is similar to RAID-50, with more capacity (two additional disks) but lower availability and performance.
- RAID-10, nospares – Striping on top of multiple RAID 1 sets, with no spares, if possible.
- RAID-50, nospares – Striping on top of two RAID 5 sets, with no spares, if possible.

Note: A no-spares RAID policy can be set only with the CLI and should be used only at installations where extra disks and personnel are available at all times to replace failed disks.

Be sure you choose the right RAID policy for a member. You can convert a member to a different RAID policy only if the new policy requires *less* disk space than the current policy.

After you set the RAID policy for the first group member, you can create volumes. Until the RAID configuration completes, performance will not be optimal, but the group is fully operational.

Using the GUI and, alternately, the CLI to set the RAID policy is described next.

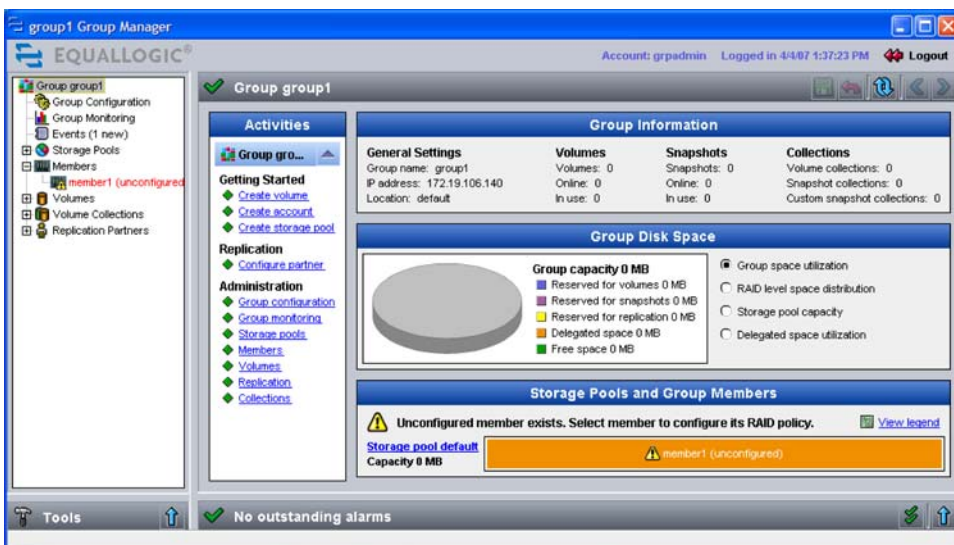
Using the GUI to Set the RAID Policy

To start the GUI, specify the group IP address in a Web browser. When prompted, log in to the group by entering the `grpadmin` account name and the password that you specified when creating the group. The Group Summary window appears.

Note: To obtain Group Manager help from the EqualLogic website, click `Tools` in the bottom left corner of the GUI and then click `Online Help`.

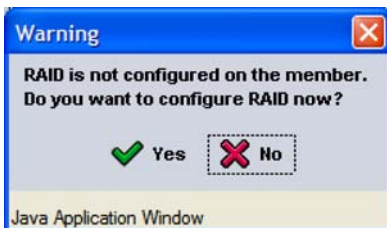
Initially, the Group Summary window shows no group capacity and indicates that a member exists with an unconfigured RAID policy. This is normal behavior.

Group Summary – RAID Policy Not Set



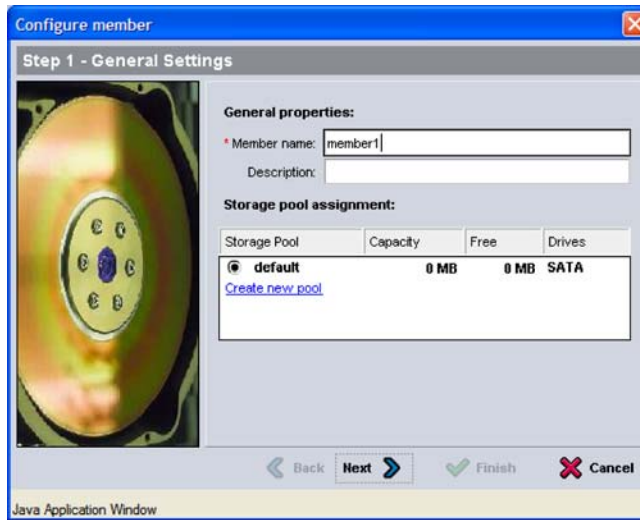
To set the RAID policy for the member, expand `Members` in the far left panel and select the member name. The following warning appears.

