Pegasus3
R4, R6, R8
(PGRDA113, PGRFA123, PGRHA133)
Product Manual
Version 1.0
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About this guide

This *Product Manual* describes how to setup, use, and maintain the Pegasus3 R8, R6 and R4 unit. It also describes how to use the Pegasus Utility software that you install and run on your computer. Please notice that there are different setup instructions for Mac users and Windows users.

Although this manual is written specifically for the Pegasus3 models, many of the functions and descriptions can be applied to previous releases of the PROMISE Pegasus line.

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 notice 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.
FCC

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio TV technician for help.

Notice: The changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equivalent.

VCCI

この装置は、クラスB 情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。

取扱説明書に従って正しい取り扱いをして下さい。

VCCI - B

KCC

이 기기는 가정용(B급) 전자파적합기기로서 주로 가정에서 사용하는 것을 목적으로 하며, 모든 지역에서 사용할 수 있습니다.
WARNING
Use the power cord included with the Pegasus3 R4, Pegasus3 R6 Pegasus3 R8.

CAUTION
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.

CAUTION
To avoid hand contact with an electrical hazard, do not remove more than one drive carrier a time or the equivalent.
**Promise Technology**  

**Pegasus3 R4/R6/R8**

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INTRODUCTION TO PEGASUS3

This chapter covers the following topics:

• “Packing List”
• “Architecture”
• “Protocol Support”
• “Key Benefits”
• “Specifications”
• “Hardware”

PROMISE Technology’s Pegasus3 R8, 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 digital Audio and Video production professionals.

Pegasus3 models (R4, R6, R8) are operationally compatible with the original release Pegasus R4 and R6 models. Use the latest version of the Pegasus Utility to monitor the Pegasus3 status and perform maintenance and management functions. The latest version of the Pegasus Utility can also be used for the original release of Pegasus and Pegasus2.

PACKING LIST

Check the shipping package to make sure you have the following items:

• Pegasus3 R4, Pegasus3 R6 or Pegasus3 R8
• Hard disk drives (four in R4, six in R6, eight in R8)
• Quick Start Guide
• Thunderbolt 3 cable
• Power cord
ARCHITECTURE

The Pegasus3 architecture is based on a state-of-the-art PMC Sierra 8067 I/O processor coupled with 1G of DDR3-1866 SDRAM memory and a world class enterprise-proven RAID engine.

PROTOCOL SUPPORT

Pegasus3 supports Thunderbolt 3™ technology, providing two channels with 40 Gb/s of throughput in both directions simultaneously. Thunderbolt 3 is NOT COMPATIBLE with the previous versions of Thunderbolt (i.e. Thunderbolt and Thunderbolt 2).

Thunderbolt 3 supports daisy-chaining up to six (6) high-speed peripheral devices, including external disks, video capture devices, and a Mini DisplayPort monitor.

Pegasus3 has two Thunderbolt ports, as required for daisy-chaining.

KEY BENEFITS

- Thunderbolt 3 40 Gb/s data connection
- PMC Sierra 8067 I/O processor
- 1G of DDR3-1866 SDRAM memory
- Pegasus Utility management tool
- Compatible with Apple Time Machine
- R6, six SATA 3.5-inch hard disk drives
- R4, four SATA 3.5-inch hard disk drives
- R8, eight SATA 3.5-inch hard disk drives
- Additional storage using multiple daisy-chained Pegasus3 enclosures
- 250W Flex-ATA Power with 80 Plus Bronze.
## Specifications

<table>
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<th>The Pegasus3 is shipped with 3.5 inch SATA Hard Disk Drives (HDD) installed in the drive carriers and placed in the drive bays.</th>
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<tr>
<td>Capacity</td>
<td>The Pegasus3 is available in three form factors that differ in the number of drives that can be installed. Total capacity depends on the size of the HDD shipped with the unit. The Pegasus3 R4 is shipped with four HDD The Pegasus3 R6 is shipped with six HDD The Pegasus3 R8 is shipped with eight HDD In addition, Pegasus3 enclosures can be connected or “daisy-chained” to other Pegasus3 units to scale up the available storage capacity.</td>
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<tr>
<td>Power supply</td>
<td>250W Flex-ATA Power with 80 Plus Bronze with PFC, 100-230V auto-ranging, 50-60Hz AC</td>
</tr>
<tr>
<td>System Fan</td>
<td>Pegasus3 R4/R6: Dimension: 92(W) x 92(H) x 25(D) mm / Airflow: 70 CFM Pegasus3 R6: Dimension: 120(W) x 120(H) x 25.8(D) mm / Airflow: 97 CFM</td>
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<td>Operating: 10% ~ 95% non-condensing Storage: 5% - 95% non-condensing</td>
</tr>
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<td>Dimensions</td>
<td>R8: 248 x 188 x 314 mm (9.8 x 7.4 x 12.4 in) R6: 248 x 188 x 235 mm (9.8 x 7.4 x 9.3 in) R4: 248 x 188 x 195 mm (9.8 x 7.4 x 7.7 in)</td>
</tr>
<tr>
<td>Weight</td>
<td>As shipped with all 3.5&quot; HDD installed: R8: 11 kg / 24.2 lb R6: 9.1 kg / 20.1 lb R4: 6.8 kg / 15 lb</td>
</tr>
</tbody>
</table>
**HARDWARE**

This section provides a brief introduction to the external hardware of the Pegasus3 R4, R6 and R8. The R4 is shorter and has four drive carriers, the R8 is taller with eight drive carriers. For the purpose of installation they are nearly identical.

*Pegasus3 R6 front view*
LED | Description
--- | ---
**System Status*** | The System Status LED located on the Power button lights blue when the Pegasus3 is operating normally. When the system is booting up, this lights orange and will light blue when fully booted if there are no problems detected. A red System Status LED indicates a serious problem such as an incomplete array or failed hard disk drive.

**Thunderbolt Link** | This LED will light blue when the Thunderbolt cable is connected, they remain dark when there is no link.

**Drive Status and Activity*** | The Drive Status LED lights blue when a physical drive is present and functioning normally. A red Drive Status LED indicates a problem with the physical drive or an array. The Drive Activity LED lights blue when the physical drive is present and blinks blue when there is activity on the drive.

* See “Checking LEDs” on page 191 for more details about using LED indicators for troubleshooting.
Note
As far as the location of the Thunderbolt ports is concerned, the back of the R4, R6 and R8 are identical, i.e. near the top and left of center. The power connection is in the lower right corner on both devices.
## Feature Description

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thunderbolt 3 Ports</td>
<td>Use a Thunderbolt 3 cable to connect the Pegasus3 to a Thunderbolt 3 ready computer. This connection completes the physical link, it is the path through which the SATA link is established.</td>
</tr>
<tr>
<td>Cooling Vents</td>
<td>The cooling vents on the back should be clear and unobstructed to allow proper airflow for disk and system cooling. Note that the air intake vents located on the front of the enclosure should also be unobstructed.</td>
</tr>
</tbody>
</table>
| Power Receptacle   | - Use an approved power cord.  
- If you have not been provided with a power cord for your product or for any AC-powered option intended for your product, purchase a power cord that is approved for use in your country.  
- You must use a power cord rated for your product and for the voltage and current marked on the electrical ratings label of the product. The voltage and current rating of the cord must be greater than the voltage and current rating marked on the product.  
- Do not place objects on AC power cords or cables. Arrange them so that no one may accidentally step on or trip over them.  
- Do not pull on a cord or cable. When unplugging from the electrical outlet, grasp the cord by the plug.  
- Make sure that the total ampere rating of all products plugged into an extension cord or power strip does not exceed 80 percent of the ampere ratings limit for the extension cord or power strip.  
- Do not disable the power cord grounding plug. The grounding plug is an important safety feature.  
- Plug the power cord into a grounded (earthed) electrical outlet that is easily accessible at all times. |
INSTALLATION AND SETUP FOR MAC USERS

This chapter contains the following topics:

• “Connect the power cord”
• “Connect Pegasus3 to your Mac”
• “Installing the Software on Mac”
• “Power modes on the Pegasus3”
• “Shutting down the Pegasus3”

CAUTION
The electronic components within the Pegasus3 unit are sensitive to damage from Electro-Static Discharge (ESD). Observe appropriate precautions at all times when handling the Pegasus3 unit or its subassemblies.

WARNING
The fan contains hazardous moving parts. Keep fingers and other body parts away.
Summary of the setup procedure

The setup procedure for the Pegasus3 is simple and easy. The device is shipped with hard disk drives installed and a RAID array configured, so it is just necessary to plug it in and connect the device. However, you should install the Pegasus Utility software used for monitoring and administration of the system. Mac users, please follow the setup procedure here or in the Quick Start Guide.

The setup process is summarized below.

1. Unpack the Pegasus3 shipping package
2. Connect the power cord and power on the Pegasus3 R4/R6/R8.
3. Connect the Pegasus3 to your computer with a Thunderbolt 3 cable.
4. Mac users can locate the Pegasus Utility installation package located on the device (Pegasus3 is shipped with RAID 5 configuration) and install the management software utility. Windows users please skip ahead to “Installation and Setup for Windows Users” on page 19.
Connect the power cord

To connect the power cord the Pegasus3 unit:

1. Attach the power cord on the back of the Pegasus3 unit. See the illustration below.
2. Plug the other end into a suitable power source.

Thunderbolt 3 and power connections

* Make sure the computer port is a Thunderbolt 3 port. The port uses a USB Type-C connector, but there is a Thunderbolt icon next to the port.
Connect Pegasus3 to your Mac

To establish the Thunderbolt 3 connection:

1. Connect a Thunderbolt 3 cable from one of the Thunderbolt 3 ports on the back of the Pegasus3 to the Thunderbolt 3 port on your computer. See “Thunderbolt 3 and power connections” on page 10.

2. If the Pegasus3 is plugged into a power source and the computer is running, the Pegasus3 will power on and begin to boot up. See “Power modes on the Pegasus3” on page 15 for information on power up and shut down behavior. You will notice the following:

   • The Power Button LED is lit orange at first, then blue.

   • The drive carrier Power / Status LEDs is lit blue.

   • The Thunderbolt 3 Link LED for the port connection is lit blue.

   See “Pegasus3 R6 front view” on page 4 for illustration of the front of the device.

   • The “PROMISE RAID” storage drive icon (see picture below) appears on your desktop. This indicates the Pegasus3 is ready for use.

Note
If the Thunderbolt 3 cable is connected to a computer that is running, the Pegasus3 will power up as soon as the power is connected.

Note
When the device is powered on by connecting the Thunderbolt 3 cable, or by pressing the Power Button, the Power Button turns orange. It takes about 30 seconds to start the Pegasus3 unit.
Installing the Software on Mac

The Pegasus3 unit ships ready to use without configuration or set-up; however it is a good idea to install the Pegasus Utility software even if you do not plan to make any changes to device configuration. The utility is useful for monitoring the system and getting firmware updates. The utility is necessary if you plan to change the default RAID configuration (Pegasus3 is shipped with a RAID 5) or if you will swap out any of the hard disks shipped with the device.

The software utility installation package is located on the Pegasus3. Follow the instructions below to install the utility.

To install the Pegasus3 Software Utility:

1. Double-click on the Pegasus3 icon on your desktop to view the device contents. See example to right.

2. Find the file “R_PROMISE_Utility_40000000x.dmg” and double-click on it to mount the virtual drive containing the installation software package.*

3. Double-click on the PROMISE_Utility_40000000x.pkg file to begin the software installation.*

* The version number of the .dmg file and .pkg file will change as it is updated. The version number used in this example is just for the purpose of illustration.
The Welcome menu explains that software will be installed on the computer. Click the **Continue** button to proceed with installation.

