# *ULTRATRAK100 TX4*

*AND*

# *ULTRATRAK100 TX8*

# USER MANUAL

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

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

This device complies with Part 5 of the FCC Rules. Operation is subject to the following conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

**NOTE:** Only digital device equipment CERTIFIED CLASS B should be attached to this equipment and that must have shielded cables.

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# INTRODUCTION

Thank you for purchasing Promise Technology's UltraTrak100 TX4 or UltraTrak100 TX8 external disk array system.

UltraTrak100 provides data storage solutions for applications where fault tolerance and data redundancy are required. The failure of any single drive will not affect data integrity or accessibility of the data. A defective drive may be replaced without interruption of data availability to the host computer. A hot spare drive will automatically replace a failed drive, securing the fault tolerant integrity of the array. The self-contained hardware-based array provides maximum performance in a compact external chassis.

The UltraTrak100 TX4 is an external disk array with an expandable capacity of up to four individual disk drives. The UltraTrak100 TX8 is an external disk array with an expandable capacity of up to eight individual disk drives.

The standard LVD SCSI interface provides compatibility with any system that utilizes a SCSI interface. No vendor unique commands are required for the operation of the disk array. Data transfer rates of up to 80 MB/sec are supported via the SCSI interface.

## ARCHITECTURAL DESCRIPTION

The UltraTrak100 disk array consists of either four (*TX4*) or eight (*TX8*) disk drive bays, an enclosure with back plane, and the array controller. Multiple fans provide redundancy to ensure continued usage during component failure. The array controller is hardware based and controls all array functions transparently to the host system. It appears to the system as a standard SCSI drive, and therefore does not require any special software drivers.

**Attention**

The electronic components within the UltraTrak100 disk array are sensitive to damage from ESD (Electro-Static Discharge). Appropriate precautions should be observed at all times when handling the array or its subassemblies.

## FEATURES AND BENEFITS

| Feature | Benefit |
|---|---|
| Maximum fault tolerance | Ensures uninterrupted data availability |
| Supports RAID levels 0, 1, 3, 5, 0+1, and JBOD | Allows system to be tuned for maximum performance |
| Emulates standard SCSI-3 drive to host | Compatible with all SCSI-3 or SCSI-2/LVD host adapters. No special operating system drivers used |
| Supports asynchronous and synchronous transfer mode | Up to 80MB/sec data transfer rates on the SCSI Bus |
| Tagged command queuing up to 32 commands | Maximum performance in Multi-Threaded Operating Systems |
| Front panel LCD and LED indicators | Easy setup and quick response to problems, ensuring maximum up time and manageability |
| Hot swap feature | Allows a defective drive to be replaced without interrupting data accessibility to the host system |
| Hot-spare drive | Maintains full fault tolerant integrity by automatically rebuilding the data from a failed drive to an installed hot spare drive |
| Automatic background data reconstruction when a drive is replaced | Array is quickly back on-line with minimal user intervention |
| Redundant fans | Load sharing and full operation even with a failed fan |
| Redundant Power Supply (*TX8 only*) | Load sharing and uninterrupted operation with failure of one power supply |

# GETTING STARTED

**Caution**

To prevent serious damage to the UltraTrak100 be sure that the voltage-select switch on the back of the power supply is set to your local voltage (see Figure 2 on page 5).

Getting started with the UltraTrak100 consist of the following steps:

1. Unpack UltraTrak100 storage subsystem (page 3).
2. Install Hard Drives (page 3)
3. Connecting the SCSI Cables (page 5).
4. Connect Power Cable and Switch Power On (page 7).
5. Assign a SCSI ID (page 7).
6. Configure the UltraTrak100 (page 8).
7. Partition and Format the Array (page 12).

## UNPACK ULTRATRAK100

Open the UltraTrak100 box and carefully remove the UltraTrak100 unit and accessories from the box. Be sure to remove the packing foam from within the UltraTrak100 door. The UltraTrak100 and accessories include the following items:

- UltraTrak100 unit
- UltraTrak100 User Manual
- Two drive-carrier keys
- Terminator
- External LVD SCSI cable
- Power cord
- Screw sets for hard drives

**Caution**

The front panel door of the UltraTrak100 has foam inside it to prevent damage during shipping. Remove this packing foam and retain for future use.

## INSTALL HARD DRIVES

Before using, the UltraTrak100 must first be populated with IDE hard drives. The UltraTrak100 can support up to four hard drives in any of the configurations listed below.

| RAID Configuration | Number of Hard Drives | | |
|---|---|---|---|
| | Minimum | Max (*TX4*) | Max (*TX8*) |
| RAID 0 | 2 | 4 | 8 |
| RAID 1 | 2 | 4 | 8 |
| RAID 3 | 3 | 4 | 8 |
| RAID 5 | 3 | 4 | 8 |
| RAID 0+1 | 4 | 4 | 8 |
| JBOD (Spanning) | 1 | 4 | 8 |

You may mix manufacturer type and drive size – however, best performance is achieved when you populate the array with identical models.

Before installing a new hard drive, be sure the jumpers on the new hard drives are set for single or master operation. Consult the drive manual for the proper settings.

Install new hard drives into the UltraTrak100 by doing the following:

1. Open the Front Panel Door on the UltraTrak100.
2. Unlock the Drive Carrier Latching Mechanism and remove an unused Drive Carrier (see Figure 1 on page 4) from the UltraTrak100. (Begin at the top and work down.)
3. Attach the Drive Carrier power cable to the hard drive (see Figure 7 on page 16).
4. Attach the Drive Carrier IDE data cable to the hard drive (see Figure 7 on page 16).
5. Lower the hard drive into the Drive Carrier so that the screw holes on the bottom line up.
6. Insert screws through the holes in the Drive Carrier and into the bottom of the hard drive. Tighten each screw; be careful not to over tighten (see Figure 6 on page 15).
7. Slide the assembled Drive Carrier back into the UltraTrak100 and lock the Drive Carrier lock.
8. Repeat steps 2 through 8 until all of the new hard drives are installed.

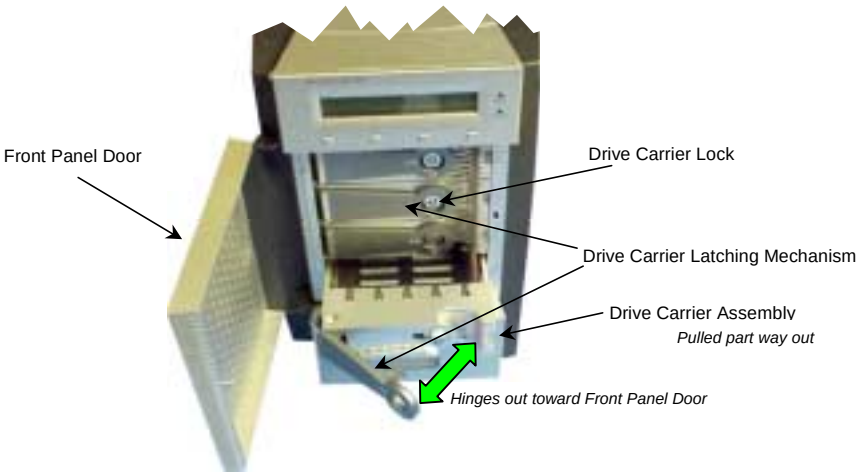



*Figure 1. UltraTrak100 Disk Drive Access (TX4 Shown)*

**Note**

The Drive Carrier Latching Mechanism must be locked or the disk drive will not power up.

## CONNECTING THE SCSI CABLES

Installation of the UltraTrak100 disk array is very similar to the installation of a standard SCSI drive. The SCSI connector accepts the standard 68-pin LVD SCSI connector used on most LVD SCSI devices. Refer to your system and/or SCSI host adapter manual for additional installation procedures that may apply to your system or host adapter.

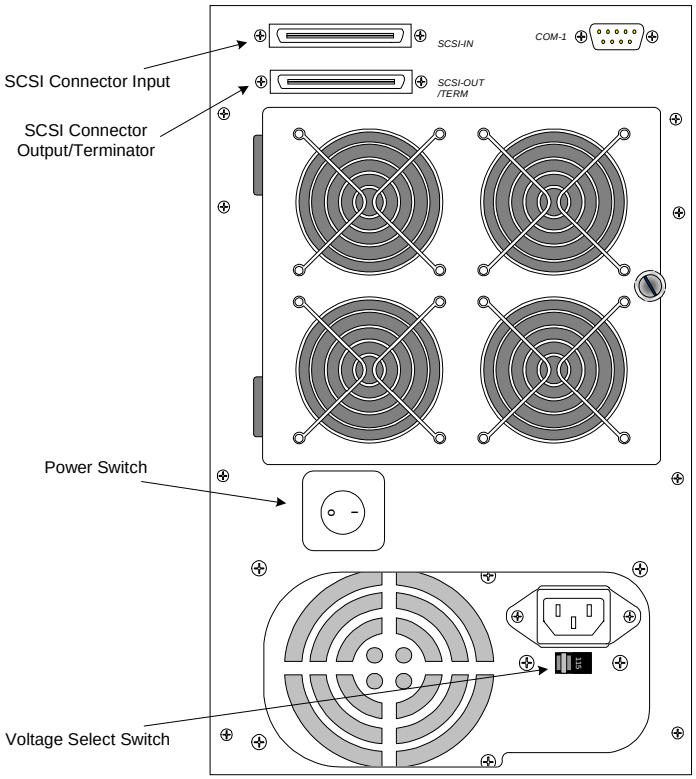



*Figure 2. Back of UltraTrak100 TX4 (see Figure 8 for TX8)*

**Caution**

To prevent possible damage to the array or system, ensure that system power is OFF before connecting the cables.

