EonStor A16F-R1211/S1211

FC-to-SATA RAID Subsystem

Installation and Hardware Reference Manual

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FCC Class A Note

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device may accept any interference received, including interference that may cause undesired operation.

NOTE:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

The changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

WARNING:

Use only shielded cables to connect I/O devices to this equipment.

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

CE This device is in conformity with the EMC.

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Safety Precautions

Precautions and Instructions

- Prior to powering on the subsystem, ensure that the correct power range is being used.
- The EonStor subsystem comes with sixteen (16) drive bays. Leaving any of these drive bays empty will greatly affect the efficiency of the airflow within the enclosure, and will consequently lead to the system overheating, which can cause irreparable damage.
- If a module fails, leave it in place until you have a replacement unit and you are ready to replace it.
- **Airflow Consideration:** The subsystem requires an airflow clearance, especially at the front and rear.
- Handle subsystem modules using the retention screws, eject levers, and the metal frames/face plates. Avoid touching PCB boards and connector pins.
- To comply with safety, emission, or thermal requirements, none of the covers or replaceable modules should be removed. Make sure that during operation, all enclosure modules and covers are securely in place.
- Be sure that the rack cabinet into which the subsystem chassis will be installed provides sufficient ventilation channels and airflow circulation around the subsystem.
- Provide a soft, clean surface to place your subsystem on before working on it. Servicing on a rough surface may damage the exterior of the chassis.
- If it is necessary to transport the subsystem, repackage all drives and replaceable modules separately.
- Dual redundant controller models come with two controller modules that must be installed into the subsystem. Single controller modules come with a single controller module and a metal sheet is placed over the lower controller bay at the rear of the subsystem. Since single controller modules cannot be upgraded, this metal sheet should NEVER be removed.

ESD Precautions

Observe all conventional anti-ESD methods while handling system modules. The use of a grounded wrist strap and an anti-static work pad are recommended. Avoid dust and debris in your work area.

About This Manual

This manual:

- Introduces the EonStor RAID Subsystem series.
- Describes all the active components in the system.

- Provides recommendations and details about the hardware installation process of the subsystem.
- Briefly describes how to monitor the subsystem.
- Describes how to maintain the subsystem.

This manual does not:

- Describe components that are not user-serviceable.
- Describe the configuration options of firmware, using terminal emulation programs, or the RAIDWatch GUI that came with your subsystem.
- Give a detailed description of the RAID processing units or the RAID controllers embedded within the subsystem.

Revision History

♦ ***May 2004:*** The ES A16F subsystem supports UPS connectivity. A new appendix, ***Appendix B***, has been added to this manual revision (v1.3) to fully describe UPS connectivity and UPS status reporting. A new installation flowchart has also been added to ***Chapter 2*** of this manual.

Who should read this manual?

This manual assumes that its readers are experienced with computer hardware installation and are familiar with storage enclosures.

Related Documentation

- Generic Operation Manual
- RAIDWatch User's Manual

These two documents can be found in the CD included with your subsystem package.

Conventions

Naming

From this point on and throughout the rest of this manual, the EonStor series is referred to as simply the "subsystem" or the "system" and EonStor is frequently abbreviated as "ES."

Warnings

Warnings appear where overlooked details may cause damage to the equipment or result in personal injury. Warnings should be taken seriously. Warnings are easy to recognize. The word "warning" is written as "**WARNING**," both capitalized and bold and is followed by text in italics. The italicized text is the warning message.

Cautions

Cautionary messages should also be heeded to help you reduce the chance of losing data or damaging the system. Cautions are easy to recognize. The word "caution" is written as "**CAUTION**," both capitalized and bold and is followed by text in italics. The italicized text is the cautionary message.

Notes

These messages inform the reader of essential but non-critical information. These messages should be read carefully as any directions or instructions contained therein can help you avoid making mistakes. Notes are easy to recognize. The word "note" is written as "**NOTE**," both capitalized and bold and is followed by text in italics. The italicized text is the cautionary message.

Lists

Bulleted Lists: Bulleted lists are statements of non-sequential facts. They can be read in any order. Each statement is preceded by a round black dot "•."

Numbered Lists: Numbered lists are used to describe sequential steps you should follow in order.

Software and Firmware Updates

Please contact your system vendor or visit Infortrend's FTP site (ftp.infortrend.com.tw) for the latest software or firmware updates. ***NOTE*** that the firmware version installed on your system should provide the complete functionality listed in the specification sheet/user's manual. We provide special revisions for various application purposes. Therefore, DO NOT upgrade your firmware unless you fully understand what a firmware revision will do.

Problems that occur during the updating process may cause unrecoverable errors and system down time. Always consult technical personnel before proceeding with any firmware upgrade.

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Chapter 1 Introduction

1.1. Product Overview

1.1.1 Product Introduction

This hardware manual briefly introduces both the single controller and dual-redundant controller EonStor A16F (ES A16F) sixteen-bay Fibre Channel (FC)-to-Serial ATA (SATA) RAID subsystem shown in ***Figure 1-1***.

Figure 1-1: EonStor 16-bay SATA RAID Subsystem

The ES A16F RAID subsystems come with one (1) (ES A16F-S1211-M2) or two (2) (ES A16F-R1211-M2) FC-to-SATA RAID controllers (IFT-7265R-F2D). The controller has two (2) 2Gbps (FC-2G) host channels that are routed through two (2) onboard hubs to four (4) external small form-factor pluggable (SFP) connectors (two per channel). The hub eliminates the need for external bypass devices (e.g., Fibre switches) when connecting to a host computer. Two (2) onboard SATA chips provide sixteen (16) 1.5GB SATA drive channels that can support up to sixteen (16) SATA hard drives. The controller board has a pre-installed 256MB SDRAM DIMM memory module and can support memory chips with capacities up to 1GB. The metal container in which the RAID controller is pre-installed is referred to as the "controller module."

The controller module is accessed through the rear of the ES A16F subsystem. Four (4) small SFP connectors on the rear panel of the controller module connect the enclosure to external FC-2G host computers and RAID expansion devices. A fifth SFP connector serves as an expansion port and can be connected to an external storage device (like Infortrend's EonStor A16F-J1210-G1 FC-to-SATA JBOD) to increase overall storage capacity.

Two (2) RS-232C (audio jack) serial port connectors are located on the rear panel of each controller module. One serial port (COM1) enables serial communication between the controller and an external PC running a pre-installed terminal emulation program that can

be used to configure and manage the RAID subsystem. The second serial port (COM2) can be used for uninterruptible power supply (UPS) support. (See ***Appendix B***) An RJ-45 Ethernet connector allows for web-based management of the subsystem.

I/O signals/commands transmitted between the controller and the drives at the front of the subsystem pass through non-user-serviceable drive-plane and mid-plane boards. The drive-plane is connected to a maximum of sixteen (16) hard drives that you purchase separately and install into the sixteen (16) drive trays that come with the subsystem. The drive trays, which must be installed in the drive bays, accommodate SATA or parallel ATA (PATA) hard drives.

Two (2), redundant, hot-swappable, dual-fan cooling modules protect the RAID subsystem from overheating and two (2), redundant, hot-swappable, 1U 460W power supply unit (PSU) modules provide constant power to the RAID subsystem. The modular nature of the RAID subsystem and the easy accessibility to all major components ensures that the ES A16F can be easily and efficiently operated and maintained.

1.1.2 Model Variations

Two (2) ES A16F models are available (one single controller and one dual-redundant controller model). These models are listed in **Table 1-1** below:

Model	Host Channels	Drive Interface	Controller Board
ES A16F-S1211-M2	2 x FC-2G	16 x SATA	1 x IFT-7265R-16F2D
ES A16F-R1211-M2	4 x FC-2G	16 x SATA	2 x IFT-7265R-16F2D

Table 1-1:- ES A16F Model Variations

- ***ES A16F-S1211-M2:*** The single controller model comes with one (1) controller module. The docking bay for the second controller module is covered with a metal sheet that must be kept in place at all times in order to properly regulate the subsystem's internal cooling airflow. This model can be upgraded into a dual-redundant controller subsystem by adding a second controller module and changing the MUX kits.

- ***ES A16F-R1211-M2:*** The dual-redundant controller model comes with two (2) redundant controller modules. If one controller module fails, the second controller module will keep the subsystem running smoothly.

1.1.3 Enclosure Chassis

1.1.3.1 Chassis Overview

The ES A16F subsystem enclosure is a 3U metal chassis. The mid-plane and the drive-plane boards divide the enclosure internally into front and rear sections. (See ***Figure 1-2***) The front section accommodates sixteen (16) drive trays (with their associated hard

drives) and the rear section accommodates two (2) PSU modules, two (2) dual-fan cooling modules, and one (1) or two (2) RAID controller modules. The two (2) handles on the front of the subsystem enable you to easily insert/extract the chassis into/from a rack or cabinet. Pre-drilled mounting holes in the sides of the 3U RAID subsystem enclosure allow you to attach separately purchased slide rails so that you can install the enclosure into a rack or cabinet.

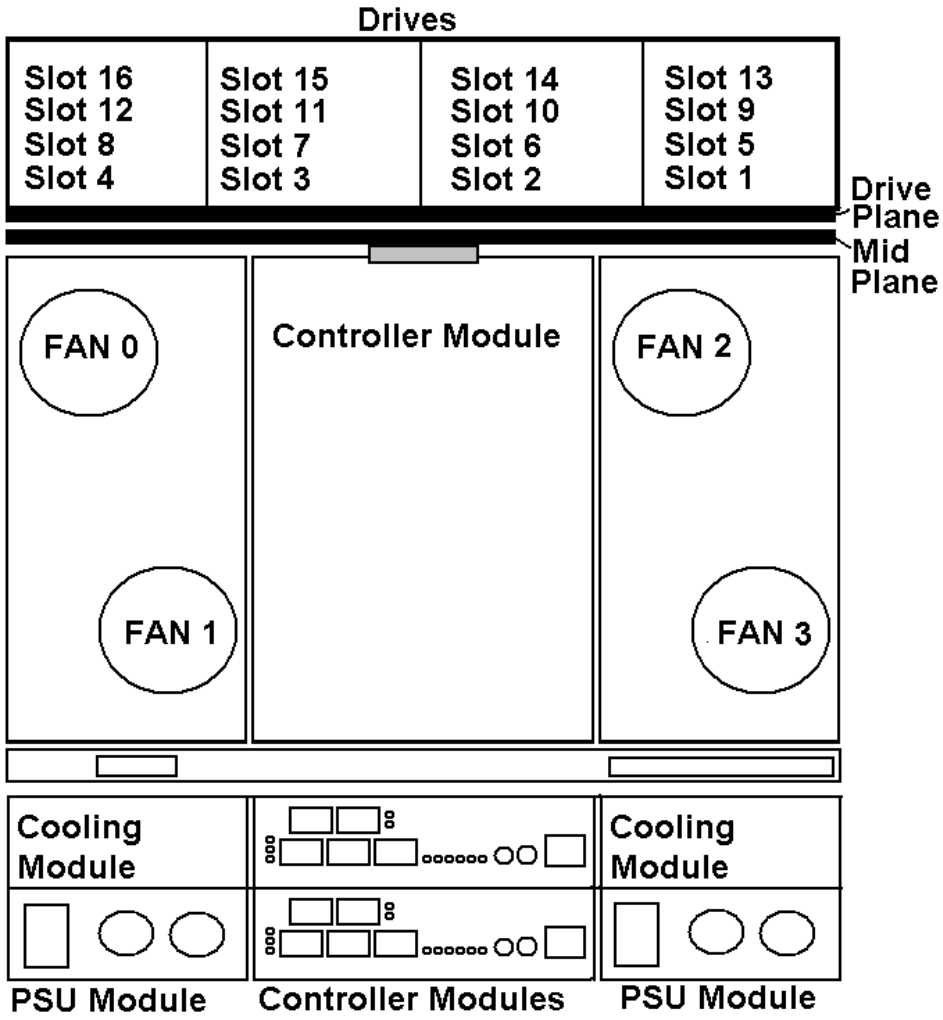

Figure 1-2: EonStor 16-bay SATA RAID Subsystem Overview

CAUTION:
When working with the subsystem, it is important to use tools with extreme care. Do not place tools or other items on top of the enclosure to help avoid damaging the outward appearance of the chassis.

1.1.3.2 Physical Dimensions

The ES A16F subsystem comes in a standard 3U chassis with the following dimensions:

- ***With handles***: 482.6mm x 131mm x 500.5mm *(width x height x depth)*
- ***Without handles***: 447mm x 131mm x 500.5mm *(width x height x depth)*

1.1.3.3 Front Panel Overview

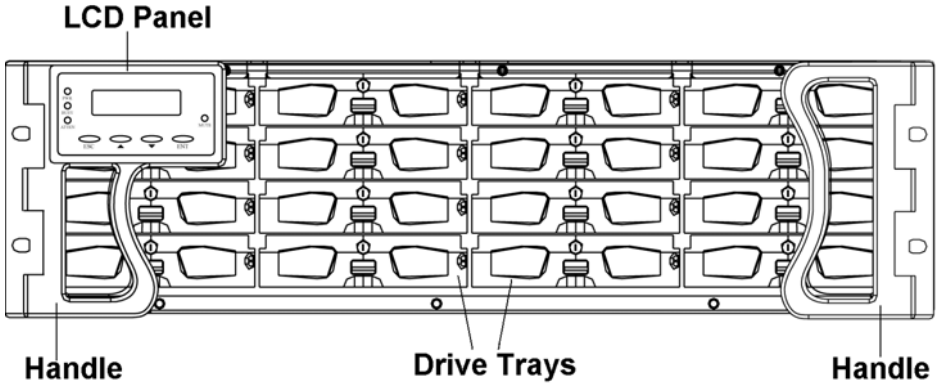

Figure 1-3: ES A16F RAID Subsystem Front View

As shown in ***Figure 1-3***, the front of the ES A16F subsystems feature a 4 x 4 layout for sixteen (16) drive trays that are designed to accommodate sixteen (16) standard 3.5" SATA or PATA drives. The front side of the ES A16F RAID subsystem also has two (2) foldable handles (see ***Figure 1-3)*** mounted on the sides. These front handles are conveniently placed and simplify moving the subsystem enclosure into and out of a rack or cabinet. The left side front-handle houses a 16x2 character LCD panel that can be used for subsystem configuration, troubleshooting and status checking.

1.1.3.4 Enclosure Numbering

The front panel of the ES A16F enclosure houses sixteen (16) hard drives in a 4x4 configuration as shown in ***Figure1-4***. When viewed from the front, the drive bays (slots) are numbered 1 to 16 from left to right, from top to bottom.

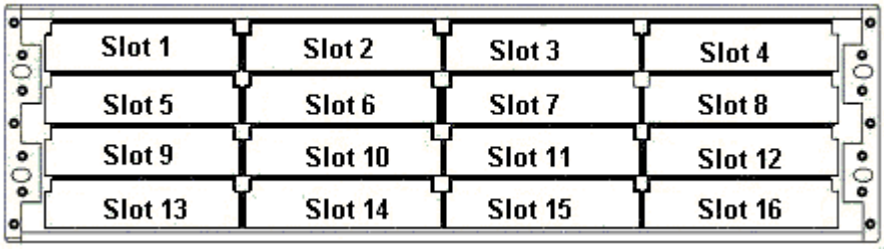

Figure1-4: Hard Drive IDs

1.1.3.5 Rear Panel Overview

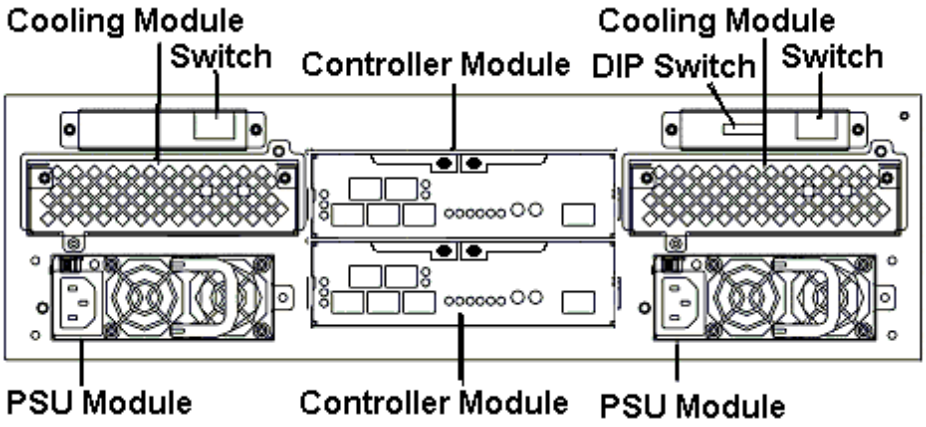

Figure 1-5: ES A16F-R1211-M2 Rear View

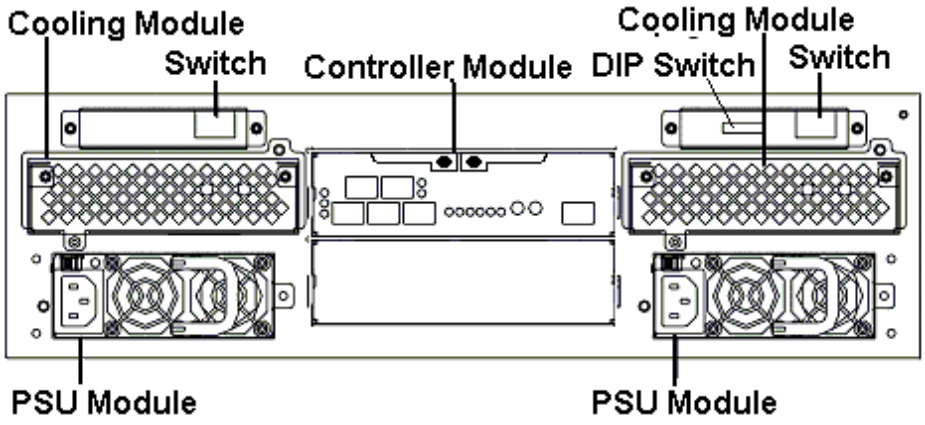

Figure 1-6: ES A16F-S1211-M2 Rear View

The rear panel for the dual-redundant controller ES A16F subsystem is shown in ***Figure 1-5*** and the single controller ES A16F subsystem rear panel is shown in ***Figure 1-6***. The rear panel provides access to all the components located in the rear section of the RAID subsystem enclosure.

Two (2) redundant, hot-swappable 460W PSU modules, which are accessible through the rear panel, connect the ES A16F subsystems to main power. A redundant, hot-swappable dual-fan cooling module is located above each PSU module. Two (2) PSU switches, located directly above the cooling fan modules, activate the PSU modules.

The controller modules, with five (5) SFP modules, two (2) RS-232C (audio jack) serial ports, one (1) RJ-45 Ethernet connector, and status-indicating LEDs, are located in the center of the rear panel. For single controller models, a metal sheet is placed beneath the RAID controller module instead of a second controller.

1.1.3.6 Mid-plane and Drive-plane Boards

Integrated drive-plane and mid-plane boards separate the front and rear sections of the ES A16F subsystems. These PCB boards provide logic level signals and low voltage power paths. They contain no user-serviceable components.

WARNING:
Accessing either the mid-plane or drive-plane boards may lead to fatal damage of the subsystem. Any interference with these boards may lead to critical and irreversible damage.

1.1.3.7 Subsystem Rack/Cabinet Installation

The ES A16F subsystems have pre-drilled screw holes for slide rail mounting. Separately purchased, independently installed Infortrend slide rails are available for rack or cabinet installation. The slide rails are listed below:

- IFT-9270CSlider36-0010
- IFT-9270CSlider32-0010

The slide rails come with their own installation instructions.

1.2. ES 16F Subsystem Components

1.2.1 LCD Panel

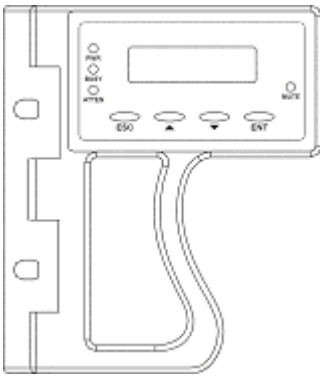

Figure 1-7: LCD Panel

The LCD panel shown in ***Figure*** 1-7 consists of a 16x2 character LCD screen with push buttons and LED status indicators. The LCD front panel provides full access to all RAID configurations and monitoring. After powering up the subsystem, the initial screen will show the subsystem model name. A different name may be assigned for the system or different arrays. This will enable easier identification in a topology with numerous arrays.

In the redundant controller subsystem, two (2) controller modules are present. After powering up the primary controller, information will be shown. To view secondary controller information, press the up and down arrow keys simultaneously. When both controllers are functioning properly, all the configuration changes can be made through the primary controller. If the primary controller malfunctions, system configuration changes must be made through the secondary controller.

1.2.2 Drive Trays

Part Number: - IFT-9270CDTray

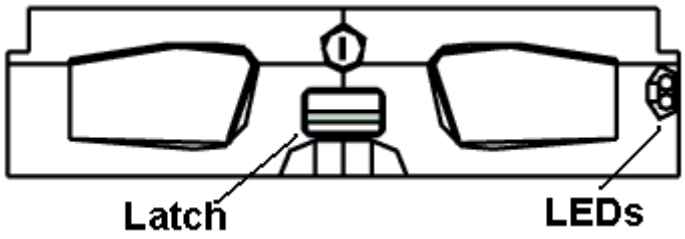

Figure 1-8: Drive Tray Front View

Each ES A16F subsystem comes with sixteen (16) drive trays. The front panel of each drive tray (see ***Figure 1-8***) contains a latch that secures the drive tray to the RAID subsystem enclosure. Two (2) status-indicating LEDs are also located on the front of the drive tray. Retention screw holes are located on the sides of the drive tray. These holes

are reserved for securing hard drives to the tray. Other retention screw holes are located on the surface of the tray at the rear. These holes are reserved for MUX kit installation and should not be used otherwise.

WARNING:
Be careful not to warp, twist, or contort the drive tray in any way (e.g., by dropping it or resting heavy objects on it). The drive tray has been customized to fit into the drive bays in the ES A16F subsystem. If the drive bay superstructure is deformed or altered, the drive trays may not fit into the drive bay.

1.2.3 MUX Kits

The ES A16F subsystem comes with sixteen (16) pre-installed SATA-to-SATA MUX kits (one in each drive tray). These MUX kits facilitate the installation of separately purchased SATA drives. When installing the drives into the drive tray, the connectors at the back of the drive must be connected to the MUX kit connectors. When installed into the enclosure, the MUX kits will connect to the controller board via the drive-plane and mid-plane boards.

