



3ware®

SATA RAID Controller

Supports the 9000 Series

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Installation Guide

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About this Guide

This guide describes how to install the 3ware 9000 series RAID controller, configure arrays, and make the arrays available to your operating system—Microsoft Windows, Red Hat Linux, SuSE Linux, or FreeBSD.

For more complete information about managing and using arrays connected to the 3ware RAID controller, see *3ware 9000 Series Serial ATA RAID Controller User Guide*.

You may also want to refer to the Knowledgebase available at the 3ware website at <http://www.3ware.com/support/>

Conventions Used in This Guide

The following conventions are used throughout this guide:

- 3BM refers to the 3ware BIOS Manager
- 3DM refers to the 3ware Disk Manager, version 2.
- *Unit* refers to one or more disks configured through 3ware software to be treated by the operating system as a single drive. Also known as an array. Array and unit are used interchangeably throughout this manual.
- **Boldface** is used for buttons, fields, and settings that appear on the screen.
- `Monospace font` is used for code and to indicate things you type.

About the 3ware RAID Controller

This section includes the following topics:

- Product Features
- What's New with the 3ware 9000 Series Controllers
- About 3ware Driver Versions
- System Requirements
- Package Contents

Product Features

The 3ware 9000 Series Serial ATA family includes 9500S-4LP, 9500S-8, 9500S-12, 9500S-8MI, and 9500S-12MI.

Features of the 3ware 9000 series controllers include:

- Advanced RAID features for greater data protection and management.
- Support for battery backup provides added data protection in the event of a power outage. (Battery Backup Unit sold separately.)
- Support for RAID units greater than 2 terabytes with 64-bit LBA support.

- An enhanced firmware platform allows future upgrades. Anticipated upgrades include Enclosure Management Services (EMS).
- AMCC's remote management software, 3ware Disk Manager 2 (3DM®2) simplifies storage configuration and management via a Web browser.

What's New With the 3ware 9000 Series Controllers

Enhancements and changes from the 7000/8000 Series controllers to the 9000-series controllers include the following:

- MultiLUN support with auto-carving of units greater than 2 terabytes into 2 terabyte volumes.
- RAID Level Migration (RLM) and Online Capacity Expansion (OCE)
- Unit naming and unit serial number support.
- Improved write performance in writes with multiple concurrent streams using Stream Fusion technology.
- Extended drive and unit status information.

System Requirements

3ware RAID controllers require the following:

- **A workstation-class or server-class motherboard** which meets the following criteria:
 - PCI slots comply with PCI 2.2 or above standards.
 - PCI slot that meets the Plug and Play and PC99 specifications.

Note: For all 3ware 9000 series models, install the card in a 64-bit, 66MHz PCI or PCI-X slot for best performance.

■ Drives

Depending on the particular model, the 3ware RAID controller may be connected to up to, four, eight, or twelve SATA drives using the supplied interface cables.

Drives must meet serial ATA 150 (SATA I) or serial ATA 300 (SATA 2) Gb/s standards. Drives may be of any capacity or physical form factor.

The length of both shielded and unshielded interface cables may not exceed 1M (39") for serial ATA controllers.

■ Operating System

3ware RAID controllers may be used with:

- Windows 2000 (Professional, Server, Advanced Server) (SP3 or newer), Windows XP Professional (SP1 or newer), Windows Server 2003 (Standard, Enterprise), Windows XP x64 Edition, Windows Server 2003 x64 Edition.
- Red Hat Linux, 32-bit and 64-bit x86
- SuSE Linux, 32-bit and 64-bit x64
- Other versions of Linux using the open source Linux driver
- FreeBSD

■ Other Requirements

- Adequate air flow and cooling
- Adequate power supply for drives

For a complete listing of features and system requirements, refer to the 9000 Series Datasheet, available from the website at www.3ware.com/products/serial_ata9000.asp.

Package Contents

If your package is missing any of the items listed below, contact 3ware before proceeding with installation (disk drives and disk mounting brackets are not included).

- 3ware Serial ATA RAID Controller in an ESD-protective bag
- Serial ATA interface cables (one per port). (Cables are not included in 9500S-8MI and 9500S-12MI.)
- 3ware installation CD with the following: 3DM 2, drivers, Command Line Interface (CLI) and *3ware 9000 Series Serial ATA RAID Controller User Guide* (.pdf format)
- 3ware Release Notes
- *3ware 9000 Series Serial ATA RAID Controller Installation Guide* (this guide)

Installation Overview

Details about each step in the installation process are included in this guide.

For your reference, the list below provides an overview of the main steps required.

- If you have a Battery Backup Unit (BBU), install it on the controller. (For details, see “Appendix A. Installing the Battery Backup Unit” on page 99.)
- Install the controller, cables, and drives.

The basic steps are listed here. For details, see “Installing the Hardware” on page 7.

- a Connect the interface cables to the controller card.
 - b Turn off power switches and unplug power cords for the equipment with which you are working.
 - c Make sure you are grounded, to avoid electrostatic discharge, which could damage computer components or accessories.
 - d Insert the controller card into the computer.
 - e If the drives are not already installed in the computer, install them.
 - f Connect the interface cables to the drives.
 - g Close up the case.
- Power on the system.

- Check the motherboard boot sequence. Refer to your system BIOS guide for more details.
- Configure RAID units.

The basic steps are listed here. For details, see “Configuring Units” on page 27.

- a Start 3BM (the 3ware BIOS Manager).
 - b Select the drives to be included and indicate that you want to create a disk array.
 - c Select the desired RAID configuration.
 - d Set other parameters, depending on the type of RAID configuration.
 - e Confirm the array configuration.
 - f Save your changes and exit.
- Specify a hot spare (optional).
 - Install the 3ware driver and make the units available to the operating system.

For details see one of the following:

- “Driver Installation Under Windows” on page 53
- “Driver Installation Under Linux” on page 65
- “Driver Installation Under FreeBSD” on page 87

Installing the Hardware

This section describes the physical installation of the 3ware 9000 RAID controllers. It contains the following topics:

- **“Before You Begin”** provides important information about things you should consider before starting installation, and tools and equipment you will need.
- **“Safety Factors”** describes important precautions for your personal safety and to protect your equipment and data. **Be sure to read this section.**
- **“Installing a Serial ATA RAID Controller”** and **“Installing a Serial ATA RAID Controller with Multi-lane Internal Connectors”** provide step-by-step instructions for installing a serial ATA RAID controller.
- **“Finishing Up”** describes the final steps required when installing a serial controller.
- **“Moving Units from an 8000 Controller to a 9000 Controller”** describes the process to follow when you change from one controller to another.



Note: If you have a BBU (Battery Backup Unit), install it first. For details, see “Appendix A. Installing the Battery Backup Unit” on page 99.

Before You Begin

The next few pages describe some factors you may want to consider during installation, and the tools and equipment you will need.

Installation Considerations

Cable Length, Routing Space, and Air Flow

When you are installing multiple drives with a controller, make sure there is adequate space in the chassis for the required cables. It is important that the cables do not obstruct the air flow or prevent proper ventilation of the system.

Selecting the Slot in Which to Install the Controller

Consider these factors when deciding on the slot in which to insert the controller:

- Cable routing may be easier if you install the 3ware RAID controller next to an open slot.
The amount of clearance you need will depend on the number of drives you will be connecting to the controller.
- While the 3ware RAID Controller runs properly in any PCI or PCI-X slot, not all slots give equal performance due to the architecture of the PCI bus.

These slots typically give the best performance:

- Slots closest to the Accelerated Graphics Port (AGP), if included.
- 64-bit PCI slots

Although the controller fits in both 32-bit and 64-bit PCI or PCI-X slots with 5V as well as with 3.3V, install it in a 64-bit slot to take full advantage of the controller's performance.

Whether to Use the LED Status Connector

3ware RAID controllers include two types of LED status connectors:

- Overall indicator, which lights when any drive is active.
- Individual LED indicators, for each drive. (Not supported on chassis that have a common ground.)

If you are building a system from scratch, you may want to consider using a chassis or drive carrier that is compatible with the 3ware RAID controller activity LEDs, such as the AMCC RDC-400 drive carrier, available through AMCC. Please check the 3ware web site (www.3ware.com) for chassis and drive carrier compatibility list.

For more information, see “Additional Details About the LED Status Connectors” on page 13.

Most chassis have a single drive activity cable that you can connect to the overall activity indicator on the 3ware 9000 controller. For the location of the overall drive activity connector, see the figure for the appropriate controller in the installation sections starting on page 12, and refer to Table 1, “LED Indicator Pin Positions,” on page 14.

Drive Installation Considerations

- **Selecting an enclosure.** If you are planning to use RAID 1, 5, 10, or 50, you may want to consider installing drives into hot-swappable enclosures, so that they can be easily removed in the event of a drive failure.
- **When to install the drive.** If the drives are not already installed in your computer, you can choose to install them either before or after connecting the interface cables to them.

What You Need: Tools and Equipment

Tools Required

You will need the following tools during installation:

- An ESD grounding strap or mat
- Standard hand tools to open your system's case and install the 3ware RAID controller into an available PCI expansion slot.

Safety Factors

Be sure to follow the guidelines presented on the next few pages to insure your own safety, and that of your equipment.

Personal Safety



Warning! High voltages may be found inside computer equipment.

Before installing any of the hardware in this package or removing the protective covers of any computer equipment, turn off power switches and disconnect power cords. Do not reconnect the power cords until you have replaced the covers.

Protecting Equipment and Data

Backing Up Your Data



Back up your data! Creating or deleting disk arrays destroys existing files on the member drives. If your drives contain valuable data, back them up and save the data elsewhere before attaching the drives to the controller.

ESD (Electrostatic Discharge) Precautions

To avoid damaging computer components and accessories when installing or removing the 3ware RAID controller, follow standard electrostatic discharge (ESD) precautions:

- When your computer case is open and its internal parts are exposed, do not touch any internal part unnecessarily.
- Always wear a grounded strap or work on an ESD-protective mat.
- Do not remove the 3ware RAID controller from its protective bag until you are properly grounded.
- Handle the 3ware RAID controller by its edges or by the black rail and metal bracket at its two ends.
- Do not touch any pin, contact, lead or component on the 3ware RAID controller.

Things to Watch Out For

Be careful when installing the 3ware RAID controller into your system. **Excessive force can damage the board or your system.**

- Be sure the board is aligned with its slot on the motherboard before installing. Do not flex the board excessively.
- Interface cable connectors must be mated carefully with the connectors in the controller. The connectors provided are keyed to prevent you from inserting them upside-down.
- Interface cables are fragile and must not be crimped or pinched. Ensure that they do not impede the flow of cooling air from fans or heat sinks in the system case.

Installing a Serial ATA RAID Controller

Figure 1 shows a 3ware Serial ATA RAID controller with twelve ports. Up to twelve drives can be attached to this particular controller, through serial ATA cables.

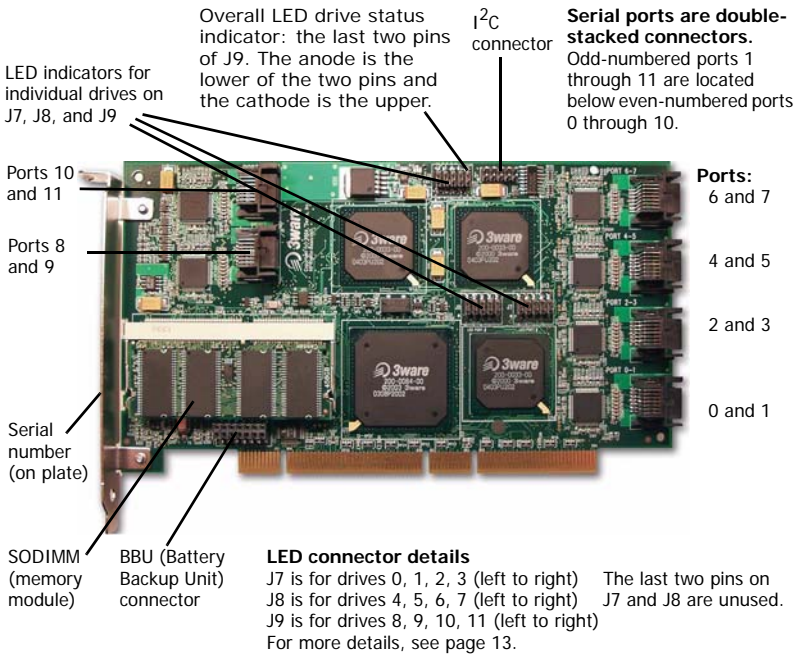


Figure 1. 12-Port 3ware 9500S-12 Serial ATA RAID Controller

Figures 2 and 3 show 3ware Serial ATA RAID controllers with 8 ports (there are two versions of the 9500S-8 controller). The earlier models use Pchip v1.4 and are not BBU-compatible. The more recent models use Pchip v1.5 and are BBU-compatible. Although the controllers look very similar, the location of the overall LED drive status indicator is different on the two versions, as shown in the respective figures. If you are not certain which version you have, you can use the 3ware CLI to determine the Pchip version (`tw_cli c0 show pchip`).

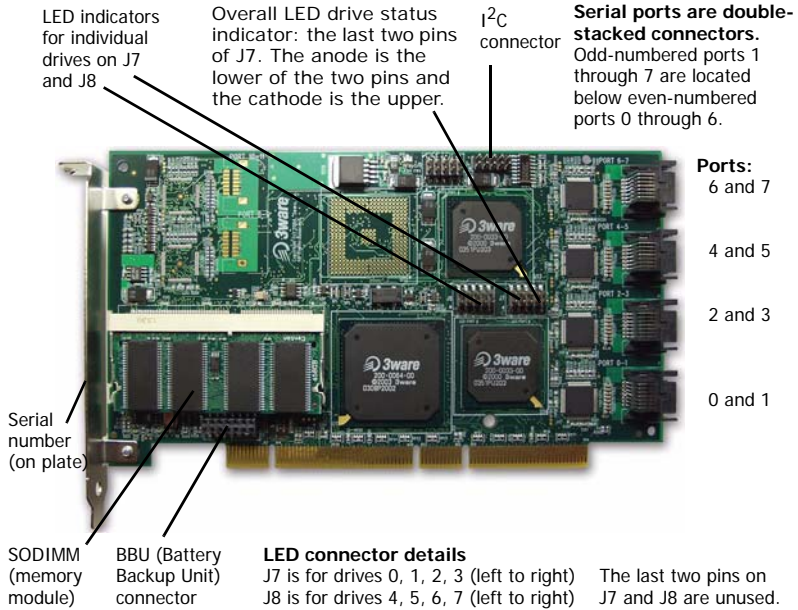


Figure 2. 8-Port 3ware 9500S-8 Serial ATA RAID Controller, Pchip v1.5 (BBU-compatible)

Additional Details About the LED Status Connectors

As shown in Figures 1 through 5, LED connectors for individual drives are on J7, J8, and J9 for the full size cards, and on J3 for the half-size 4-port card.

Pin 1 is located in the lower left-hand corner of each 10-pin connector. The odd-numbered pins, located on the bottom row, are 3.3V for the anode side of each LED to be connected. The even-numbered pins are the return or cathode side.

Table 1 summarizes the LED indicator pin positions for the different controllers.

Warning: A common or shared LED ground on a chassis is not supported and can damage the 3ware controller. Check with your chassis documentation before connecting.

