![ADTX Advanced Technology and Systems Co.,Ltd.]

ArrayMasStor "K" Series

Installation Manual and Users Guide

ArrayMasStor K Series

Introduction

Thank you for purchasing your new ArrayMasStor K-Series RAID system from ADTX®. This high quality data storage system offers very high performance with "state-of-the-art" reliability. It has been rigorously tested to ensure trouble-free operation and long life.

The K-Series is a SCSI-to-IDE RAID system with drive bay space for six EIDE disk drives. The system can be used with virtually all contemporary SCSI equipped host systems.

As a RAID data storage system, it provides both increased drive access speed and fault tolerance (i.e., one drive in the system can fail without affecting its data integrity or operations). The system provides additional fault tolerance with dual, redundant, hot-swappable fan/indicator modules and power supplies. All of its RAID functions are performed by a PowerPC® RISC CPU with high-speed SDRAM and flash memory firmware.

Its built-in hardware RAID controller employs sophisticated drive failure management capabilities that allow automatic reassignment of reserved blocks when a bad drive sector is encountered during write operations. Hot swapping of the drives is supported through automatic disconnection of a failed drive and the automatic detection of a spare "reserved" drive. If a drive fails, the system supports the automatic rebuilding of data in the background, allowing host operations to continue. Amazingly, failure recovery operations are completely transparent to the host system.

The K-Series system is so easy to use, that it can be installed, configured, and deployed by users without intimate knowledge of RAID systems. It's built-in automatic RAID setup feature can perform all of the setup, ID assignment, and configuration tasks needed for regular operation.

K-Series Product Features

- ❑ Compact (2U) rack mount enclosure
- ❑ Self-contained operation. No special host software needed
- ❑ Ultra160 SCSI host interface with transfer rates up to 160Mbyte/sec.
- ❑ Comprehensive RAID level support: 0, 1(0+1), 3, 5
- ❑ Supports up to 6 EIDE ATA-66/UDMA-66 (and ATA/UDMA-100) disk drives
- ❑ Compatibility with most contemporary 3.5" x 1" high EIDE disk drives
- ❑ Employs hot-swappable drive tray assemblies
- ❑ Incorporates a "built-in" LCD control panel and status display
- ❑ Provides up to 64MB of cache memory
- ❑ Easily upgradable firmware (Flash ROM)
- ❑ Automatic RAID Setup function for easy installation
- ❑ Dual, redundant, hot-swappable power supplies
- ❑ Dual, independent, front accessible, hot-swappable cooling fan/indicator modules

Note: The K-Series RAID system only supports IDE disk drives. It is not compatible with SCSI disk drives.

The following sections have been provided to help you set up your new RAID system and have it operating as quickly as possible. Please follow these instructions carefully. By doing so, you will be able to benefit from the system's many features and benefits in a minimum amount of time.

Unpacking the RAID system

Each K-Series RAID system is shipped with several components and accessories. Please check the following packing list and verify that you received each of these items.

Packing List

The box that the K-Series RAID system came in should include the following:

- ❑ K-Series RAID Subsystem with up to six (6) Drives and Drive trays
- ❑ One (1) removable front cover
- ❑ One (1) Power Cord
- ❑ One (1) SCSI Cable
- ❑ One (1) SCSI Bus Terminator
- ❑ One (1) pair of rack mount rails
- ❑ One (1) installation guide

Installing the RAID system

After unpacking the RAID system, place it near the host computer – preferably in its final location. (If you will be rack mounting the unit, install the supplied mounting rails into the rack cabinet and slide the RAID system onto these supporting rails. Note that the mounting rails are of the "shelf" type and do not screw to the sides of the RAID system. Finally, secure the RAID system to the rack cabinet using the brackets on the front of the RAID system - see figure 2.)

1) Make sure that both the RAID system and the host computer are powered OFF.
2) Next, make sure that the RAID system's power switch is in the OFF position (see figure 8). Connect the RAID system to an appropriate power source using the supplied power cord.
3) If the RAID system will be the last (or only) external SCSI device on the SCSI bus, install the supplied SCSI terminator onto one of its SCSI connectors (see figure 8).
4) Connect a qualified SCSI cable (supplied) to either of the SCSI connectors on the back of the RAID system's enclosure.
5) Connect the other end of the SCSI cable to an available SCSI connector on the host computer. The SCSI port on the host computer is often provided by a host bus adapter (HBA) installed inside the computer. These HBAs typically provide SCSI connectors for external devices.
6) When all connections are secure, turn the RAID system ON using its rear mounted power switch (see figure 8). Wait for it to become ready (after about 1 minute, "Ready" will be displayed on its LCD display - located on the rear of the unit).
7) Once the RAID system is "Ready", power ON the host computer system.
8) Be sure to observe the environmental requirements for the RAID system (see the specifications section at the end of this manual).

If you are not going to use the supplied SCSI cable, be certain to use a high quality SCSI cable that is certified for use with Ultra160 SCSI systems.

WARNING: *Failure to use a suitable SCSI interface cable can result in poor performance, data errors, and even loss of data.*

Note: Never "hot plug" the SCSI connections. Both the host computer and the RAID system must be powered OFF while connecting, or disconnecting, the SCSI cabling and terminators.

SCSI Termination

When using SCSI devices, it is always necessary to pay careful attention to SCSI termination. A SCSI bus must be properly terminated at both ends. The K-Series RAID systems comes with an external SCSI (LVD) terminator. If the RAID system is the last (or only) external SCSI device on the bus, it must have this terminator attached to one of the SCSI connectors on the back of the RAID system. In other words, one of the two (2) SCSI connectors on the back of the RAID system will have the terminator attached and the other connector will have a SCSI cable attached to it (connecting to the host). Since the SCSI connectors are wired in parallel inside the RAID system, either connector can be used for connecting the terminator.

Note: If you will not be using the SCSI terminator supplied with the K-Series RAID system, make certain to use a high quality LVD terminator that is certified for use with Ultra160 SCSI systems.

WARNING: *Failure to use a suitable SCSI terminator can result in poor performance, data errors, and even loss of data.*

If you want, or need, to daisy chain additional RAID systems or other SCSI devices to your K-Series system, the terminator will not be connected to the K-Series unit. Instead, the terminator must be installed onto the last SCSI device in the chain.

Installing the Front panel cover

The RAID system comes with a front cover that can be optionally attached to the front of the system. To attach the cover, align the two (2) mounting screws with the corresponding threaded holes in the front of the system. Once aligned, insert and tighten the screw fasteners on the cover. See figure 1.
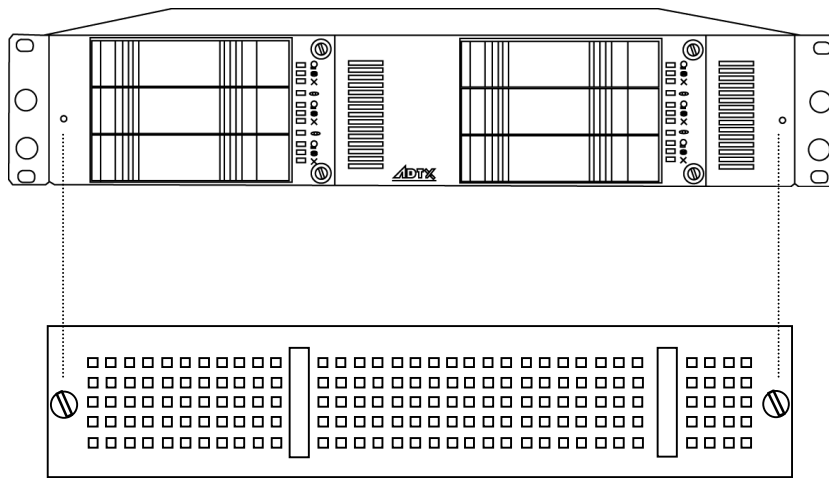
Figure 1. Attaching the front cover (optional).