Separately purchased and independently installed SATA-to-PATA MUX kits are also available. These MUX kits facilitate the installation of PATA drives into the drive tray. Prior to installing the SATA-to-PATA MUX kits into the drive tray, the pre-installed SATA-to-SATA MUX kit must be removed.

WARNING:
The MUX kits are small, delicate components that must be handled with care.

1.2.4 RAID Controller Modules

Part Number: - IFT-80AF12RC16-M2

The RAID controller module contains a main circuit board with an onboard hub, a daughterboard with two (2) additional SFP sockets, a dedicated drive-plane management interface, a preinstalled 256MB SDRAM DIMM memory module, and a BBU module. The controller module contains no user-serviceable components. Except when replacing a faulty unit, installing a BBU, or installing/upgrading the cache memory inside, the controller module should never be removed from the subsystem.

WARNING:
Although the RAID controller can be removed, the only time you should touch the controller itself is to install memory modules or a BBU. Unnecessary tampering with the RAID controller can damage the controller and make the system unusable.

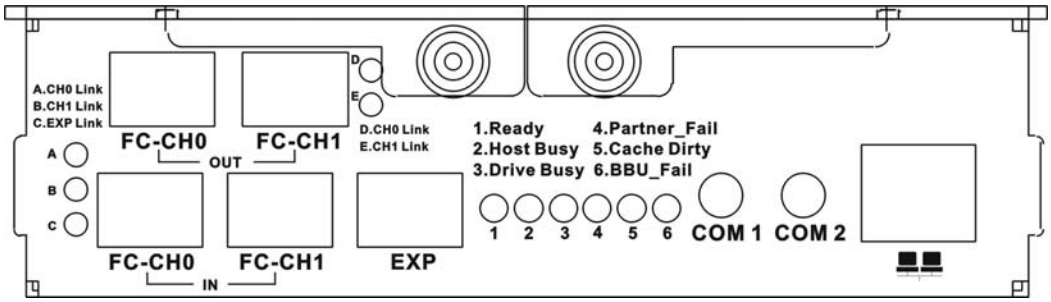

Figure1-9: ES A16F RAID Controller Module Rear Panel

The ES A16F RAID controller module rear panel is shown in ***Figure1-9*** and has five (5) SFP connectors (two labeled **FC-CH0**, two labeled **FC-CH1,** and one labeled **EXP**). Two (2) RS-232C (audio jack) serial ports (labeled **COM1** and **COM2**), one (1) RJ-45 Ethernet connector (next to **COM2**) and status-indicating LEDs (labeled from **1** to **6** and from **A** to **E**) are also seen on the controller module rear panel. The controller board is located in the controller module and can only be seen after the controller module has been removed from the subsystem enclosure. The controller module rear panel has two (2) levers that secure the controller module to the ES A16F subsystem enclosure. These levers are, in turn, secured to the rear of the controller module with two (2) hand retention screws located at the top of the controller module in the center.

1.2.5 Controller Module Interfaces

All external interfaces that connect to external devices are located on the controller module rear panel. The interfaces are listed below.

- ***IN (Host) ports***: The two (2) SFP modules (labeled **FC-CH0** and **FC-CH1**) at the bottom of the controller module are labeled as **IN** ports. These two (2) SFP connectors must be connected to an external FC-2G host computer. These SFP connectors can auto-negotiate the speed and determine whether the data transmission rate is 1Gbps or 2Gbps.

- ***OUT (Expansion) ports***: The two (2) SFP modules (labeled **FC-CH0** and **FC-CH1**) at the top of the controller module are labeled as **OUT** ports. These two (2) SFP connectors can connect to another ES A16F RAID for subsystem expansion. The FC speed on these SFP modules is fixed at 2Gbps and cannot be auto-negotiated.

- ***RCC channels:*** The ES A16F-R models come with an onboard 2Gbps redundant cache coherence (RCC) channel that communicates between the two controllers.

- ***RS-232C (Audio Jack)***: All controller modules come with two (2) RS-232C (audio jack) serial ports. The serial ports can be used for terminal emulation and uninterruptible power supply (UPS) support.

- ***Ethernet ports***: A single 10/100M Ethernet port (located next to **COM2**) is used for remote management through the network.

- ***Drive***: All models come with sixteen (16) SATA drive channels that are connected to the back plane through connectors on the host I/O board. (***NOTE:*** *Drive interfaces are not accessed through the controller module rear panel.*)

1.2.6 DIP Switch

A DIP switch (see ***Figure 1-10***), conveniently located on the rear panel next to the power switch on the right, enables the hub on the controller board and also fixes the speed of the host channel. The DIP switch has eight (8) switches, but only the fourth and fifth switches are used. Setting the DIP switch is fully discussed in **Chapter 4**.

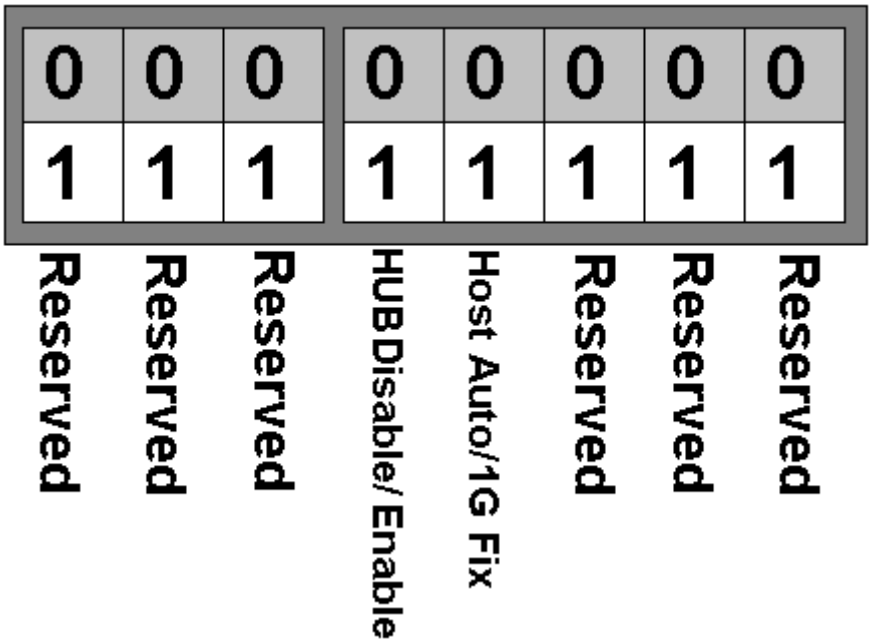

Figure 1-10: DIP Switch

1.2.7 DIMM Modules

The controller modules come with a pre-installed 256MB SDRAM DIMM module. The controller modules support memory modules with sizes from 256MB to 1GB. The DIMM module is located on the controller board.

1.2.8 BBU Module

A Li-ION BBU module, shown in ***Figure 1-11***, comes standard with the subsystem and can sustain 1GB of cache memory for up to 72 hours after a power failure. The use of a BBU is highly recommended in order to safeguard data integrity.

Figure 1-11: BBU Module

The BBU is mounted on two (2) spacers that must be inserted into the controller board. The BBU is connected to the controller board through an onboard connector. Both the BBU connector and the spacer locations are conveniently located on the controller board in unimpeded locations. When installing the BBU modules, the controller module must be removed from the subsystem.

1.2.9 Power Supply Units

Part Number: - IFT-9270CPSU

The ES A16F subsystems are equipped with two redundant, hot-swappable, 1U, 460W PSU modules (see ***Figure1-12***). The PSU modules are located on the rear panel of the subsystem. (See ***Figure 1-5*** and ***Figure 1-6***).

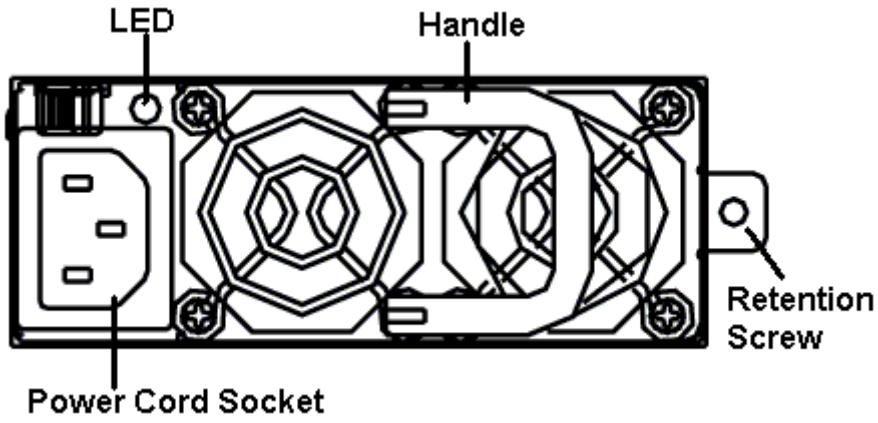

Figure1-12: PSU Module Rear View

Each PSU module comes with a single power socket for power cord plug-in and has its own power switch so you can turn the PSU on and off. Each PSU also comes with two (2) embedded cooling fans to provide sufficient airflow to keep the PSU cool. A single LED indicates the PSU status. A handle at the back of the PSU allows you to remove the

PSU from the subsystem while the system is still online. This should only be done if the PSU has failed and needs to be replaced.

A retention screw on the right side of the PSU module secures the PSU to the enclosure. If the PSU needs to be removed, the retention screw must be removed first. After installing a new PSU module, make sure that the retention screw has been firmly secured.

PSU specifications are shown in ***Appendix B***.

1.2.10 Dual-fan Cooling Modules

Part Number: - IFT-9270CFanMod

ES A16F subsystems come with two (2) hot-swappable, redundant, dual-fan cooling modules (shown in ***Figure 1-13***) pre-installed in the subsystem. Two (2) 9.7cm blowers are housed in each cooling module and provide a total of 61 CFM of airflow running at a speed of 3600rpm. These modules generate a cooling airflow from the front to the rear of the subsystem, extracting the heat generated by the SATA or PATA hard drives. The two (2) cooling fan modules are installed directly above the PSUs. (See ***Figure 1-5*** and ***Figure 1-6***).

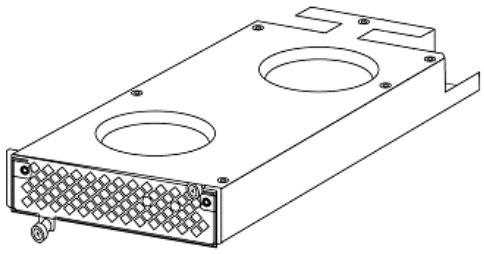

Figure 1-13: Bottom View of a Dual-fan Cooling Module

1.3. Subsystem Monitoring

The ES A16F RAID subsystem comes with several monitoring methods to give you constant updates on the status of the system and individual components. The following monitoring features are included in the subsystem.

1.3.1 I²C bus

The following ES subsystem elements interface to the RAID controller over a non-user - serviceable I^2C bus:

- PSU module
- Dual-fan cooling module

1.3.2 LED Indicators

The following active components all come with LEDs that indicate the status of the individual component:

- RAID controller (11 LEDs)
- LCD panel (3 LEDs)
- Cooling module (2 LEDs)
- PSU module (1 LED)
- Drive trays (2 LEDs)

1.3.3 Firmware and RAIDWatch™ GUI

Firmware: The firmware (FW) is pre-installed software that is used to configure the subsystem. The FW can be accessed through either the front panel LCD module or a terminal emulation program that is installed on an external computer connected to the host.

RAIDWatch: RAIDWatch is a premier, web-based graphics user interface (GUI) that can be installed on a remote computer and accessed via the web.

1.3.4 Audible Alarms

The ES A16F subsystem comes with audible alarms that are triggered when certain active components fail or when certain controller or subsystem thresholds are exceeded. When you hear an audible alarm emitted from the ES A16F subsystem, it is imperative that you determine the cause and rectify the problem immediately.

WARNING:
Failing to respond when an audible alarm is heard can lead to permanent damage of the ES A16F subsystem. When an audible alarm is heard, rectify the problem as soon as possible.

1.4. Hot-swappable Components

1.4.1 Hot-swap Capabilities

The ES A16F subsystem comes with a number of hot-swappable components. A hot-swap component is one that can be exchanged while the subsystem is still online without affecting the operational integrity of the subsystem. These components should only be removed from the subsystem when they are being replaced. At no other time should these components be removed from the subsystem.

1.4.2 Components

The following components are all hot-swappable:

- Controller modules
- PSU modules
- Cooling modules
- Hard drives

1.4.3 Normalized Airflow

Proper subsystem cooling is referred to as “normalized” airflow. Normalized airflow ensures the sufficient cooling of the subsystem and is only attained when all the components are properly installed. Therefor, a failed component should only be hot-swapped when a replacement is available. If a failed component is removed but not replaced, permanent damage to the subsystem can result.

Chapter 2
Hardware Installation

2.1. Installation Overview

This chapter gives detailed instructions on how to install the ES A16F subsystem. When installing the subsystem, it is necessary to install the controller modules, hard drives and drive trays. Depending on the type of drives being used, it may also be necessary to change the MUX kits. Installation into a rack or cabinet should occur before the hard drives or drive trays are installed into the subsystem. It is also advisable to confirm that all of the components listed on the printed unpacking list that came with the subsystem were indeed shipped with it.

CAUTION:
Please note that the installation instructions described in this manual should be carefully followed in order to avoid damage to the system.

2.2. Installation Pre-requisites

1. ***Static-free installation environment:*** The ES A16F subsystem must be installed in a static-free environment to minimize the possibility of electrostatic discharge (ESD) damage. (See ***Section 2.3***)

2. **Component check:** Before installing the ES A16F subsystem, you should confirm that you have received all of the required components by checking the package contents against the Unpacking List.

3. ***Memory modules:*** If you wish to change the pre-installed memory modules, the separately purchased modules must be installed. (See ***Section 2.6.2***)

4. ***Hard drives:*** SATA or PATA hard drives must be purchased separately prior to installing the ES subsystem. (See ***Section 2.8***)

5. ***Cabling:*** All the FC cables that connect the ES A16F subsystem to the host and are used for the expansion port must be purchased separately. (See ***Section 4.2.1***)

6. ***SFP transceivers:*** If the FC cables that were previously purchased do not come with pre-installed SFP transceivers, transceivers must be separately purchased and connected to the FC cables. (See ***Section 4.2.3***)

2.3. Static-free Installation

Static electricity can damage the electronic components of the system. Most of the controllers that are returned for repair are the result of improper installation and ESD damage. To prevent ESD damage, follow these precautions before touching or handling any of the components:

- When installing the ES A16F, you should wear an anti-static wrist band or touch a grounded metal surface to discharge any static electricity from your body.
- Avoid carpets, plastic, vinyl, and styrofoam in the work area.
- Handle all components by holding their edges or metal frame. Avoid touching PCB boards or connector pins.

2.4. General Installation Procedure

Detailed, illustrated instructions for each step are given in the following sections.

CAUTION:
To ensure that the system is correctly installed, please follow the steps outlined below. If these steps are followed, the installation will be fast and efficient. If these steps are not followed, the hardware may accidentally be installed incorrectly.

Step 1. ***Unpack***. Unpack the subsystem and make sure that all the required subsystem components have indeed arrived. (See ***Section 2.5***)

Step 2. ***Change the DIMM module.*** Although a DIMM module has been preinstalled on the controller board, if you wish to use a different DIMM module with a larger memory capacity, then the DIMM module exchange should be made first. (See ***Section 2.5***)

Step 3. ***Install the controller module.*** (See ***Section 2.7***)

Step 4. ***Rack/Cabinet installation.*** If the ES A16F is going to be installed in a rack or a cabinet, it should be installed prior to the installation of the hard drives. Installing the ES A16F into a rack or cabinet requires at least three people.

Step 5. ***Install the MUX kits.*** If PATA hard drives are going to be used in the subsystem, the pre-installed SATA-to-SATA MUX kits must be removed from the drive trays and replaced with separately purchased SATA-to-PATA MUX kits. (See ***Section 2.8***)

Step 6. ***Install hard drives.*** Separately purchased SATA or PATA hard drives must be individually installed into the drive trays. (See ***Section 2.8***)

Step 7. ***Install drive trays***. After the hard drives have been installed into the drive trays, the drive trays must be installed into the enclosure itself. (See ***Section 2.9***)

Step 8. ***Connect the cables.*** Use the supplied power cables to connect the subsystem to main power. Use separately purchased FC cables to connect the host ports to the host computers. (See ***Chapter 4***)

Step 9. ***Power up.*** Once all of the components have been properly installed and all the cables properly connected, the subsystem can be powered up and the RAID array configured. (See ***Chapter 4***)

2.4.1 Installation Procedure Flowchart

Figure 2-1 shows a flowchart of the installation procedure. As you complete each step, check off the "***Done***" box on the right. Please use this flowchart in conjunction with the instructions that follow.

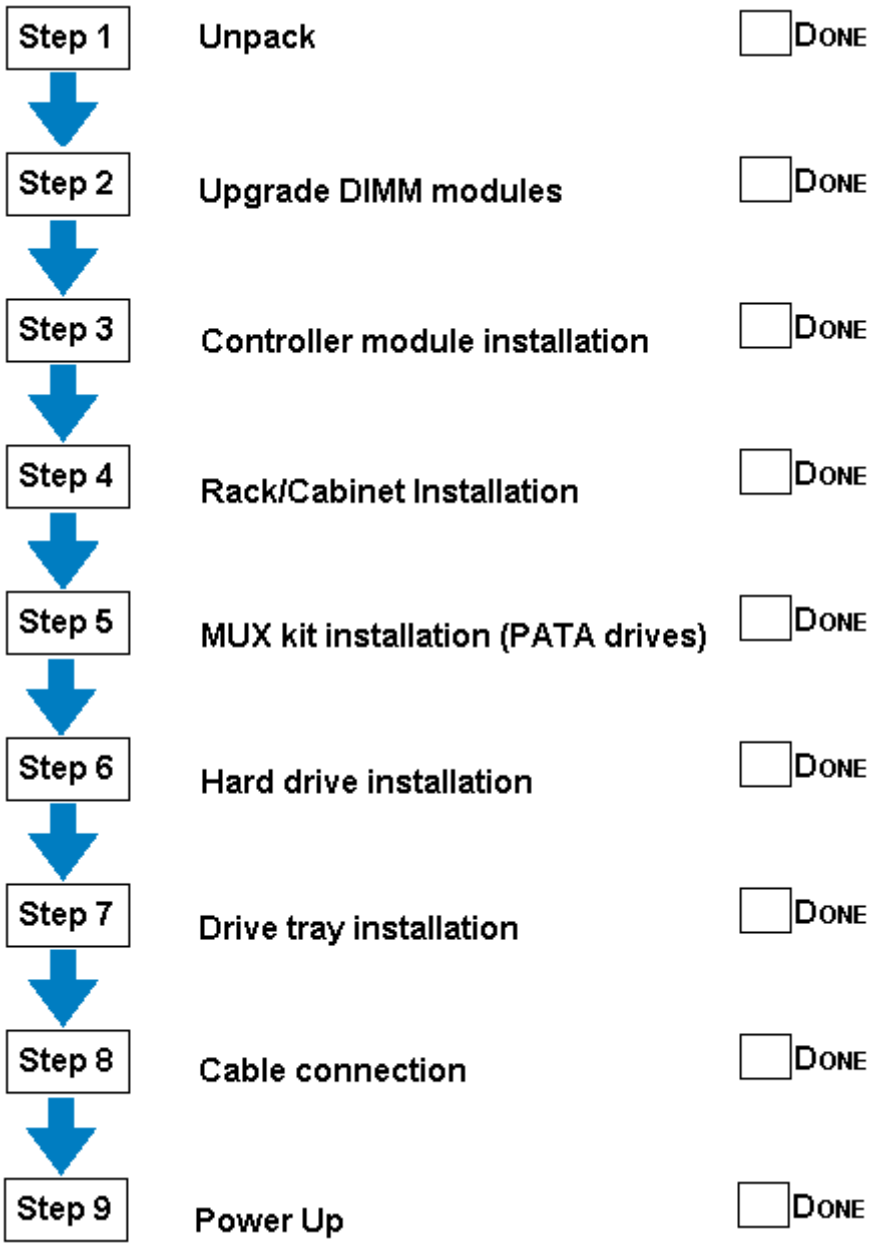

Figure 2-1: Upgrade Procedure Flowchart

2.5. Unpacking the Subsystem

The ES A16F subsystem components are packed in seven (7) boxes.

WARNING:
*For a detailed packing list, refer **Appendix C** of this manual. Do not rely on the non-definitive, summarized unpacking list shown below--it is for reference only.*

The following items should be packed in individual boxes and are not pre-installed:

- Sixteen (16) drive trays
- ***ES A16F-S***: One (1) controller module

  ES A16F-R: Two (2) controller modules
- ***ES A16F-S***: One (1) BBU module

  ES A16F-R: Two (2) BBU modules
- Accessory items

The enclosure chassis, with its pre-installed components, is located at the bottom of the package. The pre-installed components include:

- Two (2) PSU modules
- Two (2) cooling modules
- Two (2) front handles
- One (1) LCD panel pre-installed on the front handle on the left of the enclosure
- One (1) mid-plane board
- One (1) drive-plane board

For a complete and detailed unpacking list, please refer to ***Appendix C***.

2.6. Memory Module Installation

2.6.1 Memory Module Installation Overview

The ES A16F comes with a pre-installed 256MB SDRAM DIMM module on each controller. The controller supports memory up to 1GB. If SDRAM DIMM modules with a different size need to be used, the pre-installed modules must be removed and the new ones installed. Replacement and installation instructions are described fully below.

The DIMM module is located beneath a pre-installed BBU module. Prior to changing the DIMM module, the BBU module must first be removed from the controller module. For future data integrity, it is imperative that the BBU is replaced once the DIMM module has been upgraded.

If you are replacing the memory modules, please refer to the installation procedure below. If the memory modules do not need to be changed, proceed to ***Section 2.7***.

WARNING:
The controller board in the controller module is a sensitive item. Please ensure that all anti-static precautions stipulated above are strictly adhered to. Only qualified engineers should replace the DIMM module.

2.6.2 Selecting the Memory Modules

If memory module on the ES A16F controller module/s is/are going to be replaced, the following factors must be considered when purchasing replacement DIMM modules:

- ***Pre-installed SDRAM DIMM:*** The ES A16F comes with a 256MB SDRAM DIMM module pre-installed on the controller board/s. If you wish to change the size of the SDRAM DIMM, then a new, separately purchased DIMM must be installed.