Table 1: LED Indicator Pin Positions

Controller	LED Header	Pin Pair	Comment
9500S-4LP	J3	: : : : : 0 1 2 3 All	Orientation Horizontal Port number/All (all activity indicator) k-cathode-minus is on the top a-anode-plus is on the bottom
9500S-8 (Pchip v1.4)	J7	: : : : : 0 1 2 3 NU	Orientation Horizontal Port number/NU (Not Used)
	J8	: : : : : 4 5 6 7 NU	Orientation Horizontal Port number/NU (Not Used)
	J9	: : : : : NU NU NU NU All	Orientation Horizontal Not used/All (all activity indicator) k-cathode-minus is on the top a-anode-plus is on the bottom
9500S-8 (Pchip v1.5)	J7	: : : : : 0 1 2 3 All	Orientation Horizontal Port number/All (all activity indicator)
	J8	: : : : : 4 5 6 7 NU	Orientation Horizontal Port number / NU (Not Used) k-cathode-minus is on the top a-anode-plus is on the bottom

Table 1: LED Indicator Pin Positions

Controller	LED Header	Pin Pair	Comment
9500S-12	J7	: : : : : 0 1 2 3 NU	Orientation Horizontal Port number/NU (Not Used)
	J8	: : : : : 4 5 6 7 NU	Orientation Horizontal Port number/NU (Not Used)
	J9	: : : : : 8 9 10 11 All	Orientation Horizontal Port number/All (all activity indicator) k-cathode-minus is on the top a-anode-plus is on the bottom

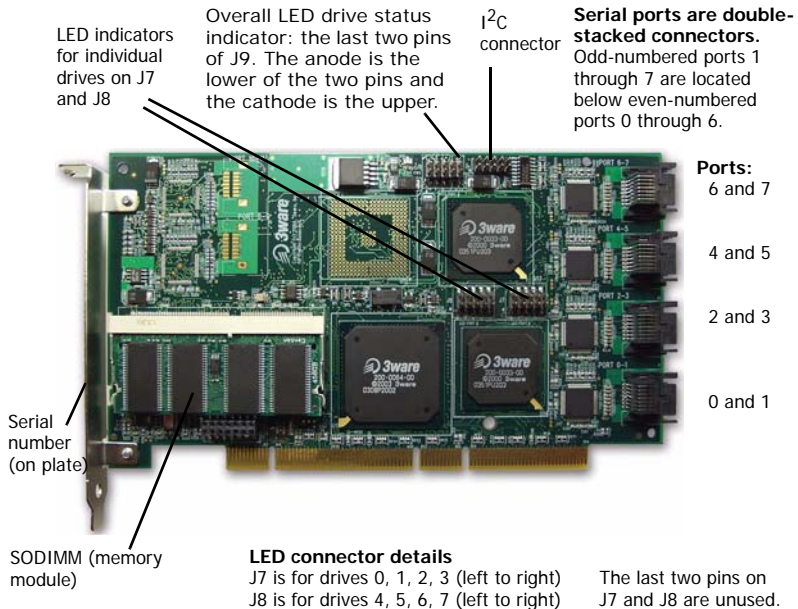


Figure 3. 8-Port 3ware 9500S-8 Serial ATA RAID Controller, Pchip v1.4 (Non-BBU Compatible)

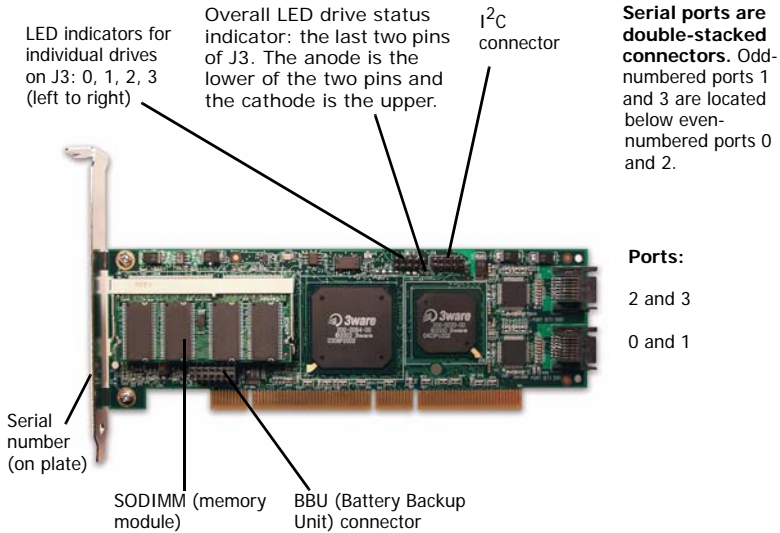


Figure 4. 4-Port 3ware 9500S-4 Serial ATA RAID Controller

To connect serial cables to the controller

- 1 Take out the serial cables provided with the 3ware SATA RAID controller.

3ware serial controllers are supplied with serial interface cables, one for each port on the controller.

One edge of each interface cable connector is keyed so that it can only be inserted in one direction. This helps to ensure proper orientation and installation

- 2 Align the cable connector with the connector on the controller, matching the slotted key and carefully mate the connectors.



Note: The connectors on the end of the serial controller and the drive are susceptible to damage from excessive bending. Be careful not to insert or remove the serial cable connector at an angle.

- 3 Repeat steps 2 and 3 for each additional interface cable. (You will connect one cable for each hard drive you will attach.)

To install the controller in the computer

- 1 If the computer is running, shut it down. Turn off power to the computer and disconnect the power cord from the outlet.
- 2 Make sure you are properly grounded. (For details about safety precautions, see page 10.)
- 3 Open the computer case according to the manufacturer's instructions.
- 4 Find the PCI slot you want to use for the serial 3ware RAID controller.

For a discussion of which slot to use, see “Selecting the Slot in Which to Install the Controller” on page 8

- 5 Remove the metal filler bracket for the slot.
Save this screw; it will be used to secure the serial 3ware RAID controller after you have seated it in the slot.
- 6 Position the card in the slot so that the contacts will mate with the grooves in the slot, and all pins make proper contact with the PCI slot pins when pushed into place.

The 3ware RAID controller is keyed to ensure proper installation into a full-sized PCI slot.

Make sure that the contacts will mate with the grooves in the slot.

- 7 Press down gently on the edge of the 3ware RAID controller directly above the slot until it is fully seated.
- 8 Check that the 3ware RAID controller's metal bracket covers the hole in the case and secure the bracket with the screw that was used to secure the filler bracket in step 5.

To connect the interface cables to the drives

- 1 If your drives are not already installed in the computer chassis or hot swap carriers, install them now. Be sure that the drives are connected to the power supply, either by cable or through the drive cage.
- 2 For each drive, select the end of an interface cable not connected to the 3ware RAID Controller and plug it into the drive or drive carrier.

One edge of each interface cable connector is keyed to ensure proper installation.

- 3 (Optional) Connect the drive activity LED connectors. See the connection details on Figure 1.

For a discussion of whether to make these connections, see “Whether to Use the LED Status Connector” on page 9 and “To connect serial cables to the controller” on page 16.

- 4 (Optional) If staggered spinup is desired (and supported by your hard drives), set the appropriate jumpers on your hard drives to enable staggered spinup.

Later, you will need to enable staggered spinup and specify the staggered method (ATA-6 or SATA OOB) in the 3ware BIOS Manager (3BM). For more information, see the *3ware 9000 Series Serial ATA RAID Controller User Guide*.

- 5 Turn to “Check your Installation and Close the Case” on page 22.

Installing a Serial ATA RAID Controller with Multi-lane Internal Connectors

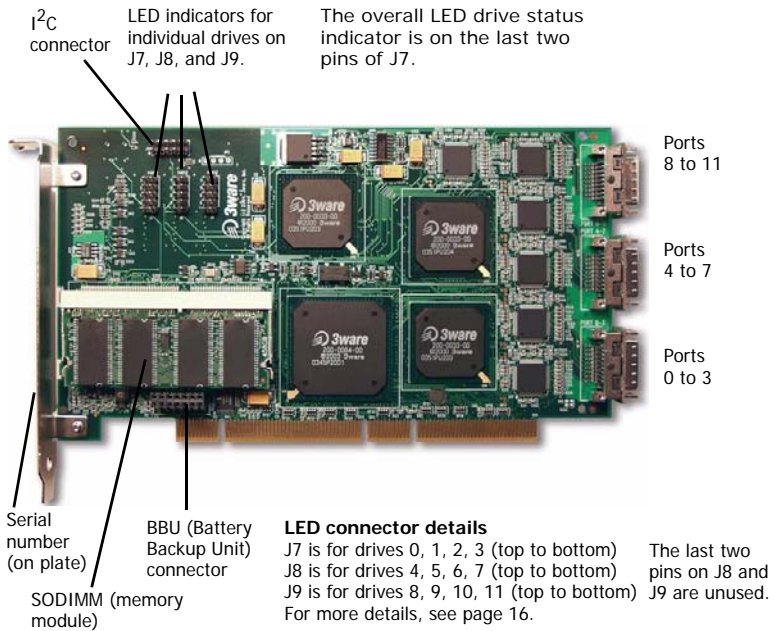


Figure 5. 12-Port 3ware 9500S-12MI Serial ATA RAID Controller

Models 9500S-12MI and 9500S-8MI, have multi-lane internal connectors, each of which can handle up to four drives. These controllers can be installed in an enclosure with a backplane. The type of cable you need will depend on the type of enclosure you have:

- For use with a backplane that has the InfiniBand 4x connectors (SFF-8470), use the InfiniBand 4x cable, which has multi-lane connectors on each end, as shown in Figure 6.



Figure 6. Multi-lane Cable (InfiniBand 4x, SFF-8470)

- For use with a backplane that has individual SATA connectors or individual serial ATA drives, use the break-out cable, which has a multi-lane connector on one end, and four individual SATA connectors on the other end.

To connect the multi-lane cables

Depending on the model of the controller and the number of drives you will be connecting, you will connect two or three multi-lane cables. Each cable supports up to four serial ATA ports.

- 1 Connect each interface cable to a multi-lane connector on the controller. See Figure 5.

When the cable is inserted correctly, you will feel it click into place.

- 2 If your enclosure has a backplane, connect the other end of each interface cable to the backplane.

If you are using a standard enclosure, connect each of the individual SATA connectors to a drive.

To install the controller in the computer

- 1 If the computer is running, shut it down. Turn off power to the computer and disconnect the power cord from the outlet.
- 2 Open the computer case according to the manufacturer's instructions.
- 3 Find the PCI slot you want to use for the serial RAID controller.
- 4 Remove the metal filler bracket for the slot.

Save this screw; it will be used to secure the 3ware RAID Controller after you have seated it in the slot.

- 5 Position the card in the slot so that the contacts will mate with the grooves in the slot and all pins make proper contact with the PCI slot pins when pushed into place.

The 3ware controller is keyed to ensure proper installation into a full-sized PCI slot.

Make sure that the contacts will mate with the grooves in the slot.

- 6 Press down gently on the edge of the 3ware RAID controller directly above the slot until it is fully seated.
- 7 Check that the 3ware RAID controller's metal bracket covers the hole in the case and secure the bracket with the screw that was used to secure the filler bracket in step 4.

To install the drives

- 1 If your drives are not already installed, install them now, either by attaching them to the backplane, or by installing them in the computer chassis.
- 2 Be sure that the power supply is connected to either the backplane or the individual drives.

- 3 Power down the system, disconnect the drives from the 7/8000 controller and remove the controller from the system.
- 4 Attach the drives to the 9000 controller, as described earlier in this section.

Finishing Up

After you have installed the controller in the computer and attached appropriate cables to the controller and drives, complete the following steps to complete the hardware installation.

Check your Installation and Close the Case

- 1 Verify that the cables do not interfere with the operation of any other components in the case or block the flow of cooling air.
- 2 Close the case and reconnect the power cables.

Configure your RAID Arrays

Turn to “Configuring Units” on page 27 for information about configuring the RAID arrays.

Moving Units from an 8000 Controller to a 9000 Controller

It is possible to move your 8000 storage units to a 9000 series controller. You will then have the advantages of the 9000 series controller.

The drive units must be in normal mode before moving the units. Incomplete, degraded, rebuilding, or initializing units cannot be converted. In addition, RAID 0, 10, and 5 units must use a standard 64 KB stripe size.

The procedure to move from the 8000 to the 9000 series depends on the type of storage unit that you have. For most units, follow the steps below. For units using JBOD, see “Moving Units from an 8000 Controller to a 9000 Controller” on page 23.



Note: In order to preserve the data that is on the units attached to the 8000, you will need to run a special utility, available from 3ware Technical Support, to convert the units to a format that the 9000 controller can use. Contact Technical Support to obtain the utility. (This utility is not required for legacy JBOD units.)

Do not remove the 8000 board from your system until you have converted the units. The units must be attached to the 8000 controller when you run the utility.



Warning: Drives configured on the 9000 cannot be used with older 3ware controllers, non-3ware controllers, or directly on the motherboard without first deleting the existing configuration to unlock the drive in read only mode.

To move units under Linux or FreeBSD

- 1 Upgrade your driver to the 9000 series driver. (For details, refer to the Linux or FreeBSD Driver Installation section.)
- 2 Run the conversion utility to convert the units.
- 3 Power down the system, disconnect the drives from the 8000 controller and remove the controller from the system.
- 4 Install the 9000 controller and attach the drives to the 9000 board, as described earlier in this section.

To move units under Windows

- 1 Install the 9000 controller in your system, while leaving the 8000 controller installed.
- 2 Install the Windows driver. (For details, see “Driver Installation Under Windows” on page 53.)
- 3 Run the conversion utility to convert the units.
- 4 Power down the system, disconnect the drives from the 7/8000 controller and remove that controller from the system.
- 5 Attach the drives to the 9000 board.

Moving Legacy JBOD Units to a 9000 Controller

To move legacy JBOD units under Linux or FreeBSD

- 1 Upgrade your driver to the 9000 series driver.
- 2 Power down the system, disconnect the drives from the 8000 controller and remove the controller from the system.
- 3 Install the 9000 controller and attach the drives to the 9000 board, as described earlier in this section.

- 4 Reboot the system and enter the 3ware 9000 series BIOS (3BM) by pressing Alt-3. Enable the Export JBOD policy on the Policy screen. (The next section in this guide, “Configuring Units”, describes how to work in 3BM. Additional information about 3BM is available in *3ware 9000 Series Serial ATA RAID Controller User Guide*.)
- 5 Press the **F8** or **Esc** key to save and exit.

To move legacy JBOD units under Windows

- 1 Install the 9000 controller in your system, while leaving the 8000 controller installed.
- 2 Install the Windows driver. (For details, see “Driver Installation Under Windows” on page 53.)
- 3 Power down the system, disconnect the drives from the 8000 controller and remove that controller from the system.
- 4 Attach the drives to the 9000 board.
- 5 Reboot the system and enter the 3ware 9000 series BIOS (3BM) by pressing Alt-3. Enable the Export JBOD policy on the Policy screen. (The next section in this guide, “Configuring Units”, describes how to work in 3BM. Additional information about 3BM is available in *3ware 9000 Series Serial ATA RAID Controller User Guide*.)
- 6 Press the **F8** or **Esc** key to save and exit.

Configuring Units

After you have physically installed your 3ware RAID controller and connected it to your disk drives, you configure how the drives connected to the controller will be used in RAID arrays.

This section includes the following topics:

- “Understanding RAID Concepts and Levels” on page 28
- “Determining What RAID Level to Use” on page 31
- “Working with the 3ware BIOS Manager (3BM)” on page 34
- “Specifying the Unit Configuration” on page 40
- “Initializing Units” on page 49
- “Checking the Motherboard Boot Sequence” on page 51
- “Installing Drivers and Making the Units Available For Use” on page 52

If you already know the RAID configuration you want, turn to “Specifying the Unit Configuration” on page 40.



Note: This section describes how to configure your RAID arrays as part of the installation process. For complete information about using 3ware BIOS Manager (3BM), including how to use it to change existing configurations, and for information about how to define and change the configuration using 3ware Disk Manager (3DM 2), see the *3ware 9000 Series Serial ATA RAID Controller User Guide*.



Note: You must attach drives before you can configure RAID arrays. If no drives are attached to the 3ware RAID controller, the 3ware BIOS will not be installed.

Understanding RAID Concepts and Levels

The following concepts are important to understand when selecting the appropriate RAID level for a system:

- **Arrays and Units.** In the storage industry, the term “array” is used to describe two or more disk drives that appear to the operating system as a single unit. When you work with 3ware software, “unit” is the term used to refer to an array of disks that is configured and managed through the 3ware software. Single-disk units can also be configured in the 3ware software.
- **Mirroring.** Mirrored arrays write data to paired drives simultaneously. If one drive fails, the data is preserved on the paired drive. Mirroring provides data protection through redundancy. In addition, mirroring using a 3ware RAID controller provides improved performance because 3ware’s TwinStor technology reads from both drives simultaneously.
- **Striping.** Striping across disks allows data to be written and accessed on more than one drive, at the same time. Striping combines each drive’s capacity into one large volume. Striped

disk arrays achieve highest transfer rates and performance at the expense of fault tolerance.

- **Distributed Parity.** Parity works in combination with striping on RAID 5 and RAID 50. Parity information is written to each of the striped drives, in rotation. Should a failure occur, the data on the failed drive can be reconstructed from the data on the other drives.
- **Hot Spare.** A single drive that is not used for user data, but rather as an extra drive that is online and available to automatically take the place of any drive that fails in a redundant unit. Used with RAID 1, 5, 10 and 50.
- **Hot Swap.** The process of exchanging a drive without having to shut down the system. This is useful when you need to exchange a degraded drive. It is also useful if you want to add disk drives to configure into a unit without shutting down the system first.

