

RAID User's Manual



Copyright

Copyright by Promise Technology, Inc. ("Promise"), 2000. No part of this manual may be reproduced or transmitted in any form without the expressed, written permission of Promise.

Trademarks

All trademarks are the property of their respective holders.

Important data protection information

You should backup all data before installing any drive controller or storage peripheral. Promise is not responsible for any loss of data resulting from the use, disuse or misuse of this or any other Promise product.

Notice

Although Promise has attempted to ensure the accuracy of the content of this manual, it is possible that this document may contain technical inaccuracies, typographical, or other errors. Promise Technology, Inc. assumes no liability for any error in this publication, and for damages, whether direct, indirect, incidental, consequential or otherwise, that may result from such error, including, but not limited to loss of data or profits.

Promise provides this publication "as is" without warranty of any kind, either express or implied, including, but not limited to implied warranties of merchantability or fitness for a particular purpose.

The published information in the manual is subject to change without notice. Promise reserves the right to make changes in the product design, layout, and driver revisions without notification to its users.

Table of Contents

INTRODUCTION.....	1
KEYS FEATURES AND BENEFITS	2
Getting Started.....	4
INSTALLING THE HARD DRIVES	4
CHECKING CMOS SETTINGS.....	6
CREATING A DISK ARRAY	7
USING THE FASTBUILD™ CONFIGURATION UTILITY.....	11
VIEWING THE BIOS SCREEN	11
NAVIGATING THE FASTBUILD™ MENU	12
CREATING ARRAYS AUTOMATICALLY	13
VIEWING DRIVE ASSIGNMENTS.....	14
VIEWING AN ARRAY	15
DELETING AN ARRAY	17
REBUILDING A MIRRORRED ARRAY	19
VIEWING CONTROLLER SETTINGS.....	22
INSTALLING DRIVERS.....	23
WINDOWS 2000	23
Windows 95/98.....	21
WINDOWS NT 4.0.....	28
USING THE FASTCHECK™ MONITORING UTILITY.....	30
INSTALLING FASTCHECK.....	30
RUNNING FASTCHECK.....	31
CLOSING FASTCHECK.....	31
USING THE FASTCHECK ARRAY WINDOW	32
SYNCHRONIZING AN ARRAY	35
REBUILDING AN ARRAY	37
USING CONTROLLER WINDOW	40
USING OPTIONS WINDOW	40
UNDERSTANDING DISK ARRAY CONCEPTS	48
ABOUT THE BIOS	48
FASTBUILD™ AUTO MENU SETUP.....	48
RESERVED SECTOR	48
DISK ARRAY TERMS.....	49
ABOUT RAID LEVELS	50
TROUBLESHOOTING & TIPS.....	53
DRIVE-RELATED ERRORS.....	53
OPERATING SYSTEM-RELATED ERRORS.....	57
FREQUENTLY ASKED QUESTIONS.....	59
PRE-INSTALLATION	59
DRIVE ISSUES.....	60
INSTALLATION ISSUES	60

RAID User' s Manual

POST-INSTALLATION..... 61



Introduction

The RAID levels supported are Striping (RAID 0) and Mirroring (RAID 1) - for master only. With striping, identical drives can read and write data in parallel to increase performance. Mirroring increases read performance through load balancing and elevator sorting while creating a complete backup of your files.

Striping (RAID 0) doubles the sustained data transfer rate of Ultra ATA/100 drives. It fully supports Ultra ATA/100 specification of up to 100 MB/sec per drive, depending on individual drive specifications. It also offers fault tolerant data redundancy for entry-level network file servers or simply for desktop PC users wanting to continually protect valuable data on their PC.

Mirroring (RAID 1) for two drives can protect data. Should a drive that is part of a mirrored array fail, the mirrored drive (which contains identical data) assumes all data handling. When a new replacement drive is later installed, the mirrored drive rebuilds data to the new drive to restore fault tolerance.

The bootable BIOS supports individual drives larger than 8.4GB. With FAT32 and NTFS partitioning, the array can be addressed as one large single volume.

Keys Features and Benefits

The following is an overview of the major RAID features, categorized as Advanced Hardware Design and Compatibility.

Advanced Hardware Design	
Features	Benefits
Supports data Striping (RAID 0) and Mirroring (RAID 1).	Provides dramatic increase in drive performance and/or fault tolerant options. Offers performance customization and data rebuild from the BIOS menu.
Supports Ultra DMA 5/4/3/2/1/0 and DMA 2/1/0.	Burst data transfer rates up to 100MB/sec from Ultra ATA/100 drives to boost overall system performance.
PCI Plug-n-Play, PCI Interrupt sharing and coexists with the system board' s standard IDE controllers.	Easy to install and supports four ATA drives.
Supports concurrent dual IDE controller operation.	Drive workload is distributed in parallel between members of the array.
Supports IDE bus master operation.	Allows multitasking during disk transfers thus increasing CPU efficiency. The CPU is free to process tasks during IDE data transfers through the PCI Bus - to or from the system memory.
Utilizes FastBuild™ auto-menu from the BIOS.	Offers application preset specific settings that can be optimized for Desktop, Server, or A/V Editing. Has "Auto Setup" option for quick and easy array builds.
Displays status and error checking messages during boot up.	Notifies user of possible errors and allows for recovery of mirrored drive arrays directly from FastBuild™.
Employs the latest Promise PCI Ultra ATA/100 ASIC technology.	Fully supports Ultra ATA/100 specifications with 100MB/sec timing and CRC error-checking at high speeds.
Mirroring supports automatic background rebuild.	Fault tolerance can be restored automatically without rebooting.

Compatibility	
Features	Benefits
Complies with PCI v2.1 Local Bus standard.	Provides highest level of hardware compatibility.
Compliant with PCI IDE Bus Master standard. PCI IDE Bus Master supports Windows 98/95 and Windows NT 3.5x / 4.0.	Provides 32-bit I/O, IDE Bus Master, and Ultra ATA performance for optimal system performance.
Tested compatibility to coexist with the system board' s integrated standard IDE controllers.	Improves system performance of new and existing installations.
Compatible with Ultra ATA/100, Ultra ATA/66, Ultra ATA/33 and EIDE.	Works with the newest and most current IDE drive specifications. Verification test has been performed with major drive manufacturers and development partners.
Features LBA and Extended Interrupt13 drive translation in controller onboard BIOS.	Breaks capacity barriers for support of drives greater than 8.4GB in capacity. Offers flexible storage options for space demanding applications.

Getting Started

This section will help you get started with the hard drive installation.

WARNING: Before installing the driver into an existing system, backup any necessary data. Failure to follow this accepted PC practice could result in data loss.

Installing the Hard Drives

WARNING: If you wish to use a Windows NT 4.x or Windows 2000 hard drive that will be configured in the Mirrored array as a boot drive, do NOT connect the hard drive to the RAID IDE connector yet. You must install the Windows NT 4.x or Windows 2000 operating system and driver with the hard drive connected to the standard IDE connector. After you're done with the installation, connect the drive to the RAID IDE connector. The "First Boot Device" field in Advanced BIOS Features of the Award BIOS setup utility must be set to "SCSI".

Hard drives must be Ultra ATA/100, Ultra ATA/66, Ultra ATA/33, EIDE and/or Fast ATA-2 compatible. For optimal performance, install **identical** drives of the same model and capacity. The drives' **matched performance** allows the array to function better as a single drive.

1. Drives in an array must be identical. If striping for performance, use two new drives. If mirroring for protection, you can use two new drives or use an existing drive and a new drive (the new drive must be the same size or larger than the existing drive). Striping or mirroring is done between 2 RAID IDE channels; not between 2 drives that are chained on the same channel.
2. Configure the jumpers of the hard drive using the correct "Master / Slave" or "Cable-Select" settings in the positions described in the table below.

NOTE: Sometimes the Master drive with no slave attached is called "Single." The master slave setting differentiates two drives chained on the same channel.

Jumper Settings		
# of Drives	IDE Channel 1	IDE Channel 2
1	M	----
2	M	M
3	M & S	M
4	M & S	M & S

M = Master, S = Slave

3. Install the hard drives into the hard drive bays of your system, including the power cables.

4. Install the 40-pin connector of the IDE cable into the RAID IDE connector and the other 40-pin connector(s) into the hard drives with the colored edge of the ribbon cable aligned with pin 1 of the drive edge connector(s).

NOTE: *You must use an 80-wire, 40-pin cable when connecting an Ultra ATA/100 hard drive.*

Checking CMOS Settings

If you want the system to boot from a drive that is connected to the RAID IDE connector or SCSI add-in card, you must first select "SCSI" in the "First Boot Device" field (Advanced BIOS Features) of the Award BIOS setup utility.

If there are drives connected to both the RAID IDE connector and SCSI add-in card, you must then select which drive you want to boot from in the "RAID Chip Boot Device" field. Refer to the system board user' s manual for more information.

Creating A Disk Array

Use the FastBuild BIOS utility to create arrays using the attached drives. There are three different scenarios in creating an array. You can (1) create an array for performance, (2) create a Security array using new hard drives (recommended), or (3) create a Security array using an existing hard drive and a new hard drive.

WARNING: If you wish to create a Security array using an existing hard drive, backup all necessary data. Failure to follow this accepted PC practice could result in data loss.

1. Boot your system. If this is the first time you are booting with the drives installed, the BIOS will display the following screen.

```
FastTrak100-Lite (tm) BIOS Version 1.xx (Build xxxx)
(c) 1995-2000 Promise Technology, Inc. All Rights Reserved.

No array defined . . .

Press <Ctrl-F> to enter FastBuild (tm) Utility
Or press <ESC> key to continue booting the system.
```

2. Press the <Ctrl-F> keys to display the FastBuild (tm) Utility Main Menu.
3. Press <1> to display the Auto Setup Menu below. This is the fastest and easiest method to creating your first array.

```
FastBuild (tm) Utility 1.xx (c) 1995-2000 Promise Technology, Inc.
[Auto Setup Options Menu]

Optimize Array for:      Performance
Typical Application usage: A/V Editing

[ Auto Setup Configuration ]

Mode ..... Stripe
Drives used in Array.....2
Array Disk Capacity..... 16126

[ Keys Available ]

[?] Up [?] Down [? , ? , Space] Change Option [ESC] Exit [Ctrl-Y] Save
```

Creating an Array for Performance

NOTE: You can create striped arrays with 1 or 2 drives.