### SCSI CABLE CONNECTION AND TERMINATION

Two 68-pin wide SCSI connectors are provided on the back of the enclosure for connecting the array to the system. These connectors are used in one of two ways:

- If the UltraTrak100 disk array is the only external SCSI device, or is the last external device in a daisy-chained configuration, connect the incoming cable

(the one which is attached to the SCSI adapter) to the top connector, and place an LVD SCSI active terminator on the other connector. An LVD SCSI active terminator is included with UltraTrak100 disk array unit.

- If the array is to be placed in the middle of a daisy-chained configuration, connect the incoming cable (the one which is attached to the SCSI adapter) to the top connector and connect the outgoing cable (the one which continues on to other devices) to the other connector. In this case, no terminator is required at the array, but the last device in the daisy chain must be terminated.

Correct SCSI termination procedures require that the first and last devices on the SCSI bus be terminated. If the first or last device is not terminated, or if devices other than the first and last are terminated, erratic SCSI bus performance will occur. Typically, the system or host adapter is the first device and is already terminated. When installing the UltraTrak100 disk array on a SCSI bus with other devices, make sure the above rules are observed with all devices on the SCSI bus. Consult your system and/or host adapter manual for additional information on correct termination procedure.

**Caution**

Improper system operation will occur if the SCSI termination is incorrect. Active termination and SCSI-3 compliant cables must be used. A SCSI-3 compliant cable is included with the UltraTrak100.

### DAISY CHAINING MULTIPLE ARRAYS

Use a standard 68-pin SCSI-3 cable assembly to attach the array to the SCSI chain. Attach each cable to the individual units to be connected on the SCSI bus. Ensure that each device has a unique SCSI ID and that only the first and last devices are terminated.

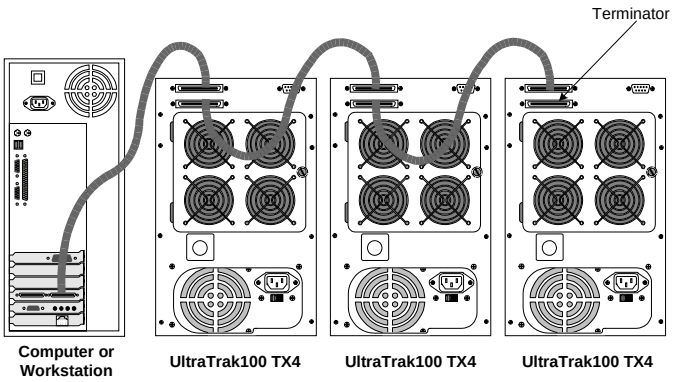



*Figure 3. Daisy Chaining Several UltraTrak100s Together*

### DAISY CHAINING WITH OTHER SCSI DEVICES

This procedure is essentially the same as the procedure outlined above for multiple arrays. Refer to the manual associated with the other device or devices for additional information that may be pertinent to that unit. Ensure that each

device has a unique SCSI ID and that only the first and last devices are terminated. (See SCSI Cable Connection and Termination on page 5).

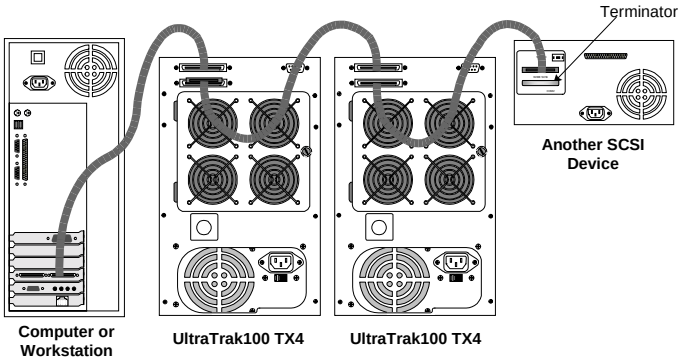



*Figure 4. Daisy Chaining UltraTrak100 with Other SCSI Devices*

## CONNECT POWER CABLE AND SWITCH POWER ON

The UltraTrak100 TX4 disk array includes a single power supply; The UltraTrak100 TX8 includes two replaceable power supply modules. Both systems will operate on either 115 volts AC or 230 volts AC. Ensure that the switch on the back of each power supply is set to your local voltage. (See Figure 2 for the TX4; see Figure 8 for the TX8.)

**Caution**

To prevent serious damage to the UltraTrak100 be sure that the voltage-select switch on the back of the power supply is set to your local voltage.

### MAIN POWER SWITCH

The power switch is located on the back of cabinet. Switch the UltraTrak100 power on by pressing the portion of this switch marked “I”. Switch the power off by pressing the portion of this switch marked “O”.

## ASSIGN A SCSI ID

Each device on a SCSI chain must have a unique ID. Do the following to assign the SCSI ID:

1. From the **Idle** mode display, enter the **Configuration** menu by pressing the **SEL** button. (See page 20 for more details.)
2. At the **Configuration** menu, use the ▼ button to select **Configure SCSI**, and then press the **SEL** button. (See page 33 for more details.)
3. At the **Configure SCSI** menu, use the ▼ button to select the **SCSI ID**, and then press the **SEL** button. (See page 34 for more details.)
4. At the **SCSI ID** menu, use the ▲ and ▼ button to select the SCSI ID number, and then press the **SEL** button. (See page 34 for more details.)
5. Press the **EXIT** button until you return to the **Idle** mode. (See page 19 for more details.)

## CONFIGURE THE ULTRATRAK100

The configuration procedures for both the UltraTrak100 TX4 and UltraTrak100 TX8 are exactly the same. The following procedures provide the basic steps needed to create an array and get your UltraTrak100 running quickly. Before beginning, you need to decide if you will create an array using the automatic setup features or if you will create the array manually. Both procedures are provided, but you can only use one of them.

You may want UltraTrak100 to create the array for you if you do not have a good technical understanding of various RAID technologies.

### HOW TO AUTOMATICALLY CREATE AN ARRAY

1. Ensure that the UltraTrak100 power is off.
2. Install the disk drives into the UltraTrak100 and lock the Drive Carrier lever.
3. Switch the power on and wait for the UltraTrak100 to initialize.
4. Press the **SEL** button on the front panel.
5. Press ▼ button once to select **Configure Array**, then press **SEL**.
6. **Array Setup** should be selected, press **SEL**.
   If the message "*No Free Disk" appears, it means that an array has already been configured. If you wish to re-create a new array, then you need to first delete array before you can proceed. (See page 29, "Delete Array", for more details.)
7. With **RAID Level** selected, press **SEL**.
8. Use the ▼ and ▲ button to select the proper RAID level for your array, press **SEL** to choose the selected RAID level. See Choosing a RAID Level on page 10 for help in choosing the proper RAID level.
9. Press **SEL** to create the array or press **EXIT** to cancel.
10. If you elected to create the array then you should see the message "Array has been created."
11. Switch the UltraTrak100 power off – wait 30 seconds and switch the power back on.

You have successfully created an array automatically. If haven't already done so, you need to select a SCSI ID before you can begin using the UltraTrak100.

### HOW TO MANUALLY CREATE AN ARRAY

1. Ensure that the UltraTrak100 power is off.
2. Install the disk drives into the UltraTrak100 and lock Drive Carrier lever.
3. Switch the power on and about one minute for the UltraTrak100 to initialize.
4. Press the **SEL** button on the front panel.
5. Press ▼ button once to select **Configure Array**, then press **SEL**.
6. Press ▼ button twice to select **Define Array**, then press **SEL**.
7. With **RAID Level** selected, press **SEL**.
8. Use the ▼ and ▲ button to select the proper RAID level for your array, press **SEL** to choose the selected RAID level. See Choosing a RAID Level on page 10 for help in choosing the proper RAID level.

**Note**

If you wish to make a RAID 0+1 array using 4, 6, or 8 drives you need to choose RAID 1 (mirroring) and then follow the steps below to create the array.

9. Press **SEL** to assign **Stripe Block Size**. 64KB is the optimum value for most applications. Choosing the proper Stripe Block Size facilitates efficient data flow. You might want to choose a different value if you know the size of the cache buffer in your hard drives or the average data block size of the data you retrieve. See Choosing Stripe Block Size on page 10 for more information.
10. Press ▼ button to choose the GB Boundary feature. Press **SEL** to toggle between **GB Boundary ON** and **GB Boundary OFF**. The size of the array is always restricted by the size of the lowest capacity disk drive. **GB Boundary ON** (recommended) causes the size of the array to be rounded down to the nearest whole gigabyte. **GB Boundary OFF** does not round off the size of the array. (For example: Enabled—1.6GB = 1GB; Disabled—1.6GB = 1.6GB.) See Gigabyte Boundary below for more information.

**Note**

The Gigabyte Boundary feature is only available for RAID levels 1, 0+1, 3, and 5.

11. Press ▼ button to choose the **Add/Remove Drives** feature then press **SEL**.
12. Use the ▼ and ▲ button to select each drive. Press **SEL** to toggle between adding or removing a drive. Press **EXIT** when done.
13. Press **SEL** to **Save Changes**
14. Press **SEL** to create the array or press **EXIT** to cancel.
15. If you pressed **SEL** to create the array then you should see the message "Array has been created."
16. Switch the UltraTrak100 power off – wait 5 seconds and switch the power back on.

You have successfully created an array manually. If haven't already done so, you need to select a SCSI ID before you can begin using the UltraTrak100.