Configurations Available with the 3ware RAID Controller

The following RAID levels and configurations are available for drives attached to a 3ware RAID controller:

- **RAID 0.** Provides striping, but no mirroring or redundancy of any kind. Striped disk arrays achieve high transfer rates because they can read and write data on more than one drive simultaneously. The stripe size is configurable in 3ware BIOS Manager (3BM). Requires a minimum of two drives.

When drives are configured in a striped disk array, large files are distributed across the multiple disks using RAID 0 techniques.

Striped disk arrays give exceptional performance, particularly for data intensive applications such as video editing, computer-aided design and geographical information systems.

RAID 0 arrays are not fault tolerant; the loss of any drive results in the loss of all the data in that array, and can even

cause a system hang, depending on your operating system. RAID 0 arrays are not recommended for high availability systems unless additional precautions are taken to prevent system hangs and data loss.

- **RAID 1.** Also known as a mirrored array. Mirroring is done on pairs of drives. Mirrored disk arrays write data to two drives using RAID 1 algorithms. This gives your system fault tolerance by preserving the data on one drive if the other drive fails. Fault tolerance is a basic requirement for mission critical systems like web and database servers.
- **RAID 5.** Combines striping data with parity (exclusive OR) to restore data in case of a drive failure. This array type provides performance, fault tolerance, high capacity, and storage efficiency. Requires a minimum of three drives.
- **RAID 10.** This array is a combination of RAID 1 with RAID 0. Striped and mirrored arrays for fault tolerance and high performance. Requires a minimum of four drives to use both RAID 0 and RAID 1 techniques.
- **RAID 50.** This array is a combination of RAID 5 with RAID 0. This array type provides fault tolerance and high performance. Requires a minimum of six drives.
- **Single Disk.** A single drive that has been configured as a unit through 3ware software (3BM, 3DM 2, or CLI). Like disks in other RAID configurations, single disks contain 3ware Disk Control Block (DCB) information and are seen by the OS as available units.

Single drives are not fault tolerant and therefore not recommended for high availability systems unless additional precautions are take to prevent system hangs and data loss.

- **JBOD.** A JBOD is an unconfigured disk attached to your 3ware RAID controller. JBOD configuration is no longer supported in the 3ware 9000 series. AMCC recommends that you use Single

Disk as a replacement for JBOD, to take advantage of advanced features such as OCE, and RLM.

JBOD units are not fault tolerant and therefore not recommended for high availability systems unless additional precautions are taken to prevent system hangs and data loss.

- **Hot Spare.** A single drive, available online, so that a redundant array can be automatically rebuilt in case of drive failure.

For additional information about RAID levels, see the article “RAID Primer” on the 3ware website, at: http://www.3ware.com/products/pdf/RAID_Primer.pdf.

Other Important Concepts

- **Write Cache.** Used to store data locally on the drive before it is written to the disk, allowing the computer to continue with its next task. Enabling write cache results in the most efficient access times for your computer system. However, there may be instances when you always want the computer to wait for the drive to write all the data to disk before going on to its next task. In this case, you must disable the write cache.

Determining What RAID Level to Use

The RAID configurations available to you are determined by the number of ports on your controller, and the number of drives attached to those ports. You can configure all drives in one array, or you can configure multiple arrays, if you have enough drives.

Table 2: Possible Configurations Based on Number of Drives

# Drives	Possible Configurations
1	Single drive or hot spare

Table 2: Possible Configurations Based on Number of Drives

# Drives	Possible Configurations
2	RAID 0 or RAID 1
3	RAID 0 RAID 1 with hot spare RAID 5
4	RAID 5 + hot spare RAID 10 Combination of RAID 0, RAID 1, single disks
5	RAID 5 + hot spare RAID 10 + hot spare Combination of RAID 0, RAID 1, hot spare, or single disks
6 or more	RAID 50 Depending on the number of drives, a RAID 50 may contain from 2 to 4 subunits. For example, with 12 drives, possible RAID 50 configurations include 2 subunits of 6, 3 subunits of 4, or 4 subunits of 3. With 10 drives, a RAID 50 will contain 2 subunits of 5 drives each. Combination of RAID 0, 1, 5, 10, hot spare, or single disks

Drive Capacity Considerations

The capacity of each drive is limited to the capacity of the smallest drive in the array. The total array capacity is defined as follows:

Table 3: Drive Capacity

RAID Level	Capacity
RAID 0	(number of drives) X (capacity of the smallest drive)
RAID 1	capacity of the smallest drive

Table 3: Drive Capacity

RAID Level	Capacity
RAID 5	(number of drives - 1) X (capacity of the smallest drive) Storage efficiency increases with the number of disks: storage efficiency = (number of drives -1)/ (number of drives)
RAID 10	(number of drives / 2) X (capacity of smallest drive)
RAID 50	(number of drives - number of subunits) X (capacity of the smallest drive)

Through drive coercion, the capacity used for each drive is rounded down so that drives from differing manufacturers are more likely to be able to be used as spares for each other. The capacity used for each drive is rounded down to the nearest GB for drives under 45 GB (45,000,000,000), and rounded down to the nearest 5 GBytes for drives over 45 GB. For example, a 44.3 GB drive will be rounded down to 44 GBytes, and a 123 GB drives will be rounded down to 120 GBytes.

Support for Over 2 Terabytes

Windows 2000, Windows XP, Linux 2.4, and FreeBSD 4.x, do not currently recognize unit capacity in excess of 2 TB.

If the combined capacity of the drives to be connected to a unit exceeds 2 Terabytes (TB), you can enable auto-carving when you configure your units.

Auto-carving divides the available unit capacity into multiple chunks of 2 TB or smaller that can be addressed by the operating systems as separate volumes.

For more information, see “Enabling Auto-Carving for Units Larger Than 2 TB” on page 47, and in *3ware 9000 Series Serial ATA RAID Controller User Guide*, see “Multi LUN Support and Auto-Carving.”

Working with the 3ware BIOS Manager (3BM)

This section describes the basics of working with the 3ware BIOS Manager (3BM) configuration utility. It includes the following sections:

- Starting the 3BM configuration utility
- Exiting the 3BM configuration utility
- Working in the 3BM configuration screens

Starting 3BM

You access the 3BM configuration utility during the start-up process for your computer.

To start 3BM

- 1 Power up or reboot your system.
- 2 While the system is starting, watch for a screen similar to Figure 7.



```
3ware ATA RAID Controller: Escalade 9500S-12
BIOS: BE9X X.XX.XX.XXX   Firmware: FE9X X.XX.XX.XXX

Unit 0 -           Mirror           111.74GB
  Port 0 - IC35L120AVVA07-0         115.03 GB
  Port 1 - IC35L120AVVA07-0         115.03 GB

Following drives will not be exported to OS:
Port 2 - IC35L120AVVA07-0         115.03 GB Unconfigured Disk
Port 3 - IC35L120AVVA07-0         115.03 GB Unconfigured Disk

----Press <Alt-3> to access 3ware BIOS Manager ----
```

Figure 7. 3ware BIOS Screen

- 3 Press **Alt-3** immediately to bring up the **3BM configuration utility** display.

A message warns you that changing your disk array configuration may overwrite data on the disks.

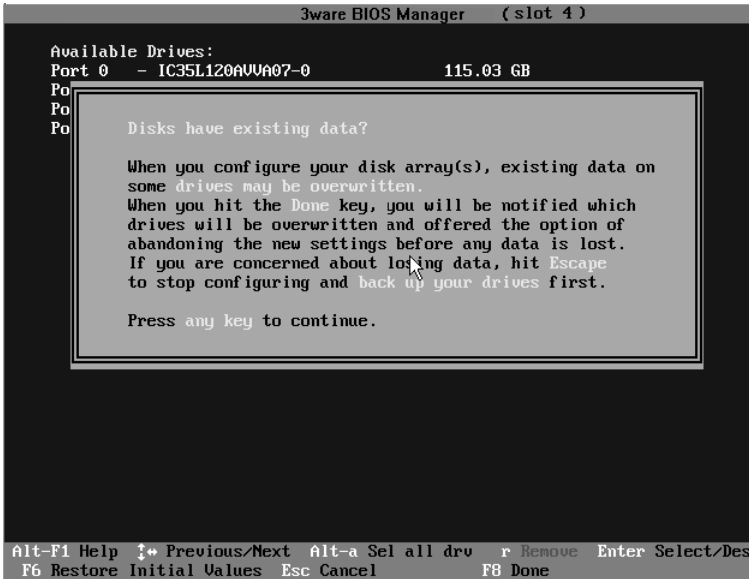


Figure 8. Warning Message When you Start 3BM

- 4 If you need to backup data before continuing, press **ESC** and do so now. Otherwise, press any key to continue.

Exiting 3BM

When you are ready to exit the 3BM configuration utility, you have the option to save the configuration changes you have made, or to discard the changes.

To save your configuration modifications

- 1 Press the **F8** or **Esc** key.

A list of affected drives appears, and a message asks you to confirm the configuration.

- 2 Type **Y**.

3BM closes and the booting process resumes.

To exit without saving changes

- 1 Press **Esc**.

If you have made changes that you have not saved, you are asked whether to save them, or not.

- 2 Select **No** to discard your changes.



Note: If you make changes on the Policy screen, those changes are saved when you leave the Policy screen. Whether you press **F8** or **Esc** to leave 3BM will not have an effect on those changes. For more information, see the *3ware 9000 Series Serial ATA RAID Controller User Guide*.

Working in the 3BM Screens

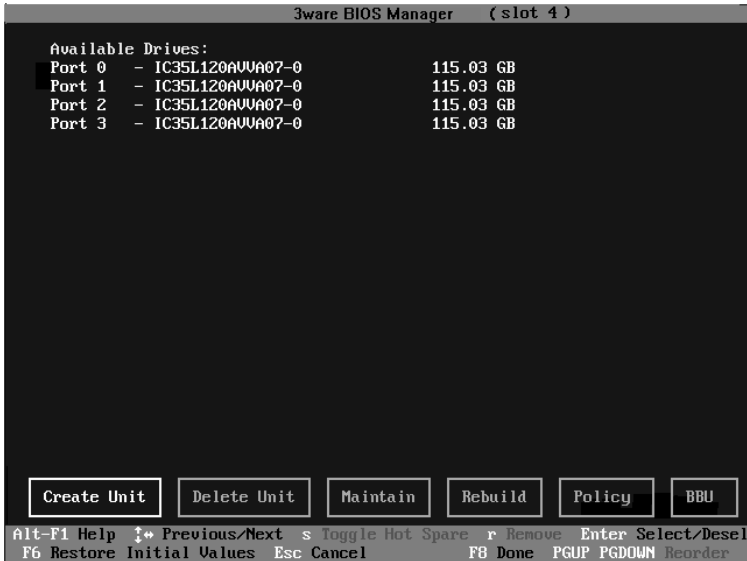


Figure 9. 3BM Configuration Utility Main Display

The main **3BM** screen shows a list of available drives. After you have configured one or more drives, it also lists the existing configuration.

- **Available Drives** lists the drives that are available to create units and hot spares.
- **Exportable Units** lists any existing units along with the drives contained in the units.
- **Incomplete Drives and Others.** If you connected drives to the controller that were previously used on a 7000/8000-series 3ware RAID controller, they may appear in a section titled Incomplete Drives and Others. Before you can use these drives, they must be deleted. For more information, see the discussion of Deleting Units in *3ware 9000 Series Serial ATA RAID Controller User Guide*.

- **Unusable Units.** Any unit that is missing too many drives to be constructed properly will be listed here.

Table 4 lists how to move around and select information in the 3BM screens.

Table 4: Working in 3BM

To do this	Use these keys
Move between units or drives in a list, and between fields and buttons	Up and Down Arrow Keys OR Left and Right Arrow Keys OR Tab and Shift+Tab
<p>Select (or unselect) what is currently highlighted.</p> <p>A selection may be a drive in a list of drives, a button at the bottom of the screen, or a field in the middle of the screen.</p> <p>In lists, an asterisk appears to the left of selected drives or units.</p>	Enter or the Spacebar
Display a drop-down list of available choices in a field	Enter
Move between choices in a field list	Up and Down Arrow Keys
Select all available drives	Alt+A
<p>Highlight one of the primary buttons on the main screen:</p> <p>Create</p> <p>Delete</p> <p>Maintain</p> <p>Rebuild</p> <p>Policy</p> <p>BBU</p>	<p>Alt+C</p> <p>Alt+D</p> <p>Alt+M</p> <p>Alt+R</p> <p>Alt+P</p> <p>Alt+B</p>

Table 4: Working in 3BM

To do this	Use these keys
Specify (or unspecify) a drive as a hot spare	S
Unlock the drives in a unit, so that they can be removed and used with a controller other than a 9000-series controller.	R (Remove)
Return to starting values for this session in the 3ware BIOS Manager	F6 Note: F6 cannot bring back previous policy settings; they are saved when you exit the Policy screen.
Display the Advanced Detail screen, where you can see the software versions (BIOS, Firmware, monitor), serial number, controller and model number, cache memory size, slot # of the 3ware card, and whether or not BBU-support is available.)	Shift+F5
Return to the main 3ware BIOS Manager screen, from the Advanced Details screen	Any key
Move a highlighted unit up or down in the list of exportable units (The top-most unit will become the bootable unit, if you install the OS.)	Page Up Page Down [Available only when there are multiple units and a unit is highlighted.]
Display context sensitive help	F1 or Alt+F1
If you have multiple 3ware controllers in your system, return to the board selection screen.	Esc

Table 4: Working in 3BM

To do this	Use these keys
Exit the utility and save or abandon all changes.	Esc
Exit the utility and save all changes	F8

Specifying the Unit Configuration

You can implement one or more units of supported RAID levels on a single controller, depending on the number of drives that the specific 3ware RAID controller supports and the number of drives attached.

Basic Steps for Creating a Unit

The process of configuring your RAID units includes these main steps, which are detailed in the step-by-step example:

- Select the drives to be included and indicate that you want to create a disk unit
- Choose the desired RAID configuration
- Set other parameters, depending on the type of RAID configuration
- Confirm the unit configuration
- Save your changes

To select the drives and create a disk unit

- 1 Select the drives to be included by highlighting each one and pressing **Enter** to select it.

When you select a drive, an asterisk appears next to it in the left-most column (see Figure 10).

You may include from one to twelve drives in the unit, depending on the number available. (For information about how many drives to select for a given RAID level, see Table 2 on page 31.)

Note: To include drives that are part of an existing unit you must first delete the other unit. Be cautious in doing this, as any existing data on that unit will be overwritten.

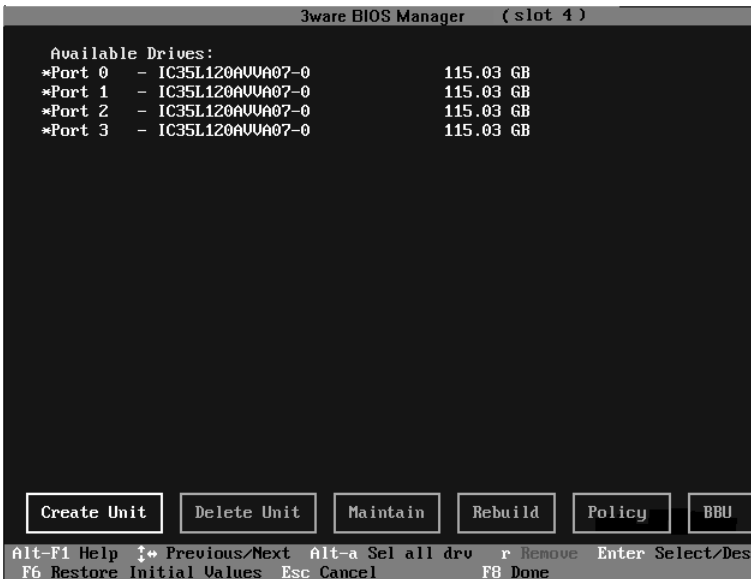


Figure 10. Asterisks Next to Selected Drives

- 2 After all drives for the unit are selected, use the **Tab** or **Right Arrow** key to move to the **Create Unit** button and press **Enter**.

The **Create Disk Array** screen appears (see Figure 11 and Figure 12 for examples).

- 3 Make sure that the proper drives are listed.