Warning RAID Not Configured



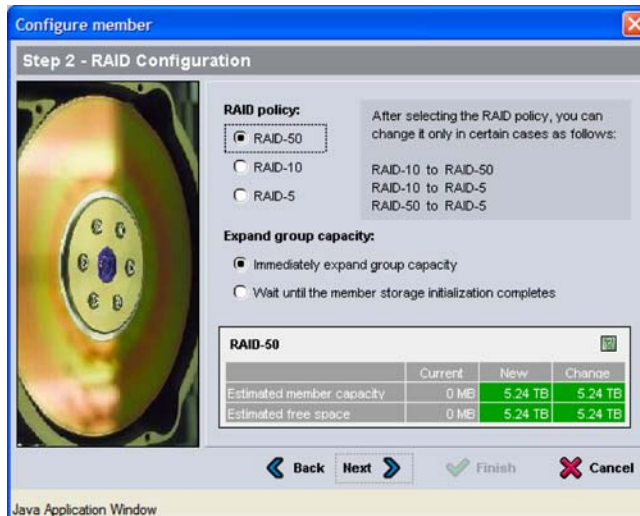
Click **Yes** and the Configure Member – General Settings dialog box appears.

Configure Member – General Settings



Enter an optional member description and click **Next**. The Configure Member – RAID Configuration dialog box appears.

Configure Member – RAID Configuration (RAID-50)

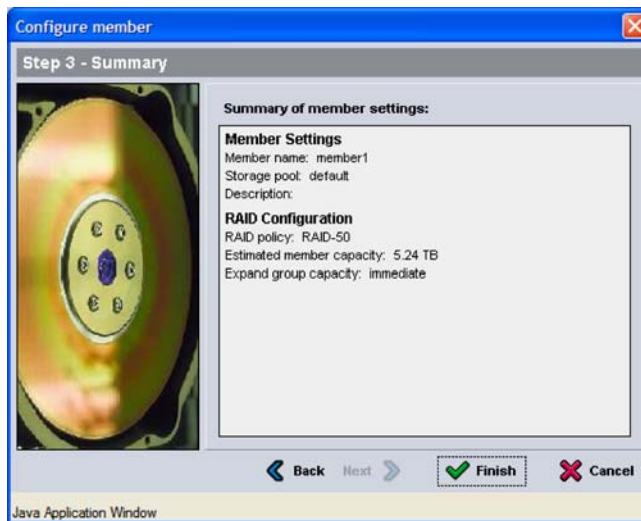


Select the RAID policy for the member.

The pool capacity values in the dialog box table will change, depending on the selected RAID policy. For example, in the preceding dialog box, selecting RAID-50 provides an estimated capacity of 5.24 TB. In contrast, selecting RAID-10 would provide less capacity, while selecting RAID-5 would provide more capacity.

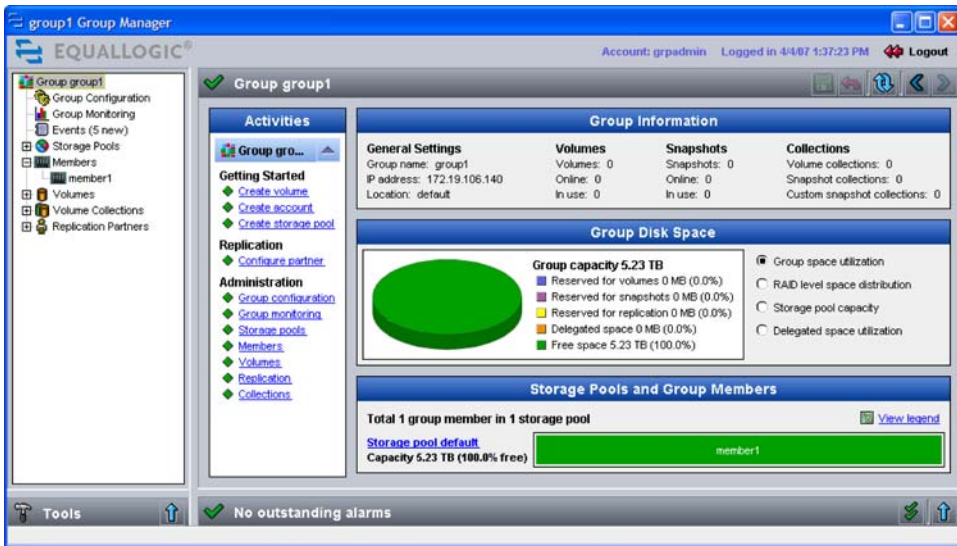
Click **Next** to continue. The Configure Member – Summary dialog box appears.