Host SCSI Requirements

In order to use the RAID system with a host computer, the host must be equipped with an Ultra160 SCSI connection (bus). Typically, a host bus adapter (HBA) is installed inside of the host as an add-on card that provides SCSI port(s) for connecting to external SCSI device(s).

Operating the RAID system

Once the RAID system is installed properly, and connected to a host computer, it generally appears and functions as a large single disk drive - from a host's point of view. After successful installation, there are primarily two operating conditions to consider: drive failures and powering OFF the RAID system.

If a drive fails, it should be replaced as soon as possible - even if you have assigned a spare drive in the configuration. Note that each drive in the RAID system is hot-swappable. As long as only one drive has a problem, it can be exchanged without powering down and without data loss (for RAID 1, 3 and 5 configurations only). RAID 0 configurations do not provide any data protection.

If one drive fails in a RAID 0 system, all data will be lost (or generally inaccessible) on all of the drives. For information relating to RAID type selection and their appropriateness for particular applications, see the section "About RAID levels" in this manual.

   In general, RAID systems are not intended to be regularly powered down. The most common practice for powering down a RAID system is to always power the host(s) down *first*. By the time the host is completely powered down, the RAID system's controller will have had time to finish clearing its cache memory, and writing out final data. Only after the host(s) are completely powered down should the RAID system be turned OFF.
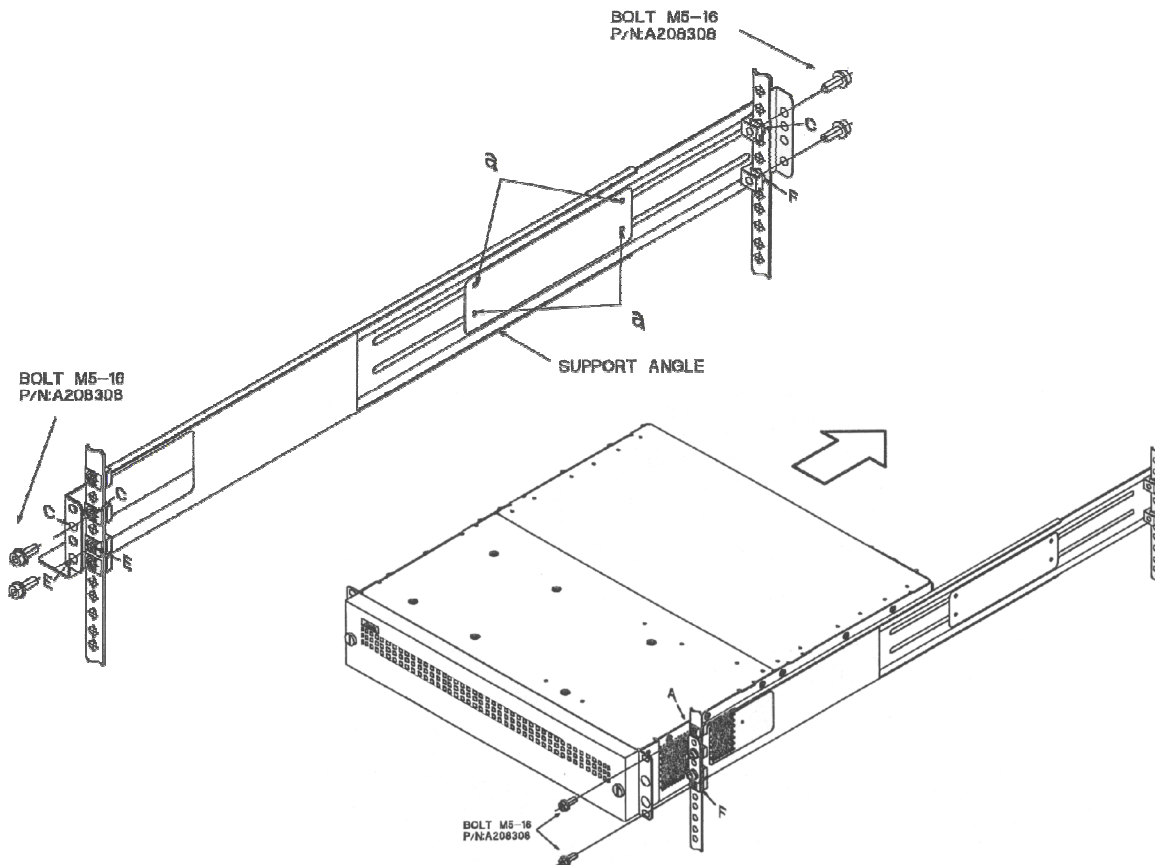
Figure 2. Rack mounting the RAID system with the supplied rails.
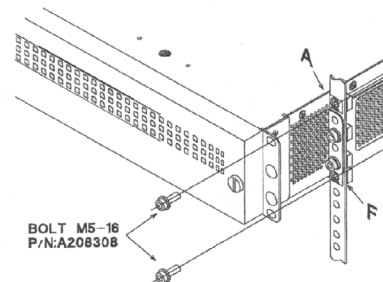
Front panel status indicators (LEDs)
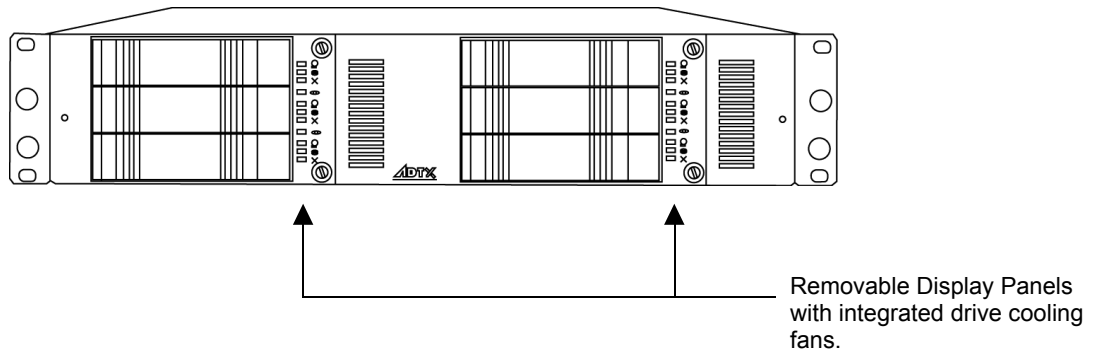
Figure 3. Front panel status indicator panels (LEDs)

Removable Display Panels with integrated drive cooling fans.

   On the front panel of the RAID system are two (2) display panels. Each corresponds to the group of three (3) drives to their left. These display panels are removable and contain two (2) drive cooling fans, along with the a set of LED indicator lights. To remove the display/fan units, unscrew the two (2) fasteners and carefully pull forward on the panel. Typically, these should **not** be removed while the RAID system is powered ON (unless replacing a failed fan).
   Along with their display functions, the fans that these panels contain provide cooling for the bank of three (3) drives to their left. If they are removed while the RAID system is powered ON, the drives could overheat. See figure 4 for a diagram of the display/fan panels and brief descriptions of their status indicators.

Power indicator for the drive to its left. Normally lit when the system is powered on.

Activity indicator for the drive to its left. This is lit when the drive is busy and being accessed.

Drive failure indicator for the drive to its left. This is lit when the drive has failed.

Fan failure indicator. This is lit when its fan #1 has failed.

Fan failure indicator. This is lit when its fan #2 has failed

Fasteners

Figure 4. Status indicators on front panel.