### GIGABYTE BOUNDARY

The Gigabyte Boundary feature is designed for fault tolerant arrays (RAID 1, 0+1, 3 and 5) in which a drive has failed and the user cannot replace the drive with 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, a 20.5 GB drive would be rounded down to 20 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, UltraTrak100 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 array is created. When enabled, the Gigabyte Boundary feature rounds the drive capacity of all drives to the common whole GB drive size. For example, with the Gigabyte Boundary feature enabled, the remaining working drives can be 20.5 GB and the replacement drive can be 20.3, since all are rounded down to 20GB. This permits the smaller drive to be used. Please note that users will lose a small amount of available storage capacity from each drives in order to arrive at a common drive size.

### CHOOSING STRIPE BLOCK SIZE

There are two issues to consider when selecting the Stripe Block Size.

First, you should choose a Stripe Block Size equal-to or smaller than the smallest cache buffer found on any array disk drive. Selecting a larger value slows the array down because disk drives with smaller cache buffers need more time for multiple accesses to fill their buffers.

Secondly, if your data retrieval consists of fixed data blocks, such as with some database or video applications – then you should choose that size as your Stripe Block Size.

### CHOOSING A RAID LEVEL

There are several issues to consider when choosing the RAID Level for your UltraTrak100 array. Appendix A - Technology Background on page 41 gives some technical insight regarding each RAID choice and the following discussion summarizes some advantages, disadvantages and applications for each choice.

***RAID 0***

| Advantages | Disadvantages |
|---|---|
| Implements a striped disk array, the data is broken down into blocks and each block is written to a separate disk drive<br>I/O performance is greatly improved by spreading the I/O load across many channels and drives<br>No parity calculation overhead is involved | Not a "True" RAID because it is not fault-tolerant<br>The failure of just one drive will result in all data in an array being lost<br>Should not be used in mission critical environments |

**Recommended Applications for RAID 0**

- Image Editing
- Pre-Press Applications
- Any application requiring high bandwidth

***RAID 1***

| Advantages | Disadvantages |
|---|---|
| Simplest RAID storage subsystem design<br>Can increase read performance by processing data requests in parallel since the same data resides on two different drives | High disk overhead - uses only 50% of total capacity |

**Recommended Applications for RAID 1**

- Accounting
- Payroll
- Financial
- Any application requiring very high availability

***RAID 3***

| Advantages | Disadvantages |
|---|---|
| High Read data transfer rate<br>Disk failure has an insignificant impact on throughput | Parity drive can become bottleneck if a lot of writes are occurring |

**Recommended Applications for RAID 3**

- Image Editing
- Prepress Applications
- Any application requiring high throughput

***RAID 5***

| Characteristics/Advantages | Disadvantages |
|---|---|
| High Read data transaction rate<br>Medium Write data transaction rate<br>Good aggregate transfer rate | Disk failure has a medium impact on throughput |

**Recommended Applications for RAID 5**

- File and Application servers
- WWW, E-mail, and News servers
- Intranet servers
- Most versatile RAID level

***RAID 0+1***

| Characteristics/Advantages | Disadvantages |
|---|---|
| Implemented as a mirrored array whose segments are RAID 0 arrays<br>High I/O rates are achieved thanks to multiple stripe segments | High disk overhead - uses only 50% of total capacity |

**Recommended Applications for RAID 0+1**

- Imaging applications
- Database servers
- General fileserver

***JBOD***

| Characteristics/Advantages | Disadvantages |
|---|---|
| Uses 100% capacity of all hard drives | The failure of just one drive will result in all data in an array being lost<br>Should not be used in mission critical environments |

**Recommended Applications for JBOD**

- File archiving
- General fileserver

***HOT SPARE DRIVE(S)***

A good precaution to protecting your array integrity in the event of drive failure is maintaining a hot spare drive. A hot spare is a drive that is connected to the array system, but is not assigned as a member of the array. In the event of the failure of a drive within a functioning fault tolerant array, the hot spare is activated as a member of the array. The spare drive effectively takes the place of the failed drive and the RAID system immediately begins to rebuild data on the drive. When the rebuild is complete, the array is returned to fault tolerant status. Once the failed drive is replaced, the new drive is automatically recognized as a hot spare in the event of a subsequent drive fault.

## PARTITION AND FORMAT THE ARRAY

Like any other type of fixed disk media in your system, a RAID array must also be partitioned and formatted before use. Use the same method of partitioning and formatting on an array as you would any other fixed disk.

Depending on the operating system you use, there may or may not be various capacity limitations applicable for the different types of partitions.

# MAINTENANCE

## DRIVE STATUS INDICATORS

As shown in the figure below, each drive has three status LEDs.


*Figure 5. Location of Drive Status Indicators (TX4 shown)*

### MEANING OF STATUS INDICATORS

| Indicator | Color | Meaning |
|---|---|---|
| Power | Off | No disk drive power – power off or no disk installed. |
| | Green | Disk power on. |
| Status | Green | Normal |
| | Amber | Data is being rebuilt to this drive |
| | Red | Failed |
| Disk | Off | No drive installed or the drive has failed |
| | Green | This will blink on and off to indicate disk activity |

## CRITICAL & OFFLINE ARRAYS

A fault tolerant array goes "critical" when a drive is removed or fails. Due to the fault tolerance of the array, the data is still available and online. However, once the array goes critical, the array has lost its fault tolerance, and performance may be adversely affected. If the fault was caused by a drive that was removed, the drive should be replaced by another drive, either identical or larger, in order for the RAID system to rebuild and restore optimal configuration.

A non-fault tolerant array goes "offline" when a drive is removed or fails. Since the array is not fault tolerant, the data stored in the array is no longer accessible. If the drive was removed, then it should be replaced to restore accessibility to the array. If the drive failed, then the entire array must be deleted and re-initialized since all data is considered lost.

## REBUILDING/SYNCHRONIZING FAULT TOLERANT ARRAYS

Though a critical array can continue storage operations, it no longer offers fault tolerance and should be addressed as soon as possible by replacing the missing or failed drive(s).

Rebuild takes a replacement drive, assigns it to the array, and then writes the redundancy data to it. Once the rebuild process is complete, the array status is upgraded from “critical” to “functional” and fault tolerance is restored.

Synchronization is a preventative maintenance measure used to avoid problems with data integrity. Synchronizing simply recalculates redundant data (similar to the rebuild process) and matches the data on the drive(s).

To synchronize the array, go to the **Configuration** menu and select **Configure Array**; then select **Advance Features** and choose **Synchronize Array**.

## WHEN A DISK DRIVE FAILS

The UltraTrak100 provides both audible and visual indicators alerting you of a drive failure. The following occur when a disk drive fails or goes offline:

- Continuously produces short beeps every two seconds when a drive fails.
- Continuously produces long beeps every 15 seconds when a drive is offline.
- The Array LED on the front panel is yellow.
- The disk drive Status LED (inside front panel door) is red.
- The LCD displays a status message about the failure.

## REPLACING A DISK DRIVE MODULE

UltraTrak100 disk drive modules should not be removed unless it has been determined that a drive in the array has failed.

Generally, a disk drive that is a member of a fault tolerant array may be replaced at any time without affecting the availability of data to the system. Depending on the RAID type, drive removed, and type of access, performance may be reduced until the drive is replaced.

Disk drives may be replaced while UltraTrak100 is running; special circuitry is designed into the UltraTrak100 that protects the components and notifies the processor.

Only a failed drive should be removed from the array. Removing any other drive may cause the array to become unavailable. The replacement drive must be of equal capacity or larger than the failed drive.

In arrays where a hot spare is already installed, the hot spare automatically replaces the failed drive. When the failed drive is replaced, the new drive becomes the new hot spare.

Reconstruction begins automatically as soon as a replacement drive becomes available to the array. However, if the replacement drive was formerly part of another array, then the previous array information must be deleted (from the replacement drive – see page 29, “Delete Array”, for more details) before reconstruction begins.

**Attention**

The electronic components within the UltraTrak100 disk array are sensitive to damage from ESD (Electro-Static Discharge). Appropriate precautions should be observed at all times when handling the array or its subassemblies.

## DRIVE REPLACEMENT

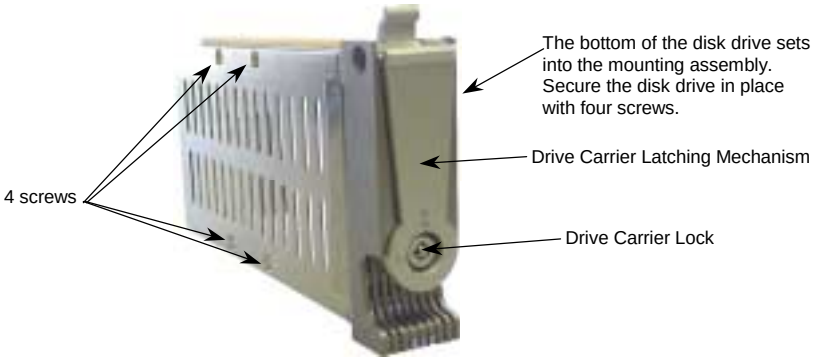



*Figure 6. Drive Carrier*

**Caution**

Do not replace the bad drive while reconstruction of the hot spare drive is in progress. Wait until the System LED and all the drive LEDs (except the failed drive) are green before replacing the failed drive.

Do the following to replace an IDE hard drive:

1. Open the Front Panel Door on the UltraTrak100.
2. Remove the hard drive you wish to replace from the UltraTrak100 by unlocking the Drive Carrier lock and sliding out the Drive Carrier.
3. Unplug the power cable and the IDE data cable from the old hard drive.
4. Remove the four screws that secure the hard drive to the Drive Carrier and remove the old hard drive from the Drive Carrier.
5. Prepare to install the new hard drive by ensuring that the jumpers on the new hard drive are set for single or master operation. Consult the drive manual for the proper settings.
6. Attach the Drive Carrier power cable to the new hard drive.
7. Attach the Drive Carrier IDE data cable to the new hard drive.
8. Lower the new hard drive into the Drive Carrier so that the screw holes on the bottom line up.

