PROMISE® TECHNOLOGY, INC.

Serial ATA Controller User Guide

Version 1.0

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Contents

Chapter 1: Introduction

Thank you for using Promise Technology's PDC20319 Serial ATA (SATA) RAID controller. The motherboard which you are using incorporates the PDC20319 SATA RAID controller and supports four integrated Promise PDC20319 Serial ATA ports and RAID 0, 1, and 0+1.

- If you are experiencing any difficulties with the hard drive being recognized by the system go to Chapter 6: Troubleshooting on page 41.
- If your operating system has crashed for some reason or you have downloaded updated drivers from the Promise Web site (www.promise.com), you may wish to reinstall software drivers for the Promise Technology's PDC20319 Serial ATA RAID controller. See Chapter 4: Installing Drivers on page 29.

About the Serial ATA Controller

Promise originally designed the Serial ATA controller as a cost-effective, high performance RAID controller that adds performance and reliability to PC desktops and servers using Serial ATA drives.

The controller has four independent data channels to support a maximum of four Serial ATA drives. Other Serial ATA controller features include:

- Striping (RAID 0) – Identical drives can read and write data in parallel to increase performance.
- Mirroring (RAID 1) – Mirroring increases read performance through load balancing and elevator sorting while creating a complete backup of your files
- Striping / Mirroring (RAID 0+1) – Combining striping with mirroring offers both high read/write performance and fault tolerance
- Single-drive (JBOD) – Single-drive uses the full capacity of attached drives of different sizes, but offers no RAID functionality

A Serial ATA controller striped array can double the sustained data transfer rate of Serial ATA drives.

The Serial ATA controller offers fault tolerance and data redundancy for entry-level network file servers or desktop PC users wanting to continually protect valuable data on their computers. Each model offers RAID 1 mirroring (for two drives) and RAID 0+1 mirroring plus striping (for four drives) to protect data.

Should a drive that is part of a mirrored array fail, the Serial ATA controller uses the mirrored drive (which contains identical data) to assume all data handling. When a new replacement drive is later installed, the Serial ATA controller restores data to the new drive from the mirrored drive to restore fault tolerance.

The Serial ATA controller bootable BIOS supports individual drives larger than 137 GB. With FAT32 and NTFS partitioning, the array can be addressed as one large single volume.

Keys Features and Benefits

The following information offers an overview of the major features of the Promise Serial ATA controller chipset.

Advanced Hardware Design	
Features	Benefits
Supports 66MHz PCI bus motherboards (backward compatible with 33MHz PCI slots)	Allows maximum data bus transfers of up to 266 MB per second (133 MB/s per 33 MHz slot), dramatically reducing the time to save and retrieve large files.
Supports data striping (RAID 0), mirroring (RAID 1), and striping/mirroring (RAID 0+1)	Provides dramatic increase in drive performance and/or fault tolerant options. Offers performance customization and data rebuild from the BIOS menu.
Supports the Serial ATA Specification	Burst data transfer rates up to 150 MB/sec from Serial ATA drives to boost overall system performance.
Independent data channels	Drives can multiply their data transfer performance when striped together with each drive using a separate data channel.
PCI Plug and Play, PCI Interrupt sharing and coexists with motherboard IDE and SCSI controllers	Easy to install; support four ATA drives on the Serial ATA controller while still supporting 4 devices on motherboard ATA controller.
Supports bus master operation	Allows multitasking during disk transfers to increase CPU efficiency. The CPU is free to process tasks during data transfers through the PCI Bus to/from system memory.
Utilizes FastBuild™ auto menu from the Serial ATA controller onboard BIOS	Offers preset application specific settings that can be optimized for Desktop, Server, or A/V Editing. Auto Setup option enables quick and easy array builds.
Displays status and error checking messages during boot	Notifies user of possible errors and allows for recovery of mirrored drive arrays directly from FastBuild™.
Employs the latest Promise PCI Serial ATA ASIC technology	Fully supports Serial ATA specifications with 150 MB/sec timing and CRC error-checking at high speeds.
Mirroring supports automatic	Fault tolerance can be restored

background rebuilds	automatically without rebooting.
Compatibility	
Features	Benefits
Complies with the PCI v2.3 Local Bus standard	Provides highest level of hardware compatibility.
Complies with SATA Specification 1.0	Provides full compatibility with first generation Serial ATA hard drives.
Compliant with PCI Bus Master standard. PCI Bus Master support	Provides 32-bit I/O, Bus Master, and Serial ATA performance for optimal system performance.
Tested compatibility to coexist with motherboards that have integrated IDE controllers	Improves system performance of new and existing installations including motherboards with Intel chipsets.
Features LBA and Extended Interrupt13 drive translation in controller onboard BIOS	Breaks capacity barriers for support of drives greater than 137 GB in capacity. Offers flexible storage options for space demanding applications.

Chapter 2: Installation

This section is designed to quickly get your Serial ATA controller Serial ATA RAID system up and running using the default settings, which will be optimal for most users.

If you wish to modify any of the default settings, refer to
Chapter 3: Using FastBuild.

Warning

Before installing the adapter into an existing system, backup any important or useful data. Failure to follow this accepted PC practice could result in data loss.

Installing the ATA Hard Drives

	Important
	If you wish to include your current bootable Serial ATA drive using the Windows NT 4.x, Windows 2000, or Windows XP operating system as part of a bootable Mirrored (RAID 1) array controlled by your Serial ATA controller, do NOT connect the hard drive yet.
	You MUST install the Windows NT4.x, 2000, or XP driver software onto this drive while it is still attached to your existing hard drive controller.

The Serial ATA controller supports only Serial ATA hard drives. For optimal performance, install all identical drives of the same model and capacity. The drives' matched performance allows the array to function better as a single drive.

If you are striping (RAID 0) for performance, use up to four new drives. If mirroring (RAID 1) 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).

1. Install the hard drives into the hard drive bays of your system
2. Connect power cables to all drives.

	Caution
	Use of removable hard drive enclosures other than Promise Technology's SuperSwap is not supported and may result in performance loss or other undesired results.

3. Attach one Serial ATA data cable to each hard drive.
4. Attach the other ends of the cables to the ATA ports on the motherboard.
5. Attach the Y-cable power splitters to the Serial ATA hard drives.

	Note
	The Serial ATA controller chip is Plug and Play compatible. No changes are necessary in the motherboard CMOS Setup for resources or drive types in most applications.

Creating Your Disk Array

You will now use the onboard FastBuild™ BIOS utility to create your array using the attached drives. There are three different scenarios for creating this array:

- Performance
- Security, using new hard drives (recommended)
- Security, using an existing hard drive and a new one

The first three steps are the same for all three choices. After that, follow the steps for the array you want to create.

1. Boot your system. If this is the first time you have booted with the SATA drives installed, the Promise onboard BIOS will display the following screen.

PDC20319 SATA RAID Controller (tm) BIOS Version 2.xx (Build xxxx)
(c) 2002-2005 Promise Technology, Inc. All Rights Reserved

No array defined . . .

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

---

2. Press <Ctrl> + <F> to display the FastBuild Utility Main Menu.
3. Press <1> to display the Auto Setup Menu shown as follows. This is the fastest and easiest method to creating your first array.

FastBuild (tm) Utility 2.xx (c) 2002-2005 Promise Technology, Inc.
[Auto Setup Options Menu]

Optimize Array for: Performance

[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

The Serial ATA controller enables you to create striped or mirrored arrays with 1, 2, 3, or 4 drives.

