



Installation Guide

Escalade™

ATA RAID Controller

Supports the 7000 and 8000 series

PN 720-0038-04, Revision A
April 29, 2003

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Before You Begin

Congratulations on selecting the Escalade ATA RAID Controller as your RAID data storage and management system. This user guide gives simple, step-by-step instructions for installing and configuring your Escalade ATA RAID Controller. To ensure your personal safety and protect your equipment and data, carefully read the information that follows the *Features* list before you begin installing.

Features

Escalade 7000 Parallel ATA Family (includes 7000-2, 7500-4, 7500-4LP, 7500-8, 7500-12)

The information in this manual also supports the following legacy products: 7410, 7810, 7450 (now 7500-4), 7850 (now 7500-8), and 7210.

- **True Hardware RAID.** Low CPU Utilization
- **RAID Support.** RAID 0, 1, 5, 10 and JBOD (7000-2 does not support RAID 5)
- **Drive Support.** Parallel UltraDMA 133, 100, 66, 33
- **Bus Type.** PCI 64 bit / 33 Mhz (7000-2 is PCI 32 bit / 33 Mhz)
- **Management.** 3DM Disk Management Utility or 3ware Command Line Interface
- **BIOS.** PC99, PnP, BBS Compliant
- **Windows Support.** W98SE, WME, WinNT4 with SP6, Win2k with SP2, and WinXP
- **Linux Support.** Redhat, SuSE. (Drivers available in Open Source.)
- **Performance.** Twinstor, Command Queuing, Elevator Seeking, R5Fusion (R5Fusion is not available on 7000-2)

- **Field Upgrades.** Field Upgradeable Firmware, BIOS, 3DM and Drivers
- **Data Integrity.** ATA Command Readback, SMART Monitoring, Dynamic Sector Repair, Rebuild Pacing, Rebuild Scheduling, Background Media Scan, Hot Swap, Hot Spare, Hardware Health Monitoring, Scheduled Verify

Escalade 8000 Serial ATA Family (includes 8500-4, 8500-8, 8500-12)

- **True Hardware RAID.** Low CPU utilization
- **RAID Support.** RAID 0, 1, 5, 10 and JBOD
- **Drive Support.** Serial ATA 150 (SATA I) drives. Parallel UltraDMA 133 and UltraDMA 100 drives are also supported when using 3ware's Parallel to Serial (CBL-P-SATA) Converter.
- **Bus Type.** PCI 64 bit / 33 Mhz
- **Management.** 3DM Disk Management Utility or 3ware Command Line Interface
- **BIOS.** PC99, PnP, BBS Compliant
- **Windows Support.** W98SE, WME, WinNT4 with SP6, Win2k with SP2, and WinXP
- **Linux Support.** Redhat, SuSE. (Drivers available in Open Source.)
- **Performance.** Twinstor, Command Queuing, Elevator Seeking, R5Fusion
- **Field Upgrades.** Field Upgradeable Firmware, BIOS, 3DM and Drivers
- **Data Integrity.** ATA Command Readback, SMART Monitoring, Dynamic Sector Repair, Rebuild Pacing, Rebuild Scheduling, Background Media Scan, Hot Swap, Hot Spare, Hardware Health Monitoring, Background Verify



Note: The Escalade Serial ATA controller can be used with either serial or parallel drives. If using the controller with parallel drives the CBL-P-SATA (Parallel to Serial Driver Converter) must be used in conjunction. The advantage of using the Escalade SerialATA Controller with parallel drives is the simpler, longer cable and increased airflow.

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):

Escalade 7000 series Parallel ATA RAID Controller

- Escalade Parallel ATA RAID Controller in an ESD-protective bag
- ATA interface cables (one per port)
- 3ware installation media with the following: 3DM, Drivers and Escalade User Guide (.pdf format)
- 3ware Release Notes
- 3ware Installation Guide

Escalade 8000 series Serial ATA RAID Controller

- Escalade Serial ATA RAID Controller in an ESD-protective bag
- Serial ATA interface cables (one per port)
- 3ware installation media with the following: 3DM, Drivers and Escalade User Guide (.pdf format)
- 3ware Release Notes
- 3ware Installation Guide

CBL-P-SATA (Parallel to Serial Drive Converter Kit)

- Escalade CBL-P-SATA (one per port)
- Power Converter Adapter (one per port)
- Jumper(s) for converter (if not already installed)
- 3ware Installation Guide

Tools Required

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

System Requirements

The Escalade ATA RAID Controller requires a workstation-class or server-class CPU whose bus complies with PCI 2.2 standards, and a PCI slot that meets the Plug and Play and PC99 specifications. The ATA RAID Controller may be connected to up to two, four, eight, or twelve IDE/ATA drives by the supplied interface cables.



Note: It is recommended that the Escalade 7000 or 8000 card be installed in the 64-bit PCI slot whenever possible for the best performance. The controllers fit in both 32-bit and 64-bit PCI slots with 5V as well as 3.3V. The 12-port 7000 board requires one full size PCI slot.

Drives must meet UltraATA-133, UltraATA-100, UltraATA-66 or UltraATA-33 standards (8000 family does not support UltraDMA-66 or UltraDMA-33 standards), but may be of any capacity or physical form factor. Length of unshielded interface cables may not

exceed 36" (91.4 cm) for parallel ATA controllers and 1M (39") for serial ATA controllers.

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



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 data elsewhere before changing your array configuration.

ESD Precautions

Standard electrostatic discharge (ESD) precautions must be followed to avoid damaging computer components and accessories when installing or removing the Escalade ATA RAID Controller.

- When the case of your computer is open and its internal parts are exposed, don't touch any internal part unnecessarily.
- Always wear a grounded strap or work on an ESD-protective mat.
- Don't remove the ATA RAID Controller from its protective bag until you are properly grounded.

- Handle the ATA RAID Controller by its edges or by the black rail and metal bracket at its two ends.
- Don't touch any pin, contact, lead or component on the ATA RAID Controller.