To create an array for best performance, follow these steps:

1. Using the Spacebar, choose "Performance" under the **Optimize Array for** section.
2. Select how you will use your PC most under the **Typical Application usage** section. The choices are A/V Editing, Server, and Desktop (the default).
3. Press the <Ctrl-Y> keys to Save and create the array.
4. Reboot your system.
5. Once the array has been created, you must FDISK and format the array as if it were a new single hard drive.
6. Install the appropriate driver. Refer to the "Installing Drivers" section of this manual.

Creating a Security Array With New Drives

NOTE: In Auto Setup, only two drives can be used for a single Mirrored array.

To create an array for data protection using new hard drives, follow these steps:

1. Using the Spacebar, choose "Security" under the **Optimize Array for** section.
2. Press the <Ctrl-Y> keys to Save.
3. The window below will appear.

Do you want the disk image to be duplicated to another? (Yes/No)
Y - Create and Duplicate
N - Create Only

4. Press "N" to select the Create Only option.
5. A window will appear almost immediately confirming that your Security array has been created.

Array has been created.
<Press Any Key to Reboot>

6. Press any key to reboot the system.
7. You must FDISK and format the array as if it were a new single hard drive.
8. Once the arrayed drives have been formatted, install the appropriate driver. Refer to the "Installing Drivers" section of this manual.

Creating a Security Array Using An Existing Hard Drive

NOTE: In Auto Setup, only two drives can be used for a single Mirrored array.

Use this method if you wish to use a drive that already contains data and/or is the bootable drive in your system. You will need another drive of identical or larger storage capacity.

WARNING: Backup all necessary data before proceeding. Failure to follow this accepted PC practice could result in data loss.

WARNING: If you wish to use a Windows NT 4.x or Windows 2000 hard drive that will be configured in the Mirrored array as a boot drive, do NOT connect the hard drive to the RAID IDE connector yet. You must install the Windows NT 4.x or Windows 2000 operating system and driver with the hard drive connected to the standard IDE connector. After you're done with the installation, connect the drive to the RAID IDE connector. For all other operating systems, please proceed.

1. Using the Spacebar, choose "Security" under the **Optimize Array for** section.
2. Press the <Ctrl-Y> keys to Save. The window below will appear.

Do you want the disk image to be duplicated to another? (Yes/No) Y - Create and Duplicate N - Create Only

3. Press <Y> to select the Create and Duplicate option. The window below will appear asking you to select the Source drive.

Source Disk		
Channel:ID	Drive Model	Capacity (MB)
Target Disk		
Channel:ID	Drive Model	Capacity (MB)
[Please Select A Source Disk]		
Channel:ID	Drive Model	Capacity (MB)
1 :Master	QUANTUMCR8.4A	8063
2 :Master	QUANTUMCR8.4A	8063
[?] Up [?] [ESC] Exit [Ctrl-Y] Save		

4. Use the arrow keys to choose the drive that contains the existing data to be copied. FastBuild will copy all data from the Source drive to the Target drive.
5. Press the <Ctrl-Y> keys to Save and start duplication. The following progress screen will appear.

Start to duplicate the image . . . Do you want to continue? (Yes/No) Y - Continue N - Abort

6. Select <Y> to continue. If you choose <N>, you will be returned to step 1.

7. Once complete, the following screen will appear confirming that your Security array has been created.

Array has been created.
<Press Any Key to Reboot>

8. Press any key to reboot the system.
9. Install the appropriate driver. Refer to the "Installing Drivers" section of this manual.

Using the FastBuild™ Configuration Utility

The FastBuild™ Configuration Utility offers several menus to create and manage the drive array. For purposes of this manual, it is assumed you have already created an array in the previous chapter and now wish to make changes to the array or view other options.

Viewing the BIOS Screen

When you boot your system with drives connected to the RAID IDE connectors, the Promise onboard BIOS will detect the drives attached and display the following screen.

```
FastTrak100-Lite (tm) BIOS Version 1.xx (Build xx)
(c) 1995-2000 Promise Technology, Inc. All Rights Reserved.

Scanning IDE drives . . . . .
```

If an array already exists, the BIOS will display the following screen showing the BIOS version and status of the array.

```
FastTrak100-Lite (tm) BIOS Version 1.xx (Build xxxx)
(c) 1995-2000 Promise Technology, Inc. All Rights Reserved.

ID      MODE  SIZE  TRACK-MAPPING  STATUS
1 *    2+0 Stripe  16126M  611/128/32  Functional

Press <Ctrl-F> to enter FastBuild (tm) Utility....
```

There are 3 array status: *Functional*, *Critical*, *Offline*.

Functional - The array is operational.

Critical - The mirrored array contains a drive that has failed or has been disconnected. The remaining drive member in the array is functional. However, the array has temporarily lost its ability to provide fault tolerance. The user should identify the failed drive through the FastBuild™ utility, and then replace the problem drive.

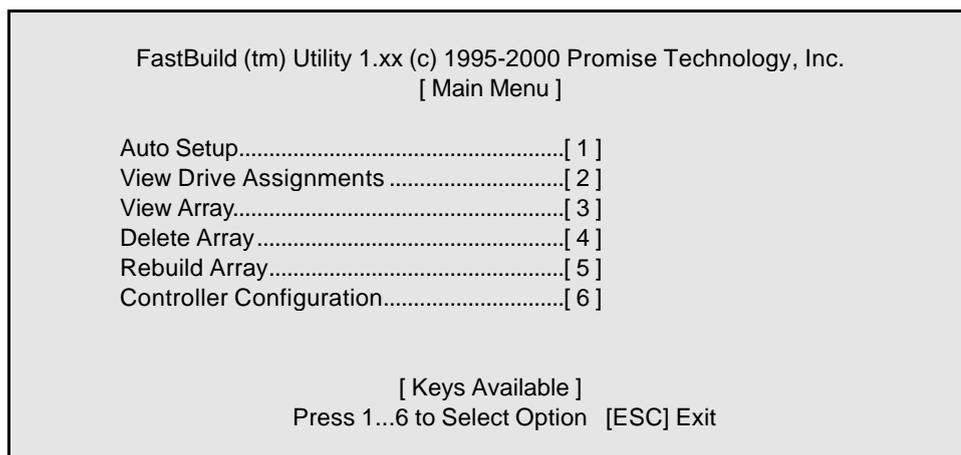
Offline - The striped array contains a drive that has failed or has been disconnected. When the array's condition is "offline," the user must replace the failed drive(s), then restore data from a backup source.

Navigating the FastBuild™ Menu

The basic navigation keys are: Arrow keys to highlight through choices, <Space> key to cycle through options, <Enter> key to select an option, and <ESC> key to abort or exit the current menu.

The Main Menu

This is the first screen that will appear when you press <Ctrl-F> to enter the FastBuild™ utility.



To create a new array automatically, follow the steps in the “Creating Arrays Automatically” section. This option is recommended for most users.

To view drives assigned to arrays, refer to the “Viewing Drive Assignments” section.

To delete an array (but not deleting the data contained in the array), refer to the “Deleting An Array” section.

To rebuild a mirrored array, refer to the “Rebuilding a Mirrored Array” section.

To view controller settings, refer to the “Viewing Controller Settings” section.

NOTE: After configuring an array using FastBuild, you must FDISK and format the arrayed drive(s) if you are using new, blank drives (depending on the type of array you are using).

Creating Arrays Automatically

“Auto Setup <1>” in the Main Menu can automatically help create a disk array. It will assign all available drives appropriate for the disk array you are creating. After making all selections, use <Ctrl-Y> to Save. FastBuild will automatically build the array.

```
FastBuild (tm) Utility 1.xx (c) 1995-2000 Promise Technology, Inc.
[Auto Setup Options Menu]

Optimize Array for:      Performance
Typical Application usage: A/V Editing

[ Auto Setup Configuration ]

Mode ..... Stripe
Spare Drive Count.....1
Drives used in Array.....2
Array Disk Capacity ..... 16126

[ Keys Available ]

[?] Up [?] Down [? ,? , Space] Change Option [ESC] Exit [Ctrl-Y] Save
```

Optimize Array For

Select Performance (RAID 0) or Security (RAID 1) under the “Optimize Array for” setting.

Performance (RAID 0 Striping)

This option provides maximum performance. The storage capacity equals the number of drives times the capacity of the smallest drive in the disk array.

NOTE: *Striped arrays can use 1 or 2 drives that were created in Auto Setup.*

Security (RAID 1 Mirroring)

This option creates a mirrored (or fault tolerant) array for data security.

NOTE: *Under the Security setting, two drives can be used for a single Mirrored array.*

Typical Application Usage

The user can choose the type of PC usage to be performed in order to optimize the way the system handles data blocks that will help enhance performance. Your choice will determine the block size used. You may choose: A/V Editing (for audio/video applications, or any similar application that requires large file transfers), Server (for numerous small file transfers), or Desktop (a combination of large and small file sizes).

Viewing Drive Assignments

“View Drive Assignments <2>” in the Main Menu displays whether drives are assigned or unassigned to disk arrays.

Under the “Assignment” column, drives are labeled according to their assigned disk array or are shown as “Free” if unassigned. Such “Free” drives can be used for a future array or used as a spare drive when a drive fails in a mirrored array. Unassigned drives are not accessible by the OS. The menu also displays the data transfer mode that relates to speed used by each drive (U5 refers to 100MB/sec transfers, U4 refers to 66MB/sec transfers, etc...).

FastBuild (tm) Utility 1.xx (c) 1995-2000 Promise Technology, Inc. [View Drive Assignments]				
Channel:ID	Drive Model	Capacity(MB)	Assignment	Mode
1 : Master	QUANTUMCR8.4A	8063	Array 1	U5
1 : Slave	QUANTUMCR8.4A	8063	Free	U5
2 : Master	QUANTUMCR8.4A	8063	Array 1	U5
[Keys Available]				
[?] Up [?] Down [ESC] Exit Mode (U=UDMA, P=PIO, D=DMA)				

Viewing an Array

“View Array <3>” in the Main Menu displays each array' s RAID mode, the number of drives used, its capacity and status.

FastBuild (tm) Utility 1.xx (c) 1995-2000 Promise Technology, Inc.
[View Array Menu]

Array No	RAID Mode	Total Drv	Capacity(MB)	Status
Array 1	Stripe	2	16126	Functional
Array 2	---	---	---	---
Array 3	---	---	---	---
Array 4	---	---	---	---

[Keys Available]

Note: * — Bootable Array

[?] Up [?] Down [ESC] Exit [Enter] Select [Space] Change Boot Drive

For more information on a particular array, use the Up or Down arrow keys to select the array then press <Enter>. The screen below will appear showing the channel ID, drive model and capacity of the drives that are in the array.