- ***SDRAM DIMM modules supported***: The ES A16F supports SDRAM DIMM modules with memory capacities from 256MB to 1GB.

- ***Installation considerations:*** When installing the SDRAM DIMM module, it is necessary to handle the controller module. The controller board is more susceptible to damage than the other components and must therefore be handled with extreme care. ALL anti-static precautions specified in ***Section 2.3*** must be strictly adhered to.

- ***Secure installation***: When replacing the DIMM module, make sure that the new DIMM module is firmly in place prior to installing the controller module. If the DIMM module is not firmly in place, the subsystem will not run and the controller will need to be removed and the DIMM module correctly installed.

- ***Redundant controllers***: The memory modules for the controllers in the redundant controller (ES A16F-R) subsystems must have exactly the **SAME SIZE** and **SPEED**.

- ***Purchasing considerations***: When purchasing an SDRAM DIMM to install on the controller board, contact your ES A16F vendor.

2.6.3 DIMM Module Installation

WARNING:
The pre-installed modules must be removed prior to installing new memory modules. Do this with care. Sensitive components can be damaged during the process.

Step 1. ***Remove the pre-installed BBU module.*** The BBU module is connected to the board through a connector at the back of the controller board (see ***Figure 2-1***). Two (2) retention screws secure the BBU module to the two (2) spacers on which it is mounted (see ***Figure 2-1***). To remove the BBU module, disconnect

it from the onboard connector and remove the two (2) retention screws that secure it to the spacers.

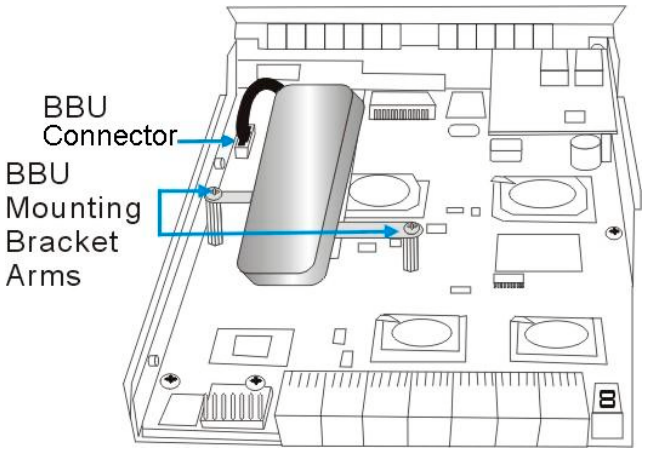

Figure 2-1: Pre-installed BBU

Step 2. ***Remove the previously installed DIMM module from the DIMM socket***. To do this, push the white clips on either side of the DIMM module in an outward direction. By doing this, the previously installed modules will be ejected from the DIMM socket. (See ***Figure 2-2***).

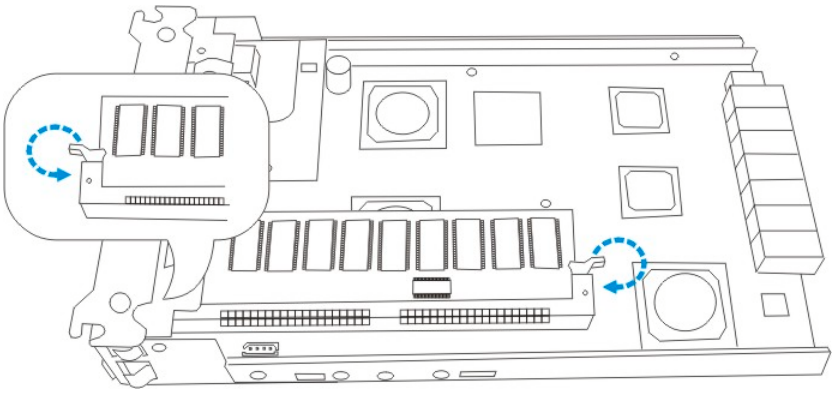

Figure 2-2: Push Back the White Clips on the Sides of the DIMM Module

Step 3. ***Pull the DIMM module out of the controller module***. To do this, elevate the rear end of the DIMM module and gently pull it out of the controller module. (See ***Figure 2-3***).

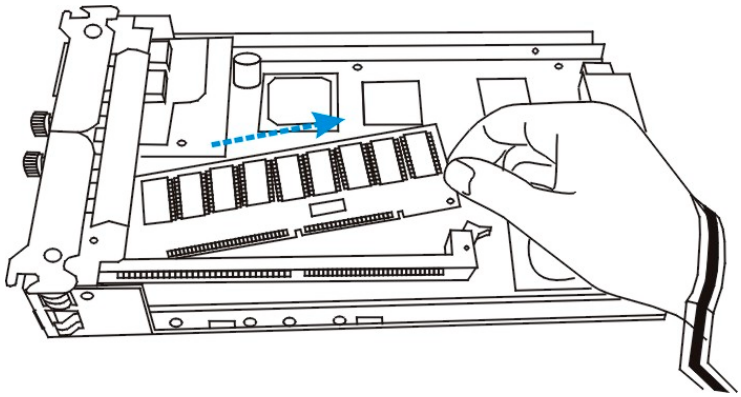

Figure 2-3: Extract the DIMM Module

Step 4. ***Insert the new DIMM module into the DIMM socket.*** To insert the DIMM module into the DIMM socket, elevate the rear of the DIMM module above the DIMM socket retention clip. Position the front of the DIMM module so that it can be easily inserted. (See ***Figure 2-4***).

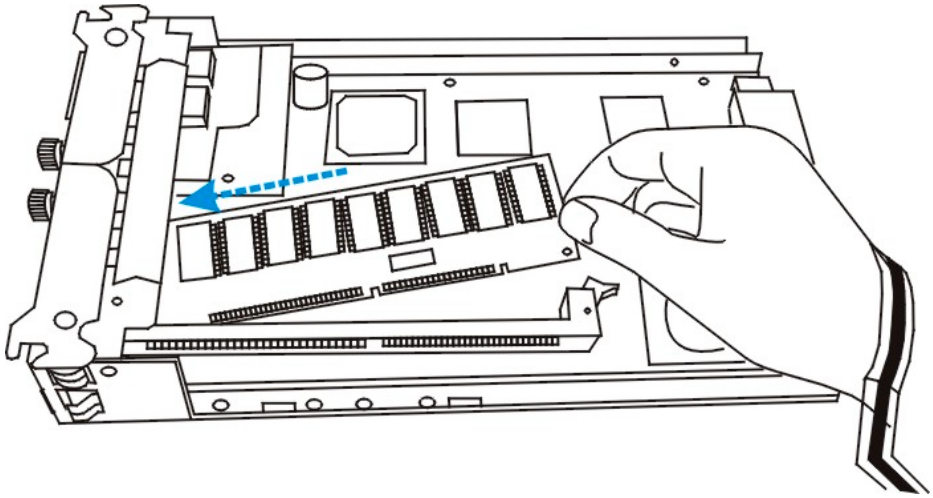

Figure 2-4: Correctly Orient the DIMM Module

Step 5. ***Insert the DIMM module into the DIMM socket***. Once the DIMM module has been correctly aligned with the DIMM socket, gently push the DIMM module into the socket. The white clips on the sides of the socket will close automatically and secure the DIMM module into the socket. (See ***Figure 2-5***).

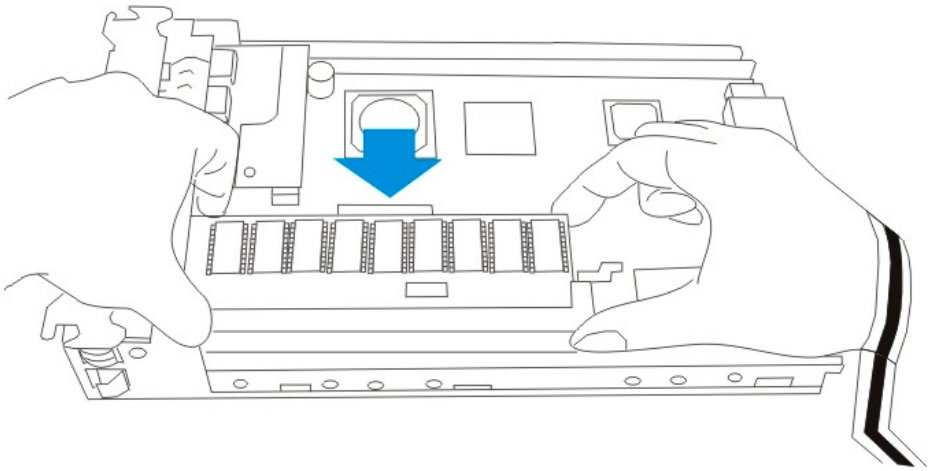

Figure 2-5: Insert the DIMM Module

Step 6. ***Re-install the BBU module.*** Once the DIMM module has been replaced, make sure that the new DIMM module has been correctly installed. After the DIMM module has been properly installed, the BBU module must be re-installed. To do this mount, the BBU correctly on the pre-installed spacers on the controller board (see ***Figure 2-1***), re-insert the retention screws to secure the BBU to the controller board, and reconnect the BBU module to the connector at the rear of the controller board. (See ***Figure 2-1***).

Step 7. After the DIMM and BBU modules have been properly installed, the controller module must be installed. To install the controller module, please refer to ***Section 2.7***.

2.7. Installing the RAID Controller Module

2.7.1 Controller Module Installation Overview

Prior to installing the controller module into the ES A16F subsystem, make sure that both the DIMM module and the BBU module have been correctly installed. When installing the controller module, remember that the controller board is a sensitive component and must be treated with care.

2.7.2 Controller Module Installation Procedure

To install a controller module, please follow these steps:

Step 1. ***Insert the controller module into the controller bay***. Make sure the two (2) folding handles on the rear side of the controller module are open and not attached to the controller module chassis. Hold the controller module by the edges and carefully align it with the controller bay. Once aligned, gently slide it into the controller bay, making sure it rests properly on the gliding rails.

Step 2. ***Gently push the controller module into the controller bay.*** Once the controller module has been properly aligned with the controller bay, gently push it in until you feel contact resistance with the docking connector. (See ***Figure 2- 6***).

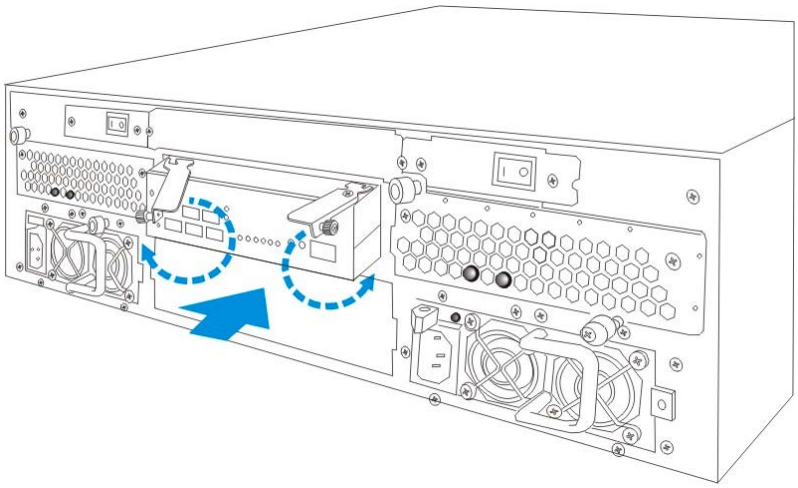

Figure 2- 6: Inserting the Controller Module

WARNING:
Installation of the top controller module is shown in ***Figure 2- 6****. If a redundant controller subsystem is being installed, a second controller module must be installed in the lower controller bay. If a single controller module is installed, a metal sheet is used to cover the lower controller bay.*

Step 3. ***Close the handles***. After the controller module has been fully inserted into the controller bay, close the folding handles on the side of the controller module and secure them to the controller module. To do this, turn the retention screws clockwise as shown in ***Figure 2- 7***.

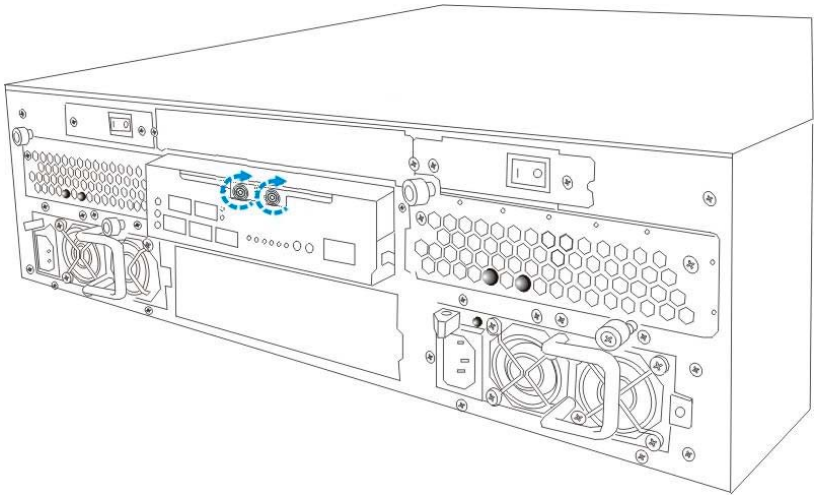

Figure 2- 7: Secure Controller Module

2.8. Hard Drive Installation

2.8.1 Hard Drive Installation Overview

WARNING:

1. *Hard drives are very delicate and must be handled with extreme care. Dropping a drive onto a hard surface (even over a short distance), hitting, or touching the circuits on the drives with your tools may all cause damage to the drives.*

2. *Observe all ESD prevention methods when installing drives.*

The ES A16F supports both SATA and PATA hard drives. The drive trays are pre-installed with SATA-to-SATA MUX kits. If you wish to install PATA drives, SATA-to-PATA MUX kits must be separately purchased and independently installed. Note also that the single controller models and the dual-redundant controller models use different MUX kits. If you upgrade the subsystem, the MUX kits must be changed.

2.8.2 Hard Drive Installation Prerequisites

NOTE:

The hard drive and drive trays should only be installed into the subsystem after the subsystem has been mounted into a cabinet. If the hard drives are installed first, the subsystem will be too heavy and mounting it into the cabinet will be far more difficult.

Hard drives for the ES A16F subsystem must be purchased separately. When purchasing the hard drives, the following factors must be considered:

***Capacity (MB/GB)*:** Use drives with the same capacity. RAID arrays use a "least-common-denominator" approach. The maximum capacity of each drive used in the array is the maximum capacity of the smallest drive.

***Profile*:** The drive trays and bays of the system are designed for 3.5-inch wide x 1-inch high hard drives. It is highly recommended that you do not try to use drives of any other size.

Drive type: The ES A16F subsystem can use either SATA or PATA hard drives. Please ensure that you purchase the correct hard drives.

2.8.3 SATA Drive Installation

The drive trays already come fitted with SATA-to-SATA MUX kits, therefore SATA drives can be immediately installed into the drive trays.

Step 1. ***Correctly orient the hard drive.*** Prior to installing the hard drive into the drive tray, make sure that the connector at the back of the drive is facing the back of the drive tray. This connector is connected to the MUX kit.

Step 2. ***Insert the hard drive***. Hold the drive at an angle and insert it into the drive tray. (See ***Figure 2-8***).

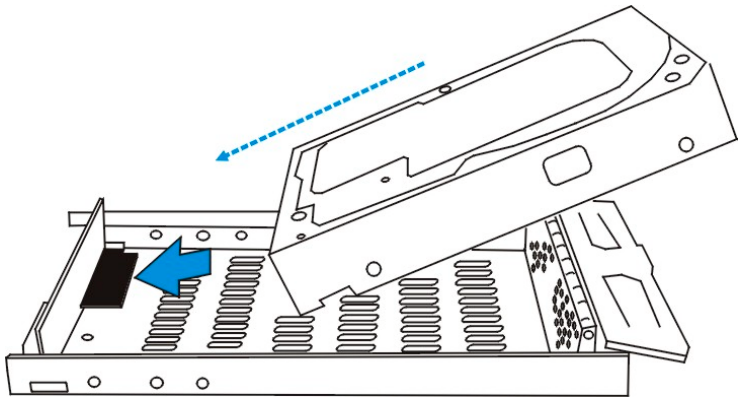

Figure 2-8: Insert the Hard Drive into the Drive Tray

Step 3. ***Connect the drive to the MUX kit.*** Once the drive tray is laying flat in the drive tray, slide it towards the rear of the drive tray until a solid connection between the drive connector and the MUX kit connector has been made. (See ***Figure 2-9***).

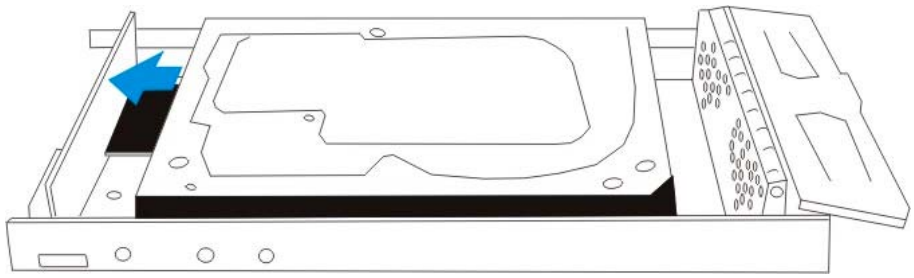

Figure 2-9: Connect the SATA Drive to the SATA-to-SATA MUX Kit

Step 4. ***Insert retention screws.*** After the drive has been properly connected to the SATA-to-SATA MUX kit, insert four (4) retention screws to ensure the drive's secure installation. (See ***Figure 2-10***).

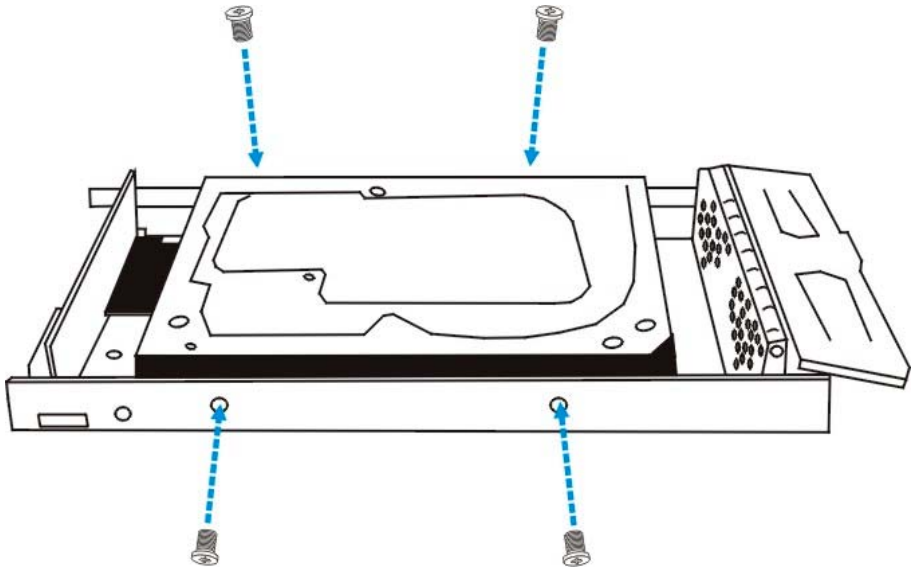

Figure 2-10: Insert the Retention Screws

2.8.4 PATA Drive Installation

If PATA drives will be used in the subsystem, separately purchased SATA-to-PATA MUX kits (IFT-9270AN2S1P) must be installed.

Step 1. ***Remove the SATA-to-SATA MUX kit.*** All drive trays come with pre-installed SATA-to-SATA MUX kits. Before installing the SATA-to-PATA MUX kits, the original MUX kits must be removed. To do this, turn the drive tray upside down and remove the two (2) retention screws that hold the SATA-to-SATA MUX kit in place. After the screws are removed, the MUX kit will easily separate from the drive tray. (See ***Figure 2-11***).

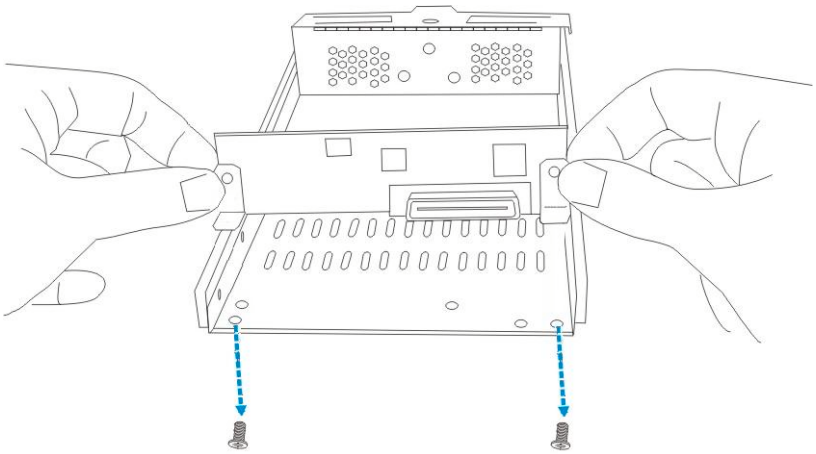

Figure 2-11: Remove the SATA-to-SATA MUX Kit

Step 2. ***Open the SATA-to-PATA MUX kit.*** A SATA-to-PATA MUX kit is shown in ***Figure 2-12.*** The MUX kit is mounted onto a metal base plate that has three (3) pre-drilled holes reserved for retention screws

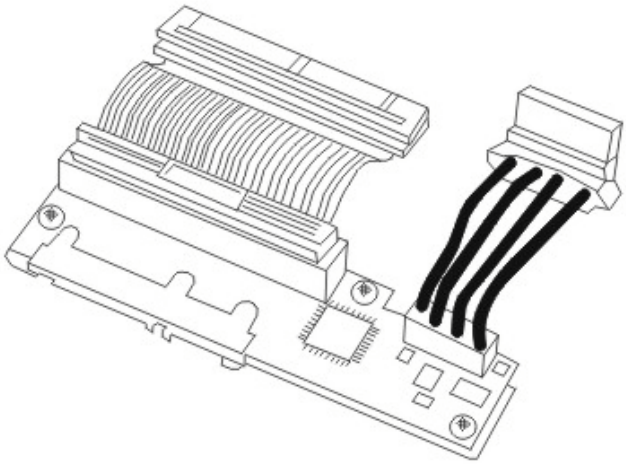

Figure 2-12: SATA-to-PATA MUX Kit

Step 3. ***Locate the drive tray retention screw holes.*** Three (3) corresponding pre-drilled screw holes can be found at the back of the drive tray shown in ***Figure 2-13***.