Front "Fresh air" intakes

Fresh cooling air is supplied to the RAID system through vents in the front panel (see figure 5). It is important NOT to block or obstruct these vents. Avoid placing "stickers" or "labels" in these two areas on the front panel.
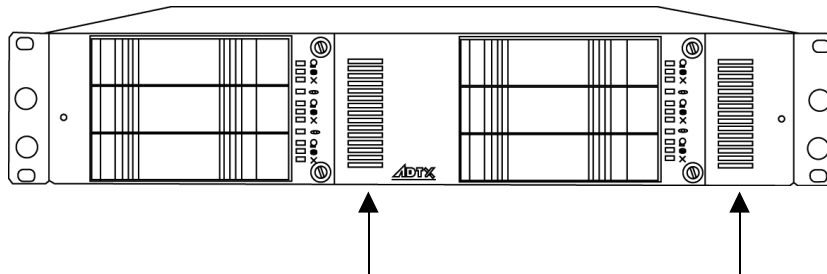
Figure 5. Location of fresh air intakes for the RAID unit.

Rack mounting the RAID unit

The RAID unit is supplied with adjustable rails (shelf type) that attach to the inside of the intended rack cabinet. Once installed inside the rack cabinet, the K-Series system slides onto them and secures to the front of the rack through holes in the front of the RAID unit. Unlike other rail types, the supplied rails do not attach to the sides of the RAID unit (see figure 2).
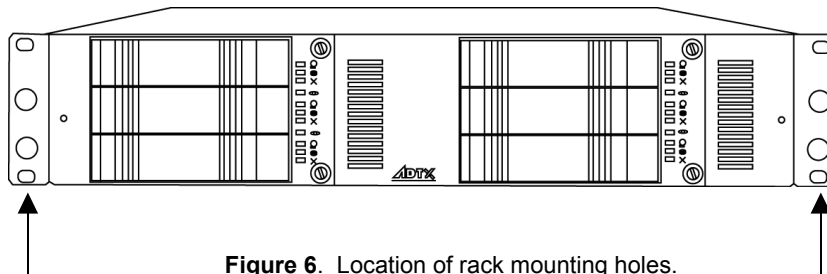
Figure 6. Location of rack mounting holes.

Side view
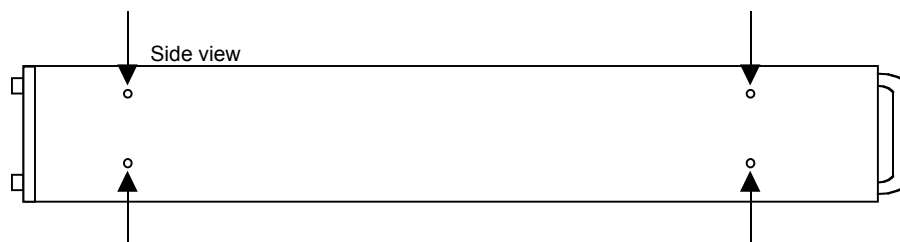
Figure 7. Screw holes for mounting the optional **pedestal** mounting kit (ordered separately.)

Identifying rear panel components

Several of the RAID system's components are accessed from the rear of the unit. See figure 8 below for locations and brief descriptions of these components.

Status indicators (LEDs). The POWER indicator is lit when power is applied to the unit. BUSY is lit when the system is powering up and when the unit is processing data and is unable to respond to new requests. ATTEN is lit when there is a problem or condition requiring user intervention, such as a hardware problem, particularly those involving the power supplies, fans, or disk drives.

Power Supply release latches

Power Switch

Display panel (LCD). Used for displaying system messages and for configuring the unit.

Mute button. Used to silence the system alarm.

POWER
BUSY
ATTEN
EXIT
ENTER
MUTE

Power Supplies

Power Supply status lights (LEDs). These are each lit when status is good.

Power cord connector (100 – 240V A/C, 50/60 Hz., 1.4A). A UPS is recommended.

Dual SCSI connectors (68 pin, **pass through**). SCSI terminator (LVD) is required if not chaining this unit to other devices. Internally, these connectors are connected in parallel.

RS-232C port. Used to communicate with the unit via an ASCI terminal. Also used as the SNMP message port. This SNMP can be connected to a terminal server or other interface for remotely monitoring the unit.

Main cooling fan. Serves as the primary hot air exhaust for the unit.

Figure 8. Component identification on rear panel.

Selection buttons for use with the Display panel above them. These allow selections to be made from the status and configuration menus on the Display panel. When **not** using the RS-232C port for system access, these buttons and the Display panel are the primary interface to the RAID controller in the system.

Product Components

The K-Series RAID system consists of a RAID controller (SCSI-to-IDE); six IDE drive bays and drive tray assemblies; redundant, hot-swappable power supplies; redundant, hot-swappable fans; and an enclosure to house and integrate these components.

RAID Controller

The SCSI-to-IDE controller used in the K-Series RAID system is the central element of the product. A hardware RAID controller is a "purpose built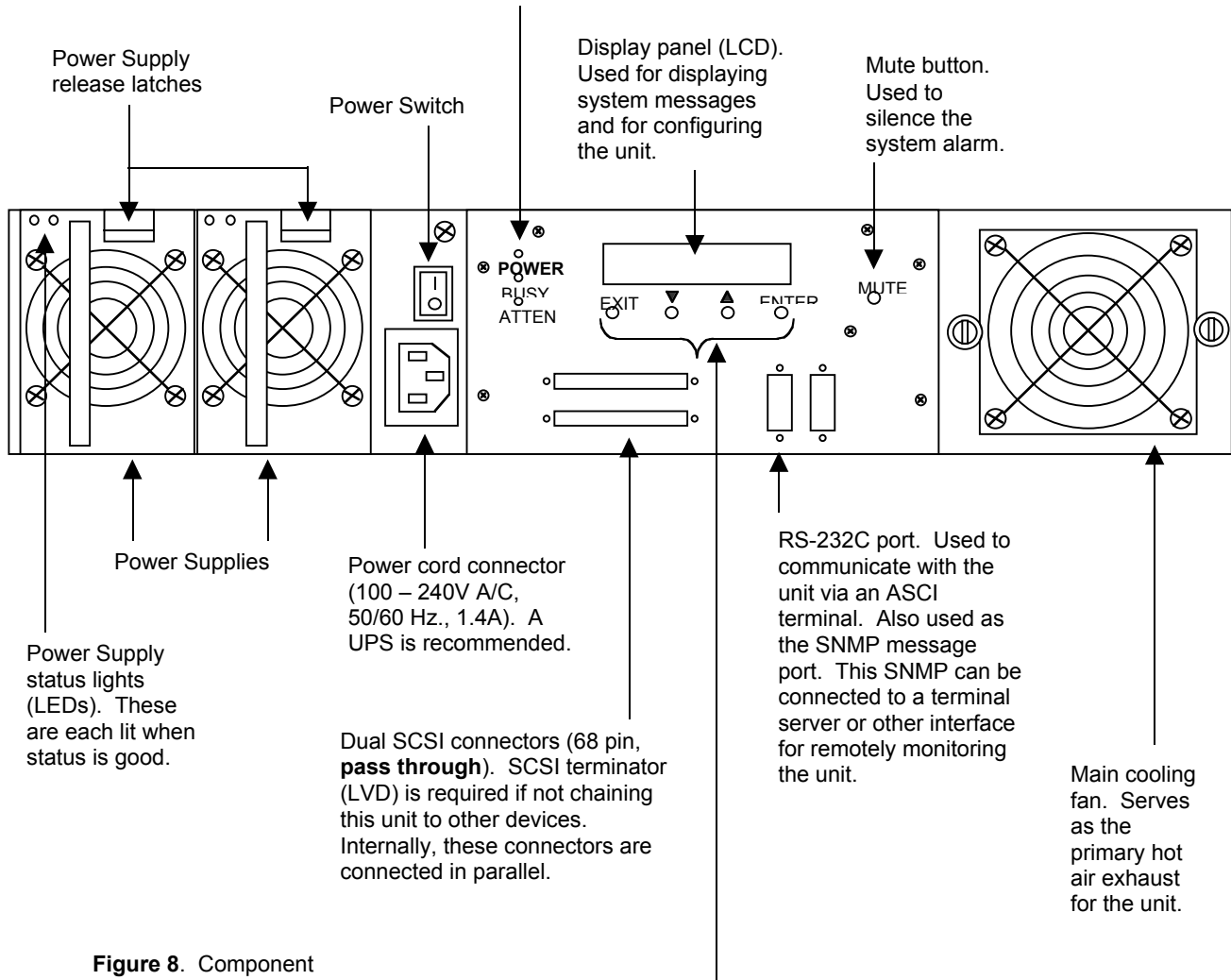", and sophisticated, computer that manages data flow to and from the array of disk drives in the most fault-tolerant manner possible. The RAID controller used in the K-Series RAID system supports RAID levels 0, 1(0+1), 3, and 5; and provides the user interfaces for system management, monitoring, and event notification.