9. Insert screws through the holes in the Drive Carrier and into the bottom of the new hard drive. Tighten each screw; be careful not to over tighten.
10. Slide the assembled Drive Carrier back into the UltraTrak100 and lock the Drive Carrier lock.

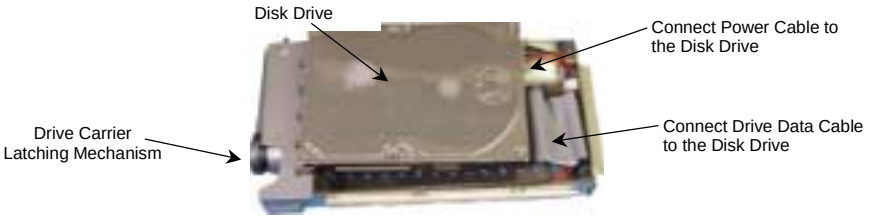



*Figure 7. Connecting Cables to Disk Drive*

**Caution**

Only qualified service personnel should remove and replace a power supply module.

## REPLACING A POWER SUPPLY MODULE (*TX8 ONLY*)

The UltraTrak100 TX8 disk array contains two hot-swappable redundant power supplies. Normally, these supplies share the load between them. However each power supply is capable of providing the power needed to maintain the array's normal operation. Each power supply LED should be on. An off or blinking LED on the power supply indicates that the power supply has failed and should be replaced. A power supply failure is also accompanied by an audible alarm (NOTE: press the Power Supply Alarm Reset button to turn off the alarm). Contact your dealer or reseller for additional details and assistance in obtaining a replacement supply.

These power supplies are accessible from the rear of the unit (see Figure 8). The power supply may be removed and replaced with an identical power supply while the array remains in operation. To protect the electronic circuits, special sensing circuitry is incorporated into the design of the UltraTrak100 TX8 disk array that detects the insertion or removal of a power supply.

Only trained and qualified personnel should remove the power supplies from the UltraTrak100 TX8.

1. Switch the failed power supply **Off**.
2. Remove the power supply locking screw.
3. Using the pull handle on the power supply pull it from the chassis.
4. Insert the new power supply into the chassis and switch the power supply power **On**.
5. Check that the Power LED indicator is illuminated.
6. Insert and tighten the power supply locking screw.

**Caution**

Risk of electrical shock. When either power supply module is removed from the chassis, AC power is accessible at the circuitry in the power supply chassis. Only trained and qualified personnel should remove the power supplies.

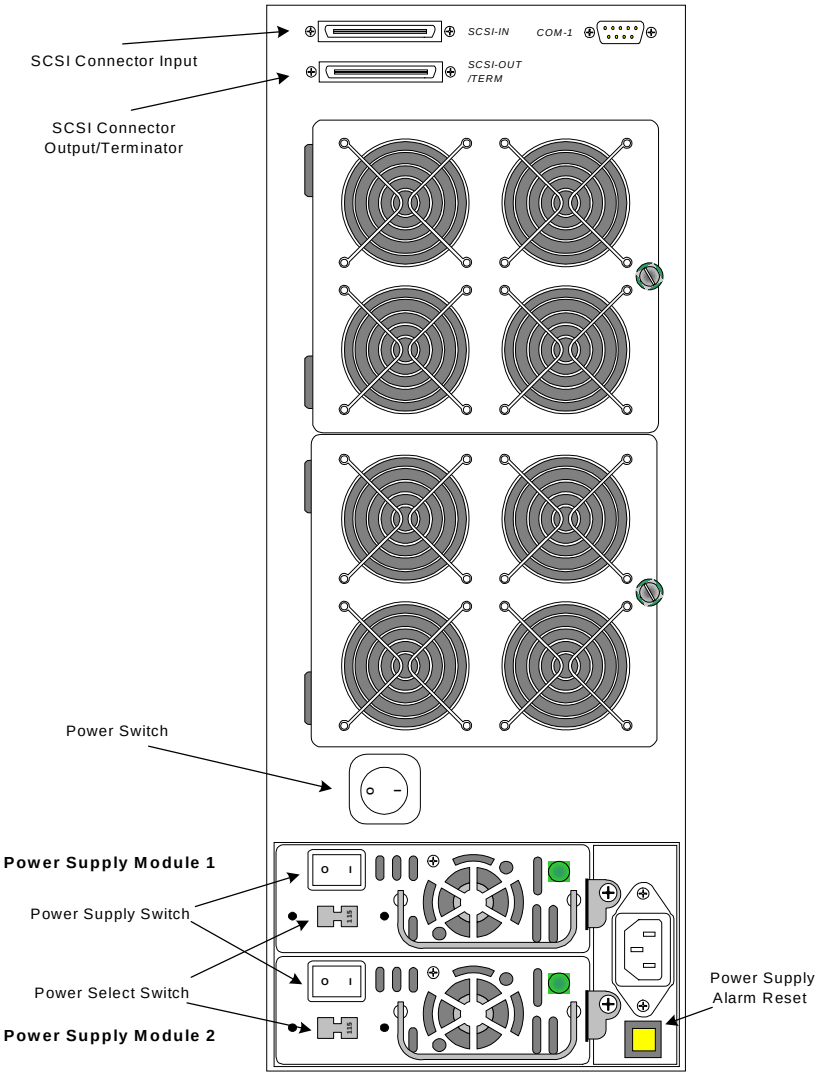
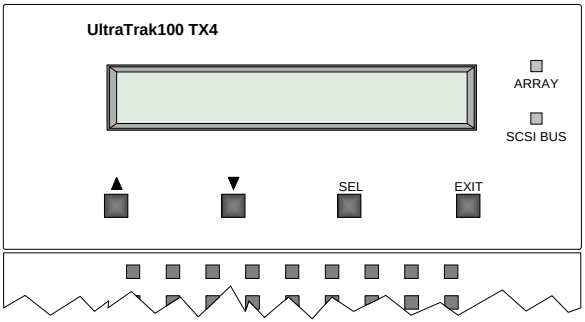



*Figure 8. Back of UltraTrak100 TX8*

# ULTRATRAK100 FRONT PANEL INTERFACE

The front panel interface for the UltraTrak100 consist of following items:

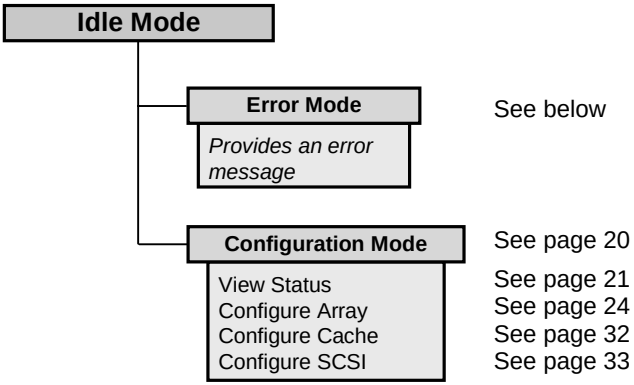



| Type of Interface | Name | Comments |
|---|---|---|
| LED Indicators | Array | Activity Indicator |
| | SCSI Bus | Activity Indicator |
| Liquid Crystal Display | Message Display Panel | This is a 24-character by 2-row LCD that displays various setup, status, and error messages. |
| Control Buttons | ▲ | Pressing this button scrolls any available messages up through the LCD and activates a message for the Select button. |
| | ▼ | Pressing this button scrolls any available messages down through the LCD and activates a message for the Select button. |
| | SEL | Pressing this button selects the LCD's active message. |
| | EXIT | Pressing this button exits the active message display to the previous level. |

## THE LCD MESSAGES

The UltraTrak100 LCD message display panel has the following modes of operation:

- Idle mode
- Error mode
- Configuration mode




### IDLE MODE

The Idle mode message, such as shown below, is displayed during normal operation of the UltraTrak100 when there are no problems or buttons being pressed:


Array status may be:

- Array Functional
- Array Critical
- Array Offline

**What you can do:**

| | |
|---|---|
| Press **SEL**: | Press to enter **Configuration** menu. |
| Press ▲: | Press to enter **Configuration** menu. |
| Press ▼: | Press to enter **Configuration** menu. |
| Press **EXIT**: | Press to enter **Configuration** menu. |

The first line of the Idle mode menu will display one of the following status messages:

- Array Functional — The array is fully operational, and no problems are present.
- Array Critical — The array is operational, but has lost its fault tolerance. For RAID array levels 1, 3 and, 5 the array contains a failed drive. The user should identify and replace the failed drive.
- Array Offline — The array is no longer operational. The array must be rebuilt from the last tape backup or other device. For RAID levels 1, 3, and 5, at least two or more drives in the array have failed. For a RAID 0 array, at least one drive has failed. The user should identify and replace the failed drives.

The second line of the Idle mode menu can also provides the following error information:

- Fan Error — Fan speed is <2000RPM or >5500RPM
- Array Rebuilding *xx*% — At least one array is rebuilding
- Array Synchronizing *xx*% — At least one array doing synchronize

## CONFIGURATION MENU

In Configuration mode you may view the status of the UltraTrak100 system and configure both UltraTrak100 hardware and arrays. The main configuration menu allows the user to select the following menus:

**View Status**
**Configure Array**
**Configure Cache**
**Configure SCSI**

Press ▲ or ▼ to move these items on the LCD.