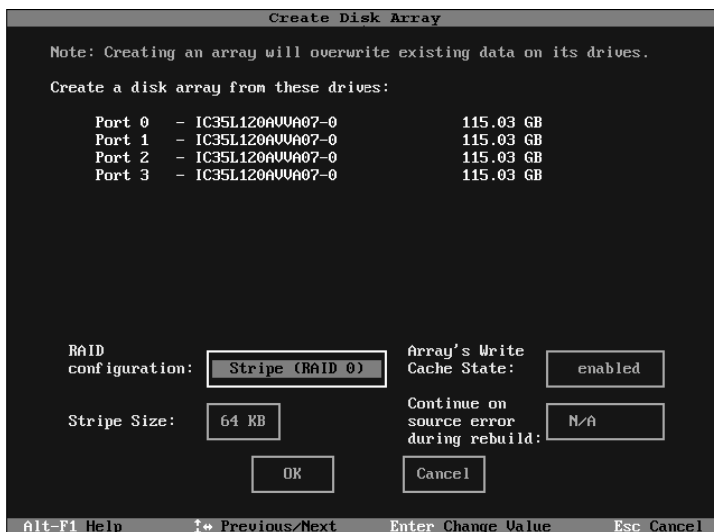


Figure 11. Create Disk Array Display, RAID 0 Example

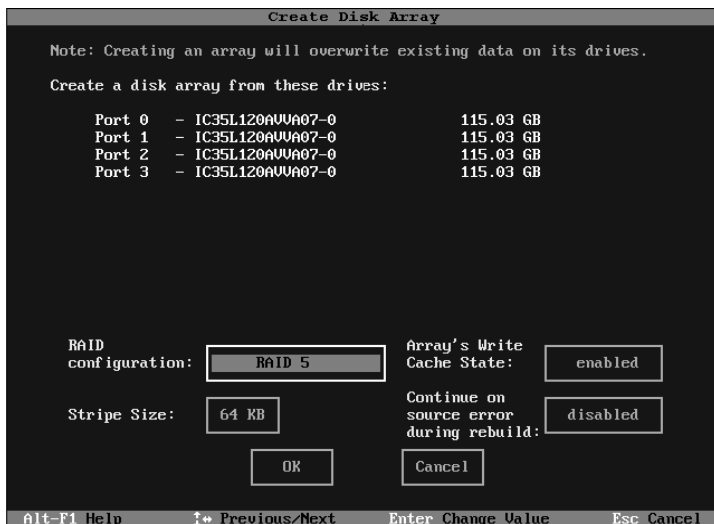


Figure 12. Create Disk Array Display, RAID 5 Example

To select the desired RAID configuration

- 1 Press **Enter** in the RAID Configuration field to display the available RAID levels for the number of drives you selected.



Figure 13. List of Configuration Choices for Four Drives

- 2 Use the **arrow keys** to highlight the desired RAID configuration and press **Enter**.

For information about the different RAID levels and when to use each, see “Understanding RAID Concepts and Levels” on page 28.

To enable or disable write cache and set striping size

The write cache and striping size parameters depend on the type of RAID level you selected.



Note: You can enable or disable the write cache again later without affecting the configuration. However, you cannot change the stripe size later without reconfiguring the unit.

- 1 Use the arrow keys or press **Tab** to move to the field **Array’s Write Cache State**.
- 2 Select whether you want the write cache to be enabled or disabled for this unit.

The default is for write cache to be enabled. For more information about write cache, see page 31.
- 3 Press **Tab** to move to the field **Stripe Size** and select the desired stripe size (16KB, 64KB, or 256KB).

Note: Striping size is not applicable for RAID 1, because it is a mirrored array without striping.

In general, use smaller stripe sizes for sequential access (such as video access) and larger stripe sizes for random access (such as a database).

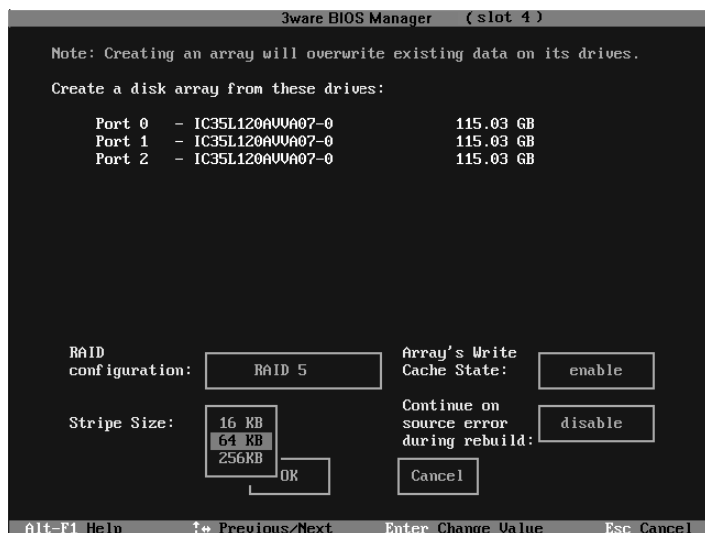


Figure 14. Stripe Sizes for a RAID 5

For information about the field “Continue on Source Error,” see the *3ware 9000 Series Serial ATA RAID Controller User Guide*.

To confirm unit configuration

- 1 Press **Tab** to select the **OK** button and press **Enter** to confirm creation of the unit.

Or, if you want to cancel the creation of the unit, tab to **Cancel** and press **Enter**.

The unit is not actually created and no data is overwritten until you have finished making all your changes and press **F8**.

- 2 If you have additional drives, go ahead and configure an additional RAID unit or designate a hot spare. Then continue on with the next section. (For details about hot spares, see page 46.)
- 3 If you configured more than one unit, and you plan to install the operating system on one of them, make that unit be the first unit (Unit 0) in the list of Exportable Units.

To move a unit up in the list, highlight it and press the **Page Up** key.

- 4 When you are finished configuring units, press **F8** to save the changes and exit 3BM.

A warning message asks you to confirm that all existing data on the drives will be deleted.

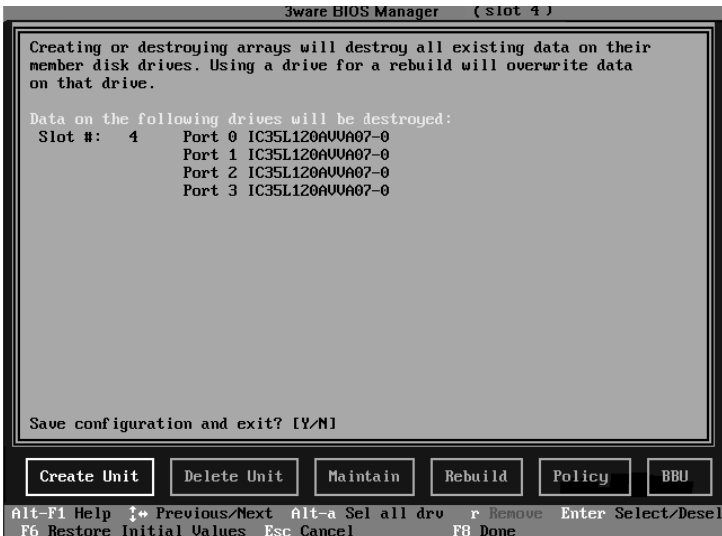


Figure 15. Confirmation Message when Saving and Exiting

- 5 Type **Y** to continue, delete any existing data on the drives, and create the unit.

Depending on the RAID configuration you are creating, initialization of the unit may begin immediately. For details, see “Initializing Units” on page 49.

Specifying a Hot Spare

You can designate one of the **Available Drives** as a hot spare in 3BM. If a hot spare is specified and a redundant unit degrades, an event notification will be generated. The hot spare will automatically replace the failed drive without user intervention.

To specify a hot spare

- 1 In the list of **Available Drives**, highlight the drive to use.
- 2 Type **s** to specify that the selected drive will be the hot spare.

You’ll see the words “Hot Spare” appear next to the drive in the Available Drives list.

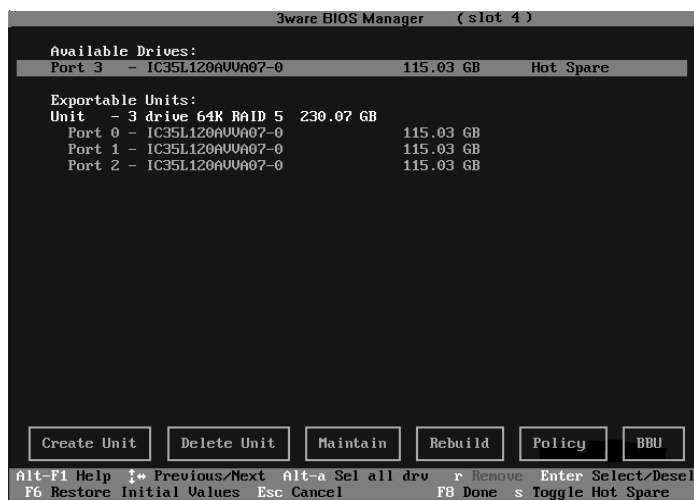


Figure 16. Hot Spare Indicated

If a hot spare is already enabled, you can disable it by following the same process.



Note: In order to replace a failed drive in a degraded unit, a hot spare drives must have the same or larger storage capacity than the failed drive.

Enabling Auto-Carving for Units Larger Than 2 TB

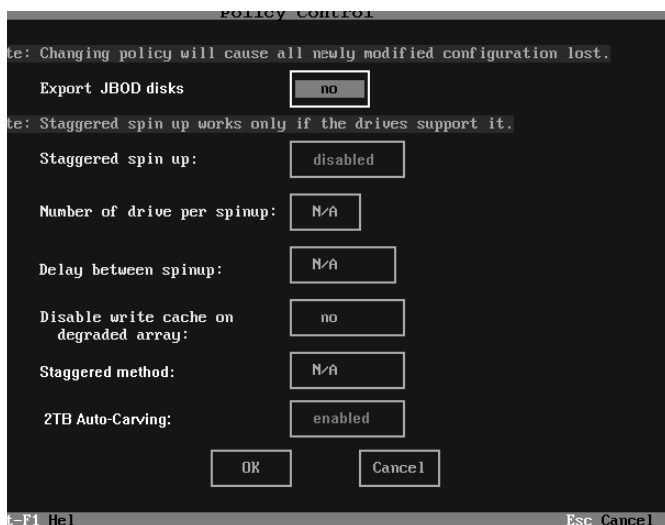
If the capacity of your unit exceeds 2TB and you are using one of the following operating systems, you will need to enable auto-carving in order to make use of the full capacity:

- Windows 2000
- Windows XP
- Linux 2.4
- FreeBSD 4.x

You must turn on the 2TB Auto-Carving policy before creating the unit. Units created with this policy turned off will not be affected. If the policy is turned off later, units that have been carved into volumes will retain their individual volumes; existing data is not affected.

To enable auto-carving

- 1 At the main 3BM screen, tab to **Policy** and press **Enter**.
- 2 On the Policy screen, tab to **2TB Auto-Carving**, and change the setting to “Enabled.”



- 3 Tab to **OK** and press **Enter**.

After you start your system, you will see multiple volumes available in the operating system: 2 TB each, plus one volume with any remaining storage beyond the multiple of 2TB. (In this release, 3BM does not show individual volumes.)

Leaving Individual Drives as JBODs

By default, if you leave individual drives unconfigured (JBODs), they will not be available to the operating system. If you want to be able to use individual drives, configure them as single-disk units.

If you have JBODs attached to an 8000 controller that you want to use with the 9000 controller, see “Moving Units from an 8000 Controller to a 9000 Controller” on page 23.

Initializing Units

Performance of RAID 5 units with 5 or more disks, and RAID 50 units with 10 or 12 disks configured into two subunits will improve after the unit has been initialized. For these configurations, foreground initialization (also known as “zeroing”) starts immediately. If you want to begin using the units right away, you can halt the zeroing process and initialize them in the background later, after the operating system is booted. (The initialization process can take several hours, depending on the size of your drives.) The disadvantage of initializing the units later in the background is that the performance RAID 5 and RAID 50 arrays will be lower until initialization is complete.

Information about initialization for each of the different RAID types is described below.

RAID 0 Units

RAID 0 units do not need to be initialized and are immediately available for use with full performance when created.

For RAID 5 and RAID 50 Units

RAID 5 units with 3 or 4 disks do not need to be initialized and are fault tolerant upon creation. Similarly, RAID 50 units with 6, 8, or 9 disks, and RAID 50 with 12 disks configured into 3 subunits of 4 or 4 subunits of 3, do not need to be initialized. This is because these configurations use an optimized writing technique which does not have to be valid to provide fault tolerance.

RAID 5 units with 5 or more disks, and RAID 50 units with 10 or 12 disks configured into two subunits do need to be initialized for full performance. For these configurations, initialization begins automatically after you create them in the 3BM utility. Zeroes are written to all unit members.

If you want to use a RAID configuration which has started initializing, press **Esc** to cancel the progress box. You can then exit 3BM and boot to the operating system before the process of writing zeroes to the drives is complete. Once you have booted to the operating system, initialization of the RAID 5 or RAID 50 unit will begin after a delay of up to ten minutes.

When initializing is done after booting to the operating system, the process of initializing takes longer than it does if initialization is done by writing zeroes to the array in the BIOS. Consequently, it will be a longer period of time until the performance of the unit is fully optimal. Data remains intact when initialization is done in the operating system.

For RAID 1 and RAID 10

RAID 1 and RAID 10 units are not initialized when they are created and are immediately available for use with full performance when created.

Initialization of RAID 1, RAID 10, RAID 5 with 3 or 4 disks, RAID 50 with 6, 8, or 9 drives, and RAID 50 with 12 drives configured in 3 subunits of 4 each or 4 subunits of 3 each will take place the first time the array is verified, either via 3BM, through 3ware 3DM 2, or through the 3ware CLI. The steps below describe how to do this through the BIOS (3BM). For information about using 3DM 2, see *3ware 9000 Series Serial ATA RAID Controller User Guide*. For information about using the CLI, see *3ware Escalade 9000 Series Serial ATA RAID Controller CLI Guide*.

To start initialization through Verify in 3BM

- 1 Reboot and restart 3BM.
- 2 Select the array you want to verify. (Highlight it and press **Enter**.)
- 3 **Tab** to **Maintain Array** and press **Enter**.

- 4 On the Maintain Disk Array screen, **Tab** to **Verify Array** and change the selection to **Yes**.
- 5 **Tab** to **OK** and press **Enter**.

Initialization of the unit begins.

Initialization of a RAID 1 unit results in data from one disk (the disk on the lower channel number) being copied to the other disk. In RAID 10 units, data from one half of the array is copied to the other half.

After the initial verification, subsequent verifies to a RAID 1 or 10 unit check for data consistency by comparing the data from one drive (or set of drives) to the other drive (or set of drives).

Checking the Motherboard Boot Sequence

Using your computer's Setup utility, ensure that it shows the appropriate boot device.

After installing the 3ware 9000 controller in your system, go into the BIOS for your computer system to check and change the boot order. This is necessary because most systems automatically change the boot order when they detect a newly installed controller and device. Refer to the documentation for your system for information about starting the system BIOS.

- **If the OS is already installed on a unit connected to the system**, be sure that device precedes the 3ware RAID controller in the boot sequence. If you have other disks installed on the motherboard, the 3ware RAID controller should precede them in boot order.
- **If you will install your OS on a disk or array attached to the 3ware RAID controller**, specify the controller as the boot device. (Note that if you configured more than one unit, the drive(s) specified as Unit 0 will be treated as the boot disk.)

Installing Drivers and Making the Units Available For Use

The final steps in setting up your RAID arrays are to load the 3ware drivers and make the units available to your operating system.

- Will the unit you have created be your system's boot device?
If so, you will install the driver for the controller as you install the operating system.
- Is the OS already installed on a unit connected to another controller or to the motherboard?

If so, you will start the OS and then install the driver.

Details for both situations are described in the next sections of this guide, under Windows Installation (see page 53), Linux Installation (see page 65), and FreeBSD Installation (see page 87).

Driver Installation Under Windows



Note: Before installing the 3ware driver, you must have already installed your 3ware RAID controller in the system.

The 3ware RAID controller can be used with Microsoft Windows 2000 (SP3 or newer), Windows XP (SP1 or newer), and Windows Server 2003. Windows 2003 64-bit for AMD Opteron is also supported. It is recommended that you upgrade to the latest service pack available.

A drive or unit managed by the 3ware RAID controller may be configured to be your system's boot device. Or, you can use another device as your boot device, such as a disk attached to the motherboard.

This chapter contains instructions for how to:

- Create a driver diskette for the 3ware RAID controller
- Install the 3ware driver and Windows on a new drive or unit.
- Install the 3ware driver when Windows is already installed on a different device.

Note: You must have administrator privileges for your system to install the Windows operating system and the 3ware driver.