FastBuild (tm) Utility 1.xx (c) 1995-2000 Promise Technology, Inc.
[View Array Menu]

Array No	RAID Mode	Total Drv	Capacity(MB)	Status
Array 1	Stripe	2	16126	Functional

Stripe Block: 64 KB

[Drive Assignments]

Channel:ID	Drive Model	Capacity (MB)	Assignment
1 : Master	QUANTUMCR8.4A	8063	Y
1 : Slave	QUANTUMCR8.4A	8063	N
2 : Master	QUANTUMCR8.4A	8063	Y

[Keys Available]

[?] Up [?] Down [ESC] Exit [Space] Select [Ctrl-Y] Save

Deleting An Array

“Delete Array <4>” menu allows you to delete disk array assignments. This is not the same as deleting data from the drives themselves. If you deleted an array by accident (and before it has been used again), the array can normally be recovered by defining the array identical to the deleted array.

WARNING: *Deleting an existing disk array could result in its data loss. Make sure to record all array information including the array type, the disk members, and stripe block size in case you wish to undo a deletion.*

FastBuild (tm) Utility 1.xx (c) 1995-2000 Promise Technology, Inc.				
[Delete Array Menu]				
Array No	RAID Mode	Total Drv	Capacity(MB)	Status
Array 1	Stripe	2	16126	Functional
Array 2	---	---	---	---
Array 3	---	---	---	---
Array 4	---	---	---	---
[Keys Available]				
[?] Up [?] Down [ESC] Exit [Del] Delete				

1. To delete an array, highlight the array you wish to delete and press the key.
2. View Array Menu will appear (see below) showing the drives that are assigned to this array.

FastBuild (tm) Utility 1.xx (c) 1995-2000 Promise Technology, Inc.				
[View Array Menu]				
Array No	RAID Mode	Total Drv	Capacity(MB)	Status
Array 1	---	---	---	---
Stripe Block: 64 KB				
[Drive Assignments]				
Channel:ID	Drive Model	Capacity (MB)	Assignment	
1 : Master	QUANTUMCR8.4A	8063	Y	
2 : Master	QUANTUMCR8.4A	8063	Y	

3. Confirm the following warning message using the <Ctrl-Y> keys to continue array deletion:

Are you sure you want to delete this array? Press Ctrl-Y to Delete, others to Abort
--

4. After deleting the array, you should create a new array in Auto Setup or View Array menu.

Rebuilding A Mirrored Array

“Rebuild Array <5>” menu is necessary to recover from an error in the mirrored disk array. An error message will appear when booting your system from the boot array.

NOTE: Drives **MUST** be replaced if they contain any physical errors.

1. On boot up, the BIOS will display an error message identifying the drive that has failed.
2. Press the <Ctrl-F> keys to enter the FastBuild Main Menu.
3. Select “View Array <3>”.
4. Select the failed array and identify the channel and ID of the failed drive.
5. Power off and physically remove the failed drive.
6. Replace the drive with an identical model.
7. Reboot the system and enter the FastBuild Main Menu.
8. Select the “Rebuild Array <5>” menu. The following screen will appear.

FastBuild (tm) Utility 1.xx (c) 1995-2000 Promise Technology, Inc. [Rebuild Array Menu]				
Array No	RAID Mode	Total Drv	Capacity(MB)	Status
Array 1	Mirror	2	16126	Critical
Array 2	---	---	---	---
Array 3	---	---	---	---
Array 4	---	---	---	---
[Keys Available]				
[?] Up [?] Down [ESC] Exit [Enter] Select				

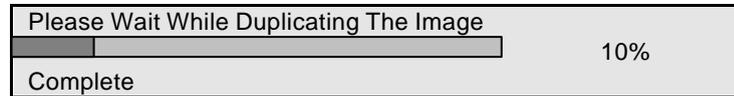
9. Highlight the array with the “Critical” status.
10. Press <Enter>. The following screen will appear.

FastBuild (tm) Utility 1.xx (c) 1995-2000 Promise Technology, Inc. [Rebuild Array Menu]			
Array No	RAID Mode	Total Drv	Status
Array 2	Mirror	2	Critical
Stripe Block: Not Available			
[Select Drive for Rebuild]			
Channel:ID	Drive Model	Capacity (MB)	
1 : Slave	QUANTUMCR8.4A	8063	
[Keys Available]			

RAID User's Manual

[?] Up [?] Down [ESC] Exit [Enter] Select

11. Under " Select Drive for Rebuild" , highlight the new drive.
12. Press <Enter> to confirm that the data will be copied to the selected new drive. All data will be copied with mirrored information from the array drive to the new drive. A progress bar will appear as below.



13. Once the rebuild process is complete, the user will be asked to reboot the system.

Viewing Controller Settings

“Controller Configuration <6>” menu allows you to enable or disable the BIOS from halting if it detected an error on boot up. You may also view the system resources (Interrupt and I/O port address) of the data channels.

```
FastBuild (tm) Utility 1.xx (c) 1995-2000 Promise Technology, Inc.
[ Adapter Configuration - Options ]

Halt On Error:  Enable

[ System Resources Configuration ]

Channel 1 (IDE1)      Interrupt : A      I/O Port : FFF0
Channel 2 (IDE2)      Interrupt : A      I/O Port : FFA8

[ Keys Available ]

[? , ? , Space] Change Option [ESC] Exit
```

Halting the Promise BIOS On Boot up Errors

“Adapter Configuration – Options” allows you to enable or disable the Promise BIOS so as to halt operation at the BIOS startup screen should an error be detected. This is the only option that can be changed on this screen.

Installing Drivers

This section details driver installation for various operating systems. It includes the driver necessary to identify the Promise controller to the operating system.

Windows 2000

Installing the Driver during Windows 2000 Installation

1. Boot from the CD-ROM. Press <F6> after the message " Press F6 if you need to install third party SCSI or RAID driver" appears.
2. When the "Windows 2000 Setup" window appears, press <S> to Specify an Additional Device(s).
3. Insert the floppy disk (included in the system board package) into a floppy drive.
4. Press <O> to select "Other" and press the <Enter> key.
5. The Windows 2000 Setup screen will appear showing " Setup will load support for the following mass storage devices:" The list includes "Win2000 Promise FastTrak100-Lite controller" .

NOTE: *If you need to install additional devices, do so at this time. Once all devices are installed, proceed to step 7.*

6. In the Windows 2000 Setup screen, press the <Enter> key. Setup will now load all device files and then continue with the Windows 2000 installation.

Confirming the Windows 2000 Driver Installation

1. In Windows 2000, open the Control Panel from “My Computer” then double-click the System icon.
2. Click the “Hardware” tab, then click the “Device Manager” tab.
3. Click “+” that is next to “SCSI & RAID Controllers hardware type.” “Win2000 Promise FastTrak/FastTrak100-Lite Controller” will appear.

Windows 95/98

Installing the Driver During Windows 95/98 Installation

The following sections detail the installation of the Windows 95/98 driver while installing its operating system. If you're installing the driver on an existing Windows 95/98 system, refer to the "Installing the Driver on an Existing Windows 95/98 System" section.

Windows 98

1. After installing and configuring the hard drive(s), partition and format them, if necessary.
2. Follow the standard procedure of installing Windows 98.
3. After installation, go to the "Start" menu and click "Settings."
4. From the "Settings" menu, click "Control Panel".
5. In the "Control Panel" window, double-click the "System" icon.
6. In the "System" window, click the "Device Manager" tab.
7. In the hierarchical display under "Other Devices", click "PCI RAID Controller" and then click the "Properties" button.
8. Click the "Driver" tab, click "Update Driver," and then click "Next".
9. Click "Search for a better driver than the one your device is using now (recommended)," then click "Next."
10. Click "Specify Location".
11. Insert the CD (included in the system board package) into a CD-ROM drive. If the "autorun" screen appears, click "Exit".
12. Click "Browse" then select [CD-ROM drive]:\RAID IDE\Win9x-me, which is where the driver is located. Click "OK".
13. Click "Next" then click "Next" again.
14. Click "Finish" then click "Yes" to restart your computer.

Windows 95

1. After installing and configuring the hard drive(s), partition and format them, if necessary.
2. Follow the standard procedure of installing Windows 95.
3. After installation, go to the "Start" menu and click "Settings".
4. From the "Settings" menu, click "Control Panel".
5. In the "Control Panel" window, double-click on the "System".
6. In the "System" window, click the "Device Manager" tab.
7. In the hierarchical display under "Other Devices", click "PCI Mass Storage Controller" then click the "Properties" button.
8. Click the "Driver" tab and then click the "Update Driver" button.

9. When asked if you want Windows to search for the driver, click "Yes (recommended)."
10. When Windows informs you that it was unable to find the drivers, click "Other Locations..."
11. Insert the CD (included in the system board package) into a CD-ROM drive. If the "autorun" screen appears, click "Exit".
12. Click "Browse" then select [CD-ROM drive]:\RAID IDE\Win9x-me, which is where the driver is located. Click "OK".
13. Click "Next" then click "Next" again.
14. Click "Finish" then click "Yes" to restart your computer.

Installing the Driver on an Existing Windows 95/98 System

The following sections detail the installation of the Windows 95/98 driver on an existing Windows 95/98 system. If you are installing the driver during a Windows 95/98 installation, refer to the "Installing the Driver During Windows 95/98 Installation" section.

Windows 98

1. After installing and configuring the hard drives, power up the system.
2. The "Add New Hardware Wizard" will appear informing you that it has found a "PCI RAID Controller." Click "Next".
3. Click the "Search for the best driver for your device" box then click the "Next" button.
4. Click the "Specify a Location" box and then click the "Next" button.
5. Insert the CD (included in the system board package) into a CD-ROM drive. If the "autorun" screen appears, click "Exit".
6. Click "Browse" then select [CD-ROM drive]:\RAID IDE\Win9x-me, which is where the driver is located. Click "Next".
7. Click "Next" then click "Next" again.
8. Click "Finish" then click "Yes" to restart your computer.

Windows 95

1. After installing and configuring the hard drives, power up the system.
2. The "Update Device Drive Wizard" will appear informing you that it has found a "PCI Mass Storage Controller." Click "Next".
3. Insert the CD (included in the system board package) into a CD-ROM drive. If the "autorun" screen appears, click "Exit".
4. Click "Browse" then select [CD-ROM drive]:\RAID IDE\Win9x-me, which is where the driver is located. Click "Next".
5. Click "Next" then click "Next" again.
6. Click "Finish" then click "Yes" to restart your computer.