Configure Member – Summary



If the member configuration is satisfactory, click **Finish**. The following Group Summary window shows a completed configuration for a one-member group.

Group Summary – Completed Member Configuration



Using the CLI to Set the RAID Policy

To access the CLI, establish a telnet or SSH connection to the group IP address or use a serial connection to the array, as described in *Step 1-G* on page 19. When prompted, log in to the group by entering the `grpadmin` account name and the password that you specified when creating the group.

To set the RAID policy for a member, use the following command format:

```
member select member_name raid-policy policy
```

The *policy* variable can be one of the following:

- RAID10
- RAID50
- RAID5
- raid10-nospares
- raid50-nospares

For example, the following command configures member01 with RAID-50:

```
> member select member01 raid-policy raid50
```

Step 4. Create a Volume

After setting the RAID policy for a member, use the Group Manager GUI or CLI to create volumes. You can specify the following information about a volume:

- Volume name – Name, up to 64 characters (including letters, numbers, periods, hyphens, and colons), that is used to identify the volume for administrative purposes. The volume name appears at the end of the iSCSI target name that is generated for the volume.
- Description – The volume description is optional.
- Storage pool – All volume data will be restricted to the members that make up the pool. By default, the volume will be assigned to the default pool. If multiple pools exist, you can assign the volume to a different pool.
- Volume size – This is the reported size of the volume as seen by iSCSI initiators. The minimum volume size is 15 MB. In addition, volume sizes are rounded up to the next multiple of 15.

Note: For a volume without thin provisioning, the volume reserve (allocated space) is the same as the reported size. For a thin-provisioned volume, the volume reserve will be less than or equal to the reported size.

- Snapshot reserve – If you want to create snapshots of the volume, specify the amount of pool space to reserve for snapshots, as a percentage of the volume reserve. The default is the group-wide volume setting. If you enter a value, this space is reserved even if you never create a snapshot.

In addition, you can specify the limit at which you will be notified that snapshot space is being depleted, in addition to the action to take when snapshot space is exceeded (either delete the oldest snapshots or set the volume offline). The defaults are the group-wide settings.

- Thin provisioning setting – By default, thin provisioning is disabled on a volume. If you enable thin provisioning, you can specify the minimum volume reserve, the in-use space warning value, and the maximum amount of in-use space.

Note: Thin provisioning is an advanced volume feature and may not be appropriate for all environments. See the PS Series *Group Administration* manual for detailed information.

- Access controls – Access control records are used to restrict volume access to hosts that supply the correct credentials. By default, no host can access a volume. A host must match a record in order to access a volume. You can restrict access according to the following:
 - CHAP user name – Restricts access to hosts that supply the specified CHAP user name (and its associated password or “secret”). The user name must match a local CHAP account or an account on an external RADIUS server.
 - IP address – Restricts access to hosts with the specified initiator IP address (for example, 12.16.22.123). Use asterisks for “wildcards,” if desired (for example, 12.16.*.*). An asterisk can replace an entire octet, but it cannot replace a digit within an octet.
 - iSCSI initiator name – Restricts access to the specified iSCSI initiator.

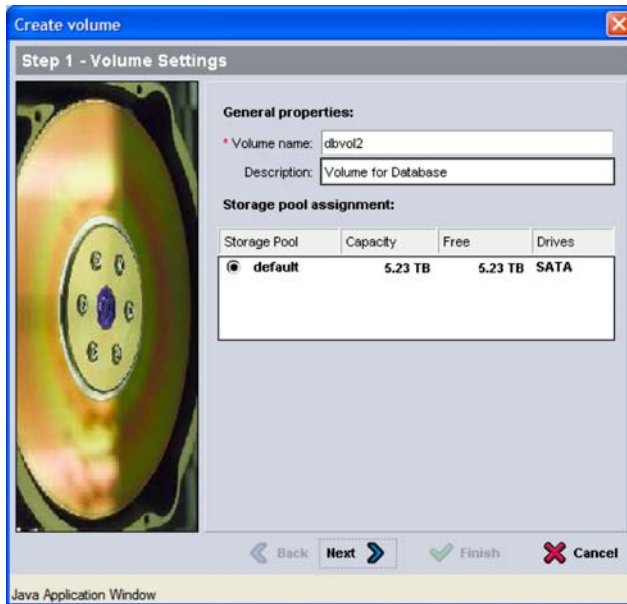
Using the GUI and, alternately, the CLI to create a volume is described next.