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

1. Select "Optimize Array" in the Auto Setup Options Menu.
2. Press the spacebar to select *Performance*.
3. Press <Ctrl> + <Y> to save and create the array.
4. Reboot the system.
5. Once the array has been created, you need to use FDISK to partition the drive and then format the array as if it were a new single hard drive.

	Note
	Refer to your Windows or DOS operating system manuals for information on formatting hard drives and using FDISK.

Creating a Security Array with New Drives

Under the Security setting, the Serial ATA controller permits two drives to be used for a single Mirrored array or four drives to be used for a Mirrored/Striped array in Auto Setup.

	Note
	When creating a Security array with new drives, a feature called Gigabyte Boundary will automatically be set to ON. For a description of this feature, refer to Gigabyte Boundary on page 20.

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

1. Select "Optimize Array" in the Auto Setup Options Menu.
2. Press the spacebar to select *Security*.
3. Press <Ctrl> + <Y> to save the selection. The following screen appears.

> Do you want the disk image to be duplicated to another or do quick initialize or create only?
>
> Y - Create and Duplicate
> N - Create Only
> I - Create and Quick Initialize

4. Press \<N\> to select the Create Only option.

5. A window appears confirming that your Security array has been created. Press any key to reboot the system.

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

---

6. Once the array has been created, you need to use FDISK to partition the drive and then format the array as if it were a new single hard drive.

	Note
	Refer to your Windows or DOS operating system manuals for information on formatting hard drives and using FDISK.

Once the arrayed drives have been formatted, proceed to Chapter 4 to install your operating system and Serial ATA controller driver.

Creating a Security Array with an Existing Data Drive

Under the Security setting, the Serial ATA controller permits two drives to be used for a single Mirrored array or four drives to be used for a Mirrored/Striped array in Auto Setup.

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

	Warning
	If you are creating a Security array using an existing hard drive, backup any important data. Failure to do so could result in data loss.

	Warning
	If you wish to include your current bootable drive using the Windows NT 4.x, Windows 2000, or Windows XP operating system as part of a bootable Mirrored (RAID 1) array on your Serial ATA controller, do NOT connect hard drives yet.
	You MUST install the Windows NT4.x, 2000, or XP driver software first to this drive while it is still attached to your existing hard drive controller. Refer to Chapter 4.

Follow these steps:

1. Select "Optimize Array" in the Auto Setup Options Menu.
2. Press the spacebar to select *Security*.
3. Press <Ctrl> + <Y> to save the selection. The following screen appears.

Do you want the disk image to be duplicated to another or do quick
initialize or create only?

Y - Create and Duplicate
N - Create Only
I - Create and Quick Initialize

4. Press <Y> to select the Create and Duplicate option. The following
   window appears asking you to select the Source drive to use. FastBuild
   will copy all data from the Source drive to the Target 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 [↓] Down [ESC] Exit [Ctrl-Y] Save

5. Use the arrow keys to select which drive contains the existing data to be
   copied.
6. Press <Ctrl> + <Y> to save settings and start duplication. The following
   confirmation screen appears.

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

7. Press <Y> to continue. If you select N, you will be returned to step 1.

8. Once complete, the following screen appears confirming that your Security array has been created. Press any key to reboot the system.

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

9. Once the arrayed drives have been formatted, proceed to Chapter 4 to install your operating system and Serial ATA controller driver.

Creating a Security Array with Quick Initialization

Under the Security setting, the Serial ATA controller permits two drives to be used for a single Mirrored array or four drives to be used for a Mirrored/Striped array in Auto Setup.

You would use this method if you wish to create a mirrored array and erase the early block from your existing drives.

Note

When creating a Security array with new drives, a feature called Gigabyte Boundary will automatically be set to ON. For a description of this feature, refer to Gigabyte Boundary on page 20.

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

1. Select "Optimize Array" in the Auto Setup Options Menu.

2. Press the spacebar to select *Security*.

3. Press <Ctrl> + <Y> to save your selection. The screen below appears.

> Do you want the disk image to be duplicated to another or do quick initialize or create only?
> Y - Create and Duplicate
> N - Create Only
> I - Create and Quick Initialize

4. Press <I> to select the Create and Quick Initialize option.

5. A window appears confirming that your Security array has been created. Press any key to reboot the system.

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

6. Once the array has been created, you need to use FDISK to partition the drive and then format the array as if it were a new single hard drive.

	Note
	Refer to your Windows or DOS operating system manuals for information on formatting hard drives and using FDISK.

Once the arrayed drives have been formatted, proceed to Chapter 4 to install your operating system and Serial ATA controller driver.

Chapter 3: Using FastBuild

The FastBuild Configuration Utility offers several menu choices to create and manage the drive array managed by Promise Technology's Serial ATA controller. It is assumed you have already created an array in the previous chapter and now wish to make a change to the array or view other options.

Viewing the PDC20319 Controller BIOS Screen

When you boot your system with the SATA drives installed, the Promise onboard BIOS detects the drives attached and displays the following screen.

```
PDC20319 SATA RAID Controller (tm) BIOS Version 2.xx (Build xxxx)
(c) 2002-2005 Promise Technology, Inc. All Rights Reserved.

Scanning Serial ATA drives . . . . .
```

If an array exists, the BIOS displays the following screen showing the controller's BIOS version and status of the array.

```
PDC20319 SATA RAID Controller (tm) BIOS Version 2.xx (Build xxxx)
(c) 2002-2005 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....
```

The array status consists of three possible conditions: *Functional, Critical, Offline.*

Functional – The array is operational.

Critical – A mirrored array contains a drive that has failed or disconnected. The remaining drive member in the array is functional; however, the array has temporarily lost its ability to provide fault tolerance. Use the FastBuild Setup utility to identify the failed drive. Then replace the drive.

Offline – A mirrored array has two drives that have failed or become disconnected or a striped array has one drive that has failed or been disconnected. When the array condition is offline, you must replace the failed drive(s) and then restore data from a backup source.

Navigating the FastBuild Setup Menu

These are some basic navigation tips for using the menus: arrow keys highlight choices; the space bar allows you to cycle through options; the enter key selects an option; the escape key aborts or exits the current menu.

Using the Main Menu

This is the first option screen when entering the FastBuild Setup.

```
FastBuild (tm) Utility 2.xx (c) 2002-2005 Promise Technology, Inc.
                        [ Main Menu ]

        Auto Setup                      [ 1 ]
        View Drive Assignments          [ 2 ]
        Define Array                    [ 3 ]
        Delete Array                    [ 4 ]
        Rebuild Array                   [ 5 ]




                      [ Keys Available ]

Press 1...6 to Select Option   [ESC] Exit
```

To create a new array automatically, follow the steps under *Creating Arrays Automatically* on page 15. Promise recommends this option for most users.

To manually create an array or define an array as bootable, follow the steps under *Manually Creating an Array* on page 18.

You will also need to manually create an array if you wish to modify the block size.

To make an existing array bootable, see page 24.

To view drives assigned to arrays, see *Viewing Drive Assignments* on page 17.

To delete an array (but not delete the data contained on the array), see *Deleting an Array* on page 25.

To rebuild a mirrored array, see *Rebuilding a Mirrored Array* on page 27.

	Notes
	After configuring the array using FastBuild, use FDISK to format the arrayed drive(s) if you are using new, blank drives. Refer to your Windows or DOS operating system manuals for information on formatting hard drives and using FDISK.