Confirming the Windows 98/95 Driver Installation

To confirm that the driver has been properly installed in Windows 95/98, perform the following steps:

1. Click "Settings" from the "Start" menu.
2. Click "Control Panel" and then double-click the "System" icon.
3. Click the "Device Manager" tab, and then click "+" that is next to "SCSI & RAID controllers." "Win95-98 Promise FastTrak100-Lite controller" will appear.

Windows NT 4.0

Installing the Driver During Windows NT 4.0 Installation

1. Start the system installation by booting from the Windows NT disk. Press the <F6> key when the message "Setup is inspecting your computer' s hardware configuration..." appears.
2. When the "Windows NT Setup" window appears, press <S> to Specify an Additional Device(s).
3. Insert the floppy disk (included in the system board package) into a floppy drive.
4. Press <O> to select "Other" and press the <Enter> key.
5. The Windows NT Setup screen will appear showing "Setup will load support for the following mass storage devices:" The list includes "Win NT Promise FastTrak100-Lite (tm) controller".

NOTE: *If you need to install additional devices, do so at this time. Once all devices are installed, proceed to step 7.*

6. In the Windows NT Setup screen, press the <Enter> key. Setup will now load all device files and then continue the Windows NT installation.
7. After installing the driver successfully, the "SCSI Adapter Setup" box will show that the "Win NT Promise FastTrak100-Lite (tm) Controller" driver has been installed.

Removing the Driver from Windows NT 4.x

1. In the "Start" menu, click "Settings" .
2. In the "Settings" menu, click "Control Panel" .
3. In "Control Panel", click "SCSI Adapter" and then click "Drivers" .
4. Click "Remove" .
5. After successfully removing it, the "SCSI Adapter Setup" box will show that "Win NT FastTrak100-Lite RAID Controller" has been removed.

Using The FastCheck™ Monitoring Utility

You can monitor the operating status of all configured arrays and drives using the provided FastCheck monitoring utility designed for Windows-based operating systems. FastCheck generates visual and audible messages alerting you of possible problems with the disk array or controller.

FastCheck visually identifies the physical location of the drives attached to the RAID IDE channel (1 or 2) and setting (Master/Slave/Cable-Select). It also displays the drives that are included in an individual array. Administrators can customize FastCheck to maintain operating logs and event notification, set Password access to the utility, and schedule maintenance on Mirrored (RAID 1) or Striped/Mirrored (RAID 0/1) arrays.

Installing FastCheck

1. From the "Start" button of the Windows Taskbar, click "Run".
2. Insert the CD (included in the system board package) into a CD-ROM drive.
3. In the Run dialog box, type in the CD-ROM drive where you inserted the CD then click "OK" or select the Promise FastCheck Utility in the autorun screen.



4. Follow the directions of the setup program.
5. During the installation process, click "Yes" if you wish to run the utility every time you startup. If you select "No", FastCheck will not initialize during startup. You may manually execute the utility via the Start button.

NOTE: We recommend that FastCheck be loaded during Startup. This insures you that it will be ready to post alerts on errors.

Running FastCheck

As described in the Installation section, the default is to load the utility during the Windows 95/98/NT/2000 startup. It appears minimized on the taskbar under Windows 95/98/NT4/2000/Millennium (see below).



To start FastCheck, double-click the FastCheck icon on the taskbar (above) or use the Taskbar' s Start/Promise/FastTrak/FastCheck Monitoring Utility menus (below).



Closing FastCheck

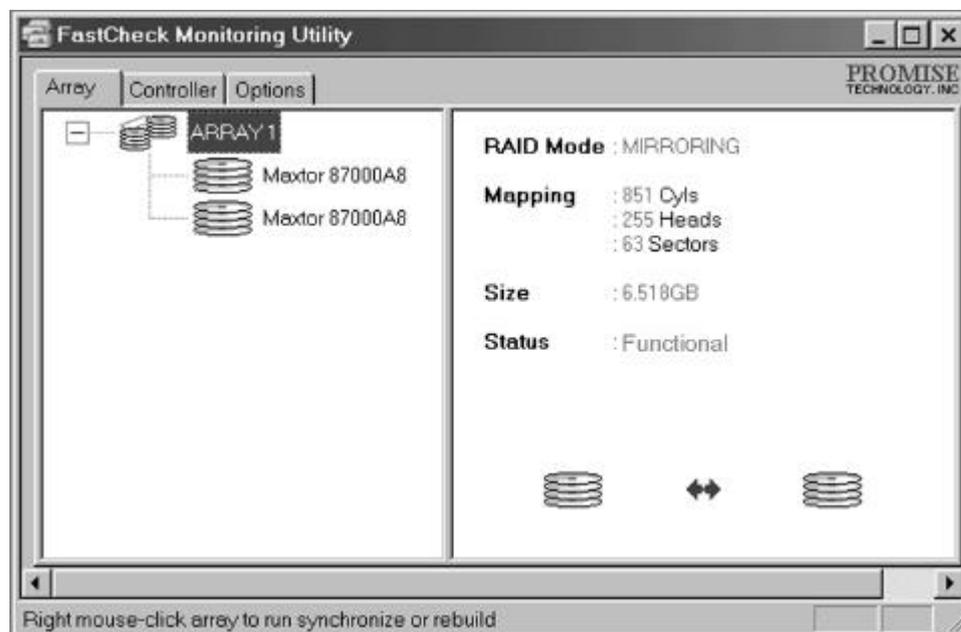
Once you start FastCheck (either automatically on startup or manually), the monitoring utility remains running at the background even if the user "closes" the FastCheck window.

To completely shut down FastCheck, perform the following steps.

1. Right-click the FastCheck icon on the Taskbar.
2. Select Exit on the pop-up window.
3. FastCheck will stop monitoring the array.

Using the FastCheck Array Window

Once you start FastCheck, the FastCheck Monitoring Utility window will appear. The main pane has three window tabs: Array, Controller, and Options. The user can switch between windows by clicking on the tab. The Array window is the active window by default (below).



The Array window (see above) displays information about the arrays configured through the FastBuild utility. From this window, you can also perform data Synchronization of mirrored arrays, or Rebuild data from one drive to a new replaced drive within a mirrored array.

While the Array window does not allow you to change the array configurations directly, it clearly identifies the drives that are associated in each array as shown in the left pane.

Viewing Array Information

By left-clicking on the Array #, the right pane shows the following information of that array:

RAID mode: Striping, Mirroring or Spanning

Mapping: (similar to physical drive specifications) Shows the # of cylinders, heads, and sectors of the array's "virtual" drive as seen by the system.

Size: Storage capacity of the array.

Status: (Functional, Critical, Offline)

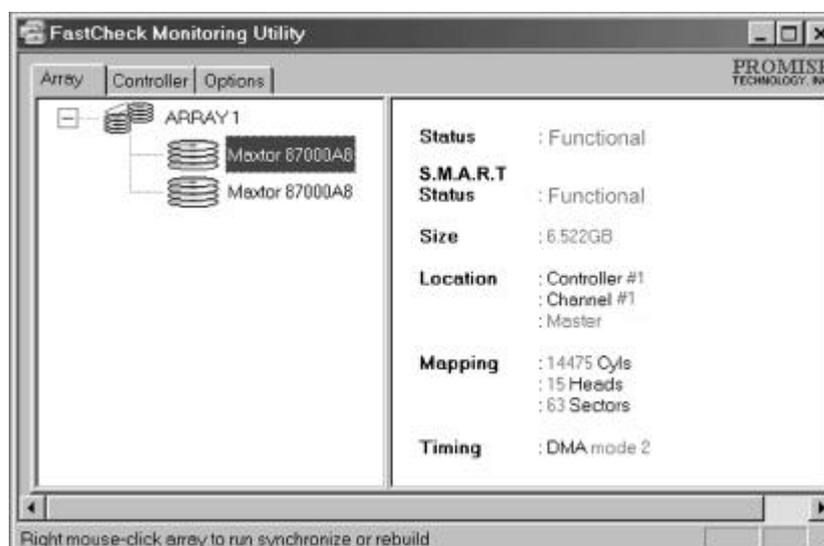
Functional: Means the array is providing full functionality.

Critical: Used only in reference to a Mirroring array (RAID 1 or RAID 0+1). A problem has been detected in one of the drives in the array and the drive has been taken "offline". However, a "critical" array will continue to save and retrieve data from the remaining working drive(s). We recommend replacing the failed drive as soon as possible since a "Critical" array offers no data redundancy.

Offline: This would appear most commonly within a RAID 0 or Spanning array. "Offline" results from a drive having failed and has taken the entire array "offline." In this case, you have likely lost data. Fix/replace the drive that has failed, then restore data from a backup source.

Viewing Arrayed Drive Information

By left-clicking on a drive member in an array in the left pane, the right pane will show the information of that drive.



Status (also shown under the Array Window) can be Functional, Critical, or Offline.

Functional: Means the drive is working normally.

Critical: A problem has been detected on the drive and the drive has been taken offline. Mirrored arrays will continue to function without the drive. Fix/replace the drive that has failed, then restore data from a backup source.

Offline: Drives that are NOT identified as "bad" may be taken offline if part of a Striping or Spanning array contains a "bad" drive. These drives do NOT need to be replaced, however.

S.M.A.R.T. Status: Indicates whether the attached hard drive implements Self-Monitoring Analysis & Reporting Technology to predict drive failure.

Size: Indicates capacity of individual drive.

