PROMISE® TECHNOLOGY, INC.

PEGASUS
R6, R4
Product Manual

Version 1.0

Copyright

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Recommendations

In this *Product Manual*, the appearance of products made by other companies, including but not limited to software, servers, and disk drives, is for the purpose of illustration and explanation only. PROMISE Technology does not recommend, endorse, prefer, or support any product made by another manufacturer.

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Chapter 3: Management with the Promise Utility, cont.

Chapter 3: Management with the Promise Utility, cont.

Chapter 5: Troubleshooting, cont.

Chapter 1: Introduction to Pegasus

This chapter covers the following topics:

PROMISE Technology's Pegasus R6 and R4 are direct attached storage (DAS) solutions for external storage targeted for small and medium business (SMB) users, small office/home office (SOHO) users, and AV professionals.

About This Manual

This *Product Manual* describes how to setup, use, and maintain the Pegasus R6 and R4 unit. It also describes how to use the Promise Utility software that you install and run on your Macintosh computer.

This manual includes a full table of contents, chapter task lists, and numerous cross-references to help you find the specific information you are looking for.

Also included are four levels of notices:

Note

A *Note* provides helpful information such as hints or alternative ways of doing a task.

Important

An *Important* calls attention to an essential step or point required to complete a task. Important items include things often missed.

Caution

A *Caution* informs you of possible equipment damage or loss of data and how to avoid them.

Warning

A Warning notifies you of probable equipment damage or loss of data, or the possibility of physical injury, and how to avoid them.

Architecture

The Pegasus architecture is based on a state-of-the-art PMC Sierra 8011 I/O processor coupled with 512 MB of DDR2 SDRAM memory and a world class enterprise-proven RAID engine.

Protocol Support

Pegasus supports Thunderbolt™ technology, providing two channels with 10 Gb/s of throughput in both directions simultaneously.

Thunderbolt supports daisy-chaining up to six (6) high-speed peripheral devices, including external disks, video capture devices, and a Mini DisplayPort monitor.

Pegasus has two Thunderbolt ports, as required for daisy-chaining.

Key Benefits

- Thunderbolt 10 Gb/s data connection
- PMC Sierra 8011 I/O processor
- 512 MB of DDR2 SDRAM memory
- Promise Utility management tool
- Compatible with Apple Time Machine
- R6, six SATA 3.5-inch hard disk drives, 6 TB or 12 TB raw capacity
- R4, four SATA 3.5-inch hard disk drives, 4 TB or 8 TB raw capacity
- Additional storage up to 72 TB using multiple daisy-chained Pegasus enclosures
- 250W Flex-ATA Power with 80 Plus Bronze.

Specifications

- Physical drive support:
  - 2.5-inch and 3.5-inch SATA hard disk drives
  - Additional storage using multiple Pegasus enclosures
  - SATA specification of 3 Gb/s transfers with CRC error-checking
  - Hot-swapping of physical drives
  - Command queuing (SATA drives)
  - Drive roaming among channels
  - S.M.A.R.T. status polling
  - Hot spare drive
  - RAID volume rebuilding
  - Background rebuilding
- Data capacity without expansion:
  - R6, 6 TB or 12 TB raw capacity
  - R4, 4 TB or 8 TB raw capacity
- Data capacity with expansion, up to 72 TB
- RAID level support: RAID 0, 1, 1E, 5, 6, and 10
- Unicode file name support
- Power Supply: 250W Flex-ATA Power with 80 Plus Bronze with PFC, 100-230V auto-ranging, 50-60Hz AC
- Error logging
- Hardware monitoring of:
  - Fan
  - Temperature
  - Power
  - Enclosure
  - Physical drives
  - Logical drives
  - RAID controller
- Temperature, Operating: 5° to 35°C (41° to 95°F)
- Humidity, Operating: 10 to 85 percent
- Dimensions (H x W x D):
  - R6, 250 x 187 x 235 mm (9.8 x 7.4 x 9.3 in)
  - R4, 195 x 187 x 235 mm (7.7 x 7.4 x 9.3 in)
- Weight with drives:
  - R6, 5.9 kg (13 lbs)
  - R4, 4.5 kg (10 lbs)

Client OS Support

The following client operating systems support the Pegasus unit:

- Mac OS 10.6 and higher
- MacBook Pro/iMac Software Update 1.5

Utility OS Support

The following client operating systems support the Promise Utility:

- Mac OS 10.6 and higher
- MacBook Pro/iMac Software Update 1.5

Certifications

Environmental: EuP Directive N, ROHS, WEEE

Safety: CB, UL, cUL, CE-LVD, PSE, BSMI, RCM

Electo-magnetic Interference: CB-EMC, FCC, CE-EMC, VCCI/PSE, BSMI, C-tick/RCM

Chapter 2: Installation and Setup

This chapter contains the following topics:

Unpacking the Pegasus Unit

The Pegasus box contains the following items:

- Pegasus R4 or R6 Unit
- *Quick Start Guide*
- Hard disk drives (Six in R6, four in R4)
- Power cord, 1.5m

Warning

The electronic components within the Pegasus unit are sensitive to damage from Electro-Static Discharge (ESD). Observe appropriate precautions at all times when handling the Pegasus unit or its subassemblies.

Warning

The fan contains hazardous moving parts. Keep fingers and other body parts away.

Important

You must obtain at least one Thunderbolt cable. The Pegasus unit does NOT ship with Thunderbolt cables.

Figure 1. Pegasus R4 front view. The R6 is similar

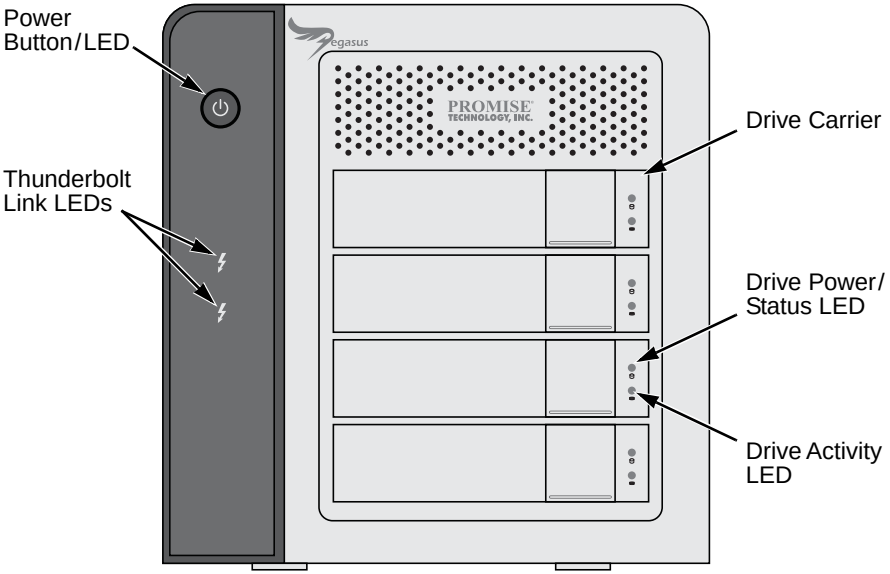
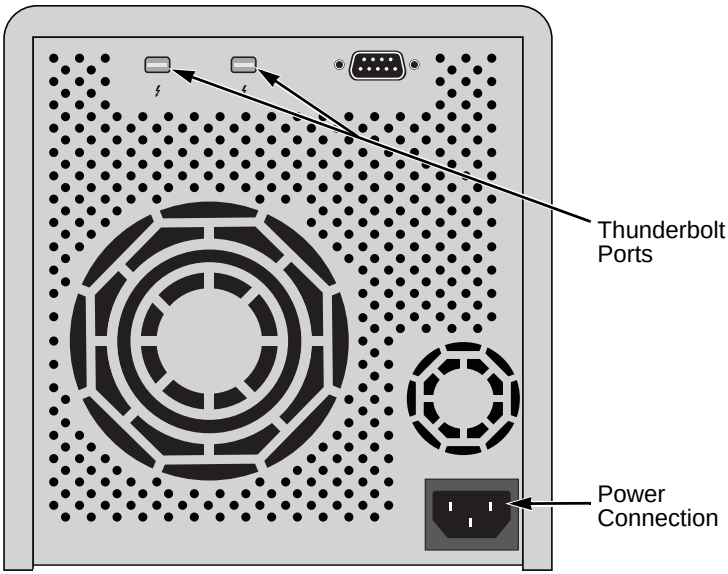


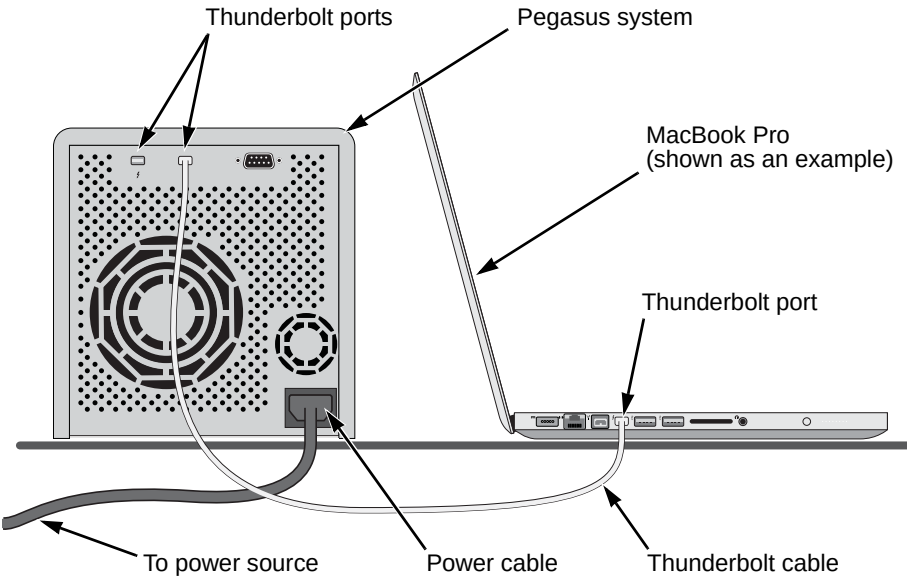
Figure 2. Pegasus R4 back view. The R6 is similar



Connecting to your Mac Computer

Connect a Thunderbolt cable from one of the Thunderbolt ports on the back of the Pegasus to the Thunderbolt port on your Mac computer.

Figure 3. Thunderbolt and power connections on a Mac computer



Notes

- Mini Display extension cables cannot be used to connect *data devices* such as Pegasus to Thunderbolt-enabled computers. Mini Display extension cables can only be used to connect *display devices* to Pegasus.
- If you have multiple Pegasus units, connect the remaining Thunderbolt port on the first unit to either Thunderbolt port on the second unit.

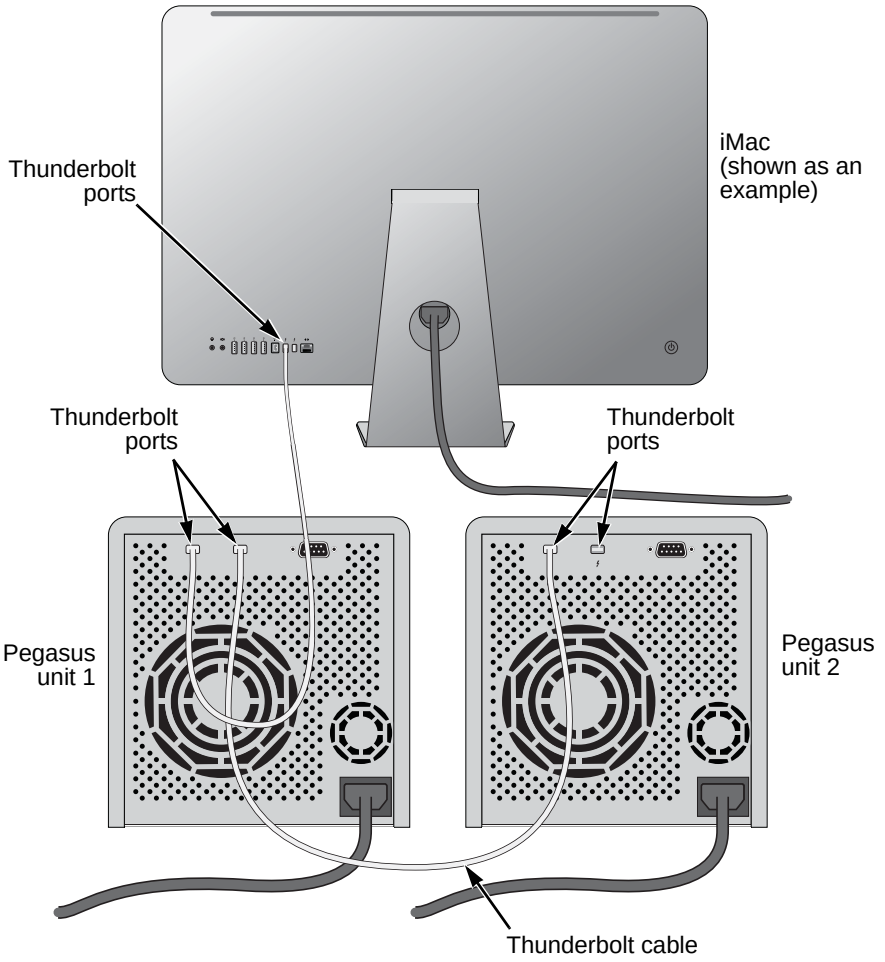
Daisy-Chaining Multiple Pegasus Units

To daisy-chain multiple Pegasus units:

1. Connect a Thunderbolt cable from one of the Thunderbolt ports on the back of your Mac computer to one of the Thunderbolt ports on the first Pegasus unit.
2. Connect a second Thunderbolt cable from other Thunderbolt port on the first Pegasus unit to one of the Thunderbolt ports on the second Pegasus unit.

   See Figure 4.

Figure 4. Thunderbolt daisy-chain connections

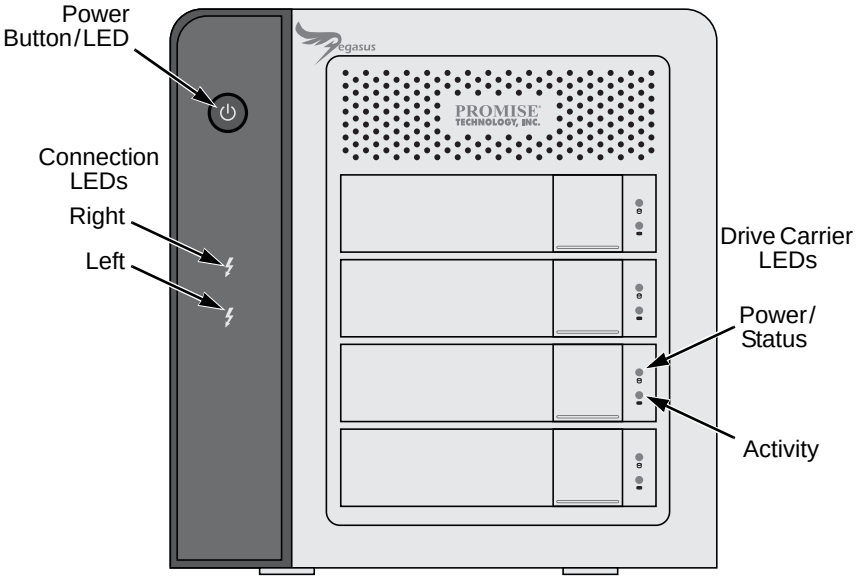


Connecting the Power

To power the Pegasus unit:

1. Attach the power cord on the back of the Pegasus unit.
   See page 7,Figure 3.
2. Plug the other end into a power source.
3. Press the Power Button.
   See Figure 5. The Power Button turns orange.
   It takes about 30 seconds to boot the Pegasus unit. When fully booted:
   - The Power Button LED turns blue.
   - The drive carrier Power/Status LEDs turn blue.

Figure 5. Pegasus R4 front view. The R6 is similar



The Connection LEDs turn blue when there is a proper connection on that Thunderbolt port.

Shutting down the Pegasus

To shut down the Pegasus unit:

Press and hold the Power Button until the Power Button LED turns red. When you release the Power Button, the LED goes dark.

Installing the Software

The Pegasus unit ships ready to use without configuration or set-up. These instructions are for users who plan to:

- Install their own physical drives
- Configure the Pegasus manually

Software installation involves two separate operations:

- Installing the OS driver
- Installing Promise Utility software

OS Support

The following operating systems support the Promise Utility:

- Mac OS 10.6.x
- MacBook Pro/iMac Software Update 1.5

MacBook Pro/iMac Software Update

Important

Be sure the *MacBook Pro/iMac Software Update 1.5* has been installed BEFORE you install the Promise driver from the software CD or from the Promise website.

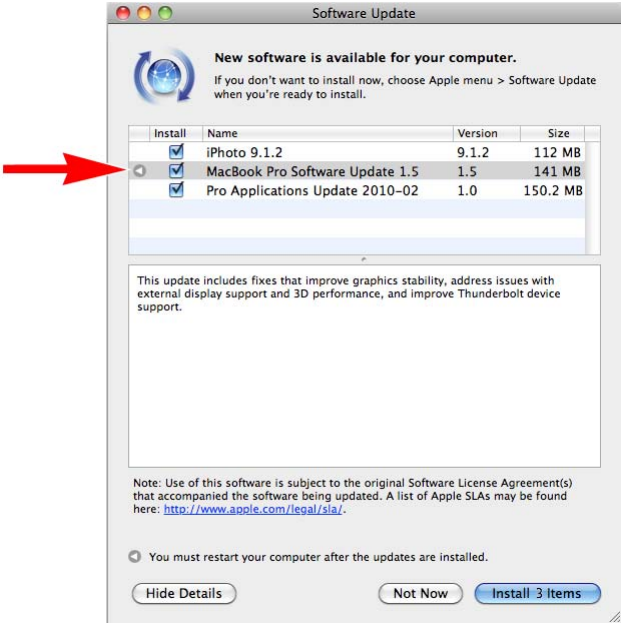
To check your software version:

1. On the MacBook Pro or iMac desktop, click the Apple icon and choose **Software Update...** from the dropdown menu.

   The Software Update dialog box opens. See page 11, Figure 6.

2. Look for *MacBook Pro/iMac Software Update 1.5.*
   - If *MacBook Pro/iMac Software Update 1.5* appears in the list, click the **Install Items** button and wait for the installation to finish.
   - If *MacBook Pro/iMac Software Update 1.5* does NOT appear in the list, the update has already been installed on your computer. Go to “Driver Installation: Macintosh” on page 11.

Figure 6. Software Update dialog box



Driver Installation: Macintosh

To install the driver software onto your computer:

1. Insert the CD into your computer's DVD-ROM.
2. Double-click the driver installer icon (right).

   The Welcome dialog box appears.

3. Click the **Continue** button.

   The Install dialog box appears.
4. Click the **Install** button.

   The password dialog box appears.
5. Type your password in the field provided and click the **OK** button.

   The Confirmation dialog box appears to inform you that you must restart your computer when installation is done.
6. Click the **Continue Installation** button to begin installation.

   In a few moments the Install Succeed dialog box appears.
7. Click the **Restart** button to restart your computer.

   When the computer has restarted, it is ready to work with the Pegasus unit.

Software Installation: Macintosh

To install the Promise Utility software onto your computer:

1. Insert the CD into your computer's DVD-ROM.
2. Double-click the **Promise Utility** installer icon (right).
   The Welcome dialog box appears.
3. Click the **Continue** button.
   The Install dialog box appears.
4. Click the **Install** button.
   The password dialog box appears.
5. Type your password in the field provided and click the **OK** button.
   In a few moments the Install Succeed dialog box appears.
6. Click the **Close** button to quit the installer.
   The installer adds a Promise Utility icon to the Applications folder.
   The Promise Utility loads automatically every time Mac OS X starts.
   Your computer is ready to manage the Pegasus unit.

Important

You must register your Pegasus unit to receive support.
Go to: https://support.promise.com/userRegistration.aspx
Thank you!

Setting up the Pegasus Unit

The Pegasus unit ships ready to use without configuration or set-up. These instructions are for users who plan to:

- Install their own physical drives
- Configure the Pegasus manually

Pegasus set-up involves three steps:

1. Opening the Promise Utility (below).
2. Creating a Disk Array and Logical Drive (page 15).
3. Formatting your Logical Drive (page 16).

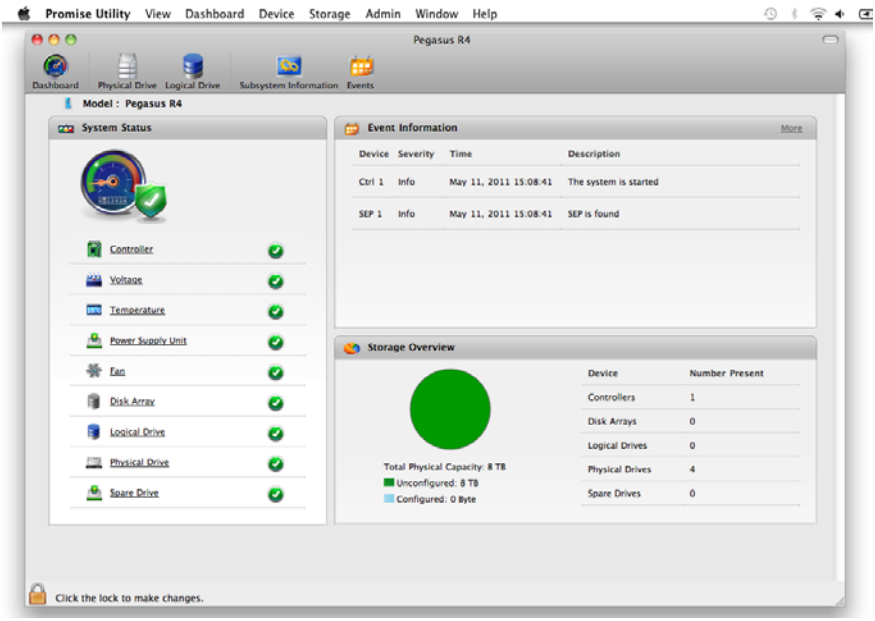
Opening the Promise Utility

Promise Utility icon

To open the Promise Utility, double-click the **Promise Utility** icon in the Macintosh Dock (right).