**What you can do:**

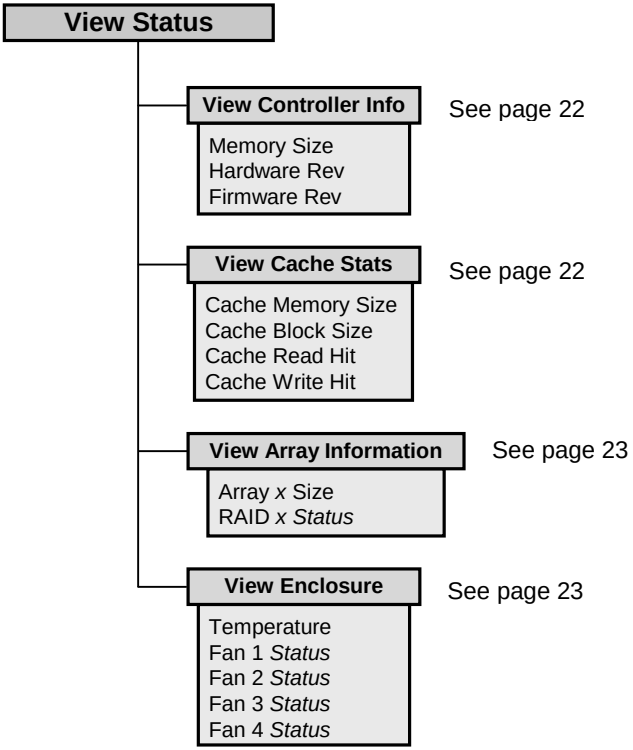
Press **SEL**: Selects one of the following active functions:

| | |
|---|---|
| **View Status** | Moves the display to the **View Status** menu. |
| **Configure Array** | Moves the display to the **Configure Array** menu. |
| **Configure Cache** | Moves the display to the **Configure Cache** menu. |
| **Configure SCSI** | Moves the display to the **Configure SCSI** menu. |

Press ▲: Moves the active message line up. (*Active is marked by *.*)

Press ▼: Moves the active message line down. (*Active is marked by *.*)

Press **EXIT**: Returns to the **Idle** mode.




## VIEW STATUS MENU

The View Status menu allows the user to select the information he wishes to view with the following menu:


**View Array Information**
**View Enclosure**

Press ▲ or ▼ to move these items on the LCD.

**What you can do:**

Press **SEL**: Selects one of the following active functions:

| | |
|---|---|
| **View Controller Info.** | Moves the display to the **View Controller Info** menu. |
| **View Cache Stats** | Moves the display to the **View Cache Stats** menu. |
| **View Array Information** | Moves the display to the **View Array Information** menu. |
| **View Enclosure** | Moves the display to the **View Enclosure** menu. |

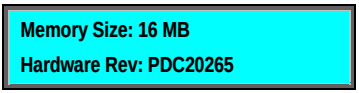
Press ▲: Moves the active message line up. (*Active is marked by **.)

Press ▼: Moves the active message line down. (*Active is marked by **.)

Press **EXIT**: Returns to the **Configuration** mode.

### *VIEW CONTROLLER INFORMATION*

The View Controller Information mode displays UltraTrak100 firmware revision, memory size, and hardware revision:




*Where the values shown are simply examples.*

**Firmware Rev: V1.00 B00**

Press ▲ or ▼ to move these items on the LCD.

**What you can do:**

Press **SEL**: Does nothing.

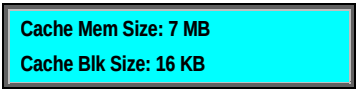
Press ▲: Moves the active message line up.

Press ▼: Moves the active message line down.

Press **EXIT**: Returns to the **Configuration** mode.

### *VIEW CACHE STATS*

The View Cache Stats mode displays the cache memory size, cache block size, the cache read hit percentage rate and the cache write hit percentage rate.




*Where the values shown are simply examples.*

**Cache Read Hit : 10%**
**Cache Write Hit : 15%**

Press ▲ or ▼ to move these items on the LCD.

**What you can do:**

Press **SEL**: Does nothing.

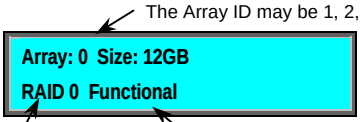
Press ▲: Moves the active message line up.

Press ▼: Moves the active message line down.

Press **EXIT**: Returns to the **Configuration** mode.

### *VIEW ARRAY INFORMATION*

The View Array Information mode displays the array ID, array size, RAID level and array status (Functional, Critical, Offline, Rebuilding and Synchronizing). If these modes of display require more than 2 lines to display information the up and down keys will be used to scroll the display.




*Where the values shown are simply examples.*

| | | |
|---|---|---|
| RAID 0 | Functional | Array is Functioning properly |
| RAID 1 | Critical | The array is in a degraded mode |
| RAID 3 | Rebuilding *x*% | Array is rebuilding – *x*% done |
| RAID 5 | Offline | Array is down |
| RAID 0+1 | Synchronizing *x*% | Array is synchronizing – *x*% done |

**What you can do:**

Press **SEL**: Does nothing.

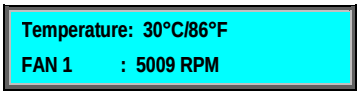
Press ▲: Moves the active message line up.

Press ▼: Moves the active message line down.

Press **EXIT**: Returns to the **View Status** mode.

### *VIEW ENCLOSURE*

The View Enclosure menu displays the following information:




*Where the values shown are simply examples.*

**FAN 2 : 4782 RPM**
**FAN 3 : 4896 RPM**
**FAN 4 : 4983 RPM**

Press ▲ or ▼ to move these items on the LCD.

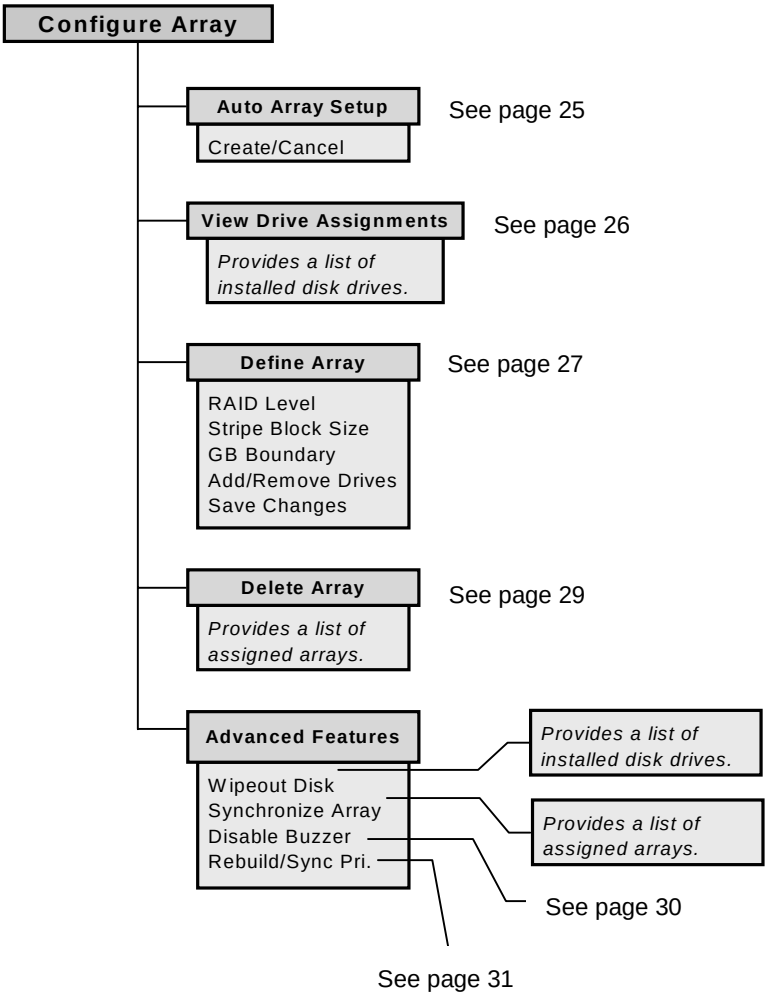
**What you can do:**

Press **SEL**: Does nothing.

Press ▲: Moves the active message line up.

Press ▼: Moves the active message line down.

Press **EXIT**: Returns to the **Configuration** mode.


Configure Array
Auto Array Setup
Create/Cancel
See page 25
View Drive Assignments
Provides a list of installed disk drives.
See page 26
Define Array
RAID Level
Stripe Block Size
GB Boundary
Add/Remove Drives
Save Changes
See page 27
Delete Array
Provides a list of assigned arrays.
See page 29
Advanced Features
Wipeout Disk
Synchronize Array
Disable Buzzer
Rebuild/Sync Pri.
Provides a list of installed disk drives.
Provides a list of assigned arrays.
See page 30
See page 31

## CONFIGURE ARRAY

The Configure Array menu will allow the creation and deletion of arrays. The configure array menu contains the following sub menus:


**Define Array**
**Delete Array**
**Advanced Feature**

Press ▲ or ▼ to move these items on the LCD.

**What you can do:**

Press **SEL**: Selects one of the following active functions:

| | |
|---|---|
| **Auto Array Setup** | Moves the display to the **Auto Array Setup** menu. |
| **View Drive Assignments** | Moves the display to the **View Drive Assignments** menu. |
| **Define Array** | Moves the display to the **Define Array** menu. |
| **Delete Array** | Moves the display to the **Delete Array** menu. |

Press ▲: Moves the active message line up.

Press ▼: Moves the active message line down.

Press **EXIT**: Returns to the **Configuration** mode.

### *AUTO ARRAY SETUP FUNCTION*

In Auto Array Setup function, if there is only one free drive, it will be configured as a RAID 0 array. If there are two free drives, they will be configured as a RAID 1 array. If there are more than two free drives, all free drives will be configured as a RAID 5 array and then display the following:


**What you can do:**

Press **SEL**: Pressing SEL will create the array.