Using the GUI to Create a Volume

To start the GUI, specify the group IP address in a Web browser. When prompted, log in to the group by entering the `grpadmin` account name and the password that you specified when creating the group. The Group Summary window appears, displaying the current group configuration and storage pool capacity.

To create a volume, click `Create volume` in the Activities panel. The Create Volume – Volume Settings dialog box appears.

Create Volume – Volume Settings

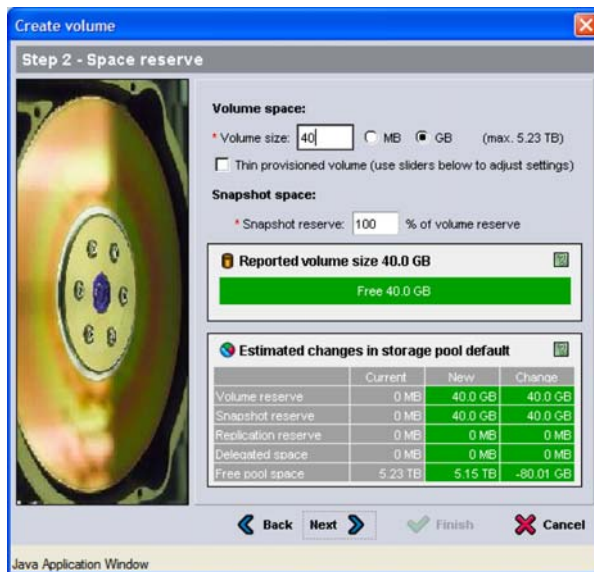


Enter the following information:

- Volume name.
- Volume description (optional)
- Storage pool

Click `Next`. The Create Volume – Space Reserve dialog box appears.

Create Volume – Space Reserve



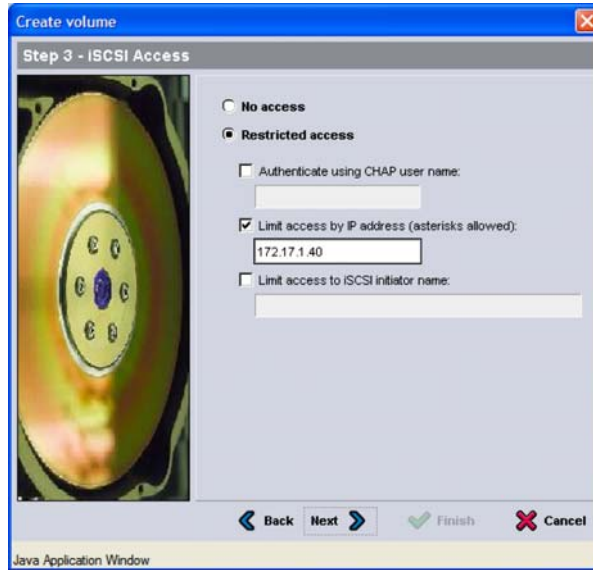
Enter the following information:

- Volume size. Be sure to specify the correct unit of measurement.
- Thin-provisioning setting. If selected, slider bars appear, enabling you to specify the minimum volume reserve, the in-use space warning value, and the maximum in-use space value for the thin-provisioned volume.
- Snapshot reserve. You can modify the snapshot space warning value and snapshot space recovery setting after creating the volume.

The values in the storage pool space table reflect the specified volume size, thin provisioning settings, and snapshot reserve.

Click **Next**. The Create Volume – iSCSI Access dialog box appears.