The Promise Utility window opens and displays the Dashboard.

Figure 7. Promise Utility Dashboard



Unlocking the UI

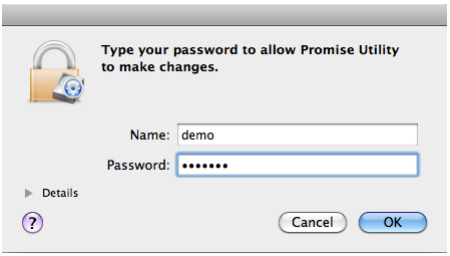
By default, the UI is locked to prevent unauthorized changes to your RAID system. When the UI is locked, you cannot create logical drives or change settings on the Pegasus unit.

To unlock the UI:

1. At the lower left screen of the Promise Utility window, click the closed lock icon.

   The Promise Utility password dialog box opens.

2. Type your Mac computer password into the Password field and click the **OK** button.



   The lock icon changes to open and you can now add and delete logical drives, make settings, run background activities, and update your Pegasus system.

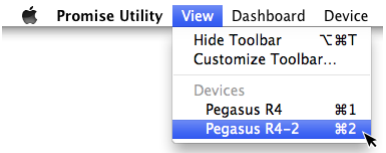
Displaying Multiple Pegasus Units

The Promise Utility displays a separate window for each Pegasus unit connected by Thunderbolt cable and powered up.

To view a list of the Pegasus units, click the **View** menu. See Figure 8.

To display a Pegasus unit in the Promise Utility, click the **View** menu and choose unit you want to see.

Figure 8. Choose among multiple Pegasus units in the View menu



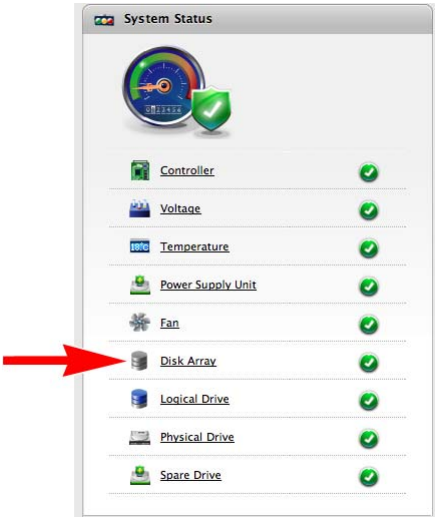
The first Pegasus unit is Pegasus R4 or (R6), the second is Pegasus R4-2 or (R6-2), the third is Pegasus R4-3 or (R6-3), and so on.

Your computer lists the Pegasus units by the order in which they are recognized, not by the cable configuration.

Creating a Disk Array and Logical Drive

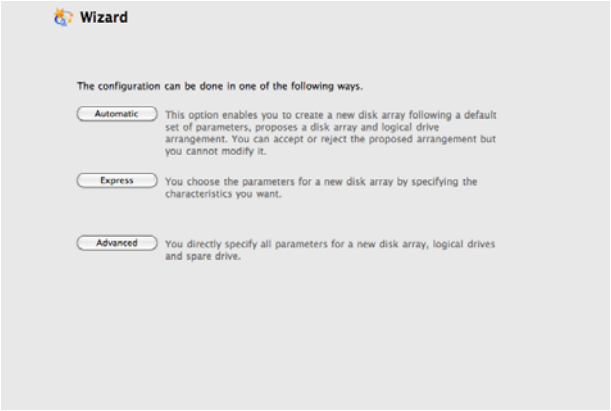
To create your disk array and logical drive, look at the Dashboard window, under System Status, click the **Disk Array** link. See page 15, Figure 9.

Figure 9. Disk Array link on the Dashboard



The Wizard dialog box opens with three configuration methods. See Figure 10.

Figure 10. Wizard dialog box



Choose the best method for your situation. See the table below.

Method	User Options	Suggested for users who are	See Page
Automatic	None	New to data storage	48
Express	General parameters	Familiar with data storage	49
Advanced	Individual parameters	Data storage professionals	51

Formatting your Logical Drive

A RAID logical drive must also be formatted to be compatible with your computer. These instructions describe partitioning and formatting using the Promise Utility with default settings.

For additional options, see “Formatting Logical Drives” on page 90.

When you create your logical drives using the Wizard *Automatic* or *Express* options, your logical drives are always formatted automatically.

When you create your logical drives using the Wizard *Advanced* option, the Format option is enabled by default.

When the Promise Utility has finished the partition and format operation, new removable-drive icons, each representing one logical drive, appear on your desktop (right).

When you see the icon, your logical drive is ready to use.

Chapter 3: Management with the Promise Utility

This chapter contains the following topics:

The Promise Utility requires a Thunderbolt connection between your computer and the Pegasus unit. See “Connecting to your Mac Computer” on page 7.

The Promise Utility must be installed onto your computer before you can use it. See “Installing the Software” on page 10.

Accessing the Promise Utility

Accessing the Promise Utility includes:

Opening

To open the Promise Utility, double-click the **Promise Utility** icon in the Macintosh Dock (right).

Promise Utility icon

The Promise Utility window opens and displays the Dashboard. See page 19, Figure 1.

Closing

There are two ways close the Promise Utility:

- Click the Promise Utility dropdown menu and choose **Quit Promise Utility**
- Press ⌘Q

Unlocking the UI

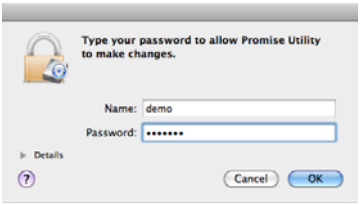
By default, the UI is locked to prevent unauthorized changes to your RAID system. When the UI is locked, you are limited to viewing information and events.

To open the lock:

1. At the lower left screen of the Promise Utility window, click the closed lock icon.

   The password dialog box opens.

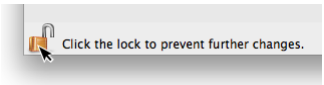
2. Type your Mac computer password into the Password field and click the **OK** button.



   The lock icon changes to open and you can now add and delete logical drives, make settings, run background activities, and update your Pegasus system.

Locking the UI

To lock the UI, click the open lock icon.

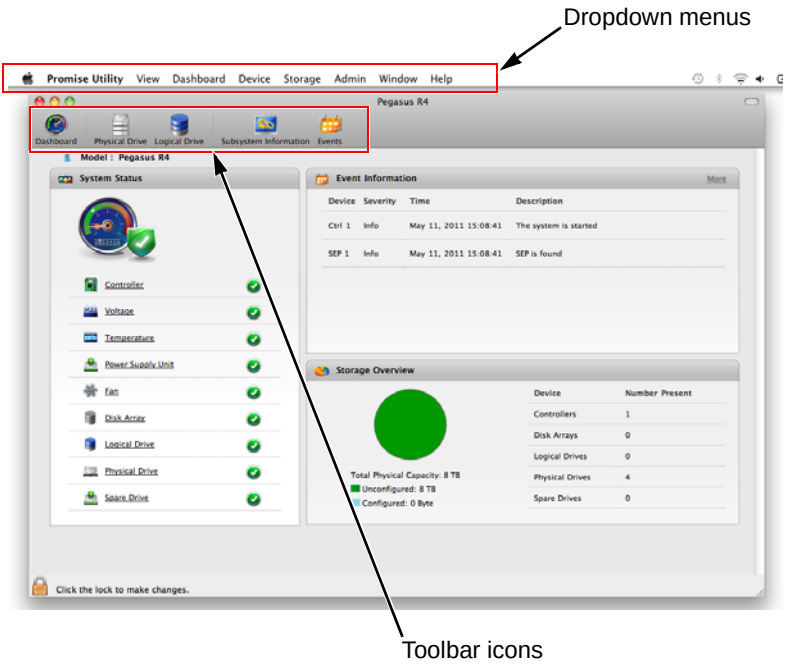


The lock icon changes to closed and you are again limited to viewing information and events.

Perusing the Promise Utility Interface

The Promise Utility interface consists of menus and icons, each leading you to a specific function.

Figure 1. The Promise Utility interface with the Dashboard displayed



Dropdown Menus

- **Promise Utility** – About, Checking for Updates, Preferences, Services, Hide, Quit
- **View** – Show/Hide Toolbar, Customize Toolbar, Devices (Pegasus units)
- **Dashboard** – Show the Dashboard
- **Device** – Front and Back Views, Component List, Physical Drive List
- **Storage** – Wizard, Disk Array List, Logical Drive List, Spare Drive List
- **Admin** – Subsystem (Pegasus unit) Information, Events, Background Activities, Firmware Update, Restore Factory Default (settings)
- **Window** – Minimize, Zoom, Close Window, Bring All to Front, Pegasus unit
- **Help** – Online help search

Toolbar Icons

The default toolbar icons are listed here:

- **Dashboard** icon – Displays the Dashboard and overview
- **Physical Drive** icon – Displays the physical drive list, settings and functions
- **Logical Drive** icon – Displays the logical drive list, settings and functions
- **Subsystem Information** icon – Displays Pegasus unit information and settings
- **Events** icon – Displays the event logs

Customizing the Toolbar

You can customize the toolbar by adding or removing icons.

To add and remove toolbar icons:

1. From the Promise Utility window, click the **View** menu and choose **Customize Toolbar...**

   The toolbar options dialog box appears.
2. Do one or both actions are needed:
   - Click and drag an icon from the dialog box to the toolbar to add the icon.
   - Click and drag an icon from the toolbar to delete the icon.
3. When you are finished, click the **Done** button.

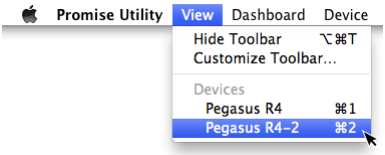
Displaying Multiple Pegasus Units

The Promise Utility displays a separate window for each Pegasus unit connected by Thunderbolt cable and powered up.

To view a list of the Pegasus units, click the **View** menu. See Figure 2.

To display a Pegasus unit in the Promise Utility, click the **View** menu and choose unit you want to see.

Figure 2. Choose among multiple Pegasus units in the View menu



The first Pegasus unit is Pegasus R4 or (R6), the second is Pegasus R4-2 or (R6-2), the third is Pegasus R4-3 or (R6-3), and so on.

Your computer lists the Pegasus units by the order in which they are recognized, not by the cable configuration.

Managing Subsystems

Subsystem management includes:

- Viewing Subsystem Information (below)
- Making Subsystem Settings (page 21)
- Clearing Statistics (page 21)
- Restoring Factory Default Settings (page 22)

Viewing Subsystem Information

The term *subsystem* refers to the Pegasus unit.

To view subsystem information, do one of the following actions:

- Click the **Subsystem Information** icon.
- From the Admin menu, choose **Subsystem Information**.

Subsystem information includes:

- Alias * – Same as controller alias
- Model
- WWN – World Wide Number
- Part number
- Vendor
- Serial number
- Revision number
- System date and time

Items with an asterisk (*) are adjustable under “Making Subsystem Settings” below.

Making Subsystem Settings

To make subsystem settings:

1. Do one of the following actions,
   - Click the **Subsystem Information** icon.
   - From the Admin menu, choose **Subsystem Information**.
2. Click the **Settings** button.
3. Make changes as required:
   - Enter an alias or change the existing alias in the field provided.
4. Click the **Save** button.

Clearing Statistics

This function clears statistical data on the RAID controller, physical drives, and logical drives.

To clear statistics:

1. Do one of the following actions,

- Click the **Subsystem Information** icon.
- From the Admin menu, choose **Subsystem Information**.

2. Click the **Clear Statistics** button.
3. Type the word “confirm” in the field provided.
4. Click the **Confirm** button.

Restoring Factory Default Settings

This feature restores settings to their default values.

Caution

Use this feature only when required and only on the settings that you must reset to default in order to set them correctly.

To restore all settings to their default values:

1. From the Admin menu, choose **Restore Factory Default**.
2. In the Restore Factory Default settings screen, check the boxes beside the settings you want to reset to default value.
   - Background activity settings
   - Controller settings
   - Physical drive settings
   - Subsystem settings
3. Click the **Submit** button.
4. In the Confirmation box, type the word “confirm” in the field provided and click the **Confirm** button.

Managing the RAID Controller

RAID controller management includes:

- Viewing Controller Information (below)
- Viewing Controller Statistics (page 24)
- Making Controller Settings (page 25)
- Updating Firmware on the Pegasus Unit (page 25)
- Making Buzzer Settings (page 26)
- Testing the Buzzer (page 26)
- Silencing the Buzzer (page 26)

Viewing Controller Information

To view controller information:

1. Do one of the following actions,
   - Click the **Dashboard** icon, then click the **Controller** link.
   - From the Device menu, choose **Component List.**
2. Mouse-over and click the controller, then click the **View** button.

   Controller information includes:
   - Controller ID
   - Vendor
   - Operational Status
   - Cache Usage – Percentage
   - Part Number
   - Hardware Revision
   - SCSI Protocol Supported
   - Single Image Version
   - Host Driver Version
   - Alias * – Same as subsystem alias
   - Model
   - Power On Time
   - Dirty Cache Usage – Percentage
   - Serial Number
   - WWN – Worldwide Number
   - BIOS Version
   - Single Image Build Date
3. Click the **Advanced Information** tab.

Advanced controller information includes:

- Memory Type
- Flash Type
- NVRAM Type
- Preferred Cache Line Size
- Coercion *
- NVRAM Size
- SMART *
- Write Back Cache Flush Interval *
- Enclosure Polling Interval *
- Forced Read Ahead (cache) *
- Memory Size
- Flash Size
- NVRAM Size
- Cache Line Size
- Coercion Method *
- Preferred Cache Line Size
- SMART Polling Interval *
- Write Through Mode *
- Adaptive Writeback Cache *
- Storage Location of the Migration Watermark

Items with an asterisk (*) are adjustable under “Making Controller Settings” on page 25.

4. Click the **X** icon to close the information panel.

Viewing Controller Statistics

To view controller statistics:

1. Do one of the following actions,
   - Click the **Dashboard** icon, then click the **Controller** link.
   - From the Device menu, choose **Component List**.
2. Mouse-over and click the controller, then click the **View** button.
3. Click the **Statistics** tab.

   Controller statistics include:
   - Data Transferred
   - Write Data Transferred
   - Non-Read/Write Errors
   - Write Errors
   - Non-Read/Write Requests
   - Write I/O Requests
   - Statistics Collection date and time
   - Read Data Transferred
   - Errors
   - Read Errors
   - I/O Requests
   - Read I/O Requests
   - Statistics Start date and time
4. Click the **X** icon to close the information panel.

Note

To clear controller statistics, see “Clearing Statistics” on page 21.

Making Controller Settings

To make controller settings:

1. Do one of the following actions,
   - Click the **Dashboard** icon, then click the **Controller** link.
   - From the Device menu, choose **Component List**.
2. Mouse-over and click the controller, then click the **Settings** button.
3. Make setting changes as required:
   - Enter, change or delete the alias in the **Alias** field.
   - **SMART Log** – Check the box to enable or uncheck to disable.
   - **SMART Polling Interval** – Enter a value into the field, 1 to 1440 minutes. 1440 minutes = 24 hours
   - **Enable Coercion** – Check the box to enable or uncheck to disable.
   - **Coercion Method** – Choose a method from the dropdown menu:
     - GBTruncate
     - 10GBTruncate
     - GrpRounding
     - TableRounding
   - **Write Back Cache Flush Interval** – Enter a value into the field, 1 to 12 seconds.
   - **Enclosure Polling Interval** – 15 to 255 seconds.
4. Click the **Save** button.
5. Click the **X** icon to close the settings panel.

Updating Firmware on the Pegasus Unit

Use this function to flash (update) the firmware on the Pegasus. See page 131 for the procedure.

Making Buzzer Settings

To make buzzer settings:

1. Do one of the following actions,
   - Click the **Dashboard** icon, then click the **Controller** link.
   - From the Device menu, choose **Component List**.
2. Mouse-over and click the buzzer, then click the **Settings** button.
3. Check the **Enable Buzzer** box to enable the buzzer.
   Or uncheck the box to disable.
4. Click the **Save** button.

Testing the Buzzer

The buzzer must be enabled to perform this procedure.

To test the buzzer:

1. Do one of the following actions,
   - Click the **Dashboard** icon, then click the **Controller** link.
   - From the Device menu, choose **Component List**.
2. Mouse-over and click the buzzer, then click the **Sound** button.

Silencing the Buzzer

To silence the buzzer:

1. Do one of the following actions,
   - Click the **Dashboard** icon, then click the **Controller** link.
   - From the Device menu, choose **Component List.**
2. Mouse-over and click the buzzer, then click the **Mute** button.

Managing Subsystems

Enclosure management includes the following functions:

- Viewing the Subsystem Information (page 27)
- Viewing Temperature Sensor Information (page 27)
- Locating a Subsystem (page 28)

Viewing the Subsystem Information

To access subsystem information:

1. Do one of the following actions,
   - Click the **Dashboard** icon, then click the **Controller** link.
   - From the Device menu, choose **Component List**.
2. Mouse-over and click the Subsystem, then click the **View** button.

   Subsystem information includes:
   - Enclosure ID
   - Enclosure Type
   - Enclosure Warning Temperature Threshold *
   - Enclosure Critical Temperature Threshold *
   - Controller Warning Temperature Threshold *
   - Controller Critical Temperature Threshold *
   - Max Number of Controllers
   - Max Number of Physical Drive Slots
   - Max Number of Fans
   - Max Number of Blowers
   - Max Number of Temperature Sensors
   - Max Number of Power Supply Units
   - Max Number of Voltage Sensors

   Items with an asterisk (*) are adjustable under “Locating a Subsystem” on page 28.
3. Click the **X** icon to close the information panel.

Viewing Temperature Sensor Information

To view the status of the temperature sensor:

1. Do one of the following actions,
   - Click the **Dashboard** icon, then click the **Controller** link.
   - From the Device menu, choose **Component List**.

2. Mouse-over and click the Enclosure, then click the **View** button.
3. Scroll down until you see Temperature Sensors.

   Enclosure information includes:

   - ID – 1
   - Status – = Normal. = Warning. = Critical.
   - Location – Not applicable for Pegasus
   - Healthy (temperature) Threshold * – Enclosure Warning Temperature Threshold
   - Current Temperature

   Items with an asterisk (*) are adjustable under “Locating a Subsystem” on page 28.
4. Click the **X** icon to close the information panel.

Locating a Subsystem

If you have multiple Pegasus units, and you want to verify which unit you are accessing in the Promise Utility, use the *Locate* function.

To locate a subsystem:

1. Do one of the following actions,
   - Click the **Dashboard** icon, then click the **Controller** link.
   - From the Device menu, choose **Component List**.
2. Mouse-over and click the Subsystem, then click the **Locate** button.

   The Drive Power/Status LEDs on all drive carriers blink blue and orange for one minute.

Figure 3. Running the Locate function to identify an enclosure

For information on Subsystem problems, see “Subsystem Problems” on page 115.

Managing Background Activities

Background activity management includes:

Background activities perform a variety of preventive and remedial functions on your physical drives, disk arrays, logical drives, and other components.

You can run a background activity immediately or schedule it to run at a later time. Scheduling options are described below.

Setting options for each activity are listed after the scheduling options. These settings determine how the background activity affects I/O performance.

Viewing Current Background Activities

To view a list of background activities, from the Admin menu, choose **Background Activities**.

The list of background appears.

- Media Patrol – See page 32
- Redundancy Check – See page 33
- Rebuild – See page 34
- Migration – See page 35
- PDM – See page 35
- Transition – See page 36
- Synchronization – See page 37

Currently running activities show a progress bar.

Viewing Scheduled Background Activities

To view a list of scheduled background activities:

1. From the Admin menu, choose **Background Activities**.
2. Click the **Scheduler** button.

   The list of scheduled background appears.

Adding a Scheduled Background Activity

To add a new scheduled background activity:

1. From the Admin menu, choose **Background Activities**.
2. Click the **Scheduler** button.

   The list of scheduled background appears.
3. Mouse-over and click the background activity, then click the **Settings** button.
4. Make settings as needed.
   - Choose the option for the activity you want:
     - Media Patrol
     - Redundancy Check
     - Spare Check
   - Choose a **Start Time** from the dropdown menus.

     The menus have a 24-hour clock.
   - Choose a **Recurrence Pattern** option, daily, weekly, or monthly.
     - For the Daily option, enter an interval in the Every field.
     - For the Weekly option, enter an interval in the Every field and choose one or more days of the week.
     - For the Monthly option, choose, Day of the Month option or a sequential and specific day from the dropdown menu. Also choose which months.
   - Choose a **Start From** date from the dropdown menus.
   - Choose an **End On** option:
     - No end date or perpetual.
     - End after a specific number of activity actions.
     - Until date from the dropdown menus.
   - For Redundancy Check, choose:
     - **Auto Fix** option – Attempts to repair the problem when it finds an error. Check to enable
     - **Pause on Error** option – The process stops when it finds a non-repairable error. Check to enable

- **Select LD** – Check the boxes for the logical drives to run Redundancy Check. Check at least one logical drive.

5. Click the **Save** button.

   To return to currently running background activities, click the **Background Activities** button.

Changing a Background Activity Schedule

To change an existing scheduled background activity:

1. From the Admin menu, choose **Background Activities**.
2. Click the **Scheduler** button.

   The list of scheduled background appears.
3. Mouse-over and click the background activity, then click the **Settings** button.
4. Make settings as needed.
   - Choose the option for the activity you want:
     - Media Patrol
     - Redundancy Check
     - Spare Check
   - Choose a **Start Time** from the dropdown menus.