4. The Software License Agreement appears, please read the statement and click **Continue** to proceed.

5. Click **Agree** if you agree to the terms of the license. To read the license, click **Read License**. Choose **Disagree** if you do not agree the terms, in which case the installation procedure is terminated.

6. If you clicked **Agree** in the previous menu, the software is now ready to install. Click **Install** to begin.
7. It takes a few seconds for the utility software to be installed. When the installation has completed, a message informs you that the installation was successful. Click **Close** to end the installation procedure.

The Pegasus Utility is now available to be used for management of the Pegasus3. Use this if you need to change a hard disk drive, or change the default array configuration, or to update the device firmware. This is also useful for monitoring the status of the system and for troubleshooting. For more information on using the Pegasus Utility, including instructions on how to use the Wizard menus to install a different RAID array configuration, please read page 112.
Power modes on the Pegasus3

The Pegasus3 introduces new power saving and response features. These are described below.

The automatic power features are:

- **Sleep** - When your computer goes to sleep, the Pegasus3 unit will pause any background activities and shut down.
- **Wake** – When your computer wakes, the Pegasus3 unit automatically powers on.
- **Shutdown** – When your computer shuts down, the Pegasus3 unit automatically shuts down.
- **Restart After Shutdown** – When your computer powers up, the Pegasus3 unit automatically powers up.
- **Spin down HDD** - The Pegasus3 includes a power saving feature that spins down the hard disk drives if the logical drive is idle for 30 minutes. This can be enabled or disabled and the idle time can be changed in the Pegasus Utility. Click on the Controller link in the Dashboard, then click the Settings button to see how to change this setting.

Shutting down the Pegasus3

The Pegasus3 shuts down automatically if you turn off your computer. If you want to turn off the Pegasus3 without shutting down your computer, follow the steps below.

To shut down the Pegasus3 unit:

1. Eject the Pegasus3 by right-clicking on the drive icon and choosing the Eject option.
2. Launch the Pegasus Utility and click on the Subsystem Information menu button at the top of the interface, unlock the user interface (see “Unlocking the UI” on page 16), click on the Shutdown button, then click on Shutdown in the new menu that appears. You will need to type “confirm” in the pop-up menu and click on the Confirm button.

Alternatively, you can press and hold the Power Button until the Power LED on the button turns orange. When you release the Power Button, the LED goes dark.
Daisy-Chaining Multiple Pegasus3 Series Units

Up to 6 Pegasus3 devices can be connected to each other and to your in a daisy chain sequential Thunderbolt 3 connection. To daisy-chain multiple Pegasus3 units:

1. Connect a Thunderbolt 3 cable from one of the Thunderbolt 3 ports on the back of your computer to one of the Thunderbolt 3 ports on the first Pegasus3 unit.

2. Connect a second Thunderbolt 3 cable from other Thunderbolt 3 port on the first Pegasus3 unit to one of the Thunderbolt 3 ports on the second Pegasus3 unit.

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 Pegasus3 unit.

To unlock the UI:

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

   The Pegasus Utility password dialog box opens.

2. Type your Mac 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 Pegasus3 system.
Displaying Multiple Pegasus Units

The Pegasus Utility displays a separate window for each Pegasus unit (including previously released versions of Pegasus) that is connected and powered up.

- To view a list of the Pegasus units, click the View menu.
- To display a Pegasus unit in the Pegasus Utility, click the View menu and choose unit you want to see.

The first Pegasus unit is Pegasus R4, R6, or R8, the second is Pegasus R4-2 or R6-2, R8-2, the third is Pegasus R4-3 or R6-3, R8-3, and so on. The Pegasus units are listed by the order in which they are recognized, not by the cable configuration.
To Create a Disk Array and Logical Drive

The Pegasus3 is shipped with HDD installed and a RAID array configured, so it is not necessary to do this yourself. However, if you want to change the disk drives or configure a different RAID, you will need to create an array and logical drive to use the storage.

Important
The Pegasus3 does NOT require any configuration to use the RAID storage. It is shipped ready to use with a RAID5 configuration.

If you are installing new disk drives, use the Wizard to create a disk array and logical drive. The procedures are described in the next chapter.

To see the Wizard menu, launch the Pegasus Utility, in the Dashboard menu, under System Status, click the Disk Array link. See page 52 for an overview of the Pegasus Utility interface.

The Wizard dialog box opens with three configuration methods.

Wizard dialog box

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

<table>
<thead>
<tr>
<th>Method</th>
<th>User options</th>
<th>Suggested for users who are</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic</td>
<td>None</td>
<td>New to data storage</td>
<td>page 113</td>
</tr>
<tr>
<td>Express</td>
<td>General parameters</td>
<td>Familiar with data storage</td>
<td>page 114</td>
</tr>
<tr>
<td>Advanced</td>
<td>Individual parameters</td>
<td>Data storage professionals</td>
<td>page 116</td>
</tr>
</tbody>
</table>
This chapter contains the following topics:

- “System requirements for Windows”
- “Summary of the setup procedure”

Windows Setup Procedure as follows:

- “Step 1: Download software and driver”
- “Step 2: Connect the Pegasus3 to your Windows computer”
- “Step 3: Power On Pegasus3”
- “Step 4: Install Driver”
- “Step 5: Install Software”
- “Step 6: Format with Pegasus Utility”
- “Step 7: Check firmware version with Pegasus Utility”

Other important procedures for Windows Users:

- “Safely Remove Pegasus3 on Windows”
- “Shutdown the Pegasus3”

CAUTION

The electronic components within the Pegasus3 unit are sensitive to damage from Electro-Static Discharge (ESD). Observe appropriate precautions at all times when handling the Pegasus3 unit or its subassemblies.

WARNING

The fan contains hazardous moving parts. Keep fingers and other body parts away.
System requirements for Windows

The Pegasus3 hardware driver for Windows can be used on computers equipped with a Thunderbolt 3 port running any edition of Windows 7, or Windows 10. The Pegasus Utility software, used for administration and management of the Pegasus3, is also compatible with these Windows operating systems.

Email event notifications for Windows

To setup email event notification in Windows, click on Global Management in the Pegasus Utility, and select Service. Please see “Setting Up Email Notifications” on page 156 for more information.

Step 1: Download software and driver

Follow these instructions to download the software and driver installation files for Windows from the PROMISE website.

1. Go to the PROMISE website (www.promise.com) and click on Support in the banner at the top of the web page, scroll down and click on Download Center.

2. In the Download Center page, scroll to find the Pegasus3 Series logo and click on it.

3. Look for the Pegaus3 model you have in the list that is presented, and click on it.

4. In the new menu, look for the download links for the Windows driver and the Pegasus Utility for Windows. Download the driver and utility and follow the instructions in this section to install both.
Step 2: Connect the Pegasus3 to your Windows computer

Insert one end of a Thunderbolt 3 cable into the Thunderbolt 3 port on the Pegasus3 and connect the other end of the cable to a Thunderbolt 3 port on your computer. Make sure the cable connector is oriented correctly to the port on both the Pegasus3 and the computer. It should fit easily in place when correctly positioned.

* Make sure the computer port is a Thunderbolt 3 port. The port uses a USB Type-C connector, but there is a Thunderbolt icon next to the port.
# Step 3: Power On Pegasus3

Follow these steps to connect the power cord and power on the Pegasus3.

1. Attach the power cord on the back of the Pegasus3 unit. (See page 6 to see an illustration of the back of device)

2. Plug the other end into a power source.

3. Press the Power Button. (See illustration of front of device below).
   You will observe that the **Power Button** LED turns orange.

   It takes about 30 seconds to boot the Pegasus3 unit. When fully booted:
   - The Power Button LED turns blue.
   - The drive carrier Power/Status LEDs turn blue.

## Pegasus3 boot up LED behavior

<table>
<thead>
<tr>
<th>Power Button/LED</th>
<th>Drive Power/Status LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thunderbolt 3 Activity LED</td>
<td></td>
</tr>
</tbody>
</table>

![Pegasus3 boot up LED behavior diagram](image-url)
Step 4: Install Driver

Locate the driver file you downloaded in Step 1 and follow the instructions in the InstallShield Wizard to install the PROMISE RAID Controller driver. It will be necessary to restart the computer after to complete the installation.

1. Double-click on the zipped file for installing the driver, the file name begins with “PegasusRAID_WinDrv_Installer” followed by the version number. The InstallShield Wizard appears. Click Next to begin the installation.
2. The License Agreement appears. Click to select the “I accept the terms of the license agreement” option if you accept, and click on **Next** to continue.

![License Agreement](image)

3. You will be informed once the driver has been installed successfully. Click on **Finish** to continue.

![InstallShield Wizard Complete](image)
4. A message prompt appears informing you that a system restart is necessary, the “Yes, I want to restart my computer now” option is selected by default. Click OK to restart now, otherwise choose the “No, ...” option and restart later. The Pegasus3 cannot be used until you reboot the computer.

![Promise Pegasus RAID Controller Driver Installer](image)

**WARNING**
DO NOT disconnect the Thunderbolt cable while Windows is running. To safely disconnect the Thunderbolt cable while the computer is running, please read “Safely Remove Pegasus3 on Windows” on page 40.
Step 5: Install Software

Follow the instructions in this section to complete the installation of the Pegasus3 on your Windows computer. You need to install Pegasus Utility software used for device management and administration.

Locate the Installation program file downloaded previously in Step 1 and follow the instructions in the InstallShield menu to install Pegasus Utility.

1. Double-click on the zipped file for installing Pegasus Utility, the file name begins with “R_Pegasus_Utility” followed by the version number.
   The InstallShield Wizard for Pegasus Utility appears. Click on Next to begin installation.
2. The License Agreement appears. Click to select the “I accept the terms of the license agreement” option if you accept, and click on **Next** to continue.

3. Choose where to put the software on your computer. Click **Browse** to choose a specific location, or click **Next** to accept the default destination. Click **Next** to continue.
4. The program is ready to be installed in the chosen location. Click **Install** to begin.

![Image of Ready to Install the Program dialog box]

5. At this point, a pop-up message might occur (if Windows Firewall is running). Click on **Allow access** to continue.

![Image of Windows Security Alert]

Click Allow access or other option as needed, then proceed.
6. Installation of Pegasus Utility is completed. Click **Finish** to close the InstallShield Wizard.

7. Another dialog menu appears asking if you want to restart your computer. You should do so now if you want to use run the Pegasus Utility.
Step 6: Format with Pegasus Utility

Now you are ready to format the Pegasus3 with the NTFS file system for use as a direct attached storage system with your Windows computer. Use Pegasus Utility to format the RAID array and perform other administrative functions including changing the type of RAID. For information on the other tasks and functions of Pegasus Utility, please read the product manual. For the purpose of this installation guide, only the basic setup using the default PROMISE Hardware RAID 5 array is described. This type of RAID provides the best balance of performance and data safety. For more information on other RAID types, please read the product manual.

**DO NOT use the Windows Disk Manager** to change the RAID on the Pegasus3. Any changes to the RAID array must be done using Pegasus Utility.

Follow the instructions below for the Windows OS you are running:

- Windows 7 users, see “Format Pegasus3 on Windows 7” on page 31.
- Windows 10 users, see “Format Pegasus3 on Windows 10” on page 35.
Format Pegasus3 on Windows 7

Windows 7 users, please follow the steps listed below to launch Pegasus Utility and format the RAID:

1. Locate Pegasus Utility and launch it. You can either click the Pegasus Utility shortcut on the desktop, or Click Start Logo at the right-bottom, All Programs > Promise > Pegasus Utility > Pegasus Utility.
2. After several seconds, the **Dashboard** menu appears. Use this menu later to view a summary of the device status. First you need to format the file system for the Pegasus3.