Create Volume – iSCSI Access

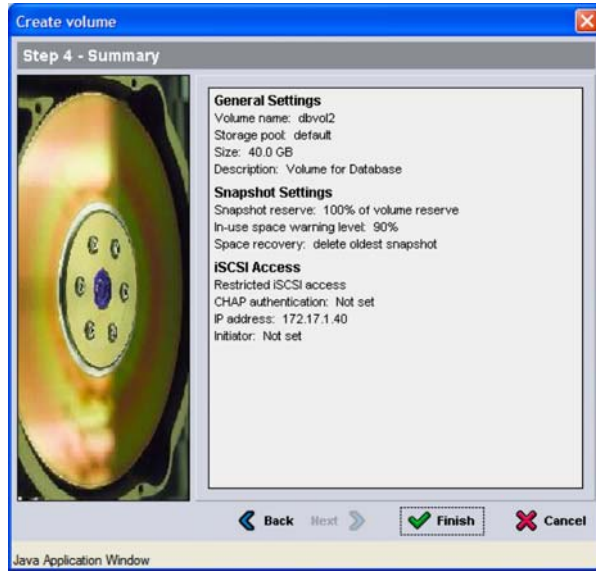


Specify the IP address, CHAP user name, or iSCSI initiator name to which the volume will be restricted. In the previous dialog box, volume access is restricted to IP address 172.17.1.40. You can set up more access controls after creating the volume.

Click **Next**. The Create Volume – Summary dialog box appears.

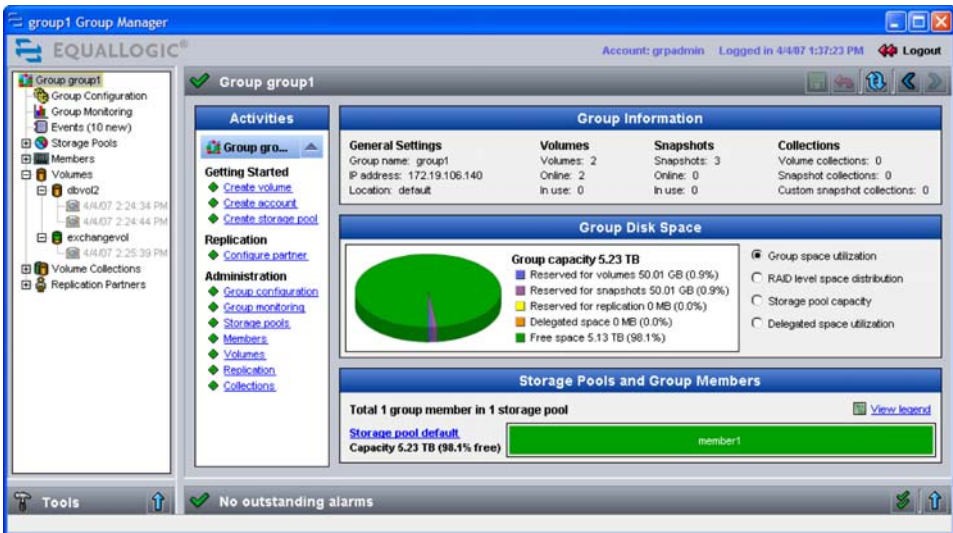
If the volume configuration is satisfactory, click **Finish** to create the volume. Click **Back** to make changes.

Create Volume – Summary



Once you create a volume, you can create snapshots of the volume or perform other tasks. The following Group Summary window shows a group with volumes and snapshots.

Group Summary – With Volumes



Using the CLI to Create a Volume

To access the CLI, establish a telnet or SSH connection to the group IP address or use a serial connection to the array, as described in *Step 1-G* on page 19. When prompted, log in to the group by entering the `grpadmin` account name and the password that you specified when creating the group.

To create a volume, use the following command format:

```
volume create volume_name size[GB] [optional_parameters]
```

Specify the volume name and size (the default is megabytes).

Optionally, specify one or more of the following snapshot space parameters:

- `snap-reserve percent_volume_reserve`
- `snap-depletion delete-oldest | volume-offline`
- `snap-warn percent_snapshot_reserve_free`

To enable thin provisioning on the volume, specify the `thin-provision` parameter and, optionally, one or more of the following parameters:

- `thin-min-reserve n%`
- `thin-growth-warn n%`
- `thin-growth-max n%`

After creating the volume, restrict host access by creating one or more access control records using the following command format:

```
volume select volume_name access create access_control
```

The `access_control` parameter can be one or more of the following:

- `initiator initiator_name`
- `ipaddress ip_address`
- `username chap_username authmethod chap`