     The menus have a 24-hour clock.
   - Choose a **Recurrence Pattern** option, daily, weekly, or monthly.
     - For the Daily option, enter an interval in the Every field.
     - For the Weekly option, enter an interval in the Every field and choose one or more days of the week.
     - For the Monthly option, choose, Day of the Month option or a sequential and specific day from the dropdown menu. Also choose which months.
   - Choose a **Start From** date from the dropdown menus.
   - Choose an **End On** option,
     - No end date or perpetual.
     - End after a specific number of activity actions.
     - Until date from the dropdown menus.
   - For Redundancy Check, choose,
     - **Auto Fix** option – Attempts to repair the problem when it finds an error. Check to enable
     - **Pause on Error** option – The process stops when it finds a non-repairable error. Check to enable

- **Select LD** – Check the boxes for the logical drives to run Redundancy Check. Check at least one logical drive.

5. Click the **Save** button.

   To return to currently running background activities, click the **Background Activities** button.

Enabling or Disabling a Scheduled Background Activity

Background activity schedules are enabled by default when you create the schedule. If you want to stop a background activity now but plan to use it again in the future, disable the scheduled activity rather than deleting it.

To enable or disable change an existing scheduled background activity:

1. From the Admin menu, choose **Background Activities**.
2. Click the **Scheduler** button.

   The list of scheduled background appears.
3. Mouse-over the background activity and click the **Settings** button.
4. Uncheck the **Enable This Schedule** box to disable this schedule.

   Check the box to enable this schedule.
5. Click the **Save** button.

   To return to currently running background activities, click the **Background Activities** button.

Deleting a Scheduled Background Activity

To delete a scheduled background activity:

1. From the Admin menu, choose **Background Activities**.
2. Click the **Scheduler** button.

   The list of scheduled background appears.
3. Mouse-over and click the background activity, then click the **Delete** button.
4. Type the word “confirm” in the field provided.
5. Click the **Confirm** button.

   To return to currently running background activities, click the **Background Activities** button.

Media Patrol

Media Patrol is a routine maintenance procedure that checks the magnetic media on each disk drive. Media Patrol checks are enabled by default on all disk arrays and spare drives. Media Patrol is concerned with the media itself, not the data recorded on the media. If Media Patrol encounters a critical error, it triggers PDM if PDM is enabled on the disk array.

See “Making Disk Array Settings” on page 53, “Running Media Patrol on your Physical Drives” on page 44, and “Media Patrol” on page 73.

Making Media Patrol Settings

To make Media Patrol settings:

1. From the Admin menu, choose **Background Activities**.
2. Click the **Settings** button.
3. Check the **Enable Media Patrol** box to enable, uncheck to disable.

   This settings enables or disables Media Patrol for all physical drives.
4. Click the **Confirm** button.
5. Click the **X** icon to close the background activities panel.

Redundancy Check

Redundancy Check is a routine maintenance procedure for fault-tolerant disk arrays (those with redundancy) that ensures all the data matches exactly. Redundancy Check can also correct inconsistencies.

See “Redundancy Check on a Logical Drive” on page 64.

Making Redundancy Check Settings

To make Redundancy Check settings:

1. From the Admin menu, choose **Background Activities**.
2. Click the **Settings** button.
3. Click the **Redundancy Check Rate** dropdown menu and choose a rate:
   - **Low** – Fewer system resources to Redundancy Check, more to data read/write operations.
   - **Medium** – Balances system resources between Redundancy Check and data read/write operations.
   - **High** – More system resources to Redundancy Check, fewer to data read/write operations.
4. Click the **Confirm** button.
5. Click the **X** icon to close the background activities panel.

Initialization

Technically speaking, Initialization is a foreground activity, as you cannot access a logical drive while it is initiating.

Initialization is normally done to logical drives after they are created from a disk array. Initialization sets all data bits in the logical drive to zero. The action is useful because there may be residual data on the logical drives left behind from

earlier configurations. For this reason, Initialization is recommended whenever you create a logical drive.

See “Initializing a Logical Drive” on page 63 and “Initialization” on page 89.

Making Initialization Settings

To make initialization settings:

1. From the Admin menu, choose **Background Activities**.
2. Click the **Settings** button.
3. Click the **Logical Drive Initialization Rate** dropdown menu and choose a rate:
    - **Low** – Fewer system resources to Initialization, more to data read/write operations.
    - **Medium** – Balances system resources between Initialization and data read/write operations.
    - **High** – More system resources to Initialization, fewer to data read/write operations.
4. Click the **Confirm** button.
5. Click the **X** icon to close the background activities panel.

Rebuild

When you rebuild a disk array, you are actually rebuilding the data on one physical drive.

- When a physical drive in a disk array fails and a spare drive of adequate capacity is available, the disk array begins to rebuild automatically using the spare drive.
- If there is no spare drive of adequate capacity, but the **Auto Rebuild** function is ENABLED, the disk array begins to rebuild automatically as soon as you remove the failed physical drive and install an unconfigured physical drive in the same slot. See “Making Rebuild Settings” on page 34.
- If there is no spare drive of adequate capacity and the Auto Rebuild function is DISABLED, you must replace the failed drive with an unconfigured physical drive, then perform a **Manual Rebuild**.

See “Rebuilding a Disk Array” on page 55 and “Spare Drives” on page 92.

Also see “Disk Array Degraded/Logical Drive Critical” on page 110 and “Disk Array Offline/Logical Drive Offline” on page 111.

Making Rebuild Settings

1. From the Admin menu, choose **Background Activities**.
2. Click the **Settings** button.

3. Click the **Rebuild Rate** dropdown menu and choose a rate:
   - **Low** – Fewer system resources to the Rebuild, more to data read/write operations.
   - **Medium** – Balances system resources between the Rebuild and data read/write operations.
   - **High** – More system resources to the Rebuild, fewer to data read/write operations.
4. Check the **Enable Auto Rebuild** box to enable Auto Rebuild (rebuilds when you swap out the failed drive with a new one).
5. Click the **Confirm** button.
6. Click the **X** icon to close the background activities panel.

Migration

The term “Migration” means either or both of the following:

- Change the RAID level of a logical drive.
- Expand the storage capacity of a logical drive.

See “Migrating a Logical Drive” on page 65 and “RAID Level Migration” on page 84.

Making Migration Settings

To make migration settings:

1. From the Admin menu, choose **Background Activities**.
2. Click the **Settings** button.
3. Click the Migration Rate dropdown menu and choose a rate:
   - **Low** – Fewer system resources to Migration, more to data read/write operations.
   - **Medium** – Balances system resources between Migration and data read/write operations.
   - **High** – More system resources to Migration, fewer to data read/write operations.
4. Click the **Confirm** button.
5. Click the **X** icon to close the background activities panel.

PDM

Predictive Data Migration (PDM) is the migration of data from the suspect disk drive to a spare drive, similar to rebuilding a disk array. But unlike rebuilding, PDM automatically copies your data to a spare drive *before* the drive fails and your logical drive goes Critical.

PDM can be triggered automatically by Media Patrol. Also see “Running PDM on a Logical Drive” on page 66 and “PDM” on page 73.

Making PDM Settings

To make PDM settings:

1. From the Admin menu, choose **Background Activities**.
2. Click the **Settings** button.
3. Make the following settings are required:
   - Click the **PDM Rate** dropdown menu and choose a rate:
     - **Low** – Fewer system resources to PDM, more to data read/write operations.
     - **Medium** – Balances system resources between PDM and data read/write operations.
     - **High** – More system resources to PDM, fewer to data read/write operations.
   - Highlight the current values in the block threshold fields and input new values.

     Reassigned block threshold range is 1 to 512 blocks.

     Error block threshold range is 1 to 2048 blocks.
4. Click the **Confirm** button.
5. Click the **X** icon to close the background activities panel.

Transition

Transition is the process of replacing a revertible spare drive that is currently part of a disk array with an unconfigured physical drive or a non-revertible spare drive.

See “Running a Transition on a Spare Drive” on page 71 and “Transition” on page 93.

Making Transition Settings

To make Transition settings:

1. From the Admin menu, choose **Background Activities**.
2. Click the **Settings** button.
3. Click the **Transition Rate** dropdown menu and choose a rate:
   - **Low** – Fewer system resources to Transition, more to data read/write operations.
   - **Medium** – Balances system resources between Transition and data read/write operations.
   - **High** – More system resources to Transition, fewer to data read/write operations.

4. Click the **Confirm** button.
5. Click the **X** icon to close the background activities panel.

Synchronization

Synchronization is automatically applied to logical drives when they are created. Synchronization recalculates the redundancy data to ensure that the working data on the physical drives is properly in sync.

Mouse-over on the logical drive, click the **View** button, and look under Logical Drive Information beside the line that says **Synchronized**. A **Yes** means the logical drive was synchronized. See “Viewing Logical Drive Information” on page 58.

Making Synchronization Settings

To make Synchronization settings:

1. From the Admin menu, choose **Background Activities**.
2. Click the **Settings** button.
3. Click the **Background Synchronization Rate** dropdown menu and choose a rate:
   - **Low** – Fewer system resources to Synchronization, more to data read/write operations.
   - **Medium** – Balances system resources between Synchronization and data read/write operations.
   - **High** – More system resources to Synchronization, fewer to data read/write operations.
4. Click the **Confirm** button.
5. Click the **X** icon to close the background activities panel.

Managing Physical Drives

Physical drive management includes:

- Viewing a List of Physical Drives (below)
- Viewing Physical Drive Information (page 38)
- Viewing Physical Drive SMART Log Information (page 40)
- Locating a Physical Drive (page 41)
- Making Global Physical Drive Settings (page 41)
- Making Individual Physical Drive Settings (page 42)
- Making Physical Drive SMART Log Settings (page 42)
- Clearing a Stale or a PFA Condition (page 43)
- Forcing a Physical Drive Offline (page 43)

Also see “Physical Drive Problems” on page 106.

Viewing a List of Physical Drives

To view a list of physical drives in the Pegasus unit, do one of the following actions:

- Click the **Physical Drive** icon.
- From the Device menu, choose **Physical Drive**.

Physical drive information includes:

- **ID** – ID number of the physical drive
- **Status** –  = Normal.  = Stale or PFA.  = Dead.
- **Model** – Make and model of the drive
- **Type** – SATA, HDD or SSD
- **Location** – Enclosure number and slot number
- **Configuration** – Array number and sequence number, spare number, unconfigured, or stale configuration
- **Capacity** – In GB

Viewing Physical Drive Information

To view physical drive information:

1. Do one of the following actions:
   - Click the **Physical Drive** icon.
   - From the Device menu, choose **Physical Drive**.
2. Mouse-over and click the physical drive you want then click the **View** button.

   Physical drive information includes:

- **Physical Drive ID** – ID number of the physical drive
- **Location** – Enclosure number and slot number
- **Alias** – If assigned
- **Physical Capacity** – Total capacity in GB
- **Configurable Capacity** – Usable capacity in GB
- **Used Capacity** – Capacity actually used in GB
- **Block Size** – Typically 512 Bytes
- **Operational Status** – OK is normal, Stale, PFA, Dead
- **Configuration Status** – Array number and sequence number, spare number
- **Model Number** – Make and model of the drive
- **Drive Interface** – SATA 1.5Gb/s or 3Gb/s
- **Serial Number** – Serial number of the drive
- **Firmware Version** – Firmware version on the drive
- **Protocol Version** – ATA/ATAPI protocol version

3. Click the **Advanced Information** tab.

   Advanced information for physical drives includes:

   - Write Cache – Enabled or disabled *
   - Read Look Ahead Cache – Enabled or disabled *
   - SMART Feature Set – Yes or No
   - SMART Self Test – Yes or No
   - SMART Error Logging – Yes or No
   - Command Queuing Support – TCQ or NCQ
   - Command Queuing – Enabled or disabled *
   - Queue Depth – Number of commands
   - Maximum Ultra DMA Mode Supported
   - DMA Mode
   - Power Saving Level – Supported by this drive
   - Medium Error Threshold **

   Items with an asterisk (*) are adjustable under “Viewing Physical Drive Statistics” on page 40.

   Items with two asterisks (**) are adjustable under “Making PDM Settings” on page 36.

4. Click the **X** icon to close the information panel.

Viewing Physical Drive Statistics

To view physical drive statistics:

1. Do one of the following actions:
   - Click the **Physical Drive** icon.
   - From the Device menu, choose **Physical Drive**.
2. Mouse-over and click the physical drive you want then click the **View** button.
3. Click the **Statistics** tab.

   Physical drive statistics include:
   - Data Transferred
   - Read Data Transferred
   - Write Data Transferred
   - Errors – Number of errors
   - Non Read/Write Errors
   - Read Errors
   - Write Errors
   - I/O Request – Number of requests
   - Non Read/Write Request – Number of requests
   - Read I/O Request – Number of requests
   - Write I/O Request – Number of requests
   - Statistics Start Time – Time and date
   - Statistics Collection Time – Time and date

   To clear physical drive statistics, see “Clearing Statistics” on page 21.
4. Click the **X** icon to close the settings panel.

Viewing Physical Drive SMART Log Information

To view physical drive SMART Log information:

1. Do one of the following actions:
   - Click the **Physical Drive** icon.
   - From the Device menu, choose **Physical Drive**.
2. Mouse-over and click the physical drive you want then click the **View** button.
3. Click the **SMART Log** tab.

   SMART Log information includes:
   - Physical Drive ID
   - SMART Support – Yes or No, depending on the drive
   - SMART Status – Enabled or disabled *

- SMART Health Status – OK is normal
- SCT Status Version
- SCT Version
- SCT Support Level
- Current Temperature
- Power Cycle Max Temperature
- Power Cycle Min Temperature
- Lifetime Max Temperature
- Lifetime Min Temperature

Items with an asterisk (*) are adjustable under “Making Controller Settings” on page 25.

4. Click the **X** icon to close the settings panel.

Locating a Physical Drive

This feature causes the drive carrier LEDs to blink for one minute to assist you in locating the physical drive, and is supported by RAID subsystems and JBOD expansion units.

To locate a physical drive:

1. Do one of the following actions:
   - Click the **Physical Drive** icon.
   - From the Device menu, choose **Physical Drive**.
2. Mouse-over and click the physical drive you want then click the **Locate** button.

   The Drive Power/Status LED for the drive carrier holding that drive blinks blue and orange for one minute.

Figure 4. Running the Locate function to identify a physical drive

Making Global Physical Drive Settings

To make global physical drive settings:

1. Do one of the following actions:
   - Click the **Physical Drive** icon.
   - From the Device menu, choose **Physical Drive**.

2. Click the **Global Physical Drive Settings** button.
3. Check the boxes to enable, uncheck to disable.
   - Enable Write Cache
   - Enable Read Look Ahead Cache
   - Enable Command Queuing
4. Click the **Save** button.
5. Click the **X** icon to close the settings panel.

Making Individual Physical Drive Settings

To make individual physical drive settings:

1. Do one of the following actions:
   - Click the **Physical Drive** icon.
   - From the Device menu, choose **Physical Drive**.
2. Mouse-over and click the physical drive you want then click the **Settings** button.
3. Make changes as needed:
   - Enter, change, or delete the alias in the Alias field.
   - Choose Unconfigured or PassThru Configuration.

     Unconfigured drives are not visible to your computer. Use them to make disk arrays.

     PassThru drives are visible to your computer and are configured as individual drives. They cannot be used to make a disk array.
4. Click the **Save** button.
5. Click the **X** icon to close the settings panel.

Making Physical Drive SMART Log Settings

To make physical drive SMART log settings:

1. Do one of the following actions:
   - Click the **Physical Drive** icon.
   - From the Device menu, choose **Physical Drive**.
2. Mouse-over and click the physical drive you want then click the **Settings** button.
3. Click the **SMART Log Settings** tab.
4. Check the box to enable the SMART log.
5. Click the **Save** button.
6. Click the **X** icon to close the settings panel.

Clearing a Stale or a PFA Condition

Stale – The physical drive contains obsolete disk array information.

PFA – The physical drive has errors resulting in a prediction of failure.

Be sure you have corrected the condition by a physical drive replacement, rebuild operation, etc., first. Then clear the condition.

To clear a Stale or a PFA condition:

1. Do one of the following actions:
   - Click the **Physical Drive** icon.
   - From the Device menu, choose **Physical Drive**.
2. Mouse-over and click the physical drive you want then click the **Clear** button.
3. Click the **Confirm** button.

   If the physical drive has *both* a Stale condition *and* a PFA condition, the first click removes the Stale condition. Click the **Clear** button a second time to remove the PFA condition.

Forcing a Physical Drive Offline

This feature applies only to physical drives assigned to disk arrays.

Caution

Forcing a physical drive offline is likely to cause data loss. Back up your data before you proceed. Use this function only when required.

Important

Forcing a physical drive offline causes your logical drives to become degraded. If Auto Rebuild is enabled and a spare drive is available, the disk array begins rebuilding itself automatically.

To force a physical drive offline:

1. Do one of the following actions:
   - Click the **Physical Drive** icon.
   - From the Device menu, choose **Physical Drive**.
2. Mouse-over and click the physical drive you want then click the **Force Offline** button.
3. In the Confirmation box, type the word “confirm” in the field provided and click the **Confirm** button.

Running Media Patrol on your Physical Drives

Media Patrol is a routine maintenance procedure that checks the magnetic media on each disk drive. Media Patrol checks are enabled by default on all disk arrays and spare drives. Media Patrol is concerned with the media itself, not the data recorded on the media. If Media Patrol encounters a critical error, it triggers PDM if PDM is enabled on the disk array. Media Patrol checks all physical drives one at a time.

To run Media Patrol on your physical drives:

1. From the Admin menu, choose **Background Activities**.

   The list of background activities appears.
2. Mouse-over Media Patrol and click the **Start** button.

Pausing and Resuming a Media Patrol

To pause or resume a Media Patrol:

1. From the Admin menu, choose **Background Activities**.

   The list of background activities appears.
2. Mouse-over Media Patrol and click the **Pause** or **Resume** button.

Stopping a a Media Patrol

To stop is to cancel the Media Patrol:

1. From the Admin menu, choose **Background Activities**.

   The list of background activities appears.
2. Mouse-over Media Patrol and click the **Stop** button.
3. In the Confirmation box, type the word “confirm” in the field provided and click the **Confirm** button.

Managing Disk Arrays

Disk array management includes:

- Viewing a List of Disk Arrays (below)
- Viewing Disk Array Information (page 45)
- Creating a Disk Array Manually (page 46)
- Creating a Disk Array and Logical Drive with the Wizard (page 47)
- Making Disk Array Settings (page 53)
- Locating a Disk Array (page 53)
- Deleting a Disk Array (page 54)
- Preparing a Disk Array for Transport (page 54)
- Rebuilding a Disk Array (page 55)

Also see “Disk Array and Logical Drive Problems” on page 110.

Viewing a List of Disk Arrays

To view a list of disk arrays, do one of the following actions:

- From the Dashboard window, click the **Disk Array** link.
- From the Storage menu, choose **Disk Array**.

The list of disk arrays appears. Each disk array lists:

- **ID** – DA0, DA1, etc.
- **Alias** – If assigned
- **Status** –  = Normal.  = Degraded.  = Incomplete, physical drive missing
- **Capacity** – Data capacity of the array
- **Free Capacity** – Unconfigured or unused capacity on the physical drives
- **Media Patrol** – Enabled or disabled on this array
- **Number of Logical Drives** – The number of logical drives on this array

Viewing Disk Array Information

To view disk array information:

1. Do one of the following actions:
   - From the Dashboard window, click the **Disk Array** link.
   - From the Storage menu, choose **Disk Array**.
2. Mouse-over and click the disk array you want then click the **View** button.

   Disk array information includes:

- **Disk Array ID** – DA0, DA1, etc.
- **Alias** – If assigned
- **Operational Status** – OK, Degraded, or Offline
- **Media Patrol** – Enabled or disabled on this array
- **PDM** – Enabled or disabled on this array
- **Total Physical Capacity** – Maximum capacity, including used and unused capacity on the physical drives
- **Configurable Capacity** – Data capacity of the array
- **Free Capacity** – Unconfigured or unused capacity on the physical drives
- **Max. Contiguous Free Capacity** – A single chunk of used capacity on the physical drives
- **Number of Physical Drives** – The number of physical drives on this array
- **Number of Logical Drives** – The number of logical drives on this array
- **Number of Dedicated Spares** – The number of spare drives dedicated to this array
- **Available RAID Levels** – RAID levels that this disk array can support

Creating a Disk Array Manually

This feature creates a disk array only. You can also use the Wizard to create a disk array with logical drives and spare drives at the same time.

To create a disk array:

1. Do one of the following actions:
   - From the Dashboard window, click the **Disk Array** link.
   - From the Storage menu, choose **Disk Array**.
2. Click the **Create Disk Array** button.
3. Accept the defaults or make changes:
   - Enter an alias in the **Alias** field

     Maximum of 32 characters; letters, numbers, space between characters, and underline.
   - **Media Patrol** – Uncheck to disable on this array.
     For more information, see “Media Patrol” on page 73.
   - **PDM** – Uncheck to disable on this array.
     For more information, see “PDM” on page 73.
4. In the **Select Physical Drives** diagram, click the drives to add them to your array.

The drive carriers turn blue when you click them. The physical drives' ID numbers appear in the field below the diagram.

5. When you have finished your settings and choices, click the **Submit** button.

   The new array appears in the list.

   - If you are done creating disk arrays, click the **Finish** button.
   - To create additional disk arrays, click the **Create More** button.

   After you create a disk array, create a logical drive on it. See "Creating a Logical Drive Manually" on page 61.

Creating a Disk Array and Logical Drive with the Wizard

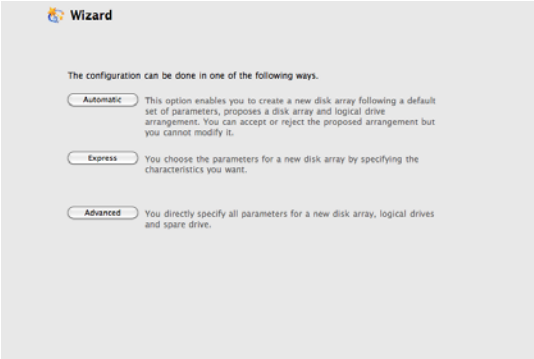
A disk array is the method of organizing the hard disk drives or solid state drives in the Pegasus unit. A logical drive is created on a disk array. The logical drive is where your computer saves files on the Pegasus.