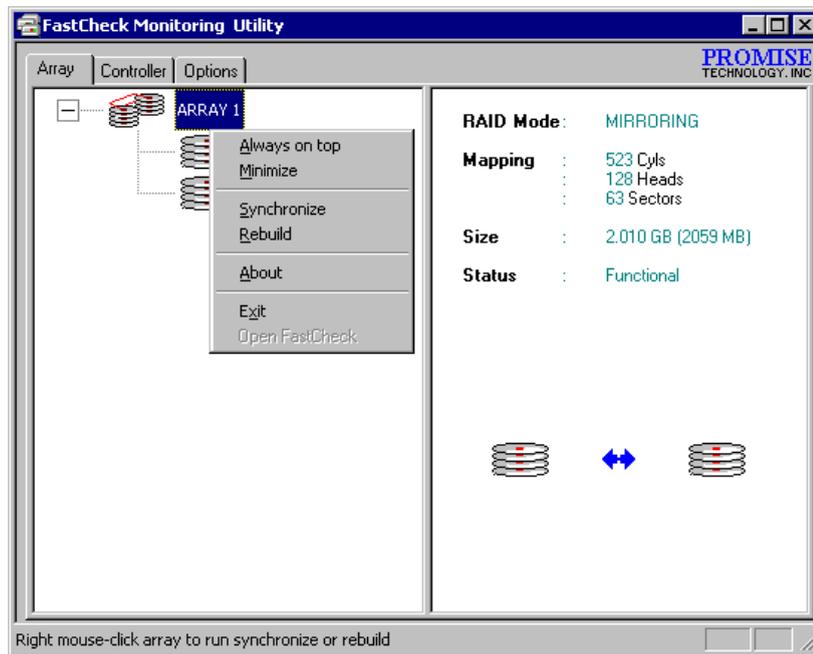
Location: Shows the physical location of the drive. Indicates the IDE channel (1 or 2), and whether the drive on the cable is Master or Slave. This allows the user to identify drives for removal/replacement.

Mapping: Indicates the physical parameters of the drive (cylinders, heads, sectors).

Timing: Shows selection of the drive timing (directly related to burst speed) based on the type of drive and cable used.

Using the Array Pull-down Menu

The bottom of the window indicates that you must right mouse-click the array to run synchronization or rebuild operations. Right-clicking displays the pull-down menu.



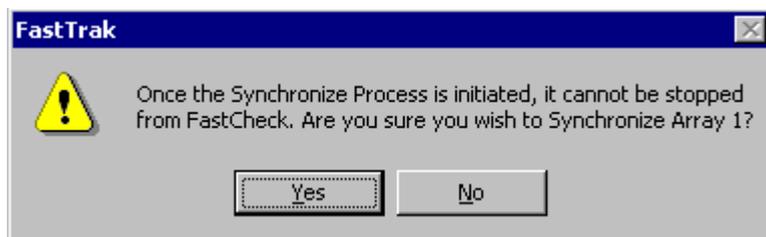
From this menu, you may choose to let the window appear **Always on Top** of the application, **Minimize** the window, **Synchronize** mirrored drives, **Rebuild** a mirrored array, use **About** to check FastCheck version #, or **Exit** the onscreen window.

Synchronizing An Array

Synchronization is a periodic maintenance procedure for Mirrored (RAID 1, RAID 0+1) arrays to maintain data consistency on all mirrored drives. During operation, array synchronization compares data differences on mirrored drives. If there are differences detected, data from the primary drive(s) is automatically copied to the secondary drive(s). This assures that all mirrored drives contain the exact information.

NOTE: You may schedule array synchronization automatically under the Options tab rather than manually initiating synchronization.

1. To synchronize, choose the Array tab (see figure on previous page).
2. Right-click on the array you wish to synchronize and choose "Synchronize" from the context menu.
3. Click "Yes" to initiate Synchronization (see below). To cancel this option, click the "No" button.



WARNING: Once initiated, synchronization CANNOT be halted. This is to prevent data errors.

- Once Synchronization is confirmed, the following screen appears. Click "OK" or close the window to proceed.



NOTE: During Array Synchronization, users may continue to access the working array and perform normal PC operations. However, system performance will be slightly degraded and the process will take longer.

- A progress bar will appear at the bottom of the FastCheck Monitoring window showing that synchronization is in progress and the percentage has been completed.



Rebuilding An Array

This command effectively copies or overwrites data from an existing data drive in the array on to a blank drive. The operation will be typically used when a failed drive has been replaced with a new drive in the mirrored array.

1. To perform a Rebuild, click the "Array" tab.
2. Right-click the array number and choose "Rebuild" from the context menu.
3. You will be asked to "Initialize Rebuild process on Array #". Click "OK".

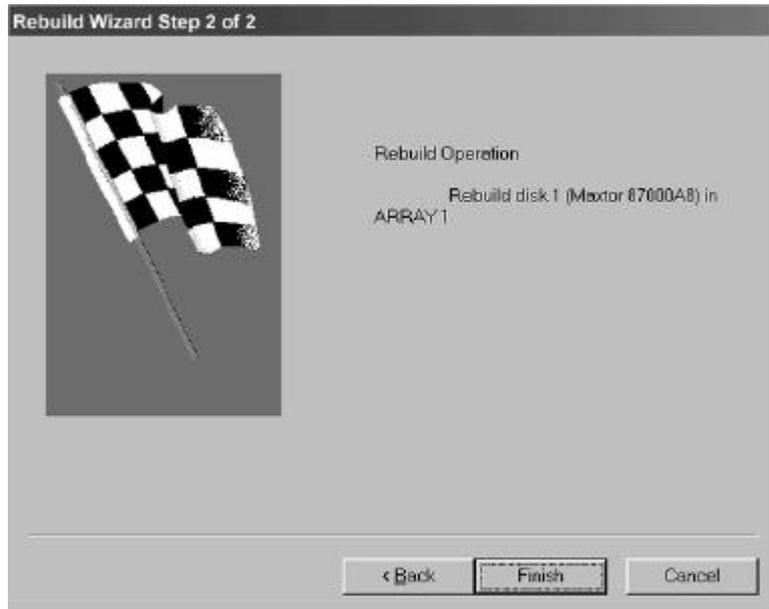
Using the Rebuild Wizard

1. Initiating the rebuild array will open the Rebuild Wizard Step 1 screen as shown below.
2. Select the Target drive that will receive data. Make sure you select the new blank or replacement drive. The unselected drive contains "good" data. It will be the remaining working drive in an array, or a system drive containing existing data that you would wish to mirror.

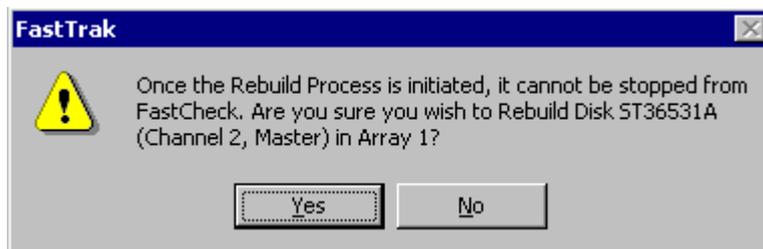


WARNING: You must be absolutely sure of the drive. If data exists on the target drive, it will be overwritten.

3. Click "Next" to proceed to Rebuild Wizard Step 2 (see next page) or "Cancel" to stop.



4. Rebuild Wizard Step 2 confirms the target or "Rebuild" disk by Array # and drive ID.
5. Click "Finish" to initiate physical Rebuild, "Back" to review Step 2, or "Cancel" to Stop. A final confirmation window appears as below:



6. Click "Yes" to initiate Rebuild. To cancel this option, click "No".

WARNING: Once initiated, Array Rebuild CANNOT be halted. This is to prevent data errors.

NOTE: During Array Rebuild, users may continue to access the array and perform normal PC operations, however the array will NOT provide data redundancy until Rebuild is completed. If you choose to continue using the PC during rebuild, system performance will be slightly degraded and the process will take longer.

6. Once Array Rebuild starts, you will return to the FastCheck Monitoring window. A progress bar showing the rebuild progress in percentage will appear at the bottom of the FastCheck Monitoring window.



***NOTE:** When a "spare" unassigned drive is present, a rebuild will automatically be performed from the remaining working drive.*

Using Controller Window

Clicking the "Controller" tab will reveal the Controller window. This displays physical information about the data channels and the attached drives.

Viewing IDE Channel Information

Left-clicking on a given Channel icon or # in the left pane will show the Base IO addresses of the channel in the right pane (used for troubleshooting).

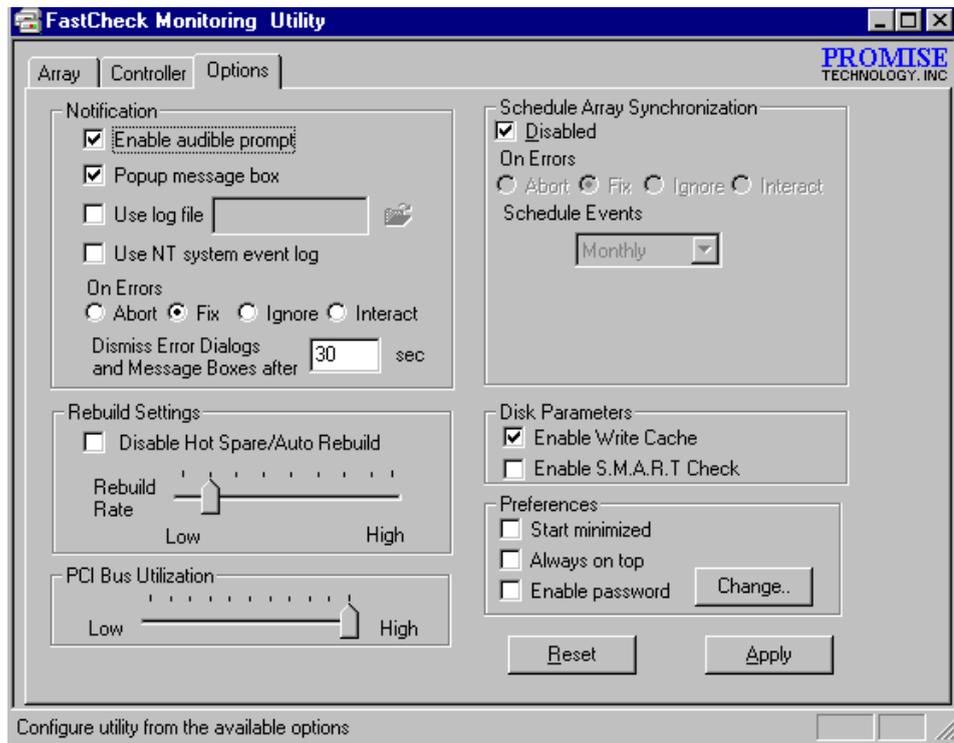
Viewing Drive Information

Left-clicking on a given drive icon or ID in the left pane will show similar information as the Array Window Drive Information in the right pane.