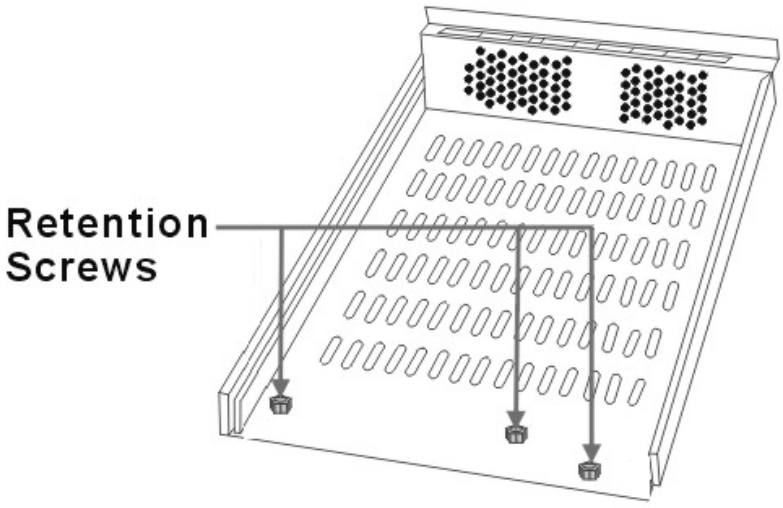

Figure 2-13: Empty Drive Tray: Dongle Kit Retention Screws

Step 4. ***Install the MUX kit.*** Place the MUX kit at the back of the drive tray. Hold the MUX kit in place and turn the drive tray over. Align the holes in the base of the drive tray with the holes in the MUX kit base tray.

Step 5. ***Insert the three (3) available retention screws.*** These screws are inserted from the bottom of the drive tray. They will firmly secure the MUX kit to the drive tray and facilitate the installation of the appropriate drive.

Step 6. ***Installed SATA-to-PATA MUX kit***. Once installed, the MUX kit will appear as shown in ***Figure 2-14***.

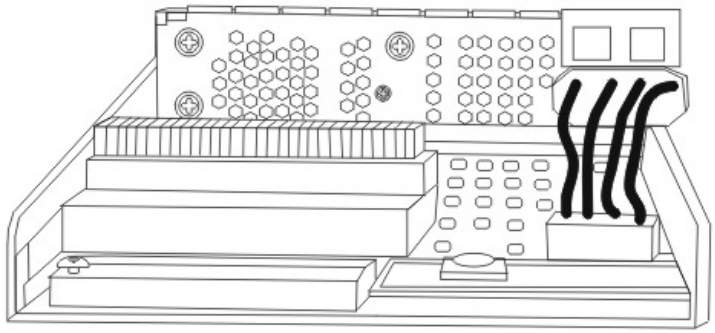

Figure 2-14: Installed SATA-to-PATA MUX Kit

Step 7. ***Connect the ATA and power cables***. ATA and power cables from the MUX kit must be connected to their corresponding connectors on the hard drive. (See ***Figure 2-15***) Make sure that these connections are secure and will not come loose.

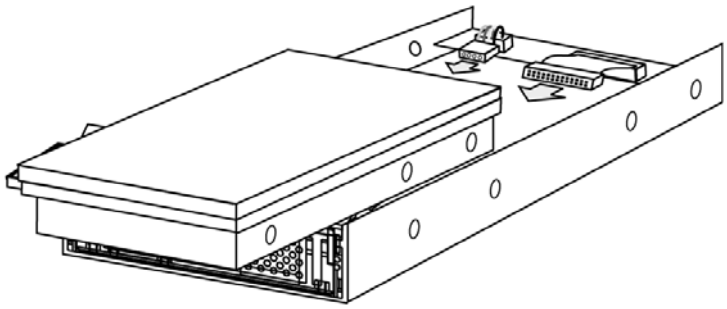

Figure 2-15: PATA Hard Drive Connectors

Step 8. ***Insert the hard drive.*** Once the connectors from the MUX kit have been firmly attached to the hard drive, place the hard drive into the drive tray as shown in ***Figure 2-16***.

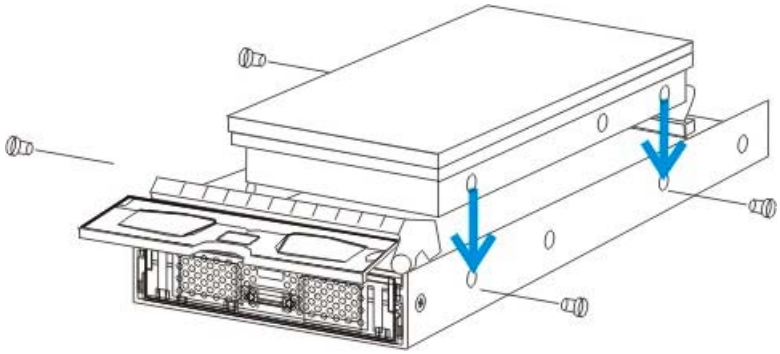

Figure 2-16: Inserting the PATA Drive

Step 9. Adjust the drive's location until the mounting holes in the drive canister are aligned with those on the hard drive. Secure the drive with the four (4) supplied 6/32 flat-head screws.

WARNING:
Only use the screws supplied with the drive canisters. Longer screws might damage the drive.

2.9. Drive Tray Installation

Once the hard drives have been installed in the drive trays, the drive trays must be installed into the ES subsystem.

Step 1. ***Make sure the key-lock is in the unlocked position***. The key-lock is unlocked if the groove on its face is in a horizontal orientation. If the groove is in a vertical position, as shown in ***Figure 2-17,*** then the key-lock is locked and the front flap on the drive tray cannot be opened.

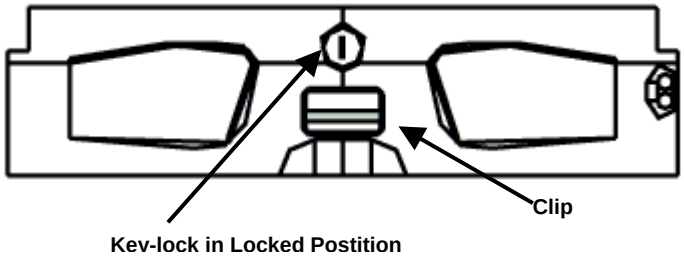

Figure 2-17: Front View of an Individual Drive Tray

Step 2. ***Open the front flap on the drive tray.*** (See ***Figure 2-18***) To open the flap, push the clip (shown in ***Figure 2-17***) on the front of the drive tray in an upward direction. The clip is easy to access and lift.

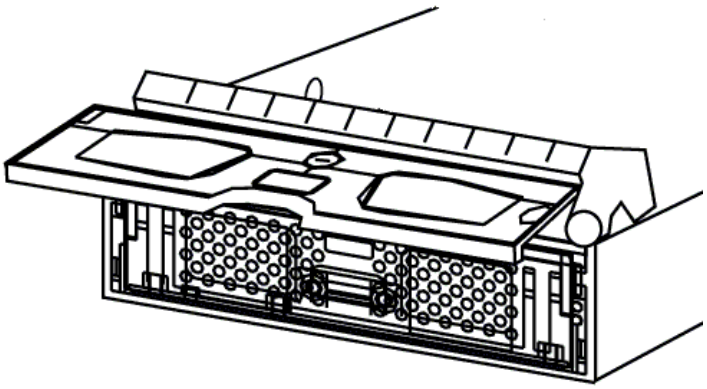

Figure 2-18: Drive Tray Front Flap

Step 3. ***Line the drive tray up with the slot*** in which you wish to insert it. Make sure that it is resting on the rails inside the enclosure. Once the drive tray is lined up with the slot, gently slide it in. This should be done smoothly and gently.

Step 4. ***Close the front flap on the drive tray***. Make sure the front flap is closed properly. Closing the front flap ensures that the SCA connector at the back of the drive tray is firmly connected to the corresponding connector on the mid-

plane board. If the front flap is not closed properly, the connection between the hard drive and the subsystem will not be secure.

Step 5. ***Lock the flap into place.*** To lock the flap into place, turn the key-lock until the groove on its face is in a vertical orientation. (See ***Figure 2-19***)

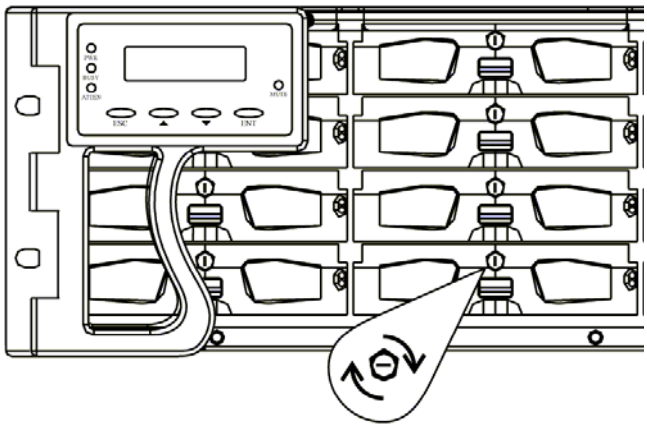

Figure 2-19: Drive Tray Key-lock Rotation

WARNING:
All the drive trays must be installed into the enclosure even if they do not contain a hard drive. If the drive trays are not installed, then the ventilation required for cooling will not be normalized and the subsystem will be irreparably damaged.

Chapter 3
Subsystem Monitoring

3.1. Subsystem Monitoring Overview

The ES A16F subsystem is equipped with a variety of self-monitoring features that keep you informed of the subsystem's operational status. These monitoring features provide vital feedback to help you maintain the operational integrity of the subsystem. Prompt response to warnings and component failure notifications will improve the overall operation and help ensure the longevity of the ES RAID subsystem.

Self-monitoring features include:

- ***Management firmware (FW)***: The ES A16F subsystem controller comes with pre-installed FW (version 3.31 or above). Device status information can be obtained from the FW. The FW can be accessed using either the LCD panel or a PC hyper-terminal. The ES A16F subsystem can be connected to a PC hyper-terminal through the **COM1** RS-232C (audio jack) serial port. The FW is fully described in the ***Generic User's Manual*** that came with the subsystem. Please refer to this manual for further details.

- ***RAIDWatch***: RAIDWatch is a fully integrated Java-based Graphics User Interface (GUI) that came with the subsystem and can be used to monitor the subsystem remotely. You can use the powerful ***Notification Process Center*** (NPC) sub-module to keep you informed over a variety of communication devices such as fax, pager, e-mail, etc. The installation and operation of RAIDWatch is fully described in the ***RAIDWatch User's Manual***. Please refer to this manual for further details.

- ***LEDs***: Device status indicating LEDs are placed on all the ES active components. These LEDs are used to inform users of the integrity of a given component or of a given FC link. You should become familiar with the different LEDs that are present on the subsystem and be aware of their functions.

- ***Audible alarm***: An audible alarm is present on the subsystem controller board and will be triggered if any of a number of threatening events occur. These events usually jeopardize the functional and operational integrity of the controller board and must be heeded at all times. Events such as a breach of the temperature threshold will trigger the alarm and if an onsite subsystem manager is present, the manager should use either the LCD panel or the PC hyper-terminal to determine the cause of the alarm and take the appropriate corrective measures.

- ***I^2C:*** The I^2C bus monitors the operational integrity of the cooling fan and PSU modules (present/not present, ready/fail, etc.).

Subsystem monitoring is a necessary part of subsystem management. When failure events or other disruptive events are detected and reported, the subsystem manager must take the appropriate action to rectify the problem. Failure to act in a properly specified manner to a system event (such as overheating) can cause severe and permanent damage to the subsystem.

3.2. Status-indicating LEDs

3.2.1 Brief Overview of the LEDs

Some of the ES A16F subsystem components have status-indicating LEDs that show the operational status and integrity of the subsystem components. The list in ***Table 3-1*** shows the number of LEDs assigned to each component. The ES A16F-S1211 model has a total of fifty-four (54) status-indicating LEDs and the ES A16F-R1211 models have sixty-five (65) LEDs.

Component	LEDs/Component	ES A16F-S1211 LEDs	ES A16F-R1211 LEDs
Controller Modules	11	11 (1 controller)	22 (2 controllers)
PSU Module	1	2 (2 PSU modules)	2 (2 PSU modules)
Cooling Module	2	4 (2 cooling modules)	4 (2 cooling modules)
LCD Panel	3	3 (1 LCD Panel)	3 (1 LCD Panel)
Drive Trays	2	32 (16 drive trays)	32 (16 drive trays)
RJ-45 Ethernet Connector	2	2 (1 connector)	2 (1 connector)
Total LEDs		**54**	**65**

Table 3-1: LED Distribution

3.2.2 Controller Module LEDs

The rear panel of the controller module is shown in ***Figure 3-1*** below. The LEDs are numbered from **1** – **6** and **A** - **E**. The LED definitions are shown in ***Table 3-2*** below.

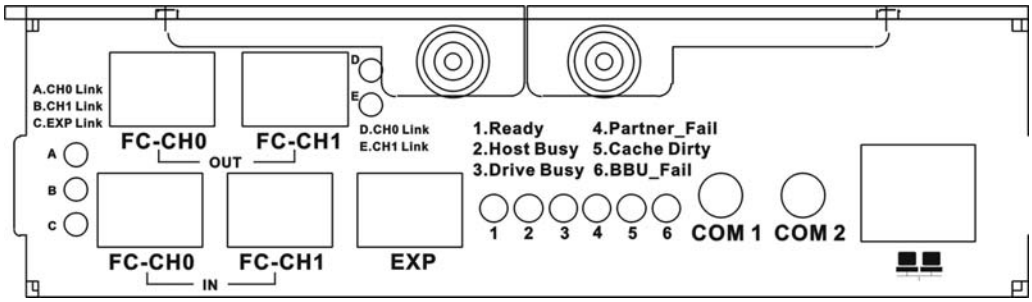

Figure 3-1: ES A16F-G Rear Panel

LED	Name	Color	Status
1	**Ready**	Green	**ON** indicates that the controller has successfully booted, is active, and operating properly. **OFF** indicates that the controller is not ready for operation.
2	**Host Ports Active**	Green	**ON** indicates that there is activity on the FC host ports, i.e., the FC host ports are busy. **OFF** indicates that there is no activity on the FC host ports, i.e., the FC host ports are not busy.
3	**Drive Ports Active**	Green	**ON** indicates there is activity on the drive ports. **OFF** indicates that there is no activity on the drive ports.
4	**Partner Fail**	Amber	**ON** indicates that the partner controller in a redundant controller subsystem has failed. *(**NOTE:** For single upgradeable controller models, the LED will be activated only after the subsystem is upgraded from single to redundant.)*
5	**Cache Dirty**	Amber	**ON** indicates that **t**he cache memory is dirty or is being held up via the BBU during a system power loss.
6	**BBU Fail**	Amber	**ON** indicates the BBU has failed and cannot sustain the cache memory. **OFF** indicates the BBU can sustain the cache memory. **FLASHING** indicates the BBU is charging. (***NOTE:** If a BBU has not been installed, then this LED will be turned **ON**.*)

Table 3-2: Controller Module LED Definitions

3.2.3 FC Controller Module LEDs

The controller modules have an additional five (5) LEDs, labeled A – E. The definitions of these LEDs are shown in ***Table 3-3*** below.

LED	Name	Color	Status
A and **D**	**CH0 LINK**	Green	**ON** indicates that channel 0 link has been established. **OFF** indicates that channel 0 link has not been established.
B and **E**	**CH1 LINK**	Green	**ON** indicates that channel 1 link has been established. **OFF** indicates that channel 1 link has not been established.
C	**EXP LINK**	Green	**ON** indicates that the expansion channel link has been established. **OFF** indicates that the expansion channel link has not been established.

Table 3-3: FC Controller Module Channel Status LEDs

3.2.4 LAN Port LEDs

The LAN port comes with two (2) LEDs. As shown in ***Figure 3-2***, one LED indicates the online status and the other indicates LAN activity. The LED definitions are shown in ***Table 3-4***.

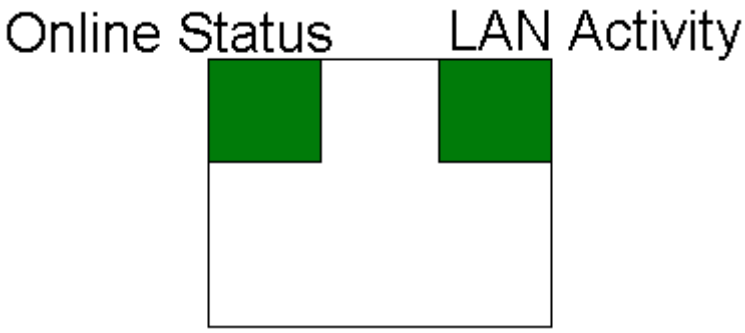

Figure 3-2: LAN Port LEDs

LED Name	Color	Status
Online Status	Green	**ON** indicates currently connected to LAN.
LAN Activity	Green	**BLINKING** indicates active transmission.

Table 3-4: LAN Connector LED Definitions

3.2.5 LCD Panel

The front panel LCD panel comes with three (3) status-indicating LEDs. The LEDs on the front panel are marked, from top to bottom, **PWR**, **BUSY**, and **ATTEN**, as shown in ***Figure 3-3*** below. The definitions of these LEDs are shown in ***Table 3-2***.

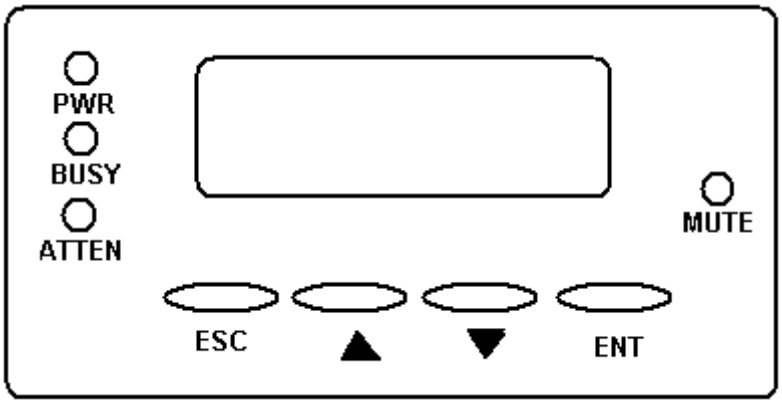

Figure 3-3: LCD Panel LEDs

LED Name	Color	Status
PWR	**Blue**	**ON** indicates that power is being supplied to the subsystem. **OFF** indicates that no power is being supplied to the subsystem.
BUSY	**White**	**ON** indicates that there is activity on the host/drive channels. **OFF** indicates that there is no activity on the host/drive channels.
ATTEN	**Red**	**ON** indicates that a component failure/status event has occurred. **OFF** indicates that the subsystem and all its components are operating correctly.

Table 3-5: LCD Panel Definitions

NOTE:
The LCD panel ATTEN LED will, during the power up process, be turned on. If the subsystem boots up correctly, then the ATTEN LED will be turned off after the boot up procedure is complete.

3.2.6 Drive Tray LEDs

The drive trays come with two (2) status-indicating LEDs, one that indicates power and the other that indicates hard drive activity. The LEDs are shown in ***Figure 3-4*** and their definitions in ***Table 3-6***.

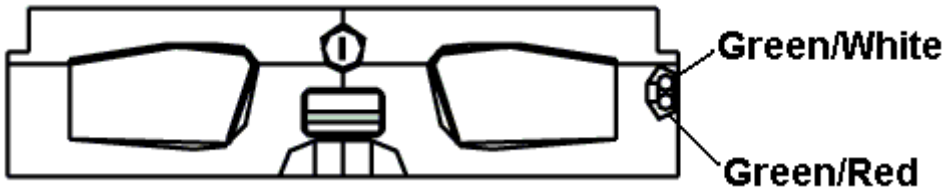

Figure 3-4: Drive Tray LEDs

LED Name	Color	Status
Drive Busy	**Green/White**	**GREEN** indicates that power is being supplied to the drive. **WHITE** indicates that the secondary controller is reading/writing to the drive. **OFF** indicates there is no read/write activity on the drive.
Power Status	**Green/Red**	**GREEN** indicates that power is being supplied to the drive. **RED** indicates that there is no power being supplied to the drive

Table 3-6: Drive Tray LED Definitions

3.2.7 PSU Module LED

The PSU module has one (1) LED located just above the power switch and just below the retention screw. (See ***Figure 3-5***) The LED indicates the operational status of the PSU module. Please refer to ***Table 3-7*** for PSU LED definitions.

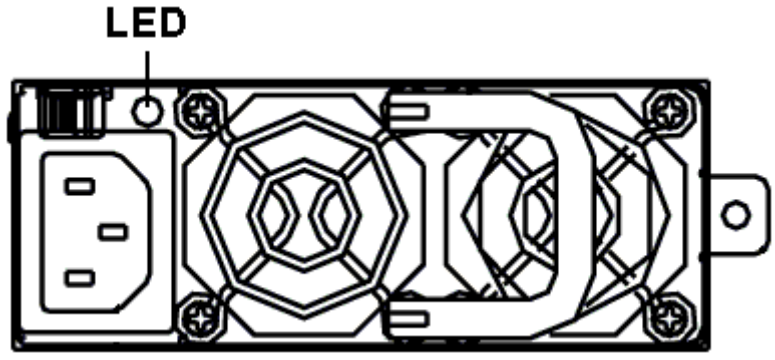

Figure 3-5: PSU Module Rear LED

Color	Status
Static Green	The PSU is operating normally and experiencing no problems
Static Red	The PSU has failed and is unable to continue providing power to the subsystem.
OFF	The PSU is not turned on. The PSU module LED will remain off even if the power cable has been plugged in but the power switch is not turned on.