Press ▲: Does nothing.

Press ▼: Does nothing.

Press **EXIT**: Press EXIT to cancel this function and return to the **Configure Array** menu.

You will see the following message if all of the drives are already configured:


**What you can do:**

Press **SEL**: Pressing SEL will save the array.

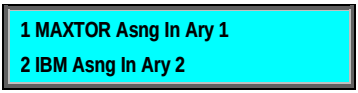
Press ▲: Does nothing.

Press ▼: Does nothing.

Press **EXIT**: Press EXIT to cancel this function and return to the **Configure Array** menu.

### *VIEW DRIVE ASSIGNMENTS*

The View Drive Assignments mode lists each installed drive by model and identifies its array ID or that it is free (if it is not assigned to an array). Each drive is displayed on one line.




*Where the values shown are simply examples.*

**3 MAXTOR Asng In Ary 3**
**4 IBM Asng In Ary 4**

Press ▲ or ▼ to move these items on the LCD.

**What you can do:**

Press **SEL**: Does nothing.

Press ▲: Moves the active message line up.

Press ▼: Moves the active message line down.

Press **EXIT**: Returns to the **Configure Array** menu.

### *DEFINE ARRAY*

The Define Array menu defines array parameters for the selected array. An array number is selected by using the up/down key to select the array number field. The **SEL** key is then used to select array number 1-4.

The parameter to be configured, RAID Level or Stripe Block size, is then selected with up/down keys. Once the parameter is selected, the value is selected with the up/down keys and then set by hitting the **SEL** key. If the **Exit** key is hit instead of the **SEL** key the parameter value is not modified and the user may then select a different parameter.


← *This feature is not available in RAID 1.*

**GB Boundary ON**
**Add/Remove Drives**
**Save Changes**

Press ▲ or ▼ to move these items on the LCD.

**What you can do:**

Press **SEL**: Selects one of the following active functions:

| | |
|---|---|
| **RAID Level** | Moves the display to the **RAID Level** menu. |
| **Stripe Block Size** | Moves the display to the **Stripe Block Size** menu. |
| **GB Boundary ON** | Toggles between **ON** and **OFF**. |
| **Add/Remove Drives** | Moves the display to the **Add/Remove Drives** menu. |
| **Save Changes** | Moves the display to the **Save Changes** menu. |

Press ▲: Moves the active message line up. (*Active is marked by **.)

Press ▼: Moves the active message line down. (*Active is marked by **.)

Press **EXIT**: Returns to the **Configure Array** menu.

You will see the following message if the array is already defined:


**What you can do:**

Press **SEL**: Pressing SEL will save the array.

Press ▲: Does nothing.

Press ▼: Does nothing.

Press **EXIT**: Press EXIT to cancel this function and return to the **Configure Array** menu.

### *STRIPE BLOCK SIZE*

The Stripe Block Size menu allows you to select a Stripe Block Size between 4KB and 64KB:


**16KB**

**...**

**64KB**

Press ▲ or ▼ to move these items on the LCD.

**What you can do:**

| | |
|---|---|
| Press **SEL**: | Selects one of the active Stripe Block Size: |
| Press ▲: | Moves the active message line up. (*Active is marked by **.) |
| Press ▼: | Moves the active message line down. (*Active is marked by **.) |
| Press **EXIT**: | Returns to the **Define Array** menu. |

### *SAVE CHANGES MENU*


**What you can do:**

| | |
|---|---|
| Press **SEL**: | Pressing SEL will create the array. |
| Press ▲: | Does nothing. |
| Press ▼: | Does nothing. |
| Press **EXIT**: | Press EXIT to cancel this function and return to the **Configure Array** menu. |

### *ADD/REMOVE DRIVES*

The Add/Remove Drives menu assigns and removes drives from arrays. All free drives are displayed as one drive per line format. The **SEL** key toggles the drive between free and assigned. Assigned drives are designated by displaying **Assigned** and free drives are designated by displaying **Free**.


*Where the values shown are simply examples.*

**3 MAXTOR Free**
**4 IBM Free**

Press ▲ or ▼ to move these items on the LCD.

**What you can do:**

Press **SEL**: Toggles the selected drive between **Free** and **Assigned**.

Press ▲: Moves the active message line up.

Press ▼: Moves the active message line down.

Press **EXIT**: Returns to the **Define Array** menu.

### *DELETE ARRAY*

The Delete Array menu allows the user to select an array and delete the configuration information for that array. This will also free any drives that have been assigned to that array.


*Only existing Array IDs are Displayed.*

**Array ID: 3**
**Array ID: 4**

Press ▲ or ▼ to move these items on the LCD.

**What you can do:**

Press **SEL**: Displays a **Delete Array** confirmation message.

Press ▲: Moves the active message line up. (*Active is marked by **.)

Press ▼: Moves the active message line down. (*Active is marked by **.)

Press **EXIT**: Returns to the **Configure Array** menu.

### *ADVANCED FEATURE*


**Disable Buzzer**
**Rebuild/Sync Pri.**

Press ▲ or ▼ to move these items on the LCD.

**What you can do:**

Press **SEL**: Selects one of the following active functions:

| | |
|---|---|
| **Wipe out disk** | Moves the display to the **Wipe out disk** menu. |
| **Synchronize Array** | Moves the display to the **Synchronize Array** menu. |
| **Disable Buzzer** | Pressing **SEL** toggles between Enable and Disable |

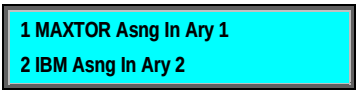
Press ▲: Moves the active message line up. (*Active is marked by *.*)

Press ▼: Moves the active message line down. (*Active is marked by *.*)

Press **EXIT**: Returns to the **Configure Array** menu.

### *WIPE OUT DISK*

The Wipe Out Disk menu allows the user to delete the area on the hard drive that contains array information used exclusively by the UltraTrak100 controller. It may be necessary to wipe out a disk if the disk was previously a member of an UltraTrak100 array and you wish to use the disk in a different UltraTrak100 array. To wipe out a disk, go to the **Configuration** menu and select **Configure Array**; then select **Advance Features** and choose **Wipe Out Disk**.




*Where the values shown are simply examples.*

**3 MAXTOR Asng In Ary 3**
**4 IBM Asng In Ary 4**

Press ▲ or ▼ to move these items on the LCD.

**What you can do:**

Press **SEL**: Displays a **Wipe out disk** confirmation message.

Press ▲: Moves the active message line up. (*Active is marked by *.*)

Press ▼: Moves the active message line down. (*Active is marked by *.*)

Press **EXIT**: Returns to the **Advance Feature** menu.

**Caution**

The **Wipe Out Disk** option will delete all data on the drive that is selected.

### *SYNCHRONIZE ARRAY*

The Synchronize Array menu allows the user to synchronize the data on each drive. Synchronization is a maintenance procedure for fault tolerant arrays (RAID 1, 0+1, 3 and 5) to maintain data consistency on all drives. To synchronize the array, go to the **Configuration** menu and select **Configure Array**; then select **Advance Features** and choose **Synchronize Array**.


*Only existing Array IDs are Displayed.*

Press ▲ or ▼ to move these items on the LCD.

**What you can do:**

| | |
|---|---|
| Press **SEL**: | Displays a **Synchronize Array** confirmation message. |
| Press ▲: | Moves the active message line up. (*Active is marked by *.*) |
| Press ▼: | Moves the active message line down. (*Active is marked by *.*) |
| Press **EXIT**: | Returns to the **Advance Feature** menu. |

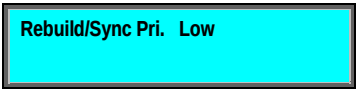
**Note**

Promise Technology suggests synchronizing an array once a month.

Synchronization is a preventative maintenance measure used to avoid problems with data integrity. Synchronizing simply recalculates redundant data (similar to the rebuild process) and matches the data on the drive(s).

### *REBUILD/SYNC PRI.*

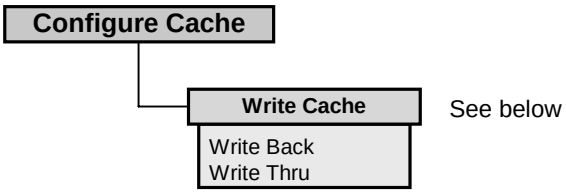
Assigns the amount of importance that UltraTrak100 gives to rebuilding/synchronizing data in the background. A **High** setting assigns most of UltraTrak100's resources to the rebuild process at the expense of responding to ongoing read/write data requests by the operating system. A **Low** setting gives priority to ongoing read/write data requests by the operating system at the expense of the rebuild/synchronization process and will typically result in longer rebuild/synchronization times. The default setting is **High**. To set the Rebuild/Sync priority, go to the **Configuration** menu and select **Configure Array**; then select **Advance Features** and choose **Rebuild/Sync Pri.**




Press ▲ or ▼ to move these items on the LCD.

**What you can do:**

| | |
|---|---|
| Press **SEL**: | Toggles the **Rebuild/Sync** priority between **High** or **Low** |
| Press ▲: | Moves the active message line up. (*Active is marked by *.*) |
| Press ▼: | Moves the active message line down. (*Active is marked by *.*) |
| Press **EXIT**: | Returns to the **Advance Feature** menu. |




## CONFIGURE CACHE

The Configure Cache menu will allow the setting of cache parameters. The following parameter is set in the Configure Cache menu:


**What you can do:**

Press **SEL**: Selects one of the following active functions:

**Write Cache** Moves the display to the **Write Cache** menu.

Press ▲: Moves the active message line up. (*Active is marked by *.*)

Press ▼: Moves the active message line down. (*Active is marked by *.*)

Press **EXIT**: Returns to the **Configuration** menu.