The Promise Utility includes a Wizard to help you set up a disk array, logical drives, and spare drive.

To open the Wizard, click the Storage menu choose **Wizard**.

The Wizard dialog box opens with three configuration methods. See Figure 5.

Figure 5. Wizard dialog box



Choose the best method for your situation. See the table on the next page.

Method	User Options	Suggested for users who are	See Page
Automatic	None	New to data storage	48
Express	General parameters	Familiar with data storage	49
Advanced	Individual parameters	Data storage professionals	51

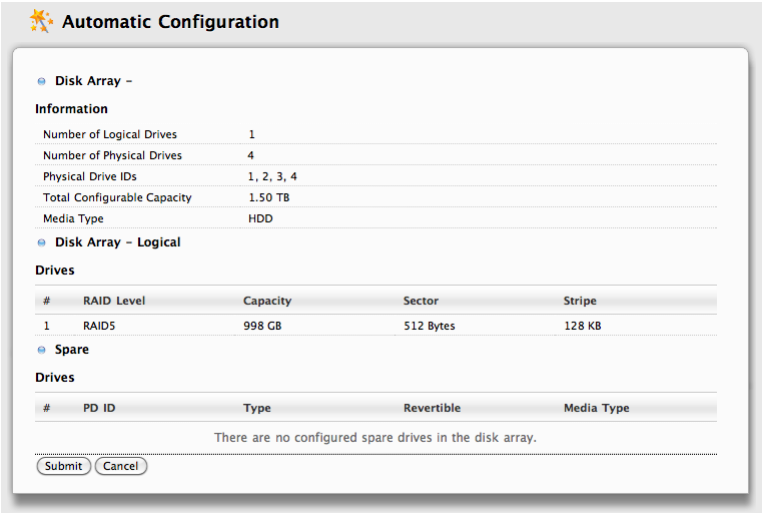
Choosing Automatic Configuration

To use the Automatic Configuration Wizard:

1. From the Storage menu choose **Wizard**.
2. Click the **Automatic** button.

   The Automatic Configuration dialog box appears. See Figure 6.

Figure 6. Automatic Configuration dialog box



3. Do one of the following actions:
   - If you agree with the proposed configuration, click the **Submit** button.

     The Wizard creates your disk array and logical drive. If you have a Pegasus R6, the Wizard also creates a spare drive.
   - If you do NOT agree with the proposed configuration, click the Dashboard icon, click the **Click here to create one** link, and then click either the **Express** or **Advanced** button.

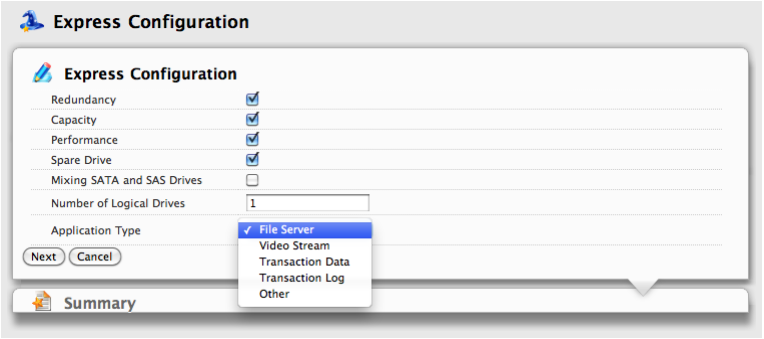
Choosing Express Configuration

To use the Express Configuration Wizard:

1. From the Storage menu choose **Wizard**.
2. Click the **Express** button.

   The Express configuration dialog box appears. See Figure 7.

Figure 7. Express Configuration dialog box

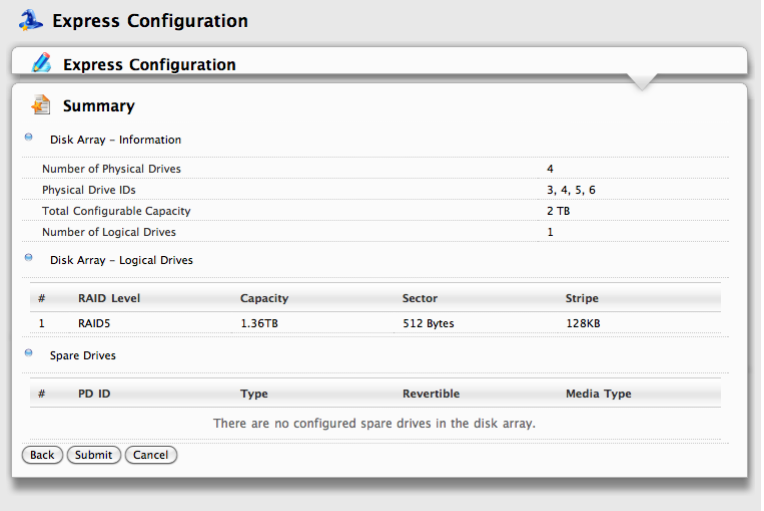


3. Check the boxes to choose any one or a combination of:
   - **Redundancy** – The array remains available if a physical drive fails
   - **Capacity** – The greatest possible amount of data capacity
   - **Performance** – The highest possible read/write speed
   - **Spare Drive** – A hot spare drive (Pegasus R6 only)
   - **Mixing SATA/SAS Drive** – Not applicable
4. In the Number of Logical Drives field, type the number of logical drives you want to make from this disk array.

   Pegasus supports 1 to 32 logical drives.
5. From the Application Type dropdown menu, choose an application that best describes your intended use for the logical drives.
   - File Server (default)
   - Video Stream
   - Transaction Data
   - Transaction Log
   - Other
6. Click the **Next** button to continue.

   The Summary dialog box appears with information on the disk arrays, logical drives, and spare drives you are about to create. See page 50, Figure 8.

Figure 8. The Summary dialog box



7. Do one of the following actions:
   - If you accept these parameters, click the **Submit** button.

     The Wizard creates your disk array and logical drives. If you have a Pegasus R6, the Wizard also creates a spare drive.
   - If you do NOT accept these parameters, click the **Back** button, then review and modify your choices.

Choosing Advanced Configuration

This option enables you to directly specify all parameters for a new disk array, logical drives, and spare drives.

To use the Advanced Configuration Wizard:

1. From the Storage menu choose **Wizard**.
2. Click the **Advanced** button.

   The Create Disk Array screen displays.

Task 1 – Disk Array Creation

To create your disk array:

1. Accept the defaults or make changes:
   - Enter an alias in the **Alias** field

     Maximum of 32 characters; letters, numbers, space between characters, and underline.
   - **Media Patrol** – Uncheck to disable on this array.
     For more information, see “Media Patrol” on page 73.
   - **PDM** – Uncheck to disable on this array.
     For more information, see “PDM” on page 73.
2. In the **Select Physical Drives** diagram, click the drives to add them to your array.

   The drive carriers turn blue when you click them. The physical drives’ ID numbers appear in the field below the diagram.
3. Click the **Next** button to continue.

   The Create Logical Drive screen displays.

Task 2 – Logical Drive Creation

To create your logical drive:

1. Enter your information and choose your options.
   - Enter a logical drive alias in the field provided
   - Choose a RAID level from the dropdown menu.

     Note the Max: capacity value. Then enter a capacity value the field provided and choose a unit of measure from the dropdown menu.
   - Choose a Stripe size.

     64 KB, 128 KB, 256 KB, 512 KB, and 1 MB are available.
   - Choose a Sector size.

     512 B, 1 KB, 2 KB, and 4 KB are available.
   - Choose a Read (cache) Policy.

     The choices are Read Cache, Read Ahead (cache), and None.

- Choose a Write (cache) Policy.

  The choices are WriteThru (write through) and WriteBack. Write back requires a Read Cache or Read Ahead Read Cache Policy.
- RAID 6 only. Choose a scheme from the dropdown menu.

  The choices are P+Q and Q+Q. If in doubt, use the default P+Q.
- If you want the Promise Utility to format your logical drives, leave the **Format** box checked.

  For additional format options, see “Formatting Logical Drives” on page 90.

2. Click the **Add** button.

   The new logical drive appears on the list at the right.

   If there is capacity remaining, you can create an additional logical drive.
3. Click the **Next** button to continue.

   The Create Spare Drive screen displays.

Task 3 – Spare Drive Creation

To create your spare drive:

1. For each of the following items, accept the default or change the settings as required:
   - Check the **Revertible** box if you want a revertible spare drive.

     A revertible spare drive returns to its spare drive assignment after you replace the failed physical drive in the disk array and run the Transition function.
   - **Global** – Can be used by any disk array
   - **Dedicated** to newly created disk array – The disk array you are now creating.
2. In the **Select Physical Drives** diagram, click a drive to choose it for your spare.

   The drive carrier turns blue when you click it. The physical drive’s ID number appears in the field below the diagram.
3. Click the **Next** button to continue.

   The Summary screen displays.

Task 4 – Summary

1. Review your choices of disk array, logical drives, and spare drive.
   - To make a change, click the **Back** button to reach the appropriate screen.
   - To accept, click the **Submit** button.

   The disk array, logical drive, and spare drive take a few moments to create.

2. Click the **Finish** button to close the Wizard.

Formatting your Logical Drives

If you left the **Format** box checked under *Task 2 – Logical Drive Creation*, your logical drives are formatted automatically.

If you UNchecked the **Format** box, you must format your logical drives manually. See “Formatting Logical Drives” on page 90.

When the Promise Utility has finished the partition and format operation, new removable-drive icons, each representing one logical drive, appear on your desktop (right).

When you see the icon, your logical drive is ready to use.

Making Disk Array Settings

To make disk array settings:

1. Do one of the following actions:
   - From the Dashboard window, click the **Disk Array** link.
   - From the Storage menu, choose **Disk Array**.
2. Mouse-over and click the disk array you want then click the **Settings** button.
3. Make setting changes as required:
   - Enter, change or delete the alias in the **Alias** field

     Maximum of 32 characters; letters, numbers, space between characters, and underline.
   - **Media Patrol** – Check to enable, uncheck to disable on this array.
   - **PDM** – Check to enable, uncheck to disable on this array.
4. Click the **Save** button.

Notes

You can also enable or disable Media Patrol for the entire RAID system. See “Making Media Patrol Settings” on page 33.

Locating a Disk Array

This feature causes the drive carrier LEDs to flash for one minute to assist you in locating the physical drives that make up this disk array.

To locate a disk array:

1. Do one of the following actions:
   - From the Dashboard window, click the **Disk Array** link.

- From the Storage menu, choose **Disk Array**.

2. Mouse-over and click the disk array you want then click the **Locate** button.

   The Drive Power/Status LED for the physical drives that make up the disk array blink blue and orange for one minute.

Figure 9. Running the Locate function to identify a disk array

Deleting a Disk Array

Caution

When you delete a disk array, you also delete any logical drives that belong to it, along with the data on those logical drives. Back up any important data before deleting a disk array.

To delete a disk array:

1. Do one of the following actions:
   - From the Dashboard window, click the **Disk Array** link.
   - From the Storage menu, choose **Disk Array**.
2. Mouse-over and click the disk array you want then click the **Delete** button.
3. In the Confirmation box, type the word “confirm” in the field provided and click the **Confirm** button.

Preparing a Disk Array for Transport

This feature prepares the physical drives that make up the disk array to be removed from the enclosure and installed in a different location.

To prepare a disk array for transport:

1. Do one of the following actions:
   - From the Dashboard window, click the **Disk Array** link.
   - From the Storage menu, choose **Disk Array**.
2. Mouse-over and click the disk array you want then click the **Transport** button.
3. In the Confirmation box, type the word “confirm” in the field provided and click the **Confirm** button.

   The disk array status changes to Transport Ready.

4. Remove the physical drives and install them in their new location.

   See the “Replacing a Physical Drive” on page 107 for more information.

Rebuilding a Disk Array

When you rebuild a disk array, you are actually rebuilding the data on one of its physical drives.

If there is no spare drive of adequate capacity, you must replace the failed drive with an unconfigured physical drive, then perform a *Manual Rebuild*.

On the carrier with the failed drive, the Drive Power/Status LED is red and the Drive Activity LED is dark.

Figure 10. Drive carrier LEDs for a dead or failed drive

That is the physical drive you must replace.

Performing a Manual Rebuild

To perform a manual rebuild:

1. From the Admin menu, choose **Background Activities**.
2. Mouse-over Rebuild and click the **Start** button.
3. From the **Source Physical Drive** dropdown menu, choose a **Source** disk array and physical drive.

   Arrays have an ID No. Physical drives have a Seq. No.(sequence number)
4. From the **Target Physical Drive** dropdown menu, choose a **Target** physical drive.
5. In the Confirmation box, type the word “confirm” in the field provided and click the **Confirm** button.

   When the disk array is rebuilding:

   - The disk array shows a green check icon and **Rebuilding** status.
   - Logical drives under the disk array continue to show a yellow ! icon and **Critical, Rebuilding** status.
   - If the buzzer is enabled, the Pegasus unit emits two quick beeps every five seconds. When the beeps stop, the rebuild is done.

Pausing and Resuming a Rebuild

To pause or resume a Rebuild:

1. From the Admin menu, choose **Background Activities**.
2. Mouse-over Rebuild and click the **Pause** or **Resume** button.

Stopping a Rebuild

To stop means to cancel a Rebuild:

1. From the Admin menu, choose **Background Activities**.
2. Mouse-over Rebuild and click the **Stop** button.
3. Click the **Confirm** button.

Also see “Making Rebuild Settings” on page 34.

Managing Logical Drives

Logical drive management includes:

- Viewing a List of Logical Drives (below)
- Viewing Logical Drive Information (page 58)
- Viewing Logical Drive Statistics (page 59)
- Making Logical Drive Settings (page 59)
- Viewing Logical Drive Check Tables (page 60)
- Creating a Logical Drive Manually (page 61)
- Formatting your Logical Drives (page 62)
- Locating a Logical Drive (page 62)
- Deleting a Logical Drive (page 63)
- Initializing a Logical Drive (page 63)
- Redundancy Check on a Logical Drive (page 64)
- Migrating a Logical Drive (page 65)
- Running PDM on a Logical Drive (page 66)

Viewing a List of Logical Drives

To view a list of logical drives, do one of the following actions:

- Click the **Logical Drive** icon.
- From the Storage menu, choose **Logical Drive**.

  The list of logical drives appears. Logical drive information includes:

  - **ID** – LD0, LD1, etc.
  - **Alias** – If assigned.
  - **Status** –  = Normal.  = Critical.  = Offline.
  - **Capacity** – Data capacity of the logical drive.
  - **RAID Level** – Set when the logical drive was created.
  - **Stripe** – Set when the logical drive was created.
  - **Cache Policy** – Read cache and Write cache settings.
  - **Array ID** – ID number of the disk array where this logical drive was created.

Viewing Logical Drive Information

To view logical drive information:

1. Do one of the following actions:
   - Click the **Logical Drive** icon.
   - From the Storage menu, choose **Logical Drive**.

   The list of logical drives appears.
2. Mouse-over and click the logical drive you want then click the **View** button.

   Logical Drive information displays, including:
   - **Logical Drive ID** – LD0, LD1, etc.
   - **Alias** – If assigned
   - **Array ID** – ID number of the disk array where this logical drive was created
   - **RAID Level** – Set when the logical drive was created
   - **Operational Status** – OK, Critical, or Offline
   - **Capacity** – Data capacity of the logical drive
   - **Number of Axles** – For RAID 10, 2 axles
   - **Physical Capacity** – Data capacity of the physical drives
   - **Number of Physical Drives** – The number of physical drives in the disk array
   - **Stripe size** – Set at logical drive creation
   - **Read Policy** – ReadCache, ReadAhead, or None *
   - **Sector size** – Set at logical drive creation
   - **Write Policy** – WriteThru or WriteBack *
   - **Current Write Policy** – May change from WriteBack to WriteThru under certain conditions.
   - **Preferred Controller ID** – Not applicable
   - **Tolerable Number of Dead Drives Per Axle** – Number of physical drives that can fail without the logical drive going offline
   - **Synchronized** – A new logical drive shows **"**No**"** until synchronizing is completed. See "Synchronization" on page 37
   - **Parity Pace** – Pertains to some RAID levels
   - **WWN** – Worldwide Number, a unique identifier assigned to this logical drive
   - **RAID 5 & 6 Algorithm** – Pertains to RAID 5 and 6
   - **Codec Scheme** – Pertains to some RAID levels
   - **Serial Number** – Assigned to this logical drive

3. Click the **X** icon to close the information panel.

Viewing Logical Drive Statistics

To view logical drive statistics:

1. Do one of the following actions:
   - Click the **Logical Drive** icon.
   - From the Storage menu, choose **Logical Drive**.

   The list of logical drives appears.
2. Mouse-over and click the logical drive you want then click the **View** button.
3. Click the **Statistics** tab.

   Logical Drive statistics display, including:
   - Data Transferred – In megabytes
   - Read Data Transferred – In megabytes
   - Write Data Transferred – In megabytes
   - Errors
   - Non-Read/Write Errors
   - Read Errors
   - Write Errors
   - I/O Requests
   - Non-Read/Write I/O Requests
   - Read I/O Requests
   - Write I/O Requests
   - Statistics Start Time
   - Statistics Collection Time
4. Click the **X** icon to close the statistics panel.

To clear physical drive statistics, see “Clearing Statistics” on page 21.

Making Logical Drive Settings

To make logical drive settings:

1. Do one of the following actions:
   - Click the **Logical Drive** icon.
   - From the Storage menu, choose **Logical Drive**.

   The list of logical drives appears.
2. Mouse-over and click the logical drive you want then click the **Settings** button.

3. Make setting changes as required:
   - Enter, change, or delete the alias in the Alias field.

     Maximum of 32 characters; letters, numbers, space between characters, and underline.
   - Choose a Read (cache) Policy.

     Read Cache, Read Ahead, and No Cache are available.
   - Choose a Write (cache) Policy.

     Write Back and Write Through (Thru) are available.
4. Click the **Save** button.

   For more information, see “Cache Policy” on page 98.

Note

The Write Cache is always set to **WriteThru** when Read Cache is set to **NoCache**.

Viewing Logical Drive Check Tables

This feature enables you to view error tables. Use this information to evaluate the integrity of the logical drive and to determine whether corrective action is needed.

To view logical drive check tables:

1. Do one of the following actions:
   - Click the **Logical Drive** icon.
   - From the Storage menu, choose **Logical Drive**.

   The list of logical drives appears.
2. Mouse-over and click the logical drive you want then click the **Check Table** button.
3. Choose an option:
   - **All** – All errors. The default choice.
   - **Read Check** – Read errors for this logical drive.
   - **Write Check** – Write errors for this logical drive.
   - **Inconsistent Block** – Inconsistent blocks for this logical drive. Mirror data for RAID levels 1, 1E and 10 or Parity data for RAID levels 5 and 6. Identified by the Redundancy Check.

   The Check Table lists:
   - **Table Type** – Read Check, Write Check or Inconsistent Block.
   - **Start Logical Block Address** – LBA of the first block for this entry.
   - **Count** – Number of errors or continuous blocks starting from this LBA.

4. Click the **X** icon to close the information panel.

To clear the check tables, see “Clearing Statistics” on page 21.

Creating a Logical Drive Manually

This feature creates a logical drive only. You can also use the Wizard to create a disk array with logical drives and spare drives at the same time. See “Creating a Disk Array and Logical Drive with the Wizard” on page 47.

To create a logical drive manually:

1. Do one of the following actions:
   - Click the **Logical Drive** icon.
   - From the Storage menu, choose **Logical Drive**.
2. Click the **Create Logical Drive** button.
3. Click the option button of the disk array you want to use and click the **Next** button.
4. Accept the defaults or make changes:
   - Optional. Enter an alias in the **Alias** field.

     Maximum of 32 characters; letters, numbers, space between characters, and underline.
   - Choose a **RAID level**.

     The choice of RAID levels depends the number of physical drives in the disk array.
   - In the Capacity field, accept the default maximum capacity or enter a lesser capacity and size in MB, GB or TB.

     Any remaining capacity is available for an additional logical drive.
   - Choose a Stripe size.

     64 KB, 128 KB, 256 KB, 512 KB, and 1 MB are available.
   - Choose a Sector size.

     512 B, 1 KB, 2 KB, and 4 KB are available.
   - Choose a Read (cache) Policy.

     Read Cache, Read Ahead, and No Cache are available.
   - Choose a Write (cache) Policy.

     Write Back and Write Through (Thru) are available.

     The Write Cache is always set to WriteThru when the Read Cache is set to NoCache.
   - For RAID 6 logical drives, choose a Codec Scheme from the dropdown menu.

     P+Q and Q+Q are available.

- If you want the Promise Utility to format your logical drives, leave the **Format** box checked.

  For additional format options, see “Formatting Logical Drives” on page 90.

5. Click the **Add** button.

   The new logical drive appears on the list at the right.

   If there is capacity remaining, you can create an additional logical drive.

   Pegasus supports up to 32 logical drives.

6. When you are finished, click the **Submit** button.

   The new logical drive or drives appear in the logical drive list.

Formatting your Logical Drives

If you left the **Format** box checked when you created your logical drives, they are formatted automatically.

If you UNchecked the **Format** box, you must format your logical drives manually. See “Formatting Logical Drives” on page 90.

When the Promise Utility has finished the format operation, new removable-drive icons, each representing one logical drive, appear on your desktop (right).

When you see the icon, your logical drive is ready to use.

Your logical drives are ready to use.

Locating a Logical Drive

This feature causes the drive carrier LEDs to flash for one minute to assist you in locating the physical drives that make up this logical drive.

To locate a logical drive:

1. Click the **Storage** tab.
2. Click the **Logical Drive** icon.

   The list of logical drives appears.

3. Mouse-over and click the logical drive you want then click the **Locate** button.

   The Drive Power/Status LEDs for the physical drives that make up the logical drive blink blue and orange for one minute.