Table 3-7: PSU Module LED Definitions

3.2.8 Cooling Module LED

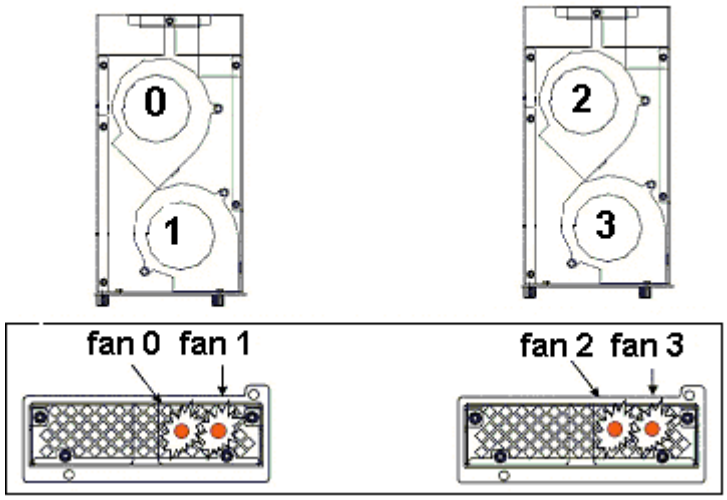

Figure 3-6: Cooling Fan Module LEDs and Cooling Fan Locations

Each cooling module has two (2) red LEDs on the back. Each LED corresponds to a single fan within the cooling module. (See ***Figure 3-6***)

RED	Status
OFF	The respective cooling fan is operating without any difficulties.
ON	The respective cooling fan has failed and the module must be replaced.

Table 3-8: Cooling Fan Module LED Definitions

3.3. Audible Alarm

Different controller environmental and operational parameters (such as temperature, etc.) have been assigned a range of values between which they can fluctuate. If either the upper or lower thresholds are exceeded, an audible alarm will automatically be triggered. The alarm will also be triggered when an active component of the ES A16F subsystem fails. If the ES A16F subsystem manager is onsite and is alerted by the alarm, the manager needs to read the error message on the LCD screen or on the PC terminal to determine what has triggered the alarm. After determining what has occurred, the ES A16F subsystem manager must take appropriate actions to rectify the problem.

WARNING:
Whenever an alarm is triggered, you must determine the problem. If the audible alarm is ignored or not taken seriously and the problem is not rectified, permanent damage to the system can result.

3.3.1 Default Threshold Values

Table 3-9 shows the default threshold values for the ES subsystem. If any of these values are surpassed, the alarm will sound:

Parameter	***Upper Threshold***	***Lower Threshold***
+3.3V	+3.6V	+2.9V
+5V	+5.5V	+4.5V
+12V	+13.2V	+10.8V
CPU Temperature	90ºC	0ºC
Board Temperature	90ºC	0ºC

Table 3-9: Default Threshold Values

The thresholds in ***Table 3-9*** are the default threshold values. The user can change these values. To see how to change these values, please refer to the ***Generic Operation Manual*** that came with your system.

3.3.2 Failed Devices

If any of the following devices fail, the audible alarm will be triggered:

- RAID controller modules
- Cooling modules
- PSU modules

- BBU modules
- Hard drives

3.4. I^2C Monitoring

The PSU and cooling fan modules are monitored using I^2C. If either of these modules fails, the failure will be detected and you will be notified through the various methods described above.

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Chapter 4
Subsystem Connection and Operation

4.1 FC Host Connection Prerequisites

NOTE:
The topics covered in ***Section*** *4.2 only pertain to the FC models.*

4.1.1 Cabling

The FC Standard allows for optical connections. Optical cables can be used over long distances, have been shown to be more reliable, and are less susceptible to EMI. Due to the extremely high data transfer rates, optical cables are preferred for 2Gbps FC connectivity.

WARNING:
All cables must be handled with care. To prevent interference within a rack system, the cable routing path must be carefully planned and they must not be bent.

4.1.2 FC Lasers

WARNING:
Lasers can be hazardous and may cause permanent eye damage or blindness, and therefore must be treated with respect and used with caution. ***Never look at lasers without knowing whether they are on or off.***

Wavelengths: The lasers on FC fiber optic cables emit either short wave (SW) beams (770nm - 860nm) or long wave (LW) (1270 nm - 1355 nm) beams. Cables using either of these wavelengths can be used.

Laser types: Two (2) types of laser devices can be used in FC cables: Optical Fibre Control (OFC) and non-OFC lasers. The OFC lasers are high-powered and can be used over long distances.

Safety features: Due to their high power output, OFC lasers usually come with a safety mechanism that switches the laser off as soon as it is unplugged. Non-OFC lasers are low power and do not come with these safety features; however, they can still inflict damage.

4.1.3 SFP Transceivers

Once you have purchased your FC cables, it may be necessary to connect them to SFP transceivers. These transceivers should typically have at least 2Gbps bi-directional data links, a laser transmitter (for fiber optic cables), an LC connector, and a metal enclosure to lower the EMI.

NOTE:
LC connectors are small form-factor, fiber-optic connectors based on a 1.25-mm ceramic ferrule with the familiar latching mechanism of the RJ-45 modular plug and jack.

Other beneficial features for a typical SFP transceiver include a single power supply, low power dissipation, and hot-swap capability. It is also important that any transceiver you use meets the FC performance and reliability specifications.

NOTE:
SFP modules must be purchased separately. Please purchase the correct SFP modules from your EonStor RAID subsystem vendor/distributor.

4.1.4 Fibre Channel Topologies

The Fibre Channel Standard has been designed to support three (3) separate topologies. They are point-to-point, Fibre Channel arbitrated loop (FC-AL), and fabric switch topologies.

- **Point-to-Point**: Point-to-point topology is the simplest topology that can be used. It is a direct connection between two Fibre Channel devices.

- **FC-AL**: This is the most common topology currently in use. Fibre Channel devices are all connected in a loop. Each device is assigned an arbitrated loop physical address (AL_PA). The FC-AL supports 127 devices in a single loop.

- **Fabric**: The fabric topology supports up to 2^{24} Fibre Channel devices. This topology allows many devices to communicate at the same time. A Fibre switch is required to implement this topology.

All ES A16F subsystems support the three topologies discussed above.

4.1.5 Points of Failure

The primary concern for configuring host-side topologies is that ***points of failure*** are avoided. It is therefore recommended that the host side be connected to at least two (2) HBAs. It is also preferable to connect the FC RAID subsystems to the host computer(s) through either a FC-2G hub or a Fibre switch.

NOTE:
To create dual-redundant data paths on the host side, it is necessary for third-party failover software to be installed on the host computer.

4.1.6 DIP Switch Settings

Prior to inserting the subsystem into a storage environment, the DIP switch settings must be made. The DIP switch settings are shown in ***Figure 4- 1***.

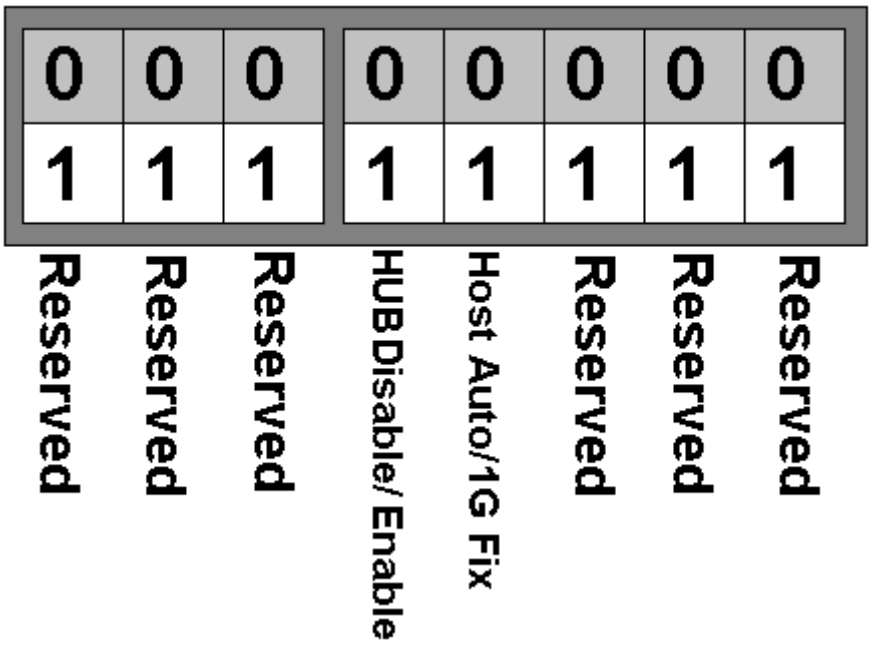


Figure 4- 1: DIP Switch

- ***Enabling the hub:*** The controller board has an onboard hub through which the host channels are routed to two (2) SFP connectors each. If the FC-CH0/FC-CH1 (OUT) SFP connectors (see ***Figure 4- 2***) are going to be connected to an external device (another subsystem), the fourth switch from the left must be enabled. The default setting of "**1**" must be retained. If these SFP ports will not be connected, the hub must be disabled. To do this, make the setting "**0.**"

- ***Host channel speed:*** For FC speed auto-detection, retain the default setting of the fifth switch from the left at "**0.**" To set the host channel speed to 1Gbps, set the switch to "**1.**"

4.1.7 Sample Topology

In the configuration shown in ***Figure 4- 2,*** two (2) ES A16F-R1211 subsystems are connected together. Each subsystem is connected to two (2) host computers and to an EonStor A16F-J1210 JBOD. JBODs expand the overall capacity of the storage network.

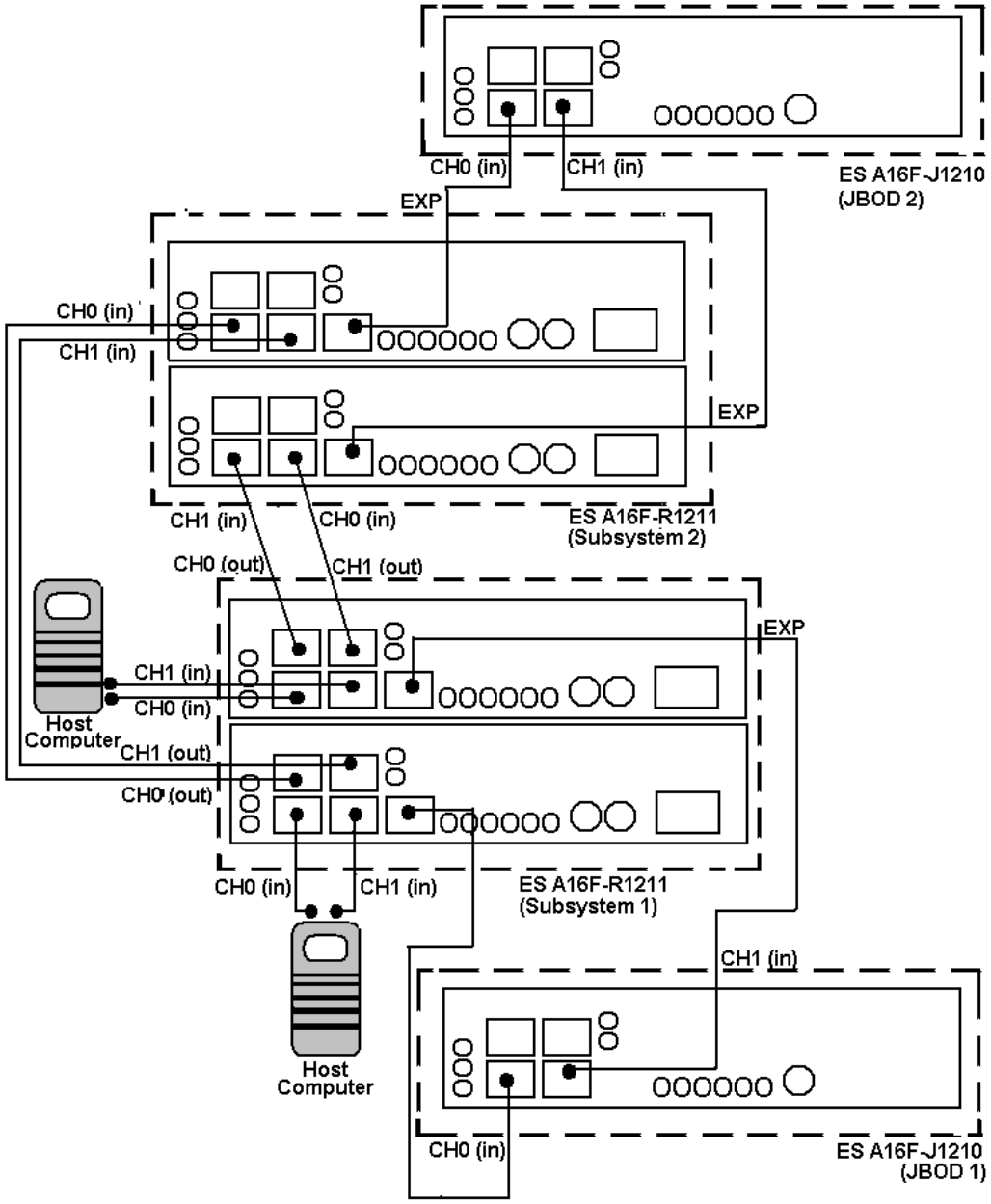


Figure 4- 2: Sample Topology Includes Four Hosts, Two ES A16F-R1211 Subsystems, and Two ES A16F-J1210 JBODs

- ***Labels:*** In ***Figure 4- 2***, the two (2) subsystems are arbitrarily labeled as ***Subsystem 1*** and ***Subsystem 2***. ***Subsystem 1*** is the subsystem at the bottom of ***Figure 4- 2*** and ***Subsystem 2*** is located directly above. ***JBOD 1*** (which is connected to ***Subsystem 1***) and ***JBOD 2*** (which is connected to ***Subsystem 2***) are arbitrary labels assigned to the two expansion JBODs featured in the example configuration shown in ***Figure 4- 2***.

- ***Connections***

- The input ports of both controller modules on ***Subsystem 1***, ***CH0 (in)*** and ***CH 1 (in)*** are connected to host computers. Notice how the input ports from each controller module are connected to the same host computer.
- ***Subsystem 1*** controller module output ports, ***CH0 (out)*** and ***CH1 (out)*** are both connected to the input ports, ***CH0 (in)*** and ***CH 1 (in)***, on ***Subsystem 2***. Note how the output ports from a single controller module on ***Subsystem 1*** are connected to the input ports on the same controller module in ***Subsystem 2***.
- ***Subsystem 2***controller module output ports, ***CH0 (out)*** and ***CH1 (out)***, are, in the topology shown above, not connected to any other subsystems. In reality, they can be connected to the input ports on another ES A16F-R subsystem.
- The expansion ports (***EXP***) from both the controller modules on each subsystem are connected to separate EonStor A16F-J1210 proprietary JBODs. The expansion ports from ***Subsystem 1*** are connected to ***JBOD 1*** and the expansion ports from ***Subsystem 2*** are connected to ***JBOD 2***.

♦ ***Full redundancy:*** In the configuration shown in In the configuration shown in ***Figure 4- 2 ,***all the components and all the data paths are completely redundant. If any of the controller modules on either subsystem fails, the alternative controller module will take over the operation of the subsystem. All the paths created between the different components are dual. If one path fails, I/O traffic will be transmitted along the alternative path. If one of the host computers fails, the second host computer that is connected to the subsystem can resume the operation of the subsystem.

♦ ***DIP switch settings:*** The subsystems and the JBODs in the example shown in ***Figure 4- 2*** each come with a DIP switch. The DIP switch can be used to enable/disable the hub and fix the speed of the host "***IN***" channels on the subsystem. DIP switch settings are discussed in ***Section 4.1.6***. For the JBOD, please refer to the documentation that came with the product.

♦ ***Further expansion***: The configuration shown in ***Figure 4- 2*** can be expanded further by adding more EonStor A16F-J1210 JBODs or ES A16F subsystems. JBODs can be connected to the ***CH0 (out)*** and ***CH1 (out)*** ports on ***JBOD 1*** and ***JBOD 2***. Additional subsystems can be connected to the ***CH0 (out)*** and ***CH1 (out)*** ports on ***Subsystem 2***.

4.2 Power On

Once all the components have been installed in the EonStor subsystem, the host channels have been connected to the host, and the expansion cables have been connected to the JBODs, the subsystem can be powered on.

4.2.1 Check List

BEFORE powering on the EonStor subsystem, please check the following:

☐ ***Memory Modules*** – Memory modules have been correctly installed on the controller boards.

☐ ***BBU Modules*** – If used, that the BBU modules have been installed correctly.

☐ ***Hard Drives –*** Hard drives have been correctly installed on the drive trays.

☐ ***Drive Trays*** – **ALL** the drive trays, whether or not they have a hard drive, have been installed into the subsystem.

☐ ***DIP Switch Settings*** – All the appropriate DIP switch settings have been made. The hub has been enabled/disabled (as required) and the speed of the host channel selected as auto-detect or fixed at 1Gbps.

☐ ***Cable Connections –*** The host ports on the subsystem have been correctly connected to a host computer.

☐ ***Power Cables –*** The power cables have been connected to the PSU modules on the subsystem and plugged into main power.

☐ ***Ambient Temperature*** – All the subsystem components have been acclimated to the surrounding temperature.

4.2.2 Power On Procedure

When powering on the EonStor subsystem, please follow these steps.

1. ***Power on the Fibre Channel connection devices.***

   These devices include the hubs, switches, and any other such device that have been connected to the ES A16F subsystem. Please refer to the manual that came with your FC device to see the power on procedure.

2. ***Power on the JBODs.***

   If the expansion ports on any of the redundant controllers have been connected to a JBOD, the JBOD must be powered up first. Please refer to the instruction manual that came with the JBOD to see its own power on procedure.

3. ***Power on the EonStor subsystem.***

   The EonStor subsystem should only be powered on after all the JBODs and Fibre Channel connection devices have been powered on first. The power on procedure for the EonStor subsystem is described below.

4. ***Power on the host computers.***

   The host computers should be the last devices that are turned on. Please refer to the manual that came with your host computers to see their own power on procedures.

4.2.3 EonStor Power On Procedure

To power on the subsystem, turn on the two power switches located on the rear panel of the subsystem. (See ***Figure 4- 3***) Each switch controls a single PSU, therefore make sure that both switches are turned on.

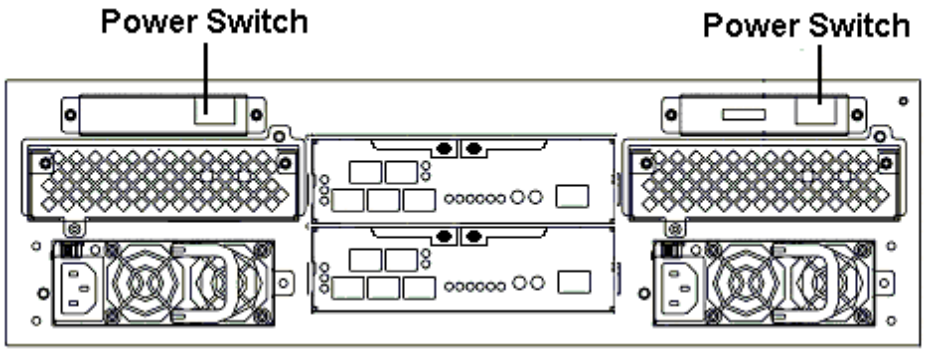


Figure 4- 3: EonStor Subsystem Power Switches

CAUTION:
Although the PSUs are redundant and a single PSU can provide sufficient power to the system, it is advisable to turn both of the power switches on. If only one PSU is operating and fails, the whole system will crash.

4.2.4 Power On Status Check

Once the ES A16F subsystem has been powered on, the status of the entire subsystem should be checked to ensure that everything is running smoothly and that there are no complications or malfunctions.

- ***Controller Module LEDs*** – The *controller ready*, *FC Host Ports Active*, and *SATA Device Ports Active* LEDs should all flash green.

- ***Drive Tray LEDs –*** The green LED for all the drive trays (that contain hard drives) should light up, showing that there is power.

- ***LCD Panel LEDs –*** The blue LED on the LCD panel should come on, indicating that power is being supplied to the system.

- ***Firmware and RAIDWatch*** – The overall status of the system may be checked using the pre-installed firmware or the RAIDWatch GUI.

- ***Audible Alarm*** **-** If any errors occur during the initialization process, the onboard alarm will sound in a hastily repeated manner.

Drive tray LEDs should normally start flashing, indicating the RAID control units are attempting to access the hard drives.

System firmware supports the configuration of a delayed sequence for starting drives. Please consult your ***Generic Operation Manual*** for more details.

NOTE:
The subsystem has been designed to run continuously. Even if a component failure occurs the fault can be corrected online.

4.2.5 LCD Screen

When powering on the subsystem, the following messages should appear on the front panel LCD screen. Wait for the front panel LCD to show "**READY**" or "**No Host LUN**" before the host boots up. Refer to ***Figure 4-4*** on how to read the screens.

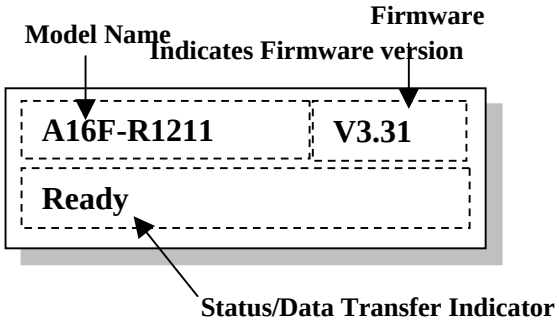
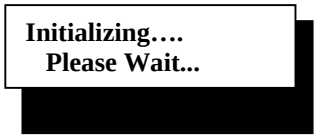
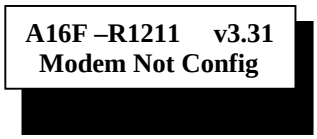


Figure 4-4: The LCD Start-up Screen

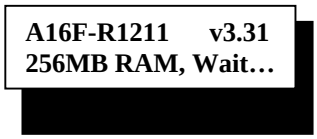
The LCD screen startup sequence is shown and described in the sequence below.

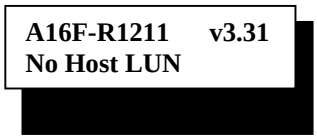


This screen appears when the PSUs are turned on.



This screen appears after the initialization process. It clearly shows the model name.





System is ready. You can now start to configure the subsystem.

4.3 Power Off Procedure

To power down the EonStor subsystem, please follow these steps:

NOTE:

When powering down the EonStor subsystem, please ensure that no time-consuming processes, like a "logical drive parity" check or a "background scrub," are running.

1. ***Stop I/O access to the system.***

   Use the software provided on the host computer to stop all I/O accesses to the EonStor subsystem. Please refer to the user manual that came with your host computer.

2. ***Disconnect the host***.

   The host must be disconnected from the subsystem. To do this, disconnect the FC cables from both the host and the EonStor subsystem.