- Status** (also shown under the Array Window) It could be Functional, Critical, or Offline.
- Functional:** The drive is working normally.
- Critical:** A problem has been detected in the drive and the drive has been taken offline as part of a mirroring array. Mirrored arrays will continue to function without the drive. Fix/replace the drive that has failed then restore data from a backup source.
- Offline:** Drives that are NOT identified as "bad" may be taken offline if part of a Striping or Spanning array contains a "bad" drive. These drives do NOT need to be replaced, however.
- S.M.A.R.T. Status:** Indicates whether the attached hard drive implements Self-Monitoring Analysis & Reporting Technology to predict drive failure.
- Size:** Indicates the capacity of the individual drive.
- Location:** Shows physical location of the drive. Indicates the IDE channel (1 or 2) and the drive that is Master or Slave. This allows you to identify the drives for removal/replacement.
- Mapping:** Indicates the physical parameters of the drive (cylinders, heads, sectors).
- Timing:** Shows the drive timing (directly related to burst speed) based on the type of drive and cable used.

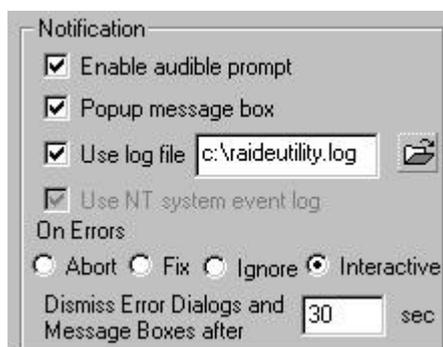
Using Options Window

Clicking on the Options tab reveals the Options window. Array administrators can customize the FastCheck Monitoring Utility in four major areas: Notification, Array Synchronization Scheduling, setting Password and Desktop Appearance. Most options relate to Mirroring arrays (RAID 1 or RAID 0+1).



Selecting Notification Options

This section of the Options window allows users to select how they are notified of a system event. A System Event includes driver-initiated Rebuilds (automatic rebuild using a "hot" spare standby drive), user-initiated manual Rebuilds or manual Synchronization, and Error-Handling for these processes.



Enable audible prompt turns on/off the audible alarm of an event (typically a drive failure, or completion of rebuild or synchronization).

Popup message box turns on/off the appearance of an event message box that would typically indicate a drive failure, or completion of rebuild or synchronization.

Use log file allows writing operating event logs of the array activity (alerts and status reports) to a given file name and directory. If a file name is used but the path left blank, the default directory is the same as that of the FastCheck Utility (typically C:\Program Files\Promise\FastTrak100-Lite).

Use NT system event log is automatically grayed out under Windows 95/98/2000/Millennium. Under Windows NT4, it permits you to write array logging to NT's own event log.

1. To view FastCheck events under Windows NT, go to Start/Programs/Administrative Tools/Event Viewer.
2. In Event Viewer, choose "Log" from the menu bar, and then click "Application". Any events generated by FastCheck will appear under the Source column as "FastCheck".

On Errors offers four radio buttons for the user to select the procedure they would like to perform if an Error is detected during automatic/manual Rebuilds or manual Synchronization. There are three types of errors that can be detected - a data mismatch between the primary and secondary drives, a physical media error on the source or target drive, or a total disk failure. The options for handling Errors are as follows:

Abort: Stops any Synchronization or Rebuild process if an error is encountered.

Fix: In most cases, the system will automatically correct errors. The method of correction varies depending on the type of error.

Ignore: The system will log the event error and continue the rebuild or synchronization process. Use this setting if you want to detect the presence of

errors, but do not want to fix these errors yet. The user may then decide what to do about the error(s) detected.

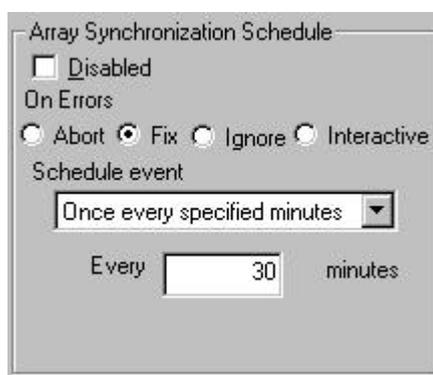
WARNING: This may result in mismatched drives under RAID 1 or 0+1.

Interactive: By checking this option, a window will appear each time an error is detected asking whether you want to Abort, Fix, or Ignore the error (see Troubleshooting section).

Dismiss Error Dialogs designates the length of time (in seconds) that a Message box or Error Dialog box appears on the screen.

Scheduling Array Synchronization

This section of the Options window allows a user to schedule when and how often the system will perform synchronization maintenance of a mirrored array.



Disable (the default). Click to turn off automated scheduling of synchronization. When unchecked, the Scheduling section will be highlighted (see above).

On Errors offers four radio buttons for the user to select the procedure they would like to perform if an error is detected during a scheduled Synchronization. There are three types of errors that can be detected -- a data mismatch between the primary and secondary drives, a physical media error on the source or target drive, or a total disk failure. The options for handling Errors are as follows:

Abort: Stops the Synchronization process if an error is encountered.

Fix: In most cases, the system will automatically correct errors. The method of correction varies depending on the type of error (see Appendix under Error Correction Methodology).

Ignore: The system will log the event error and continue the synchronization process. (Warning: this may result in mismatched drives under RAID 1 or 0+1). Use this setting if you want to detect the presence of errors, but do not want to fix these errors yet. The user may then decide what to do about the error(s) detected.

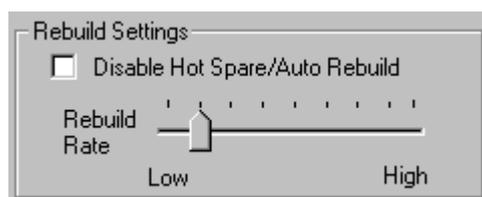
Interactive: By selecting this option, a window will appear each time an error is detected asking whether you want to Abort, Fix, or Ignore the error (see Troubleshooting for more details).

Schedule event drop down box allows scheduling synchronization by minute, by hour, by day, by week, or by month. If enabled, the default is By Month. This allows synchronization to take place during an off-hour when the system is either not in use or not at peak demand.

Start time designates hr/min/ am/pm.

On the designates day of week or by ordinal (1st, 2nd, 3rd....) selection.

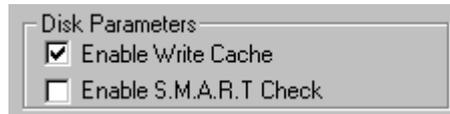
Setting Rebuild Options



Disable Hot Spare/Auto Rebuild turns off the use of a “hot” spare drive and automatic rebuilding of a mirrored array. The default is unchecked (or enable Hot Spare/Auto Rebuild).

Rebuild Rate assigns the amount of importance that is given to mirroring data from one drive to another in the background. A “high” setting assigns most of the resources to the rebuild process at the expense of responding to ongoing read/write data requests by the operating system. A “low” setting gives priority to ongoing read/write data requests by the operating system at the expense of the rebuild process and will typically result in longer rebuild time. The setting shown above is the default.

Setting Disk Parameters Option

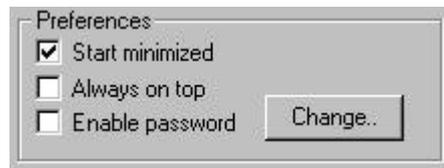


Enable Write Cache allows you to enable/disable write cache for hard drives that include this performance feature. FastCheck automatically recognizes such drives and enables the feature as the default setting. For drives that do not use write caching, this option is automatically grayed out.

Enable S.M.A.R.T. Check tells FastCheck to regularly monitor each drive to assure that drive failure prediction is functioning. The default is unchecked, meaning FastCheck will not monitor this function.

Setting Screen Preferences

This section controls how the FastCheck utility screen is displayed and sets the security password to protect the administrative settings.



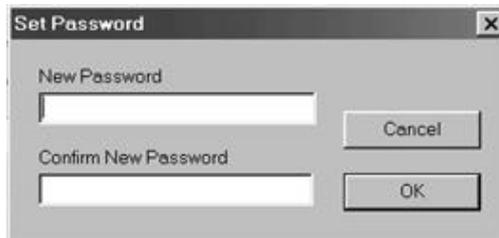
Start Minimized FastCheck will appear on the toolbar only on startup. Click on the icon to see the FastCheck utility screen.

Always on Top FastCheck will appear above all programs until closed or minimized manually.

Enable Password turns on/off the use of a Password every time the FastCheck Monitoring Utility icon is selected or when the program is running from the Start menu. Disabling the use of a current password requires password entry (see Creating Password on next page).

Creating a Password

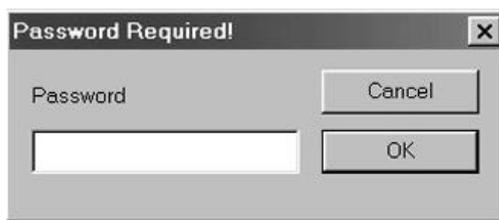
1. To create a password, click **Enable Password** in the Preferences section. The "Set Password" window will appear.



2. Type the password you want to use. Press the <Tab> key or click to retype the same password in the "Confirm New Password" section. Click the <OK> button.

NOTE: Remember to record the password in a secure place in case you forget it.

3. A confirmation screen will appear showing that "Password Checking is Enabled". Click the <OK> button.
4. Once the password feature is enabled, the following window will appear every time you try to open the FastCheck window.



Changing Password

1. Input the original password you first created to gain access to FastCheck.
2. Click the "Options" tab, then click the "Change" button in the Password section. The Set Password screen will appear.
3. Type the password you want to use. Press the <Tab> key or click to retype the same password in the "Confirm New Password" section.
4. Click <OK>.

Disabling Password

1. Input the original password you first created to gain access to FastCheck.
2. Click the Options tab.
3. Uncheck the "Enable Password" checkbox. Click the "Apply" button.

Understanding Disk Array Concepts

About the BIOS

The Promise BIOS code extends the standard disk service routine provided through Int13. The BIOS is bootable for DOS and other operating systems that rely on the system BIOS for drive operation. It can support drives and disk arrays with capacities exceeding 8.4 GB and using Extended Interrupt13. When the BIOS appear during boot up, press <Ctrl-F> to enter the FastBuild™ utility and select the menu settings.

FastBuild™ Auto Menu Setup

The setup utility is used to build and manage disk arrays. It is menu driven and features "Auto Setup <1>" which uses a simple, interactive setup process. Once the array is built, all the array members store the configuration information in the drive' s reserved area.

Reserved Sector

Array configuration data about the drive member and other members in the disk array are saved in a special location on the disk drives called the reserved sector. If any member of the array becomes corrupt or lost, the redundant configuration data on the other members can be used for rebuilds.