Materials Required

- 3ware software CD-ROM
- Microsoft Windows 2000, XP, or Server 2003 installation CD-ROM. (Not required if Windows is already installed on another drive.).
- Floppy diskette, to create a driver diskette.

If you are installing Windows, you must create a 3ware driver diskette. If Windows is already installed on another device, you may install the 3ware driver from either the 3ware software CD-ROM or from a diskette.

Creating a 3ware Driver Diskette

If you are installing Windows on a new unit or drive managed by the 3ware RAID controller, you must create a 3ware driver diskette.

To create a driver diskette

- 1 Insert the 3ware software CD into your system.
- 2 When the 3ware Escalade Menu appears, click **Driver and Firmware Disks**.

- 3 In the 3ware Driver & Firmware Images menu, click the appropriate button to create the driver diskette that you need.

Note that there are both 32-bit and 64-bit AMD drivers available for Windows. Be sure to select the correct one.

- 4 When the confirm message appears, insert a blank diskette into a floppy drive and click the **Yes** button to begin the process.

Installing the 3ware Driver and Windows on a New Unit

If you want to install Windows on a new drive configuration managed by the 3ware RAID controller, follow the instructions in this section.

If Windows is already installed on another drive, turn to “Installing the Driver on a System that Boots from a Different Device” on page 56.

To install Windows and the 3ware driver

- 1 Boot from the Windows 2000, Windows XP, or Windows Server 2003 CD and press **F6** when you see the message: “Press F6 if you need to install a 3rd party SCSI or RAID driver” at the bottom of the display.
- 2 When you see the message: “Setup could not determine the type of one or more mass storage devices or you have chosen to manually specify an adapter...”
Type **S** to specify that you have an additional 3ware RAID controller.
- 3 Insert the 3ware driver diskette and press **Enter**.
- 4 When a box with **AMCC 3ware Series ATA RAID Controller** appears, press **Enter** to select it.

- 5 Type **S** if you have additional devices to add. Otherwise, press **Enter**.
- 6 If the “Digital Signature Not Found” message appears, click **Yes** to continue the installation.

(If there are multiple controllers in the system, you will see this message once for each controller.)
- 7 Continue with the normal Windows installation at this point. There are no instructions after installing the driver that are specific to 3ware. If you need additional instructions, refer to the Windows 2000, Windows XP, or Windows Server 2003 documentation supplied by Microsoft.
- 8 Turn to page 56 and follow the instructions for “Making Units Managed by a 3ware Controller Available to Windows”.

Installing the Driver on a System that Boots from a Different Device

If you are installing the 3ware RAID controller on a system that already has the operating system installed on another drive, follow the instructions in this section, depending on the version of Windows installed on your system:

- “To install the 3ware driver under Windows 2000” on page 57
- “To install the 3ware driver under Windows XP or 2003” on page 60

To install the 3ware driver under Windows 2000

When you start Windows after installing a 3ware RAID controller, Windows recognizes it as a Plug and Play device, and brings up the **Found New Hardware Wizard**. This wizard guides you through installing the 3ware drivers (see Figure 17). Note that you will see screens for the installation of two drivers during this process.



Figure 17. Found New Hardware Wizard, Windows 2000

- 1 Click the **Next** button and respond to the questions the Wizard displays using the default selections.
- 2 When the Wizard prompts you to select a device driver, click Have Disk, and then indicate that it is on the CD or floppy.
- 3 If the “Digital Signature Not Found” message appears, click **Yes** to continue the installation.

- 4 When the Completing the Found New Hardware Wizard screen appears (Figure 18), click **Finish**.

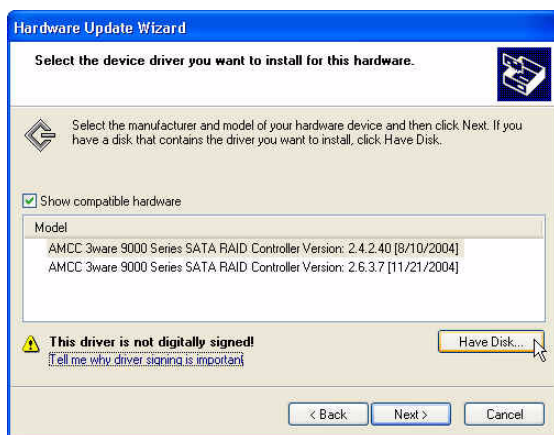


Figure 18. Completing Found New Hardware Wizard

- 5 If the “Completing” screen similar to Figure 18 indicates that you should restart your computer, do so now.

- When the Install Hardware Device Drivers screen appears (Figure 19), click **Next** and follow the prompts on the screen to install the second driver.

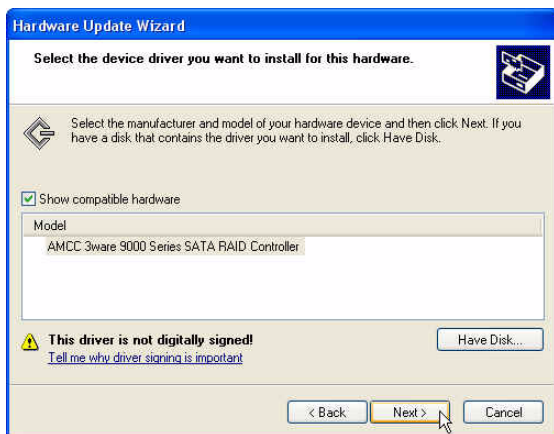


Figure 19. Install Hardware Device Drivers

- When the second Completing the Found New Hardware screen appears, click **Finish**.



Figure 20. Completing Found New Hardware Wizard

After the driver has been installed, continue with the instructions under “Making Units Managed by a 3ware Controller Available to Windows” on page 63.

To install the 3ware driver under Windows XP or 2003

When you start Windows after installing a 3ware RAID controller, Windows recognizes it as a Plug and Play device, and brings up the **Found New Hardware Wizard**. This wizard guides you in installing the 3ware drivers (see Figure 21). Note that you will see screens for the installation of two drivers during this process.



Figure 21. Found New Hardware Wizard, Windows XP and 2003

- 1 Click the **Next** button and respond to the questions the Wizard displays.
- 2 When the Wizard prompts you to select a device driver, click **Have Disk**, and then indicate that it is on the CD or floppy.
- 3 If the “Digital Signature Not Found” message appears, click **Yes** to continue the installation.

- 4 When the Completing the Found New Hardware Wizard screen appears (Figure 22), click **Finish**.

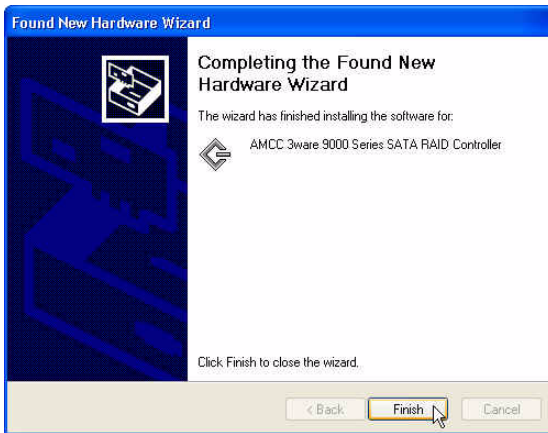


Figure 22. Completing Found New Hardware Wizard

- 5 If the “Completing” screen similar to Figure 22 indicates that you should restart your computer, do so now.
- 6 When the Welcome to the Found New Hardware Wizard screen appears again (Figure 23), click **Next** and follow the prompts on the screen to install the second driver.



Figure 23. Welcome to the Found New Hardware Wizard

- 7 When the second Completing the Found New Hardware screen appears, click **Finish**.



Figure 24. Completing Found New Hardware Wizard

After the driver has been installed, continue with the instructions below under “Making Units Managed by a 3ware Controller Available to Windows” on page 63.

Making Units Managed by a 3ware Controller Available to Windows

After the 3ware driver has been installed, you need to partition and format the new units or disks.

- 1 Remove the driver diskette or CD, reboot the system, and log in as the system administrator.
- 2 Use **Disk Administrator** to partition and format the new arrays or disks:
 - a From the **Start** menu, choose **Administrative Tools > Computer Management**.
 - b In the Computer Management window, under **Storage**, select **Disk Management**.

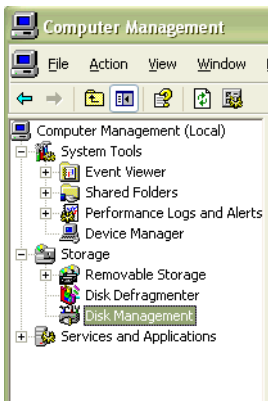


Figure 25. Computer Management Screen

- 3 Follow the steps that appear on the screen to write a signature to the drive.
- 4 Right-click on the drive and select **Create Volume**.
- 5 Follow the steps the appear on-screen to create a volume and to assign a drive letter.

Finishing Up

Your RAID unit is now ready for use.

You may also want to install 3ware's browser-based Disk Management tool, 3DM 2, or the 3ware Command Line Interface (CLI). With 3DM 2 and CLI, you can maintain your RAID units while running Windows. For more information, see the *3ware 9000 Series Serial ATA RAID Controller User Guide* and the *3ware Escalade 9000 Series Serial ATA RAID Controller CLI Guide*.

Driver Installation Under Linux



Note: Before installing the 3ware driver, you must have already installed your 3ware RAID controller in the system.

A drive or unit managed by the 3ware RAID controller may be configured to be your system's boot device. Or, you can use another device as your boot device, such as a disk attached to the motherboard.

The steps you follow to install the driver and make your RAID unit available depend on which version of Linux you are using, and whether it will be your boot device. This chapter provides step-by-step instructions for the following situations:

- Red Hat Linux Installation
 - Installing the 3ware driver and Red Hat Linux on a new drive or unit (page 68).
 - Installing the 3ware driver on a system that boots Red Hat Linux from a different device (page 70).
- SuSE Linux Installation
 - Installing the 3ware driver and SuSE Linux with YaST2 on a new drive or unit (page 81).
 - Installing the 3ware driver on a system that boots SuSE Linux from a different device (page 81).

If you are using a Linux distribution for which there is not a compiled driver available from 3ware, you can copy the source from the 3ware software CD or download the source from the 3ware website and compile a new driver. For more information, see “Compiling a 3ware Driver for Red Hat Linux” on page 77 and “Compiling a 3ware Driver for SuSE Linux” on page 83.

For information about upgrading a driver that is already loaded, see *3ware 9000 Series Serial ATA RAID Controller User Guide*.

Obtaining 3ware Linux Drivers

Obtain the 3ware driver for Linux from one of these two sources:

- **3ware software CD-ROM.** Compiled and tested drivers for Red Hat and SuSE Linux are included on this CD.
- **3ware web site.** You can download the latest compiled and tested driver for RedHat or SuSE Linux from the 3ware web site at <http://www.3ware.com>. Included in these downloads is the Linux driver source, which you can use to compile the latest driver for RedHat, SuSE, and other versions of Linux.

Although the drivers are also available in external Linux distributions and from open source at www.kernel.org, those drivers do not include the firmware image, which updates the BIOS in the controller. It is recommended that you use the drivers from the 3ware CD or web site, because they have a bundled firmware image.

Be Sure to Use the Correct Drivers

The Linux 3w-9xxx drivers included on the 3ware CD are only for 3ware 9000 series controllers. 3ware 7/8000 series controllers use a Linux driver labeled 3w-xxxx. The drivers for the 9000 series controllers and the 7/8000 series controllers are not interchangeable, but can be used together when both controller types are installed in the same system. The examples in this manual

refer only to the 9000 series driver. For information about using the 7/8000 driver and controller, refer to the user guide or installation procedure for the 7/8000-series controller.



Warning: Be sure to use the correct driver for your processor.

Be sure you load the correct driver on your system. It is possible to load the wrong driver onto a system, however when you boot such systems, they will not work.

For Red Hat, AMCC offers the following drivers:

- x86 32-bit for Intel x86
- x86 32-bit for AMD Athlon
- amd 64-bit, used for both AMD Opteron and Intel 64-bit Xeon (EM64T)

For SuSE, AMCC offers the following drivers:

- x86 32-bit, for Intel x86 and AMD Athlon
 - amd 64-bit, for AMD Opteron and Intel 64-bit Xeon (EM64T)
-

Determining the Current Version of your 3ware Driver

If you already have a 3ware controller installed, you can check the current driver version.

If you have a 2.4 kernel or earlier, type the following command:

```
cat /proc/scsi/3w-9xxx/*
```

where the asterisk (*) represents SCSI host ID and “9xxx” represents the family of the controller. For example:

```
cat /proc/scsi/3w-9xxx/0
```

If you have a 2.6 kernels with sysfs, type the following command:

```
cat /sys/class/scsi_host/<hostid>/stats
```

where <hostid> is usually host0, unless other SCSI devices are available, in which case it may be host1 or higher.

If you have a 2.6 kernel without sysfs, type the following command:

```
dmesg | grep 3w
```

(dmesg can also be used with earlier kernel versions.)

Driver Installation Under Red Hat Linux

Materials Required

- 3ware software CD-ROM
- Floppy diskette, if you need to create a driver diskette.
- Red Hat Linux installation CD-ROM and boot disk. (Not required if Red Hat Linux is already installed on another drive.)

Creating a Red Hat Linux Driver Diskette

If you are installing Linux on the new drive or unit managed by the 3ware RAID controller, you must create a 3ware driver diskette. If Linux is already installed on another device, you may install the 3ware driver from either the 3ware software CD-ROM or make a driver diskette.

To create a driver diskette

- 1 Insert the 3ware software CD into your system.
- 2 When the 3ware Escalade Menu appears, click the **Driver & Firmware Disks** button.
- 3 In the 3ware Driver & Firmware Disk Images menu, click the button for the driver disk you want to create.
A confirmation window opens.
- 4 Insert a blank diskette into a drive and click the **Yes** button to begin creating the driver floppy diskette.

Installing the 3ware Driver and Red Hat Linux on a New Unit

Note: If Red Hat Linux is already installed and bootable on another drive, turn to “Installing the 3ware Driver on a Red Hat Linux System that Boots From a Different Device” on page 70.



Note: We have tested some older systems where an IDE drive connected to the motherboard interfered with using a drive or unit managed by the 3ware RAID controller as a boot device. Disconnecting the IDE drive while installing Linux will eliminate this problem. After Linux is installed, the drive can be reconnected.

- 1 Boot with the Red Hat CD or diskette:
 - a Insert either the Red Hat CD-ROM disk or a Red Hat boot diskette into your computer.
 - b Start or reboot your computer.
 - c When the **Welcome to Red Hat** display appears, type `expert` at the boot prompt.
`boot: expert`

A number of files will load and then a message will prompt you to insert your driver disk.

- 2 Install the driver:

Insert the driver diskette containing the 3ware driver for Red Hat and press **Enter**.

The system automatically reports:

```
Loading 3w-9xxx driver
```

- 3 When prompted, select the proper language and keyboard types for your locality.
- 4 If asked for what type of media, select **Local CD-ROM** since you are installing from the Red Hat CD-ROM.

Installing the 3ware Driver on a Red Hat Linux System that Boots From a Different Device

The steps for installing the 3ware driver vary slightly, depending on your specific installation requirements. Select the appropriate set of steps below, based on whether:

- You want to update the RAM disk
- You prefer to load the driver manually or from a script, instead of updating the RAM disk

About Variables In the Driver Installation Instructions

These conventions are used for variable text for kernel strings and module names in the instructions on the following pages.

Kernel String Conventions

<kernel string> refers to the kernel version.

The kernel string will have different endings, depending on the kernel you are using.

- For an SMP kernel (multi-processor), the kernel string will end in `smp`. For example: `2.4.18-14smp`.
- For an Enterprise kernel, the kernel string will end in `enterprise`. For example: `2.4.18-14enterprise`
- For a Bigmem kernel, the kernel string will end in `bigmem`. For example: `2.4.18-14bigmem`
- For a Hugemem kernel, the kernel string will end in `hugemem`. For example: `2.4.18-14hugemem`

Module Naming Conventions

`3w-9xxx.*` refers to the specific module you will copy in the examples shown in steps 3 and 4.

The name of the module you will copy (`3w-9xxx.*`) varies, depending on the kernel; however you will always copy it to a file named `3w-9xxx.o` for 2.4 kernels, or `3w-9xxx.ko` for 2.6 kernels.