![Dashboard menu](image1.png)

3. Click on the **Logical Drive** menu icon near the top of the menu. Notice in the middle of the menu a description of the RAID array that is already setup. The default setup is a RAID 5 using all the hard disks. If you want to change this, please see the product manual. Otherwise, to begin using the Pegasus3 right away, click on the **Format** button to begin the formatting procedure.

![Logical Drive menu](image2.png)
4. The formatting options appear in a new menu. You can type in a different name for the Volume or leave the default PromiseRAID. Most users should use the **Partition Type** set to the default **GPTFormat**. The other Partition Type option, **MBRFormat** (master boot record) does not support Logical Drives greater than 2 TB. The Format Type is set to NTFS, the standard Windows file system. Click **Format** to start formatting the array.

5. In order to safeguard against unintended changes to the RAID setup or file system, the Pegasus3 requires that you confirm your decision to begin formatting the drives. To continue formatting, type **confirm** in the space provided and click on the **Confirm** button.
6. When the array is finished formatting, Windows will alert you that a New Volume has been installed. You can see the New Volume in Windows Disk Manager.

7. Make sure you check the firmware version of the Pegasus3 and update it if needed. Go to “Step 7: Check firmware version with Pegasus Utility” on page 39.
**Format Pegasus3 on Windows 10**

Windows 10 users, please follow the steps listed below to launch Pegasus Utility and format the RAID:

1. Locate Pegasus Utility and launch it. You can use Microsoft Cortana to open it, or click on the Pegasus Utility shortcut on the desktop.

---

**Launch with Cortana**

Cortana can do much more... 
Ask me anything
2. After several seconds, the **Dashboard** menu appears. Use this menu later to view a summary of the device status. First you need to format the file system for the Pegasus3.

3. Click on the **Logical Drive** menu icon near the top of the menu. Notice in the middle of the menu a description of the RAID array that is already setup. The default setup is a RAID 5 using all the hard disks. If you want to change this, please see the product manual. Otherwise, to begin using the Pegasus3 right away, click on the **Format** button to begin the formatting procedure.
4. The formatting options appear in a new menu. You can type in a different name for the Volume or leave the default PromiseRAID. Most users should use the **Partition Type** set to the default **GPTFormat**. The other Partition Type option, **MBRFormat** (master boot record) does not support Logical Drives greater than 2 TB. The Format Type is set to NTFS, the standard Windows file system. Click **Format** to start formatting the array.

5. In order to safeguard against unintended changes to the RAID setup or file system, the Pegasus3 requires that you confirm your decision to begin formatting the drives. To continue formatting, type **confirm** in the space provided and click on the **Confirm** button.
6. When the array is finished formatting, Windows will alert you that a New Volume has been installed. You can see the New Volume in Windows Disk Manager.

7. Make sure you check the firmware version of the Pegasus3 and update it if needed. Go to “Step 7: Check firmware version with Pegasus Utility” on page 39.
Step 7: Check firmware version with Pegasus Utility

It might be necessary to update the firmware on the Pegasus3. If you do not know the firmware version, use Pegasus Utility to check the firmware version. Go to Admin>Firmware Update to see the Single Image Version number. Follow the instructions below to update the firmware before using the Pegasus3.

Important
If the Single Image firmware version is 6.00.0000.12 or later, it is not necessary to update. If the firmware is an earlier version (6.00.0000.11 or lower number), you need to update the firmware to operate in Windows.

Updating Firmware

The update procedure should be done before using the Pegasus3 with your Windows computer. Make sure to download the latest firmware from the PROMISE website at www.PROMISE.com/support/download.aspx and place the .img file on your computer.

To update the controller firmware:

1. From the Admin menu tab, choose Firmware Update. Check the Single Image Version number. If the version number is 6.00.0000.12 the firmware does not need to be updated. If the number is 6.00.0000.11 or lower, continue with the firmware update procedure.

2. Click on the padlock icon to unlock the menu, and type in the password for your computer when the prompt appears.

3. Click the Browse button and locate the .img file you downloaded from PROMISE.

4. Click the Next button.

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

6. The process will take several seconds. When it is completed, you will be prompted to restart the computer. Restart your computer and continue to use the Pegasus3.
Safely Remove Pegasus3 on Windows

To disconnect the Pegasus3 drive from your Windows computer while the computer is running, it is necessary to perform a simple procedure to safely disconnect the storage volume from Windows. If you remove the Thunderbolt 3 cable while the operating system is running, data on the Pegasus3 might be damaged.

If the computer has been shutdown, it is safe to disconnect the Thunderbolt 3 cable. Alternatively, you can shutdown the Pegasus3. See “Shutdown the Pegasus3” on page 42.

Safely Remove Pegasus3 on Windows 7

To disconnect the Pegasus3 from a Windows 7 computer:

1. Click on the attached drives icon in the System Tray to reveal the eject options and choose the *Eject Promise Pegasus* option.

2. Wait for the message to appear telling you it is safe to remove the Pegasus3. You can now safely power off the system or disconnect the Thunderbolt 3 cable.
Safely Remove Pegasus3 on Windows 10

To disconnect the Pegasus3 from a Windows 7 computer:

1. Click on the attached drives icon in the System Tray to reveal the eject options and choose the **Eject Promise Pegasus** option.

2. Wait for the message to appear telling you it is safe to remove the Pegasus3. You can now safely power off the system or disconnect the Thunderbolt 3 cable.
## Shutdown the Pegasus3

To shutdown the Pegasus3 on either Windows 7, or Windows 10:

1. Open Pegasus Utility and click on the **Subsystem Information** menu icon, click on the **Shutdown** tab.

2. Click on the **Shutdown** button.
3. To prevent accidental shutdown, you must confirm that you want to shutdown the system. Type `confirm` in the space provided and click on the Confirm button.

4. A message appears informing you that the shutdown process will take a few minutes. If you want to move the device, wait until the system is completely powered off before disconnecting the power cord.
MANAGING THE PEGASUS3

This chapter contains the following topics:

• “Accessing the Pegasus software utility”
• “Managing Subsystems”
• “Managing the RAID Controller”
• “Managing Enclosures”
• “Managing Background Activities”
• “Managing Physical Drives”
• “Managing Disk Arrays”
• “Managing Logical Drives”
• “Managing Spare Drives”

The Pegasus software utility requires a Thunderbolt connection between your computer and the Pegasus unit. See “Viewing Runtime Events” on page 193, and “Installation and Setup for Windows Users” on page 19.

The Pegasus management software utility must be installed onto your computer before you can use it. Note that the management utility

**Note**
The software utility used from management of the Pegasus3, and other devices in the Pegasus line, is called *Pegasus Utility* in Windows, and *Promise Utility* in Mac. The software utility has the same functions in both operating systems.
The examples referenced in this chapter are taken from the Promise Utility in Mac; therefore the term Promise Utility is used to refer to the Pegasus3 software used for managing the device.
Accessing the Pegasus software utility

Access Promise Utility in Mac

For Mac users, accessing the Promise Utility includes:

- Opening and Closing
- Unlocking the UI

Opening

To open the Promise Utility, double-click the Promise Utility icon in the Macintosh Dock.

The Promise Utility window opens and displays the Dashboard.

See “The Promise Utility interface with the Dashboard displayed” on page 48.

Closing

There are two ways close the Promise Utility:

Promise Utility icon on Mac desktop

- Click the Promise Utility dropdown menu and choose Quit Promise Utility
- Press cmd-Q (ﬁ Q)

Access Pegasus Utility in Windows

In Windows, you can click on the shortcut for Pegasus Utility on the Desktop. In Windows 10 you also have the option to use Windows Cortana.

Please see “Installation and Setup for Windows Users” on page 19 to see examples of the shortcut for the different Windows OS.
Unlocking the UI in Mac

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 Pegasus3 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 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 Pegasus3 system.
Displaying Multiple Pegasus Units

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

Note
The Pegasus Utility can also be used for earlier releases of Pegasus, Pegasus2 and Pegasus3; models R4, R6 and R8.

- To view a list of the Pegasus, Pegasus2, or Pegasus3 units, click the View menu.
- To display a Pegasus unit in the Promise Utility, click the View menu and choose unit you want to see.

The first Pegasus unit is Pegasus R4, R6, or R8, the second is Pegasus R4-2 or R6-2, R8-2, the third is Pegasus R4-3 or R6-3, R8-3, and so on. The Pegasus units are listed by the order in which they are recognized, not by the cable configuration.
Perusing the Promise Utility interface

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

*The Promise Utility interface with the Dashboard displayed*

- **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** – Enclosure (Pegasus unit) Information, Events, Background Activities, Firmware Update, Performance Monitor and Restore Factory Default (settings)
- **Window** – Minimize, Zoom, Close Window, Bring All to Front, Pegasus unit
- **Help** – Online help search

Most of the functions accessed in the menu bar are described in this chapter.
**Toolbar Icons**

The default toolbar icons are listed here:

- **Dashboard** icon – Displays the Dashboard and overview
- **Wizard** icon - Displays the Wizard options for quickly setting up RAID arrays
- **Physical Drive** icon – Displays the physical drive list, settings and functions
- **Disk Array** icon - Display menu for monitoring, managing and creating disk arrays
- **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.

**Customize toolbar**
Device menus

Use the Device drop-down menu in the menu bar at the top of your desktop to view an active display of the Pegasus2 device, as well as access to menus used to configure settings for device hardware and physical drives.

To view the Promise Utility menu bar, just select the Promise Utility window, and the menu bar lists the Device, Admin and other menus categories.

Device menu options on Mac

Note
The Physical Drive menu and Component List are also accessible using the Physical Drive and Controller menu links listed under System Status in the Dashboard menu.
Component List

Go to the Device drop-down menu and choose the Component List option to display the device ID, operational status, enclosure type, and status description of all enclosures. The Enclosure, Controller, Buzzer and Fan menus are described in relevant sections of this chapter. See “Viewing Controller Information” on page 63, “Viewing the Enclosure Information” on page 70, and “Making Buzzer Settings” on page 68 for more information.

Component List on Mac

![Component List on Mac](image-url)
**Physical Drive menu**

Go to **Admin** drop-down menu and choose the **Physical Drive** option to display the Physical Drive menu. This is the same menu you see by clicking the Physical Drive menu button at the top of the Promise Utility window, or by clicking the Physical Drive menu link under System Status in the Dashboard. See “Managing Physical Drives” on page 90 for more information.

**Physical Drives List on Mac**

<table>
<thead>
<tr>
<th>ID</th>
<th>Status</th>
<th>Model Number</th>
<th>Type</th>
<th>Location</th>
<th>Configuration</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Hitachi HD572202</td>
<td>SATA HDD</td>
<td>Slot 1</td>
<td>Unconfigured</td>
<td>2 TB</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Hitachi HUA72302</td>
<td>SATA HDD</td>
<td>Slot 2</td>
<td>Unconfigured</td>
<td>2 TB</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Hitachi HUA72302</td>
<td>SATA HDD</td>
<td>Slot 3</td>
<td>Unconfigured</td>
<td>2 TB</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Hitachi HD572202</td>
<td>SATA HDD</td>
<td>Slot 4</td>
<td>Unconfigured</td>
<td>2 TB</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Hitachi HUA72302</td>
<td>SATA HDD</td>
<td>Slot 5</td>
<td>Unconfigured</td>
<td>2 TB</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Hitachi HUA72302</td>
<td>SATA HDD</td>
<td>Slot 6</td>
<td>Unconfigured</td>
<td>2 TB</td>
</tr>
</tbody>
</table>

Click the lock to prevent further changes.
**Front View**

The Front View active menu lets you view the enclosures and all components on the front of the Pegasus3.