IDE Drive Bays and Drive Tray Assemblies

Drive bays are the spaces provided in the K-Series enclosure for disk drives. The drive tray assemblies are containers that house the individual drives and permit hot-swapping. The bays and drive assemblies in the product are designed for contemporary 3.5" x 1" EIDE disk drives.

Power Supplies

The system comes with two (2) redundant, hot-swappable power supplies. Each power supply provides power to the RAID system simultaneously and each is capable of supplying the required power to the RAID system - alone if necessary. Note that prolonged single power supply operation is not recommended (and compromises the high availability intent of the system). Operating the system with only one power supply should only take place if a power supply failure occurs. Failed power supplies should be replaced as soon as possible.

Fans

The system comes standard with two (2) redundant, hot-swappable drive cooling fan modules. Each fan module contains two (2) fans and provides airflow to the three (3) drive bays to their left. Note that prolonged single fan operation is not recommended (and compromises the high availability intent of the system). Operating the system with a failed fan should only occur if a fan fails. Failed fan modules should be replaced as soon as possible.

Enclosure

The "enclosure" (or system cabinet) houses the controller, drives/drive tray assemblies and bays, power supplies, and fans. The enclosure effectively combines (or integrates) all of the individual components to form the complete RAID system. The enclosure's controls and features are described throughout this manual.

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RAID Overview

Redundant Array of Inexpensive Disks (RAID) is a storage technology used to improve the performance, and increase the reliability, of a data storage system. This technology was developed around the idea of grouping multiple disk drives together (an array) to provide features and functionality that's not available in a single disk drive.

Two primary concepts underlying RAID are:

a) That distributing data over multiple disk drives can dramatically improve performance

and

b) That using multiple drives properly allows for any one drive to fail without loss of data and without system downtime. In the event of a disk failure, disk access will continue normally and the failure will be transparent to the host system.

Though originally conceived with SCSI drives in mind, RAID principles have been very successfully applied to IDE, Fibre Channel, and other types of drives. The K-Series RAID system employs IDE drives.

NOTE: The K-Series RAID system has been designed to tolerate a single fault in any major component except the controller itself. One of any (or even one of "each" in a worst case scenario) redundant component can fail and the data on the system will still be maintained and available. These redundant components include the drives, fans, and power supplies within the system.

Non-RAID Storage

One common option for expanding the capacity of standard (non-RAID) disk storage is to simply install multiple disk drives into the system and then combine (or concatenate) them end to end. This approach to expanding capacity is generally referred to as *disk spanning*.

(Note that the K-Series RAID system *does not support non-RAID storage.)*

With disk spanning, the total disk capacity is equivalent to the sum of the capacities of all drives in the combination. The combination is then presented to (and appears as) a single logical drive to the system. Thus, for example, combining four 100 GB drives in this way would create a single "logical" or "virtual" drive with a total disk capacity of 400 GB.

Disk spanning is generally considered non-RAID due to the fact that it provides neither redundancy nor improved performance. Disk spanning is inexpensive, flexible, and easy to implement; however, it does not improve the performance of the drive-group and any single disk failure will result in total data loss.

Since the K-Series RAID system does not support non-RAID storage configurations, a minimum of two disk drives must be installed into the unit. The following section describes each of the RAID levels supported by the system.

About RAID levels

RAID generally has six common levels (or defined configurations): RAID 0 ~ 5. RAID levels 0, 1, 3 and 5 are the most commonly used, while RAID levels 2 and 4 are rarely implemented.

The following sections describe in detail each of the commonly used RAID levels.

IMPORTANT: The K-Series RAID system only supports RAID 0, RAID 1, RAID 3, RAID 5, RAID 3+Spare, and RAID 5 +Spare. It's Auto Setup default RAID settings are described later in the section "Auto RAID Setup".

RAID 0

RAID 0 implements *block striping* where data is broken into logical blocks and striped across several drives. Although called "RAID 0," this is not a true implementation of RAID because there is **no facility for redundancy**. In the event of a disk failure, data is lost and/or generally made inaccessible.

In block striping, the total disk capacity is equivalent to the sum of the capacities of all the drives in the array. This combination of drives appears to the system as a single logical "or virtual" drive.

RAID 0 provides the highest performance **but offers no data redundancy or drive failure protection**. It is typically faster than the other RAID levels because data can be simultaneously transferred to/from multiple disks **and** because there are **no** complex or time consuming calculations performed for error correcting hamming code and/or parity generation. Furthermore, read and write operations to different drives can be processed in parallel.

RAID 1

RAID 1 (or *disk mirroring*) copies (or writes) the same data onto two sets of drives. By keeping two copies of data on separate disks or arrays, data is protected against a disk failure. If, at any time, a disk on either side fails, the remaining good disk (copy) can provide all of the data needed, thus preventing downtime.

With disk mirroring, the total "usable" storage capacity is equivalent to half the sum of the capacities of all drives in the array. Thus, for example, combining **four** 100 GB drives would create a single logical or "virtual" drive with a total "usable" disk capacity of 200 GB. This combination of drives is presented to (and appears as) a single logical drive to the system.

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NOTE: One drawback to RAID 1 is that it does not usually allow run-time expansion. Once a RAID 1 array has been created, to expand it, the data must be backed up elsewhere before new drive(s) can be added. Other RAID levels generally permit run-time expansion.

RAID 1 is typically simple and easy to implement; however, it is more expensive since twice as many drives are required for a given amount of usable capacity.

In addition to the data protection RAID 1 provides, this RAID level can also improve performance. In cases where multiple concurrent I/Os are occurring, these I/Os can be distributed between the mirrored copies, thus reducing total effective data access time.

RAID 1 (0+1)

RAID 1 (0+1) combines RAID 0 and RAID 1 – *mirroring and disk striping*. RAID (0+1) allows multiple drive failures because of the full redundancy of the disk drives. *If more than two disk drives are chosen for RAID 1, RAID (0+1) will be performed automatically*.

IMPORTANT: RAID (0+1) will not appear in the list of RAID levels supported by the controller. If you wish to perform RAID 1, the controller will determine whether to perform RAID 1 or RAID (0+1). This will depend upon the number of drives selected for the logical drive.

RAID 3

RAID 3 implements *block striping with dedicated parity*. This RAID level separates data into logical blocks, the size of a disk block, and then stripes these blocks across several drives. One drive is dedicated to parity. If a disk fails, the original data can be reconstructed from the parity information on the dedicated parity drive.

With RAID 3, the total disk capacity is equivalent to the sum of the capacities of all of the drives in the combination, **excluding the parity drive**. Thus, for example, combining **four** 100 GB drives, would create a single logical drive with a total disk capacity of 300 GB. This combination of drives is presented to (and appears as) a single logical drive to the system.

RAID 3 provides increased data transfer rates when data is being accessed in large chunks or sequentially. However, during write operations that do not span multiple drives, performance is reduced since the information stored in the parity drive needs to be re-calculated and re-written every time new data is written to any of the data disks.

RAID 5

RAID 5 implements *multiple-block striping with distributed parity*. This RAID level offers the same redundancy available in RAID 3; though the parity information is distributed across all disks in the array. Data and relative parity are never stored on the same disk. If a disk fails, the original data can be reconstructed using the available parity information that was distributed across the drives.

RAID 5 offers increased data transfer rates when data is accessed in large chunks (i.e., sequentially) and reduced data access time for many simultaneous I/O's when they do not span more than one drive.