The following example creates a 50 GB volume and two access control records for the volume. Only a host that has IP address 112.15.7.119 or 112.15.12.120 will be able to access the volume and its snapshots.

```
> volume create staff1 50GB
> volume select staff1 access create ipaddress 112.15.7.119
> volume select staff1 access create ipaddress 112.15.12.120
```

Step 5. Connect to the Volume from a Host System

A PS Series group volume is seen on the network as an **iSCSI target**. When you create a volume, its iSCSI target name is generated automatically. An example of an iSCSI target name for a volume named `dbvol` is as follows:

```
iqn.2001-05.com.equallogic.5-4a0900-2f00000-007eca92d654f160-dbvol
```

To display the iSCSI target name for a volume, do either of the following:

- In the CLI, enter the command: `volume show volume_name`
- In the GUI, select the volume name in the far left panel and then click the `Status` tab to display the iSCSI target name at the bottom of the iSCSI Connections panel.

To connect to a volume, the host must have an **iSCSI initiator** running and must match the security credentials in one of the volume's access control records. Hardware and software initiators are available from a variety of vendors. Configure your initiator using the instructions provided by the vendor.

Note: It is *strongly* recommended that you visit the EqualLogic Customer Support website to obtain important information about using initiators to access PS Series group volumes.

The exact procedure for connecting to an iSCSI target depends on the initiator. See the initiator documentation for details. In most cases, you use the initiator configuration utility to specify the group IP address as either the **target portal** or the **discovery address**. If the initiator supports the discovery process, it will return a list of iSCSI targets (volumes) that the host can access.

If the initiator does not support discovery, you must also specify the target name. The standard iSCSI port number (3260) may also be required.

Using the initiator configuration utility, select the desired target and log in or connect to the target. If the volume's access control records use CHAP for initiator authentication, enter the CHAP credentials (user name and password or "secret") at this time. Note that CHAP must already be set up in the group, as described in the PS Series *Group Administration* manual.

Once the host connects to the iSCSI target, the volume is seen by the host as a regular disk that can be formatted using the normal operating system utilities. For example, you can partition the disk and create a file system, if desired.

Advanced Operations and More Information

After getting started, you can customize a PS Series group and also utilize the full set of product features and host-based solutions.

You can also obtain technical support. For more information, see *Product Documentation and Technical Support* on page vi.

The following table lists advanced operations. These group, volume, and member tasks are fully documented in the *Group Administration* manual.

Advanced Operations

Group Task	Description
Add a member.	Although a one-member group is fully functional, adding more arrays expands storage pool capacity, increases network bandwidth, and improves overall group performance—without disrupting data availability. Refer to the <i>Group Administration</i> guide for details on adding a member to a group.
Modify the date, time, or time zone or configure NTP.	Group time is based on the clock on the first member, which is set at the factory. The default time zone is EST. You can also configure the group to use an NTP server.
Create administration accounts.	The <code>grpadmin</code> account is the default administration account. You can set up additional accounts.
Set up event notification.	To be informed of significant events in a timely manner, set up e-mail or syslog notification.
Configure iSNS.	To automate iSCSI target discovery, you can configure the group to use an iSNS server.
Configure CHAP.	You can use CHAP to restrict host access to volumes. Both initiator and target CHAP authentication are supported.
Configure SNMP.	To monitor traps from the group, you can use SNMP.
Create pools.	With multi-member groups, you can create additional pools and assign members and volumes to the pools.

Advanced Operations (Continued)

Volume Task	Description
Create access control records for a volume.	An access control record specifies the criteria that a host must meet in order to access the volume.
Create snapshots of a volume.	Snapshots are point-in-time copies of volume data that can be used for backups.
Set up replication across different groups.	Replicas are point-in-time copies of volume data that are stored separately from volumes for disaster recovery.
Clone a volume, snapshot, or replica.	Cloning creates a new volume in the group where the cloned volume, snapshot, or replica resides.
Promote a replica set.	Promotion stops replication, creates a new volume, and transforms the replicas into corresponding snapshots.
Create collections.	Collections provide a way to group multiple related volumes together for the purpose of creating snapshots or replication. The administrator can create a multi-volume snapshot or replica in a single operation or through a single schedule.
Member Task	Description
Add network connections.	Multiple connections provide performance and availability.
Add disks.	Adding disks increases capacity.