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Creating Arrays Automatically

The Auto Setup (1) selection from the Main Menu automatically creates your disk array by assigning all available drives appropriate for the disk array you are creating. After making your selections, press <Ctrl> + <Y> to save the settings. FastBuild will automatically build the array.

```
        FastBuild (tm) Utility 2.xx (c) 2002-2005 Promise Technology, Inc.
                          [Auto Setup Options Menu]

Optimize Array for:                                  Performance
                       [ Auto Setup Configuration ]

      Mode.............................................Stripe
      Spare Drive Count ................................ 1
      Drives used in Array............................. 2
      Array Disk Capacity (size in MB).................. 16126

                          [ Keys Available ]

[↑] Up [↓] Down [←, →, Space] Change Option [ESC] Exit [Ctrl-Y] Save
```

Optimizing Arrays

Select whether you want Performance (RAID 0) or Security (RAID 1, RAID 0+1) under the "Optimize Array for" setting.

Performance

RAID 0 (Striping) enables high performance. The storage capacity of the array equals the number of drives times the capacity of the smallest drive in the disk array.

Note

The Serial ATA controller permits striped arrays using 1, 2, 3, or 4 drives attached in Auto Setup mode.

Under the Security setting, the Serial ATA controller permits two drives to be used for a single Mirrored array or four drives to be used for a Mirrored/Striped array in Auto Setup.

Security

(RAID 1 Mirroring, or RAID 0+1 Striping/Mirroring) creates a mirrored (or fault tolerant) array for data security. The storage capacity of the array equals one-half the number of drives times the capacity of the smallest drive in the disk array.

	Note
	Under the Security setting, the Serial ATA controller permits two drives to be used for a single Mirrored array or four drives to be used for a Mirrored/Striped array in Auto Setup.

Security and Performance

RAID 0+1 (Striping/Mirroring) creates an array with striping for high performance plus mirroring for fault tolerance and data security. The storage capacity for the array equals the number of drives times the capacity of the smallest drive in the disk array. This option requires 4 drives.

Defining Typical Application Usage

Allows the user to select the type of PC usage that will be performed in order to optimize how the Serial ATA controller handles data blocks to enhance performance. Your choice determines the block size used. You may select from the following options:

- A/V Editing (for audio/video applications, or any similar application that requires large file transfers)
- Server (for numerous small file transfers)
- Desktop (a combination of large and small file sizes)

Using a Hot Spare Drive

If a third drive is attached and is not assigned to a mirrored two-drive disk array (one of which is optimized for Security), it will be recognized as a spare drive. Such a drive is immediately used as a standby replacement. It is automatically added to an array once a disk member of the array has been detected as failed.

To restore fault tolerance as quickly as possible, the Serial ATA controller begins to perform an automatic data rebuild on the spare drive in the background without the need to restart the system.

At a later time, the failed drive can be physically removed from the system and an extra drive added in its place to function as the spare drive.

	Important
	The hot spare drive must have a capacity that is equal to or larger than the smallest array member.

Creating Multiple Disk Arrays

If you plan to create multiple arrays, take note of the following:

1. Attach only the drives necessary to create the first disk array and complete the Auto Setup (1).

2. Install the additional drives needed for the second array and again use the Auto Setup (1).

Note

If you wish to customize the settings of individual disk arrays (such as block size), you must manually create disk arrays with the Define Array (3) option from the Main Menu.

Viewing Drive Assignments

The View Drive Assignments (2) option in the Main Menu displays whether drives are assigned to a disk array or are unassigned.

Under the Assignment column, drives are labeled with their assigned disk array or 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, provided the free drive's capacity is equal to or larger than the smallest array member. Unassigned drives are not accessible by the OS. The menu also displays the data transfer mode that relates to the speed used by each drive (U5 refers to 100MB/sec transfers, U4 refers to 66MB/sec transfers, etc.)

```
            FastBuild (tm) Utility 2.xx (c) 2002-2005 Promise Technology, Inc.
                            [ View Drive Assignments ]

Channel:ID        Drive Model      Capacity(MB)    Assignment     Mode
1 :               QUANTUMCR8.4A        8063          Array 1        S
2 :               QUANTUMCR8.4A        8063           Free          S
3 :               QUANTUMCR8.4A        8063          Array 1        S
4 :               QUANTUMCR8.4A        8063           Free          S


                              [ Keys Available ]


[↑] Up [↓] Down  [ESC] Exit   Mode (S=Serial)
```

Creating Arrays Manually

The Define Array (3) option from the Main Menu allows users to begin the process of manually defining the drive elements and RAID levels for single or multiple disk arrays controlled by the Serial ATA controller.

Users will commonly create one or two drive arrays with the Serial ATA controller, though the chipset and motherboard support a maximum of four arrays. You may use a single drive in striping mode with the Serial ATA controller. In this rare scenario, an individual array ID is created that offers conventional controller performance depending on the drive type. At a later time, you can add a second drive to the array and recreate the array to support RAID 1 mirroring.

Note

For most installations, Promise recommends Auto Setup for easy disk array creation.

FastBuild (tm) Utility 2.xx (c) 2002-2005 Promise Technology, Inc.
[Define 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

---

To manually create an array from the Define Array Menu:

1. Press the up ↑ and down ↓ arrow keys to highlight the array number you wish to define, and press <Enter> to select.
2. The Define Array Definition Menu appears, enabling you to make disk array drive assignments (see next page).

Selecting Array Type

1. Under the Definition section of this menu, highlight the Array # for which you want to assign a RAID level.

2. Press the spacebar to cycle through three array types:
   - Performance (RAID 0 Striping)
   - Security (RAID 1 Mirroring
   - RAID 0+1 Striping/Mirroring (for 4 drives)

See page 37 for more information about RAID levels.

```
        FastBuild (tm) Utility 2.xx (c) 2002-2005 Promise Technology, Inc.
                          [ Define Array Definition Menu ]

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

Stripe Block:  64 KB                               Gigabyte Boundary: ON
                          [ Drive Assignments ]

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

                           [ Keys Available ]

[↑] Up [↓] Down   [ESC] Exit   [Space] Select   [Ctrl-Y] Save
```

Selecting Stripe Block

For RAID 0 and RAID 0+1 arrays you may manually select the stripe block size. Press the spacebar to scroll through choices progressing as follows (16, 32, 64, 128, 256 MB).

The size selected affects how the Serial ATA controller sends and retrieves data blocks to and from the drives. You will need to perform your own testing to determine how the data block size is affecting your particular use of the array. In general, a larger block size is better when handling large data transfers (such as in A/V editing or graphics-intensive work) while a smaller block size is better when handling e-mail and other common server data. The default is 64K.

Gigabyte Boundary

The Gigabyte Boundary feature is designed for mirrored arrays (RAID 1 or RAID 0+1) in which a drive has failed and the user cannot replace the drive with another drive of the same capacity or larger. Instead, the Gigabyte Boundary feature permits the installation of a replacement drive that is slightly smaller (within 1 gigabyte) than the remaining working drive (for example, an 80.5 GB drive would be rounded down to 80 GB).

This can be helpful in the event that a drive fails and an exact replacement model is no longer available. Without this feature enabled, the Serial ATA controller will NOT permit the use of a replacement drive that is slightly smaller than the remaining working drive.

For the Gigabyte Boundary feature to work, the Gigabyte Boundary feature must be set to ON when the original mirrored array is created. When enabled, the Gigabyte Boundary feature rounds the drive capacity of both drives down to the combined total GB drive size. For example, with the Gigabyte Boundary feature enabled, the remaining working drive can be 80.5 GB and the replacement drive can be 80.3, since both are rounded down to 80 GB.