Spare drives in RAID configurations

  RAID implementations include one other basic concept that can be introduced at this point: spare drives. RAID levels 3 and 5 allow users to assign a drive as a "spare". Spare drives are fully functioning, "ON and ready", disk drives that a RAID controller will use to replace a failed drive as soon as the failure is detected. The purpose of this, obviously, is to enhance the existing fault-tolerant capabilities (and High Availability intent) of a RAID data storage system. Implementing and assigning a spare drive is discussed later in this manual.

  The K-Series RAID system permits you to assign a hot-spare drive that will be used in the event of a drive failure. When a drive has been installed and configured in the array as a spare, any drive failure will cause an automatic rebuild of the array without data loss or any need for user management (for RAID levels 3 and 5 only). Spare drives are indicated by a cross (+) on the LCD display panel.

```
Ready          ↕
RAID5          +
```
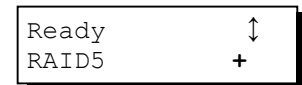
RAID Rebuilding

  If your array has a drive failure without an installed spare, it will be necessary for you to remove the failed drive and install a good replacement as soon as possible.

  Once you have replaced the failed drive, the array will automatically rebuild data onto the new drive without data loss (for RAID 1, 3, and 5 only). The percentage of rebuild completion will be displayed on the LCD display panel.

  After the rebuild is complete, the RAID system will return to normal operation and will again be capable of sustaining a drive failure without a loss of function or data (for RAID 1, 3, and 5 only).

Removing a Drive from the RAID system (with power off)

WARNING – **Unless you are replacing a failed drive**, the RAID system should be powered OFF before performing the following procedure. Removing a "good" drive with the system while the system is powered ON will cause the RAID system to enter a degraded mode for RAID levels 1, 3, and 5 (and engage the spare drive if one has been assigned). In degraded mode, the data on the system will no longer be protected. ***If the drives are configured for RAID 0 operation, removing a good drive will cause permanent data loss***.

Additionally, removing a drive, that is still spinning, can be difficult to grasp due to the centripetal forces created by the rotating disks inside of the drive. This can make the drive hard to handle, possibly causing it to slip from your hand and fall. If you must remove a spinning drive, don't pull it all the way out of the system in one motion. Instead, disengage the latch by swinging it completely forward. Then pull the drive partially forward to disengage its power connection. Wait for the drive to spin down completely (approx. 30 seconds). Once the drive has spun down, you can remove it carefully.

To remove a drive from the system, pull the "latch lever" forward on the front of the drive that you wish to extract (see figure 9). Be sure to swing the latch handle until it is fully extended (perpendicular to the front panel). Then, carefully pull the drive tray forward and out of the unit. When removed from the system, drives are susceptible to damage from static electricity. Extracted drives must be place on, or in, antistatic materials immediately after removal. Take care not to touch any of the exposed circuitry or connectors on the drive. Do not expose extracted drives to dust, moisture, or excessive heat.

To reinsert a drive tray into the system, carefully slide it into the unit (with the latching lever fully extended) until the drive is near its final position. Then, swing the latch toward its closed position until it snaps the drive into place. If any noticeable resistance is felt, do not force the latch or drive tray into the unit. Instead, pull the tray back out and carefully retry its insertion – being careful to line up its guide rails with those in the slot. If the drive tray still gives resistance and won't slide smoothly into the bay, check that the guide rails within the drive bay are secure and properly aligned.

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WARNING: Be sure that the drive is replaced into the same slot, or bay, that it came from. Mixing up drive positions can result in permanent data loss!

Figure 9. Removing a drive tray

To remove a "Failed" drive from the system (with or without power applied), refer to the section titled "Removing a Failed drive".

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Removing a Power Supply from the RAID system (with power off)

WARNING – The RAID system must be powered OFF before performing the following procedure.

Redundant Power Supplies

   The K-Series RAID system has two independent, redundant power supplies. Each power supply receives current from the same power cable, and each supply is capable of providing all necessary power to the array and enclosure. Both power supplies provide power to the system when both are functioning.

   Each power supply provides power to the RAID system simultaneously and each is capable of supplying the required power to the RAID system - alone if necessary. Note that prolonged single power supply operation is not recommended (and compromises the high availability intent of the system). Operating the system with only one power supply should only take place if a power supply failure occurs. Failed power supplies should be replaced as soon as possible

   If a power supply fails, the failure will be detected by the RAID controller, the failure will be recorded in the Event Log, the Attention LED will light, and the alarm will sound. Each power supply also has two (2) status lights (LEDs). The LEDs are both green when the power supply is operating properly and turns amber (or extinguishes completely) if the power supply has failed.

   To remove a power supply from the system, push down on the "latch" on the top of the power supply that you wish to extract (see figure 10). Continue pressing down on the "latch" while pulling on the power supply's handle. Then, carefully pull the power supply out of the unit. When removed from the system, power supplies are susceptible to damage from static electricity. Extracted power supplies must be placed on, or in, antistatic materials immediately after removal. Take care not to touch any of the exposed circuitry or connectors on the power supply. Do not expose extracted power supplies to dust, moisture, or excessive heat.

   Before sliding a new power supply into the unoccupied bay, you must suspend data transmissions from the array host. In general, to do this requires pausing all services, software and I/O operations that may be accessing the data on the array.

WARNING – *If data is still being sent or received when a new power supply is installed in the unit, it is possible you will encounter data errors.*

   Once data I/O has been suspended by the host, a new power supply can then be gently slid into the unoccupied space. We recommend that you keep a spare power supply handy should a replacement be needed. Spare power supplies can be obtained from the supplier of your K-Series RAID system. Having two (2) working power supplies in the system maintains the security and High Availability provided by redundant power supplies.

To reinsert a power supply into the system, carefully slide the power supply into the unit until the locking latch "snaps" the power supply into position. The power supply fits snuggly and can require a firm push, at the end of its travel, to engage the securing latch.

Press down on, and "hold down", the locking latch while pulling on the power supply handle.
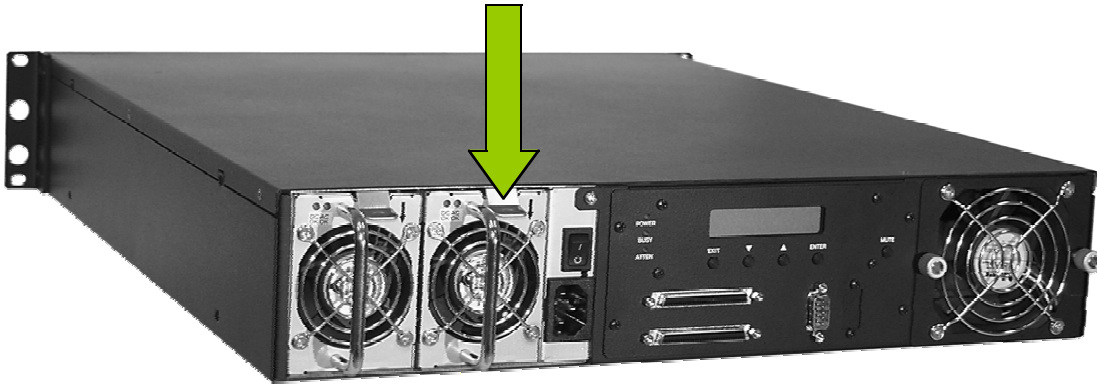

Figure 10. Removing a Power Supply

To replace a "Failed" power supply in the system (with power applied), refer to the section titled "Removing a Failed power supply".