Mechanical Concerns

Be careful when installing the Escalade ATA RAID Controller into your system. Excessive force can damage the board, the cables, your drives 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 without bending any pins. 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.

Hardware Installation



Warning: Before proceeding with hardware installation, read the *Before You Begin* section that completely describes personal and system precautions. Failing to do so may result in personal injury or damage to your computer or the Escalade ATA RAID Controller.

To remove an existing Escalade ATA RAID Controller

- 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 Disconnect the disks from the existing Escalade ATA RAID Controller installed in your system. If your boot disk is connected to the ATA RAID Controller and you intend to retain it as your boot device, note or mark which physical disk is connected to slot 0 on the controller. This disk should be reconnected to slot 0 on the new ATA RAID Controller. Preserving the slot order of how the other drives are connected is unimportant, even if the disks are part of a disk array. However, it is recommended that a plug-to-plug replacement is followed.
- 4 Remove the screw in the metal bracket at the end of the old ATA RAID Controller. Save the screw for installing the new controller.
- 5 Gently remove the ATA RAID Controller from the PCI slot.
- 6 Remove the cables from the ATA RAID Controller and discard. Reusing interface cables is not recommended.

Installing a Parallel ATA RAID Controller



Note: If you are not installing a ParallelATA RAID Controller, continue to page18 “Installing a SerialATA RAID Controller”.

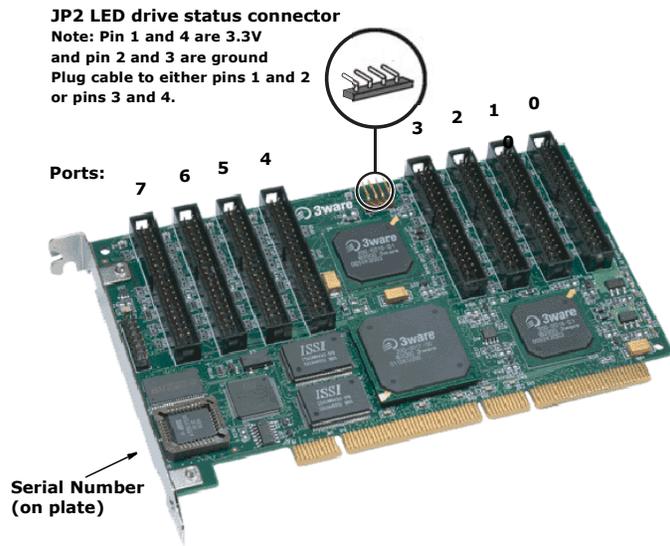


Figure 1. 8-Port Escalade 7500-8 ATA RAID Controller Layout

Connect the interface cables to the Escalade ATA RAID Controller

- 1 Connect the interface cables supplied with the product to the ATA RAID Controller. See Figure 1.



Note: UltraATA-66, UltraATA-100 and UltraATA-133 drives require 40-pin, 80-conductor ribbon cables. These cables have color coded ends. For optimum performance, the blue end must be connected to the ATA RAID Controller and the black end must be connected to the hard drive.

- 2 One edge of each interface cable should have a colored (usually red) line denoting the conductor to Pin 1. Align the ATA RAID Controller so that the colored line is toward the top edge of the controller. Mate the connectors carefully without bending any pins.
- 3 Install the other connectors in the same manner.

Install the Escalade ATA RAID 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 ATA RAID Controller.



Hint: Cable routing may be easier if you install the ATA RAID Controller next to an open slot.

- 4 Remove the metal filler bracket for the slot. Save this screw; it will be used to secure the ATA RAID Controller after you have seated it in the slot.



Hint: While the ATA RAID Controller runs properly in any PCI slot, not all slots give equal performance due to the architecture of the PCI bus. In our laboratories, we have noticed that the slots closest to the Accelerated Graphics Port (AGP) or in the 64-bit PCI slot typically give the best performance. Our card should fit in both 32-bit and 64-bit PCI slots with 5V as well as with 3.3V.

- 5 Line the ATA RAID Controller up so that all pins make proper contact with the PCI slot pins when pushed into place. The black end rail opposite the metal bracket may be removed if needed to fit the ATA RAID Controller inside the chassis. The short 4-port or 8-port Escalade ATA RAID Controller is keyed to ensure proper installation in a full-sized PCI slot.
- 6 Ensure that the contacts will mate with both grooves in the slot. Press down gently on the edge of the ATA RAID Controller directly above the slot until it is fully seated.
- 7 Check that the ATA 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.

Connect the drives to the interface cables

- 1 Be sure to use the supplied cables. With the higher speeds of UltraATA-133, UltraATA-100 and UltraATA-66, using quality cables is important.
- 2 Before connecting your drives, check your drives' jumper setting. The range of settings provided vary by manufacturer as do the method for adjusting them. Refer to information provided with your drives for the method required to set them. To operate properly, the Escalade ATA RAID Controller requires that drives be set as **Single** (if available on your drive) or **Master**.
- 3 If your drives are not already installed in the computer chassis, do so now. Be sure that the drives are connected to the power supply.

- 4 For each drive, select the black end of an interface cable not connected to the ATA RAID Controller and plug it into the drive or drive carrier. The cable's colored edge denotes Pin 1 and should be adjacent to the 4-pin power plug.



Note: Continue to page 22 "Check your installation and close the case".