3. ***Flush the cache.***

   Use the Shutdown Controller function to flush all cached data. This prepares the RAID subsystem to be powered down.

4. ***Turn off the power.***

   Turn off the power switches at the top of the rear panel of the EonStor RAID subsystem. Once the RAID subsystem has been powered down, other devices connected to the subsystem may be powered down.

Chapter 5
Subsystem Maintenance and Upgrading

5.1. Introducing Subsystem Maintenance and Upgrading

5.1.1 Maintenance

Constant monitoring and maintenance of your ES A16F subsystem will minimize subsystem downtime and preserve the working integrity of the system for a longer period of time. If any of the subsystem components fail, they must be replaced as soon as possible.

WARNING:

Do not remove a failed component from the subsystem until you have a replacement on hand. If you remove a failed component without replacing it, the internal airflow will be disrupted and the system will overheat causing damage to the subsystem.

All of the following components can be replaced in case of failure:

1. Controller modules – ***Section 0***
2. PSU modules – ***Section 5.3***
3. Cooling modules – ***Section 5.4***
4. Hard drives – ***Section 5.5.2***
5. MUX kits – ***Section 5.6***

5.1.2 Upgrading

The following single-upgradeable model can be upgraded to a dual-redundant controller subsystem:

From **ES A16F-S1211** to **ES A16F-R1211**

When upgrading from a single to dual-redundant model, a second controller module must be installed into the subsystem.

5.1.3 General Notes on Component Replacement

- With the exception of the RAID controller module on the ES A16F-S1211 model, all of the components on the ES subsystem, including the PSU modules, cooling modules, and drive trays, are hot-swappable and can be changed while the subsystem is still in operation

- Qualified engineers who are familiar with the ES A16F subsystem should be the only ones who make component replacements. If you are not familiar with the ES subsystem and/or with RAID subsystem maintenance in general, it is strongly advised that you refer ES subsystem maintenance to a suitably qualified maintenance engineer.

- Normalized airflow is directly dependent upon the presence of all subsystem components. Even if a subsystem component fails, it should not be removed from the subsystem until a replacement is readily at hand and can be quickly installed. Removing a subsystem component without replacing it can lead to permanent subsystem damage.

- When replacing any hot-swappable component, caution should be taken to ensure that the components are handled in an appropriate manner. The rough or improper handling of components can lead to irreparable damage.

- When removing a controller module from the subsystem, ensure that the power has been turned off and that all precautionary measures, without exception, are adhered to. The controller board is very sensitive and can be easily damaged.

5.2. Replacing Controller Module Components

5.2.1 Overview

The controller module consists of the components shown below:

Component	Maintenance Procedures
DIMM Module	The DIMM module must be replaced when the DIMM module fails or if a larger capacity DIMM module is required.
BBU Module	The BBU can be installed after the initial installation procedure or replaced if a previously installed BBU module is damaged and fails.
Controller Module	If the controller module in a single controller model fails, it is necessary to power the system down and replace the controller. If a controller module in a dual-redundant model fails, the controller can be replaced while the system remains online.

5.2.2 Notes on Controller Module Maintenance

- The controller module contains a DIMM module and a BBU module. When replacing the controller module, these components can be removed and used on the new controller module if they are undamaged.

- When replacing the controller module, you must remember that the controller board is one of the most sensitive components in the ES A16F subsystem. All previously stipulated safety precautions (see ***Chapter 2***) must be strictly adhered to. Failure to adhere to these precautions can result in permanent damage to the controller board, resulting in timely delays.

- For your own safety and that of the subsystem, make sure that no power is being supplied to the system prior to replacing the controller module.

5.2.3 Removing the Controller Module

To remove the controller module:

Step 1. If you have a ***single controller model***, the subsystem must be either ***powered off*** (if possible) or, in case of controller module failure, ***turned off***. If you have a ***redundant controller module,*** then the system can continue to operate with only a single controller module and does not have to be powered down.

Step 2. ***Disconnect all cables*** that are connected to the controller module you wish to replace. These include the cables connecting to the host, FC cables connected to the expansion port (for the redundant models), Ethernet cables connected to the LAN port, and any cables connected to the RS-232C audio jacks.

Step 3. Once all the cables have been disconnected, ***loosen the silver hand screws*** that secure the ejector handles to the controller module. (See ***Figure 5-1***)

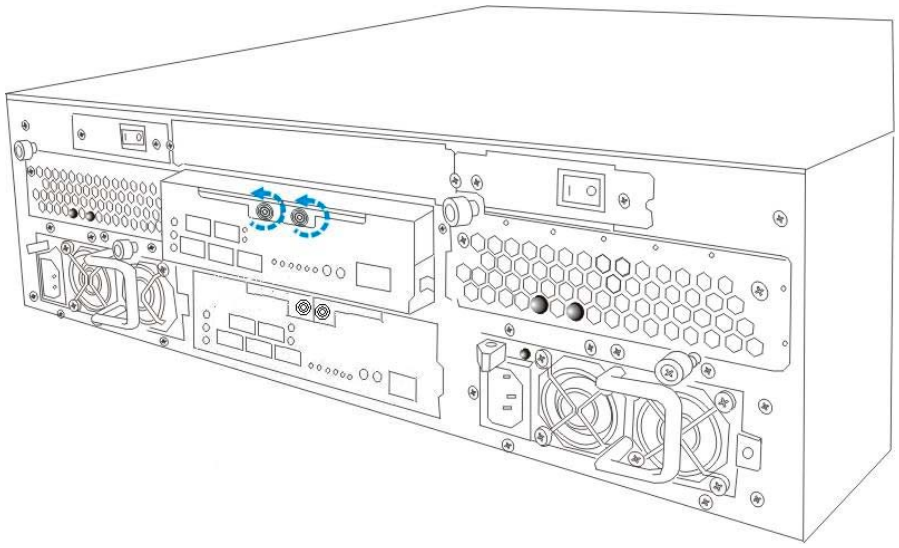


Figure 5-1: Remove the Retention Screws.

Step 4. After both these screws have been loosened, gently ***open the ejector handles***. When the ejector handles are opened, the controller module will automatically be eased out of the controller module bay in the subsystem. (See ***Figure 5-2***)

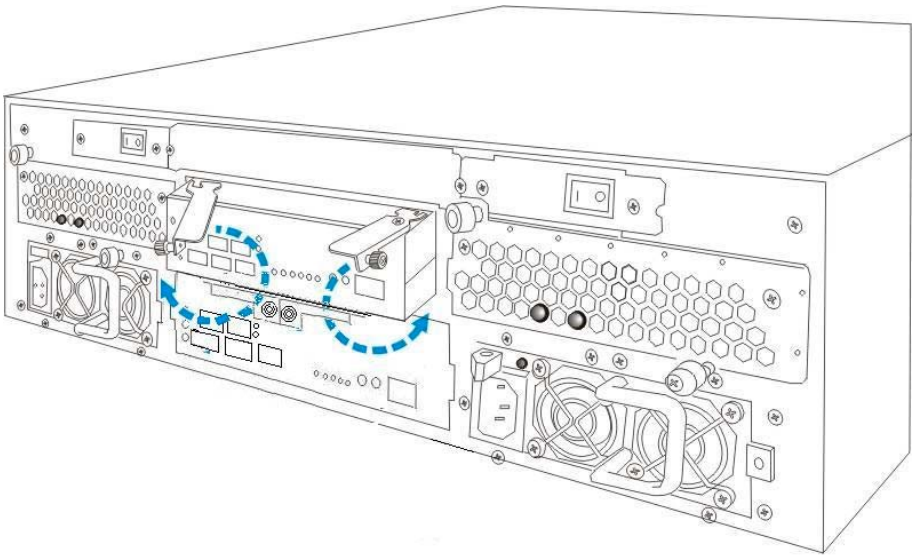


Figure 5-2: Open the Ejector Handles.

Step 5. Carefully pull the controller module out of the subsystem chassis. (See ***Figure 5-3***)

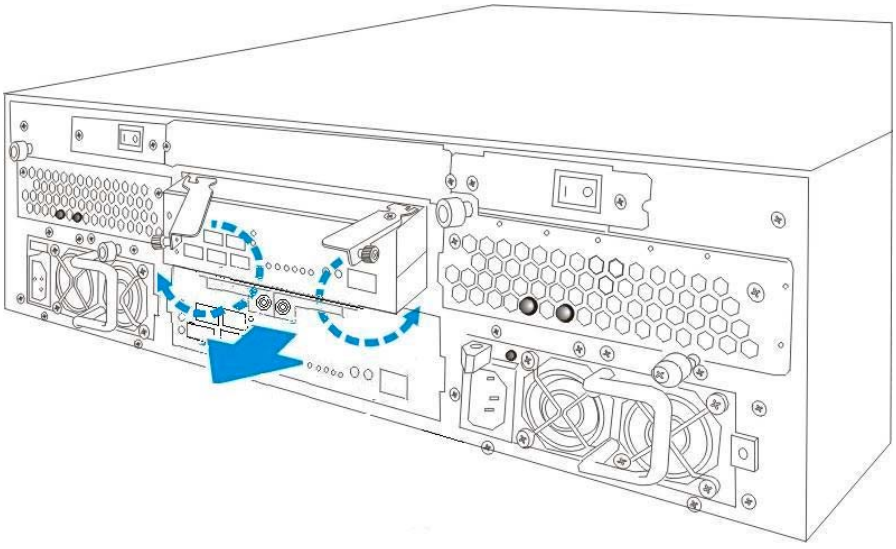


Figure 5-3: Gently Slide the Controller Out of the Chassis

5.2.4 Replacing the BBU

NOTE: *When replacing a BBU in a single controller model, the whole subsystem needs to be powered down. Therefore, when replacing a failed BBU, you should carefully select the time at which the replacement is made to minimize the overall disruption to the service.*

To replace a BBU module, please follow these steps:

Step 1. Remove the controller module from the ES subsystem. (See ***Section 5.2.2***)

Step 2. After the controller module has been removed from the subsystem, ***disconnect the BBU cable*** from the connector on the side of the controller board. (See ***Figure 5-4***)

Step 3. After the cable has been disconnected***, remove the retention screws*** from the arms of the BBU. These retention screws are attached to spacers that are connected to the BBU board. (See ***Figure 5-4***)

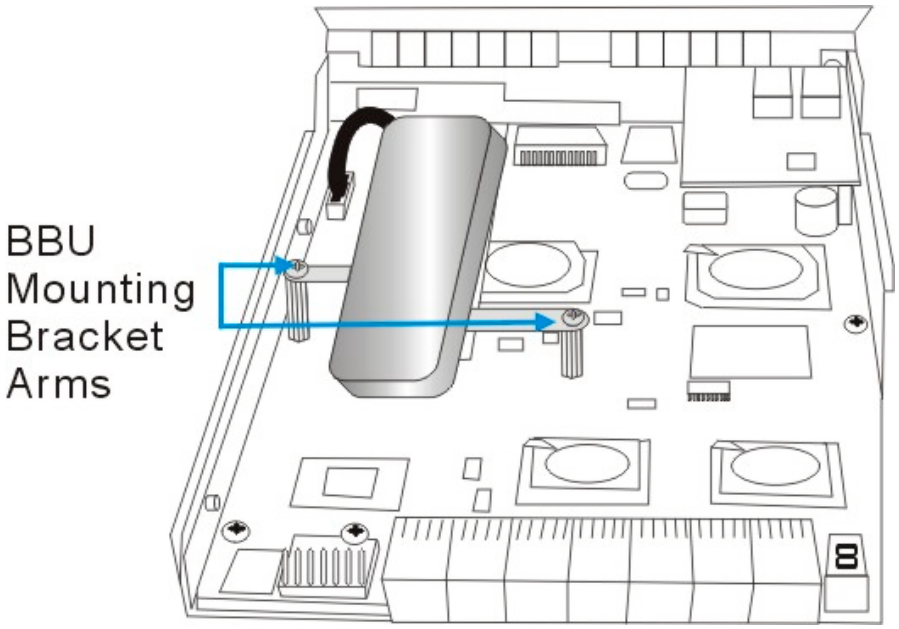


Figure 5-4: Disconnect BBU Connector and Remove BBU Retention Screws

Step 4. Once the failed BBU has been removed from the controller module, re-install the new BBU. To do this, mount the BBU correctly on the pre-installed spacers on the controller board, re-insert the retention screws to secure the BBU to the controller board, and reconnect the BBU module to the connector at the rear of the controller board.

5.2.5 DIMM Module Replacement

If a DIMM module fails or a DIMM module with a higher memory capacity is required, the onboard DIMM module must be replaced.

- ***Failed DIMM module***: If a DIMM module in a single-upgradeable model has failed, prior to removing the controller module turn off both PSU modules and disconnect all the cables connected to the controller.

- ***DIMM module replacement***: If a DIMM module is going to be replaced in a single-upgradeable model, prior to removing the controller module, make sure that the subsystem is correctly powered down and disconnect all the cables connected to the controller.

- ***Dual-redundant model DIMM replacement/failure***: If the DIMM module on a dual-redundant model has failed or is going to be replaced, the subsystem can be kept online. When replacing the DIMM module, be sure to use a module of the SAME SPEED and SIZE as the one already installed in the subsystem.

  NOTE: *When replacing a DIMM, the whole subsystem needs to be powered down. Therefore, when replacing a DIMM, you should carefully select the time when the replacement will be made to minimize the overall disruption to service.*

- ***Replacing the DIMM module:*** For complete illustrated instructions on how to replace a DIMM module, refer to ***Chapter 2***, ***Section 2.6***.

5.2.6 Replacing the Controller Module

If the controller module has failed, it must be replaced. To replace a failed controller module:

Step 1. Remove the controller module from the EonStor subsystem (see ***Section 5.2.2***), the BBU module (if it was installed, see ***Section 5.2.4)***, and the DIMM module. (See ***Section 5.2.5***)

Step 2. After these three items have been removed, ***install the DIMM module and the BBU module*** onto the new controller module.

Step 3. Once the DIMM module and the optional BBU module have been installed on the new controller module, ***install the new controller module*** into the ES subsystem. (See ***Section 2.7***)

Step 4. ***Re-attach all the cables*** that were removed. These include the cables that connect to the host, FC cables connected to the expansion port (redundant models only), the Ethernet cable that was previously attached to the LAN port, and any cables that were attached to the RS-232C audio jacks.

Step 5. If you are using a single controller module, ***power up*** the system.

5.3. Replacing a Failed PSU Module

5.3.1 Notes on PSU Module Maintenance

- ***Two redundant PSU modules***: The ES comes with two fully redundant, hot-swappable PSU modules. These modules are located at the rear of the subsystem.

- ***Immediate replacement***: When a PSU fails, it should ideally be replaced immediately. Do not remove the PSU module unless a replacement is readily available. Removing a PSU without a replacement will cause severe disruptions to the internal airflow and the subsystem will overheat, possibly causing irreparable damage to some of the subsystem components.

WARNING:

Although the PSU modules are fully redundant, it is not advisable to run the EonStor subsystem with a single PSU module for a long period of time. If the second PSU module fails, the subsystem will be shut down.

5.3.2 Replacing the PSU Module

To replace a PSU, please follow these steps:

Step 1. ***Turn off the PSU***. The power switch is located at the top of the rear panel, directly above the PSU module. (See ***Figure 5-5***)

Step 2. Once the power switch has been turned off, ***remove the power cable*** that connects the EonStor subsystem to the main power. The power cable socket is found on the left-hand side.

Step 3. After the power cable has been removed from the socket, ***remove the retention screw*** on the right-hand side of the PSU. (See ***Figure 5-5***.)

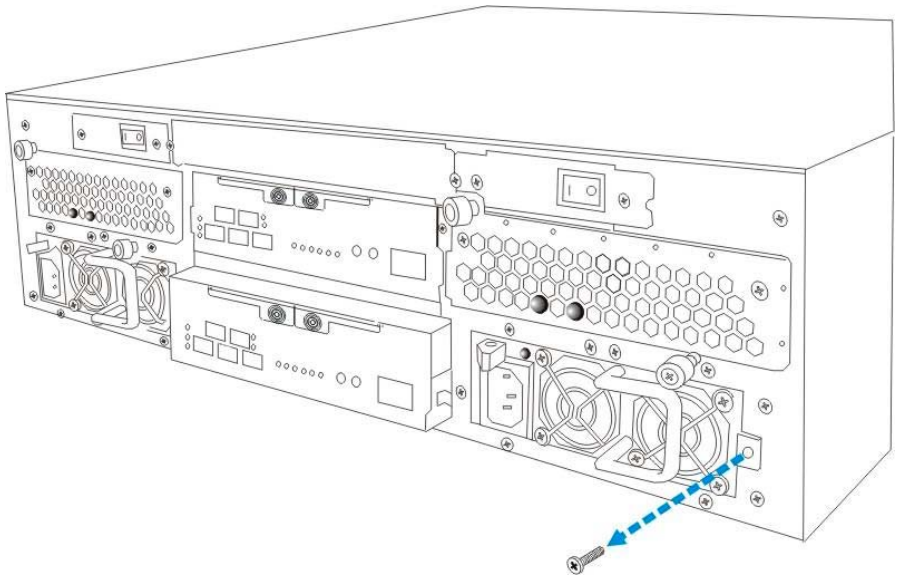


Figure 5-5: Removing the PSU Retention Screw

Step 4. Locate the clip at the top left-hand corner of the PSU. This clip secures the PSU into the subsystem enclosure. To remove the PSU, ***push this clip towards the right***. (See ***Figure 5-6***)

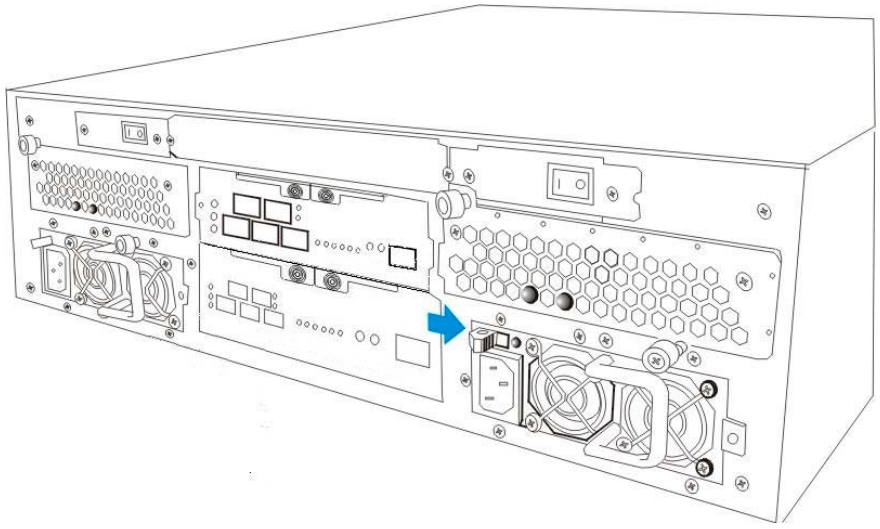


Figure 5-6: Dislodging the PSU

Step 5. After the PSU module has been dislodged from the enclosure, use the handle at the rear of the PSU to ***gently pull the PSU module out of the enclosure***. (See ***Figure 5-7***)

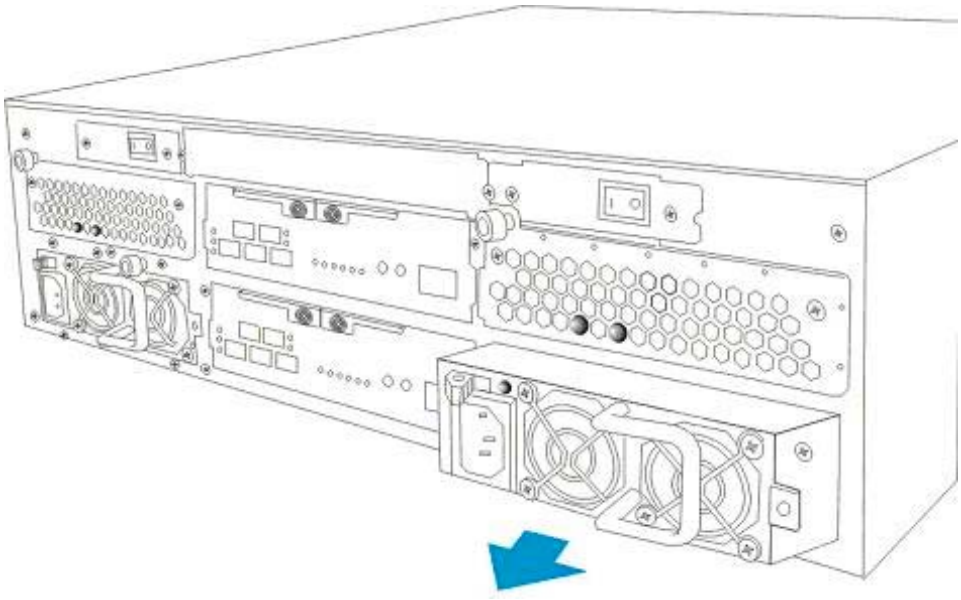


Figure 5-7: Removing the PSU from the Subsystem

Step 6. Once the faulty PSU has been removed, ***insert the new PSU module*** into the subsystem. Push the PSU into the slot until it clicks into place. To firmly secure the PSU into place, reinsert the retention screw. Replace the power cable that connects the PSU module to the main power. Turn the PSU module on.

5.4. Cooling Module Maintenance

5.4.1 Notes on Cooling Module Maintenance

WARNING:
The latches at the back of the cooling module secure the cooling fan module into the enclosure. If these latches are broken, the warranty on the cooling fan module will be void.

- ***Two redundant cooling modules***: The ES subsystem is equipped with two redundant, hot-swappable, dual-fan cooling modules located above the PSU modules. These cooling modules control the internal operational temperature of the subsystem and therefore their working integrity should be maintained at all times.

- ***Detecting a failed cooling fan module***: If a cooling module fails, you can choose to be notified of the failure by the LED located at the back of the module, an audible alarm, the firmware, the RAIDWatch Panel View, or the NPC.

- ***Replacing a cooling module***: When you are notified that a cooling module has failed, it should be replaced as soon as possible. A failed cooling module should only

be removed from the subsystem when you have a replacement module that can be installed as soon as the failed cooling module has been removed.

WARNING:

Although the cooling fan modules are fully redundant, it is not advisable to run the EonStor subsystem with a single cooling module for a long period of time. If the second cooling module fails, the system is at risk of sustaining irreparable damage.