Move the cursor over the drive carrier to display the information of the installed physical drive, including the device ID, physical capacity, operational status, etc. Click on the drive to bring up the Physical Drive Information, displaying the detailed information of the device.

Front View options include the ability to indicate which carriers contain unconfigured physical disks (colored green), or to highlight arrays (colored purple).

**Device - Front View display menu**

Show Unconfigured Physical Drives

Click the Show unconfigured PD(s) box to identify any unconfigured physical drives, these appear colored light green.
Highlight Arrays

Click the **Highlight Arrays** button to identify the physical drives assigned to a disk array, these appear colored purple.

Click on of the following items in the drop-down menu:

- **All DA** – Show all disk arrays
- **DA0 (DA1, DA2, etc.)** – a specific disk array
- **close** – Click to close the menu and return to normal view.

The carriers containing drives that do not belong to the chosen disk array will be highlighted.

---

**Back View**

Go to **Admin** drop-down menu and choose the **Back View** option to see a virtual view of the back of the Pegasus3. Move the cursor over the Power Supply (PSU) or system fan, and component status information is displayed.

---

**Device - Back View display menu**

![Back View](image-url)
Managing Subsystems

Enclosure management includes:

- “Viewing Subsystem Information”
- “Making Subsystem Settings”
- “Clearing Statistics”
- “Restoring Factory Default Settings”
- “Saving a Service Report”
- “Updating Firmware”
Viewing Subsystem Information

The term enclosure refers to the Pegasus unit.

To view enclosure information, click the Subsystem Information icon.

Subsystem Information includes:

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

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

Subsystem Information
Making Subsystem Settings

To make enclosure settings:

1. Click the **Subsystem Information** icon.
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.

*Settings - Subsystem Information*
Clearing Statistics

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

To clear statistics:

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

*Clearing Statistics - Subsystem Information*
Restoring Factory Default Settings

This feature restores settings to their default values.

To restore all settings to their default values:

1. From the Admin drop-down menu in the menu bar at the top of your desktop, 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
   - Enclosure settings
   - Smart Fan setting

3. Click the Submit button.

4. In the Confirmation box, type the word “confirm” in the field provided and click the Confirm button.

![Restore Factory Default settings](image)
Saving a Service Report

A service report can be useful to technical support for troubleshooting or diagnosing issues on the device. To save a service report to your computer, click on the **Subsystem Information** menu link, and click on the **Save Service Report** button. A dialog prompt will ask you where you want to save the HTML file containing the service report. Choose a location and click the **Save** button. A technical support representative might ask you to email this file for system analysis.

**Note**
You must unlock the Promise Utility interface to allow selection of *Restore Factory Default*.
Updating Firmware

For best performance, it is a good idea to keep the Pegasus3 firmware up to date. The update procedure is used for the controller and other system hardware. Download the latest firmware from the PROMISE website at www.PROMISE.com/support/download.aspx and place the .img file on your computer.

Keep in mind that after the update process, it will be necessary to restart your computer.

To update the controller firmware:

1. From the Admin drop-down menu in the menu bar at the top of your desktop, choose Firmware Update.

2. Click on the padlock icon to unlock the menu, and type in the password for your computer when the prompt appears.

3. Click the Choose File button and locate the .img file you downloaded from PROMISE.

4. Click the Submit button.

5. In the Confirmation box, type the word "confirm" in the field provided and click the Confirm button.

6. The process will take several seconds to complete. Once the process has completed, you will be prompted to restart the computer. Once you’ve restarted your computer, you may continue to use the Pegasus3.
Managing the RAID Controller

RAID controller management includes:

- “Viewing Controller Information”
- “Viewing Controller Statistics”
- “Making Controller Settings”
- “Making Buzzer Settings”
Viewing Controller Information

To view controller information, from the Device menu, choose **Component List**, the Information tab is displayed.

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 enclosure alias
- Model
- Power On Time
- Dirty Cache Usage – Percentage
- Serial Number
- WWN – Worldwide Number
- BIOS Version
- Single Image Build Date

**Controller Information**
To view advanced information, click the Advanced Information tab.

Advanced controller information includes:

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

Items with an asterisk (*) are adjustable under “Making Controller Settings” on page 66.

Click the X icon to close the information panel.
Viewing Controller Statistics

To view controller statistics:

1. Click the **Dashboard** icon, then click the **Controller** link.

2. 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

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

*Controller Statistics*

![Controller Statistics Image]
Making Controller Settings

To make controller settings:

1. From the Device menu, choose Component List.

2. Mouse-over the controller, then click the Settings button.

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:
  - GBTTruncate
  - 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.
- **Adaptive Writeback Cache** – Check the box to enable or uncheck to disable.
- **Forced Read Ahead** – Check the box to enable or uncheck to disable.
- **Enable HDD Park Ahead (Level 1)** – Check the box to enable
  - HDD Park Ahead Interval [10 - 1440] – Enter a value into the field, 1 to 1440 minutes. 1440 minutes = 24 hours
- **Enable HDD Low Rotation Speed (Level 2)** – Check the box to enable
  - HDD Low Rotation Speed Interval [10 - 1440] – Enter a value into the field, 1 to 1440 minutes. 1440 minutes = 24 hours
- **Enable HDD Idle Spin Down (Level 1)** – Check the box to enable
  - HDD Idle Spin Down Interval [10 - 1440] – Enter a value into the field, 1 to 1440 minutes. 1440 minutes = 24 hours

3. Click the Save button.

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

![Controller Settings](image)

**Controller**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller ID</td>
<td>1</td>
</tr>
<tr>
<td>Alias</td>
<td></td>
</tr>
<tr>
<td>Enable SMART Log</td>
<td></td>
</tr>
<tr>
<td>SMART Polling Interval</td>
<td>10 minute(s)</td>
</tr>
<tr>
<td>Enable Coercion</td>
<td></td>
</tr>
<tr>
<td>Coercion Method</td>
<td>GBTruncate</td>
</tr>
<tr>
<td>Write Back Cache Flush Interval</td>
<td>3 second(s)</td>
</tr>
<tr>
<td>Enclosure Polling Interval</td>
<td>15 second(s)</td>
</tr>
<tr>
<td>Adaptive Writeback Cache</td>
<td></td>
</tr>
<tr>
<td>Forced Read Ahead</td>
<td></td>
</tr>
<tr>
<td>Enable HDD Park Ahead (Level 1)</td>
<td></td>
</tr>
<tr>
<td>HDD Park Ahead Interval</td>
<td>8 minute(s)</td>
</tr>
<tr>
<td>Enable HDD Low Rotation Speed (Level 2)</td>
<td></td>
</tr>
<tr>
<td>HDD Low Rotation Speed Interval</td>
<td>8 minute(s)</td>
</tr>
<tr>
<td>Enable HDD Idle Spin Down (Level 3)</td>
<td></td>
</tr>
<tr>
<td>HDD Idle Spin Down Interval</td>
<td></td>
</tr>
<tr>
<td>Save</td>
<td></td>
</tr>
<tr>
<td>Cancel</td>
<td></td>
</tr>
</tbody>
</table>
Making Buzzer Settings

To make buzzer settings:

1. From the Device menu, choose **Component List**.

2. Mouse-over 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.

*Buzzer Settings*
Managing Enclosures

Enclosure management includes the following functions:

- “Viewing the Enclosure Information”
- “Viewing Temperature Sensor Information”
- “Locating an Enclosure”
Viewing the Enclosure Information

To access enclosure information:

1. Click the Dashboard icon, then click the Controller link.

2. Mouse-over the Enclosure, then click the View button.

Enclosure information includes:

- Enclosure ID
- Enclosure Warning Temperature Threshold
- Controller Warning Temperature Threshold
- SEP Firmware Version
- Max Number of Controllers
- Max Number of Fans
- Max Number of Power Supply Units

- Enclosure Type
- Enclosure Critical Temperature Threshold
- Controller Critical Temperature Threshold
- Max Number of Physical Drive Slots
- Max Number of Temperature Sensors
- Max Number of Voltage Sensors

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

Enclosure Information
Viewing Temperature Sensor Information

To view the status of the temperature sensor:

1. Click the **Dashboard** icon, then click the **Temperature** link.

2. Scroll down until you see **Temperature Sensors**.

   Temperature Sensors information includes:

   - ID
   - Status (Normal, Warning or Critical icon)
   - Location (Controller or Backplane)
   - Healthy Threshold (Enclosure Warning Temperature Threshold)
   - Current Temperature

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

*Enclosure Information - Temperature Sensors*
Locating an Enclosure

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 an enclosure:

1. Go to Admin drop-down menu and choose the Back View option to see a virtual view of the back of the Pegasus3.

2. Mouse-over the Enclosure, then double-click on it to activate the Locate function.

Double-click on the back view to activate Locate

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

Running the Locate function to identify an enclosure
Managing Background Activities

Background activity management includes:

• “Viewing Current Background Activities”
• “Viewing Scheduled Background Activities”
• “Adding a Scheduled Background Activity”
• “Changing a Background Activity Schedule”
• “Enabling or Disabling a Scheduled Background Activity”
• “Deleting a Scheduled Background Activity”
• “Media Patrol”
• “Redundancy Check”
• “Initialization”
• “Rebuild”
• “Migration”
• “PDM”
• “Transition”
• “Synchronization”

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, click on the *Background Activities* icon.

The list of background appears:

- Media Patrol
- Redundancy Check
- Rebuild
- Migration
- PDM
- Transition
- Synchronization

Running activities will illustrate a progress bar of the process currently running in the background.

*Background Activities*
Viewing Scheduled Background Activities

To view a list of scheduled background activities:

1. Click on the **Background Activities icon**.
2. Click the **Scheduler** button.

The list of scheduled background appears.

Adding a Scheduled Background Activity

To add a new scheduled background activity:

1. Click on the **Background Activities icon**.
2. Click the **Scheduler** button.
   The list of scheduled background activities appears.
3. Click the **Add Schedule** button.

Add a Background Activity Schedule
4. Modify schedule settings as desired. Choose the option for the activity you want to modify:
   • 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 you will be designating for the reoccurrence pattern.
   
   • 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.

6. To return to the running background activities, click the **Background Activities** button.
Changing a Background Activity Schedule

To change an existing scheduled background activity:

1. Click on the **Background Activities icon**.

2. Click the Scheduler button.
   The list of scheduled background appears.

3. Mouse-over the background activity, then click the **Settings** button.

**Change a Background Activity Schedule**

![Scheduler Interface](image)
4. Modify settings as needed.

Choose the option for the activity you want to modify:
- 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 you will be designating for the reoccurrence pattern.

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 the 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. Click on the Background Activities icon.
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.

Enable/disable a Background Activity Schedule

![Scheduler interface](image)
Deleting a Scheduled Background Activity

To delete a scheduled background activity:

1. Click on the **Background Activities icon**.

2. Click the Scheduler button.
   The list of scheduled background appears.

3. Mouse-over the background activity, then click the **Delete** button.
   To return to currently running background activities, click the Background Activities button.

**Delete a Background Activity Schedule**

![Scheduler interface with delete confirmation dialog box]

**Are you sure that you want to delete this schedule?**

- Confirm
- Cancel
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 116.

Making Media Patrol Settings

To make Media Patrol settings:

1. Click on the Background Activities icon.
2. Click the Settings button.
3. Check the Enable Media Patrol box to enable, uncheck to disable. This setting 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.

Media Patrol

![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. Click on the Background Activities icon.
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 Initializing.

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 134.