This permits the smaller drive to be used. Please note that users will lose a small amount of available storage capacity from both drives in order to arrive at a common drive size.

	Note
	Gigabyte Boundary is automatically disabled when creating a mirrored array (RAID 1) from an existing drive (versus using two brand new drives). This protects the existing drive's partition table in order to maintain data integrity.

Assigning Drive(s) to an Array

1. Under the Drive Assignments section, highlight a drive by pressing the ↑ and ↓ keys.

2. Press the spacebar to change the Assignable option to 'Y' and add the drive to the disk array.

3. Press <Ctrl> + <Y> to save the disk array information. Depending on the array type selected, the following scenarios will take place:

   − If you selected a Striping, Spanning, or Mirroring/Striping array, the initial Define Array Menu screen will appear with the arrays defined. From there you may press the escape key to exit and return to the FastBuild Main Menu.

   − If you selected a Mirroring array for two drives, an additional window appears as described in order to create the array. To do this you will use either two brand new drives, or one drive that contains existing data that you wish to mirror.

Creating a Mirrored Array Using New Drives

As described in the Drive Assignments Option section above, if you selected a mirroring array and wish to use the two new assigned drives, follow these directions.

1. Assign new drives to a Mirroring array
2. Save the information by pressing <Ctrl> + <Y>, the window below will appear.

Do you want the disk image to be duplicated to another or do quick initialize or create only?

Y - Create and Duplicate

N - Create Only

I - Create and Quick Initialize

3. Press <N> to select the Create Only option. A screen appears confirming that your Security array has been created.

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

4. Press any key to reboot the system.

Adding Fault Tolerance to an Existing Drive

The Serial ATA controller will create a mirrored array using an existing system drive with data. You must assign the existing drive and another drive of same or larger capacity to the Mirroring array. The BIOS will send the existing data to the new blank drive.

	Warning
⚠	Backup any necessary data before proceeding. Failure to follow this accepted PC practice could result in data loss.

	Warning
⚠	If you wish to include your current bootable drive using the Windows NT 4.x or Windows 2000 operating system as part of a bootable Mirrored (RAID 1) array controlled by the Serial ATA controller, you MUST install the driver software while the bootable drive is still attached to your existing hard drive controller. See Chapter 4.

1. Assign the drives to a Mirroring array.
2. Press <Ctrl> + <Y> to save your settings. The following screen appears.

Do you want the disk image to be duplicated to another or do quick initialize or create only?

Y - Create and Duplicate

N - Create Only

I - Create and Quick Initialize

	Note
📝	Gigabyte Boundary is automatically disabled when creating a mirrored array (RAID 1) from an existing drive (versus using two brand new drives). This protects the existing drive's partition table in order to maintain data integrity.

3. Press <Y> to select the Create and Duplicate option. The following screen appears asking you to select the Source drive to use. FastBuild will copy all data from the Source drive to the Target 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 :                    QUANTUMCR8.4A             8063
 2 :                    QUANTUMCR8.4A             8063

[↑] Up [↓]   [ESC] Exit   [Ctrl-Y] Save
```

4. Press the up ↑ and down ↓ arrow keys to select which drive contains the data to be copied.

Warning

All target drive data will be erased. Make sure you select the correct drive.

5. Press <Ctrl> + <Y> to save the settings and start the duplication. You are prompted to confirm the duplication.

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

6. Press <Y> to continue. If you select N, you will be returned to step 1.
7. Once you select Y, the following progress screen appears. The process takes a few minutes.

```
Please Wait While Duplicating The Image

                                                    10%
Complete
```

Once mirroring is 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.

Making a Disk Array Bootable

Warning

If you plan to boot from an array on the Serial ATA controller, you must configure the system BIOS Setup to use the Serial ATA controller as a bootable device.

This option is not available if the Serial ATA controller is being used as a secondary controller.

When you have returned to the Define Array Menu window shown below, you will see the array or arrays you have created. You now may use the menu to select which array will be used as the bootable array.

```
     FastBuild (tm) Utility 2.xx (c) 2002-2005 Promise Technology, Inc.
                          [ Define Array Menu ]

  Array No      RAID Mode      Total Drv     Capacity(MB)        Status
 *  Array 1       Stripe           2            13044          Functional

 Note: * — Bootable Array

 [↑] Up [↓] Down   [ESC] Exit   [Enter] Select   [Space] Change Boot Drive
```

1. Highlight the array that you want to boot from using the up ↑ and down ↓ keys.
2. Press the spacebar.
3. An asterisk (*) appears next to the array number to indicate it is bootable. The system will now recognize this array as the first array detected. The system will then use this bootable array as the (fixed) boot C: drive.

Important

The bootable array must contain your configured operating system.

Creating a Hot Spare Drive for Mirrored Arrays

To enable automatic rebuilds of a mirrored array, attach a spare drive to the Serial ATA controller. Drives that are not assigned to an array and are the same size or larger than the original will be used for the automatic rebuild. This is performed in the background under all supported operating systems, except DOS. At a later time, the system can be turned off and the failed drive can be physically removed.

About Array Order

During startup, the disk arrays on the Serial ATA controller are recognized in this order:

1. The array set to bootable in the FastBuild Setup.
2. The Array number (i.e. Array 0, Array 1…). This would be involved in determining which drive letters will be assigned to each disk array.

Saving Array Information

All disk array data is saved into the reserved sector on each array member. Promise suggests that users record their disk array information for future reference.

Another feature of the Serial ATA controller disk array system is the ability to recognize drive members even if drives are moved to a different SATA drive connector on the motherboard. Since each drive's array data identifies itself to the array, it is possible to move or swap drives without modifying the array setup. This is valuable when adding drives, or during a rebuild.

Deleting an Array

The Delete Array (4) Menu option enables you to delete disk array assignments. This is not the same as deleting data from the drives themselves.

	Important
	If you delete an array by accident, immediately define a new array identical to the one you deleted. This action normally recovers 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 2.xx (c) 2002-2005 Promise Technology, Inc.
                          [ Delete Array Menu ]

Array No        RAID Mode       Total Drv    Capacity(MB)        Status
Array 1         Stripe              2            16126           Functional
Array 2         Mirror              2            8063            Functional
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 delete key.
2. The Array Definition menu appear as follows, showing which drives are assigned to this array.

```
        FastBuild (tm) Utility 2.xx (c) 2002-2005 Promise Technology, Inc.
                          [ Define Array Menu ]

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

Stripe Block: 64 KB                              Gigabyte Boundary: OFF
                         [ Drive Assignments ]

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

3. Press <Ctrl> + <Y> to confirm the following warning message and 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, create a new array using Auto Setup or the Define Array menu from the FastBuild Main Menu.

Rebuilding a Mirrored Array

The Rebuild Array (5) Menu option can be used to recover from an error in a mirrored disk array. You will receive an error message when booting your system from the Serial ATA controller BIOS.

Important

Drives MUST be replaced if they contain any physical errors.