Installing a Serial ATA RAID Controller

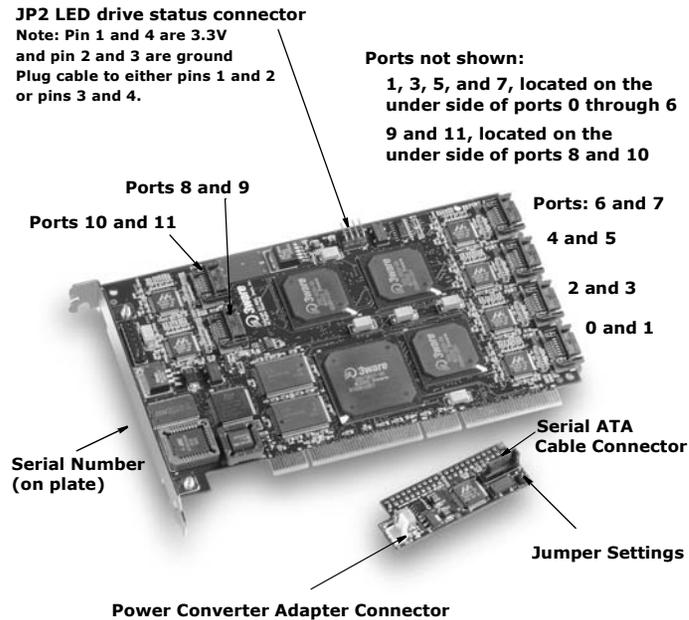


Figure 2. 12-Port Escalade 8500-12 Serial ATA RAID Controller with CBL-P-SATA (Parallel to Serial ATA Converter)

Connect the interface cables to the Escalade Serial ATA RAID Controller

- 1 Connect the interface cables supplied with the product to the ATA RAID Controller. See Figure 2.

- 2 One edge of each interface cable connector is keyed to ensure proper orientation and installation. Carefully mate the connectors without bending any pins.
- 3 Install the other connectors in the same manner.



Note: The connectors on the end of the controller are susceptible to damage from excessive bending.

- 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 ATA RAID Controller.



Hint: Cable routing may be easier if you install the ATA RAID Controller next to an open slot.

- 4 Remove the metal filler bracket for the slot. Save this screw; it will be used to secure the serial ATA RAID Controller after you have seated it in the slot.



Hint: While the ATA RAID Controller runs properly in any PCI slot, not all slots give equal performance due to the architecture of the PCI bus. In our laboratories, we have noticed that the slots closest to the Accelerated Graphics Port (AGP) or in the 64-bit PCI slot typically give the best performance. Our card should fit in both 32-bit and 64-bit PCI slots with 5V as well as with 3.3V.

- 5 Line up the ATA RAID Controller so that all pins make proper contact with the PCI slot pins when pushed into place. The

- Escalade ATA RAID Controller is keyed to ensure proper installation into a full-sized PCI slot.
- 6 Ensure that the contacts will mate with both grooves in the slot. Press down gently on the edge of the ATA RAID Controller directly above the slot until it is fully seated.
 - 7 Check that the ATA 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.

Connect the drives to the interface cables

Using native serial ATA drives

- 1 If your drives are not already installed in the computer chassis, install them now. Be sure that the drives are connected to the power supply.
- 2 For each drive, select the end of an interface cable not connected to the ATA RAID Controller and plug it into the drive or drive carrier. One edge of each interface cable connector is keyed to ensure proper installation.

Using parallel ATA-133 or ATA-100 drives with converter kit (CBL-P-SATA)



Note: UltraATA-66 and UltraATA-33 drives are not supported.

- 1 Before connecting your drives, check each drive's jumper setting. The range of settings vary by manufacturer as do the method for adjusting them. Refer to information provided with your drives for the method required to set them. To operate properly, the Escalade ATA RAID Controller requires that drives be set as Single (if available on your drive) or Master.

- 2 Install two jumpers on the converter if not already installed. See Figure 3 for location to set jumper settings.
- 3 Connect a Power Converter Adapter to each converter. See Figure 3 for connector locations.
- 4 When you have completed steps 2 and 3 for each converter, install a Converter onto the back of each parallel ATA drive. Make sure that each converter is properly aligned and securely pushed in. The converter board's power connector must be adjacent to the drive's power connector. See Figure 3.



Note: The Serial ATA Converter has sharp points. Please use caution when pushing the converter onto the back of the drive.

- 5 Connect the Power Adapter to the power receptacle on the drive.
- 6 If your drives are not already installed in the computer chassis, install them now. Be sure that the drives are connected to the power supply.
- 7 Connect each power adapter to the power supply.
- 8 For each drive, select the end of an interface cable not connected to the ATA RAID Controller and plug it into the Converter.



Figure 3. Parallel ATA Drive with Serial ATA Converter Installed

Check your installation and close the case

- 1 After all of the drives are connected to the ATA RAID Controller and it is installed in its slot, 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.

Check motherboard boot sequence

Using your computer's Setup utility, ensure that your boot device precedes the Escalade ATA RAID Controller in the boot sequence. If you have other disks installed on the motherboard, the ATA RAID Controller precedes them in boot order.



3ware Disk Array Configuration Utility

The 3ware Disk Array Configuration Utility allows you to create disk arrays by combining disks, deleting disks or breaking disk arrays back into their member disks. You can also specify an available drive as a hot spare. If an array becomes degraded, the hot spare will automatically be substituted for the faulted drive.



Note: The BIOS will not be installed if no drives are attached to the Escalade ATA RAID Controller. The ATA RAID Controller shares one IRQ on the PCI bus.

Hot spare and hot swap

Hot Spare is the label given to a drive that is available, active and designated as a spare. This designated drive is applied automatically when a drive degrades and the array is rebuilt. *Hot Swap* is the term applied to the process of swapping out a degraded drive, programmatically and using 3DM, with a pre-assigned spare.

There are two methods for adding a drive as a spare. You may designate a drive as a Hot Spare during the BIOS page display, or you may designate a drive as a Hot Spare through the 3DM configure page. These two methods are discussed below.

BIOS Screen

When designating spare in the BIOS screen, it is assumed that as you are creating your array, you are “setting aside” drive(s) as Hot Spares. This is done by using the S key on the selected drive. Leaving a drive undesignated results in it becoming a JBOD drive. JBOD drives become available to the operating system as distinct

volumes, and, consequently, they cannot be designated as spares at a later time. If a spare is designated in the BIOS screen, the designation and configuration is in effect from this point on. The spare drive will be displayed as a Hot Spare in the 3DM configuration page.