Making Initialization Settings

To make initialization settings:

1. Click on the Background Activities icon.
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 85.

- 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 204 and “Managing Spare Drives” on page 145. Also see “Disk Array and Logical Drive Problems” on page 202.

Rebuild Settings
Making Rebuild Settings

1. Click on the Background Activities icon.

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 140.

**Making Migration Settings**

To make migration settings:

1. Click on the Background Activities icon.
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 142.

Making PDM Settings

To make PDM settings:
1. Click on the Background Activities icon.
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.

PDM
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 page 153.

Making Transition Settings

To make Transition settings:

1. Click on the **Background Activities icon**.

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 125.

Making Synchronization Settings

To make Synchronization settings:

1. Click on the Background Activities icon.
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.

Synchronization
Managing Physical Drives

Physical drive management includes:

• “Viewing a List of Physical Drives”
• “Viewing Physical Drive Information”
• “Viewing Physical Drive Statistics”
• “Viewing Physical Drive SMART Log Information”
• “Locating a Physical Drive”
• “Making Global Physical Drive Settings”
• “Making Individual Physical Drive Settings”
• “Making Physical Drive SMART Log Settings”
• “Clearing a Stale or a PFA Condition”
Viewing a List of Physical Drives

To view a list of physical drives in the Pegasus unit, click the **Physical Drive** icon.

Physical drive information includes:

- **ID** – ID number of the physical drive
- **Status** (Normal, Stale or PFA or Dead icon)
- **Model Number**
- **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

**Physical Drive List**

<table>
<thead>
<tr>
<th>ID</th>
<th>Status</th>
<th>Model Number</th>
<th>Type</th>
<th>Location</th>
<th>Configuration</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Hitachi HDS72202</td>
<td>SATA HDD</td>
<td>Slot 1</td>
<td>Array0 No.4</td>
<td>2 TB</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Hitachi HUA72302</td>
<td>SATA HDD</td>
<td>Slot 2</td>
<td>Array0 No.0</td>
<td>2 TB</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Hitachi HUA72302</td>
<td>SATA HDD</td>
<td>Slot 3</td>
<td>Array0 No.1</td>
<td>2 TB</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Hitachi HDS72202</td>
<td>SATA HDD</td>
<td>Slot 4</td>
<td>Array0 No.5</td>
<td>2 TB</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Hitachi HUA72302</td>
<td>SATA HDD</td>
<td>Slot 5</td>
<td>Array0 No.2</td>
<td>2 TB</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Hitachi HUA72302</td>
<td>SATA HDD</td>
<td>Slot 6</td>
<td>Array0 No.3</td>
<td>2 TB</td>
</tr>
</tbody>
</table>
Viewing Physical Drive Information

To view physical drive information:

1. Click the **Physical Drive** icon.
2. Mouse-over 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

![Physical Drive Information](image)
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
- Power Saving Level – Supported by this drive
- Medium Error Threshold **
- Drive Temperature
- Drive Reference Temperature

Items with an asterisk (*) are adjustable under “Viewing Physical Drive Statistics” on page 94.

Items with two asterisks (**) are adjustable under “Making PDM Settings” on page 87.

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

**Physical Drive Advanced Information**

![Physical Drive Advanced Information](image-url)
Viewing Physical Drive Statistics

To view physical drive statistics:

1. Click the **Physical Drive** icon.

2. Mouse-over 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 58.

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

*Physical Drive Information - Statistics*
Viewing Physical Drive SMART Log Information

To view physical drive SMART Log information:

1. Click the Physical Drive icon.
2. Mouse-over 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

Items with an asterisk (*) are adjustable under “Making Controller Settings” on page 66.

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

*Physical Drive SMART Log Information*
Making Global Physical Drive Settings

To make global physical drive settings:

1. Click the Physical Drive icon.
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.

*Physical Drive Global Settings*
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 enclosures and JBOD expansion units.

To locate a physical drive:

1. Click the Physical Drive icon.

2. Mouse-over 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.

Running the Locate function to identify a physical drive

![Diagram showing drive Power/Status LEDs blinking blue and orange](image-url)
Making Physical Drive SMART Log Settings

To make physical drive SMART log settings:

1. Click the **Physical Drive** icon.
2. Mouse-over 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.

### Physical Drive SMART Log Settings

![Physical Drive List](image)

<table>
<thead>
<tr>
<th>ID</th>
<th>Status</th>
<th>Model Number</th>
<th>Type</th>
<th>Location</th>
<th>Configuration</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
<td>Hitachi HUA72302</td>
<td>SATA HDD</td>
<td>Slot 2</td>
<td>Array0 No.0</td>
<td>2 TB</td>
</tr>
<tr>
<td></td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Physical Drive Settings](image)

![Image showing Physical Drive Settings dialog box]

- **Enable SMART Log**
- **Save**
- **Cancel**

<table>
<thead>
<tr>
<th>ID</th>
<th>Status</th>
<th>Model Number</th>
<th>Type</th>
<th>Location</th>
<th>Configuration</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
<td>Hitachi HUA72302</td>
<td>SATA HDD</td>
<td>Slot 3</td>
<td>Array0 No.1</td>
<td>2 TB</td>
</tr>
<tr>
<td></td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 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.

*Physical Drive Settings*
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 first corrected the condition by a physical drive replacement, rebuild operation, etc. Then clear the condition.

To clear a Stale or a PFA condition:

1. Click the **Physical Drive** icon.
2. Mouse-over 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.

*Clear a stale drive or PFA condition*
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. Click on the Background Activities icon. The list of background activities appears.

2. Mouse-over Media Patrol and click the Start button.

Running Media Patrol

Pausing and Resuming a Media Patrol

To pause or resume a Media Patrol:

1. Click on the Background Activities icon. The list of background activities appears.

2. Mouse-over Media Patrol and click the Pause or Resume button.
Stopping a Media Patrol

To stop is to cancel the Media Patrol:

1. Click on the **Background Activities** icon. 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.

*Stop Media Patrol*
Managing Disk Arrays

Disk array management includes:

- “Viewing a List of Disk Arrays"
- “Viewing Disk Array Information”
- “Creating a Disk Array Manually”
- “Making Disk Array Settings”
- “Locating a Disk Array”
- “Deleting a Disk Array”
- “Preparing a Disk Array for Transport”
- “Rebuilding a Disk Array”

Also see “Disk Array and Logical Drive Problems" on page 202.
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 or Incomplete/physical drive missing icon)
  - **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

List of Disk Arrays

<table>
<thead>
<tr>
<th>ID</th>
<th>Alias</th>
<th>Status</th>
<th>Capacity</th>
<th>Free Capacity</th>
<th>Media Patrol</th>
<th>Number of LDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>✅</td>
<td>6 TB</td>
<td>4 TB</td>
<td>Enabled</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
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 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

_Disk Array Information_
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. From the Dashboard menu, click the **Disk Array** link.
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 underscore.
   - **Enable Media Patrol** – Uncheck to disable on this array.
     For more information, see “Media Patrol” on page 81.
   - **Enable PDM** – Uncheck to disable on this array.
     For more information, see “PDM” on page 87.
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 130.
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 Pegasus 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 and choose Wizard.

The Wizard dialog box opens with three configuration methods.

**Wizard dialog box**

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

<table>
<thead>
<tr>
<th>Method</th>
<th>User Options</th>
<th>Suggested for users who are</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic</td>
<td>None</td>
<td>New to data storage</td>
<td>page 109</td>
</tr>
<tr>
<td>Express</td>
<td>General parameters</td>
<td>Familiar with data storage</td>
<td>page 110</td>
</tr>
<tr>
<td>Advanced</td>
<td>Individual parameters</td>
<td>Data storage professionals</td>
<td>page 112</td>
</tr>
</tbody>
</table>
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.

Automatic Configuration dialog box

![Automatic Configuration dialog box](image)

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 **Cancel** button to return to the original Automatic Configuration menu.
Choosing Express Configuration

To use the Express Configuration Wizard:

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

The Express configuration menu appears.

**Express Configuration menu**

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** – Check box to create a hot spare drive (R6 and R8 only)
   - **Number of Logical Drives** – Enter a number of logical drives to create
   - **Application Type** - Choose how the storage is used

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.

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
5. 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 example below.

**Express Configuration Summary**

![Express Configuration Summary](image)

6. 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 an R6 or R8, 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 underscore.
   - **Media Patrol** – Uncheck to disable on this array.
     For more information, see “Media Patrol” on page 81.
   - **PDM** – Uncheck to disable on this array.
     For more information, see “PDM” on page 87.

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.

Advanced Configuration - Create Disk Array
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.
   - Enter a value for Capacity and choose the unit for the value (MB, GB, TB)
   - 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 50 only. Choose the number of axles to use.
   - If you want the Pegasus Utility to format your logical drives, leave the Format box checked. For additional format options, see “Formatting Your Logical Drives” on page 132.

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.

Advanced Configuration - Create Logical Drive
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.

**Advanced Configuration - Create Spare Drive**
**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.

When the Pegasus 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 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 underscore.
   • Enable Media Patrol – Check to enable, uncheck to disable on this array.
   • Enable PDM – Check to enable, uncheck to disable on this array.

4. Click the Save button.

Create a Disk Array
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 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.

Delete a Disk Array
**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 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.

*Running the Locate function to identify a disk array*

![Diagram showing drive Power/Status LEDs blinking blue and orange](image)
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 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 “Transport” on page 205 for more information.

Transporting a disk array
**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.

*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. Click on the Background Activities icon.

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.

Rebuilding a disk array
**Pausing and Resuming a Rebuild**

To pause or resume a Rebuild:

1. Click on the **Background Activities** icon.
2. Mouse-over Rebuild and click the **Pause** or **Resume** button.

**Pausing a disk array rebuild**
**Stopping a Rebuild**

To stop or cancel a Rebuild:

1. Click on the **Background Activities** icon.
2. Mouse-over Rebuild and click the **Stop** button.
3. Click the **Confirm** button.
   Also see “Making Rebuild Settings” on page 85.

**Stopping a disk array rebuild**

![Background Activities Table]

<table>
<thead>
<tr>
<th>Background Activity</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media Patrol</td>
<td>Media Patrol is not running. Last Media Patrol Start Time: Oct 9, 2016 10:02:45 Last Media Patrol Stop Time: Oct 9, 2016 10:08:44.</td>
</tr>
<tr>
<td>Redundancy Check</td>
<td>No logical drive available for Redundancy Check.</td>
</tr>
<tr>
<td>Initialization</td>
<td>No logical drive available for initialization.</td>
</tr>
<tr>
<td>Migration</td>
<td>Disk array migration is not running.</td>
</tr>
<tr>
<td>PDM</td>
<td>PDM is not running.</td>
</tr>
<tr>
<td>Transition</td>
<td>Transition is not available. Array was not rebuilt or spare drive is not reversible.</td>
</tr>
<tr>
<td>Synchronization</td>
<td>Synchronization is not running.</td>
</tr>
</tbody>
</table>

---

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Managing Logical Drives

Logical drive management includes:

- “Viewing a List of Logical Drives”
- “Viewing Logical Drive Information”
- “Viewing Logical Drive Statistics”
- “Making Logical Drive Settings”
- “Viewing Logical Drive Check Tables”
- “Creating a Logical Drive Manually”
- “Formatting Your Logical Drives”
- “Locating a Logical Drive”
- “Deleting a Logical Drive”
- “Initializing a Logical Drive”
- “Redundancy Check on a Logical Drive”
- “Migrating a Logical Drive”
- “Running PDM on a Logical Drive”
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 or Offline icon)
- **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.

### Logical Drive list

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 the logical drive you want then click the **View** button.
3. Click the **X** icon to close the information panel.
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 89
- **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 No** – Serial number assigned to this logical drive
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 the logical drive you want then click the View button.