Figure 11. Running the Locate function to identify a disk array

Deleting a Logical Drive

Caution

When you delete a logical drive, all the data on the logical drive is lost. Back up any important data before deleting a logical drive.

This action requires Administrator or Super User privileges.

To delete a logical drive:

1. Do one of the following actions:
   - Click the **Logical Drive** icon.
   - From the Storage menu, choose **Logical Drive**.

   The list of logical drives appears.
2. Mouse-over and click the logical drive you want then click the **Delete** button.
3. In the Confirmation box, type the word “confirm” in the field provided and click the **Confirm** button.

Initializing a Logical Drive

Initialization is normally done to logical drives after they are created from a disk array.

Caution

When you initialize a logical drive, all the data on the logical drive is lost. Backup any important data before you initialize a logical drive.

To initialize a logical drive:

1. From the Admin menu, choose **Background Activities**.

   The list of background activities appears.
2. Mouse-over Initialization and click the **Start** button.
3. Check the box to the left of the logical drive you want to initialize.
4. Choose the initialization option you want:

- **Quick Initialization** – Check the box and enter a value in the Quick Initialization Size field. This value is the size of the initialization blocks in MB.
- **Full Initialization** – Do not check the box. Enter a hexadecimal value in the Initialization Pattern in Hex field or use the default 00000000 value.

5. Click the **Confirm** button.
6. In the Confirmation box, type the word “confirm” in the field provided and click the **Confirm** button.

Pausing and Resuming an Initialization

To pause or resume Initialization:

1. From the Admin menu, choose **Background Activities**.

   The list of background activities appears.
2. Mouse-over Initialization and click the **Pause** or **Resume** button.

Stopping an Initialization

To stop means to cancel an Initialization:

1. From the Admin menu, choose **Background Activities**.

   The list of background activities appears.
2. Mouse-over Initialization and click the **Stop** button.
3. In the Confirmation box, type the word “confirm” in the field provided and click the **Confirm** button.

Redundancy Check on a Logical Drive

Redundancy Check is a routine maintenance procedure for fault-tolerant disk arrays (those with redundancy) that ensures all the data matches exactly. Redundancy Check can also correct inconsistencies.

To run Redundancy Check on a logical drive:

1. From the Admin menu, choose **Background Activities**.

   The list of background activities appears.
2. Mouse-over Redundancy Check and click the **Start** button.
3. Check the boxes to the left of the logical drives on which to run Redundancy Check.
4. Check the options you want:
   - **Auto Fix** – Attempts to repair the problem when it finds an error
   - **Pause on Error** – The process stops when it finds a non-repairable error
5. Click the **Confirm** button.

Pausing and Resuming a Redundancy Check

To pause or resume a Redundancy Check:

1. From the Admin menu, choose **Background Activities**.

   The list of background activities appears.
2. Mouse-over Redundancy Check and click the **Pause** or **Resume** button.

Stopping a Redundancy Check

To stop is to cancel the Redundancy Check:

1. From the Admin menu, choose **Background Activities**.

   The list of background activities appears.
2. Mouse-over Redundancy Check and click the **Stop** button.
3. Click the **Confirm** button.

Migrating a Logical Drive

The term “Migration” means either or both of the following:

- Change the RAID level of a logical drive.
- Expand the storage capacity of a logical drive.

Before you begin a migration, examine your current disk array to determine whether:

- The physical drives in your array can support the target RAID level.
- There is sufficient capacity to accommodate the target logical drive size.

If you need to add physical drives to your array, be sure there are unassigned physical drives are installed in your RAID system before you begin migration.

See “Migration” on page 35, “RAID Levels” on page 75 and “RAID Level Migration” on page 84.

Migrating a Logical Drive

To migrate a logical drive:

1. From the Admin menu, choose **Background Activities**.

   The list of background activities appears.
2. Mouse-over Migrate and click the **Start** button.
3. In the **Select Disk Array** dropdown menu, choose the source disk array.
4. In the **Select Physical Drives** diagram, click the drives to add them to your array.

   The ID numbers of the chosen drives appear in the field below the diagram.
5. Click the **Next** button.
6. Check the box next to the logical drive you want to modify.

7. From the dropdown menu, choose a **target RAID level**.

   The choice of RAID levels depends the number of physical drives in the disk array. See the Note below.

8. In the **Capacity** field, accept the current capacity.

   Or check the **Expand Capacity** box and enter a greater capacity and size in MB, GB or TB.

   If there is capacity remaining, you can create an additional logical drive.

9. Click the **Next** button.

   The logical drive ID numbers, with the original and target RAID levels and capacities are shown

10. To accept the proposed target values, click the **Confirm** button.

Note

When you add physical drives to a RAID 10 array, it becomes a RAID 1E array by default.

If you are adding an even number of physical drives to a RAID 10 array and you want the target array to be RAID 10, you must specify RAID 10 under RAID level.

Running PDM on a Logical Drive

Predictive Data Migration (PDM) is the migration of data from the suspect disk drive to a spare drive, similar to rebuilding a disk array. But unlike rebuilding, PDM automatically copies your data to a spare drive *before* the drive fails and your logical drive goes Critical.

PDM can be triggered automatically by Media Patrol. See “PDM” on page 35.

To run PDM on a logical drive:

1. From the Admin menu, choose **Background Activities**.

   The list of background activities appears.

2. Mouse-over PDM and click the **Start** button.

3. Choose a Source Physical Drive.

   The Source Physical Drive is the drive suspected of possible failure.

   Source Physical Drives are identified by the disk array number and their sequence number in the disk array.

4. Choose a Target Physical Drive.

   The Target Physical Drive is the replacement drive.

   Target physical drives are identified by their physical drive ID number.

5. Click the **Confirm** button.

Pausing and Resuming PDM

To pause or resume PDM:

1. From the Admin menu, choose **Background Activities**.
   The list of background activities appears.
2. Mouse-over PDM and click the **Pause** or **Resume** button.

Stopping PDM

To stop is to cancel PDM:

1. From the Admin menu, choose **Background Activities**.
   The list of background activities appears.
2. Mouse-over PDM and click the **Stop** button.
3. Click the **Confirm** button.

Managing Spare Drives

Spare drive management includes:

- Viewing a List of Spare Drives (below)
- Viewing Spare Drive Information (page 68)
- Creating a Spare Drive Manually (page 69)
- Making Spare Drive Settings (page 70)
- Running Spare Check (page 70)
- Deleting a Spare Drive (page 71)
- Running a Transition on a Spare Drive (page 71)

Viewing a List of Spare Drives

To view a list of spare drives, do one of the following actions:

- From the Dashboard window, click the **Spare Drive** link.
- From the Storage menu, choose **Spare Drive**.

  Spare Drive information displays, including:

  - **ID** – Spare0, Spare1, etc.
  - **Status** –  = Normal.  = Rebuilding.  = Failed or missing
  - **Configurable Capacity** – Usable capacity of the spare drive
  - **Physical Drive ID** – ID number of the physical drive chosen for this spare
  - **Revertible** – Yes or No
  - **Spare Type** – Global or Dedicated
  - **Dedicated to Array** – ID number of the disk array to which the spare is dedicated

Viewing Spare Drive Information

To view spare drive information:

1. Do one of the following actions:
   - From the Dashboard window, click the **Spare Drive** link.
   - From the Storage menu, choose **Spare Drive**.

   The list of spare drives appears.
2. Mouse-over and click the spare drive you want then click the **View** button.

   Spare Drive information displays, including:

   - **Spare Drive ID** – Spare0, Spare1, etc.

- **Physical Drive ID** – ID number of the physical drive chosen for this spare
- **Location** – Enclosure number and slot number
- **Model Number** – Make and model of the physical drive
- **Operational Status** – OK, Rebuilding, Failed or Missing
- **Spare Type** – Global or Dedicated *
- **Physical Capacity** – Total data capacity of the spare drive
- **Revertible** – Yes or No *
- **Configurable Capacity** – Usable capacity of the spare drive
- **Spare Check Status** – Not Checked or Healthy
- **Media Patrol** – Enabled or Not Enabled *
- **Dedicated to Array** – ID number of the disk array to which the spare is dedicated *

Items with an asterisk (*) are adjustable under “Making Spare Drive Settings” on page 70.

For Spare Check Status, see “Running Spare Check” on page 70.

3. Click the **X** icon to close the information panel.

Creating a Spare Drive Manually

This feature creates a spare drive only. You can also use the Wizard to create a disk array with logical drives and spare drives at the same time. See Spare Drives for more information.

For more information on settings options, see “Spare Drives” on page 92.

To create a spare drive:

1. Do one of the following actions:
   - From the Dashboard window, click the **Spare Drive** link.
   - From the Storage menu, choose **Spare Drive**.
2. Click the **Create Spare Drive** button.
3. For each of the following items, accept the default or change the settings as required:
   - Check the **Revertible** box if you want a revertible spare drive.

     A revertible spare drive returns to its spare drive assignment after you replace the failed physical drive in the disk array and run the Transition function.
   - **Global** – Can be used by any disk array
   - **Dedicated** to a disk array. Click the option button next to the disk array to which this spare drive is dedicated.

4. In the **Create Spare Drive** diagram, click a drive to choose it for your spare.

   The drive carrier turns blue when you click it. The physical drive's ID number appears in the field below the diagram.

5. Click the **Submit** button to continue.

   If you are done creating spare drives, click the **Finish** button.

   To create another spare drive, click the **Create More** button.

Making Spare Drive Settings

For more information on settings options, see "Spare Drives" on page 92.

To make spare drive settings:

1. Do one of the following actions:
   - From the Dashboard window, click the **Spare Drive** link.
   - From the Storage menu, choose **Spare Drive**.

   The list of spare drives appears.

2. Mouse-over and click the spare drive you want then click the **Settings** button.
3. Accept the default or change the settings as required:
   - In the **Revertible** dropdown menu, choose Yes or No.
   - In the **Spare Type** dropdown menu, choose **Global** or **Dedicated**.
   - If you use chose a Dedicated spare, check the box beside the disk array to which this spare drive is assigned.
4. Click the **Save** button.

Running Spare Check

Spare Check verifies the status of your spare drives.

To run spare check:

1. Do one of the following actions:
   - From the Dashboard window, click the **Spare Drive** link.
   - From the Storage menu, choose **Spare Drive**.

   The list of spare drives appears.

2. Mouse-over and click the spare drive you want then click the **Spare Check** button.
3. Click the **Confirm** button.

   Spare Check has no pause, resume or stop functions. When the Spare Check is completed, it adds *Healthy* next to Spare Check Status on the Spare Drive information box.

After the “Spare Check completed” message appears, click the **View** button to see Spare Check Status.

Deleting a Spare Drive

This action requires Administrator or a Super User privileges.

To delete a spare drive:

1. Do one of the following actions:
   - From the Dashboard window, click the **Spare Drive** link.
   - From the Storage menu, choose **Spare Drive**.

   The list of spare drives appears.
2. Mouse-over and click the spare drive you want then click the **Delete** button.
3. In the Confirmation box, type the word “confirm” in the field provided and click the **Confirm** button.

Running a Transition on a Spare Drive

Transition is the process of replacing a revertible spare drive that is currently part of a disk array with an unconfigured physical drive or a non-revertible spare. You must specify an unconfigured physical drive of the same or larger capacity and same media type as the revertible spare drive.

Also see “Transition” on page 36 and page 93.

Running a Transition

To run a transition on a revertible spare drive:

1. From the Admin menu, choose **Background Activities**.

   The list of background activities appears.
2. Mouse-over Transition and click the **Start** button.
3. Choose a Source Physical Drive.

   The Source Physical Drive is the revertible spare drive that is now part of the disk array.

   Source Physical Drives are identified by the disk array number and their sequence number in the disk array.
4. Choose a Target Physical Drive.

   The Target Physical Drive is the drive that replaces the revertible spare.

   Target physical drives are identified by their physical drive ID number.
5. Click the **Confirm** button.

Pausing and Resuming a Transition

To pause or resume Transition:

1. From the Admin menu, choose **Background Activities**.
   The list of background activities appears.
2. Mouse-over Transition and click the **Pause** or **Resume** button.

Stopping, Pausing or Resuming a Transition

To stop is to cancel a Transition:

1. From the Admin menu, choose **Background Activities**.
   The list of background activities appears.
2. Mouse-over Transition and click the **Stop** button.
3. Click the **Confirm** button

Chapter 4: Technology Background

This chapter covers the following topics:

- Disk Arrays (below)
- Logical Drives (page 75)
- Formatting Logical Drives (page 90)
- Spare Drives (page 92)
- RAID Controllers (page 98)

Disk Arrays

Disk array technology includes:

- Media Patrol (page 73)
- PDM (page 73)

Media Patrol

Media Patrol is a routine maintenance procedure that checks the magnetic media on each disk drive. Media Patrol checks all physical drives assigned to disk arrays and spare drives. Media Patrol does not check unconfigured drives.

Media Patrol checks are enabled by default on all disk arrays and spare drives. You can disable Media Patrol in the disk array and spare drive settings, however that action is not recommended.

Unlike Synchronization and Redundancy Check, Media Patrol is concerned with the condition of the media itself, not the data recorded on the media. If Media Patrol encounters a critical error, it triggers PDM, if PDM is enabled on the disk array.

Media Patrol has three status conditions:

- **Running** – Normal. You can access your logical drives at any time.
- **Yield** – Temporary pause while a read/write operation takes place.
- **Paused** – Temporary pause while another background runs. Or a pause initiated by the user.

See “Running Media Patrol on a Disk Array” on page 129

PDM

Predictive Data Migration (PDM) is the migration of data from the suspect disk drive to a spare disk drive, similar to rebuilding a logical drive. But unlike Rebuilding, PDM constantly monitors your disk drives and automatically copies

your data to a spare disk drive BEFORE the disk drive fails and your logical drive goes Critical.

The following actions trigger PDM:

- A disk drive with unhealthy status (see below)
- Media Patrol finds a disk critical error
- You initiate PDM manually

  See “Running PDM on a Logical Drive” on page 66.

PDM also counts the number of media errors reported by Media Patrol. A disk drive becomes unhealthy when:

- A SMART error is reported
- The bad sector remapping table fills to the specified level.

Because data would be lost if written to a bad sector, when a bad sector is detected, the disk drive creates a map around it. These maps are saved in the bad sector remapping table, which have a capacity of 512 reassigned blocks and 2048 error blocks. See “PDM” on page 35.

You can specify the maximum levels for the reassigned and error blocks in PDM settings. When the table fills to a specified value, PDM triggers a migration of data from the suspect drive (the disk drive with the bad sectors) to a replacement physical drive.

During data migration, you have access to your logical drives but they respond more slowly to read/write tasks because of the additional operation. The time required for data migration depends on the size of the disk drives.

PDM is enabled on all disk arrays by default. You can disable PDM in the disk array settings, however that action is not recommended. See “Making Disk Array Settings” on page 53.

Logical Drives

Logical drive technology includes:

- RAID Levels (page 75)
- RAID Level Migration (page 84)
- Stripe Size (page 88)
- Sector Size (page 88)
- Initialization (page 89)

RAID Levels

RAID (Redundant Array of Independent Disks) allows multiple physical drives to be combined together in a disk array. Then all or a portion of the disk array is formed into a logical drive. The operating system sees the logical drive as a single storage device, and treats it as such.

RAID 0 – Stripe

When a logical drive is striped, the read and write blocks of data are interleaved between the sectors of multiple physical drives. Performance is increased, since the workload is balanced between drives or “members” that form the logical drive. Identical drives are recommended for performance as well as data storage efficiency.

Figure 1. RAID 0 Striping interleaves data across multiple drives

The disk array’s data capacity is equal to the number of disk drive members multiplied by the smallest drive’s capacity. For example, one 100 GB and three 120 GB drives form a 400 GB (4 x 100 GB) disk array instead of 460 GB.

If physical drives of different capacities are used, there is unused capacity on the larger drives.

RAID 0 logical drives on Pegasus consist of one or more physical drives.

Advantages	Disadvantages
• Implements a striped disk array, the data is broken down into blocks and each block is written to a separate disk drive • I/O performance is greatly improved by spreading the I/O load across many channels and drives • No parity calculation overhead is involved	• Not a true RAID because it is not fault-tolerant • The failure of just one drive results in all data in an disk array being lost • Should not be used in mission critical environments

Recommended Applications for RAID 0:

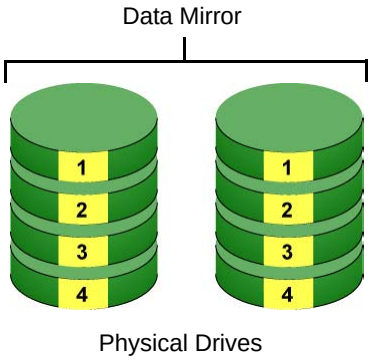
- Image Editing
- Pre-Press Applications
- Any application requiring high bandwidth

RAID 1 – Mirror

When a logical drive is mirrored, identical data is written to a pair of physical drives, while reads are performed in parallel. The reads are performed using elevator seek and load balancing techniques where the workload is distributed in the most efficient manner. Whichever drive is not busy and is positioned closer to the data is accessed first.

With RAID 1, if one physical drive fails or has errors, the other mirrored physical drive continues to function. Moreover, if a spare physical drive is present, the spare drive is used as the replacement drive and data begins to mirrored to it from the remaining good drive.

Figure 2. RAID 1 Mirrors identical data to two drives



The logical drive's data capacity equals the smaller physical drive. For example, a 100 GB physical drive and a 120 GB physical drive have a combined capacity of 100 GB in a mirrored logical drive.

If physical drives of different capacities are used, there is unused capacity on the larger drive.

RAID 1 logical drives on Pegasus consist of two physical drives.

If you want a mirrored logical drive with more than two physical drives, see "RAID 1E – Enhanced Mirror" on page 79.

Advantages	Disadvantages
• Simplest RAID storage subsystem design • Can increase read performance by processing data requests in parallel since the same data resides on two different drives	• Very high disk overhead – uses only 50% of total capacity

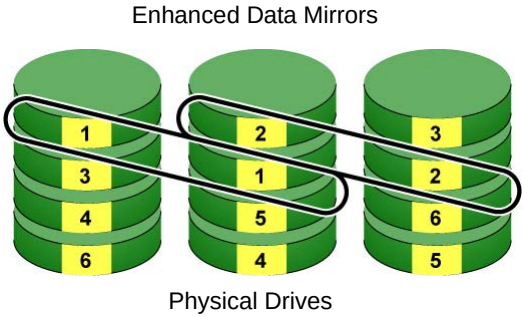
Recommended Applications for RAID 1:

- Accounting
- Payroll
- Financial
- Any application requiring very high availability

RAID 1E – Enhanced Mirror

RAID 1E offers the security of mirrored data provided by RAID 1 plus the added capacity of more than two physical drives. It also offers overall increased read/write performance plus the flexibility of using an odd number of physical drives. With RAID 1E, each data stripe is mirrored onto two physical drives. If one drive fails or has errors, the other drives continue to function, providing fault tolerance.

Figure 3. RAID 1E can mirror data over an odd number of drives



The advantage of RAID 1E is the ability to use an odd number of physical drives, unlike RAID 1 and RAID 10. You can also create a RAID 1E Logical Drive with an even number of physical drives. However, with an even number of drives, you obtain somewhat greater security with comparable performance using RAID 10.

RAID 1E logical drives consist of three or more physical drives. You can create an array with just two physical drives and specify RAID 1E. But the resulting array is actually a RAID 1.

Advantages	Disadvantages
• Implemented as a mirrored disk array whose segments are RAID 0 disk arrays • High I/O rates are achieved thanks to multiple stripe segments • Can use an odd number of disks	• Very high disk overhead – uses only 50% of total capacity

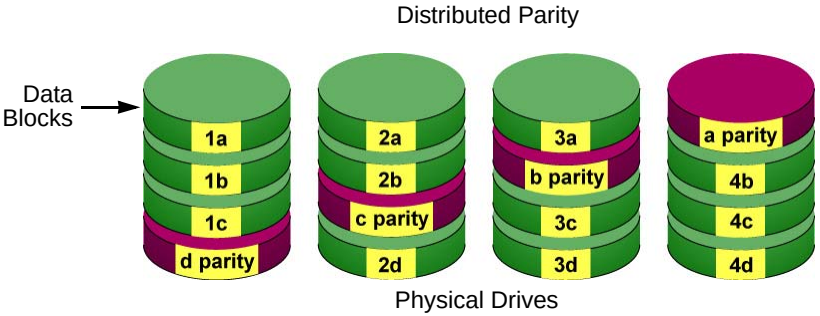
Recommended Applications for RAID 1E:

- Imaging applications
- Database servers
- General fileserver

RAID 5 – Block and Parity Stripe

RAID 5 organizes block data and parity data across the physical drives. Generally, RAID Level 5 tends to exhibit lower random write performance due to the heavy workload of parity recalculation for each I/O. RAID 5 is generally considered to be the most versatile RAID level. It works well for file, database, application and web servers.

Figure 4. RAID 5 stripes all drives with data and parity information



The capacity of a RAID 5 logical drive equals the smallest physical drive times the number of physical drives, minus one. Hence, a RAID 5 logical drive with four 100 GB physical drives has a capacity of 300 GB. A RAID 5 logical drive with two 120 GB physical drives and one 100 GB physical drive has a capacity of 200 GB.

RAID 5 is generally considered to be the most versatile RAID level.

A RAID 5 on Pegasus R4 consists of three or four physical drives.

A RAID 5 on Pegasus R6 consists of three to six physical drives.

Advantages	Disadvantages
• High Read data transaction rate • Medium Write data transaction rate • Good aggregate transfer rate • Most versatile RAID level	• Disk failure has a medium impact on throughput

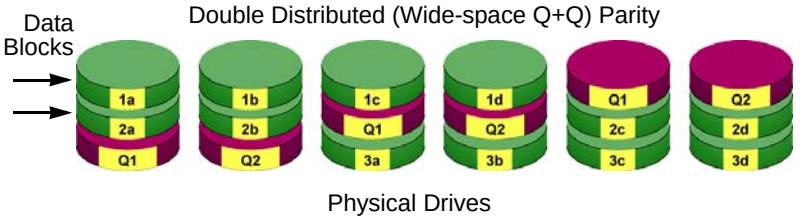
Recommended Applications for RAID 5:

- File and Application servers
- WWW, E-mail, and News servers
- Intranet servers

RAID 6 – Block and Double Parity Stripe

RAID level 6 stores dual parity data is rotated across the physical drives along with the block data. A RAID 6 logical drive can continue to accept I/O requests when any two physical drives fail.