3DM Configure Page

In order to designate an available drive as a spare from the 3DM configure page, you must ensure that the drive is not a JBOD drive or part of an existing array. To designate a drive as a Hot Spare from this page, you must use one of the two following methods:

Replacing a Defective Drive with a Spare

Replace the drive at the operating system level while the system is powered. This should only be done with an approved and recognized hot swap drive-carrier. If you do not use an approved and recognized hot swap drive-carrier, connecting interface cables and power cables can/will crash the system from bus or power supply issues. Select the checkbox next to the drive to be removed and click **Remove Drive**. Select the same checkbox and then click **Add Spare**.

Adding a Spare Drive to an Available Port

To add a new spare, follow the same steps except you will not be required to remove a drive.

Invoking the 3ware BIOS tool

Power up or reboot your system. Before the boot phase, wait until you see a screen similar to Figure 4.

```

3ware Storage Controller : Escalade 7810
BIOS: BE7X 1.08.00.026  Firmware: FE7X 1.05.00.014

Array Unit 0 - 64K RAID 10 1.0 GB
Port 0 - QUANTUM FIREBALLP LM30 512 M
Port 1 - QUANTUM FIREBALLP LM30 512 M
Port 2 - Maxtor 98196H8 512 M
Port 3 - QUANTUM FIREBALLP LM30 512 M

Following drives will not be exported to OS:
Port 5 - QUANTUM FIREBALL EX3.2A 3.2 GB Hot Spare
Port 7 - IC35L020AVER07-0 512 M Hot Spare

0000 Press <Alt-3> to access 3ware Configuration Screen 0000

```

Figure 4. 3ware BIOS Tool

Press **Alt-3** immediately to bring up the **3ware Disk Array Configuration** display.



Note: If drives are attached and you do not want to install the 3ware BIOS, press **Alt-b** to bypass the BIOS installation. This is useful when booting temporarily from another device.

Exiting the 3ware BIOS tool

To save your configuration modifications hit the **F8** key. After you have hit the **F8** key to commit your changes, a list of affected drives will be displayed and you will be asked to confirm your configuration. The booting process will resume.

To exit the 3ware Disk Array Configuration Utility without saving your changes hit **Esc**.

Determining your configuration



Caution: Configuring a disk array writes format-type data onto its member disks and overwrites all the files on those disks. Be sure to back up data that requires retention.

- All supported RAID levels (0,1,5,10) can be created based on the number of drives that the ATA RAID Controller supports.
- Multiple arrays of supported RAID levels can be implemented on a single controller based on the number of drives that the ATA RAID Controller supports.

The **3ware Disk Array Configuration** main display shows the current disk drive configuration.

- **Available Drives** reports independent drives (JBOD) not associated with an array and hot spares.
- **Disk Arrays** lists any existing arrays along with their member disks.

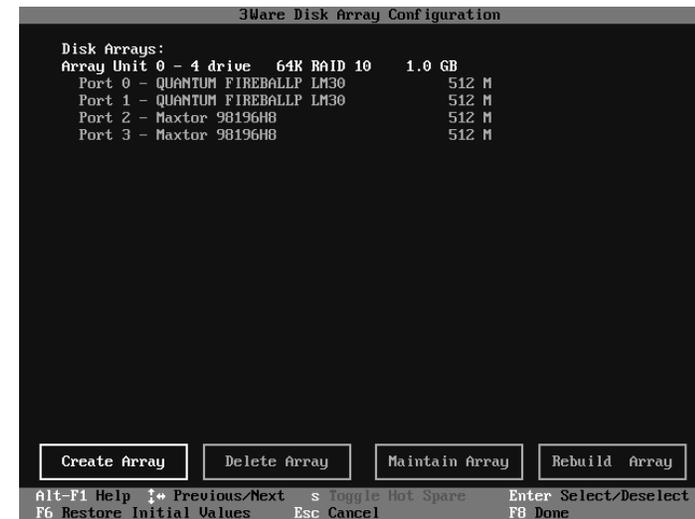


Figure 5. Disk Array Configuration Main Display, RAID 1 Example

Throughout the utility (see Figure 5) use the **Up and Down** arrow keys to navigate, **Enter** to select the disks or buttons and **F1** for context sensitive help. **Toggle Hot Spare** verbiage is black when the cursor is over a drive that can be specified as a hot spare and gray when hot spare cannot be specified. If you've made mistakes and want to start over, pressing **F6** will return your starting values. Pressing **Escape** will exit the configuration utility as well as abandon your changes. Pressing **F8** will save your changes and exit the utility.

Displaying advance details

Selecting **Shift-F5** will show the software versions (BIOS, Firmware, monitor) and slot # of the 3ware card (see Figure 6). Press **Escape** to return to the main 3ware Disk Array Configuration screen.

```

Advance Details
BIOS Version: BE7X 1.08.00.026 Bus.Dev.Fun: 00.0B.0 Slot# 3 BaseID: DC00
FW Version: FE7X 1.05.00.014 Monitor Version: ME7X 1.01.00.034 Model:

Press any key to continue.

```

Figure 6. Disk Array Advance Details Screen

Creating a disk array

To create an array, first select the drives to be included by navigating the cursor over each drive and pressing **Enter** (see Figure 7). An asterisk in the left most column indicates the drive is selected. You may include from two to twelve drives in the array by selecting drives from the **Available Drives** section. To include drives that are part of an existing disk array you must first delete the array.



Note: Accelerate keys. Anywhere in the BIOS configuration screen, if a user hits the corresponding accelerate keys, it immediately highlights the appropriate button:
 Alt-C for "Create Array"
 Alt-D for "Delete Array"
 Alt-M for "Maintain Array"
 Alt-R for "Rebuild Array"

```

3Ware Disk Array Configuration

Available Drives:
*Port 0 - QUANTUM FIREBALLP LM30      512 M
*Port 1 - QUANTUM FIREBALLP LM30      512 M
Port 2 - Maxtor 98196H8                512 M
Port 3 - Maxtor 98196H8                512 M

Create Array  Delete Array  Maintain Array  Rebuild Array

Alt-F1 Help  F2 Previous/Next  s Toggle Hot Spare  Enter Select/Deselect
F6 Restore Initial Values  Esc Cancel  F8 Done

```

Figure 7. Selecting Drives for a Mirrored Array

Determining your configuration



Hint: 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:

- RAID 0: (the number of drives) X (the capacity of the smallest drive)
- RAID 1: the capacity of the smallest drive
- RAID 5: (the number of drives - 1) X (capacity of the smallest drive)
- RAID10: (the number of drives / 2) X (capacity of smallest drive)

Navigate to the **Create Array** button after selecting all the drives for the array. Hit **Enter** to bring up the **Create Disk Array** display (see Figure 8 and Figure 9 for examples). Check that the proper drives are listed.