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RAID controller functions

  The LCD Display panel provides a current status readout and complete access to all of the controller's functions and settings. The entire RAID system can be installed, monitored and maintained using only the LCD panel
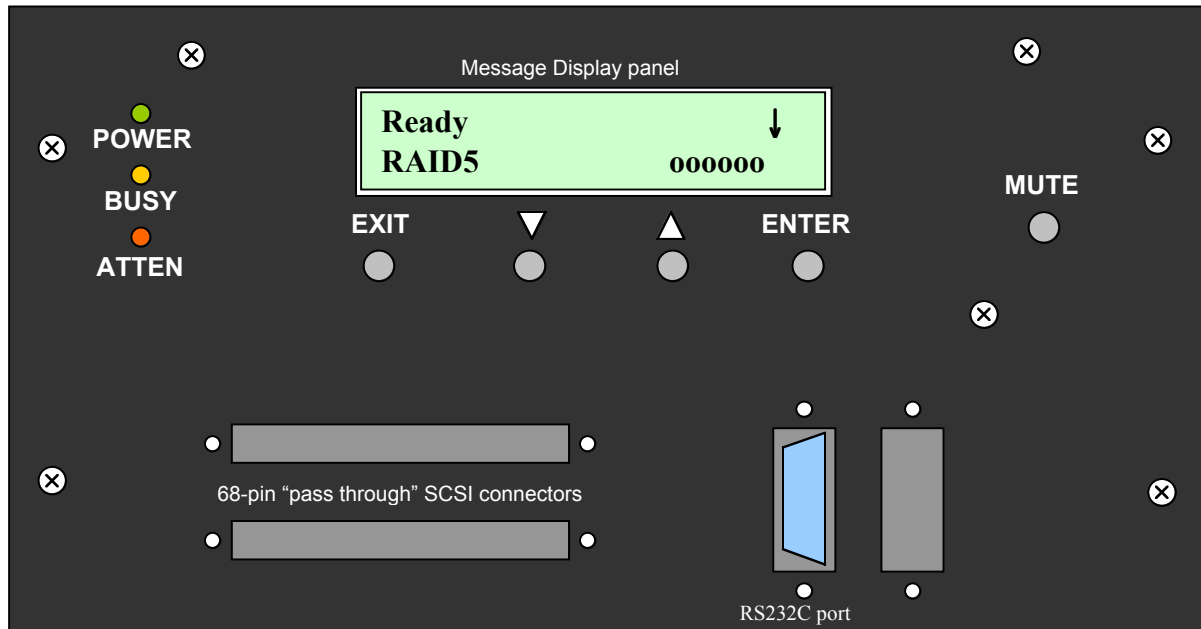

Figure 11. View of the RAID controller panel on the rear of the RAID system.

RAID Controller button functions

EXIT − Use this button to cancel a selection in the Message Display or to move up one menu level.

ENTER − Use this button to accept a selection in the Message Display. For some selections, pressing this button takes you one step deeper into the menu choices.

_ - Use the "down arrow" button to decrease "value" selections in the display, such as a SCSI ID number. It is often used to move down through a "list" of menu options. This button is also used in conjunction with the "up arrow" button to "toggle" between two settings, such as "YES" or "NO".

_ - Use the "up arrow" button to increase "value" selections in the display. It is often used to move up through a "list" of menu options. This button is also used in conjunction with the "down arrow" button to "toggle" between two settings, such as "YES" or "NO".

RAID Controller Connectors

SCSI – These connectors are the main data access buses (or channels) to the RAID system. When NOT chaining with other SCSI devices, an **LVD terminator** must be placed on one of the connectors. These connectors are pass through connections and are wired in parallel internally.

RS232C – Use this connector to connect the RAID system to an external ASCII terminal or terminal server. When used with an ASCII terminal, all of the RAID system's options are available through this port – *this includes all of the functions typically accessed via the LCD Display panel*.

Using the RAID Controller Functions

  This section provides a description, and explanation, of the commands and information available via the LCD Display panel.

Basic Features

  The controller firmware's basic features allow you to create, monitor and maintain a RAID array directly via the LCD panel. This section describes the basic displays and functions provided via the LCD Display panel.

Front Panel Ready Mode

  After a RAID has been setup and is operating normally, the controller will operate in ready mode and will display the following information via the LCD, pressing the up and down arrow keys on the front panel navigates from one display to another:

Ready – indicates what RAID level the array is currently operating at and shows the status of each drive bay. (Default display.)
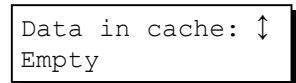
```
Ready           ↓
RAID5
```

Event [00] – if there is a currently pending serious error event, the error event log entry will be listed immediately after the Ready screen. Note that if no errors are pending, the display immediately after Ready will be the cache status below.
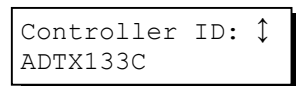
```
[00] Disk3:     ↕
Drive Failure
```

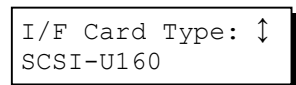**Data in Cache** – displays how much of the cache is currently used.

```
Data in cache: ↕
Empty
```

Controller ID – displays which type of controller is installed.
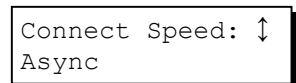
```
Controller ID: ↕
ADTX133C
```

I/F Card Type – indicates the type of host interface currently installed in the unit (SCSI Ultra160).
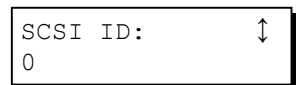
```
I/F Card Type: ↕
SCSI-U160
```

Connect Speed – indicates the optimum host speed (based on the type of interface) of the currently connected host.

```
Connect Speed: ↕
Async
```

SCSI ID – displays the current SCSI ID assigned to the RAID array.

```
SCSI ID:        ↕
0
```

RAID Capacity – indicates the size of the RAID system storage (it does not include capacity of spares).

```
RAID Capacity: ↕
39171MB
```

LUN # – shows the size of a partition (possibly followed by other partitions, up to eight total).

```
LUN 0:          ↕
39171MB
```

Disk # – displays information about a disk drive, including its manufacturer (if known) and its size. Each drive bay will be listed regardless of whether or not it has a drive installed. Empty bays will be listed as "Vacant."

```
Disk1:Online   ↕
IBM      19569MB
```

CPU Type – lists an abbreviation of the name of the controller CPU (e.g., "PPC603e" means PowerPC 603e).

```
CPU Type:      ↕
PPC603e
```

IDE Chip – lists an abbreviation of the name of the IDE interface control chip.
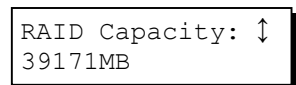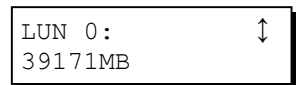
```
IDE Chip:      ↕
HPT370
```

RAM Size – indicates the size of the controller RAM.

```
RAM Size:      ↕
64MB
```

CPU Temperature – a constant, real-time measurement of the controller CPU temperature. The first number is the current CPU surface temperature, the second number is the peak temperature since the unit was last powered on.

```
CPU Temp:      ↕
31°C/31°C
```

Board Temperature – a constant, real-time measurement of the controller temperature. The first number is the current board temperature, the second number is the peak temperature since the unit was last powered on.

```
Board Temp:    ↕
40°C/40°C
```

Backplane ID – describes the type of backplane installed in the subsystem. Useful when contacting tech support for troubleshooting.

```
BackPlane ID:  ↕
5
```

Bootrecord Version – provides important information for technical support troubleshooting.

```
Bootrecord Ver:↕
1.11B
```

Firmware Version – shows the version number of the currently running firmware.

```
Firmware Ver:  ↕
1.33C
```

Serial Number – shows the manufacturer's serial number for this controller/subsystem unit.

```
Serial No.:    ↑
567891
```

Front Panel Configuration Options

This section explains how to use the basic setup and configuration functions available via the LCD panel. Choices are displayed in order.