Figure 5. RAID 6 stripes all drives with data and dual parity



Hence, a RAID 6 logical drive with (7) 100 GB physical drives has a capacity of 500 GB. A RAID 6 logical drive with (4) 100 GB physical drives has a capacity of 200 GB.

RAID 6 becomes more capacity efficient in terms of physical drives as the number of physical drives increases.

RAID 6 provides double fault tolerance. Your logical drive remains available when up to two physical drives fail.

RAID 6 is generally considered to be the safest RAID level.

A RAID 6 on Pegasus R4 consists of four physical drives.

A RAID 6 on Pegasus R6 consists of four to six physical drives.

Advantages	Disadvantages
• High Read data transaction rate • Medium Write data transaction rate • Good aggregate transfer rate • Safest RAID level	• High disk overhead – equivalent of two drives used for parity • Slightly lower performance than RAID 5

Recommended Applications for RAID 6:

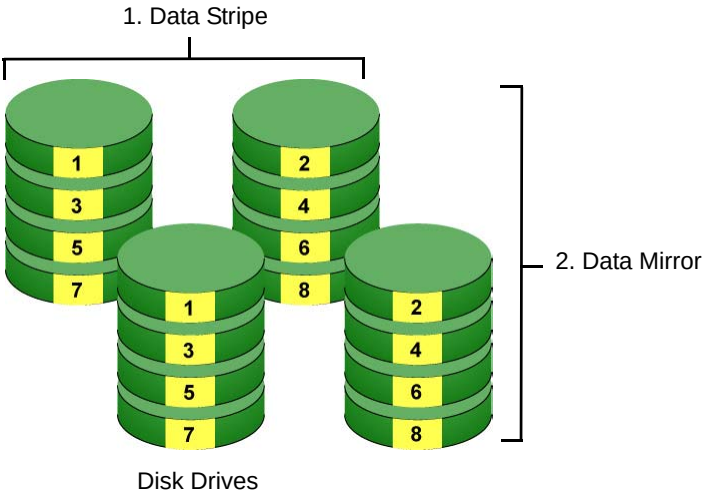
- Accounting and Financial
- Database servers
- Any application requiring very high availability

RAID 10 – Mirror + Stripe

Mirror + Stripe combines both of the RAID 1 and RAID 0 logical drive types. RAID 10 can increase performance by reading and writing data in parallel or striping, and duplicating the data, or mirroring.

PROMISE implements RAID 10 by creating a data stripe over one pair of disk drives, then mirroring the stripe over a second pair of disk drives. Some applications refer to this method as RAID 0+1.

Figure 6. PROMISE RAID 10 starts with a data stripe, then mirrors it



The data capacity RAID 10 logical drive equals the capacity of the smallest physical drive times the number of physical drives, divided by two.

In some cases, RAID 10 offers double fault tolerance, depending on which physical drives fail.

RAID 10 arrays require an even number of physical drives and a minimum of four.

For RAID 10 characteristics using an odd number of physical drives, choose RAID 1E.

Advantages	Disadvantages
• Implemented as a mirrored disk array whose segments are RAID 0 disk arrays • High I/O rates are achieved thanks to multiple stripe segments	• Very high disk overhead – uses only 50% of total capacity

Recommended Applications for RAID 10:

- Imaging applications
- Database servers
- General fileserver

RAID Level Migration

The term “Migration” means either or both of the following:

- Change the RAID level of a logical drive.
- Expand the storage capacity of a logical drive.

On Pegasus, RAID level migration is performed on the disk array but it applies to the logical drives. Migration does not disturb your data. You can access the data while the migration is in progress. When migration is done, your disk array has a different RAID level and/or a larger capacity.

Migration Requirements

The following conditions affect RAID level migration:

- The disk array and logical drive must show a green check  icon.
- The Target disk array may require more physical drives than the Source disk array.
- If the Target disk array requires an EVEN number of physical drives but the Source disk array has an ODD number, ADD a physical drive as part of the migration process.
- You cannot reduce the number of physical drives in your disk array, even if the Target disk array requires fewer physical drives than the Source disk array.
- RAID 1 (mirroring) works with two drives only. Only a single-drive RAID 0 disk array can migrate to RAID 1. Other RAID Levels use too many drives to migrate.
- You cannot migrate a disk array when it is Critical or performing activities such as Synchronizing, Rebuilding, and PDM.
- For RAID 6, you can add more physical drives.

Source and Target RAID Levels

The tables on the following pages show the migration options for each source logical drive by its RAID level. The available target RAID levels are shown with their requirements.

RAID 0

A RAID 0 source logical drive can migrate to the following target logical drives:

Target	Requirements
RAID 0	Add physical drives.
RAID 1	2 physical drives only. Only a single-drive RAID 0 can migrate to RAID 1 by adding 1 physical drive.
RAID 1E	3 or more physical drives. If existing physical drives have no unused space, add 1 or more physical drives.
RAID 5	3 physical drives minimum, maximum 4 (R4) or 6 (R6). RAID 0 must have less than 4 (R4) or 6 (R6) physical drives. If existing physical drives have no unused space, add 1 or more physical drives.
RAID 6	4 physical drives minimum, 4 (R4) or 6 (R6). If existing physical drives have no unused space, add 1 or more physical drives.
RAID 10	4 physical drives minimum. Even number of physical drives. If existing physical drives have no unused space, add 1 or more physical drives.

See “Migrating a Logical Drive” on page 65.

RAID 1

A RAID 1 Source logical drive can migrate to the following Target logical drives:

Target	Requirements
RAID 0	None.
RAID 1E	3 or more physical drives. Add 1 or more physical drives.
RAID 5	3 physical drives minimum, 4 (R4) or 6 (R6). RAID 1 must have less than 4 (R4) or 6 (R6) physical drives. Add 1 or more physical drives.
RAID 10	4 physical drives minimum. Even number of physical drives. Add 2 or more physical drives.

See “Migrating a Logical Drive” on page 65.

RAID 1E

A RAID 1E Source logical drive can migrate to the following Target logical drives:

Target	Requirements
RAID 0	None.
RAID 1E	Add physical drives.
RAID 5	3 physical drives minimum, 4 (R4) or 6 (R6). RAID 1E must have less than 4 (R4) or 6 (R6) physical drives. If existing physical drives have no unused space, add 1 or more physical drives.
RAID 10	4 physical drives minimum. Even number of physical drives. If existing physical drives have no unused space, add 1 or more physical drives.

See “Migrating a Logical Drive” on page 65.

RAID 5

A RAID 5 Source logical drive can migrate to the following Target logical drives:

Target	Requirements
RAID 0	None.
RAID 1E	None.
RAID 5	Add physical drives. Maximum of 4 (R4) or 6 (R6).
RAID 6	4 physical drives minimum, maximum of 4 (R4) or 6 (R6). If existing physical drives have no unused space, add 1 or more physical drives.
RAID 10	4 physical drives minimum. Even number of physical drives. If existing physical drives have no unused space, add 1 or more physical drives.

See “Migrating a Logical Drive” on page 65.

RAID 6

A RAID 6 Source logical drive can migrate to the following Target logical drives:

Target	Requirements
RAID 6	Add physical drives. Maximum of 4 (R4) or 6 (R6).

See “Migrating a Logical Drive” on page 65.

RAID 10

A RAID 10 Source logical drive can migrate to the following Target logical drives:

Target	Requirements
RAID 0	None.
RAID 1E	None.
RAID 5	3 physical drives minimum, maximum of 4 (R4) or 6 (R6). RAID 10 must have less than 4 (R4) or 6 (R6) physical drives.
RAID 6	4 physical drives minimum, maximum of 4 (R4) or 6 (R6). The RAID 10 logical drive must have less than 4 (R4) or 6 (R6) physical drives. If existing physical drives have no unused space, add 1 or more physical drives.
RAID 10	Add physical drives in multiples of two. Even number of physical drives.

When you migrate RAID 10 logical drive, it becomes RAID 1E by default.

If you want a RAID 10 logical drive, there must be an even number of physical drives and you must specify RAID 10 for the target logical drive.

See “Migrating a Logical Drive” on page 65.

Stripe Size

Stripe Size, also called “Stripe Block Size,” refers to the size of the data blocks written to, and read from, the physical drives. Stripe Size is specified when you create a logical drive. You can choose Stripe Size directly when you use the Wizard Advanced Configuration function to create a logical drive.

You cannot change the Stripe Size of an existing logical drive. You must delete the logical drive and create a new one.

The default stripe size is 128 KB. When you create your logical drive using the Wizard Advanced option or you create a logical drive manually, you can choose a stripe size of 64 KB, 128 KB, 256 KB, 512 KB, and 1 MB.

See “Creating a Disk Array and Logical Drive with the Wizard” on page 47 and “Creating a Logical Drive Manually” on page 61.

There are two issues to consider when choosing the Stripe Size:

- You should choose a Stripe Size equal to, or smaller than, the smallest cache buffer found on any physical drive in the disk array. Selecting a larger value slows read/write performance because physical drives with smaller cache buffers need more time for multiple accesses to fill their buffers.
- If your data retrieval consists of fixed data blocks, such as with some database or video applications, then you should choose that size as your Stripe Size.

If you do not know the cache buffer or fixed data block sizes, choose 64 KB as your Stripe Size. Generally speaking,

- Email, POS, and web servers prefer smaller stripe sizes.
- Video and database applications prefer larger stripe sizes.

Sector Size

A sector is the smallest addressable area on a physical drive. Sector size refers to the number of data bytes a sector can hold. A smaller sector size is a more efficient use of a physical drive’s capacity. 512 bytes (512 B) is the most common sector size, and the default in the Promise Utility.

When you create your logical drive using the Wizard Advanced option or you create a logical drive manually, you can choose a sector size of 512 B, 1 KB, 2 KB, or 4 KB.

See “Creating a Disk Array and Logical Drive with the Wizard” on page 47 and “Creating a Logical Drive Manually” on page 61.

Initialization

Initialization is done to logical drives after they are created from a disk array. Full initialization sets all data bits in the logical drive to a specified pattern, such as all zeros. The action is useful because there may be residual data on the logical drives left behind from earlier configurations. For this reason, Initialization is recommended for all new logical drives.

See “Initializing a Logical Drive” on page 63.

Caution

When you initialize a logical drive, all the data on the logical drive is lost. Backup any important data before you initialize a logical drive.

Formatting Logical Drives

A RAID logical drive must also be formatted to be compatible with your computer. In this *Product Manual*, the term *format* includes both partition and format operations.

You can format your logical drives using the:

- Promise Utility with default settings (below)
- Promise Utility with custom settings (page 90)
- Disk Utility (page 91)

Both the Promise Utility and the computer's disk utility offer a choice of formatting options. However, if there is no specific reason to customize, the default format settings are recommended.

Promise Utility with default settings

Wizard Automatic or Express

When you create your logical drives using the Wizard *Automatic* or *Express* options, your logical drives are always formatted automatically.

When the Promise Utility has finished the format operation, new removable-drive icons, each representing one logical drive, appear on your desktop (right).

When you see the icon, your logical drive is ready to use.

Wizard Advanced or Manual Creation

When you create your logical drives using the Wizard *Advanced* option, the Format option is enabled by default.

When the Promise Utility has finished the format operation, new removable-drive icons, each representing one logical drive, appear on your desktop (right).

When you see the icon, your logical drive is ready to use.

For more information, see "Creating a Disk Array and Logical Drive with the Wizard" on page 47 and "Creating a Logical Drive Manually" on page 61.

Promise Utility with custom settings

To use your own format settings, you must create your logical drives using the Wizard *Advanced* option or create your logical drives manually, and you must UNcheck the Format box.

See "Creating a Disk Array and Logical Drive with the Wizard" on page 47 and "Creating a Logical Drive Manually" on page 61.

To format your logical drives using the Promise Utility with your own settings:

1. In the Logical Drive list, mouse-over the logical drive you want to format, and click the **Format** button.
2. Supply information as required:
   - Optional. Type a different name into the Volume Name field.
   - Choose a partition from the Partition Type dropdown menu.
   - Choose a format type from the Format Type dropdown menu.

   For Macintosh computers, the default *GPT Format* partition and the default *Journaled HFS+* format are recommended.
3. Click the **Format** button.

   When the Promise Utility has finished the partition and format operation, new removable-drive icons, each representing one logical drive, appear on your desktop (right).

   When you see the icon, your logical drives are ready to use.

Disk Utility

For information on using your computer's disk utility, see the online help or the computer's *User Manual*.

To format your logical drives using the computer's disk utility, you must create your logical drives using the Wizard *Advanced* option or create your logical drives manually, and you must UNcheck the **Format** box.

See "Creating a Disk Array and Logical Drive with the Wizard" on page 47 and "Creating a Logical Drive Manually" on page 61.

To format your logical drives using the computer's disk utility:

1. Click the **Go** menu and choose **Utilities** from the dropdown list.
2. Double-click the **Disk Utility** icon to open the utility.
3. In the drive list, highlight the logical drive you want to format and click the **Partition** button.
4. Make your Volume Scheme, Volume Information, and Options settings and click the **Apply** button.

   For Macintosh computers, the default *GPT Format* partition and the default *Journaled HFS+* format are recommended.
5. In the Confirmation dialog box, click the **Partition** button.

   When the disk utility has finished the partition and format operation, new removable-drive icons, each representing one logical drive, appear on your desktop (right).

   Your logical drives are ready to use.

Spare Drives

Spare drive technology includes:

Definition

A spare drive is a physical drive that you designate to automatically replace the failed physical drive in a disk array. See “Creating a Spare Drive Manually” on page 69.

The general recommendation is to:

- Provide at least one spare drive
- Configure the spares as **global revertible** spare drives

Options

There are several options you can specify for a spare drive:

- **System Options**
  - **Revertible** – Returns to its spare drive assignment after you replace the failed physical drive in the disk array and run the Transition function.
  - **Media Patrol** – By default, Media Patrol runs on spare drives unless you disable it.
- **Spare Type**
  - **Global** – Can be used by any disk array
  - **Dedicated** – Can be used only by the assigned disk array
- **Media Type (type of physical drive)**
  - Hard Disk Drive (HDD)
  - Solid State Drive (SSD)

Requirements

The spare drive must:

- Have adequate capacity to replace the largest physical drive in your disk arrays.
- Be the same media type as the physical drives in your disk arrays.

A revertible spare drive requires:

- You to replace the failed physical drive in the disk array

- You to run the Transition function

Transition

Transition is the process of replacing a revertible spare drive that is currently part of a disk array with an unconfigured physical drive or a non-revertible spare. The revertible spare drive returns to its original status. In order to run the Transition function, the spare drive must be revertible.

In addition, you must specify an unconfigured physical drive of the same or larger capacity and same media type as the revertible spare drive.

Running a Transition

The Transition feature enables you to specify “permanent” spare drives for your Pegasus unit. Transition is the process of replacing a revertible spare drive that is currently part of a disk array with an unconfigured physical drive or a non-revertible spare. The revertible spare drive returns to its original status.

Transition happens automatically when the following sequence of events takes place:

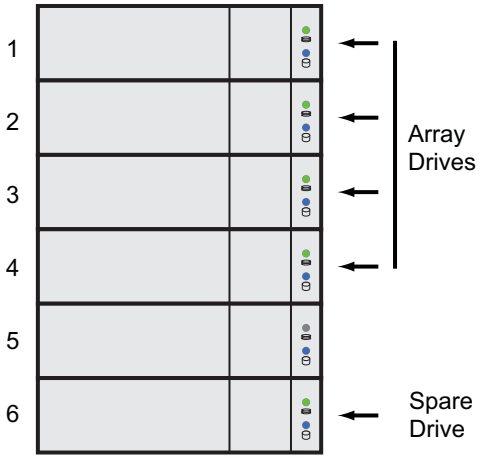
- You create a revertible spare drive. See “Creating a Spare Drive Manually” on page 69.
- A physical drive assigned to your disk array fails and the array goes critical or degraded.
- Pegasus automatically rebuilds your array to the revertible spare drive and the array becomes functional again.
- You replace the failed physical drive with a new physical drive of equal or greater capacity.
- Pegasus automatically transitions (moves) the data from the revertible spare to the new physical drive.
- The new physical drive becomes part of the array and the revertible spare drive returns to its original spare status.

Transition happens manually when you specify a different unconfigured physical drive to transition (move) the data from the revertible spare drive.

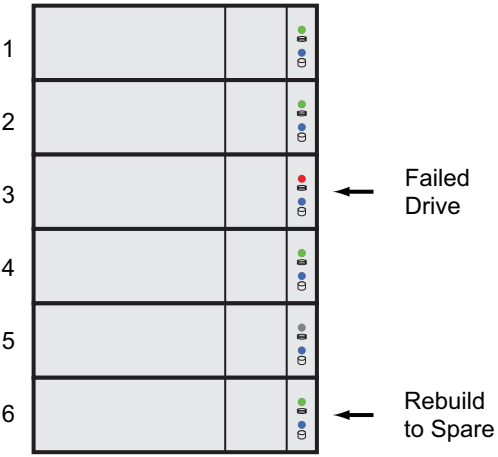
See the example on the following pages.

Example

Following is an example to explain the Transition function.

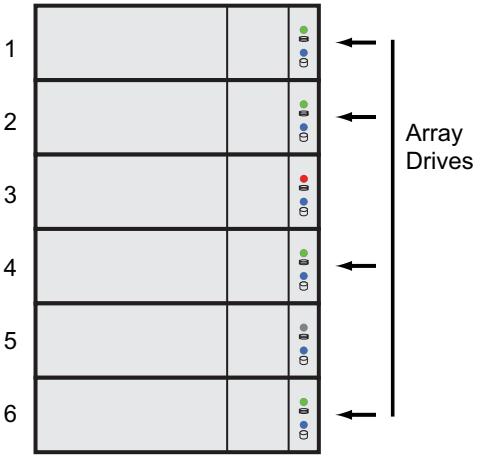


In the example above, there is a four-drive RAID 5 disk array and a global spare drive. Physical drives 1, 2, 3, and 4 belong to the disk array. Physical drive 5 remains unconfigured. Physical drive 6 is a revertible spare drive.



If a physical drive fails in a disk array and there is a spare drive of adequate capacity available, the controller automatically rebuilds the array using the spare

drive. In this example, physical drive 3 failed and the array is rebuilt using physical drive 6, the revertible spare drive.

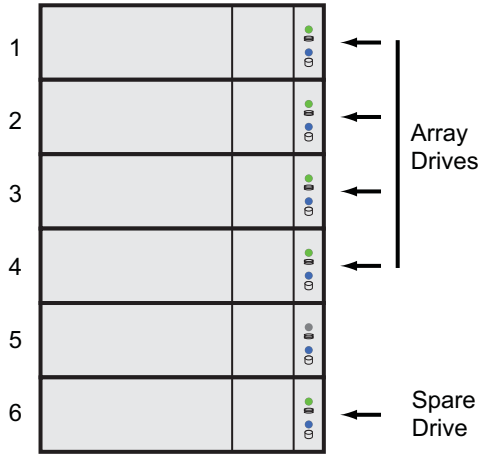


When the rebuild is complete, the spare drive has replaced the failed drive. In this example, failed drive 3 was replaced by spare drive 6. The disk array now consists of physical drives 1, 2, 4, and 6.

There is no spare drive at this moment. Even if physical drive 5 is of adequate capacity, it has not been designated as a spare, therefore the controller cannot use it as a spare.

Automatic Transition

At this juncture, you would replace the failed drive in slot 3 with a new one of the same or greater capacity.



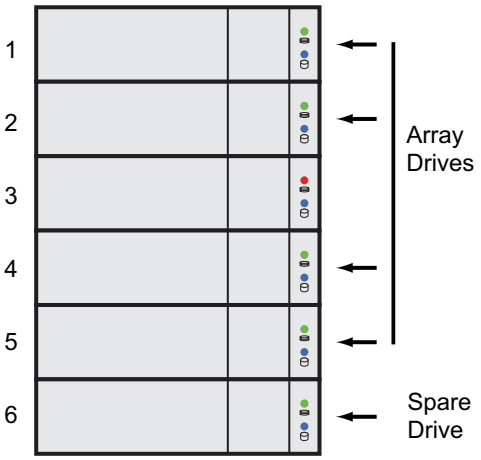
When the Pegasus controller detects the new drive in slot 3, the controller:

- Automatically transitions the data on drive 6 to drive 3
- Returns drive 6 to spare status

When the Automatic Transition is finished, physical drives 1, 2, 3, and 4 belong to the disk array and physical drive 6 is a revertible spare drive. The original configuration is restored.

Manual Transition

If you wanted to use the drive in slot 5 as a member of the disk array, rather than the drive in slot 3, you would run the Transition function manually. See “Running a Transition on a Spare Drive” on page 71.



When the Manual Transition is finished, physical drives 1, 2, 4, and 5 belong to the disk array and physical drive 6 is a revertible spare drive.

At this point, you would replace the drive in slot 3. The new drive in slot 3 remains unconfigured until you assign it to a disk array or as a spare.

RAID Controllers

RAID controller technology includes;

- Cache Policy (page 98)
- Capacity Coercion (page 98)

Cache Policy

As it is used with Pegasus, the term cache refers to any of several kinds of high-speed, volatile memory that hold data moving from your computer to the physical drives or vice-versa. Cache is important because it can read and write data much faster than a physical drive. There are read caches, which hold data as it is read from a physical drive; and write caches, which hold data as it is written to a physical drive.

In order to tune the cache for best performance in different applications, user-adjustable settings are provided. Cache settings are made on the RAID controller. See “Making Controller Settings” on page 25.