Figure 8. Create Disk Array Display, RAID 0 Example

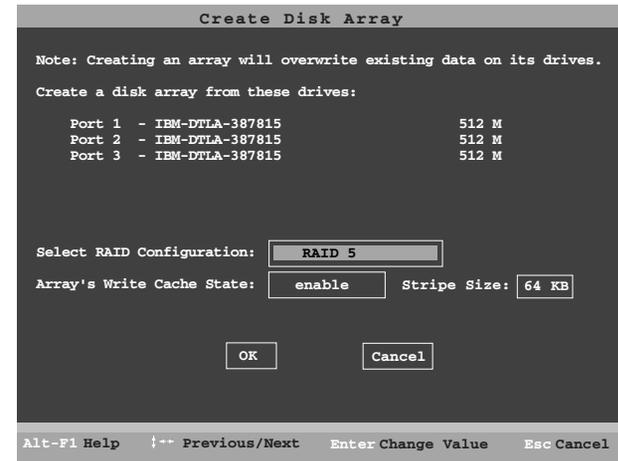


Figure 9. Create Disk Array Display, RAID 5 Example

Select RAID configuration

The Escalade ATA RAID Controller gives you a choice of four RAID configurations. Select one.

- **Stripe (RAID 0):** maximizes performance and capacity through a process called striping. High performance arrays write portions of a single file across multiple drives. There is no fault tolerance.
- **Mirror (RAID 1):** duplicates or “mirrors” the data on both drives. No data will be lost if one of the drives fails.
- **RAID 10:** combines mirroring and striping, providing both fault tolerance and high performance. **RAID 10 arrays require a minimum of four drives.** Configurations consist of 4, 6, 8, 10 or 12 drives.
- **RAID 5:** combines parity data and striping, providing fault tolerance, high capacity and high storage efficiency. The parity data is distributed across all drives, rather than being concentrated on

a single disk. **RAID 5 arrays require a minimum of three drives.** Configurations consist of at least 3 drives and up to 12 drives.



Figure 10. BIOS Initialization Screen for RAID 5

Select striping size

For a RAID 0 or RAID 10 configuration select the striping size. Sizes of 64K, 128K, 256K, 512K or 1M are selected using the **Stripe Size** box shown in Figure 8. RAID 5 only allows a 64K stripe size. RAID 1 does not allow the user to select the striping size.

Select write cache properties

The Escalade ATA RAID Controller gives you a choice of disabling the write cache for your disk arrays. Write cache is 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 the write cache

results in the most efficient access times for your computer system. 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. For this case, you must disable the write cache. To disable the write cache, select **disable** from the array's **Write Cache State** selection. The default for **Write Cache State** is **enable**.

Confirm array configuration

Select the **OK** button to confirm creating the array or **Cancel** to reject it. The array is not actually created and no data will be overwritten until you have finished making all your changes and select the **F8** key.



Note: The current limitation is 2 TB for any physical or logical unit. If you attempt to create an array over 2 TB the BIOS will display the following message: “The amount of disk space available exceeds the maximum allowable capacity. The array capacity will be limited to 2 TB.”

For RAID 5 Arrays

Because of the Read-Modify-Write operations, zeros are first written to all drives in the array before the array is functional. The screen shown in Figure 10 appears after selecting **OK** to confirm array creation.

If desired, the write-zeros operation can be aborted by rebooting the system. Once booted to the operating system, the array goes into initialization mode after a delay of up to ten minutes. The advantage of doing this is that the RAID 5 can be used immediately, although it will not be fault tolerant until the initialization is complete. The disadvantage of doing this is that it will take longer for

the array to be fully redundant, as it takes longer to initialize an array than it takes to write zeros to the array.



Caution: When running in initializing mode the array is not redundant. You cannot remove any drive.

For RAID 1 or 10 Arrays

RAID 1 and 10 arrays are not profiled when created, or initialized after booting into the OS. When the firmware receives the first verify request, given that the array was never initialized, the initialization will then begin. Any subsequent verify operations will then perform the verification of the array (check data consistency). An AEN will inform the user that the first verify is actually an initialization.

Specifying a Hot Spare

The Escalade ATA RAID Controller gives you the option to specify a hot spare from one of your **Available Drives**. If a hot spare is specified and the array degrades, an event notification will be generated. The hot spare will dynamically replace the failed drive in an array without user intervention. Select a hot spare by navigating to an **Available Drive**. The **Toggle Hot Spare** verbiage at the bottom of the screen will be black if the drive can be used as a hot spare. Enter **s** to select the hot spare or to disable the hot spare if it is already enabled.



Note: Hot spare drives need to have the same or larger storage capacity than the RAID 1, RAID 5 or RAID 10 drives.

Changing an existing configuration

- 1 Back up any disk arrays that contain data that you want to retain before the configuration change.
- 2 Create new disk arrays following the instructions in the **Determining your configuration, Creating a disk array and Deleting a disk array** sections. You may need to delete existing arrays to free up disks first.
- 3 Boot, partition and format any new disk arrays or free disks.
- 4 When you are finished configuring, restore from backup any data saved from previous disk arrays

Modifying a disk array

To modify an existing array you must first delete it then recreate it with the new drives. As with all disk array operations, there is no way to modify an existing array without overwriting data on the drives involved.

Deleting a disk array

To delete an array (see Figure 11) first select the array by navigating to it and hitting **Enter**. An asterisk in the left most column indicates the array is selected.