The available module files are:

- For UP kernels: `3w-9xxx.o`
- For SMP kernels: `3w-9xxx.smp`
- For Enterprise kernels: `3w-9xxx.ent`
- For Bigmem kernels: `3w-9xxx.big`
- For Hugemem kernels: `3w-9xxx.hug`
- For IA32E kernels: `3w-9xxx.i32`

To install the 3ware driver and update the RAM disk

- 1 Log in as root and open a console window.
- 2 Mount the CD which contains the 3ware driver:

To mount the CD, type: `mount /dev/cdrom`
and press Enter.

- 3 Copy the driver:

For Redhat workstation on Intel x86, type:

```
cp /mnt/cdrom/packages/drivers/linux/redhat/  
ws3_u3/x86_intel/3w-9xxx.* /lib/modules/  
<put kernel string here>/kernel/drivers/scsi/  
3w-9xxx.o
```

If prompted to overwrite, type `y`.

For Redhat workstation on AMD Athlon 32-bit, type:

```
cp /mnt/cdrom/packages/drivers/linux/redhat/  
ws3_u3/x86_athlon/3w-9xxx.*  
<put kernel string here>/kernel/drivers/scsi/  
3w-9xxx.o
```

If prompted to overwrite, type `y`.

For Redhat workstation on AMD Opteron and Intel EM64T, type:

```
cp /mnt/cdrom/packages/drivers/linux/redhat/  
ws3_u3/x86_64/3w-9xxx.*  
<put kernel string here>/kernel/drivers/scsi/  
3w-9xxx.ko
```

If prompted to overwrite, type `y`.

- 4 If you installed a previous driver when you installed your operating system, then perform this step to copy the driver into the update directory, as well. Otherwise, go on to Step 5.

For Redhat workstation on Intel x86, type:

```
cp /mnt/cdrom/packages/drivers/linux/redhat/  
ws3_us/x86_intel/3w-9xxx.* /lib/modules/  
<put kernel string here>/update 3w-9xxx.o
```

If prompted to overwrite, type *y*.

For Redhat workstation on AMD Athlon 32-bit, type:

```
cp /mnt/cdrom/packages/drivers/linux/redhat/  
ws3_us/x86_athlon/3w-9xxx.* /lib/modules/  
<put kernel string here>/update 3w-9xxx.o
```

If prompted to overwrite, type *y*.

For Redhat workstation on AMD Opteron and EM64T, type:

```
cp /mnt/cdrom/packages/drivers/linux/redhat/  
ws3_us/x86_64/3w-9xxx.* /lib/modules/  
<put kernel string here>/update 3w-9xxx.ko
```

If prompted to overwrite, type *y*.

Note: Use the appropriate module name and kernel string, as described under “About Variables In the Driver Installation Instructions” on page 71.

- 5 **For 2.4 Kernels**, add the following line to `/etc/modules.conf`:

```
alias scsi_hostadapter 3w-9xxx.o
```

For 2.6 Kernels, add the following line to `/etc/modprobe.conf`

```
alias scsi_hostadapter 3w-9xxx.ko
```

- 6 Update the `modules.dep` file, by issuing the following command:

```
Run /sbin/depmod -a
```

- 7 Run `mkinitrd` by entering the following:

```
/sbin/mkinitrd -v -f /boot/initrd-<kernel string>.img  
  <kernel string1>
```

where `<kernel string1>` is the `/lib/modules` directory from which to copy the 3w-9xxx driver.

Example:

```
/sbin/mkinitrd -v -f /boot/initrd-2.4.18-14.img  
  2.4.18-14
```

- 8 If you are using the GRUB boot loader, skip to Step 5.

If you are using the LILO boot loader, run LILO to update the boot record on disk by typing the following:

```
/sbin/lilo
```

The output should be similar to:

```
Added linux *
```

- 9 Reboot.

The 3ware driver will be loaded from the ram disk automatically at boot time.

To install the 3ware driver and load the driver manually instead of using a RAM disk

- 1 Log in as root and open a console window.
- 2 Mount the CD which contains the 3ware driver:

To mount the CD, type: `mount /dev/cdrom`

and press Enter.

3 Copy the driver:

For Redhat workstation on Intel x86, type:

```
cp /mnt/cdrom/packages/drivers/linux/redhat/  
ws3_u3/x86_intel/3w-9xxx.* /lib/modules/  
<put kernel string here>/kernel/drivers/scsi/  
3w-9xxx.o
```

If prompted to overwrite, type *y*.

For Redhat workstation on AMD Athlon 32-bit, type:

```
cp /mnt/cdrom/packages/drivers/linux/redhat/  
ws3_u3/x86_athlon/3w-9xxx.* /lib/modules/  
<put kernel string here>/kernel/drivers/scsi/  
3w-9xxx.o
```

If prompted to overwrite, type *y*.

For Redhat workstation on AMD Opteron and EM64T, type:

```
cp /mnt/cdrom/packages/drivers/linux/redhat/  
ws3_u3/x86_64/3w-9xxx.* /lib/modules/  
<put kernel string here>/kernel/drivers/scsi/  
3w-9xxx.ko
```

If prompted to overwrite, type *y*.

Note: Use the appropriate module name and kernel string, as described under “About Variables In the Driver Installation Instructions” on page 71.

4 If you installed a previous driver when you installed your operating system, then perform this step to copy the driver into the update directory, as well. Otherwise, go on to Step 5.

For Redhat workstation on Intel x86, type:

```
cp /mnt/cdrom/packages/drivers/linux/redhat/  
ws3_u3/x86_intel/3w-9xxx.* /lib/modules/  
<put kernel string here>/update 3w-9xxx.o
```

If prompted to overwrite, type *y*.

For Redhat workstation on AMD Athlon 32-bit, type:

```
cp /mnt/cdrom/packages/drivers/linux/redhat/  
ws3_u3/x86_athlon/3w-9xxx.* /lib/modules/  
<put kernel string here>/update 3w-9xxx.o
```

If prompted to overwrite, type *y*.

For Redhat workstation on AMD Opteron and EM64T, type:

```
cp /mnt/cdrom/packages/drivers/linux/redhat/  
ws3_u3/x86_64/3w-9xxx.* /lib/modules/  
<put kernel string here>/update 3w-9xxx.ko
```

If prompted to overwrite, type *y*.

Note: Use the appropriate module name and kernel string, as described under “About Variables In the Driver Installation Instructions” on page 71.

- 5 Add the following line to /etc/modules.conf:

```
alias scsi_hostadapter 3w-9xxx
```

- 6 Update the modules.dep file, by issuing the following command:

```
Run /sbin/depmod -a
```

- 7 Load the driver manually.

```
Type: modprobe 3w-9xxx
```

You can also incorporate the insmod command into a startup script.

Compiling a 3ware Driver for Red Hat Linux

For Experts Only

If necessary, you can compile the 3ware driver yourself. (For example, if you are running a different kernel version.)

Notes:

You must have a full Linux kernel source tree in `/usr/src/linux` in order to do the compile.

In addition, you must boot to the UP kernel to use the make targets. Otherwise errors will result that will cause the driver build to fail.

The instructions below are for compiling the driver under a 2.4 kernel. For information about compiling the driver under a 2.6 kernel, see the Knowledgebase on the website at www.3ware.com

- 1 Download the 3ware driver source from 3ware's website.
- 2 Copy the driver source into a working directory. (The latest 3ware driver source is bundled with the latest firmware.)
- 3 Untar the driver source with this command:

```
tar xzfv 3w-9xxx.tgz
```

The driver source will be output to a directory called driver.
- 4 Change directory to driver.

```
cd driver
```
- 5 Red Hat 7.2 and later support multiple build targets from makefile. Boot to UP version of kernel to build all modules.

Note: In the commands below, remember that the text you enter is case sensitive. (Be sure to type `Makefile.rh`, not `makefile.rh`.)

To build UP module, type:

```
make -f Makefile.rh
```

The file created is `3w-9xxx.o` for 2.4 kernels, and `3w-9xxx.ko` for 2.6 kernels.

To build SMP module, type:

```
make smp -f Makefile.rh
```

The file created is `3w-9xxx.smp`

To build Enterprise module, type:

```
make ent -f Makefile.rh
```

The file created is `3w-9xxx.ent`

To build Bigmem module, type:

```
make big -f Makefile.rh
```

The file created is `3w-9xxx.big`

To build Hugemem module, type:

```
make hug -f Makefile.rh
```

The file created is `3w-9xxx.hug`

To build Boot module

(this is used when creating a driver for the 32-bit driver diskette), type:

```
make bot -f Makefile.rh
```

The file created is `3w-9xxx.bot`

To build IA32E module

(this is used when creating a driver for the x86_64/EM64T 64-bit driver diskette), type:

```
make ia32e -f Makefile.rh
```

The file created is `3w-9xxx.i32`

- 6 Copy the module as follows:

For 2.4 kernels, copy module to:

```
/lib/modules/<kernel string>/kernel/drivers/scsi/  
3w-9xxx.o
```

- 7 If you installed a previous driver when you installed your operating system, then perform this step to copy the driver into the update directory, as well.

```
/lib/modules/<kernel string>/update/3w-9xxx.o
```

Driver Installation Under SuSE Linux

Materials required

- 3ware software CD-ROM
- Floppy diskette, if you need to make a driver diskette.
- SuSE Linux Installation CD-ROM/DVD (Not required if SuSE Linux is already installed on another drive.)

Creating a SuSE Linux Driver Diskette

If you are installing Linux on the new drive or unit managed by the 3ware RAID controller, you must create a 3ware driver diskette. If Linux is already installed on another device, you may install the 3ware driver from the 3ware software CD-ROM.

To create a driver diskette

- 1 Insert the 3ware software CD into your system.
- 2 When the 3ware Escalade Menu appears, click **Driver and Firmware Disks**.
- 3 In the 3ware Driver and Firmware Disk Images menu, click the button for the driver disk you want to create.
A confirmation window opens.
- 4 Insert a blank diskette into a drive and click the **Yes** button to begin copying the driver to the floppy diskette.

Installing the 3ware Driver and SuSE Linux with YaST2 on a New Unit



Note: If SuSE Linux is already installed on another drive, turn to “Installing the 3ware Driver on a SuSE Linux System that Boots from a Different Device” on page 81.

- 1 Boot directly from the SuSE installation CD #1 or DVD.
- 2 **When installing SuSE**, press the **F6** key
You will then be prompted to insert the driver disk.
- 3 Insert the 3ware Linux driver installation diskette.
- 4 Click **OK** and continue with installation.

Installing the 3ware Driver on a SuSE Linux System that Boots from a Different Device

- 1 Log in as root.
- 2 Edit `/etc/sysconfig/kernel` and make sure the file contains the following line:

```
INITRD_MODULES="reiserfs 3w-9xxx"
```



Note: Other modules may be listed before or after `3w-9xxx`, depending on the installation. You may see entries like `reiserfs`, `ext3` or `scsi_mod`. If present, leave them (ensuring there is a space between each module name), since the system needs them to boot properly.



Note about variables: In the instruction below, replace <kernel string> with the kernel version you are using (i.e. 2.6, etc.), replace *** with your version of SuSE.

In addition, replace 3w-9xxx.* with the appropriate module file for your kernel. The available module files are:

For UP kernels: 3w-9xxx.ko

For SMP kernels: 3w-9xxx.smp

For BigSMP (high memory) kernels: 3w-9xxx.big

- 3 If you are using SuSE 9.1 or earlier, after the existing 3w-xxx entry, add

```
3w-9xxx to /lib/modules/<kernel string>/modules.dep  
file
```

- 4 Mount the CD-ROM, copy and install the appropriate driver for your system.

Note: The AMD 64-bit driver is also used for 64-bit Intel Xeon systems.

```
mount /dev/cdrom /cdrom  
cp /cdrom/packages/drivers/linux/suse/***/3w-9xxx.* /  
lib/modules/<kernel string>/kernel/drivers/scsi/  
/sbin/inmod /lib/modules/<kernel string>/  
kernel/drivers/scsi/3w-9xxx.ko
```

If the driver installation fails, confirm that the correct driver was installed from the CD-ROM. If a driver is not available for your system, you will need to compile your own driver, as described below.

- 5 Run `/sbin/depmod -a`
- 6 Type `/sbin/mkinitrd`

- 7 If you are using the GRUB boot loader, you are finished.

If you are using the LILO boot loader, run LILO to update the boot record on disk by typing the following:

```
/sbin/lilo
```

The output should be similar to:

```
Added linux *
```

Compiling a 3ware Driver for SuSE Linux

For Experts Only

If you wish to compile the driver yourself (for a different kernel version that you are running), then perform the following steps. (Note that the steps vary somewhat for 2.4 kernels and 2.6 kernels; instructions are provided for each.)

You must have a full Linux kernel source tree in `/usr/src/linux` in order to do the compile.

To compile a 3ware driver for SuSE Linux 2.4 kernels

- 1 Download the 3ware 2.4 driver source from the 3ware website (www.3ware.com) or copy the driver source from the CD into a working directory.

- 2 Install the Kernel source under `/usr/src`.

- 3 Create a symbolic link.

```
ln -s /usr/src/<Kernel Src Dir > /usr/src/linux
```

- 4 Change the directory to

```
cd /usr/src/linux
```

- 5 Copy the config file for the kernel you want to build module for from the appropriate /usr/src/linux/arch directory (listed below) to /usr/src/linux/.config.

kernel	directory
x86 UP	/usr/src/linux/arch/i386/defconfig.default
x86 SMP	/usr/src/linux/arch/i386/defconfig.smp4g
x86 ATHLON	/usr/src/linux/arch/i386/defconfig.athlon

- 6 Make oldconfig

- 7 Untar the driver source with this command:

```
tar zxfv 3w-9xxx.tgz
```

The driver source will be output to a directory called “driver”.

- 8 Change directory to driver.

```
cd driver
```

- 9 To build UP module boot to desired UP kernel, type:

```
make -f Makefile.oth
```

The created file is 3w-9xxx.o

- 10 To build SMP module boot to desired SMP kernel, type:

```
make smp -f Makefile.oth
```

The created file is 3w-9xxx.smp

- 11 Copy the module 3w-9xxx.o to the scsi directory.

```
/lib/modules/<kernel string>/kernel/drivers/scsi/  
3w-9xxx.o
```

- 12 Edit /etc/modprobe.conf and add

```
alias scsi_hostadapter 3w-9xxx
```

- 13 Load the module

```
modprobe 3w-9xxx
```

To compile a 3ware driver for SuSE Linux 2.6 kernels

- 1 Download the 3ware 2.6 driver source from the 3ware website (www.3ware.com).
- 2 Copy the driver source into a working directory. (The latest 3ware driver source is bundled with the latest firmware and is in the /src sub-directory.)
- 3 Install the Kernel source under /usr/src
- 4 Create a symbolic link.


```
ln -s /usr/src/<Kernel Src Dir > /usr/src/linux
```
- 5 Change the directory to


```
cd /usr/src/linux
```
- 6 Copy the config file for the kernel you want to build module for from the appropriate /usr/src/linux/arch directory (listed below) to /usr/src/linux/.config.

kernel	directory
x86 UP	/usr/src/linux/arch/i386/defconfig.default
x86 SMP	/usr/src/linux/arch/i386/defconfig.smp
x86 Big SMP	/usr/src/linux/arch/i386/defconfig.bigsmp
x86_64 UP	/usr/src/linux/arch/x86_64/defconfig.default
x86_64 SMP	/usr/src/linux/arch/x86_64/defconfig.smp

- 7 Make oldconfig
- 8 Untar the driver source with this command:


```
tar zxfv 3w-9xxx.tgz
```

The driver source will be output to a directory called “driver”.

- 9 Change directory to driver.

```
cd driver
```

- 10 To build the module, type

```
make
```

The 3w-9xxx.ko module will be built and output to the driver directory created when you untared the 3w-9xxx.tgz file.

This will take a while, since the 2.6 build process exports our module to the kernel module list and then builds all kernel modules.

- 11 Copy the module 3w-9xxx.ko to

```
/lib/modules/<kernel string>/kernel/drivers/scsi/  
3w-9xxx.ko
```

- 12 Edit /etc/modprobe.conf and add

```
alias scsi_hostadapter 3w-9xxx
```

- 13 Load the module

```
modprobe 3w-9xxx
```

Driver Installation Under FreeBSD



Note: Before installing the 3ware driver, you must have already installed your 3ware RAID controller in the system.

A drive or unit managed by the 3ware RAID controller may be configured to be your system's boot device. Or, you can use another device as your boot device, such as a disk attached to the motherboard.