Read Cache Policy

- **Read Cache** – The read cache is enabled but no pre-fetch action.
- **Read Ahead** – The read cache and predictive pre-fetch feature are enabled. Read-ahead anticipates the next read and performs it before the request is made. Can increase read performance.
- **No Cache** – The read cache is disabled.

Write Cache Policy

- **Write Back** – Data is written first to the cache, then to the logical drive. Better performance. Pegasus has a cache backup battery to protect data in the cache from a sudden power failure.
- **Write Thru** – Also “Write Through.” Data is written to the cache and the logical drive at the same time. Safer.

Capacity Coercion

This feature is designed for fault-tolerant logical drives (RAID 1, 1E, 5, 6, and 10). It is generally recommended to use physical drives of the same size in your disk arrays. When this is not possible, the system adjusts for the size differences by reducing or coercing the capacity of the larger drives to match the smaller ones. With Pegasus, you can choose to enable capacity coercion and any one of four methods.

Enable capacity coercion and choose the method in the Controller Settings menu. See “Making Controller Settings” on page 25.

The choices are:

- **GB Truncate** – (Default) Reduces the useful capacity to the nearest 1,000,000,000 byte boundary.
- **10GB Truncate** – Reduces the useful capacity to the nearest 10,000,000,000 byte boundary.
- **Group Rounding** – Uses an algorithm to determine how much to truncate. Results in the maximum amount of usable drive capacity.
- **Table Rounding** – Applies a predefined table to determine how much to truncate.

Capacity coercion also affects a replacement drive used in a disk array. Normally, when an physical drive fails, the replacement drive must be the same capacity or larger. However, the capacity coercion feature permits the installation of a replacement drive that is slightly smaller (within 1 gigabyte) than the remaining working drive. For example, the remaining working drives can be 80.5 GB and the replacement drive can be 80.3, since all are rounded down to 80 GB. This permits the smaller drive to be used.

Without capacity coercion, the controller does not permit the use of a replacement physical drive that is slightly smaller than the remaining working drives.

Chapter 5: Troubleshooting

This chapter deals problems you might encounter with your Pegasus unit and how to resolve them.

Responding to an Audible Alarm

The Pegasus unit has two beep patterns:

- **Two beeps, not repeated** – The Pegasus is powering up or ready
- **Two beeps, continuously repeated** – The Pegasus reports a problem

When you boot Pegasus unit, the buzzer beeps twice to acknowledge power up and twice again when the unit is online and ready for work.

If you hear the repeating two-beep pattern, check the following items:

- System Status LED (below)
- Drive Carrier LEDs (page 103)

Checking LEDs

When you boot Pegasus unit, the Power Button LED turns orange. When fully booted, the LED turns blue. See page 102, Figure 1.

See “Subsystem LEDs” on page 102.

The drive carrier Power/Status LEDs turn blue if a physical drive is installed.

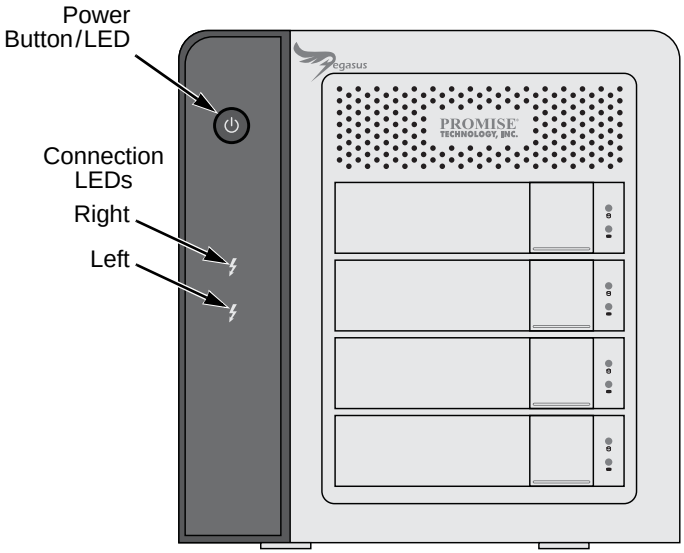
See “Drive Carrier LEDs” on page 103.

Subsystem LEDs

The Pegasus subsystem LEDs are the Power Button and the Thunderbolt ports.

State	Power Button	Thunderbolt LEDs
Dark	No power	No connection
Blue	Normal	Normal
Flashing Blue	—	Activity
Orange	Booting or shutting down	—

Figure 1. Subsystem LEDs



Drive Carrier LEDs

The Pegasus unit spins up the disk drives sequentially to equalize power draw during start-up. After a few moments:

- The Power/Status LEDs turn blue.
- The Activity LEDs turn blue if a drive is installed.

The drive carrier Power/Status LEDs report the condition of the physical drives.

See the table on the next page.

Figure 2. Drive carrier LEDs

Drive Carrier LEDs		
State	**Power/Status**	**Drive Activity**
Dark	No power	No drive in carrier
Steady Blue	Power is present	Drive is present
Flashing Blue	—	Activity on drive
Blinking Blue and Orange	Locator feature or Drive is rebuilding	—
Red	Drive error or failure	—

See “Physical Drive Problems” on page 106 for a discussion of rebuilding and failed physical drives for more information.

The Locator feature is triggered from the Promise Utility. It causes the LEDs to blink orange and blue for one minute. That action helps you find the specific drive. See “Locating a Physical Drive” on page 41.

Figure 3. Locate feature on a drive carrier

Promise Utility

If you can open the Promise utility, but you cannot create or delete disk arrays and logical drives, nor can you make settings changes, check the UI lock. See “Unlocking the UI” on page 18.

Viewing the Event Logs

Viewing Event Logs includes:

- Viewing Runtime Events (page 104)
- Viewing NVRAM Events (page 104)
- Event Severity Descriptions (page 105)

Viewing Runtime Events

To display Runtime Events, click the **Events** icon.

The log of Runtime Events appears.

Events are added to the top of the list. Each event includes:

- **Index** – Sequence number of the event. Begins with 0 at system startup.
- **Device** – Disk Array, Logical Drive, Physical Drive by its ID number.
- **Event ID** – Hexadecimal identifier of the event
- **Severity** – (lowest to highest) Information, Warning, Minor, Major, Critical and Fatal
- **Time** – Date and time the event happened.
- **Description** – A description of the event in plain language.

Viewing NVRAM Events

This screen displays a list of and information about 63 most important events over multiple subsystem startups.

To display NVRAM events:

1. Click the **Events** icon.

   The log of Runtime Events appears.
2. Click the **Runtime Events** button.

   The log of NVRAM Events appears.

   Events are added to the top of the list. Each item includes:

   - **Index** – Sequence number of the event. Begins with 0 at system startup.
   - **Device** – Disk Array, Logical Drive, Physical Drive by its ID number.

- **Event ID** – Hexadecimal identifier of the event
- **Severity** – (lowest to highest) Information, Warning, Minor, Major, Critical and Fatal
- **Time** – Date and time the event happened.
- **Description** – A description of the event in plain language.

Event Severity Descriptions

Level	Meaning
Fatal	Non-Recoverable error or failure has occurred
Critical	Action is needed now and the implications of the condition are serious
Major	Action is needed now
Minor	Action is needed but the condition is not a serious at this time
Warning	User can decide whether or not action is required
Information	Information only, no action is required

Physical Drive Problems

Physical drive troubleshooting includes:

- Diagnosis using the Promise Utility (below)
- Locating a Physical Drive (page 107)
- Replacing a Physical Drive (page 107)
- Physical Drive Warning Message (page 109)

Physical drives are the foundation of data storage. A physical drive problem can affect your entire RAID system.

Diagnosis using the Promise Utility

In the Promise Utility, when a yellow !  icon or a red X  icon appears beside a physical drive, check the drive's operational status:

1. Click the **Physical Drive** icon.
2. Mouse-over and click the physical drive you want then click the **View** button.

   Look under Operational Status for the condition of the physical drive.

   - **Offline** – Check the drive for:
     - **PFA Condition** – Caused by a bad block or sector. See Note 1 below.
     - **Stale Condition** – Caused by obsolete array information on the physical drive. See Note 2 below.
   - **Drive Failed or Dead** – The physical drive cannot be repaired. You must replace the failed drive.

Note 1: Clear the error condition. Then the physical drive is available. See "Clearing a Stale or a PFA Condition" on page 43.

Note 2: Identify the disk array to which the physical drive belongs. Then delete the disk array. If the error condition remains on the physical drive, clear the error condition.

Locating a Physical Drive

To locate a physical drive:

1. Do one of the following actions:
   - Click the **Physical Drive** icon.
   - From the Device menu, choose **Physical Drive**.
2. Mouse-over and click the physical drive you want then click the **Locate** button.

   The Power/Status LED for the drive carrier holding that drive blinks blue and orange for one minute.

Figure 4. Running the Locate function to identify a physical drive

Replacing a Physical Drive

A failed physical drive displays a red X icon in the Promise Utility and a red Power/Status LED on the drive carrier.

Figure 5. Failed physical drive

Check the failed drive, then obtain a replacement drive of the same:

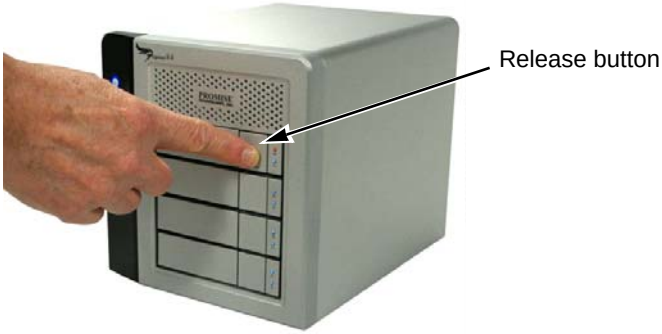
- **Type** – Hard disk drive (HDD) or solid state drive (SSD)
- **Interface** – SATA 3 Gb/s or 6 Gb/s
- **Spin speed** – 7,200 RPM or 15,000 RPM
- **Capacity** – Equal size or larger

You do not have to install the identical make and model of physical drive. However replacing with the same make and model of drive makes the process easier and simpler.

You can replace a physical drive without shutting down the Pegasus unit.

To replace a physical drive:

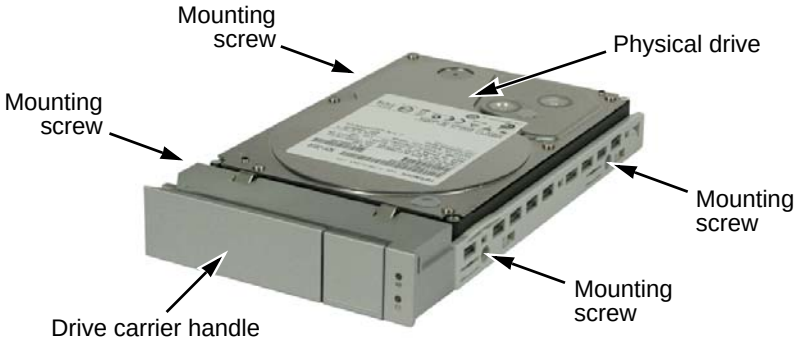
1. Press the release button to unlock the drive carrier.



The drive carrier handle swings out.

2. Grasp the handle and gently pull the drive carrier out of the Pegasus unit and place it onto a static-free surface.

3. Remove the four mounting screws, then slide the failed drive out of the carrier.



4. Place the replacement drive into the carrier then install the four mounting screws.

   Tighten the screws just until they are snug.

5. Position the drive carrier handle in outward position and slide the drive carrier back into the Pegasus unit.

6. Press the drive carrier handle inward until it locks.

Physical Drive Warning Message

If you see messages that says, “ajar HDD from the backplane,” you must reseat the physical drives.

To reseat the physical drives:

1. On the Pegasus unit, press and hold the Power Button LED until it turns red.

   See page 102, Figure 1.

2. Wait until the Power Button LED goes dark.
3. For each drive carrier, press the Release button, pull the drive carrier part way out of the unit, then press the drive carrier back in until it locks.

   See “Replacing a Physical Drive” on page 107.

4. Press the Power Button LED to power up the Pegasus unit.

Disk Array and Logical Drive Problems

Disk array and logical drive troubleshooting includes:

- Disk Array Degraded/Logical Drive Critical (page 110)
- Disk Array Offline/Logical Drive Offline (page 111)
- Repairing an Offline Disk Array or Logical Drive (page 111)
- Rebuilding a Disk Array (page 112)
- Incomplete Array (page 112)
- Unreadable Disk Warning (page 114)

Disk array problems typically result from a physical drive failure. The most common problem is a degraded disk array. The RAID controller can rebuild a degraded disk array. See “Rebuilding a Disk Array” on page 112.

Disk Array Degraded/Logical Drive Critical

Disk arrays are made up of physical drives. Logical drives are created on the disk array.

When one of the physical drives in a disk array fails:

- The operational status of the disk array becomes **Critical**.
- The operational status of the logical drives becomes **Critical** or **Degraded**.
- The operational status of the physical drive becomes **Dead** or **Offline**.

The Promise Utility reports these conditions in the following places:

- Dashboard icon – A yellow ! icon beside the disk arrays, logical drives, and physical drives under System Status.
- Physical Drive icon – Physical drives are shown Dead or Offline and marked with a red X icon, or Missing.
- Logical Drive icon – Disk Array and Logical Drive are marked Critical with a yellow ! icon.

  RAID 6 logical drives are marked:

  - Degraded with a yellow ! icon when ONE physical drive is offline.
  - Critical with a yellow ! icon when TWO physical drives are offline.

  RAID 0 logical drives show Offline status and a red X icon.
- Events icon – Logs a Major event for the logical drives and a Warning event for the physical drive.

If there is no spare drive in the Pegasus unit, you must provide the replacement drive. See “Replacing a Physical Drive” on page 107.

Disk Array Offline/Logical Drive Offline

Disk arrays are made up of physical drives. Logical drives are created on the disk array. When a disk array and its logical drives go **Offline**, the data stored in the logical drives is no longer accessible.

RAID 0 logical drives go **Offline** when ONE physical drive is removed or fails.

RAID 1, 1E, 5, and 10 logical drives go **Offline** when TWO physical drives are removed or fail.

RAID 6 logical drives go **Offline** when THREE physical drives are removed or fail.

The Promise Utility reports these conditions in the following places:

- Dashboard icon – A red X icon appears beside the disk arrays, logical drives, and physical drives under System Status.
- Physical Drive icon – Physical drives are shown Dead, Offline, or Missing.
- Logical Drive icon – Disk Array and Logical Drives are marked with a red X icon.
- Event icon – Major event for the logical drive and a Warning event for the physical drive.

  Under Background Activities, no Rebuild takes place. See Repairing, below.

Repairing an Offline Disk Array or Logical Drive

RAID 1, 1E, 5, 6, and 10 Logical Drives

If a fault-tolerant logical drive, RAID 1, 1E, 5, 6, and 10, goes **Offline**, it may be possible to recover your data.

Warning

Take no further corrective action until you have consulted with Technical Support! See page 121.

RAID 0 Logical Drives

If a logical drive based on a non-fault-tolerant disk array, RAID 0, goes offline, all of the data on the logical drive is lost.

To recreate your logical drive:

1. Identify the failed physical drive.

See “Locating a Physical Drive” on page 107.

2. Replace the failed drive.

   See “Replacing a Physical Drive” on page 107.

3. If the disk array had more than one physical drive, delete the disk array and re-create it.

   See “Deleting a Disk Array” on page 54 and “Creating a Disk Array and Logical Drive with the Wizard” on page 47.

4. Restore the data from your backup source.

Rebuilding a Disk Array

When you rebuild a disk array, you are actually rebuilding the data on one of its physical drives.

If there is no spare drive of adequate capacity, you must replace the failed drive with an unconfigured physical drive, then perform a Rebuild manually.

See “Replacing a Physical Drive” on page 107.

To perform a manual rebuild:

1. From the Admin menu, choose **Background Activities**.
2. Mouse-over Rebuild and click the **Start** button.
3. From the **Source Physical Drive** dropdown menu, choose a **Source** disk array and physical drive.

   Arrays have an ID No. Physical drives have a Seq. No.(sequence number)

4. From the **Target Physical Drive** dropdown menu, choose a **Target** physical drive.
5. In the Confirmation box, type the word “confirm” in the field provided and click the **Confirm** button.

   When the disk array is rebuilding:

   - The disk array shows a green check  icon and **Rebuilding** status.
   - Logical drives under the disk array continue to show a yellow !  icon and **Critical, Rebuilding** status.
   - If the buzzer is enabled, the Pegasus unit emits two quick beeps every five seconds. When the beeps stop, the rebuild is done.

Incomplete Array

A more serious, but far less common problem is an Incomplete Array. An incomplete array results from a physical drive that fails or becomes missing during:

- RAID level migration
- Disk array transport

Migration

Normally, if a physical drive or the controller fails during migration, the disk array goes critical, and you can rebuild it.

Transport

Transport is the action of moving the physical drives of a disk array:

- To different slots in the same subsystem
- From one subsystem to another

If a physical drive fails during a transport, or you do not move all of the physical drives to their new locations, the Promise Utility displays an incomplete array. When the Promise Utility discovers an incomplete array, it displays a dialog box asking you to:

- Click the **OK** button to accept the incomplete array.
- Click the **Cancel** button to reject the incomplete array.

Before you accept the incomplete array, be sure all of the physical drives are present and that their drive carriers are properly installed into the subsystem. See “Replacing a Physical Drive” on page 107.

If you choose to accept the incomplete array:

1. Click **OK** in the incomplete array dialog box.
2. Check the operational status of the logical drives in the array.
   - If the logical drives are **Critical**, proceed with a rebuild.
   - If the logical drives are **Offline**, contact Technical Support. See page 121.
3. Restore your data from a backup source.

If you choose NOT to accept the incomplete array:

1. Click **Cancel** in the incomplete array dialog box.
2. Do one of the following:
   - Delete the array. This action deletes all logical drives on the array.
   - Replace the missing physical drive.

Unreadable Disk Warning

Your Pegasus logical drive displays on the computer's desktop as a removable-drive icon (right).

If your computer's operating system recognizes a logical drive but cannot access it, the computer might display a warning message. See Figure 6.

Figure 6. Warning message

Normally, you never see this warning message for Pegasus logical drive because the Promise Utility formats your logical drives automatically.

If the warning message appears, try using the computer's disk utility to REPAIR the problem logical drive. For more information, see the utility's online help or the computer's *User Manual*.

If the disk utility cannot repair the logical drive, contact Technical Support for advice and assistance. See page 121.

Caution

If a logical drive has been in use and suddenly displays this warning message, do NOT format the logical drive. Formatting erases all of your data on your logical drive.

Subsystem Problems

Subsystem problem troubleshooting includes:

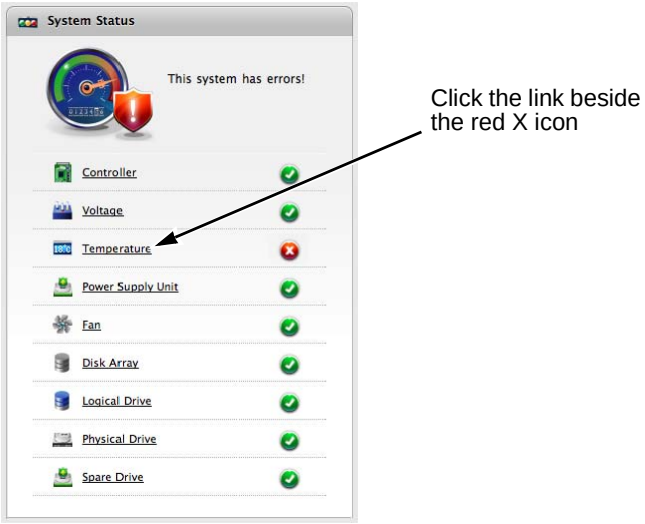
- Diagnosing a Subsystem Problem (below)
- Overheating (page 116)
- Power Supply (page 117)

Diagnosing a Subsystem Problem

Check System Status on the Dashboard tab. If a yellow ! or red X appears in the System Status box:

1. Click the name link of the component with the red X icon.

Figure 7. System Status box on the Dashboard



The list containing the problem component displays. In the case of a high-temperature issue, shown in the example above, the Component List displays.

2. For physical drives, disk arrays, logical drives, and spare drives, mouse-over the component with the red X icon and click the **View** button.

Overheating

Overheating is a potentially serious condition because the excessively high temperatures can lead to physical drive failure and controller malfunction.

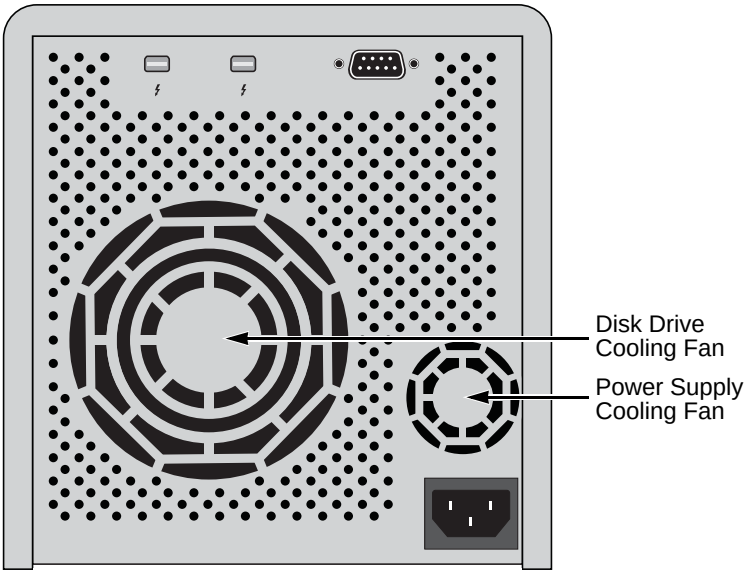
Overheating usually results from:

- Fan failure
- Inadequate air circulation around the subsystem

Fan Failure

The larger fan on the back of the Pegasus unit cools the physical drives and the RAID controller. The smaller fan cools power supply. Cooling fans are not field-replaceable. If there is any problem with a cooling fan, contact Technical Support to make arrangements for a repair.