Follow these steps before using the Rebuild Array menu option:

1. On bootup, the Serial ATA controller Startup BIOS will display an error message identifying which drive has failed.
2. Press <Ctrl> + <F> to enter the FastBuild Main Menu.
3. Select the Define Array submenu (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) option. The following screen appears.

```
      FastBuild (tm) Utility 2.xx (c) 2002-2005 Promise Technology, Inc.
                           [ Rebuild Array Menu ]

   Array No        RAID Mode    Total Drv      Capacity(MB)       Status
   Array 1           Stripe         2              16126         Functional
   Array 2           Mirror         2               8063          Critical
   Array 3           ——            ——             ——             ——
   Array 4           ——            ——             ——             ——

                              [ Keys Available ]

   [↑] Up [↓] Down    [ESC] Exit    [Enter] Select
```

9. Highlight the array whose Status is Critical.
10. Press <Enter>. The following screen appears.

```
FastBuild (tm) Utility 2.xx (c) 2002-2005 Promise Technology, Inc.
                      [ Rebuild Array Menu ]

Array No          RAID Mode         Total Drv           Status
Array 2            Mirror               2               Critical

Stripe Block: Not Available                   Gigabyte Boundary: ON
                   [ Select Drive for Rebuild ]

Channel:ID                  Drive Model              Capacity (MB)
 1 : Slave               QUANTUMCR8.4A                   8063

                        [ Keys Available ]

[↑] Up [↓] Down    [ESC] Exit   [Enter] Select
```

11. Under Select Drive for Rebuild, highlight the replacement drive.

12. Press <Enter> and confirm that the data will be copied on to the selected drive. All data on the replacement drive will be written over with mirrored information from the array drive. A progress bar appear as shown in the following screen.

```
Please Wait While Duplicating The Image

                                                    10%

Complete
```

13. Once the rebuild process is complete, reboot the system.

Chapter 4: Installing Software Drivers

This chapter covers driver installation procedures for Windows operating systems that support the Serial ATA controller. The Serial ATA controller software drivers for Windows are included on the driver diskette.

Drivers and installation instructions for Linux and Novell operating systems are downloadable from the Promise website at www.promise.com.

	Important
✓	If you wish to include your current bootable ATA drive using the Windows NT4.x, Windows 2000, or Windows XP operating system with your Serial ATA controller, you MUST install the Windows NT4.x, 2000, or XP driver software first onto this drive while it is still attached to your existing hard drive controller.

Windows XP Installation

This section covers the installation of the Serial ATA controller drivers during the installation of Windows XP.

1. Start the installation:
   - Floppy Install: Boot the computer with the Windows XP installation diskettes.
   - CD-ROM Install: 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 XP Setup window appears, press <S> to specify Additional Device(s).
3. Insert the Serial ATA controller driver diskette into drive A: and press <Enter>.
4. Select "WinXP Promise Technology's PDC20319 Serial ATA RAID Controller" from the list that appears on screen, and then press < Enter>.
5. Press <S> to use the driver on the floppy disk and then press <Enter> to continue with the installation.

   The Windows XP Setup screen appears again displaying the message "Setup will load support for the following mass storage devices:" The list includes the WinXP Promise Technology's PDC20319 Serial ATA RAID Controller.

	Note
	If there are any additional devices to be installed, specify them now. When all devices have been specified, continue to the next step.

6. From the Windows XP Setup screen, press <Enter>. Setup will now load all device files and then continue the Windows XP installation.

Existing Windows XP Installation

After connecting SATA hard drives to the Serial ATA controller, Windows XP setup displays a "Found New Hardware" dialog box. Under Windows XP, "Mass Storage Controller" will be displayed.

1. Insert the Serial ATA controller driver diskette into the A:\ drive.
2. Select "Install the software automatically" and press <Enter>.
3. Select "WinXP Promise Technology's PDC20319 Serial ATA RAID Controller" from the list that appears on screen, and then press <Enter>.
   If using a driver that has not been digitally signed by Microsoft, you will be asked if you want to continue the installation.
4. Click **Continue**. The drivers are installed.
5. When the New Hardware Wizard has finished installing the Serial ATA controller, click **Finish**.

Confirming Windows XP Driver Installation

1. Right-click the My Computer icon and select Manage from the popup menu.
2. From the left panel, select Device Manager.
3. Click the "+" in front of SCSI controllers. WinXP Promise Technology's PDC20319 Serial ATA RAID controller appears in the SCSI controller list.

Windows 2000 Installation

This section covers the installation of the Serial ATA controller drivers during the installation of Windows 2000.

1. Start the installation:

   − Floppy Install: Boot the computer with the Windows 2000 installation diskettes.

   − CD-ROM Install: 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 is generated, press <S> to specify an Additional Device(s).

3. Insert the Serial ATA controller driver diskette into drive A: and press <Enter>.

4. Select "Win2000 Promise Technology's PDC20319 Serial ATA RAID Controller" from the list that appears on screen then press <Enter>.

   The Windows 2000 Setup screen appears again displaying the message "Setup will load support for the following mass storage devices:" The list includes the Win2000 Promise Technology's PDC20319 Serial ATA RAID controller.

	Note
	If there are any additional devices to be installed, specify them now. When all devices are specified, continue to the next step.

5. From the Windows 2000 Setup screen, press <Enter>. Setup will now load all device files and then continue the Windows 2000 installation.

Existing Windows 2000 Installation

After connecting SATA hard drives to the Serial ATA controller, Windows 2000 setup displays a "New Hardware Found" dialog box. Under Windows 2000, "PCI Mass Storage Controller" will be displayed.

1. Select "Add New Hardware Wizard" from the list, and then press <Enter>.
2. Select "Add/Troubleshoot a device" and click **Next**. The new hardware wizard will show a device list
3. Select "Mass Storage controller," click **Next**, and then **c**lick **Finish**.
4. Select "Display a list the known drivers for this device so that I can select a specific driver" then click **Next**.
5. When the Windows 2000 supported SCSI adapter drivers list appears, click **Have disk**.
6. Insert the Serial ATA controller driver diskette in drive A:\.
7. Type **A:\Win2000** in the text box. Click OK.
8. Select "Win2000 Promise Technology's PDC20319 Serial ATA RAID Controller" from the list that appears on screen, then click **Next**.
9. Click **Yes** to confirm continue the installation and copy the driver to system.
10. Remove the diskette and click **Finish** to restart the system. Windows 2000 will then restart for the driver installation to take effect.

Confirming Windows 2000 Driver Installation

1. Right-click the My Computer icon and select Manage from the popup menu.
2. From the left panel, select Device Manager.
3. Click the "+" in front of SCSI controllers. Win2000 Serial ATA controller appears in the SCSI controller list.

Windows NT4.x Installation

This section covers the installation of the Serial ATA controller drivers while installing Windows NT4.0.

1. Start the system installation by booting from the Windows NT disk:

   − Floppy install: boot the system with the Windows NT installation diskettes.

   − CD-ROM disk install: boot from the CD-ROM disk and press <F6> when the message "Setup is inspecting your computer's hardware configuration…" appears.

2. When the Windows NT Setup window is generated, press <S> to specify additional devices.

3. Press <O> to select Other then press <Enter>.

4. Insert the Serial ATA controller driver diskette into drive A: and press <Enter>.

5. Select "WinNT PDC20319 SATA RAID controller" from the list that appears on screen then press <Enter>.

6. The Windows NT Setup screen appears displaying the message "Setup will load support for the following mass storage devices:" The list includes the WinNT Promise Technology's PDC20319 Serial ATA (SATA) RAID Controller.

Note

If there are any additional devices to be installed, specify them now. When all devices are specified, continue to the next step.

7. From the Windows NT Setup screen, press <Enter>. Setup loads all device files and then continues the Windows NT installation.

8. After a successful installation, the SCSI Adapter Setup box shows that the WinNT Promise Serial ATA controller driver has been installed.