3. Click the Statistics tab.

   Logical Drive Statistics

4. 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

5. Click the X icon to close the statistics panel.

To clear the check tables, see “Clearing Statistics” on page 58.
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 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 underscore.
   - 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 “Read Cache Policy” and “Write Cache Policy”.

**Logical Drive Settings**
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 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 58.

**Logical Drive Check Table**
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 108. 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 radio button of the disk array you want to use and click the Next button.

Create a Logical Drive
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 underscore.

- Choose a **RAID level**.
  The choice of RAID levels depends on 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 Pegasus Utility to format your logical drives, leave the **Format** box checked.
  See “Formatting Your Logical Drives” on page 132.

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 Your Logical Drives” on page 132.

When the Pegasus 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 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.

*Running the Locate function to identify a disk array*

Drive Power/Status LEDs blink blue and orange
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 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.

*Delete a Logical Drive*
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. Click on the Background Activities icon. 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.

Logical Drive Initialization
Pausing and Resuming an Initialization

To pause or resume Initialization:

1. Click on the Background Activities icon. The list of background activities appears.

2. Mouse-over Initialization and click the Pause or Resume button.

Pause/Resume Initialization
Stopping an Initialization

To stop means to cancel an Initialization:

1. Click on the Background Activities icon. 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.

Stop Initialization
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. Click on the **Background Activities** icon. 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.

*Redundancy Check*
**Pausing and Resuming a Redundancy Check**

To pause or resume a Redundancy Check:

1. Click on the **Background Activities icon**. The list of background activities appears.

2. Mouse-over Redundancy Check and click the **Pause** or **Resume** button.

---

**Pause/Resume Redundancy Check**

---

![Background Activities](image)
### Stopping a Redundancy Check

To stop is to cancel the Redundancy Check:

1. Click on the **Background Activities icon**. The list of background activities appears.

2. Mouse-over Redundancy Check and click the **Stop** button.

3. Click the **Confirm** button.

---

#### Stop Redundancy Check

---

![Background Activities](image)
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 “RAID Levels” on page 163, and “Accessing the Pegasus software utility” on page 45 and “RAID Level Migration” on page 173.

Migration
To migrate a logical drive:

1. Click on the **Background Activities** icon.
   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.

   **Migration - choose RAID**

![Background Activities Interface](image)

   - **Media Patrol**: Media Patrol is not running. Last Media Patrol Start Time: Oct 9, 2016 10:02:45 Last Media Patrol Stop Time: Oct 9, 2016 10:03:44.
   - **Redundancy Check**: Redundancy Check is not running.
   - **Initialization**: Initialization is not running.
   - **Rebuild**: No dead physical drives available in the subsystem for rebuild.

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, type “Confirm” and click the **Confirm** button.
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 87. To run PDM on a logical drive:

1. Click on the Background Activities icon. 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.

Run PDM
**Pausing and Resuming PDM**

To pause or resume PDM:

1. **Click on the Background Activities icon.**
   
   The list of background activities appears.

2. **Mouse-over PDM and click the Pause or Resume button.**

**Pause/Resume PDM**

![Background Activities](image-url)

- **Media Patrol**
  - Media Patrol is not running.
  - Last Media Patrol Start Time: Oct 9, 2016 10:02:45
  - Last Media Patrol Stop Time: Oct 9, 2016 10:08:44.

- **Redundancy Check**
  - Redundancy Check is not running.

- **Initialization**
  - Initialization is not running.

- **Rebuild**
  - No dead physical drives available in the subsystem for rebuild.

- **Migration**
  - Disk array migration is not running.

- **PDM**
  - PD4 – Running
    - Progress:
      - Target PD: 76% – Paused
      - Current LD Progress: 76% – Dis
      - Disk Array ID: 0
      - Seq No: 0

- **Transition**
  - Transition is not available. Array was not rebuilt or spare drive is not revertible.

- **Synchronization**
  - Synchronization is not running.
Stopping PDM

To stop is to cancel PDM:

1. Click on the Background Activities icon.
   The list of background activities appears.

2. Mouse-over PDM and click the Stop button.

3. Click the Confirm button.

Pause/Resume PDM

![Background Activities](image-url)
Managing Spare Drives

Spare drive management includes:

- “Viewing a List of Spare Drives”
- “Viewing Spare Drive Information”
- “Creating a Spare Drive Manually”
- “Making Spare Drive Settings”
- “Running Spare Check”
- “Deleting a Spare Drive”
- “Running a Transition”
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 or Failed/missing icon)
- **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

**List of Spare Drives**

<table>
<thead>
<tr>
<th>ID</th>
<th>Status</th>
<th>Config Capacity</th>
<th>Physical Drive ID</th>
<th>Revertible</th>
<th>Type</th>
<th>Dedicated to Array</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>![emoji]</td>
<td>2 TB</td>
<td>6</td>
<td>No</td>
<td>Global</td>
<td>View, Settings, Spare Check, Delete</td>
</tr>
</tbody>
</table>
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 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 150.

   For Spare Check, see “Running Spare Check” on page 151.

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

---

*Spare Drive information*
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.

For more information on settings options, see “Spare Drives” on page 183.

To create a spare drive:

1. From the Dashboard window, click the **Spare Drive** link.
2. Click the **Create Spare Drive** button.

   **Create Spare Drive - Choose physical drive**

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.

   - **Type** (choose spare type)
     - **Global** – Can be used by any disk array
     - **Dedicated** to a disk array. Click the radio button next to the disk array to which this spare drive is dedicated.

   - **Media Type** If you have more than one type of physical drive installed (SSD and HDD for example) choose the type of drive for the spare.
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 183.

To make spare drive settings:

1. From the Dashboard window, click the **Spare Drive** link. The list of spare drives appears.

2. Mouse-over 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.

*Spare Drive Settings*
Running Spare Check

Spare Check verifies the status of your spare drives. To run spare check:

1. From the Dashboard window, click the **Spare Drive** link. The list of spare drives appears.
2. Mouse-over 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.

Run a Spare Check

![Spare Drive](image)
Deleting a Spare Drive

This action requires Administrator or a Super User privileges. To delete a spare drive:

1. From the Dashboard window, click the **Spare Drive** link. The list of spare drives appears.

2. Mouse-over 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 88 and “Transition” on page 184.
Running a Transition

To run a transition on a revertible spare drive:

1. Click on the **Background Activities** icon. 
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.

Running a Transition

![Background Activities](image)
Pausing and Resuming a Transition

To pause or resume Transition:

1. Click on the Background Activities icon. The list of background activities appears.

2. Mouse-over Transition and click the Pause or Resume button.

Pausing/Resuming a Transition

![Background Activities](image-url)
Stopping, Pausing or Resuming a Transition

To stop is to cancel a Transition:

1. Click on the Background Activities icon.
   The list of background activities appears.

2. Mouse-over Transition and click the Stop button.

3. Click the Confirm button

Stopping a Transition

![Background Activities](image-url)
Setting Up Email Notifications

You can use email notifications to receive alerts about events such as a drive error or drive failure on the Pegasus3, so that you can take corrective action.

To setup Email notification settings:

1. In Mac, click on Promise Utility in the top menu bar and select Preferences, click on the Email menu tab.
   In Windows, click on Global Management in the Pegasus Utility, and select Service.
2. For Mac, click the padlock icon to the menu so you can make settings changes. You need to enter the administrator user name and password to change settings.
   Note that you need to click the padlock icon even if it is unlocked when the Preferences menu appears.

In Windows Pegasus Utility, click Global Management, and select Service.
3. Click on Turn On Email Service.

4. Click to Enable ESMTP based on your own Email service environment. 
   Typically ESMTP should be enabled for most users. You can test the email notification to see if it works with ESMTP enabled. If it does not work, try disabling ESMTP and testing it again.

5. If ESMTP is enabled, enter your email account user name in the SMTP Authentication Username entry field, and enter your email account password in the SMTP Authentication Password entry field. Again, this is only needed if you have ESMTP enabled (See step 4).

---

**Note**

If you are using a public email server, such as Google Gmail or Yahoo mail, for the Email Sender address, you might not be able to receive the Pegasus Event Email Notification. Instead, you will receive an email server blocking notification. This because the email server security mechanism does not allow the Pegasus to sign in. It will be necessary to change the security settings on the account in order to allow the Pegasus to sign in and send notification emails. Consult the security settings instructions of your email service to lower the security level if you want to use this public email service for notifications. Use the Test Email button to test the email notifications after making the changes.
6. Enter the email address used for the sender’s address in **Email Sender (From) Address**.

7. Enter the email address to receive the email notification in **Receiver’s Email Address**.

8. The default value in **SMTP Server Port** is 25, change this only if your company uses a different port for SMTP.

9. Enter the subject text used for the notification emails in **Email Subject**.

10. Use the **Level** dropdown menu in Level to select the event urgency level of the notifications to be sent. Note that your choice of notification urgency level effects how frequently an email notification will be sent. For example, if you choose **Warning**, you will receive many emails which are not urgent. It is recommended to use the **Major** level to alert of significant events that might effect performance or device health so that **Critical** or **Fatal** events might be avoided.

11. Click **Save** to save the settings.

12. It is recommended to run a test of the settings to make sure you are able to receive notifications. Click **Test Email** to send test email to the receiver. If the test email is received, you do not need to change any settings. If an email is not received, check the settings again to make sure they were correctly typed. Also try disabling ESMTP and test the email notifications settings again.

To clear the settings entered in the menu, click the **Clear** button.
This chapter covers the following topics:

- “Disk Arrays”
- “Logical Drives”
- “Formatting Logical Drives”
- “Spare Drives”
- “RAID Controllers”
Disk Arrays

Disk array technology includes:

- Media Patrol
- PDM

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 “Media Patrol” on page 85.
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 146.

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 91.

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 120.
Logical Drives

Logical drive technology includes:

- “RAID Levels”
- “RAID Level Migration”
- “Stripe Size”
- “Sector Size”
- “Initialization”

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.

*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.

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

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.

**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”.

![Diagram of RAID 1 mirroring]
### Advantages

- Simplest RAID level
- Can increase read performance by processing data requests in parallel since the same data resides on two different drives

### Disadvantages

- 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.

**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.
### 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.

**RAID 5 stripes all drives with data and parity information**

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

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.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• High Read data transaction rate</td>
<td>• Disk failure has a medium impact on throughput</td>
</tr>
<tr>
<td>• Medium Write data transaction rate</td>
<td></td>
</tr>
<tr>
<td>• Good aggregate transfer rate</td>
<td></td>
</tr>
<tr>
<td>• Most versatile RAID level</td>
<td></td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• High Read data transaction rate</td>
<td>• High disk overhead – equivalent of two drives used for parity</td>
</tr>
<tr>
<td>• Medium Write data transaction rate</td>
<td>• Slightly lower performance than RAID 5</td>
</tr>
<tr>
<td>• Good aggregate transfer rate</td>
<td></td>
</tr>
</tbody>
</table>

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.

**PROMISE RAID 10 starts with a data stripe, then mirrors it**

![Diagram of RAID 10 setup]
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.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| • 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 50 – Striping of Distributed Parity**

RAID 50 combines both RAID 5 and RAID 0 features. Data is striped across physical drives as in RAID 0, and it uses distributed parity as in RAID 5. RAID 50 provides data reliability, good overall performance, and supports larger volume sizes.

The data capacity RAID 50 logical drive equals the capacity of the smallest physical drive times the number of physical drives, minus two.

RAID 50 also provides very high reliability because data is still available even if multiple physical drives fail (one in each axle). The greater the number of axles, the greater the number of physical drives that can fail without the RAID 50 logical drive going offline.