The steps you follow to install the driver and make your RAID unit available depend on whether it will be your boot device. This chapter provides step-by-step instructions for the following situations:

- “Installing the Driver While Installing FreeBSD on the 3ware RAID Controller” on page 88
- “Installing the 3ware Driver on a FreeBSD System that Boots from a Different Device” on page 92

Obtaining 3ware FreeBSD Drivers

FreeBSD 4.10 and later have 9.xxx driver support built in. No driver installation is required.

If you are using FreeBSD 4.8 or 4.9, you will need to install the 3ware FreeBSD driver as described below.

The 3ware software CD-ROM that came with the 3ware RAID controller includes compiled and tested drivers for FreeBSD 4.8 and 4.9. To see if a more recent driver is available, please see the 3ware web site.

Materials Required

■ 3ware driver

The driver and the corresponding source files can be found on the 3ware CD-ROM, at

`/packages/drivers/freebsd/<OS version>`

and

`/packages/drivers/freebsd/src/<OS version>`

where OS version is either 4.x or 5.x

You can also download the FreeBSD driver from the 3ware web site (<http://www.3ware.com>).

■ FreeBSD installation CD-ROM or diskette

Installing the Driver While Installing FreeBSD on the 3ware RAID Controller



Note: Some versions of FreeBSD cannot boot to arrays larger than 1 TByte. If you want to create an array larger than 1 TByte, check to make sure that the version of FreeBSD you have supports it.

To install the driver as a module

- 1 Boot with the FreeBSD CD-ROM or diskette.
- 2 In the sysinstall menu, select Configure > Load KLD module.

Note: Immediately after the OS starts booting from the CD, insert an MS-DOS floppy with the 3ware driver, `twa.ko`, into the floppy drive. If you do not insert it immediately, sysinstall may fail to recognize the floppy drive.

- 3 Load the driver from the floppy drive.
- 4 Run the FreeBSD installation and reboot.

For instructions on how to install FreeBSD, see the FreeBSD website, at <http://www.freebsd.org/>

- 5 Remove the floppy disk and the CD.
- 6 On reboot, escape to the loader menu.

Note: Once again, immediately after the OS starts booting, insert an MS-DOS floppy with the 3ware driver, `twa.ko`, into the floppy drive. If you do not insert it immediately, the loader may fail to recognize the floppy drive.

- 7 At the loader prompt, run 'lsdev' to make sure the floppy drive has been discovered.
- 8 Load the driver from the floppy. For example, if the floppy drive is `disk0`, type

```
load disk0:twa.ko
```

- 9 Run 'boot'.

The system should now be able to boot.

- 10 After the system boots up, do the following:
 - a Create a directory for the floppy.

```
mkdir /floppy
```

- b Mount the floppy.

```
mount -t msdos /dev/fd0 /floppy
```

- c Copy the driver file to the appropriate directory.

For FreeBSD 4.x, copy the files to:

```
cp /floppy/twa.ko /modules/twa.ko
```

For FreeBSD 5.x, copy the files to:

```
cp /floppy/twa.ko /boot/kernel/twa.ko
```

- d Add line 'twa_load="YES"' to the file
/boot/loader.conf

- 5 Eject the floppy disk and reboot.

The 3ware driver, twa.ko, should be automatically loaded at reboot time.

To make the driver part of the kernel

- 1 Boot with the FreeBSD CD-ROM or diskette.
- 2 In the sysinstall menu, select Configure > Load KLD module.

Note: Immediately after the OS starts booting from the CD, insert an MS-DOS floppy with the 3ware driver, twa.ko, into the floppy drive. If you do not insert it immediately, the sysinstall may fail to recognize the floppy drive.

- 3 Load the driver from the floppy drive.
- 4 Remove the floppy disk and the CD.
- 5 Go through OS installation. Make sure you install the kernel sources during this step.
- 6 On reboot, escape to the loader menu.

Note: Immediately after the OS starts booting, insert an MS-DOS floppy with the 3ware driver, twa.ko, into the floppy

drive. If you do not insert it immediately, the loader may fail to recognize the floppy drive.

- 7 At the loader prompt, run 'lsdev' to make sure the floppy drive has been discovered.
- 8 Run 'load disk0:twako' (assuming disk0 is the floppy drive)
- 9 Run 'boot'.

The system should now be able to boot.

- 10 After the system boots up, change the kernel build infrastructure to include the 3ware driver sources.
 - a Change to the following directory:
`cd /usr/src/sys/i386/conf`
 - b Copy the configuration file to a custom file. For example, if the configuration file is GENERIC, type
`cp GENERIC custom`
 - c Edit the custom file and add the lines shown below under RAID controllers
`device twa # 3ware Escalade 9000 series`
 - d Save the file.
 - e Change to the following directory:
`cd /sys/conf`
 - f Edit the file "files.i386" and add the lines shown below

<code>dev/twa/tw_cl_fwimg.c</code>	optional twa
<code>dev/twa/w_cl_init.c</code>	optional twa
<code>dev/twa/tw_cl_intr.c</code>	optional twa
<code>dev/twa/tw_cl_io.c</code>	optional twa
<code>dev/twa/tw_cl_misc.c</code>	optional twa
<code>dev/twa/tw_osl_cam.c</code>	optional twa
<code>dev/twa/tw_osl_freebsd.c</code>	optional twa
 - g Save the file.
 - h Add the following line to "Makefile.i386"
`CFLAGS+=-I/sys/dev/twa`
 - i If you intend to bundle the firmware image with the driver, add the following line to /sys/conf/options:

```
TWA_FIRMWARE_FLASH                opt_twa.h
```

and the following line to your kernel configuration file (“custom” in the example above):

```
options                            TWA_FLASH_FIRMWARE
```

- j If you intend to enable printing of debug messages in the driver, add the following line to `/sys/conf/options`:

```
TWA_DEBUG                          opt_twa.h
```

and the following line to your kernel configuration file (“custom” in the example above):

```
options                            TWA_DEBUG=<number from 0 to 10>
```

Specifying 0 in the above line prints no debug messages, whereas specifying 10 prints a LOT of debug messages.

- 11 Rebuild the kernel and install the new kernel.
- 12 Reboot with the rebuilt kernel.

Installing the 3ware Driver on a FreeBSD System that Boots from a Different Device

To install the 3ware driver as a module

- 1 Copy the driver from the 3ware CD-ROM at

```
/packages/drivers/freebsd/<OS version>
```

For FreeBSD 4.x, copy the driver into `/modules`

For FreeBSD 5.x, copy the driver into `/boot/kernel`.

- 2 Load the driver

```
kldload twa.ko
```

If units are present, you should see unit information in the system log (usually, `/var/log/messages`).

Note: Since `twa.ko` behaves like a SCSI driver, the units that it controls are seen as `da0`, `da1` etc.

To make the driver part of the kernel

- 1 Create the directory `/sys/dev/twa`

```
mkdir /sys/dev/twa
```
- 2 Copy the 3ware driver source file archive (`twa.tgz`) to the directory you created in step 1.
- 3 Unpack the 3ware driver source files.

```
cd /sys/dev/twa  
tar -xzvf twa.tgz
```
- 4 Change the kernel build infrastructure to include the 3ware driver sources.
 - a Change to the following directory:

```
cd /usr/src/sys/i386/conf
```
 - b Copy the configuration file to a custom file. For example, if the configuration file is `GENERIC`, type

```
cp GENERIC custom
```
 - c Edit the custom file and add the lines shown below under **RAID controllers**.

```
device twa # 3ware Escalade 9000 series
```
 - d Save the file.
 - e Change to the following directory:

```
cd /sys/conf
```
 - f Edit the file “`files.i386`” and add the lines shown below

```
dev/twa/tw_cl_fwimg.c           optional twa  
dev/twa/w_cl_init.c            optional twa  
dev/twa/tw_cl_intr.c          optional twa  
dev/twa/tw_cl_io.c            optional twa  
dev/twa/tw_cl_misc.c          optional twa  
dev/twa/tw_osl_cam.c          optional twa  
dev/twa/tw_osl_freebsd.c      optional twa
```
 - g Save the file.

- h Add the following line to “Makefile.i386”
`CFLAGS+=-I/sys/dev/twa`
 - i If you intend to bundle the firmware image with the driver, add the following line to `/sys/conf/options`:
`TWA_FIRMWARE_FLASH` `opt_twa.h`
- and the following line to your kernel configuration file (“custom” in the example above):

- ```
options
```
- TWA\_FLASH\_FIRMWARE
- j If you intend to enable printing of debug messages in the driver, add the following line to `/sys/conf/options`:  
`TWA_DEBUG`                                      `opt_twa.h`
- and the following line to your kernel configuration file (“custom” in the example above):

```
options TWA_DEBUG=<number from 0 to 10>
```

Specifying 0 in the above line prints no debug messages, whereas specifying 10 prints a LOT of debug messages.

- 5 Rebuild the kernel and install the new kernel.
- 6 Reboot with the rebuilt kernel.

## Compiling the Driver as a Loadable Module

If you wish to compile the driver yourself (for a different kernel version that you are running), then perform the following steps.

- 1 Create the directories `/sys/modules/twa` and `/sys/dev/twa`  
`mkdir /sys/modules/twa`  
`mkdir /sys/dev/twa`
- 2 Copy the 3ware driver source file archive (`twa.tgz`) to `/sys/dev/twa`.

- 3 Unpack the driver source files.

```
cd /sys/dev/twa
tar -xzvf twa.tgz
```

- 4 Move the Makefile to /sys/modules/twa

```
mv Makefile /sys/modules/twa
```

- 5 Change the directory to /sys/modules/twa/

```
cd /sys/modules/twa
```

- 6 Uncomment or comment the following line in Makefile, based on whether or not you intend to bundle the firmware image with the driver:

```
TWA_FLASH_FIRMWARE=1
```

- 7 If you intend to enable printing of debug messages in the driver, uncomment the following line in Makefile:

```
CFLAGS+=-DTWA_DEBUG=<number from 0 to 10>
```

Specifying 0 in the above line prints no debug messages, whereas specifying 10 prints a LOT of debug messages.

- 8 Build the driver

```
make clean
make depend
make
```

- 9 Copy the driver to the appropriate directory.

For FreeBSD 4.x, copy it to

```
cp twa.ko /modules/twa.ko
```

For FreeBSD 5.x, copy it to

```
cp twa.ko /boot/kernel/twa.ko
```

- 10 Unload the existing driver, if any

```
kldunload twa.ko
```

- 11 Load the new driver.

```
kldload twa.ko
```





# Troubleshooting: Problems and Solutions

This chapter includes solutions to problems users sometimes encounter when using 3ware RAID controllers.

For support, troubleshooting tips, frequently asked questions, software releases, and compatibility information related to 3ware RAID controllers, refer to:

- 3ware support page at:  
<http://www.3ware.com/support/>
- 3ware knowledgebase:  
<http://www.3ware.com/KB/kb.asp>
- 3ware software downloads:  
<http://www.3ware.com/support/download.asp>
- 3ware documentation:  
<http://www.3ware.com/support/userdocs.asp>
- 3ware Compatibility Lists:  
[http://www.3ware.com/support/sys\\_compatibility.asp](http://www.3ware.com/support/sys_compatibility.asp)

## Hardware installation

**Q1: The rail on the 3ware RAID controller doesn't fit in the case.**

Use a screwdriver to remove the black end rail. It aligns and secures the 3ware RAID controller in the computer chassis but is not critical for operation.

**Q2: The system doesn't begin booting (no BIOS runs) when the 3ware RAID controller is installed but boots OK when the controller is removed.**

Check the cabling between the drives and the 3ware RAID controller. A cable plugged in upside down can prevent your system from running its BIOS.

**Q3: The 3ware BIOS screen never appears.**

The 3ware RAID controller is not installed properly. Reinstall the hardware and reboot. There may also be a problem with the motherboard. Please check the Motherboard Compatibility List on the 3ware website at <http://www.3ware.com/products/compatibility.asp> to see if your motherboard has been tested by 3ware.

**Q4: Some of the drives do not appear in the Disk Array Configuration Utility's main display.**

Your drives are not connected properly to the 3ware RAID controller. Check that both the power and ATA cables are connected properly and that the drives are all properly jumpered. To operate properly, the 3ware RAID controller requires that drives be set as **Single** (if available on your drive) or **Master**.

**Q5: Preventing the 3ware BIOS from installing.**

If drives are attached and you do not want to install the 3ware BIOS, press **Alt-b** to bypass the BIOS installation when you start the system. This is useful when booting temporarily from another device, if the operating system is already installed on the 3ware unit. This saves the step of changing the boot order in 3BM and having to change it back again.

# Appendix A. Installing the Battery Backup Unit

The Battery Backup Unit (BBU) is an add-on that can be attached to a 3ware 9000 RAID controller to supply power to the memory module from an attached battery pack in the event of a system power loss. This allows the controller to use write-caching for optimal performance and not be exposed to data loss in the event of a system power failure. When fully charged, the battery preserves the contents of the controller cache memory for a limited period of time (up to 72 hours). When power is restored, cached data is flushed to disks.



**Caution:** Both the 3ware RAID controller and the Battery Backup Unit are sensitive electronic equipment and can be damaged through electrostatic discharge.

When installing the BBU on the controller, be sure you are grounded. Use a grounding strap, or work on an ESD-protective mat.

- Do not remove the 3ware controller or BBU from their protective bags until you are properly grounded.
- Handle the 3ware RAID controller by its edges or by the black rail and metal bracket at its two ends.
- Do not touch any pin, contact, lead, or component on the 3ware RAID controller.



**Important:** The battery is a heat-sensitive component. The cooler the battery, the longer the battery lasts. If possible, place the controller with the BBU in a slot with good airflow, away from components that generate the most heat in the system, such as video cards.

---

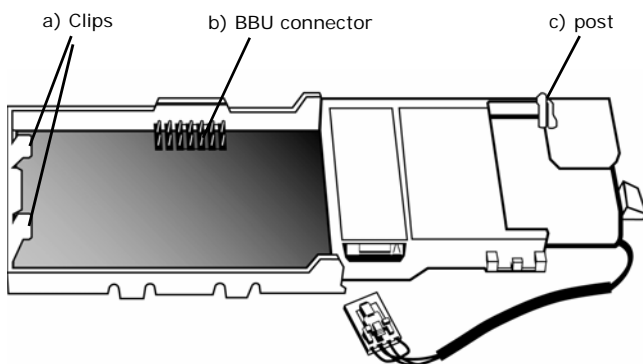
## Tools and equipment required

- Phillips-head screwdriver
- Grounding strap
- Battery Backup Unit (BBU) and battery
- 3ware 9000 series controller

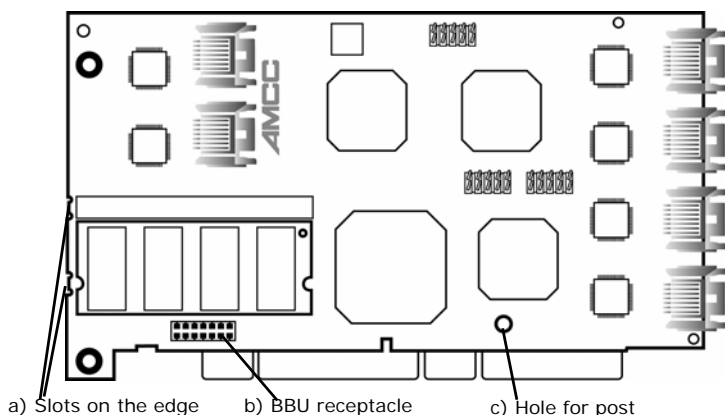
## Installation Overview

The Battery Backup Unit (BBU) attaches to the controller at three points, as illustrated in Figures 1 through 3:

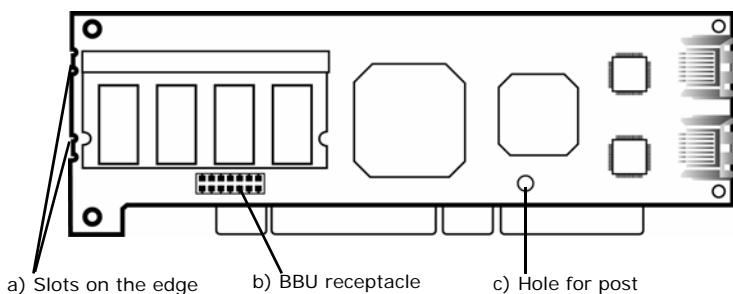
- a Slots on the edge of the controller (visible after removing the PCI bracket) match to clips on the BBU
- b Receptacle on the controller matches to connector on the BBU
- c Post hole on the controller mates to post on the BBU



**Figure 1. Points of connection on the BBU (bottom view)**



**Figure 2. Points of connection on the full-height controller (top view)**



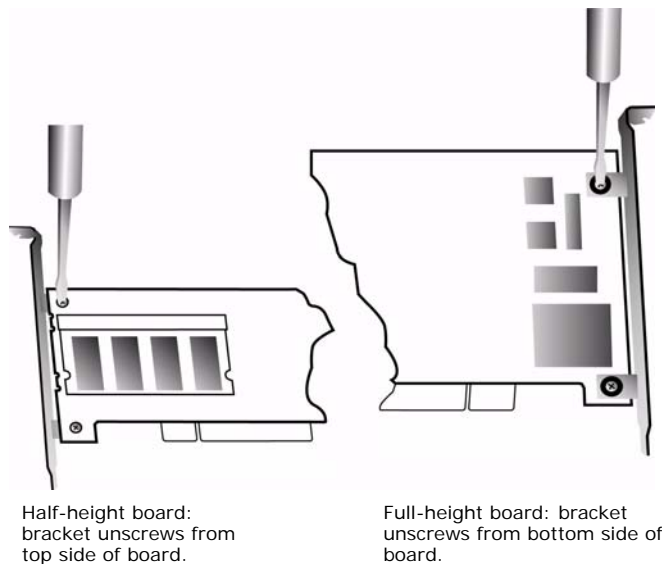
**Figure 3. Points of connection on the half-height controller (top view)**



**Note:** If your 9000 series controller does not have the BBU receptacle, contact technical support for assistance.

## Installation Instructions

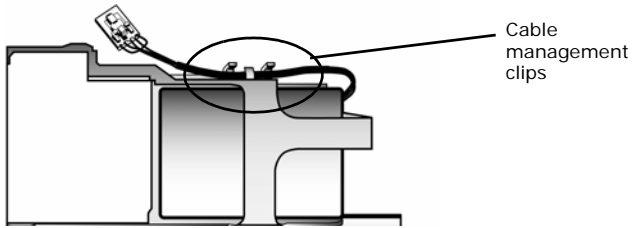
- 1 For full-height controllers, turn the controller memory-side down on a flat surface.
- 2 Remove the screws that connect the PCI bracket to the controller and set the bracket aside.