Existing Windows NT4.x Installation

This section covers the installation of Serial ATA controller drivers on a system that has Windows NT4.0 already installed and running.

Note

Do not attach the boot drive or any other hard drive to the Serial ATA controller before completing this step.

1. Click **Start**, **Settings**.
2. From the Settings menu, select Control Panel.
3. Double-click the SCSI Adapters icon. The SCSI Adapters dialog box appears.
4. Select Drivers then click **Add**.
5. In the Install Drivers dialog box, click **Have Disk**.
6. When Install From Disk appears, insert the Serial ATA controller driver diskette in drive A.
7. Type "A:\NT4" in the text box window then click **OK**.
8. When the Install Driver dialog box appears, select "WinNT Promise Technology's PDC20319 Serial ATA (SATA) RAID Controller" then click **OK**.
9. When the Select SCSI Adapter Option dialog box appears, click **Install**.
10. After a successful installation, the SCSI Adapter Setup box shows that the WinNT Promise Technology's PDC20319 Serial ATA (SATA) RAID Controller has been installed.
11. Power off your system.
12. If you plan to move the boot drive to a the SATA disk array, do it now. Otherwise, reboot.

Removing the Driver from Windows NT4.x

1. Click **Start**, **Setup**, then select the Control Panel.
2. In Control Panel, select SCSI Adapter then select Drivers.
3. Click **Remove**.
4. After successful removal, the SCSI Adapter Setup box shows that the WinNT Promise Technology's PDC20319 Serial ATA (SATA) RAID Controller has been removed.

Chapter 5: Disk Array Concepts

About the Serial ATA controller

Promise Technology's PDC20319 Serial ATA (SATA) RAID Controller is a high performance Serial ATA RAID controller that features concurrent data channel operation and onboard BIOS. The channels on the Serial ATA controller support concurrent operations that allow for overlapped I/O under multi-tasking operating systems and shared workloads between multiple drives.

About the Serial ATA Controller BIOS

The Serial ATA controller contains a BIOS code that 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. When the Serial ATA controller BIOS appears during bootup, press <Ctrl> + <F> to enter the FastBuild setup to select from menu settings.

	Note
	If there are no SATA drives connected to the Serial ATA controller, the following message appears during boot:
	No drive attached to controller, the BIOS is not installed.

FastBuild Auto Menu Setup

This setup utility is used to build and manage Serial ATA controller disk arrays. The utility is menu driven and features the Auto Setup (1) option that uses a simple, interactive setup process. Once the array is built, each HDD in the array stores the configuration information in the drive's reserved area. Refer to Chapter 3 for a description of individual functions.

Reserved Sector

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

Disk array members do not recall their drive positions. This allows drives to be placed on different SATA hard drive connectors within the system without reconfiguring or rebuilding.

Disk Array Terminology

Disk Array Description

A disk array is formed from a group of two or more disk drives that 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 among multiple physical drives.

Fault tolerance is achieved through data redundancy operations 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, install identical Serial ATA drives in disk arrays. 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 has coded information in its reserved sector configuration that identifies the drive as a member of the array. Disk members in a disk array are recognized as a single physical drive to the system.

Disk Array Types

For most installations, the FastBuild setup Auto Setup (1) option is the optimal configuration.

There are four disk array types (RAID 0, 1, 0+1 and JBOD) in three categories that can be installed on the SATA drive connecters that are controlled by the Serial ATA controller. Striping is in the Performance category while Mirroring and Striping/Mirroring are in the Security category.

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

| RAID Level	Performance	Security	Capacity	Number of drives
RAID 0 (Striping)	Highest	No	No. Drives x Smallest Size	2 to 4
RAID 1 (Mirroring)	Normal	Yes	Smallest Size Drive	2
RAID 0+1 (Stripe/Mirror)	High	Yes	2x Smallest Size Drive	4

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 100 GB and three 120 GB drives will form a 400 GB (4 x 100 GB) disk array.

Stripe Size – A value can be set from 16 KB to 256 KB sector size. The size can directly affect performance. In the FastBuild BIOS, the default is 64 KB.
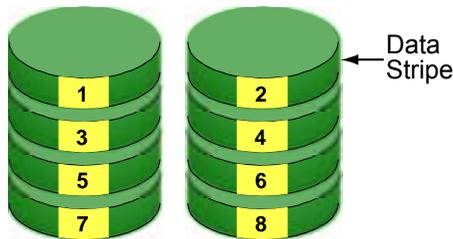
Disk Drives

Mirroring (RAID 1)

Writes duplicate data on 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 controller channels. If one of the mirrored drives suffers a mechanical failure (for example, 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.

Data Mirror

Disk Drives

On the next reboot, the FastBuild™ Utility will display an error in the array and recommend replacing the failed drive. Users may choose to continue using their PC; however Promise recommends 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 100 GB drives that have a combined capacity of 200 GB would have 100 GB 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. You can attach a third drive to the ATA connectors without assigning it to the array. Such a drive will be activated to replace a failed drive that is part of a mirrored array. A rebuild takes place 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 the same or larger capacity than the smallest array member.

Striping/Mirror (RAID 0+1)

A combination of RAID 0 and RAID 1 arrays. It can increase performance by reading and writing data in parallel while protecting data with duplication. A minimum of four drives are required.

With a four-drive disk array, two pairs of drives are striped. Each pair mirrors the data on the other pair of striped drives. The data capacity is similar to a standard Mirroring array with half of total capacity dedicated for redundancy.

Data Stripe

Data Mirror

Disk Drives
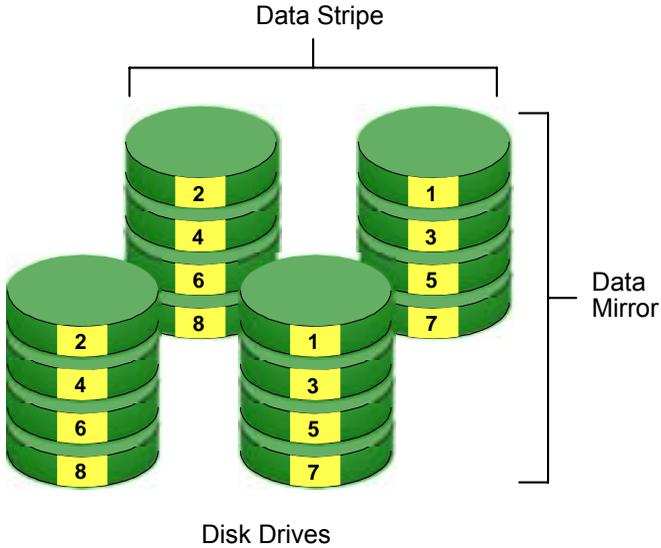
About Dual Data Redundancy

One unique (though rarely occurring) feature of RAID 0+1 is dual fault tolerance. In some cases, two drives can fail simultaneously and still maintain the integrity of data. There are six combinations in which two drives can fail. The Serial ATA controller protects the data array in four of those cases.

	Note
	Because of the serial nature of Serial ATA controller, any issues with master/slave drive settings do not apply.

Assume the drives are configured as follows:

- CH indicates channels on the Serial ATA controller
- A/B indicates which striped pair the drive belongs to
- 1/2 indicates the striped data section

CH 1	CH 2	CH 3	CH 4
Drive A1	Drive A2	Drive B1	Drive B2

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

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

Chapter 6: Troubleshooting & Tips

Read this section for assistance with troubleshooting conflicts with the Serial ATA controller. Refer to the README.TXT file on the Serial ATA controller driver and utility diskette for more recent information as well as the Promise Online services listed in Appendix A.