A minimum of six drives are required for a RAID 50.
### RAID 50 - Striping of Distributed Parity

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• High Read data transaction rate</td>
<td>• Higher disk overhead than RAID 5 (two drives as hot spares)</td>
</tr>
<tr>
<td>• Medium Write data transaction rate</td>
<td></td>
</tr>
<tr>
<td>• Good aggregate transfer rate</td>
<td></td>
</tr>
<tr>
<td>• High reliability</td>
<td></td>
</tr>
<tr>
<td>• Supports large volume sizes</td>
<td></td>
</tr>
</tbody>
</table>

Recommended Applications for RAID 50 include applications that require high fault tolerance and good I/O performance.

- File and Application servers
- Transaction processing
- Office application with many users accessing small files
**RAID 60 – Double Parity + Stripe**

The PROMISE RAID 60 combines RAID 6 distributed (double) parity and RAID 0 block-level striping.

RAID 60 can increase performance by reading and writing data in parallel or striping, while simultaneously providing parity.

PROMISE implements RAID 60 by creating a data stripe across two RAID 6 sets. This creates very high fault tolerance, two drives in each RAID 6 set can fail without interrupting I/O or loss of data.

A minimum of eight drives are required for a RAID 60, so this option is available on the R8.

*PROMISE RAID 60 starts with RAID 6 double parity, then stripes the blocks*

![Diagram of RAID 60 configuration]

RAID 60 is available on the R8. To figure out the capacity, multiply the smallest drive capacity by four. So an R8 with 8 2 TB drives has a capacity of 8 TB with a RAID 60.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• High Read data transaction rate</td>
<td>• High disk overhead</td>
</tr>
<tr>
<td>• Medium Write data transaction rate</td>
<td>(four drives as hot spares on R8)</td>
</tr>
<tr>
<td>• Good aggregate transfer rate</td>
<td>• Slightly lower performance than RAID 50</td>
</tr>
<tr>
<td>• Safest RAID level</td>
<td></td>
</tr>
</tbody>
</table>

Recommended Applications for RAID 60 include applications that require extremely high fault tolerance and good I/O performance.
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 but you cannot change the RAID level.

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 1

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

<table>
<thead>
<tr>
<th>Target</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAID 0</td>
<td>None.</td>
</tr>
<tr>
<td>RAID 1E</td>
<td>3 or more physical drives. Add 1 or more physical drives.</td>
</tr>
<tr>
<td>RAID 5</td>
<td>3 physical drives minimum, maximum 4 (R4), 6 (R6) or 8 (R8). RAID 1 must have less than 4 (R4), 6 (R6) or 8 (R8) physical drives. Add 1 or more physical drives.</td>
</tr>
<tr>
<td>RAID 10</td>
<td>4 physical drives minimum. Even number of physical drives. Add 2 or more physical drives.</td>
</tr>
<tr>
<td>RAID 50</td>
<td>6 physical drives minimum.</td>
</tr>
</tbody>
</table>

See “Migrating a Logical Drive” on page 144.

RAID 0

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

<table>
<thead>
<tr>
<th>Target</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAID 0</td>
<td>Add physical drives.</td>
</tr>
<tr>
<td>RAID 1</td>
<td>2 physical drives only. Only a single-drive RAID 0 can migrate to RAID 1 by adding 1 physical drive.</td>
</tr>
<tr>
<td>RAID 1E</td>
<td>3 or more physical drives. If existing physical drives have no unused space, add 1 or more physical drives.</td>
</tr>
<tr>
<td>RAID 5</td>
<td>3 physical drives minimum, maximum 4 (R4), 6 (R6) or 8 (R8). RAID 0 must have less than 4 (R4), 6 (R6) or 8 (R8) physical drives. If existing physical drives have no unused space, add 1 or more physical drives.</td>
</tr>
<tr>
<td>RAID 6</td>
<td>4 physical drives minimum, 4 (R4), 6 (R6) or 8 (R8). If existing physical drives have no unused space, add 1 or more physical drives.</td>
</tr>
<tr>
<td>RAID 10</td>
<td>4 physical drives minimum. Even number of physical drives. If existing physical drives have no unused space, add 1 or more physical drives.</td>
</tr>
<tr>
<td>RAID 50</td>
<td>6 physical drives minimum.</td>
</tr>
<tr>
<td>RAID 60</td>
<td>8 physical drives minimum.</td>
</tr>
</tbody>
</table>

See “Migrating a Logical Drive” on page 144.
RAID 1E

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

<table>
<thead>
<tr>
<th>Target</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAID 0</td>
<td>None.</td>
</tr>
<tr>
<td>RAID 1E</td>
<td>Add physical drives.</td>
</tr>
<tr>
<td>RAID 5</td>
<td>3 physical drives minimum, 4 (R4), 6 (R6) or 8 (R8). RAID 1E must have less than 4 (R4), 6 (R6) or 8 (R8) physical drives. If existing physical drives have no unused space, add 1 or more physical drives.</td>
</tr>
<tr>
<td>RAID 10</td>
<td>4 physical drives minimum. Even number of physical drives. If existing physical drives have no unused space, add 1 or more physical drives.</td>
</tr>
<tr>
<td>RAID 50</td>
<td>6 physical drives minimum.</td>
</tr>
</tbody>
</table>

See “Migrating a Logical Drive” on page 144.

RAID 5

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

<table>
<thead>
<tr>
<th>Target</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAID 0</td>
<td>None.</td>
</tr>
<tr>
<td>RAID 1E</td>
<td>None.</td>
</tr>
<tr>
<td>RAID 5</td>
<td>Add physical drives. Maximum of 4 (R4), 6 (R6) or 8 (R8).</td>
</tr>
<tr>
<td>RAID 6</td>
<td>4 physical drives minimum, maximum of 4 (R4), 6 (R6) or 8 (R8). If existing physical drives have no unused space, add 1 or more physical drives.</td>
</tr>
<tr>
<td>RAID 10</td>
<td>4 physical drives minimum. Even number of physical drives. If existing physical drives have no unused space, add 1 or more physical drives.</td>
</tr>
<tr>
<td>RAID 50</td>
<td>6 physical drives minimum.</td>
</tr>
<tr>
<td>RAID 60</td>
<td>8 physical drives minimum.</td>
</tr>
</tbody>
</table>

See “Migrating a Logical Drive” on page 144.
RAID 6
A RAID 6 Source logical drive can migrate to the following Target logical drives:

<table>
<thead>
<tr>
<th>Target</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAID 6</td>
<td>Add physical drives. Maximum of 4 (R4), 6 (R6) or 8 (R8).</td>
</tr>
<tr>
<td>RAID 60</td>
<td>8 physical drives minimum.</td>
</tr>
</tbody>
</table>

See “Migrating a Logical Drive” on page 144.

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

<table>
<thead>
<tr>
<th>Target</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAID 0</td>
<td>None.</td>
</tr>
<tr>
<td>RAID 1E</td>
<td>None.</td>
</tr>
<tr>
<td>RAID 5</td>
<td>3 physical drives minimum, maximum of 4 (R4), 6 (R6) or 8 (R8). RAID 10 must have less than 4 (R4), 6 (R6) or 8 (R8) physical drives.</td>
</tr>
<tr>
<td>RAID 6</td>
<td>4 physical drives minimum, maximum of 4 (R4), 6 (R6) or 8 (R8). 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.</td>
</tr>
<tr>
<td>RAID 10</td>
<td>Add physical drives in multiples of two. Even number of physical drives.</td>
</tr>
<tr>
<td>RAID 50</td>
<td>6 physical drives minimum.</td>
</tr>
<tr>
<td>RAID 60</td>
<td>8 physical drives minimum.</td>
</tr>
</tbody>
</table>

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 144.
RAID 50
A RAID 50 Source logical drive can migrate to the following Target logical drives:

<table>
<thead>
<tr>
<th>Target</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAID 0</td>
<td>None</td>
</tr>
<tr>
<td>RAID 5</td>
<td>None</td>
</tr>
<tr>
<td>RAID 6</td>
<td>None</td>
</tr>
<tr>
<td>RAID 10</td>
<td>None</td>
</tr>
<tr>
<td>RAID 1E</td>
<td>None</td>
</tr>
<tr>
<td>RAID 60</td>
<td>None</td>
</tr>
</tbody>
</table>

See “Migrating a Logical Drive” on page 144.

RAID 60
A RAID 60 Source logical drive can migrate to the following Target logical drives:

<table>
<thead>
<tr>
<th>Target</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAID 6</td>
<td>None</td>
</tr>
</tbody>
</table>

See “Migrating a Logical Drive” on page 144.
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 112 and “Creating a Logical Drive Manually” on page 134.

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 Pegasus 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 112 and “Creating a Logical Drive Manually” on page 134.

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 138.

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:

• Pegasus Utility with default settings (below)
• Pegasus Utility with Custom Settings (page 90)
• Disk Utility (page 91)

Both the Pegasus 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.

**Pegasus 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 Pegasus 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 Pegasus 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.
**Pegasus 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 Pegasus 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 Mac computers, the default *GPT Format* partition and the default *Journaled HFS+* format are recommended.

3. Click the **Format** button.

When the Pegasus 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 112 and “Creating a Logical Drive Manually” on page 134.

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 Mac 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 (page 92)
- Options (page 92)
- Requirements (page 92)
- Transition (page 93)

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 152.
- 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 Pegasus controller cannot use it as a spare.

Automatic Transition

At this juncture, you would replace the failed drive in slot 3 with a new physical drive 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 (“Read Cache Policy” and “Write Cache Policy”)
- “Capacity Coercion”

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. This provides better performance.
- Write Thru – Also “Write Through.” Data is written to the cache and the logical drive at the same time. This is 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 a 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.
This chapter deals problems you might encounter with your Pegasus unit and how to resolve them.

- “Responding to an Audible Alarm” (below)
- “Checking LEDs”
- “Pegasus Utility”
- “Viewing the Event Logs”
- “Physical Drive Problems”
- “Disk Array and Logical Drive Problems”
- “Subsystem Problems”
- “Connection Problems”
- “Performance Monitor”

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
- Drive Carrier LEDs
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.

<table>
<thead>
<tr>
<th>State</th>
<th>Power Button</th>
<th>Thunderbolt LEDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark</td>
<td>No power</td>
<td>No connection</td>
</tr>
<tr>
<td>Blue</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Flasing Blue</td>
<td>—</td>
<td>Activity</td>
</tr>
<tr>
<td>Orange</td>
<td>Booting or shutting down</td>
<td>—</td>
</tr>
</tbody>
</table>

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 below.

<table>
<thead>
<tr>
<th>State</th>
<th>Power/Status</th>
<th>Drive Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark</td>
<td>No power</td>
<td>No drive in carrier</td>
</tr>
<tr>
<td>Steady Blue</td>
<td>Power is present</td>
<td>Drive is present</td>
</tr>
<tr>
<td>Flashing Blue</td>
<td>—</td>
<td>Activity on drive</td>
</tr>
<tr>
<td>Blinking Blue and Orange</td>
<td>Locator feature or Drive is rebuilding</td>
<td>—</td>
</tr>
<tr>
<td>Red</td>
<td>Drive error or failure</td>
<td>—</td>
</tr>
</tbody>
</table>

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 Pegasus 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 197.

**Locate feature on a drive carrier**
Pegasus Utility

If you can open the Pegasus 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 in Mac” on page 51.

Viewing the Event Logs

Viewing Event Logs includes:

• “Viewing Runtime Events”
• “Viewing NVRAM Events”
• “Event Severity Descriptions”

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.