Figure 8. Pegasus cooling fans



Inadequate Air Circulation

Air circulation around the Pegasus unit might be a more complex problem. Check for these conditions:

- Accumulated dust or objects blocking the fans
- Less than a minimum of 13 cm (5 inches) space between the back of the unit and the wall or other object
- Ambient temperature above 35°C (95°F) where the unit is operating

To cool down a Pegasus unit:

- Correct any problems identified above.
- Shut down the Pegasus unit.

  Press and hold the Power Button for a few seconds until the LED turns red.

  The Promise Utility displays the message: *Unable to connect to the device*.
- Wait at least one hour, then restart the Pegasus unit.

  Press the Power Button. The Pegasus boots within a few seconds.

Power Supply

The power supply used in the Pegasus unit is not field-replaceable. If there is any problem with the power supply, contact Technical Support to make arrangements for a repair. See page 121.

Connection Problems

Connection problem troubleshooting includes:

- Cables (below)
- Daisy-Chains (page 119)

Cables

While the installation of the cables and components was correct, they don't function properly, or at all, because:

- A connector is dirty or corroded
- A connector is loose or damaged
- A cable looks OK outside but has an open circuit inside
- The wrong cable was used. See the Note below

Be sure to use approved cables because:

- They are the proper ones for your system.
- They are sold in brand-new condition.

Note

Mini Display extension cables cannot be used to connect *data devices* such as Pegasus to Thunderbolt-enabled computers.

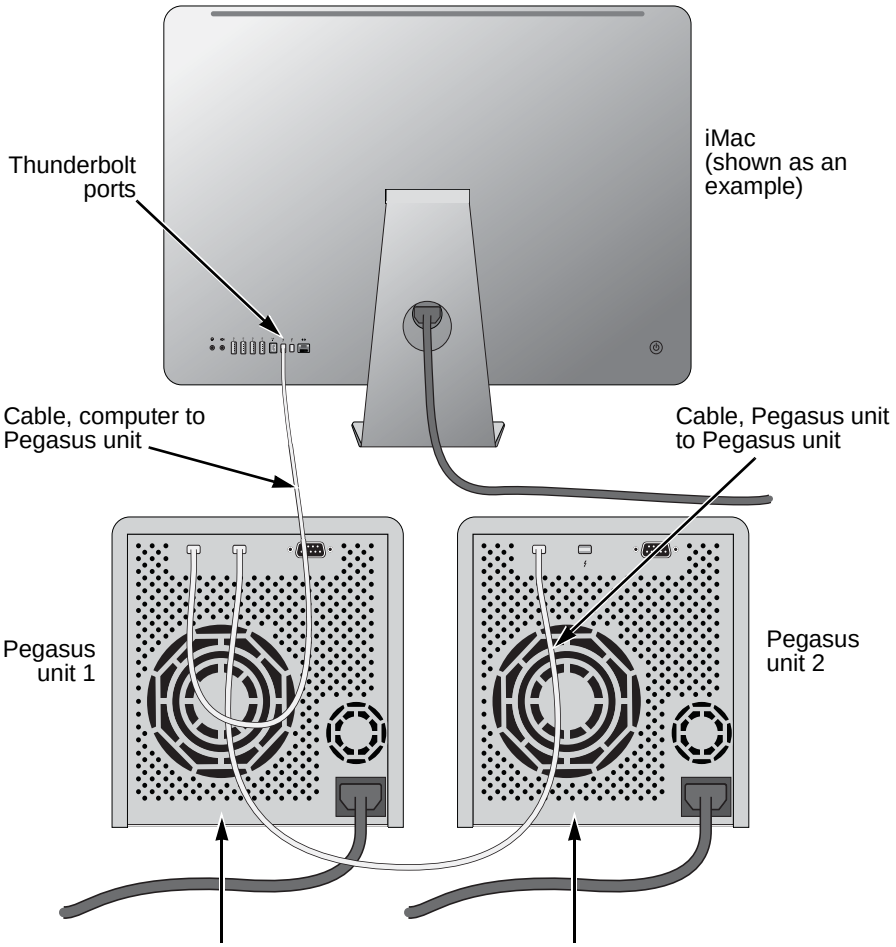
Mini Display extension cables can only be used to connect *display devices* to Pegasus.

Daisy-Chains

If you have multiple Pegasus units daisy-chained together, all Pegasus units must be running to provide access to your volumes and the data they contain.

If you shut down a Pegasus unit in the chain, that unit and those below it are effectively disconnected from your computer. See Figure 9.

Figure 9. Thunderbolt daisy-chain connections



Chapter 6: Support

Contacting Technical Support

Important

You must register your Pegasus unit to receive support.

Go to: https://support.promise.com/userRegistration.aspx

Thank you!

PROMISE Technical Support provides several support options for PROMISE users to access information and updates. We encourage you to use one of our electronic services, which provide product information updates for the most efficient service and support.

PROMISE E-Support: https://support.promise.com

PROMISE Web site: http://www.promise.com/apple/

When you contact us, please have the following information available:

- Product model and serial number
- BIOS, firmware, and driver version numbers
- A description of the problem/situation
- System configuration information, including: motherboard and CPU type, hard drive models, SAS/SATA/ATA/ATAPI drives & devices, and other controllers.

United States

580 Cottonwood Drive

Milpitas, Ca 95035, USA

Apple Pre-Sales: 1 408 228-1400 Option 2

Apple Support Phone Toll Free: 1-800-888-0245 Option 8

Fax: 1 408 228-1097

Apple Sales Email: apple@promise.com

Technical Support (E-Support): https://support.promise.com

Website: http://www.promise.com/apple/

Australia

Apple Pre-Sales Toll Free: 1800-149-746
Apple Support Phone Toll Free: 1800-149-746
Apple Sales Email: apple@promise.com
Technical Support (E-Support): https://support.promise.com
Web site: http://www.promise.com/apple/

EMEA

Netherlands

Science Park Eindhoven 5228
5692 EG Son, The Netherlands
Apple Pre-Sales Toll Free Phone (0830 to 1700): 0800-917-027
Apple Support Phone (0830 to 1700) Toll Free: 0800-917-027
Apple Support Phone (After Hours, English only) Toll Free: 0800-917-027
Fax: +31 (0) 40-256-9463
Apple Sales Email: apple@promise.com
Technical Support (E-Support): https://support.promise.com
Web site: http://www.promise.com/apple/

Austria

Apple Pre-Sales Toll Free Phone (0830 to 1700): 0800-295-731
Apple Support Toll Free Phone (0830 to 1700): 0800-295-731
Apple Support Toll Free Phone (After Hours, English only): 0800-295-731
Apple Sales Email: apple@promise.com
Technical Support (E-Support): https://support.promise.com
Web site: http://www.promise.com/apple/

France

Apple Pre-Sales Toll Free Phone (0830 to 1700): 0800-917-027
Apple Support Toll Free Phone (0830 to 1700): 0800-917-027
Apple Support Toll Free Phone (After Hours, English only): 0800-917-027
Apple Sales Email: apple@promise.com
Technical Support (E-Support): https://support.promise.com
Web site: http://www.promise.com/apple/

Germany

Europaplatz 9

44269 Dortmund, Germany

Apple Pre-Sales Toll Free Phone (0830 to 1700): 0800-187-3557

Apple Support Toll Free Phone (0830 to 1700): 0800-187-3557

Apple Support Toll Free Phone (After Hours, English only): 0800-187-3557

Apple Sales Email: apple@promise.com

Technical Support (E-Support): https://support.promise.com

Web site: http://www.promise.com/apple/

Sweden

Apple Pre-Sales Toll Free Phone (0830 to 1700): 020-797-720

Apple Support Toll Free Phone (0830 to 1700): 020-797-720

Apple Support Toll Free Phone (After Hours, English only): 020-797-720

Apple Sales Email: apple@promise.com

Technical Support (E-Support): https://support.promise.com

Web site: http://www.promise.com/apple/

Switzerland ITF

Apple Pre-Sales Toll Free Phone (0830 to 1700): 0800-562-898

Apple Support Toll Free Phone (0830 to 1700): 0800-562-898

Apple Support Toll Free Phone (After Hours, English only): 0800-562-898

Apple Sales Email: apple@promise.com

Technical Support (E-Support): https://support.promise.com

Web site: http://www.promise.com/apple/

Norway ITF

Apple Pre-Sales Toll Free Phone (0830 to 1700): 0800-15406

Apple Support Toll Free Phone (0830 to 1700): 0800-15406

Apple Support Toll Free Phone (After Hours, English only): 0800-15406

Apple Sales Email: apple@promise.com

Technical Support (E-Support): https://support.promise.com

Web site: http://www.promise.com/apple/

Belguim

Apple Pre-Sales Toll Free Phone (0830 to 1700): 0800-71915
Apple Support Toll Free Phone (0830 to 1700): 0800-71915
Apple Support Toll Free Phone (After Hours, English only): 0800-71915
Apple Sales Email: apple@promise.com
Technical Support (E-Support): https://support.promise.com
Web site: http://www.promise.com/apple/

Luxembourg

Apple Pre-Sales Toll Free Phone (0830 to 1700): 0800-26425
Apple Support Toll Free Phone (0830 to 1700): 0800-26425
Apple Support Toll Free Phone (After Hours, English only): 0800-26425
Apple Sales Email: apple@promise.com
Technical Support (E-Support): https://support.promise.com
Web site: http://www.promise.com/apple/

United Kingdom

Apple Pre-Sales Toll Free Phone (0830 to 1700): 0800-587-1068
Apple Support Toll Free Phone (0830 to 1700): 0800-587-1068
Apple Support Toll Free Phone (After Hours, English only): 0800-587-1068
Apple Sales Email: apple@promise.com
Technical Support (E-Support): https://support.promise.com
Web site: http://www.promise.com/apple/

Taiwan

Apple Pre-Sales Toll Free (24x7 English only): 008-0113-6030
Apple Support Phone Toll Free (24x7 English only): 008-0113-6030
Apple Sales Email: apple@promise.com
Technical Support (E-Support): https://support.promise.com
Web site: http://www.promise.com/apple/

China

Room 1108, West Wing, Shi Chuang Plaza, 22 Information Road
Shangdi IT Park, Haidian District, Beijing 100085
Apple Pre-Sales Toll Free: 86-10-8857-8085/8095
Apple Support Phone Toll Free: 86-10-8857-8085/8095
Fax: 86-10-8857-8015
Apple Sales Email: apple@promise.com
Technical Support (E-Support): https://support.promise.com
Web site: http://www.promise.com/apple/

Korea

Apple Pre-Sales Toll Free (24x7 English only): 00798-14-800-7784
Apple Support Phone Toll Free (24x7 English only): 00798-14-800-7784
Apple Sales Email: apple@promise.com
Technical Support (E-Support): https://support.promise.com
Web site: http://www.promise.com/apple/

Hong Kong

Apple Pre-Sales Toll Free Phone (24x7 English only): 800-933-480
Apple Support Toll Free Phone (24x7 English only): 800-933-480
Apple Sales Email: apple@promise.com
Technical Support (E-Support): https://support.promise.com
Web site: http://www.promise.com/apple/

Singapore

Apple Pre-Sales Toll Free Phone (24x7 English only): 800-492-2153
Apple Support Toll Free Phone (24x7 English only): 800-492-2153
Apple Sales Email: apple@promise.com
Technical Support (E-Support): https://support.promise.com
Web site: http://www.promise.com/apple/

Japan

3F, Mura Matsu Bldg, 3-8-5, Hongo Bunkyo-ku
Tokyo 113-0033, Japan
Apple Pre-Sales Toll Free Phone (24x7 English only): 0066-3384-9021
Apple Support Toll Free Phone (24x7 English only): 0066-3384-9021
Apple Sales Email: apple@promise.com
Technical Support (E-Support): https://support.promise.com
Web site: http://www.promise.com/apple/

Limited Warranty

PROMISE Technology, Inc. (“PROMISE”) warrants that this product, from the time of the delivery of the product to the original end user:

a) all components, except for the fan and power adapter, for a period of two (2) years;

a) the fan and power adapter for a period of one (1) year;

b) will conform to PROMISE’s specifications;

c) will be free from defects in material and workmanship under normal use and service.

This warranty:

a) applies only to products which are new and in cartons on the date of purchase;

b) is not transferable;

c) is valid only when accompanied by a copy of the original purchase invoice;

d) Is not valid on spare parts.

This warranty shall not apply to defects resulting from:

a) improper or inadequate maintenance, or unauthorized modification(s), performed by the end user;

b) operation outside the environmental specifications for the product;

c) accident, misuse, negligence, misapplication, abuse, natural or personal disaster, or maintenance by anyone other than a PROMISE or a PROMISE-authorized service center.

Disclaimer of other warranties

This warranty covers only parts and labor, and excludes coverage on software items as expressly set above.

Except as expressly set forth above, PROMISE DISCLAIMS any warranties, expressed or implied, by statute or otherwise, regarding the product, including, without limitation, any warranties for fitness for any purpose, quality, merchantability, non-infringement, or otherwise. PROMISE makes no warranty or representation concerning the suitability of any product for use with any other item. You assume full responsibility for selecting products and for ensuring that the products selected are compatible and appropriate for use with other goods with which they will be used.

PROMISE DOES NOT WARRANT that any product is free from errors or that it will interface without problems with your computer system. It is your responsibility

to back up or otherwise save important data before installing any product and continue to back up your important data regularly.

No other document, statement or representation may be relied on to vary the terms of this limited warranty.

PROMISE's sole responsibility with respect to any product is to do one of the following:

a) replace the product with a conforming unit of the same or superior product;

b) repair the product.

PROMISE shall not be liable for the cost of procuring substitute goods, services, lost profits, unrealized savings, equipment damage, costs of recovering, reprogramming, or reproducing of programs or data stored in or used with the products, or for any other general, special, consequential, indirect, incidental, or punitive damages, whether in contract, tort, or otherwise, notwithstanding the failure of the essential purpose of the foregoing remedy and regardless of whether PROMISE has been advised of the possibility of such damages. PROMISE is not an insurer. If you desire insurance against such damage, you must obtain insurance from another party.

Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, so the above limitation may not apply to you.

This warranty gives specific legal rights, and you may also have other rights that vary from state to state. This limited warranty is governed by the State of California.

Your Responsibilities

You are responsible for determining whether the product is appropriate for your use and will interface with your equipment without malfunction or damage. You are also responsible for backing up your data before installing any product and for regularly backing up your data after installing the product. PROMISE is not liable for any damage to equipment or data loss resulting from the use of any product.

Returning Product For Repair

If you suspect a product is not working properly, or if you have any questions about your product, contact our Technical Support Staff through one of our Technical Services, making sure to provide the following information:

- Product model and serial number (required)
- Return shipping address
- Daytime phone number
- Description of the problem
- Copy of the original purchase invoice

The technician will assist you in determining whether the product requires repair. If the product needs repair, the Technical Support Department will issue an RMA (Return Merchandise Authorization) number.

Important

Obtain an RMA number from Technical Support *before* you return the product and write the RMA number on the label. The RMA number is essential for tracking your product and providing the proper service.

Return ONLY the specific product covered by the warranty (do not ship cables, manuals, diskettes, etc.), with a copy of your proof of purchase to:

USA and Canada:	PROMISE Technology, Inc. Customer Service Dept. Attn.: RMA # _____ 47654 Kato Road Fremont, CA 94538
Other Countries:	Check PROMISE E-Support: https://support.promise.com for the location nearest you. Contact the office or repair depot for full instructions before shipping the product.

You must follow the packaging guidelines for returning products:

- Use the original shipping carton and packaging
- Include a summary of the product's problem(s)
- Write an attention line on the box with the RMA number
- Include a copy of proof of purchase

You are responsible for the cost of insurance and shipment of the product to PROMISE. Note that damage incurred due to improper transport or packaging is not covered under the Limited Warranty.

When repairing returned product(s), PROMISE may replace defective parts with new or reconditioned parts, or replace the entire unit with a new or reconditioned unit. In the event of a replacement, the replacement unit will be under warranty for the remainder of the original warranty term from purchase date, or 30 days, whichever is longer.

PROMISE will pay for standard return shipping charges only. You will be required to pay for any additional shipping options (such as express shipping).

Appendix A: Updates

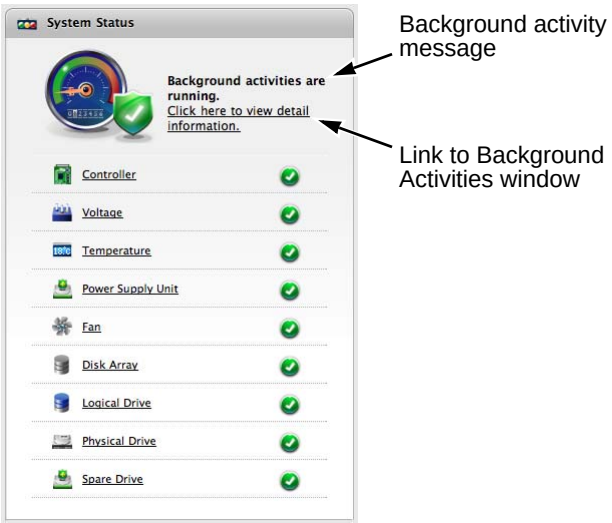
This appendix contains the following topics

Updating the Firmware

Preparing the Pegasus Unit

To update the firmware on the Pegasus unit:

1. Download the latest firmware image file from PROMISE support: http://www.promise.com/support/ and save it to your computer.
   The image file name has an .img (image) suffix.
2. Verify that no background activities are running on the Pegasus unit.
3. Click the **Dashboard** icon and look at the System Status panel.
   If any background activity is running, it is reported here.



4. Click the link to view the Background Activities window.
   Here you can view the current activities and their progress.

That information can help you decide whether to:

- Wait until all activities are finished.
- Pause or cancel the activities and proceed with the update.

Updating the Firmware

To update the firmware on the Pegasus unit:

1. Click the **Admin** dropdown menu and choose **Firmware Update**.

   The Controller Firmware Update window shows the image version and build date of the firmware that is currently running on the Pegasus.
2. Click the **Choose File** button.
3. Navigate to the location of the firmware image file on your computer and double-click the file to load it into the Controller Firmware Update window.
4. Click the **Next** button to validate the firmware image file.

   Look beside Flash Image Status to verify that the image file is validated.
5. Click the **Submit** button.

   The Confirm dialog box appears.
6. Type **confirm** into the field provided and click the **Confirm** button.

   The progress of the update displays.

Warning

- Do NOT power off the Pegasus during the update!
- Do NOT move to any other screen until the firmware update operation is completed!

When the update is completed a message tells you to reboot the system.

7. Click the **OK** button.
8. On the Pegasus unit, press and hold the Power Button/LED until it turns red.

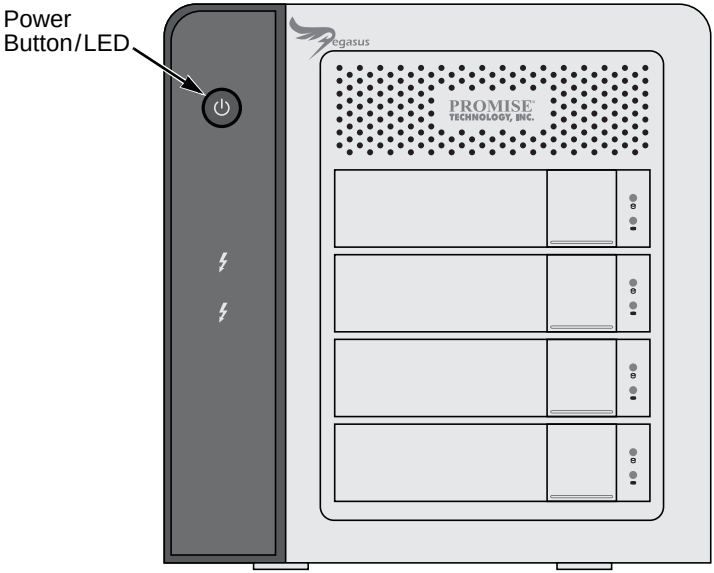
   See page 133, Figure 1. When you release the Power Button/LED, it goes dark and your logical drive icons disappear from the desktop (right).

9. Press the Power Button/LED again to boot the Pegasus unit.

   At first, the Power Button/LED is orange. When it turns blue, the Pegasus is fully booted and running the new firmware.

   Your logical drive icons reappear on the desktop.

Figure 1. Pegasus R4 front view. The R6 is similar



Updating Drivers

To install an updated driver onto your computer:

1. Download the latest driver installer file from PROMISE support: http://www.promise.com/support/ and save it to your computer.

   The driver installer file name has a .pkg (package) suffix.

2. Double-click the driver installer icon (right).

   The Welcome dialog box appears.

3. Click the **Continue** button.

   The Install dialog box appears.

4. Click the **Install** button.

   The password dialog box appears.

5. Type your password in the field provided and click the **OK** button.

   The Confirmation dialog box appears to inform you that you must restart your computer when installation is done.

Updating the Software

To install updated Promise Utility software onto your computer:

1. Download the latest software installer file from PROMISE support: http://www.promise.com/support/ and save it to your computer.

   The software installer file name has a .pkg (package) suffix.

2. Double-click the **Promise Utility** installer icon (right).

   The Welcome dialog box appears.

3. Click the **Continue** button.

   The Install dialog box appears.

4. Click the **Install** button.

   The password dialog box appears.

5. Type your password in the field provided and click the **OK** button.

   In a few moments the Install Succeed dialog box appears.

6. Click the **Close** button to quit the installer.

Appendix B: Important Information

GNU General Public License

This product includes copyrighted third-party software licensed under the terms of the GNU General Public License. Please see the GNU General Public License (“GPL”) for the exact terms and conditions of this license at www.gnu.org.

The GPL source code incorporated into the product is available for free download at our web site www.PROMISE.com/support/download/download_eng.asp.

Subject to GPL, you may re-use, re-distribute and modify the GPL source code. Note that with respect solely to the GPL Software, no warranty is provided, we do not offer direct support for the distribution.

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