System CMOS Issues

Set motherboard CMOS to boot to the Serial ATA controller
On some motherboard BIOS, it is necessary to set the Boot sequence to FT S150TX Ary 1, A:, C:.

Motherboard CMOS displays C: or D: drive failure during startup
Refer to the Drive-Related Errors section.

Drive-Related Errors

Critical Array status error reported during boot
If a critical status error message appears on the Serial ATA controller BIOS startup screen for a mirrored array (see below), there is a drive in the array that has failed or is not responding. The Serial ATA controller identifies the failed drive by its channel number. 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
> Array Status: Critical
>
> Please retry using Promise Array Management utility to recover all data. Reboot the system by pressing the ENTER key.

Try powering the system off and on to reset the drive. Confirm that cables are properly attached and the drive is receiving power. If the drive still appears to have failed, refer to the Rebuilding an Array option in the Promise Array Management (PAM) utility.

Drive cannot be formed into an Array

Drives must support Serial ATA and be free of media defects to be added into an array. Promise recommends 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.

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

Do not reference C: or D: in the Motherboard Standard CMOS for drives attached to the Serial ATA controller. Only enter drive information in the motherboard CMOS for drives attached to the onboard IDE controller.

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

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

Unable to Partition or Format Array

When you cannot partition or format an Array, there are two possible causes:

- The Serial ATA controller is the bootable device but the array is not set to be bootable.

  If the Serial ATA controller is the bootable device, make sure that the array is set to be bootable:

  1. During system boot, press <Ctrl> + <F> to enter the FastBuild BIOS utility
  2. Select option 3, "Define Array."
  3. Press the up ↑ and down ↓ keys to highlight the array that you want to boot from.
  4. Press the spacebar to select.

  An asterisk ***** appears next to an array number indicating it as bootable. The system will now recognize this array as the first array detected. The system will use this bootable array as the (fixed) boot C: drive.

- The Reserve Sector of one of the drives has become corrupt or bad.

  If the Reserve Sector of one of the drives has become corrupt or bad, removing the Reserve Sector will remedy any issue related directly to a Bad Reserve Sector.

Warning

Before removing the Reserve Sector of the drive(s), backup any existing data. Removal of the reserve sector of any drive permanently deletes all existing data on the hard drive.

For Mirrored arrays (RAID 1), remove the Reserve Sector from the mirrored drive first (this will appear during Step 3 below) then rebuild the mirrored array. Remove the Sector on 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. During system boot, press <Ctrl> + <F> to enter the FastBuild BIOS utility.
2. Select option 2, "View Drive Assignments."
3. Press the up ↑ and down ↓ arrow keys to highlight the drive where you wish to remove the reserve sector.
4. Press <Alt> + <F1>. The highlighted drive will start blinking on the screen.
5. Press <Ctrl> + <Tab>. A message appears that informs you the reserved sector (which is where array information is kept) on the disk will be wiped.
6. Press <Y> to confirm.
7. Take the appropriate action:
   − For striped arrays, repeat this process for each member of the particular array that is having a problem. When you are finished, press the escape key twice to reboot.
   − For mirrored arrays, pres the <Esc> key twice to reboot.
8. After rebooting, use FastBuild to re-create the array.
   − For striped arrays, use FDISK and FORMAT after setting up the array.
   − For mirrored arrays, rebuild the mirrored array.

Array Constantly Goes into Critical or Offline Mode During Reboot
Refer to *Unable to Partition or Format Array* earlier in this section.

Cannot Rebuild Mirrored (RAID 1) Array

See *Unable to Partition or Format Array* earlier in this section.

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

See *Unable to Partition or Format Array* earlier in this section.

Operating System-Related Issues

Different drive lettering under Windows NT
This may happen when using a SCSI card in addition to the Serial ATA controller. Windows NT does not necessarily load the driver for the boot device controller first. This results in a drive that in MS-DOS is the C: drive being the D:, or E:, etc. in Windows NT. Use the Windows NT Disk Administrator utility to reassign the letters that NT has improperly assigned to the drives. See your Windows NT documentation for instructions on how to use Disk Administrator.

The Operating System no longer boots after creating a Mirrored Array using your existing boot drive under Windows XP/2000/NT4
This is due to Drive Geometry issues. You can verify this if you move the original drive back to the onboard controller and it boots successfully. 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 the Operating System boot record.

For Windows NT, Windows 2000, and Windows XP, Promise recommends a clean install of the Operating System. This action restores the MBR and OS boot record. This requires repartitioning and formatting the drive.

Promise Windows driver does not appear in Device Manager
Windows may already be listing the controller under Other Devices instead of the Hard disk controllers section. In Device Manager click Other Devices to see if the Serial ATA controller lists as a RAID Controller. If so, highlight this listing and click **Properties**, then click the Driver tab. Depending on your version of Windows, select either Change Driver or Update Driver. Follow the onscreen prompts to complete the installation of the driver. If Windows asks if you want to test if the device can be removed safely, click **Cancel**. Reboot the system to complete installation of the driver.

"Inaccessible Boot Device" Message Appears During Floppyless Install of Windows NT, 2000, or XP
The F6 key was not pressed at the appropriate time. Reboot the system, and press <F6> when the message "Setup is inspecting your computer's hardware configuration…" appears in Windows NT4 or the message "Press F6 if you need to install third party SCSI or RAID driver" appears in Windows 2000.

A "No Hard Drives Found" message appears during a CD-ROM installation of Windows NT, 2000, or XP
The F6 key was not pressed at the appropriate time. Reboot the system, and press <F6> when the message "Setup is inspecting your computer's hardware configuration…" appears in Windows NT4 or the message "Press F6 if you need to install third party SCSI or RAID driver" appears in Windows 2000 and XP.

Performance Tips

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

**Use the Serial ATA controller as drive D: or as another non-bootable drive
in a Striped Array**
For audio and video editing, assign the original system boot drive on the
standard IDE controller as the C: drive. Partitioning software such as FDISK will
see the array as one physical drive (D: or above). This prevents file
fragmentation and provides better accessibility to the array.

Optimize Array for "Performance"
The Promise FastBuild BIOS Utility auto setup menu enables you to optimize
the array for A/V Editing. The default Performance setting (Striping) selects a
Stripe Block size of 64. This larger block size is recommended for the data
streaming requirements of A/V editing. You may select an even larger block size
in manual mode (see Chapter 3).

```
   PDC20319 SATA RAID controller (tm) BIOS Version 1.xx (Build xxxx)
        (c) 1995-2002 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 Array .................... 2
       Array Disk Capacity ........................ 13044

                           [ Keys Available ]

   [↑] Up [↓] Down  [←, →, Space] Change Option  [ESC] Exit  [Ctrl-Y] Save
```

Appendix A: 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 a Serial ATA controller array?
A: You can use any Serial ATA hard drive(s) to create arrays on the Serial ATA controller. You should use matching drives for multiple-drive arrays to maximize capacity usage as well as performance.

Q: Will ACPI work with HDDs on the Serial ATA controller?
A: Yes.

Q: Can I use ATAPI devices on the Serial ATA controller?
A: No. The Serial ATA controller does not support ATAPI devices.