View Runtime Events
Viewing NVRAM Events

This screen displays a list of and information about 508 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

<table>
<thead>
<tr>
<th>Level</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal</td>
<td>Non-Recoverable error or failure has occurred</td>
</tr>
<tr>
<td>Critical</td>
<td>Action is required now and the implications of the condition are serious</td>
</tr>
<tr>
<td>Major</td>
<td>Action is required now</td>
</tr>
<tr>
<td>Minor</td>
<td>Action is required but the condition is not a serious at this time</td>
</tr>
<tr>
<td>Warning</td>
<td>User can decide whether or not action is required</td>
</tr>
<tr>
<td>Information</td>
<td>Information only, no action is required</td>
</tr>
</tbody>
</table>
### View NVRAM Events

#### NVRAM Events

<table>
<thead>
<tr>
<th>Index</th>
<th>Device</th>
<th>Event ID</th>
<th>Severity</th>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>239</td>
<td>LD 0</td>
<td>0x00090004</td>
<td>Major</td>
<td>Oct 10, 2016 10:38:55</td>
<td>Logical drive has been set to critical</td>
</tr>
<tr>
<td>238</td>
<td>Ctrl 1</td>
<td>0x00040005</td>
<td>Info</td>
<td>Oct 10, 2016 10:38:55</td>
<td>The system is started</td>
</tr>
<tr>
<td>237</td>
<td>Ctrl 1</td>
<td>0x00040006</td>
<td>Info</td>
<td>Oct 9, 2016 18:00:41</td>
<td>The system is stopped by host unplug</td>
</tr>
<tr>
<td>236</td>
<td>Subsys</td>
<td>0x00080000</td>
<td>Info</td>
<td>Oct 9, 2016 17:37:02</td>
<td>Media patrol is started</td>
</tr>
<tr>
<td>235</td>
<td>LD 0</td>
<td>0x00090004</td>
<td>Major</td>
<td>Oct 9, 2016 17:35:48</td>
<td>Logical drive has been set to critical</td>
</tr>
<tr>
<td>234</td>
<td>Ctrl 1</td>
<td>0x00040005</td>
<td>Info</td>
<td>Oct 9, 2016 17:35:48</td>
<td>The system is started</td>
</tr>
<tr>
<td>233</td>
<td>Ctrl 1</td>
<td>0x00040006</td>
<td>Info</td>
<td>Oct 9, 2016 17:04:00</td>
<td>The system is stopped by host unplug</td>
</tr>
<tr>
<td>232</td>
<td>PD 3</td>
<td>0x000D0008</td>
<td>Warning</td>
<td>Oct 9, 2016 16:05:08</td>
<td>Physical Disk has been removed</td>
</tr>
<tr>
<td>231</td>
<td>LD 0</td>
<td>0x00090004</td>
<td>Major</td>
<td>Oct 9, 2016 16:05:07</td>
<td>Logical drive has been set to critical</td>
</tr>
<tr>
<td>230</td>
<td>PD 3</td>
<td>0x000D001A</td>
<td>Major</td>
<td>Oct 9, 2016 16:05:07</td>
<td>Physical Disk is marked as DEAD due to removal</td>
</tr>
<tr>
<td>229</td>
<td>Ctrl 1</td>
<td>0x00040005</td>
<td>Info</td>
<td>Oct 9, 2016 16:01:57</td>
<td>The system is started</td>
</tr>
<tr>
<td>228</td>
<td>Ctrl 1</td>
<td>0x00040006</td>
<td>Info</td>
<td>Oct 9, 2016 15:39:48</td>
<td>The system is stopped by host unplug</td>
</tr>
</tbody>
</table>

Click the lock to prevent further changes.
Saving All Logs

To save event logs,

1. Click the Events icon.
   
   The log of Runtime Events appears.

2. Click the **Save All Logs (debug purpose)** button in the top of the menu.

3. You are asked to confirm that you want to save all logs. In the Confirmation box, type the word “confirm” in the field provided and click the **Confirm** button.

---

*Save All Logs*
Physical Drive Problems

Physical drive troubleshooting includes:

- “Diagnosis using the Pegasus Utility”
- “Locating a Physical Drive”
- “Replacing a Physical Drive”
- “Physical Drive Warning Message”

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

Diagnosis using the Pegasus Utility

In the Pegasus 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 104.

**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.

   *Running the Locate function to identify a physical drive*

   ![Power/Status LEDs blink blue and orange]

   **IMPORTANT**
   Please read the Compatibly List for physical drives before purchasing new drives to install in Pegasus3. Download the list from the PROMISE website.
Replacing a Physical Drive

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

*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 the physical drives being used. 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.

---

**CAUTION**

To avoid hand contact with an electrical hazard, remove only one drive carrier a time.
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.
1. Remove the four mounting screws, then slide the failed drive out of the carrier.

2. Place the replacement drive into the carrier then install the four mounting screws. Tighten the screws just until they are snug. Position the drive carrier handle in an outward position and slide the drive carrier back into the Pegasus unit.

3. 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.

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 198.

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”
- “Disk Array Offline / Logical Drive Offline”
- “Repairing an Offline Disk Array or Logical Drive”
- “Rebuilding a Disk Array”
- “Incomplete Array”
- “Unreadable Disk Warning”

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 204.

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 Pegasus 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 198.
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 Pegasus 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!

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 197.

2. Replace the failed drive.
   
   See “Replacing a Physical Drive” on page 198.

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 121 and “Creating a Disk Array and Logical Drive with the Wizard” on page 112.

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 198. To perform a manual rebuild:

1. Click on the **Background Activities** menu icon.

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 Pegasus3 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 Pegasus Utility displays an incomplete array. When the Pegasus 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 198.

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 “Contacting Technical Support” on page 212.
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.

**Warning message**

![Warning message](image)

Normally, you never see this warning message for Pegasus3 logical drive because the Pegasus 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 “Contacting Technical Support” on page 212.

---

**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”
- “Overheating”
- “Power Supply”

**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.

   **System Status box on the Dashboard**

   ![Dashboard Screenshot]

   The System Status list contains a list of all the components with their appending status. In case there is a failure with one of the components, an indicator icon will be displayed next to the component.

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 Pegasus unit

**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.

*Pegasus3 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 Pegasus 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 “Contacting Technical Support” on page 212.
Connection Problems

Cables

If the installation of the cables and components are correctly installed, but they don’t function properly, or at all, some of the possible reason could be:

• 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. Look for the Thunderbolt logo on the cable. 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

Thunderbolt 3 cables are labeled with a Thunderbolt logo and the number three (3). See example illustration below.
Performance Monitor

The Performance Monitor display can be useful for diagnosing performance issues that will not necessarily trigger any alerts to appear in the System Status display or event logs. You can use it for testing performance of different drive types.

To display the Performance Monitor information, choose Performance Monitor from the Admin drop-down menu in the Menu Bar. Note that it is necessary to unlock the interface before the option can be selected.

Note
You must unlock the Pegasus Utility interface to allow selection of the Performance Monitor display.

Performance information is displayed in graph form for logical drives and physical drives. Use the pull-down menus to displayed what parameter is being measured and which logical or physical drive you want to monitor. The parameters available for measurement are Bandwidth (in MB/s) and I/O requests.
CONTACTING TECHNICAL SUPPORT

Promise offers local Phone Support for Pegasus series during normal business hours:

For telephone support and business hours click here (http://www.promise.com/ContactUs) Web support and Live Chat is offered 24/7

Web: https://support.promise.com


Please be sure to register your product at PROMISE eSupport (https://support.promise.com)

The information below is required for troubleshooting. Please register this information or have it readily available at the time of your support call

- **TLA number** - Located on the outside of the box or on label toward rear of Pegasus chassis
- **Serial number** - Located on label toward rear of Pegasus chassis
- **Config Logs**. Please refer http://kb.promise.com/cat/pegasus3-series/ for instruction on acquiring Config Logs.

LIMITATIONS

RMAs issued before 12:00 noon PST M-F can be shipped out on same day. RMAs issued after 12:00 noon PST M- F ship out the next business day.

RMA METHODS

1. **Cross Ship** (NOT applicable in APAC and EMEAR)

For this method, Credit card information is required for security purposes. The replacement item is first sent to you (customer). Thirty (30) days, from the day of shipment, are allotted for returning the defective unit. If the defective part is not returned within the allotted 30 days, your credit card will be charged the MSRP of the replacement part(s) shipped.

1. **Return and Replace**

Credit card information is not needed for this method. Once your request for an RMA is approved, an RMA number will be emailed to you along with specific shipping instructions. Product(s) must be returned in its original packaging (inner and outer box). If you do not have the original packaging contents please contact Promise Technical Support. All RMA are shipped standard ground to your location.

See “Returning the Product For Repair” on page 218 for more details.
United States
- 580 Cottonwood Drive
- Milpitas, Ca 95035, USA
- Technical Support (E-Support): https://support.promise.com
- Web Site: http://www.promise.com

Australia
- Technical Support (E-Support): https://support.promise.com
- Web Site: http://www.promise.com

EMEA

Netherlands
- Science Park Eindhoven 5228
- 5692 EG Son, The Netherlands
- Technical Support (E-Support): https://support.promise.com
- Web Site: http://www.promise.com

Austria
- Technical Support (E-Support): https://support.promise.com
- Web Site: http://www.promise.com

France
- Technical Support (E-Support): https://support.promise.com
- Web Site: http://www.promise.com

Germany
- Europaplatz 9
- 44269 Dortmund, Germany
- Technical Support (E-Support): https://support.promise.com
- Web Site: http://www.promise.com

Sweden
- Technical Support (E-Support): https://support.promise.com
- Web Site: http://www.promise.com

Switzerland ITF
- Technical Support (E-Support): https://support.promise.com
- Web Site: http://www.promise.com
Norway ITF
Technical Support (E-Support): https://support.promise.com
Web Site: http://www.promise.com

Belgium
Technical Support (E-Support): https://support.promise.com
Web Site: http://www.promise.com

Luxembourg
Technical Support (E-Support): https://support.promise.com
Web Site: http://www.promise.com

United Kingdom
Technical Support (E-Support): https://support.promise.com
Web Site: http://www.promise.com

Taiwan
Technical Support (E-Support): https://support.promise.com
Web Site: http://www.promise.com

China
Room 1108, West Wing, Shi Chuang Plaza, 22 Information Road
Shangdi IT Park, Haidian District, Beijing 100085
Fax: 86-10-8857-8015
Technical Support (E-Support): https://support.promise.com
Web Site: http://www.promise.com
Korea
Technical Support (E-Support): https://support.promise.com
Web Site: http://www.promise.com

Hong Kong
Technical Support (E-Support): https://support.promise.com
Web Site: http://www.promise.com

Singapore
Technical Support (E-Support): https://support.promise.com
Web Site: http://www.promise.com

Japan
3F, Mura Matsu Bldg, 3-8-5, Hongo Bunkyo-ku
Tokyo 113-0033, Japan
Technical Support (E-Support): https://support.promise.com
Web Site: http://www.promise.com
**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 for a period of three (3) years;

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.

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 THE 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, and be ready 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 helps you determine whether the product requires repair. If the product needs repair, the technician issues 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, CDs, etc.

USA and Canada: Promise Technology, Inc.
Customer Service Dept.
Attn.: RMA # ______
47654 Kato Road
Fremont, CA 94538

Asia-Pacific: Please return the product to your dealer or retailer or Contact Promise technical support for instructions before shipping the product.

Other Countries Please 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 your 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 is under warranty for the remainder of the original warranty term from purchase date, or 30 days, whichever is longer.

Promise pays for outbound standard shipping charges only. You must pay for any additional shipping options, such as express shipping and return of the defective part or unit.