To access these menus, press the Menu/EXIT button for two seconds. The following display will appear prior to the first menu:

```
Press 2 seconds
for Main Menu
```

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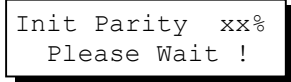
Auto RAID Setup

to start an Auto RAID installation, press the ENTER
button. You will be asked to confirm. Use the arrow keys to display
your choice and press the ENTER button again.

```
Auto RAID Setup↓
```

WARNING: Creating a new RAID will destroy all currently stored data

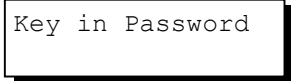If you choose Yes, the display will show a parity initialization percentage.

```
Init Parity  xx%
  Please Wait !
```

Password Option – if you would like to set a controller password, press
the ENTER button. The Set/Change screen will be displayed. Press the
ENTER button to create or change the password. If you would like to
cancel an existing password, scroll down to the Cancel screen and press
the ENTER button

```
Password
Option          ↕
```

The password is a four-digit code consisting of numbers from 0 to 9. To
change a digit, use the arrow keys to scroll to your choice and press
ENTER to move to the next digit. You will be asked to re-type the
password to confirm and will receive an error message if the two passwords
do not match. Otherwise, you will see a confirmation that the password was
successfully changed

```
Key in Password
```

If later you want to modify the password, it will be necessary for you to
enter the old password in order to set a new one.

View Event Log – if you would like to view the contents of the current
event log press the ENTER button.

```
View Event Log ↑
```

Event log items will be listed, most recent first, and numbered from 00 to
99. Press the arrow buttons to navigate through the list of events to display
the one you want. Note that the events listed will match the listings in the
terminal manager event logs.

```
[03]Controller
Init Completed
```

Advanced Functions

This section explains how to use advanced features of the controller firmware via the LCD panel.
Because misuse of these functions can cause operational problems, including data loss, we
recommend that only experienced users access them.

Set SCSI ID# – SCSI IDs permit SCSI devices to be daisy-chained
onto the same bus. The default ID is 0. The SCSI ID can be set
to any number from 0 to 15, but no two SCSI devices on the same
bus can have the same ID.

To set the SCSI ID on the RAID system, perform the following steps:

1) Make sure that the unit is powered on and "Ready".

```
Ready         _
RAID5
```

2) Press and hold the "EXIT" button on the rear control panel until the following message is displayed:

```
Set SCSI ID#  _
```

3) Press the "ENTER" button.

```
Set from 0 to
1              ↕
```

The display will show the current ID (0 in the example display).
use the ↑ and ↓ arrow keys until the desired ID is displayed on the second line (select an ID from 0 to 15). Then press the "ENTER" button.

You will need to confirm your selection. Use the ↑ and ↓ arrows to display either "YES" or "NO".

```
ID 1 Confirm
NO
```

If you select "YES", you will see the following message:

```
Not take effect
until power ON
```

If you have changed the SCSI ID, the new ID will not be used until the next time the unit is powered OFF and then back ON. If you have not selected or confirmed a new SCSI ID, and you wish to abort the SCSI ID selection menus, simply press "EXIT".

Menu RAID Setup – this menu allows users to control the parameters of the RAID setup, including the RAID level. Press the ENTER button to access it.

```
Menu RAID Setup↕
```

First, you will be prompted to select a RAID level. Display the level you want to use (only those levels for which there are sufficient drives installed will be displayed) and press the ENTER button. You will be prompted to confirm. Display Yes and press the ENTER button to confirm the selected RAID level. The LCD will display the parity percentage as the new RAID is created.

```
Select RAID#
[RAID5]         ↓
```

```
Init Parity  xx%
  Please Wait !
```

Selecting RAID Levels

Advanced users can also use either the Display panel or the terminal emulation utility to manually configure a new RAID array.

Step 1 : To use the Display panel to create a new RAID array, press the **EXIT** button for two seconds to enter the Main Menu.
Step 2 : Press the **Down** button twice to display the Menu RAID Setup.
Step 3 : Press **ENTER** to select.
Step 4 : Press the **Down** button to display all of the available RAID options (the K-Series RAID system will only list the RAID options that are suitable for the number of disk drives installed).
Step 5 : Select the RAID level by displaying it and pressing **ENTER**.
Step 6 : Confirm the selection by pressing the **Down** button once to display YES and then press **ENTER**.

When the initialization is complete, the LCD will display the Ready screen and you may now connect a host and use your RAID array.
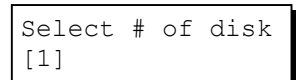
Adding Drives to the RAID system

RAID Expansion – if, after adding a new drive, you would like to make your RAID bigger, select RAID expansion. Note that you can also use an already installed spare drive to do a RAID expansion, although this method will leave your array without a backup spare and is not recommended.
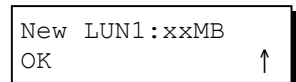
```
RAID Expansion ↕
```

First, you will be prompted to select how many drives to add to the RAID. The number available will depend upon how many new drives or spares are installed. Scroll through the available numbers using the arrow buttons and press ENTER to select.

```
Select # of disk
[1]
```

Next, you will be asked to confirm the new LUN1 size. Choose Cancel or OK and press the ENTER button. The creation of the new RAID will be displayed as an expansion percentage "completed" until the process is finished.

```
New LUN1:xxMB
OK              ↑
```

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Troubleshooting

Controller

Problems with the controller fall into two categories, serious and disastrous. The controller is the only major component in the K-Series RAID system that can cause a fatal failure on its own.

After the system "Power On Self Test" (POST) is complete, the controller will begin initializing the RAID. The following message will be displayed by the LCD panel:

```
Initializing...
   Please Wait...
```

If everything is working normally, shortly after this message, the system should be up and running. The LCD display panel will display the Ready screen.

Problems at Startup

Controller failure at startup will most likely result in a failure to initialize the RAID. If your system hangs at this point of the power-up (wait at least 5 minutes before deciding that the system is stuck), power off, wait 10 seconds, and try again.

Attempt this remedy three times, if the system still does not initialize, check all other components for good connections and status as indicated by LEDs.

Other Problems

The controller is the heart and brain of a RAID array. If during normal operations the controller fails, the most obvious symptoms will be that the LCD does not light and the array is inaccessible.

Note: Once the POST and RAID initialization are completed (meaning that the controller is functioning properly), any subsequent failures or problems will most likely generate an event message in the array event log.

Enclosure

The enclosure elements (power supplies, fans, drive trays, LED indicators, ports) are, in most cases, monitored by the terminal utility via the system's RS-232C interface.

Power Supplies

The system comes with two, hot-swappable, redundant power supplies, each of which can supply sufficient power for the entire array indefinitely.

If a power supply fails, a variety of things will happen. The event will be recorded in the array event log by the controller. At the same time, the system alarm will sound and the Attention LED

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will light. On the power supply itself, the status LED(s) will change from Green to Amber (or extinguish completely), indicating which power supply has failed.

Because the unit comes with redundant power supplies, it is possible to replace a failed power supply without powering down or otherwise interrupting data flow.

To determine which power supply has failed, carefully examine the LED and fans of both supplies. The LED of a failed power supply should be amber and the fans of that supply should not be turning. If you are uncertain which power supply has failed, power down the host and make certain that the array cache is empty BEFORE removing a power supply.

To check the cache, press the down arrow button once from the LED Ready display. If it reads "Empty," there is no data in the cache and you may safely power down or remove a suspect power supply.

Note: The terminal utility error readout for the power supplies is unable to display *which* power supply has failed. Check the back of the power supplies themselves to determine which one has failed.

Once you have determined which power supply has failed, to replace it, turn the hand-screw counter-clockwise until the power supply is free, raise the handle on the failed unit, and gently pull the power supply out of the enclosure.

Before sliding a new power supply into the unoccupied bay, you must suspend data transmissions from the array host. In general, to do this requires pausing all services and software that may access the data on the array.

WARNING: *If data is still being sent and received when a new power supply is installed in the unit, it is possible you will encounter data errors*

Once data I/O has been suspended by the host, a new power supply can then be gently slid into the unoccupied space.

Fans
The system also comes with two hot-swappable cooling fans. Both fans are necessary to maintain adequate airflow throughout the enclosure, particularly over extended periods of time.