5.4.2 Replacing a Cooling Module

To replace a cooling module, please follow these instructions:

Step 1. Two (2) retention screws secure the cooling module to the EonStor subsystem. The first retention screw is at the top on the right, and the second screw is at the bottom on the left. ***Remove these retention screws***.

Step 2. Once **BOTH** retention screws have been removed, gently pull the cooling module out of the EonStor subsystem enclosure. (See ***Figure 5-8***)

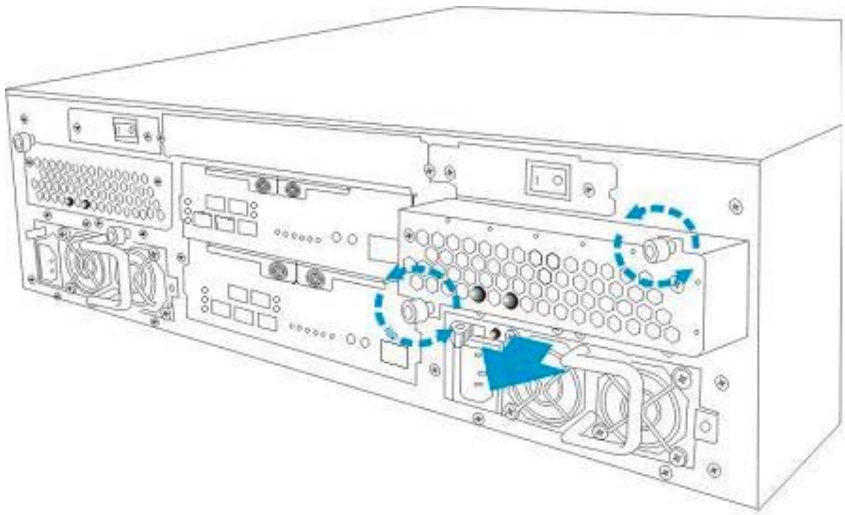


Figure 5-8: Removing the Cooling Module Retention Screws

Step 3. Once the damaged/broken cooling module has been removed, gently slide the new cooling module into the EonStor chassis. Re-insert both retention screws that were previously removed.

5.5. Drive Tray Maintenance

5.5.1 Notes on Hard Drive Maintenance

- ***Hot-swappable drive trays***: The drive trays are all hot-swappable. If a hard drive fails, it can be replaced while the subsystem is still running.

- ***Remove drives slowly***: When removing a drive tray, withdraw it from the enclosure slowly. If the drive tray is removed too quickly a drive I/O timeout will occur.

- ***Open flap***: Once the flap on the drive tray has been opened, the drive tray must be removed from the subsystem. Failure to remove the drive tray from the subsystem after the flap has been opened will result in Data Compare Errors.

- ***Replacement on-hand***: Before removing a failed hard drive from the subsystem, make sure you have a replacement hard drive readily available. Do not leave the drive tray slot open for an extended period of time. If the drive tray slot is left unoccupied for an extended period of time, the normalized airflow will be disrupted and subsystem components will overheat and may become permanently damaged.

5.5.2 Hard Drive Replacement

When a hard drives fails, it needs to be replaced. To replace a hard drive, please follow these steps:

Step 1. ***Remove the drive bay*** from the ES A16F enclosure. To remove the drive bay from the enclosure, the key-lock must be unlocked. To do this, turn the silver key-lock on the front of the drive tray until the groove on its face is in a horizontal orientation.

Step 2. Once the key-lock is unlocked, ***open the front flap*** by lifting up the latch at the front of the drive tray. This will dislodge the hard drive from the enclosure and the hard drive can be carefully withdrawn.

Step 3. ***Remove the retention screws*** on the sides of the drive tray from the hard drive and then remove the hard-drive from the drive tray.

Step 4. Once the hard drive has been removed from the drive tray, ***disconnect the drive*** from the MUX kit.

Step 5. Install the new hard drive. Please refer to the complete hard drive installation procedure in Chapter 2.

5.6. Replacing a MUX Kit

If a MUX kit is damaged or broken, it needs to be replaced. To replace a MUX kit, please follow these instructions:

Step 1. **Remove the drive tray** from the drive bay in the subsystem.

Step 2. After the drive tray has been removed, **remove the hard drive from the drive tray**.

Step 3. After the hard drive has been removed, ***turn the drive tray over*** and ***remove the retention screws*** that hold the MUX kit in place. For SATA-to-SATA MUX kit replacement, see ***Figure 5-9***; for SATA-to-PATA MUX kit replacement, see ***Figure 5-10***.

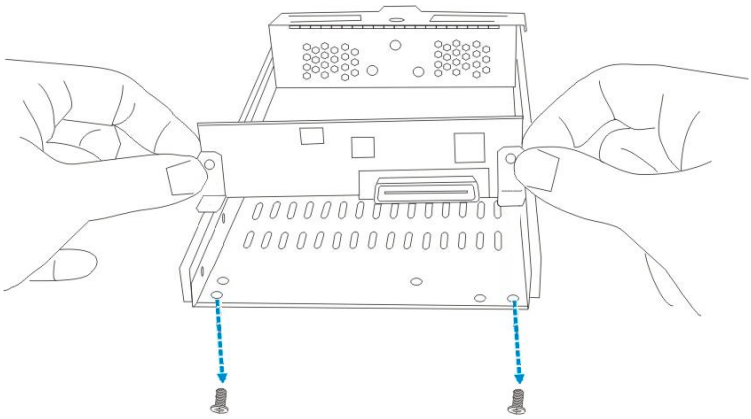


Figure 5-9: Replacing a SATA-to-SATA MUX Kit

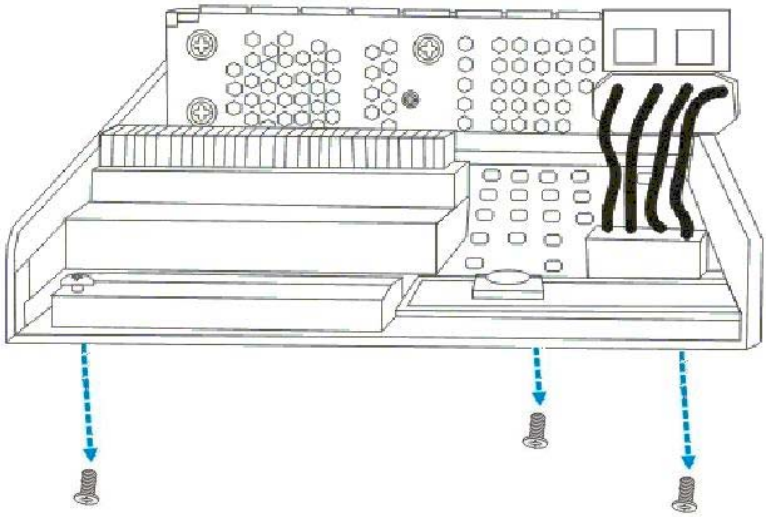


Figure 5-10: Replacing a SATA-to-PATA MUX Kit

Step 4. Once the retention screws have been removed, re-install the new MUX kit using the instructions given in ***Chapter 2***.

Step 5. Once the new MUX kit has been installed on the drive tray***, re-install the hard drive***.

Step 6. After the hard drive has been placed in the drive tray, ***re-insert the drive tray*** in to the ES A16F subsystem.

5.7. Subsystem Upgrade

The ES A16F-S can be upgraded from a single controller to a dual-redundant RAID subsystem. To upgrade the subsystem, you must purchase a controller module and install it into the ES subsystem.

5.7.1 Notes on Upgrading

- ***Hot install***: It is possible to install the new controller module without powering down the subsystem.

- ***Firmware***: Please ensure that the firmware version on the second controller is the same as the version on the currently installed controller. For further information on firmware versions and configurations, please refer to the ***Generic Operation Manual*** on the CD that came with the subsystem or the technical support division in your company.

- ***DIMM module***: The DIMM module installed on the controller module must be identical in speed and size to the DIMM module already installed on the operational controller module.

- ***MUX kits***: When upgrading from a single to a dual-redundant controller model, the MUX kits on the drive trays must be changed from the IFT-9270AN1S1S to the IFT-9270AN2S1S SATA-to-SATA MUX kits.

5.7.2 Installing the Second Controller Module

Step 1. ***Replace the MUX kits***. Before installing the new controller into the subsystem, the MUX kits on the drive trays must be replaced. To do this, please refer to ***Section 5.6***.

Step 2. ***Install a DIMM module***. If the controller module does not have a pre-installed DIMM module, a DIMM module that has the same speed and size as the DIMM module on the operational controller module must be installed. For complete instructions on how to install the DIMM module, please refer to ***Chapter 2***.

Step 3. ***Remove the metal plate retention screws***. In the single-upgradeable models, a metal sheet is placed over the second controller bay and must be removed. To remove the sheet, remove the two (2) retention screws that secure the sheet to the chassis. (See ***Figure 5-11***)

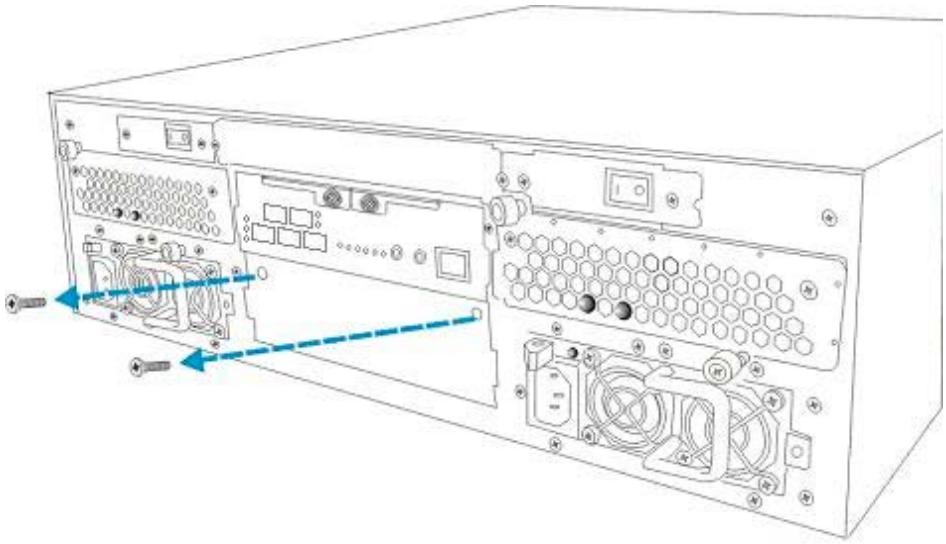


Figure 5-11: Remove the Metal Sheet Retention Screws

Step 4. ***Remove the metal sheet***. After the retention screws have been removed from the subsystem, removed the metal sheet from the controller bay. (See ***Figure 5-12***)

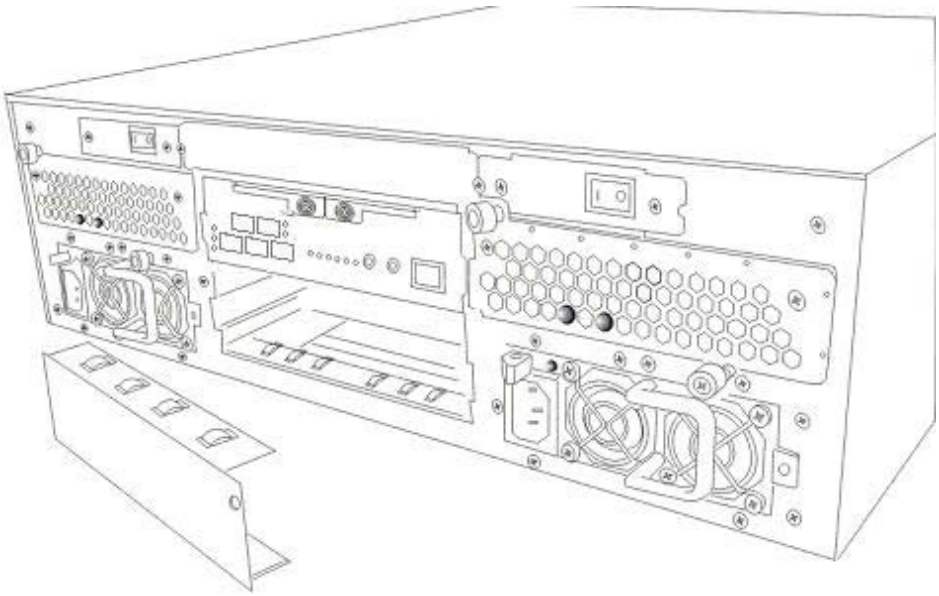


Figure 5-12: Remove the Metal Sheet

Step 5. ***Insert the new controller module***. After the metal sheet has been removed from the front of the lower controller bay, install the new controller module. Controller module installation is described in ***Chapter 2***. Please refer to ***Section 2.7*** for complete installation instructions.

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Appendix A
Subsystem Features

A.1. Flexible Configuration Options

A.1.1 Single and Redundant Models

The ES series described in this manual comes as a single or redundant RAID subsystem. The controller modules come with five (5) SFP connectors: four (4) SFP connectors are pre-set as host channels; the fifth SFP connector is used for system expansion.

A.1.2 Rear Panel Variations

The rear panels of the single and redundant controller modules do not look the same. For the single controller model, a pre-attached sheet covers the location where the second controller module would be in the redundant model. This sheet should not be removed unless a system upgrade is being done as the sheet normalizes the internal airflow and keeps the system properly ventilated.

NOTE:
If the metal sheet covering the second controller module bay in the single controller model is removed, the subsystem may sustain irreparable damage.

A.1.3 Fibre Channel Configuration

All ES RAID subsystems come with two (2) FC-2G host channels. The redundant models also come with an FC-2G expansion port.

The host channels support point-to-point, Fibre switch, and Fibre Channel arbitrated loop (FC-AL) connectivity, and can therefore connect to the Host Bus Adapter (HBA) through either a hub or a fabric switch.

A.2. Redundant Features

A.2.1 Dual-active Redundant Controllers

The RAID controllers in the EonStor subsystem can be configured in a dual-active redundant mode. If one controller fails, the other controller will automatically take over the workload of the failed controller and manage the entire storage system. Both the cache writes and configuration data are fully synchronized. Failover and failback operations are completely transparent to the host and I/Os are moved between the controllers without any user intervention.

A.2.2 Redundant Data Paths

Dual data paths can be connected to the HBA from the EonStor RAID subsystem. If one data path fails, the data can be transmitted through the alternative data path. Full host-side redundancy can be achieved if two host channels are connected to two separate HBAs and then to the host computer.

A.3. Fault Tolerance

A.3.1 Intelligent Drive Handling

Hard drives can fail and bad blocks may occur simultaneously on two member drives of an array. The occurrence of bad blocks on more than one drive can cause loss of data. To prevent data loss, two options can be implemented: "Media Scan" and "Bad Block Handling in Degrade Mode."

Media Scan can be performed regularly to examine drives and, if any bad blocks are found during the process, data can be reconstructed onto good sectors automatically.

If bad blocks are encountered on yet another drive during the rebuild process, the block LBA (Logical Block Address) of those bad blocks will be shown and the rebuild process of the unaffected sectors will continue, salvaging most of your precious data.

Intelligent drive handling will occur in both the degraded mode and during the rebuild process. Optional write-verify for normal writes, rebuild writes, and LD initialization is also available. Further low quality drive handling comes in the transparent resetting of unresponsive hard drives. Power-failure management and bad-drive handling during LD expansion provide further data security..

A.3.2 UPS Support

The addition of a second RS-232C (audio jack) serial port (**COM2**) facilitates the connection of the subsystem to a UPS. UPS is a battery backup connected directly to the main power and to the subsystem power cables. The COM2 port is also connected to the UPS, and UPS status signals are transmitted through the COM2 serial port to the controller module. If the main power is interrupted in any way, the UPS unit (depending on its size) will ensure the uninterrupted running of the subsystem. UPS support is fully described in ***Appendix B***.

A.3.3 Hot-swappable Active Components

All the active components, including the controller modules, power supply units (PSU), battery back up units (BBU), and hard drives, are hot-swappable. If any of these components fail, they can be replaced without turning off the system or disrupting its smooth operation.

A.3.4 Global and Local Spares

Both Global and Local (dedicated) spares are supported. The controller(s) will automatically disconnect from a failed drive and start to rebuild data on the spare drive. The spare drive will then replace the failed drive.

A.3.5 Hot-swapping of Drives

A failed drive in the EonStor subsystem can be exchanged without turning off the system or interrupting its smooth operation. Once the failed drive is replaced, the data will be rebuilt in the background. Hot-swapping is supported through the automatic disconnection from a failed drive and the detection of a reserve drive. All these failure recovery procedures are completely transparent to the host.

A.3.6 S.M.A.R.T. Support

S.M.A.R.T (Self Monitoring Analysis and Reporting Technology) is supported with configurable reaction schemes. You may select different reaction schemes for immediate prevention against S.M.A.R.T.-detected errors. Available options include: detect only, clone and replace, and perpetual clone. A faulty drive can be cloned to an active spare upon the discovery of errors.

A.3.7 Other Fault Tolerant Features

Other comprehensive failure management features on the EonStor RAID subsystem include:

- Automatic bad-block assignment
- Background rebuilding
- Verify-after-write support on normal writes, rebuild writes, and/or RAID initialization writes
- Regeneration of parity of logical drives in the background
- Auto change cache policy to force the cache policy to change from write-back to write-through when a warning occurs
- Auto shutdown of the controller when the controller starts to overheat

A.4. SAN Features

A.4.1 Logical Unit Numbers

Up to 1024 Logical Unit Numbers (LUNs) are supported. Each LUN can be mapped to a logical unit (drive or volume). The LUN provides the logical unit with a unique signifier which enables the controllers to identify it.

A.4.2 LUN Masking

The RAID controllers in the EonStor subsystem support LUN masking, so that a specific LUN can be uniquely assigned to a specific host. The host will then only be able to access the LUNs which are assigned to it, and all the other LUNs will be hidden.

A.5. Mechanical Features

A.5.1 Modular Design

The modular design of the EonStor subsystems simplifies the installation process and makes these systems easy to maintain and replace.

A.5.2 Cableless Design

All the active components are cableless, which simplifies the system installation.

Appendix B
Uninterruptible Power Supply

B.1. Uninterruptible Power Supply Overview

An uninterruptible power supply (UPS) is a separately purchased battery backup unit that is connected to an Infortrend subsystem. If the UPS is sufficiently large, it can be used to power the whole subsystem in the event of an AC power failure.

B.2. Compatible UPS Supplies

The APC SMART UPS series is compatible with the EonStor subsystems.

B.3. Serial Communication Cables

Part Number: IFT-9270CUPSCab-0030

The ES A16F-R1211 is shipped with two (2) customized audio jack-to-DB9 serial communication cables. These cables are used to connect the controller modules on a subsystem to a PC hyperterminal for subsystem management. If you wish to use a UPS with your subsystem, two (2) additional audio jack-to-DB9 serial communication cables (see ***Figure B-1***) must be purchased.

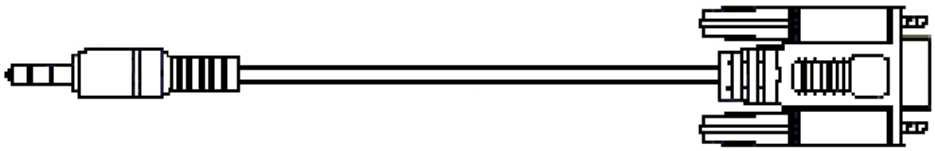

Figure B-1: Audio Jack-to-DB9 Serial Communication Cable

CAUTION:
The pin outs on the audio jack-to-DB9 serial cable used to connect to the UPS are different from the pin outs on the serial cables that were shipped with the subsystem. When connecting the UPS device, please be sure to use the correct cable.

B.4. Connecting the UPS to the Subsystem

B.4.1 Connect the PSU Module Power Cords

The two (2) power cords shipped with the subsystem must be plugged into the power cord sockets in the rear of the PSU modules. The plug at the other end of the power cable must be inserted into a socket on the UPS. (See ***Figure B-2***) Please refer to the UPS manual to determine the location of these sockets. The UPS must then be connected to main power.

B.4.2 Set the Baud Rate

The default baud rate for the COM 2 serial port is 38400 and must be changed to 2400. To see how to change the baud rate, please refer to the ***Generic Operation Manual*** that came with the subsystem.

B.4.3 Connect COM2

The separately purchased audio jack-to-DB9 serial cables are used to connect the COM2 ports on the controller modules to the UPS directly. (See ***Figure B-2*** and ***Figure B-3***) These cables are used to transmit UPS status updates to the controller modules and will in turn determine the write policy of the controller module. To connect the serial communication cable to the subsystem controller, insert the audio jack connector on one end of the cable into the COM2 port on the controller module. To see how to connect the DB9 connector to the UPS, please refer to the documentation that came with your UPS.

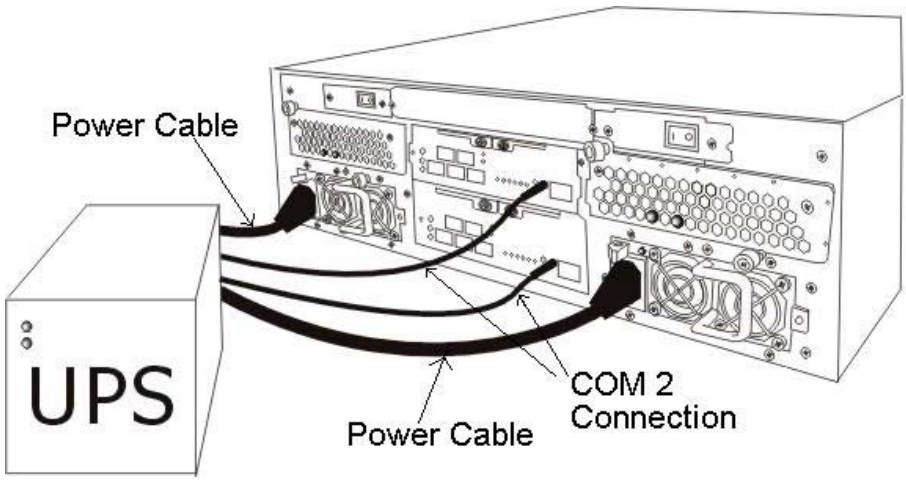

Figure B-2: Connecting the UPS to the ES A16F-R1211 Subsystem

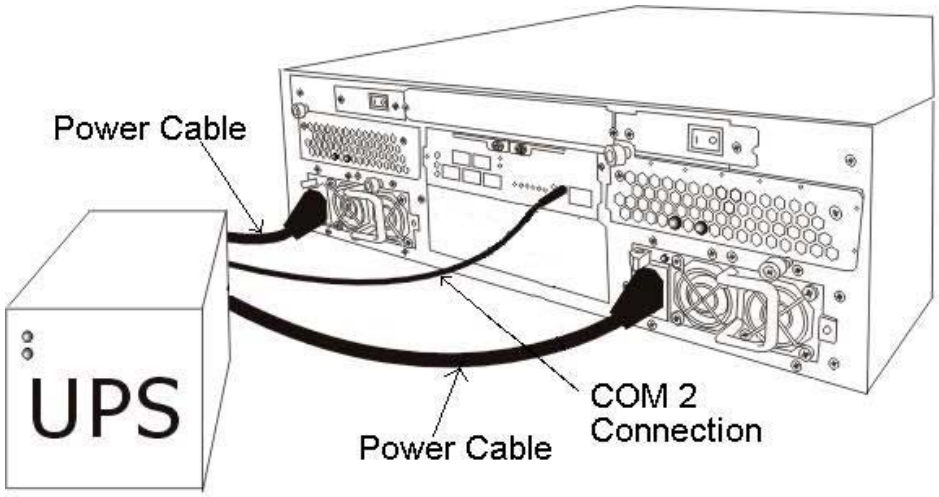

Figure B-3: Connecting the UPS to the ES A16F-S1211 Subsystem

B.5. Power On

When powering on the subsystem, the UPS must be powered on before the subsystem. To see how to power on the UPS, please refer to the documentation that came with your UPS. Note that the power on sequence described in ***Chapter 4*** will be altered. The power on sequence when a UPS is connected is shown below:

Step 1. Power on Fibre Channel connection devices (including hubs and switches).