Disk Array Terms

Disk Array Description

A "disk array" is formed from a group of 2 or more disk drives which appear to the system as a single drive. The advantage of an array is to provide better throughput performance and/or data fault tolerance. Better performance is accomplished by sharing the workload in parallel among multiple physical drives. Fault tolerance is achieved through data redundant operation where if one (or more) drive fails or has a sector failure, a mirrored copy of the data can be found on another drive(s).

For optimal results, select identical Ultra ATA/100 drives in the same disk array. The drives' **matched performance** allows the array to function better as a single drive.

Disk Array Member

The individual disk drives in an array are called "members." Each member of a specific disk array is coded in their "reserved sector" with configuration information that identifies the drive as a member. All disk members in a formed disk array are recognized as a single physical drive to the system.

Disk Array Types

For most installations, "Auto Setup "<1>" in the FastBuild™ utility will configure your system.

There are two disk array types in three categories that can be installed on the system board. Striping is in the Performance category while Mirroring is in the Fault Tolerance category. Spanning (JBOD) is in the Capacity category.

Disk arrays within the Performance and Fault Tolerance categories conform with the Redundant Array of Independent Disks technology, or RAID. The RAID levels supported are 0 and 1.

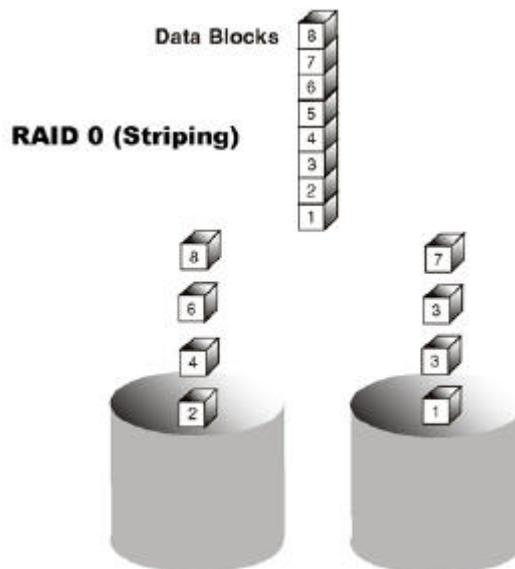
RAID Level	Performance	Capacity	# of Drives
RAID 0 (Striping)	Highest	# Drives x Smallest Size	2
RAID 1 (Mirroring)	Normal	50% min	2

About RAID Levels

Striping (RAID 0)

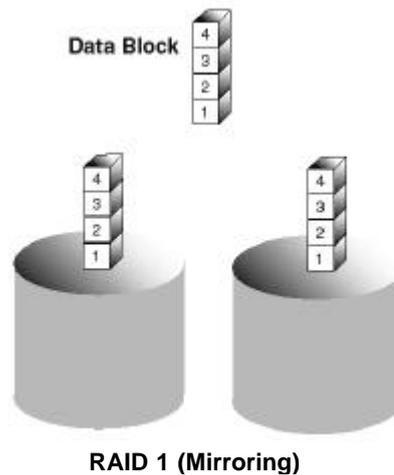
Reads and writes sectors of data interleaved between multiple drives. When any disk member fails, it affects the entire array. Performance is better than a single drive since the workload is balanced between the array members. This array type is for high performance systems. Identical drives are recommended for performance as well as data storage efficiency. The disk array data capacity is equal to the number of drive members times the smallest member capacity. For example, one 1GB and three 1.2GB drives will form a 4GB (4 x 1GB) disk array.

Stripe Size - a value can be set from 1KB to 1024KB sector size. The size can directly affect performance. In the FastBuild BIOS, the "Desktop" default is 8KB while "Server" and "A/V Editing" are 64KB.



Mirroring (RAID 1)

Writes duplicate data on to a pair of drives while reads are performed in parallel. ATA RAID 1 is fault tolerant because each drive of a mirrored pair is installed on separate IDE channels. If one of the mirrored drives suffers a mechanical failure (e.g. spindle failure) or does not respond, the remaining drive will continue to function. This is called **Fault Tolerance**. If one drive has a physical sector error, the mirrored drive will continue to function.



On the next reboot, the FastBuild™ utility will display an error in the array and recommend replacement of the failed drive. You may choose to continue using your PC, however we recommend replacing the failed drive as soon as possible.

Due to redundancy, the drive capacity of the array is half the total drive capacity. For example, two 1GB drives that have a combined capacity of 2GB would have 1GB of usable storage. With drives of different capacities, there may be unused capacity on the larger drive.

Using a Spare Drive

Under a RAID 1 setup, an extra "hot spare" drive (a third drive) can be attached and not assigned to the array. Such a drive will be activated to replace a failed drive. A rebuild is performed automatically in the background to mirror the good drive data on to the spare.

At a later time, the system can be powered off and the failed drive can be physically removed and replaced. Spare drives must be of the same or larger in capacity than the smallest array member.

Under RAID 0+1, the array maintains data integrity if any 1 or 2 combination survives.

Event	Failed Drives	Array Status	Why?
1	A1/A2	Working	B1/B2 retain array integrity
2	B2/B1	Working A1/A2	retain array integrity
3	A1/B2	Working B1/A2	retain array integrity
4	B1/A2	Working A1/B2	retain array integrity
5	A1/B1	Offline	B2/A2 contain only half of the array data
6	B2/A2	Offline	A1/B1 contain only half of the array data

Troubleshooting & Tips

This section is used to assist troubleshooting conflicts and installation problems. Also refer to the "README.TXT" file in the CD for more recent information as well as the **PromiseOnline™** services listed in Appendix A.

Drive-Related Errors

Critical Array Status Error Reported during Boot

If the critical status error message of a mirrored array appears on the BIOS startup screen (see below), there is a drive in the array that has failed or is not responding. The system will identify the failed drive by channel number and Master/Slave designation (if 2 drives exist on the same cable). The mirrored array has lost its fault tolerance, but will still perform normal drive reads and writes.

Operation aborted because FastBuild encountered an error as follows:

Location: Channel 2 - Master Drive
Array Status: Critical

Please retry using FastCheck utility to recover all data. Reboot the system by pressing the ENTER key.

Try powering the system off and on to reset the drive. Also confirm that cables are properly attached and the drive is receiving power. If the drive still appears to have failed, proceed to FastCheck's "Rebuild Array" option.

Drive cannot be formed into an array

Drives must support Ultra DMA or Multi-word DMA and be free of media defects before adding it into an array. We recommend using new identical drives for each array. Re-secure data and power cabling while checking for proper alignment. Typically, pin 1 of the drive is closest to the power connector.

Possible Master/Slave problems

Master/slave problems may exist between two ATA or IDE drives of different brands attached to a single cable. For both compatibility and better performance, choose drives of the same model/brand and install them on separate cables.

System CMOS displays C: or D: drive failure during Startup

Do not reference C: or D: for drives attached to the RAID IDE connectors. Only enter these drive information in the Standard CMOS Features for drives attached to the standard IDE hard drive add-in card or the onboard standard IDE connectors.

FDISK reports a much lower drive capacity if a single physical drive or a striped array exceeds 64GB

Due to a limitation with FDISK, the utility reports only the storage capacity that exceeds 64GB. This is a cosmetic, not actual, limitation. Simply create a single DOS drive partition, reboot, then format the partition. The Format command will recognize the total capacity of the partition accurately. Windows NT/2000/98 will now recognize the total capacity of your array.

Unable to partition or format array

The Reserve Sector of one of the drives has become corrupted or bad. Removing the Reserve Sector will remedy any issue related directly to a Bad Reserve Sector.

WARNING: *Before removing the Reserve Sector of any drive(s), backup all existing data. Removing the reserve sector of a drive permanently delete all existing data from the hard drive. For Mirrored arrays (RAID 1), you should remove the Reserve Sector from the "mirrored" drive first (this will appear during Step 3 below) then rebuild the mirrored array. Remove the sector from the Master Drive only as a last resort. For Striped arrays (RAID 0), removing the Reserve Sector from any of the drives that are striped will destroy the arrayed data.*

To remove the Reserve Sector, follow these steps:

1. When the system boots, press <Ctrl-F> to enter FastBuild.
2. Press <2> to "View Drive Assignments".
3. Using the arrow keys, highlight the drive you wish the reserve sector removed.
4. Press <Alt-F1>. The highlighted drive will start blinking on the screen.
5. Press <Ctrl-Tab>. A message will appear informing you that the reserved sector (which is where array information is kept) on the disk will be wiped.
6. Press <Y> to confirm.
7. For mirrored arrays, hit the <Esc> key twice to reboot and skip to step 10.
8. For striped arrays, repeat this process for each member of the particular array that is having a problem.
9. Once you're done, hit the <Esc> key twice to reboot.
10. After rebooting, use FastBuild to re-create the array. For mirrored arrays, rebuild the mirrored array. For striped arrays, use FDISK and FORMAT after setting up the array.

Array Constantly Goes Into Critical or Offline Mode During Reboot

Refer to "Unable to Partition or Format array" above.

Cannot Rebuild Mirrored (RAID 1) Array

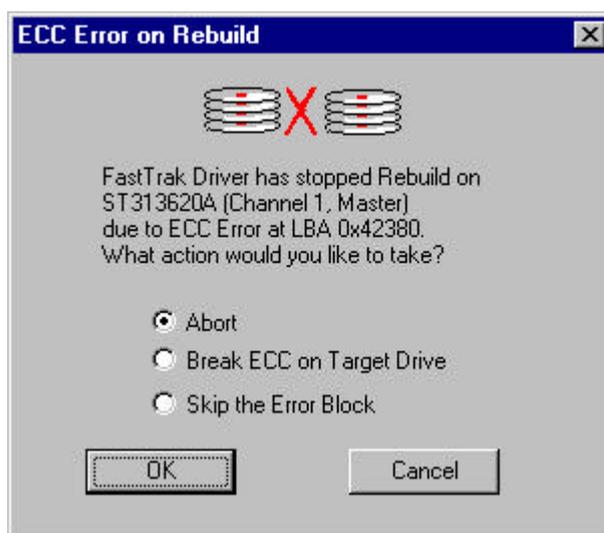
Refer to "Unable to Partition or Format array" above.

Fatal Errors or Data Corruption Are Constantly Reported When Reading or Writing to Drive Array

Refer to "Unable to Partition or Format array" above.

ECC Error Reported on Rebuild

The following screen will appear if a data error is detected on either the source or target drive during Rebuild, that is, if you have set the On Errors setting to "Interactive" in FastCheck's Options window.