Index

A

- access controls, for volumes 29
- array
 - adding to a group 20
 - configuration prompts 20
 - configuring 20
 - console connection 19
 - creating a group 20
 - disk installation 10
 - documentation vi
 - environment requirements 7
 - LED descriptions 15
 - network address 20
 - network connection examples 14
 - network connection guidelines 12
 - password for logging in 21
 - power requirements 7
 - power supply connections 11
 - powering on 15
 - rack mounting 8
 - serial connection 19
 - setting the RAID policy 23
 - steps for setting up and using 2
 - unpacking 3
 - warranty vii

C

CHAP

- specifying host credentials 35
- using access control records 35

CLI, accessing 27

collections, defined 37

console connection (serial) 19

control modules

- LED indicators 17

- model differences 5, 19
- model restrictions v
- network connections 12
- serial connections 19

D

default gateway (member) 20

disks

- handling requirements 10
- installing 10
- LED indicators 17
- storage requirements 10

documentation, array vi

E

electrostatic protection device, using 3

F

fan trays, LED indicators 18

Flow Control recommendation 13

G

Gigabit Ethernet recommendation 13

group

- accessing the CLI from a host 27
- accessing the GUI from a host 24
- accessing volumes from a host 35
- advanced operations 36
- configuration prompts 21
- creating 20
- customizing 36
- defined 1
- increasing capacity 2
- IP address 21
- name 21
- online help 24

- password for adding members 21
- password for managing 21

- GUI, accessing 24

H

- hardware

- console connection 19
- control module models v
- disk installation 10
- environment requirements 7
- LED descriptions 15
- optional 7
- power supply connections 11
- powering on array 15
- rack mounting array 8
- required 4, 5
- serial connection 19
- setting up 3
- shipping box contents 4, 5
- unpacking 3

- hosts

- accessing CLI 27
- accessing GUI 24
- accessing volumes 29
- connecting to volumes 35
- Flow Control recommendation 13
- Jumbo Frames recommendation 13
- specifying CHAP credentials 35

I

- initiator (iSCSI)

- accessing a volume 35
- defined 1
- host requirements 35

J

- Jumbo Frames recommendation 13

L

- LEDs, location and description 15

M

- member

- adding to a group 20
- configuring 20
- defined 1
- increasing bandwidth 13
- increasing capacity 2
- multipath I/O recommendation 13
- network address 20
- network cable requirement 12
- network connection examples 14
- network connection guidelines 12
- network connection requirement 12
- setup prompts 20
- subnet access recommendation 13

N

- netmask (member) 20

- network

- array IP address 20
- connection guidelines 12
- group IP address 21
- improving performance 13

- network interfaces

- connecting 14
- description 12
- LED indicators 17
- redundant 12

O

- online help, accessing 24

P

- passwords

- for adding a member 21

- for logging in to group 21
- pools, assigning volumes 28
- power supplies
 - connecting array 11
 - LED indicators 18
 - turning on 15
 - using UPS systems 11
- product return requirements 3

R

- rack mounting array
 - four-pole rack 8
 - two-pole rack 8
 - using non-threaded poles 7
- RAID levels, supported 23
- RAID policy
 - descriptions 23
 - setting with CLI 27
 - setting with GUI 24

S

- serial connection, setting up 5, 19
- setup utility
 - array configuration prompts 20
 - creating a group 20
 - example of creating a group 22
 - group configuration prompts 21
- shipping box contents 4, 5
- snapshot space, volume settings 28
- Spanning-Tree recommendation 13
- spares, set as part of RAID policy 23
- storage pools, defined 1
- switches, recommendations
 - Flow Control 13
 - Jumbo Frames 13

- Spanning-Tree 13
- unicast storm control 13
- VLAN 13

T

- target (iSCSI)
 - connecting to 35
 - defined 1
 - obtaining name 35
- thin provisioning, enabling on a volume 28

U

- unicast storm control 13
- UPS systems, using for availability 11

V

- VLAN recommendation 13
- volumes
 - access controls 29
 - accessing from a host 35
 - assigning to a pool 28
 - connecting to 35
 - creating with CLI 34
 - creating with GUI 30
 - defined 1
 - naming 28
 - reported size 28
 - snapshot reserve size 28
 - target name for 35
 - thin provisioning settings 28
 - volume reserve 28

W

- warranty, array vii

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