Step 2. Power on any expansion JBODs connected to the subsystem.

Step 3. Power on the UPS.

Step 4. Power on the ES A16F-R1211 subsystem.

Step 5. Power on the host computers.

Step 6. Trigger the firmware to allow the subsystem to detect the UPS. To see how to do this please, refer to the ***Generic Operation Manual*** that came with the subsystem.

NOTE:

A UPS can be connected to the subsystem after the subsystem has been powered on, but you will have to trigger the firmware to allow the subsystem to detect the UPS.

B.6. UPS Status Monitoring

If a UPS has been correctly connected to the subsystem, the status of the UPS will be constantly monitored by the controller through the COM2 (audio jack) serial port. The status of the UPS will determine the controller's write policy, and messages that appear on the LCD panel and other monitoring devices will keep you informed of the UPS status.

B.6.1 Normal Operational Status

If the UPS has been connected to main power and the UPS battery power level is above 50%, then no status messages will appear and the default "Write Back" write policy will be implemented by the controller.

B.6.2 UPS Messages

The following messages may appear on the LCD screen:

Message 1: "*UPS connection is absent*"

This message appears when COM2 has not been connected to the UPS.

Message 2: "*UPS connection detected*"

This message appears when the COM2 ports on the subsystem have been connected to the UPS.

Message 3: "*Warning: UPS AC Power-Loss detected*"

This message appears when the UPS battery power level remains above 50% but its connection to the AC power supply has been disrupted in some way. The write policy changes from write back to write through.

Message 4: "*Warning: UPS Battery Low 50%. Please shut down to protect data loss*"

This message appears when the UPS battery power level has dipped below 50% of its capacity and the UPS has either been disconnected from the AC power supply or the AC power supply has been disrupted. The write policy will be changed from the default write back to write through. If this message appears, the subsystem should be properly shut down to avoid data loss.

Message 5: "*Warning: UPS Battery Low 50%*"

This message appears when the UPS battery power level has dipped below 50% of its capacity. The default write policy will be changed from the default write back to write through.

Message 6: "*UPS Battery restored to safe level*"

This message appears when the UPS battery power level has been restored to above 50% of its capacity. The write policy will be changed from write through to write back.

Message 7: "*UPS AC Power Restored*"

This message appears when the AC power supply to the UPS has been reconnected. If the UPS battery power level is below 50%, the write policy will remain as write through. If the battery power level is above 50%, the write policy will change from write through to write back.

B.6.3 UPS Message Summary

The table below (***Table B-1***) summarizes the UPS messages described above. It is important that you become familiar with these messages and their meanings to help maintain the integrity of the data running through your subsystem.

Message	AC Power	Battery Power Level (BPL)	Write Policy Status
UPS connection is absent	N/A	N/A	Write back
UPS connection detected	N/A	N/A	Write back
Warning: UPS AC Power-Loss detected	Disconnected	BPL > 50%	Write through
Warning: UPS Battery Low 50%. Please shut down to protect data loss	Disconnected	BPL < 50%	Write through
Warning: UPS Battery Low 50%.	Connected	BPL < 50%	Write through
UPS AC Power Restored	Reconnected	BPL > 50%	Write back
UPS AC Power Restored	Reconnected	BPL < 50%	Write through
UPS Battery restored to safe level	Reconnected	BPL > 50%	Write back

Table B-1: UPS Status Messages

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Appendix C Specifications

C.1. Technical Specifications

Environmental Specifications	
Humidity	5 ~ 95% (non condensing)
Temperature	*Operating*: 0º to 40ºC *Non-operating*: -20º to 60ºC
Altitude	*Operating*: 12,000 ft *Packaging*: 20,000 ft

Power Requirements	
Input Voltage	90VAC @ 8AC 260VAC @ 4AC with PFC (auto-switching)
Frequency	47-63Hz
Power Consumption	460W

Dimensions	
Height	131mm
Width	447mm
Length	500mm
EMI/EMC	
• FCC Class-A • CE • UL	

Safety Requirements
• UL60950

Shock	
Half-sine	*Operating:* 10G peak, 11ms duration *Non-operating:* 100G, 180 in/sec 240G, 2ms, half-sine
Square	240G, 2ms, half-sine

Vibration	
Operating	5~500Hz, 0.5G, X/Y/Z
Non-operating	5~500Hz, 1.5G, X/Y/Z

Warning Alarms
• Audible alarms • System LEDs • Event notification via the RAIDWatch Manager

C.2. Controller Specifications

C.2.1 Configuration

Specification	
RAID Levels	0, 1(0 + 1), 3, 5, 10, 30, 50, JBOD, and non-RAID disk spanning
Host O/S Compatibility	Host O/S independent
Host Interface	2GB FC
Host Channels	Pre-configured host channels
Drive Interface	Supports up to 16 channels of 1.5GB SATA
Drive Channels	All drive channels are pre-set and cannot be changed
Cache Mode	Write-through or write-back
Cache Memory	Up to 1GB SDRAM with/without ECC, non-register
Number of LUNs	Up to 32 per Fibre ID
Multiple Target IDs/Host Channel	Yes
Aliases for Target IDs	Yes
Firmware on Flash Memory	Yes
Drive Hot-swapping	Yes
Controller Hot-swapping	Yes (redundant controller models only)

C.2.2 Architecture

Specification	
Dimensions	255mm (L) x 142mm (W)
CPU	400MHz PowerPC 750Cxe
Fibre Controllers	QLogic ISP2312
DIMM Slot	One 168-pin DIMM module
PC-133 Support	Yes
ASIC	Infortrend 64-bit chipset
Flash ROM	32Mbit (4MB)
NVRAM	32Kb with RTC
Hardware XOR	Yes
I/O Channel Bandwidth	1-2GB/second
Real-time Clock	For event messages with time record

C.2.3 Environmental Specifications

Specification	
Input Voltage	+5V DC +12V DC
Power Consumption	
MTBF (under 40°C)	
Operating temperature	0 – 40ºC
Relative Humidity	15 ~ 95% non-condensing
Altitude	0-40,000 ft

C.3. Drive Tray Specifications

Specification	
Tray Pitch	27.6mm
Tray Width	< 110mm
Tray Carrier Depth	180mm
Tray Plastic Depth	30mm
Total Depth	210mm (= 180mm + 30mm)
Key-lock	Yes

C.4. Power Supply Specifications

Specification	
Dimension	265mm (D) x 107mm (W) x 42.2mm (H)
Nominal Power	460W
DC Output	12.0V: 32A – 38A (peak) 5.0V: 25A 3.3V: 20A
Input Frequency	47 ~ 63Hz
AC Input	90VAC @ 8AC – 260VAC @ 4AC with PFC
Power Factor Correction	Yes
Hold-up Time	At least 16ms at 115/230VAC full load after a loss of AC input
I^2C	Through backplane to controller
Over-temperature Protection	Lost cooling or excessive ambient temperature
Cooling Fans	Two fans for each unit (inside PSU)

C.5. RAID Management

Specification	
Performance Monitoring	Yes
Remote Control and Monitoring	Yes
Event Broadcast/Alert	Yes (via Java-based RAIDWatch Manager and Event Monitor)
Event Notification	Yes (via RAIDWatch's sub-module, NPC)
Hardware Connection	In-band over Fibre, Ethernet, or RS-232C
Configuration on Disk	Configuration data stored on disks for logical drive assemblies to exist after controller replacement
Failure Indicator	Via alarm, LCD panel, RAIDWatch Manager, or terminal emulation

C.6. Fault Tolerance Management

Specification	
Drive S.M.A.R.T Support	Yes (with user-configurable detect only, clone and replace, and perpetual clone functions)
Battery Back-up Option	Yes
ISEMS (Infortrend Simple Enclosure Management Service) via I^2C Interface	Yes
Automatic Drive Failure Detection	Yes
Automatic Rebuild on Spare Drives	Yes
Regenerate Logical Drive Parity	Yes
Bad Block Reassignment	Yes
Automatic Rebuild upon Failed Drive Replacement	Yes
Manual Clone of Suspected Failed Drive	Yes
Concurrent Rebuild on Multiple Drives in a RAID (0 + 1) Logical Drive	Yes
Salvage the 2nd Temporary Failed Drive in a RAID 1, 3 or 5 Logical Drive	Yes
Salvage the 1st Temporary Failed Drive in a RAID 0 Logical Drive	Yes

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Appendix D
Packaging

D.1. Overview

The EonStor subsystem is packed in seven (7) boxes as shown in ***Table D-1***. Six (6) boxes are shipped in a single (1) container box. The subsystem chassis is at the bottom of the box. Two (2) boxes containing hard drive trays and two (2) boxes containing controller modules are placed on top of the chassis. The box containing the accessory items is on top of the controller boxes.

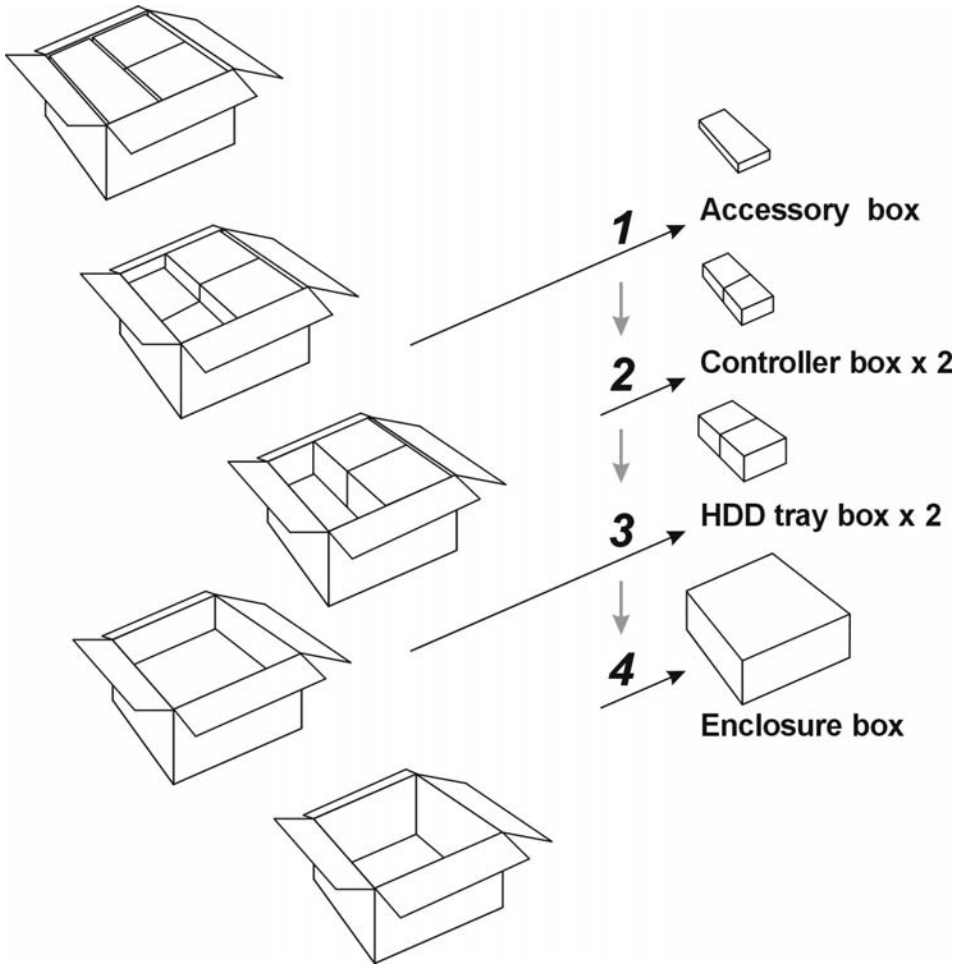

Table D-1: ES A16F Packaging

D.2. Container Contents

D.2.1 Accessory Box

The accessories box contains the items shown in ***Table D-2***.

ES A16F-	S1211-M2	R1211-M2
CD Pack*	1	1
Power Cords	2	2
RS-232C Audio Jack Cable	1	2
Null Modem	1	2
Screws for Mounting Drives	70	70
Quick Installation Guide	1	1
Enclosure Rack-mounting Screws	4 x M6 4 x M5 4 x #10-32	4 x M6 4 x M5 4 x #10-32

Table D-2: ES A16F Accessory Box Contents

****The CD pack comes with the Hardware Manual, Operation Manual, GUI, and GUI User's Manual.***

D.2.2 Hard Drive Tray Box

There are two (2) drive tray boxes. Each box comes with the following items:

- Eight (8) drive trays
- Eight (8) SATA-to-SATA MUX kits (pre-installed on the drive trays)

D.2.3 Controller Box

The controller box contains the following items pre-installed in the controller module:

- Controller board (IFT-7265R-16F2D)
- I/O board (IFT-9270A-FCC2)
- 256MB DIMM module

- BBU module (IFT-9270ABT)
- Two (2) retention screws

*__NOTE:__ *For the single and single-upgradeable models, the second controller box only contains a dummy plate, not a controller.*

D.2.4 Enclosure Box

The enclosure box comes with two (2) EP foam blocks that secure the chassis within the bottom of the box. The enclosure chassis contains the components shown below:

- Two (2) system PCBs
- Two (2) PSU modules
- Two (2) cooling modules
- One (1) power switch board
- One (1) power switch board with enclosure configuration switch
- One (1) LCD panel and two (2) front handles
- One (1) plastic bag enclosing the chassis

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Appendix E
Spare Parts and Accessories

E.1. Spare Parts

Spare parts that come with the subsystem are listed in ***Table E-1***.

Spare Part	Model Name	Description
Controller Module	IFT-80AF12RC16-M2	Controller module with a 256MB DIMM module, IFT-7265R-16F2D controller board, IFT-9270A-FCC2 I/O board, and controller canister
Controller Module	IFT-80AF12RC16	Controller module with an IFT-7265R-16F2D controller board, IFT-9270A-FCC2 I/O board, and controller canister
Hard Drive Tray	IFT-9270CDTray	Empty tray with lock mechanism
PSU Module	IFT-9270CPSU	1U 460W power supply unit
Cooling Fan Module	IFT-9270CFanMod	1U dual-fan cooling module with cage
Left Handle	IFT-9270HandLLCD	Left handle with LCD panel
Right Handle	IFT-9270CHandR	Right handle for RAID subsystem
MUX Kit (Redundant Controller Model)	IFT-9270AN2S1S	SATA-to-SATA MUX kit for the ES A16F-R1211-M2 subsystem
Hard Drive Tray + MUX Kit (Redundant Controller Model)	IFT-9270ADT2S1S	Hard drive tray with pre-installed SATA-to-SATA MUX kit for the ES A16F-R1211-M2 subsystem
MUX Kit (Single Controller Model)	IFT-9270AN1S1S	SATA-to-SATA MUX kit for the ES A16F-S1211-M2 subsystem
Hard Drive Tray + MUX Kit (Single Controller Model)	IFT-9270ADT1S1S	Hard drive tray with pre-installed SATA-to-SATA MUX Kit for the ES A16F-S1211-M2 subsystem

Table E-1: Spare Parts Shipped with the Subsystem

Spare parts that must be purchased separately are listed in ***Table E-2***.

Spare Part	Model Name	Description
MUX Kit (Redundant Controller Subsystem)	IFT-9270AN2S1P	SATA-to-PATA MUX Kit for the ES A16F-R1211-M2 subsystem
Hard Drive Tray + MUX Kit (Redundant controller subsystem)	IFT-9270ADT2S1P	HDD Tray with pre-installed SATA-to-PATA MUX Kit for the ES A16F-R1211-M2 subsystem

Table E-2: Separately Purchased Spare Parts

E.2. Accessories

Accessories that came with the subsystem are listed in ***Table E-3.***

Spare Part	Model Name	Description
BBU Module	IFT-9270ABT	BBU module that can sustain 1GB DIMM memory for 72 hours
Null Modem	IFT-9011	Null modem cable
Serial Port Cable	IFT-9270ASCab	RS-232C serial cable and audio-jack-to-DB-9 cable for FW download
Serial Port Cable	IFT-9270CUPSCab-0030	RS-232C serial cable and audio-jack-to-DB-9 cable for UPS status monitoring

Table E-3: Accessories Shipped with the Subsystem

Accessories that must be purchased separately are listed in ***Table E-3.***

Spare Part	Model Name	Description
Slider Rail	IFT-9270Cslider32	24"~32" slide rail for cabinet/rack installation
Slider Rail	IFT-9270Cslider36	26"~36" slide rail for cabinet/rack installation

Table E-4: Separately Purchased Accessories

Appendix F
Pin Outs

F.1. SFP Connector Pin Outs

Each of the SFP host or expansion ports is comprised of a case bottom, an EMI case, and a 20-pin host connector. These port sockets receive Small-Form-Factor (SFP) fiber optic and copper-based transceivers. You may contact our technical support for an updated list of SFP transceiver modules that have been tested to comply with the sockets. The pin outs are shown in ***Figure F-1*** and their definitions are shown in ***Table F-1***.

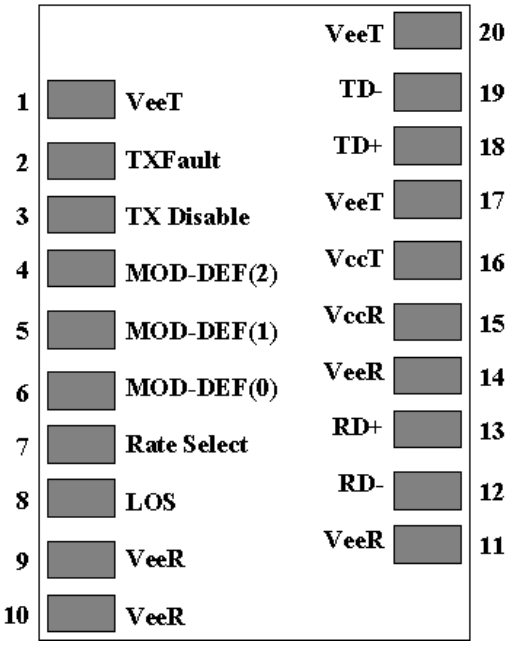

Figure F-1: SFP Connector Pin Outs

Pin	Pin Name	Pin Description
1	V_{EET}	Transmitter ground (common with receiver ground)
2	T_{FAULT}	Transmitter fault; not supported
3	T_{DIS}	Transmitter disable; laser output disabled on high or open
4	MOD_DEF(2)	Module definition 2; data line for serial ID
5	MOD_DEF(1)	Module definition 1; clock line for serial ID
6	MOD_DEF(0)	Module definition 0; grounded within the module
7	Rate Select	No connection required
8	LOS	Indicates loss of signal; logic 0 indicates normal operation
9	V_{EER}	Receiver ground (common with transmitter ground)
10	V_{EER}	Receiver ground (common with transmitter ground)
11	V_{EER}	Receiver ground (common with transmitter ground)
12	RD-	Receiver inverted DATA out; AC coupled
13	RD+	Receiver non-inverted DATA out; AC coupled
14	V_{EER}	Receiver ground (common with transmitter ground)
15	V_{CCR}	Receiver power supply
16	V_{CCT}	Transmitter power supply
17	V_{EET}	Transmitter ground (common with receiver ground)
18	TD+	Transmitter non-Inverted DATA in 100 ohm termination between TD+ and TD-; AC coupled thereafter
19	TD-	Transmitter inverted DATA in. See TD+
20	V_{EET}	Transmitter ground (common with receiver ground)

Table F-1: SFP Pin Out Definitions

F.2. DB9 Audio Jack Pin Outs

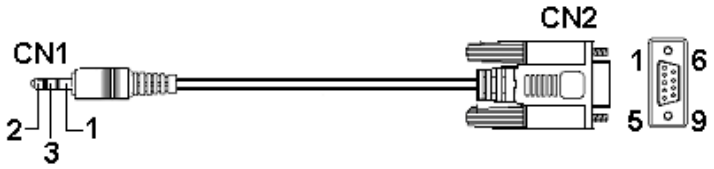

Figure F-2: RS-232C (Audio Jack) Pin Outs

CN1 Pin Number	Pin Name	CN2 Pin Number
1	Ground	5
2	Brown	3
3	Black	2

CN 2	Pin 4 and Pin 6 are short	Pin 7 and Pin 8 are short

Table F-2: RS-232C (Audio Jack) Pin Out Definitions

F.3. Ethernet Port Pin Outs

Pin	Pin Name	Pin	Pin Name
1	LAN_TXP	**7**	LAN_RXP
2	LAN_TXN	**8**	LAN_RXN
3	CT	**9**	Pulled high for Pin 10
4	N1	**10**	LAN_LEDG (Link OK)
5	N1	**11**	Pulled high for Pin12
6	CT	**12**	LAN_LEDY (data transfer)

Table F-3: Ethernet Port Pin Outs

F.4. Main Power

IEC-type receptacle.

F.5. Drive Expansion Ports

Same as host SFP sockets.

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