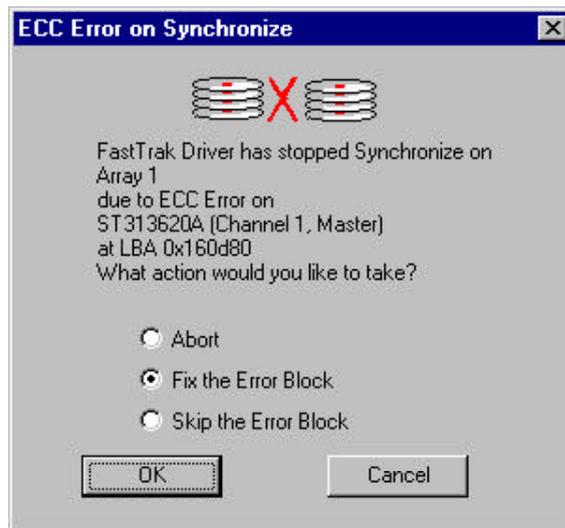


Your choices are as follows:

- Abort:** Halts the rebuild process. You may select to retry at a later date.
- Break ECC on Target Drive:** If the error is detected on the source drive, FastTrak will copy the bad data sector on to the target drive to assure that both drives are identical. If the error is detected on the target drive, FastCheck will again copy the data contained in the good sector of the source drive to the target drive.
- Skip the Error Block:** The system will log the event error and continue the rebuild process. Use this setting if you want to detect the presence of errors, but do not want to fix these errors yet. You may then decide what to do about the error(s) detected.

ECC Error Reported on Synchronize

The following screen will appear if a data error is detected on either source or target drive during Synchronization, that is, if you have set the On Errors setting to "Interactive" in FastCheck's Options window for Scheduled Synchronization or for Manual Synchronization under Notification options.



Your choices are as follows:

- Abort:** Halts the synchronization process. You may select to retry at a later date.
- Fix the Error Block:** The system will take a good data block from either drive and copy it to the drive where the error was detected.
- Skip the Error Block:** The system will log the event error and continue the synchronization process. Use this setting if you want to detect the presence of errors, but do not want to fix these errors yet. You may then decide what to do about the error(s) detected.

Operating System-Related Errors

The operating system no longer boots after creating a Mirrored Array with an existing boot drive that uses Windows 98/NT4/2000.

This is due to Drive Geometry issues. You can verify this by attaching the original drive to the standard IDE connector and check whether it boots. Each controller can view a drive differently. This can be an issue for a new controller that loads the original Master Boot Record (MBR) and then has a problem translating it or an issue of Operating System boot record.

For Windows NT or Windows 2000, we recommend a "clean" install of the operating system. This restores the MBR and OS boot record. You will then need to repartition and format the drive.

For Windows 98, you can perform the DOS Command "SYS C:" from a bootable floppy or CD-ROM to restore the operating system boot record and transfer the system files to the boot drive. If this does not work, the Windows 98 registry may have become corrupted during the boot process and must be restored. See the Windows documentation to perform this procedure.

Promise Windows driver did not appear in Device Manager

Windows may have listed the controller under "Other Devices" instead of "Hard Disk Controllers". In Device Manager' s "Other Devices", check for "RAID Controller". Highlight it and click the "Properties" button, and then click the "Driver" tab. Depending on the Windows version, choose either "Change Driver" or "Update Driver". Then follow the on-screen prompts to complete installing the driver. If you want to test whether the device can be removed safely, click "Cancel". Reboot the system to complete installing the driver.

The "Inaccessible Boot Device" Message Appears During Floppyless Install of Windows NT or 2000

The <F6> key was not pressed at the appropriate time. When in Windows NT4, reboot the system and press the <F6> key when the message "Setup is inspecting your computer's hardware configuration..." appears. When in Windows 2000, reboot the system and press the <F6> key when the message "Press F6 if you need to install third party SCSI or RAID driver" appears.

The "No Hard Drives Found" Message Appears During CD-ROM Install of Windows NT or 2000

The <F6> key was not pressed at the appropriate time. When in Windows NT4, reboot the system and press the <F6> key when the message "Setup is inspecting your computer's hardware configuration..." appears. When in Windows 2000, reboot the system and press the <F6> key when the message "Press F6 if you need to install third party SCSI or RAID driver" appears.

Performance Tips

Here are some tips that may optimize performance in a RAID 0 striped array. If you are using an audio/video editing card, we also recommend that you review your card' s documentation for additional information.

Use Drives Attached to RAID IDE as D: or other non-bootable drive in a Striped Array

For A/V editing, keep the original system boot drive that is attached to the standard IDE controller as C: drive. Partitioning software such as FDISK will see the array as one physical drive, D: drive (or later). This will prevent file fragmentation and provide better accessibility to the array.

Optimize Array for "Performance"

The FastBuild BIOS Utility auto setup menu allows optimizing the array for A/V Editing. The default Performance setting (Striping) selects a Stripe Block size of 64. Larger block size is recommended for data streaming requirements of A/V editing. You may select an even larger block size in manual mode.

FastTrak (tm) / FastTrak100-Lite (tm) BIOS Version 1.xx (Build xxxx)
(c) 1995-2000 Promise Technology, Inc. All Rights Reserved.

[Auto Setup Options Menu]

Optimize Array for: Performance
Typical Application usage: A/V Editing

[Auto Setup Configuration]

Mode Stripe
Stripe Block Size 64
Drive used in Array2
Array Disk Capacity 13044

[Keys Available]

[?] Up [?] Down [? , ? , Space] Change Option [ESC] Exit [Ctrl-Y] Save

Frequently Asked Questions

This section lists frequently asked questions involving pre-installation, drive issues, installation, and post-installation.

Pre-Installation

(Speed, Device Types, Capacity, Cabling)

Q: What kind of hard drives can I use for creating an array?

A: You can use any IDE/EIDE hard drive(s) to create arrays. You should use matching drives for multiple-drive arrays to maximize capacity usage as well as performance. Ultra ATA/100 drives are recommended for highest performance.

Q: Can I use ATAPI devices on the array?

A: No. There is no driver layer that will support ATAPI packet messages.

Q: How does the Promise controller provide storage and/or data protection with their arrays?

A: The controller implements three different types of RAID levels as follows:

RAID 0 (stripe)

For capacity - The array will be as big as the smallest HDD in the array times the number of HDDs that are in the array. Any larger HDDs will simply be truncated. The truncated space on the bigger HDDs will then be unusable.

For sustained data transfers - A RAID 0 array consisting of two HDDs will transfer at about twice the speed of the slowest HDD in the array. A RAID 0 array consisting of four HDDs will transfer at about three times the speed of the slowest HDD in the array.

RAID 1 (mirror)

For capacity - The array will be as big as the smallest HDD in the array. The larger HDD will simply be truncated. The truncated space on the bigger HDD will then be unusable.

For sustained data transfers - The array will write data at the rate of the slowest HDD in the array and will read data at twice the rate of the slowest HDD in the array.

JBOD (spanning)

For capacity - The array will combine the sizes of the HDDs in the array. As soon as one HDD is filled to capacity, the next HDD will automatically be used.

For sustained data transfers - There is no performance increase with spanning (reading or writing).

Drive Issues

Q: Can I add a drive to a RAID array via hot-swap and dynamically adjust the array size/configuration?

A: No. The system does not support dynamically adjustable RAID size/configurations.

Q: Do the HDDs have to be the same size?

A: The HDDs that you use do not have to be the same size. If the sizes differ, the system will "adjust" the HDDs so that they are compatible. Basically, it will truncate the bigger HDD so the sizes match. Any unused space that results from this is unusable, so don' t use HDDs that differ too much. It' ll work, but it' s a waste.

Q: Can I take a set of drives belonging to an array in one server and move it to another server?

A: Yes. All controllers read arrays the same way. Once the drives are all connected, you must restart the system for it to recognize the newly-inserted array configuration.

Q: If I have a problem with one of the drives, how can I low level format it to correct the problem?

A: Do NOT do this. Low-level formatting IDE drives is unnecessary and generally does not correct problems. Errors such as bad sectors or ECC/CRC failure are best remedied by completely replacing the drive. For this reason, drives attached should NOT be low level formatted.

Q: Do I have to install disk management software on my array in order to access the full storage capacity of drives?

A: No! Disk management software would only complicate things. The array should be fully addressable by your O/S as it is. Remember that some operating systems have varying limits on the sizes of partitions and logical drives that can be defined. Consult your O/S documentation about partitioning larger drives.

Q: What system BIOS CMOS settings do I use for the drives on the RAID IDE connectors?

A: None. The drives are supported by the FastBuild BIOS and/or an O/S driver, not by your system BIOS.

Q: How do I partition/format a RAID array?

A: The system sees an array as a single HDD. Therefore, anything that you can do to a single HDD can also be done to an array. You can, and should, use the FDISK and FORMAT utilities to partition/format the array. You can partition the array however you see fit. You can also format the array with whatever file system you wish.

Installation Issues

(Capacity, Booting)

Q: Why are some drives recognized by the Setup utilities as only partial capacity?

A: Some hard drive models are shipped with a jumper that reduces the addressable capacity of the drive to prevent problems with older systems which won' t support larger drives. Consult the documentation accompanying the hard drive to set the jumper appropriately in order to utilize the full capacity of the drive.

Q: How can I change the system boot sequence in order to boot from the array?

A: The boot sequence is controlled by the system BIOS. As far as the system BIOS is concerned, the Promise controller and defined arrays are categorized as a "SCSI" device (even though the BIOS will not attempt to access the array as any type of SCSI device). This allows you to set the boot sequence of the system BIOS CMOS setup utility to boot from "SCSI" first, rather than "IDE" (the standard onboard IDE or one which effectively replaces it).

Post-Installation

(Memory Managers, FDISK)

Q: Why does my system reboot after the QEMM driver loads from CONFIG.SYS?

A: The problem lies in the QEMM "Stealth" feature. This feature places the drive information from the DOS System area into the upper reaches of RAM where Windows resides. This causes the RAID controller to lose track of its drives when asked to execute the next line in the CONFIG.SYS file. This forces the reboot that you see. Disable QEMM' s stealth feature to correct this problem.

Q: Why can' t I see the drives on the RAID IDE connectors under FDISK?

A: The RAID controller is dedicated to RAID array management and does not provide any means of addressing individual hard drives through the Int 13h interface used by FDISK. In order to access drives on the RAID IDE connectors from MSDOS, you must first create a RAID array.

Q: Is the S3 or S4 function supported?

A: Drives that are attached to the RAID IDE connectors only support S3. S4 is not supported.