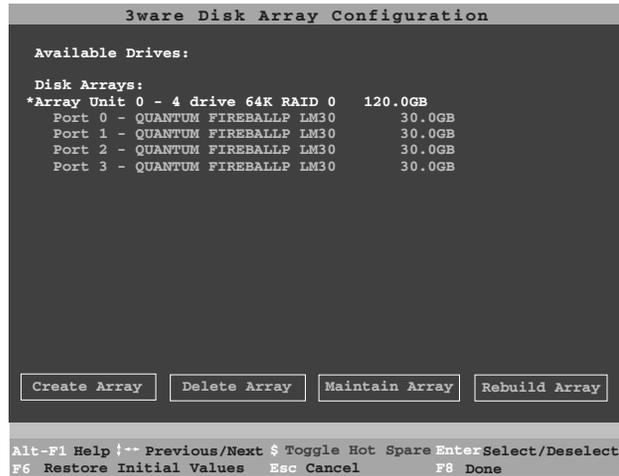


Figure 11. Delete Disk Array Display

Navigate to the **Delete Array** button and hit **Enter** to bring up the **Delete Disk Array** display. Check that the correct drives are listed. Select the **OK** key to confirm deleting the array or **Cancel** to reject it. Recall that the array is not actually deleted and no data will be overwritten until you have finished making all your changes and selected the **F8** key.

How to maintain or verify a disk array

The **Maintain Disk Array** (see Figure 12) shows the current disk array configuration that you have selected. The array's **Write Cache State** can be changed. Refer to **Select write cache properties** paragraph in the **Creating a disk array** section. **Verify Array** can be specified as **no** or **yes**. The default is **no**. **Yes** launches a foreground process that checks the data integrity of a fault tolerant

array. If the verify array process determines that the mirrored drives are not identical or the parity is not correct, the array is degraded and the rebuild process is launched.

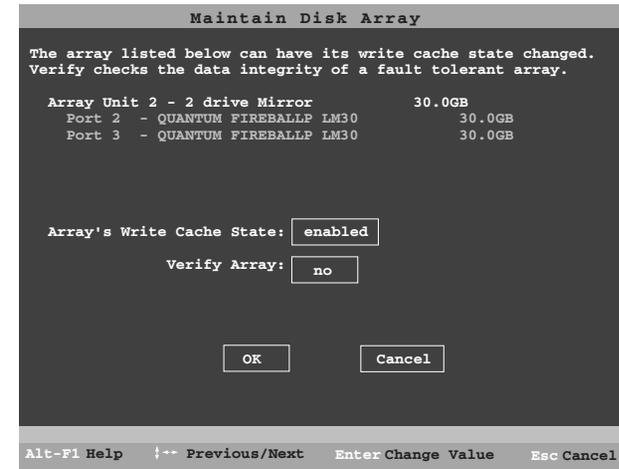


Figure 12. Maintain Disk Array Display



Note: Fault tolerant arrays can not be verified until after they are initialized. For RAID 1 and 10 arrays the initial verify must first be done in 3DM, otherwise the initialization will not be done.

Rebuilding a mirrored disk array

Escalade ATA RAID Controllers allow you to create fault tolerant disk arrays by selecting a mirrored RAID 1 or RAID 10 array. These disk arrays store identical data on two or more drives to protect against drive failure. If one or more of the drives of a mirrored

array is removed, unplugged or fails on read or write requests, the array is marked as **DEGRADED** and the drive is marked as **Not In Use** or is not displayed if no longer available. (see Figure 13 and Figure 14).

You can still read and write data from a degraded disk array, but the array will not be fault tolerant until it is rebuilt using the Rebuild feature, described in the *3ware Disk Array Configuration Utility* or *3DM Disk Management Utility* chapters.

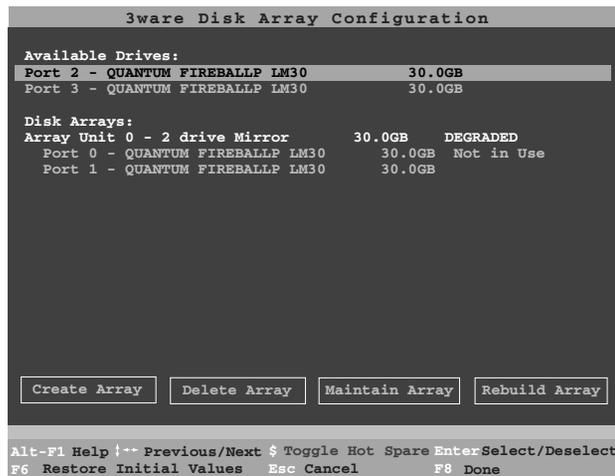


Figure 13. Degraded RAID 1 Array Drive When Not in Use

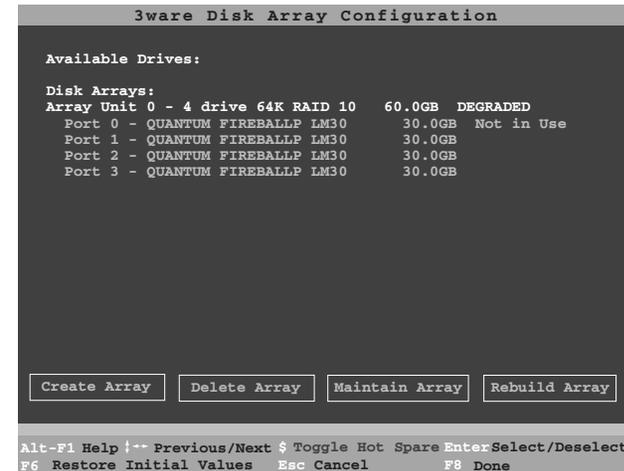


Figure 14. Degraded RAID 10 Array Drive When Not in Use



Note: A RAID 10 array can be configured with either four, six, eight, ten or twelve drives. In a 4-drive configuration, up to two drives can be rebuilt. In a 6-drive configuration, up to three drives can be rebuilt. In an 8-drive configuration, up to four drives can be rebuilt. In a 12-drive configuration, up to six drives can be rebuilt.