Q: How can I change the resources that the Serial ATA controller uses?
A: The Serial ATA controller is fully Plug and Play. This means all the resources that it uses are given to it by the Plug and Play BIOS on the motherboard. The Serial ATA controller does support IRQ sharing, but this will not work unless ALL the concerned devices support the feature. If your motherboard allows you to control the assignment of these resources, you may be able to remedy the problem by resetting the configuration data in your CMOS. This is usually an option in the Plug and Play section of your CMOS .

Q: How does the Serial ATA controller provide storage and/or data protection with their arrays?
A: The Serial ATA controller implements three different types of RAID levels on ATA hard drives as follows:

RAID 0 (Stripe)
For capacity – the Serial ATA controller array will be as big as the smallest drive in the array times however many drives are in the array. Any larger drives will be truncated. The truncated space on the bigger drive will then be unusable.

For sustained data transfers – using the Serial ATA controller, a RAID 0 array consisting of two drives will transfer at about twice the speed of the slowest drive in the array. A RAID 0 array consisting of four drives will transfer at about three times the speed of the slowest drive in the array.

RAID 1 (Mirror)
For capacity – the Serial ATA controller array will be as big as the smallest drive in the array. The larger drive will be truncated. The truncated space on the bigger drive will then be unusable.

For sustained data transfers – the Serial ATA controller array writes data at the rate of the slowest HDD in the array and reads data at twice the rate of the slowest HDD in the array.

Drive Issues

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

A: No. The PDC20319 SATA RAID system does not support dynamically adjustable RAID size/configurations.

Q: Do the serial ATA HDDs on the Serial ATA controller have to be the same size?

A: The HDDs that you use with the Serial ATA controller do not have to be the same size. If the sizes differ, the Serial ATA controller truncates the bigger HDD so the drives match. The resulting difference in HDD space is unusable, so avoid using HDDs of significantly different capacities.

Q: I already have an array on an older Promise SATA RAID controller. Can I move that array to my new Serial ATA controller?

A: Yes. All Promise controllers read the arrays the same way and can be moved from one controller to another.

Q: Can I take a drive used in a Serial ATA controller array and access it directly with a different controller, such as one inserted into a PCI slot?

A: Yes, but only under certain configurations. First, the controller must address the drives as LBA, not CHS.

Second, only Single-drive striped (RAID 0) and Mirrored (RAID 1) array configurations allow the drive(s) to be accessed individually on another controller. Multiple-drive striped (RAID 0) will not work.

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

A: Do NOT do this! Low-level formatting hard disk drives is not only unnecessary but it generally does not correct problems commonly experienced during use.

Errors such as bad sectors or ECC/CRC failure are best remedied by replacing the drive. For this reason, do NOT low-level format the drives attached to the Serial ATA controller.

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 will only complicate things. The array should be fully addressable by your OS 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 OS documentation about partitioning larger drives.

Q: What system BIOS setup settings do I use for the drives on the Serial ATA controller?

A: None. The drives on the Serial ATA controller are supported by the Serial ATA controller BIOS and OS drivers, not by your system BIOS.

Q: How do I partition or format my Serial ATA controller array?

A: The Serial ATA controller represents the array as a single HDD to your system. Therefore, anything that you can do to a single HDD you can do to a Serial ATA controller array. For example, you should use the FDISK and FORMAT utilities to partition/format the array. You can partition the array as you see fit. You can format the array with any file system you wish.

Installation Issues

(Capacity, Booting)

Q: Why are some drives recognized by the Serial ATA controller Array Setup utilities with only partial capacity?

A: Some hard drives ship with a jumper that reduces the addressable capacity of the drive to prevent problems with older systems that don't support larger drives. Consult your hard drive documentation to set the jumper so that you can use the full capacity of the drive.

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

A: The boot sequence is controlled by the system BIOS. As far as the system BIOS is concerned, the Serial ATA controller and defined arrays are categorized as a SCSI device. This allows you to set the boot sequence in your BIOS setup utility to boot from SCSI first, rather than IDE.

Q: How can I change the boot sequence between a PCI SCSI card and the Serial ATA controller array?

A: Since the devices are Plug and Play, it is difficult to determine which device is addressed first. Some newer motherboard BIOS have advanced options that identify devices and allow you to select which device will be assigned resources first.

Post-Installation

Q: Why can't I see the drives on the Serial ATA controller under FDISK?

A: You have not created an array yet. If no array has been created, the system will not recognize drive(s) attached to the Serial ATA controller.

Appendix B: Technical Support

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

If you decide to contact us, please have the following information available:

- Product model and serial number

- BIOS and driver version numbers

- A description of the problem / situation

- System configuration information, including: motherboard and CPU type, hard drive model(s), IDE/ATAPI drives & devices, and other controllers.

Technical Support Services

Promise Online™ Web Site	http://www.promise.com (tech documents, drivers, utilities, etc.)

USA Tech Support Center

E-mail Support	support@promise.com
Fax Technical Support	(408) 228-6401 Attention: Technical Support
Phone Technical Support	(408) 228-6402 7:30-5:00pm M-F Pacific Standard Time
If you wish to write us for support:	Promise Technology, Inc. Attn: Technical Support 1745 McCandless Drive Milpitas, CA 95035, USA

European Tech Support

E-mail Support	support@promise.nl
Fax Technical Support	+31 (0)40-256-9463 Attention: Technical Support
Phone Technical Support	+31 (0)40-235-2600 8:30-5:00pm The Netherlands Time
If you wish to write us for support:	Promise Technology Europe B.V. Attn: Technical Support

	Luchthavenweg 81-125 5657 EA Eindhoven, The Netherlands
Pacific Rim Sales Office	
E-mail Support	support@promise.com.tw
Fax Technical Support	+886-3-578-2390 Attention: Technical Support
Phone Technical Support	+886-3-578-2395 (Ext. 8870) 9:00-6:00pm Taiwan Time
If you wish to write us for support:	Promise Technology, Inc. Attn: Technical Support 2F, No. 30, Industry E. Rd. IX Science-based Industrial Park Hsinchu, Taiwan, R.O.C.

China Office	
E-mail Support	support-china@promise.com
Fax Technical Support	+86 (0) 10-687-23940 Attention: Technical Support
Phone Technical Support	+86 (0) 10-687-23941 9:00-6:00pm China Time
If you wish to write us for support:	Promise Technology China Attn: Technical Support Room 3217, No. 11 South Zhong Guan Cun Street Hai Dian District Beijing 100081 P.R. China

Limited Warranty

Promise Technology, Inc. ("Promise") warrants that for Three (3) years from the time of the delivery of the product to the original end user:

a) the product will conform to Promise's specifications;

b) the product will be free from defects in material and workmanship under normal use and service.

This warranty:

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

b) is not transferable;

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

This warranty shall not apply to defects resulting from:

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

b) operation outside the environmental specifications for the product;

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

Disclaimer of other warranties

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

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

Promise does not warrant that any product is free from errors or that it will interface without problems with your computer system. It is your responsibility to back up or otherwise save important data before installing any product and continue to back up your important data regularly.

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

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

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

b)   repair the product;

c)   recover the product and refund the purchase price for the product.

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

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

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

Your Responsibilities

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

Returning Product for Repair

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

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

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

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

USA and Canada:	Promise Technology, Inc. Customer Service Dept. Attn.: RMA # _____ 1745 McCandless Drive Milpitas, CA 95035
Other Countries:	Return the product to your dealer or retailer. Contact them for instructions before shipping the product.

You must follow the packaging guidelines for returning products:

Use the original shipping carton and packaging or similar packaging if the original is not available

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

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

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

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