### *WRITE CACHE*

Setting the Write Cache to **Write Back** improves performance, because a write to the high-speed cache is faster than to disk. Data normally written to disk is first written into the UltraTrak100's cache, allowing the system CPU to continue with other tasks while the UltraTrak100 handles writing data from it's cache to the array. However, write-back cache data is lost with a system power outage or other event where the data has not yet been saved to disk. Setting the Write Cache to **Write Thru** forces UltraTrak100 to immediately save all writes to the drive.


**What you can do:**

Press **SEL**: Selects one of the following active functions:

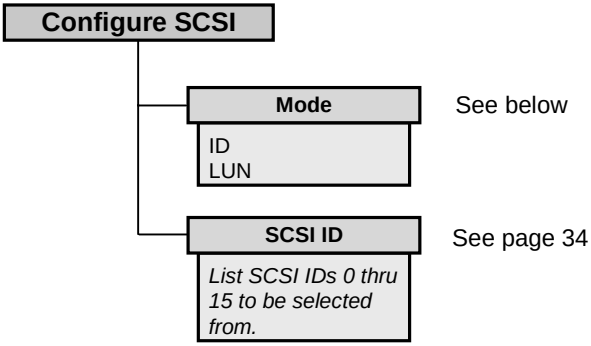
**Write Back** Select function and return to **Configure Cache** menu.

**Write Thru** Select function and return to **Configure Cache** menu.

Press ▲: Moves the active message line up. (*Active is marked by *.*)

Press ▼: Moves the active message line down. (*Active is marked by *.*)

Press **EXIT**: Returns to the **Configuration** menu.




## CONFIGURE SCSI

The Configure SCSI menu will allow the setting of SCSI parameters. The following parameters are set in the configure SCSI menu:


**What you can do:**

Press **SEL**: Selects one of the following active functions:

- **Mode** — Move the display to the **Mode** menu.
- **SCSI ID** — Move the display to the **SCSI ID** menu.

Press ▲: Moves the active message line up. (*Active is marked by *.*)

Press ▼: Moves the active message line down. (*Active is marked by *.*)

Press **EXIT**: Returns to the **Configuration** menu.

### *MODE*

Select one of the following SCSI ID modes:


Selected toggles between these two when **SEL** is pressed.

**What you can do:**

Press **SEL**: Selects one of the following active functions:

- **ID** — Select device **ID** mode.
- **LUN** — Select **LUN** (logical unit number) mode.

Press ▲: Moves the active message line up. (*Active is marked by *.*)

Press ▼: Moves the active message line down. (*Active is marked by *.*)

Press **EXIT**: Returns to the **Configure SCSI** menu.

When using **ID** mode, if you have multiple arrays within an UltraTrak100 unit, each array will use a separate SCSI ID. When using **LUN** mode, each UltraTrak100 unit will use a single SCSI ID, with the first array being LUN 0, the second array being LUN1, etc. Enable Multiple LUN support in your SCSI adapter if you choose **LUN** mode. In most cases it is preferable to use **ID** mode.

### *SCSI ID*

Select a SCSI ID between 0 and 15:


**2**
**...**
**15**

Press ▲ or ▼ to move these items on the LCD.

**What you can do:**

Press **SEL**: Selects one of the following active functions:

*from a list of numbers between 1 and 15.* Selects the **SCSI ID** – The word **Selected** appears next to the selected ID.

Press ▲: Moves the active message line up. (*Active is marked by **.)

Press ▼: Moves the active message line down. (*Active is marked by **.)

Press **EXIT**: Returns to the **Configure SCSI** menu.

**Note**

If you have multiple arrays and are using **ID** mode, be aware that each array will use a SCSI ID. If, for example, you have created two separate arrays and have selected **SCSI ID** 4, array 1 would have **SCSI ID** 4 and array 2 would have **SCSI ID** 5.

# CONTACTING PROMISE 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
- 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<br>(technical documents, drivers, utilities, etc.) |

**USA Tech Support Center**

| | |
|---|---|
| E-mail Support | support@promise.com |
| Fax Technical Support | (408) 452-9163<br>Attention: Technical Support |
| Phone Technical Support | (408) 452-1180<br>7:30-5:00pm M-F Pacific Standard Time |
| If you wish to write us for support: | Promise Technology, Inc.<br>Attn: Technical Support<br>1460 Koll Circle, Suite A<br>San Jose, CA 95112 USA |

**European Tech Support**

| | |
|---|---|
| E-mail Support | support@promise.nl |
| Fax Technical Support | +31 (0)40 256 94 63<br>Attention: Technical Support |
| Phone Technical Support | +31 (0)40 256 94 61<br>8:30-5:00pm The Netherlands Time |
| If you wish to write us for support: | Promise Technology Europe B.V.<br>Attn: Technical Support<br>1 European Business Centre, Unit 1.25<br>Luchthavenweg 81<br>5657 EA Eindhoven, The Netherlands |

**Pacific Rim Sales Office**

| | |
|---|---|
| E-mail Support | support@promise.com.tw |
| Fax Technical Support | +886 3 578 23 90<br>Attention: Technical Support |
| Phone Technical Support | +886 3 578 23 95<br>9:00-5:30pm Taiwan Time |
| If you wish to write us for support: | Promise Technology, Inc.<br>Attn: Technical Support<br>2F, No. 30, Industry E. Rd. IX,<br>Science-Based Industrial Park,<br>Hsin-Chu, Taiwan, R.O.C. |

**China Office**

| | |
|---|---|
| E-mail Support | support-china@promise.com |
| Fax Technical Support | +86 (0) 10 6872 3940<br>Attention: Technical Support |
| Phone Technical Support | +86 (0) 10 6872 3942<br>9:00-6:00pm China Time |
| If you wish to write us for support: | Promise Technology China<br>Attn: Technical Support<br>Room 3217, No. 15, Bai Shi Qiao Road<br>Hai Dian District Beijing 100081<br>P.R. China |

# LIMITED WARRANTY

Promise Technology, Inc. (Promise Technology) warrants that for two (2) years from the time of the delivery of the product to the original end user:

a. the product will conform to Promise Technology'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 Technology or a Promise Technology-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 Technology 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 Technology 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 Technology 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.

Promise Technology'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 Technology 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 Technology has been advised of the possibility of such damages. Promise Technology is not an insurer. If you desire insurance against such damage, you must obtain insurance from another party.

# RETURNING PRODUCT FOR REPAIR (USA & CANADA)

If you suspect a product is not working properly, or if you have any questions about your product, contact our Technical Support Department through one of our technical services. You may reach our Technical Support Department as follows:

- Call us at (408) 452-1180
- E-mail us at support@promise.com

However, before contacting Technical Support we ask that you first visit our Technical Support web page at http://support.promise.com for the latest product information and updates.

Please provide the following information when contacting Technical Support:

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

The 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:

PROMISE TECHNOLOGY, INC.
Customer Service Dept.
Attn.: RMA # _____
1460 Koll Circle
San Jose, CA 95112

You must follow the packaging guidelines for returning products:

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

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

When repairing returned product(s), Promise Technology 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 Technology will pay for standard return shipping charges only. You will be required to pay for any additional shipping options (such as express shipping).

## 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 Technology is not liable for any damage to equipment or data loss resulting from the use of any product.

# APPENDIX A - TECHNOLOGY BACKGROUND

## INTRODUCTION TO RAID

RAID (Redundant Array of Independent Disks) allows multiple hard drives to be combined together to form one large logical drive or “array.” As far as the operating system is concerned, the array represents a single storage device, and treats it as such. The RAID software and/or controller handles all of the individual drives on its own. The benefits of a RAID can include: higher data transfer rates for increased server performance, increased overall storage capacity for a single drive designation (such as, C, D, E, etc.), data redundancy/fault tolerance for ensuring continuous system operation in the event of a hard drive failure.

Different types of arrays use different organizational models and have varying benefits. The following outline breaks down the properties for each type of RAID array:

## RAID 0 – STRIPING

When a disk array is striped, the read and write blocks of data are interleaved between the sectors of multiple drives (see Figure A1). Performance is increased, since the workload is balanced between drives (or "members") that form the array. Identical drives are recommended for performance as well as data storage efficiency. The disk array's data capacity is equal to the number of drive members multiplied by the smallest array member's capacity.

For example, one 1GB and three 1.2GB drives will form a 4GB (4 x 1GB) disk array instead of 4.6 GB. The stripe block size value can be set logically from 4KB, 8KB, 16KB, 32KB, and 64KB. This selection will directly affect performance. Larger block sizes are better for random disk access (like email, POS, or web servers), while smaller sizes are better for sequential access.

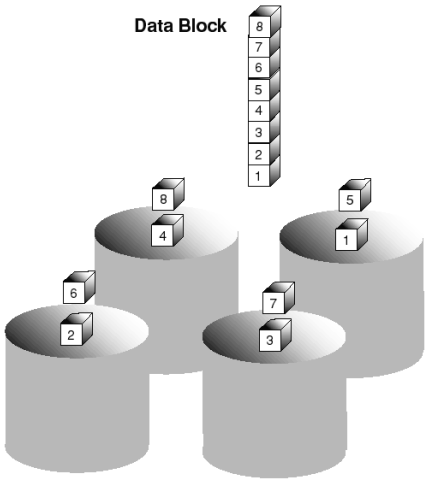



*Figure A1. RAID 0 striping interleaves data across multiple drives*

## RAID 1 – MIRRORING

When a disk array is mirrored, identical data is written to a pair of drives, while reads are performed in parallel. The reads are performed using elevator seek and load balancing techniques where the workload is distributed in the most efficient manner. Whichever drive is not busy and is positioned closer to the data will be accessed first.