Rebuilding a RAID 5 disk array

Escalade ATA RAID Controllers allow you to create fault tolerant RAID 5 disk arrays. These disk arrays achieve fault tolerance by using a simple (exclusive OR) function to generate the parity data

that is distributed on all drives. If one of the drives is removed, unplugged or fails on read or write requests, the array is marked as **DEGRADED** and the drive is marked as **Not In Use** or is not displayed if no longer available (see Figure 15). When running in Degraded mode, the missing data is reconstructed from all non-degraded drives.

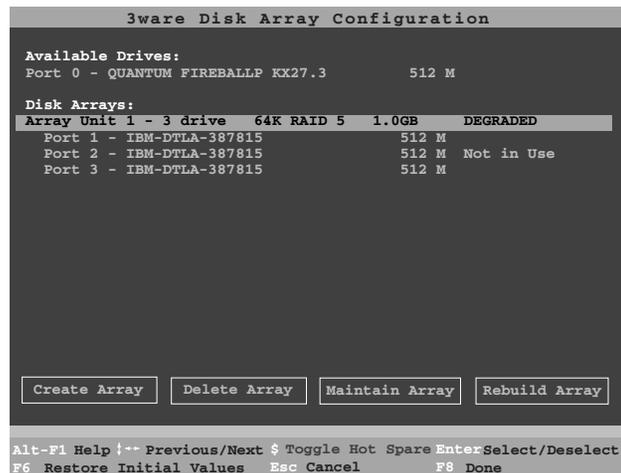


Figure 15. Degraded RAID 5 Array Drive When Not in Use

As in the case of RAID 1 and 10 arrays RAID 5 arrays allow you to read and write data from a degraded disk array, but the array will not be fault tolerant until it is rebuilt using the Rebuild feature. (Refer to the *3ware Disk Array Configuration Utility* or *3DM Disk Management Utility* chapters for more information.)

Rebuilding a mirrored or RAID 5 array with no hot spare

- 1 Reboot the system and enter the **Disk Array Configuration Utility**.

- 2 If your mirrored or RAID 5 array has a **Not in Use** member drive, the drive may still be usable. Try rebuilding with the **Not in Use** drive intact. Simply select the array and then the **Rebuild** button.
- 3 Confirm that you selected the correct array by hitting **OK** in the **Rebuild** confirmation display.
- 4 Select **F8** to exit the **Disk Array Configuration Utility**. The array will begin rebuilding after completion of the operating system load.
- 5 If the rebuild fails and you have no **Available Drives**, you must power down the system and replace the failed or Not In Use drive. Power on the system and enter the **Disk Array Configuration Utility**.
- 6 Select an available drive to replace the faulted drive in the array by navigating the cursor over the available drive and hitting **Enter** (see Figure 16). An asterisk in the left most column indicates the drive is selected.
- 7 Navigate to the degraded array and press **Enter** to select it.

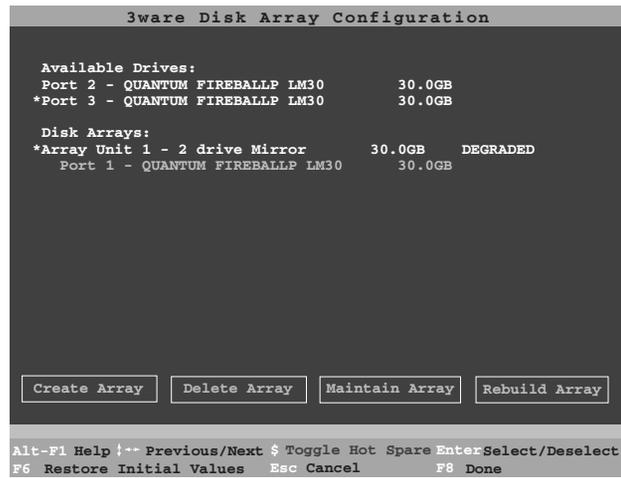


Figure 16 Select Available Drive to Replace Faulted Drive, RAID 1 Example

- 8 Navigate to the **Rebuild Array** button and press **Enter** (see Figure 17). A status screen will be displayed with your requested array and member drives.
- 9 Select **OK** to continue.

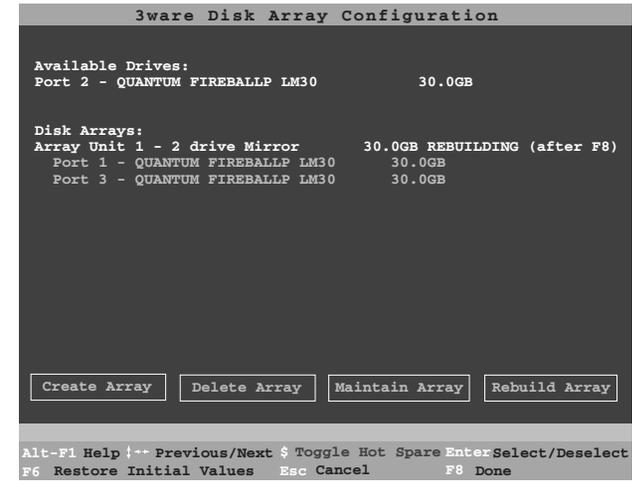


Figure 17. Rebuild Array Status Display, RAID 1 Example

10 Press **F8** to rebuild. The rebuild confirmation screen will be displayed (see Figure 18).

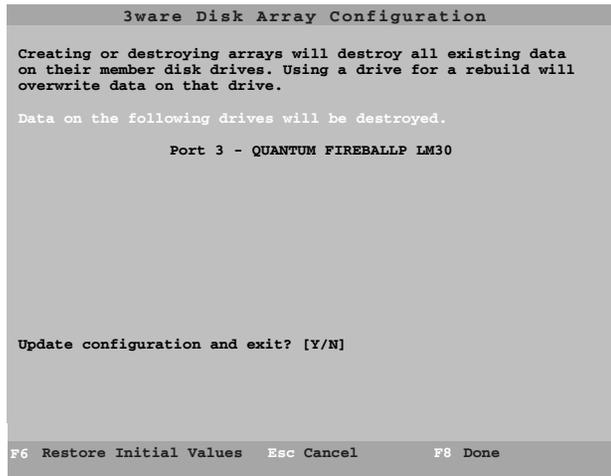


Figure 18. Rebuild Confirmation Display

11 Enter **Y** to update configurations and exit.

Auto rebuild of a mirrored or RAID 5 array

If a hot spare is specified and the mirrored or RAID 5 array degrades, an event notification is generated and the hot spare dynamically replaces the failed drive in the array without user intervention. Rebuild will automatically be launched as a background process and an event notification will notify the user when the rebuild process is complete.