**Figure 4. Removing the screws from the PCI bracket**

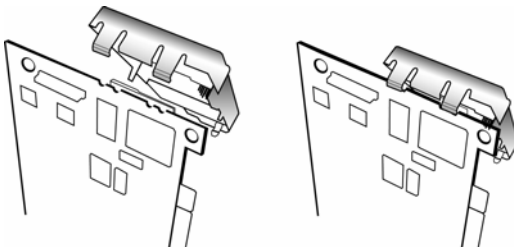
- 3 For full-height controllers, turn the controller memory side up.

- 4 Make sure the battery cable is fastened under the cable management clips, as shown in Figure 5.

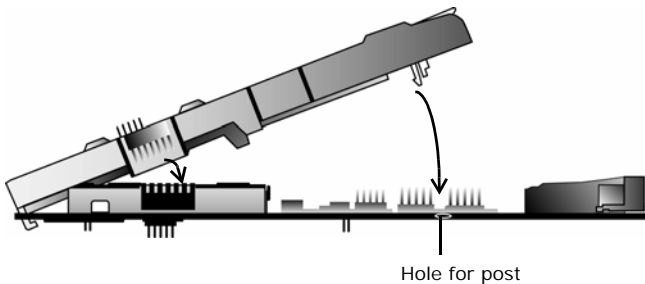


**Figure 5. Battery cable inserted through cable management clips**

- 5 Match the clips on the end of the BBU to the slots on the edge of the controller to create a hinge and rotate the BBU to position it over the card, as shown in Figures 6 and 7.

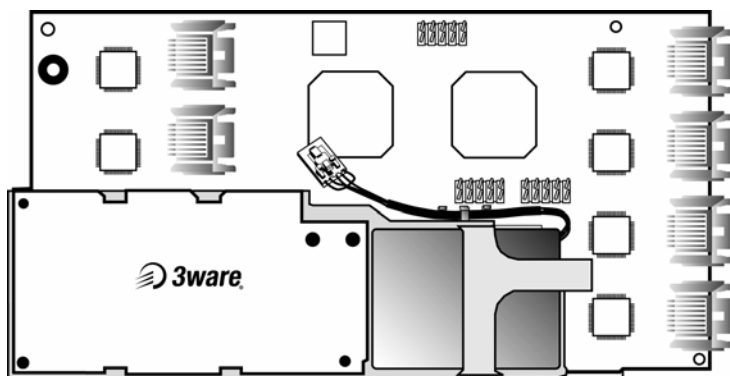


**Figure 6. Clips on the BBU match to slots on the controller**



**Figure 7. BBU rotates into position on the controller**

- 6 Align the Battery Backup Unit to the controller with these connectors:
  - Mate the connector on the BBU with the receptacle on the controller.
  - Match the plastic post on the BBU with the hole on the controller.
- 7 Press down gently until the BBU is seated.



**Figure 8. BBU attached to controller**

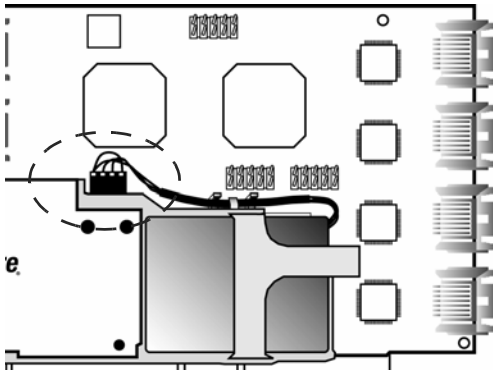
- 8 Reconnect the PCI bracket, using the phillips screws you removed in Step 2.

For the full-height board, the bracket sits on top of the board, and screws are inserted from the bottom.

For the half-height board, the bracket sits on the bottom of the board, with screws inserted from the top.



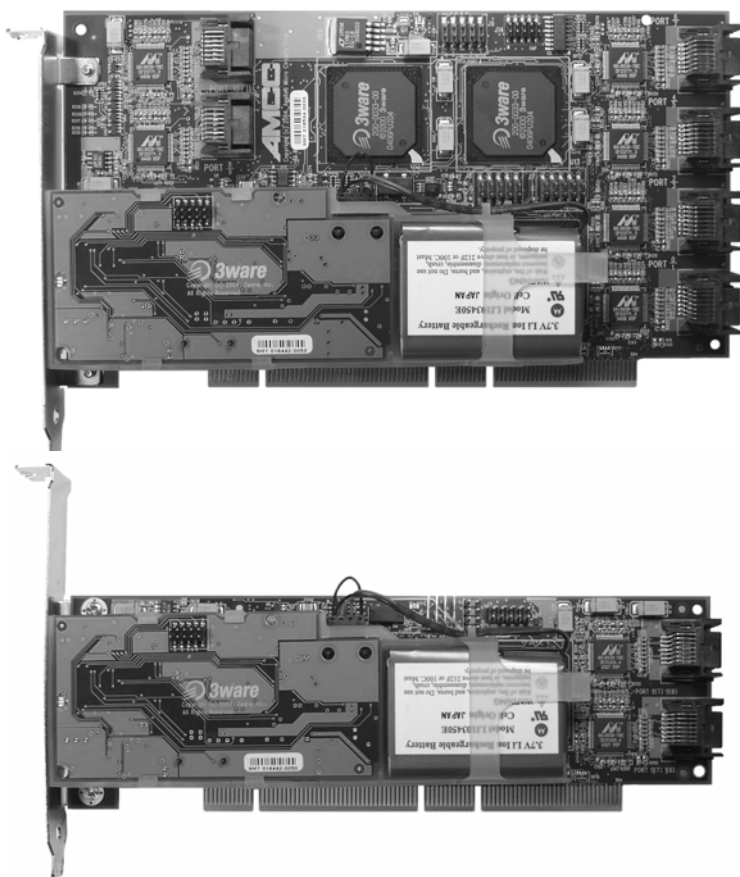
- 9 Insert the battery power connector into the power receptacle on the BBU.



**Figure 9. Battery power connector and power receptacle**

The controller is now ready to install in your system. Figures 10 and 11 show the BBU fully installed on 3ware controllers.

You can check the status of the battery, and run a battery test to determine if the battery needs to be replaced. For details, see *3ware 9000 Series Serial ATA RAID Controller User Guide*.



**Figure 10. BBU installed on controllers**

## Replacing the Battery

The Battery Backup Unit (BBU) will last for many years. The battery has an expected life span of one to two years depending on usage.

You can check the current status of the battery, and test it. For details, see instructions in *3ware 9000 Series Serial ATA RAID Controller User Guide*.



**Caution:** There is a risk of explosion if the battery is replaced by an incorrect type. To obtain a replacement battery, contact AMCC.

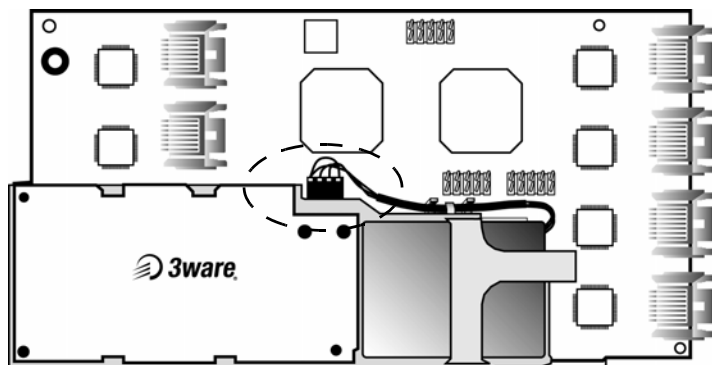
For proper battery disposal resources, contact RBRC, The Rechargeable Battery Recycling Corporation ([www.rbr.com](http://www.rbr.com)).

---

### To replace the battery

- 1 Make sure the system is powered down, that you are grounded, and follow all appropriate safety procedures.
- 2 If necessary, remove the 3ware RAID controller from your system.

- 3 Disconnect the battery power cable from the BBU.  
To do so, press down on the lever-like clip on the battery power connector and slide it out of the slot.



**Figure 11. Power cable from the battery to the BBU**

- 4 Slide the battery out of the plastic.
- 5 Insert the new battery and cable it up.
- 6 If necessary, reinstall the 3ware RAID controller, close up your system and restart it.
- 7 Run a battery test to compute the estimated battery capacity of this new battery.

You can run the battery test from the BBU page of either 3BM or 3DM 2. For detailed instructions, see the *3ware 9000 Series Serial ATA RAID Controller User Guide*.

# Appendix B. Compliance and Conformity Statements

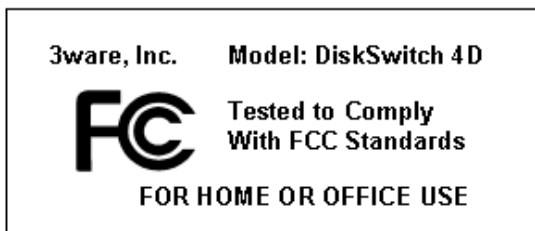
## Federal Communications Commission Radio Frequency Interference Statement

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 in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, 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.

To maintain compliance with FCC radio frequency emission limits, use shielded cables and connectors between all parts of the computer system.



## Microsoft Windows Hardware Quality Lab (WHQL)

AMCC is committed to Microsoft Windows Hardware Quality Labs (WHQL) certification for all its products. However, a product's software drivers are typically submitted for certification at nearly the same time as their release to market. Since the certification process may lag behind the release of the drivers, please refer to our website at [www.3ware.com](http://www.3ware.com) for current certification information.

## European Community Conformity Statement

The StorSwitch Controller Card Model StorSwitch 4D is in conformity with the following Common Technical Regulations and/or normative documents:

- EN 55022**    Limits and methods of measurements of radio interference characteristics of information technology equipment

**EN 61000-4-2** Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques Section 2: Electrostatic discharge immunity test

**EN 61000-4-3** Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques Section 3: Radiated, Radio-Frequency, Electromagnetic Field Immunity Test

**EN 61000-4-4** Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques Section 4: Electrical fast transient/burst immunity test

**EN 60950** Safety of information technology equipment, including electrical business equipment following the provisions of the Electromagnetic Compatibility Directive 89/23/EEC Low Voltage Directive.



# Appendix C. Warranty, Technical Support, and Service

## Limited Warranty

**RAID Controller Hardware.** 3-Year Hardware Warranty: AMCC warrants this product against defects in material and workmanship for a period of thirty-six (36) months from the date of original purchase. AMCC, at no charge and at its option, will repair or replace any part of this product which proves defective by reason of improper workmanship or materials. Repair parts or replacement products will be provided by AMCC on an exchange basis and will be either new or refurbished to be functionally equivalent to new. Products or parts replaced under this provision shall become the property of AMCC.

**Battery Backup Unit (BBU) Hardware.** 1-Year Hardware Warranty: AMCC warrants this product against defects in material and workmanship for a period of twelve (12) months from the date of original purchase. AMCC, at no charge and at its option, will repair or replace any part of this product which proves defective by reason of improper workmanship or materials. Repair parts or replacement products will be provided by AMCC on an exchange basis and will be either new or refurbished to be functionally equivalent to new. Products or parts replaced under this provision shall become the property of AMCC.

**Software Warranty:** AMCC will replace a defective media purchased with this product for a period of up to 30 days from the date of purchase.



For detailed terms and conditions, please see the Limited Hardware Warranty and Software License Agreement at our website:  
[http://www.3ware.com/support/rma\\_form.asp](http://www.3ware.com/support/rma_form.asp)

AMCC warranty service is provided by returning the defective product to AMCC.

## Exclusions

This warranty does not cover any damage to this product which results from accident, abuse, misuse, natural or personal disaster, or any unauthorized disassembly, repair or modification. AMCC shall not be liable for any incidental or consequential damages, including but not limited to loss of profits, other loss, damage or expense directly or indirectly arising from the customer's misuse of or inability to use the product, either separately or in combination with other equipment, regardless of whether AMCC has been advised of the possibility of such damages. AMCC is not liable for and does not cover under warranty, any costs associated with servicing and/or the installation of AMCC products. This warranty sets for the entire liability and obligations of AMCC with respect to breach of warranty and the warranties set forth or limited herein are the sole warranties and are in lieu of all other warranties, expressed or implied, including warranties or fitness for particular purpose and merchantability.

## State Law Provisions

This warranty gives you specific legal rights and you may have other rights which vary from state to state. Some states do not allow the exclusion of incidental or consequential damages or allow limitation of implied warranties or their duration, so that the above exclusions or limitations may not apply.

## Obtaining Warranty Protection

To obtain warranty service during the warranty period call AMCC toll free at (800)-945-7273 or (408) 523-1145 (direct) as soon as you have identified a problem with your AMCC 3ware Serial ATA RAID controller unit. You will be issued a return material authorization (RMA) number. AMCC will send a replacement in approximately two business days after receipt of the defective unit (transit time not included).

Advanced replacement is available with a credit card number with authorization in the amount equaling the then current list price of the AMCC 3ware Serial ATA RAID Controller, including shipping costs. As soon as practicable thereafter, AMCC will ship the advanced replacement to you at the address of your choosing. Upon receipt of the advanced replacement, we ask that you immediately ship the defective 3ware RAID Controller to AMCC, RAID Products RMA DEPT, 6290 Sequence Drive, San Diego, CA 92121. If AMCC receives the defective AMCC 3ware Serial ATA RAID Controller from you within thirty (30) days of the date of shipment of the advanced replacement, AMCC will destroy your credit card authorization and you will not be charged for the advanced replacement.

Please use the original packing material contents of the box when exchanging or returning a product.

For information about the status of a replacement, please contact AMCC Technical Support.

## AMCC's Technical Support and Services for 3ware RAID Controllers

Product information, Frequently Asked Questions, software upgrades, driver files and other support are available through the 3ware World Wide Web site at <http://www.3ware.com>.

The 3ware software library is accessible at:  
<http://www.3ware.com/support/download.asp>

Web-based software downloads feature upgrading multiple switches simultaneously.

For specific answers to questions or to give feedback about the product, visit our Web site at <http://www.3ware.com/support> and use our convenient e-mail form. AMCC also offers toll-free (800) 945-7273 and (408) 523-1145 direct phone support during normal business hours.

## Sales and Ordering Information

For sales information, send an electronic mail message to [3wareSales@amcc.com](mailto:3wareSales@amcc.com).

## Feedback on this manual

Your feedback is welcome. If anything in the guide seems unclear please let us know by sending e-mail to [3wareSupport@amcc.com](mailto:3wareSupport@amcc.com).



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