With RAID 1, if one drive fails or has errors, the other mirrored drive continues to function. This is called *Fault Tolerance*. Moreover, if a spare drive is present, the spare drive will be used as the replacement drive and data will begin to be mirrored to it from the remaining good drive.

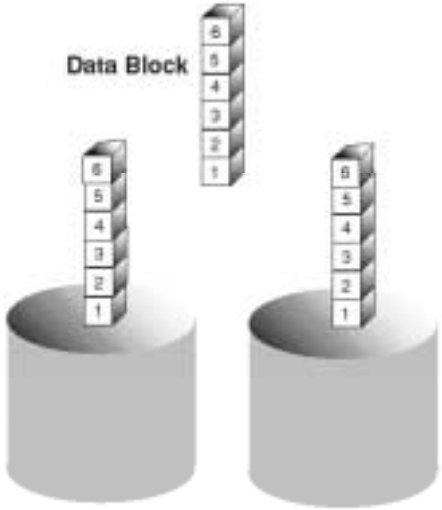



*Figure A2. RAID 1 mirrors identical data to two drives*

Due to the data redundancy of mirroring, the drive capacity of the array is only the size of the smallest drive. For example, two 1GB drives which have a combined capacity of 2GB instead would have 1GB of usable storage when set up in a mirrored array. Similar to RAID 0 striping, if drives of different capacities are used, there will also be unused capacity on the larger drive.

## RAID 0+1 – STRIPING/MIRROR

Striping/mirroring combines both of the previous array types. It can increase performance by reading and writing data in parallel while protecting data with duplication. At least four drives are needed for RAID0+1 to be installed. With a four-drive disk array, drive pairs are striped together with one pair mirroring the first pair. The data capacity is similar to a standard mirroring array, with half of the total storage capacity dedicated for redundancy. An added plus for using RAID 0+1 is that, in many situations, such an array offers double fault tolerance. Double fault tolerance may allow your data array to continue to operate depending on which two drives fail.

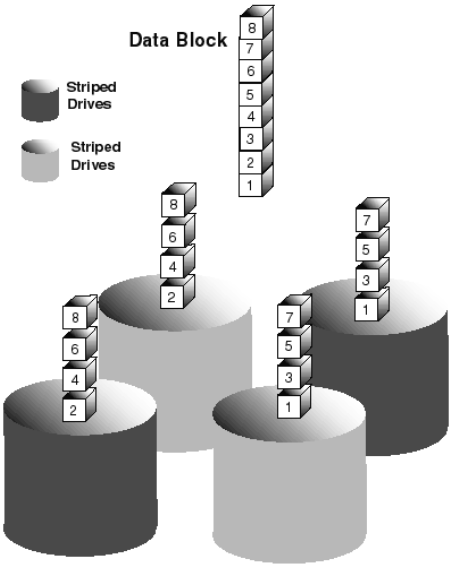



*Figure A3. RAID 0+1 striping and mirroring of two drive pairs*

## RAID 3 – BLOCK STRIPING WITH PARITY DRIVE

RAID level 3 organizes data across the physical drives of the array, and stores parity information on to a drive dedicated to this purpose. This organization allows increased performance by accessing multiple drives simultaneously for each operation, as well as fault tolerance by providing parity data. In the event of a hard drive failure, data can be re-calculated by the RAID system based on the remaining drive data and the parity information.

The adjustable block size of the RAID 3 array allows for performance tuning based on the typical I/O request sizes for your system. The block size must be set at the time it is created and cannot be adjusted dynamically. Generally, RAID Level 3 tends to exhibit lower random write performance due to the heavy workload going to the dedicated parity drive for parity recalculation for each I/O.

The capacity of a RAID 3 array is the smallest drive size multiplied by the number of drives less one. Hence, a RAID 3 array with (4) 1.0 GB hard drives will have a capacity of 3.0GB. An array with (2) 1.2GB hard drives and (1) 1.0GB hard drive will have a capacity of 2.0GB.

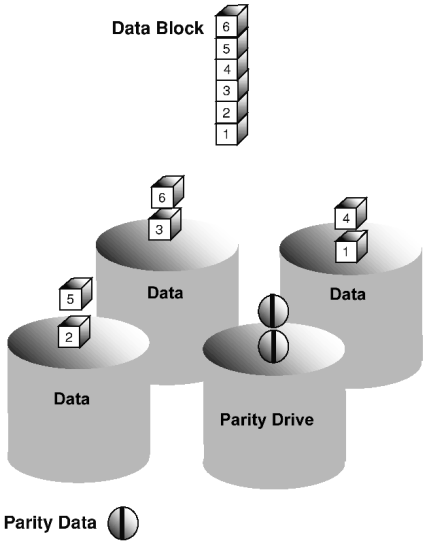



*Figure A4. RAID 3 multiple drives stripe data w/ one dedicated parity drive*

## RAID 5 – BLOCK AND PARITY STRIPING

RAID 5 is similar to RAID 3 as described above except that the parity data is rotated across the physical drives along with the block data. Having the parity data striped across all the physical drives in this manner removes the random write performance bottleneck of RAID 3. The total capacity of a RAID 5 array is calculated the same as a RAID 3 array.

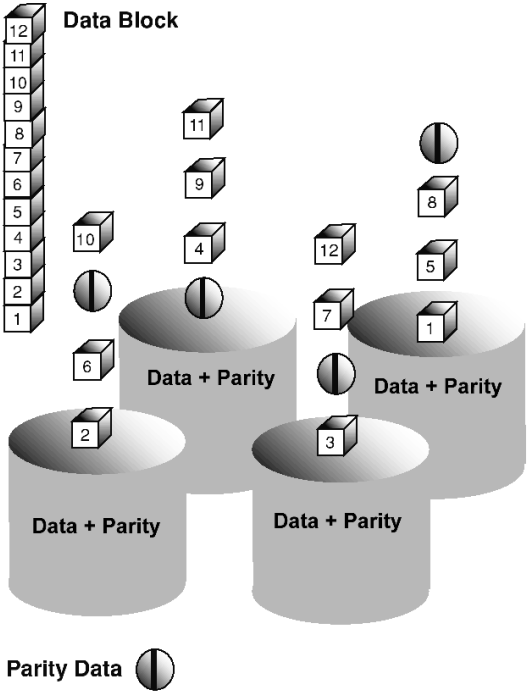



*Figure A5. RAID 5 stripes all drives with data and parity information*

## JBOD (SPANNING)

In a Spanning array, the disk array capacity is equal to the sum of all drives, even if the drives are of different capacities. Spanning stores data onto a drive until it is completely filled then proceeds to store data on to the next drive in the array. There are no performance or fault tolerance array features in this type of array. When a disk member fails, the entire array is offline.

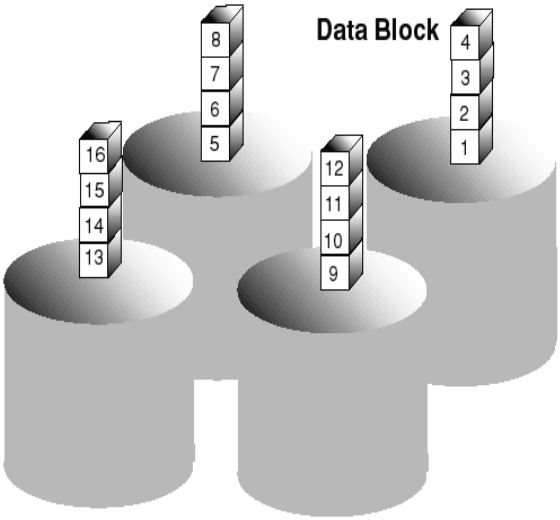



*Figure A6: Spanning uses full capacity of drives*

# Appendix B - Frequently Asked Questions

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

**Q. What kind of hard drives can I use for an UltraTrak100 array?**

A. You can use any Ultra ATA/100, Ultra ATA/33/66, or EIDE hard drive(s) to create arrays on the UltraTrak100. 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 add a drive to an UltraTrak100 RAID array via hot-swap and dynamically adjust the array size/configuration?**

A. No. The UltraTrak100 does not support dynamically adjustable RAID size/configurations.

**Q. Can I take a set of drives that make up an array created on one UltraTrak100 and move it to another UltraTrak100?**

A. Yes. All UltraTrak100's read the 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. Can I take a drive used in an UltraTrak100 array and access it directly with a different controller, such as the one integrated on the motherboard?**

A. Yes, but only under certain configurations. The following array configurations will allow the drive(s) to be accessed individually on another controller: mirror (RAID 1), or single drive striped (RAID 0). Multiple drives striped will not work.

**Q. How can I be sure that write-back cache has flushed before I reboot after partitioning and formatting an array?**

A. A cache flush is always triggered immediately following any write from the int 13h BIOS. This level of array support is what FDISK and FORMAT use to access the drive from MSDOS. With no delay in the write operation, there is no cached data waiting to be written. If you are running from Windows NT/2000 or other operating systems, as usual, make sure to shut down Windows properly so that the operating system can trigger and flush the cache as necessary. NOTE: powering off before a proper shutdown is complete may result in the loss of unwritten data in the cache, possibly causing problems in a subsequent boot or access to the data that was unwritten.

**Q. Why can't I see the drives on the UltraTrak100 under FDISK?**

A. If you have not created an array, the physical drive(s) attached to the UltraTrak100 card will not be recognized by the operating system. The UltraTrak100 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 UltraTrak100 from MSDOS at all, you must first create a RAID array.

**Q. Why can't I see the array I just created in the Windows NT/2000 Disk Administrator?**

A. Since Windows NT/2000 does not yet support any method of dynamically adding and/or removing logical devices to/from the system, you must restart Windows. The next boot will show the new array under Disk Administrator.