Auto rebuild on power failure

During driver startup 3ware's auto rebuild feature sets a flag indicating that the driver loaded. Upon an orderly shutdown the flag is rewritten, indicating a clean shutdown. During the next system power cycle the firmware queries the flag. For a RAID 1 or 10 configuration, if there was a problem, the firmware degrades the secondary drive in the array and starts the background rebuild of the mirrored drive. When the rebuild is complete the two halves of the mirror are redundant again. For a RAID 5 configuration, if there is a problem, the firmware starts the background verification that checks that the parity matches the data.

Cancelling and restarting a rebuild with a new drive

Currently, a rebuild cannot be cancelled using the 3DM software, but a rebuild can be aborted by physically removing the disk used to replace the degraded drive. Abort a rebuild by following the applicable procedure below.

If your system has hot swap carriers:

- 1 Remove the disk while the system is powered. The rebuild will be immediately aborted.
- 2 Go to the Configure screen and click the box in front of the disk drive that was removed. Click on Remove Drive.
- 3 Add another drive and click on the box in front of this port. Click on Add Drive. The drive is called "RAID Disk".
- 4 Click the boxes in front of the RAID Disk and the degraded array. Select Rebuild. The rebuild starts with the new disk drive.

If your system does not have hot swap carriers:

- 1 Power down the system and remove the disk drive that caused the array to become degraded.
- 2 Add a different disk drive to rebuild the array.
- 3 Press Alt + F3 at Boot time to enter 3ware BIOS.
- 4 Select the degraded array and the newly added drive.
- 5 Select Rebuild.

6 Press F8 to start a rebuild with this drive.



Note: If the rebuild is not started in the 3ware BIOS, the new drive cannot be used to rebuild the degraded array. Booting with the drive attached will make the drive appear as a single disk (JBOD) to the operating system.



Additional Procedures

After completing the steps described in “Hardware Installation” and “3ware Disk Array Configuration Utility”, the operating system, disk drivers, and 3DM disk management application must be installed next. The *Escalade User Guide* describes these procedures in detail for a variety of Window and Linux operating system versions under the following installation scenarios:

- Installing the ATA RAID Controller and operating system
- Installing the ATA RAID Controller and operating system using boot diskettes
- Installing the ATA RAID Controller on systems that boot from a different device (i.e., operating system has been installed on a drive connected to another controller)
- Replacing an existing ATA RAID Controller with a new version of the controller

The *Escalade User Guide* is included on the 3ware CD-ROM packaged with the ATA RAID Controller. Finish setting up your 3ware ATA RAID Controller and RAID array by performing one of the procedures listed above followed by installation of the 3DM disk management application.

Troubleshooting: Problems and Solutions



Note: For more troubleshooting tips and frequently asked questions, refer to 3ware's support web page at <http://www.3ware.com/support>.



Note: More troubleshooting problems and solutions can be found on the 3ware web site at <http://www.3ware.com/NewFaq/3ware.htm>.

Hardware installation

Q1: The rail on the ATA RAID controller doesn't fit in the case.

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

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

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

Q3: The 3ware BIOS screen never appears.

The ATA 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 ATA 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 ATA RAID controller requires that drives be set as **Single** (if available on your drive) or **Master**.

Appendix A

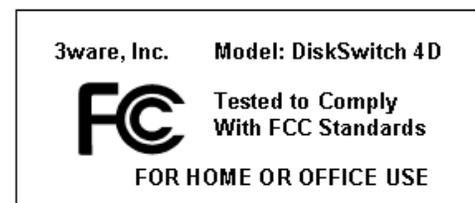
Compliance and Conformity Statements

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)

3ware, Inc. 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 WEB site at 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 B Warranty, Technical Support and Service

Limited Warranty

3-Year Hardware Warranty: 3WARE, INC. warrants this product against defects in material and workmanship for a period of thirty-six (36) months from the date of original purchase. 3ware, 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 3ware 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 3ware.

Software Warranty: 3WARE, INC. 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

3ware warranty service is provided by returning the defective product to 3ware.

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. 3WARE 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 3WARE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. 3WARE IS NOT LIABLE FOR and DOES NOT COVER UNDER WARRANTY, ANY COSTS ASSOCIATED WITH SERVICING AND/OR THE INSTALLATION OF 3WARE PRODUCTS. THIS WARRANTY SETS FOR THE ENTIRE LIABILITY AND OBLIGATIONS OF 3WARE WITH RESPECT TO BREACH OF WARRANTY and THE WARRANTIES SET FORTH OR LIMITED HEREIN

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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 3ware toll free at (877)-883-9273 or (408) 523-1111 (direct) as soon as you have identified a problem with your Escalade ATA RAID Controller unit. You will be issued a return material authorization (RMA) number. 3ware will send a replacement within two business days after receipt of the defective unit.

Advanced replacement is available with a credit card number with authorization in the amount equaling the then current list price of the Escalade ATA RAID Controller, including shipping costs. As soon as practicable thereafter, 3ware 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 Escalade ATA RAID Controller to 3ware at 455 West Maude Avenue, Sunnyvale, CA 94085. If 3ware receives the defective Escalade ATA RAID Controller from you within thirty (30) days of the date of shipment of the advanced replacement, 3ware 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.

3ware Technical Support and Services

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>. 3ware's 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. 3ware also offers toll-free (877) 883-9273 and (408) 523-1111 direct phone support during normal business hours.

Sales and ordering information

For sales information, send an electronic mail message to sales@3ware.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 support@3ware.com.

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