If a fan fails, it will register as an error event and be logged and viewable via the LCD display panel.

After replacing a fan/indicator module, all displays and readouts should reflect that the fan error has been repaired.

Drive Trays

  Drive trays as a component separate from drives are unlikely to encounter problems unrelated to a drive failure. In the event that you suspect a drive failure may in fact be a problem with a drive tray, shut down the host, remove the questionable drive and tray, and examine the power and data cables to see if they have come loose or are damaged.

If, after checking the cables and returning the drive to its bay in the enclosure, the drive is still showing a failure, the drive itself has probably failed.

LEDs

  LEDs, both on the enclosure and on each drive tray, are primarily used to indicate the status of the drives, power supplies, and array. Each of the LEDs listed below has a warning function:

❑   **Attention LED –** front panel, upper left side – when lit, indicates that some error has occurred.
❑   **Drive Fault LEDs –** front panel, one each to the left of each drive bay – when lit, indicates that the drive in the corresponding bay has failed.
❑   **Power Supply LEDs –** upper center of each power supply – when lit green, the power supply is working; when lit amber, the power supply has failed. (Note that these are distinct from the power LEDs on each drive tray and on the main front panel.)

Ports

  The ports on the K-Series RAID system are not likely to fail even under the most strenuous circumstances. It is much more likely that a cable has failed, so the first thing to do if you suspect a port or cable failure is to replace the cable with one that is known to be good. If replacing the cable repairs the problem, the failure is with the old cable not the port.   Note that a SCSI bus must be terminated at both ends.

Replacement Parts

  New fans, power supplies, trays, and other similar enclosure parts may be available from your supplier. Please note that replacement parts are *not* available directly from the manufacturer. We suggest that you contact your supplier in the event of a failure or damage to inquire about replacement part availability.

Drives

  Drives sometimes fail. One purpose for a RAID array is to protect data integrity in the event of a drive failure. In a RAID1, RAID3, or RAID5 configuration, a single drive failure is not catastrophic. Data is not only protected, it remains available despite the drive failure.

If a drive fails, the Attention LED will light, the red Fault LED to the left of the bay will also light, the alarm will sound, the LCD will display an error icon, and the event log will record the drive failure.

Spare Installed

  If the array has a spare drive already installed, the spare will automatically replace the failed drive.

NOTE: It is highly recommended that you replace a failed drive even if you already have a spare. An installed spare provides an additional safeguard against future drive failures.

No Spare Installed

  If there is no hot-ready spare drive installed, a single drive failure in a RAID1, RAID3, or RAID5 array will still not result in data loss or downtime. If a drive fails without a spare, remove the failed drive and replace it with a new one of equal or greater capacity.

  The RAID controller will automatically rebuild the array once a new drive has been installed to replace the failed drive.   The new drive can be installed in any unoccupied drive bay.

Notes and Warnings

  These notes and warnings are also included within the text of the relevant sections in this manual. They are collected here for reference.

Topic	
Fault Tolerance (Note)	The K-Series RAID system has been designed to tolerate a single fault in any major component except the controller itself. A drive, fan, and/or power supply can fail and data will still be maintained and available.
RAID Level Support (Important)	The K-Series RAID system supports RAID 0, RAID 1, RAID 3, RAID 5, RAID 3+Spare, and RAID 5 +Spare.
RAID 1 Expansion (Note)	One drawback to RAID 1 is that it does not allow run-time expansion. Once a RAID 1 array has been created, to expand it, the data must be backed up elsewhere before a new drive can be added. Other RAID levels generally permit run-time expansion.
RAID 0+1 (Important)	RAID (0+1) will not appear in the list of RAID levels supported by the RAID controller. If you wish to perform RAID 1, the controller will determine whether to perform RAID 1 or RAID (0+1). This will depend upon the number of drives selected for the logical drive.
SCSI Default Settings (Important)	If you don't want to use the default SCSI ID setting, it is highly recommended that you change the setting before creating a new RAID using Auto RAID Setup. The RAID initialization process can take a long time depending upon the size of the disk drives used. Changing the SCSI ID setting requires reinitializing the array, potentially doubling setup time if not done first.

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Single Host Limitation (Important)	The K-Series RAID system can only have one host connected at a time. Sharing the array storage capacity is accomplished through the host OS and hardware, ***not*** through the K-Series RAID system.
Auto RAID Setup via LCD (Note)	It is recommend that Auto RAID Setup be used via the LCD display panel to create an array.
Data Erasure during Auto RAID Setup (Warning)	Using Auto RAID Setup will **erase** all information currently stored on the disk drives installed in the array.
Contact Service (Warning)	It is highly recommended that you contact your service representative before attempting any of the **Download** functions, since failure to do them properly can result in serious damage to your RAID controller.
Failed Drive Removal (Warning)	A failed drive will be indicated by a "**X**" mark in the LCD display panel and by a lit red LED just to the right of the drive bay. DO NOT remove the wrong drive! Removing the wrong drive may result in complete data loss!
New Power Supply Install (Warning)	If data is still being sent and received when a new power supply is installed into the unit, it is possible you will encounter data errors.
New RAID Data Wipe (Warning)	Creating a new RAID set will **erase** all currently stored data.

Remote Monitoring and Management

RS-232C Interface

If your data volume is large, it may improve your throughput performance to use a null modem cable for array management. The K-Series RAID system comes with a standard, 9-pin RS-232C serial port, which, using a null modem cable, can be connected to any COM port on a host computer for management purposes. The firmware-based terminal array management interface can manage the array through the RS-232C port.

The port's transmission settings have the following preset values and cannot be modified:

- Baud Rate: **38400bps**
- Parity: **No**
- Bits: **8**
- Stop Bits: **1**

In order to manage the array using the RS-232C port, use a null modem port adapter (not included) and a serial cable (not included), connect the cable to the RS-232C port on the RAID system and to the appropriate COM port on the management host. Set the above values in your terminal software, and launch the software. This will give you access to the firmware-based management program.

The firmware-based management program is a standard VT-100 terminal accessible program which will automatically start if you connect your host computer to the array via the RS-232C port and start any VT-100 terminal program using the communications protocol settings listed above.

ADTX MasStor K-Series Specifications

Model		AXRR-K40006S-F	AXRR-K60006S-F	AXRR-K80006S-F	AXRR-K10006S-F
Capacity of each drive[1] (IDE)		40 GB	60 GB	80 GB	100 GB
Usable system Capacity[1] w/6 drives (approx.)	RAID 0	240 GB	360 GB	480 GB	600 GB
	RAID 1	120 GB	180 GB	240 GB	300 GB
	RAID 3	200 GB	300 GB	400 GB	500 GB
	RAID 5	200 GB	300 GB	400 GB	500 GB
Drive RPM		7200	7200	7200	7200
Data transfer rates[3] Max/Sustained Reads/Sustained Writes MB/s (approx.)		160/110/100	160/110/100	160/110/100	160/110/100
SCSI interface		Ultra 160 (LVD), Dual 68-pin connectors (pass through)			
RS-232C interface		One male DB-9 serial port (38400, n, 8, 1) for terminal connection			
Power supply rating (each) peak/continuous		250/223W			
Input power requirements[2] (total)		100-240 VAC, 47-63 Hz, 6A peak, 1.4A typ.			
Operating temperature		5º to 40º C			
Relative Humidity		10-95%, non-condensing			
Altitude		Sea level to 10,000 ft			
Weight (approx.) lb./kg		44/20			
Dimensions		88 x 437 x 510mm (H - W - D)			

[1] All capacities are approximate and can vary based upon manufacturing lots for the HDDs.
[2] Universal, auto sensing. UL, CSA, TUV approvals. Meets FCC and FTZ regulations.
[3] Transfer rates can vary significantly depending upon the HDD.

(These specifications are subject to change without notice. Contact ADTX for the latest information and specification updates)
(ADTX shall not be responsible for any typographical errors within this document)