

SecurStor 16i

iSCSI to SATA-II

RAID Subsystem

Installation and Hardware Reference Manual

For all technical support assistance:

Phone: (800) 995-1014 or (972) 980-7098

Web: <http://www.emdstorage.com>

Contact Information

Company Address: Excel Meridian Data, Inc.
3220 Commander Drive, Suite 101
Carrollton, Texas 75006, U.S.A.

Phone: (800) 995-1014 or (972) 980-7098

Fax: (972) 980-0375

URL: www.EMDStorage.com

Hours: Mon-Fri 7:30am to 6:30pm Central Time

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This Edition First Published 2006

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Restricted Access Location:

This equipment is intended to be installed in a RESTRICTED ACCESS LOCATION only.



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To Prevent Electric Shock:

Access to this equipment is granted to trained operators and service personnel only. Only modules housed in hot-swap canisters are field-serviceable. Accessing the backplane can cause electric shock.

FCC (applies in the U.S. and Canada)

FCC Class B Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules (47 CFR, Part 2, Part 15 and CISPR PUB. 22 Class B). These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this user's guide, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, you are encouraged to try to correct the interference by one or more of the following measures:

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

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

Warning:

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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.



This device is in conformity with the EMC.



(Certified Worldwide)

This device meets the requirements of the CB standard for electrical equipment with regard to establishing a satisfactory level of safety for persons using the device and for the area surrounding the apparatus. This standard covers only safety aspects of the above apparatus; it does not cover other matters, such as style or performance.

For Power Supplies' compatibility to China Compulsory Certification.



ITE BSMI Class A, CNS 13438 (for Taiwan)

D33225

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For more details information about recycling of this product, please contact your local city office, your household waste disposal service or the shop where you purchased the product.

Safety Precautions

Precautions and Instructions

- Prior to powering on the subsystem, ensure that the correct power range is being used.
- The SecurStor 16i subsystem comes with 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. The airflow direction is from front to back.
- 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 all enclosure modules and covers are securely in place during operation.
- 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 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 SecurStor 16i 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.

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
- Quick Install Guide

Conventions

Naming

From this point on and throughout the rest of this manual, the SecurStor 16i series is referred to as simply the “subsystem” or the “system” and SecurStor is frequently abbreviated as “SS.”



Important Messages

Important messages appear where mishandling of components is possible or when work order can be misconceived. These messages also provide important information associated with other aspects of system operation. The word “important” is written as **IMPORTANT**, both capitalized and bold and is followed by text in italics. The italicized text is the message to be delivered.



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.



Steps

Steps are used to describe sequential steps of a specific work procedure. Adherence to the sequential steps can guarantee effectiveness and lower the chance of failure.

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 Excel Meridian Data 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 chapter briefly introduces the SecurStor 16i iSCSI-to-SATA-II storage subsystem. The SecurStor 16i subsystem comes with four (4) GbE host ports capable of large I/O transfers over iSCSI packets.

EMD Storage's iSCSI storage supports network initiators compatible with the IETF iSCSI standard (RFC 3720) with the following functionalities:

- Access control via IQN and IP
- CHAP security
- Jumbo frames
- Header Digest mode



Figure 1-1: SecurStor 16i Subsystem

Internet SCSI (iSCSI) protocols are embedded in firmware and I/Os are rapidly processed via dedicated algorithms. The iSCSI storage is built around reliable hardware and sophisticated RAID technologies. I/O requests are packaged and transmitted over local area networks (LANs), wide area networks (WANs), or the Internet using the existing networking hardware and thus the total cost of ownership is reduced. With the help of the networking flexibility, the subsystem is ideal for location-independent data storage, backup, and retrieval.

The subsystem delivers extreme performance that result from the combined performance of multiple disk drives and the level of data protection unseen in other iSCSI storages. Featuring all standard RAID functionalities as other SecurStor subsystems, the SS 16i subsystem provides a reliable platform for IT operations such as backup, data-mining, or strategic allocation.

This subsystem features a high-density architecture that supports up to sixteen (16) hot swappable, SATA-II hard drives in a 3U-profile chassis. The subsystem is powered by a RAID controller board featuring the latest ASIC400, RAID6 ASIC as the XOR engine. The pre-installed 512MB DDR RAM DIMM module can be upgraded to a 2GB capacity DIMM to support complicated applications that hold numerous ID/LUN combinations.

The controller board is housed in a metal canister and is referred to as the “controller module.” The controller module is comprised of a main circuit board, an interface faceplate, and a metal canister. The controller module is accessed through the rear of the SecurStor 16i with the help of ejection levers. An optional battery backup unit

(BBU) is now equipped with an EEPROM that helps record the installation date and notify system administrators if the battery's life expectancy is reached. The BBU is hot swappable and is accessed through the controller's faceplate.

Four (4) RJ-45 connectors connect the subsystem to network switches or Ethernet ports of independent devices. Dual-redundant, hot-swappable cooling modules and power supplies protect the subsystem from overheating and the down time by power outage. The modular nature of the subsystem and the easy accessibility to all major components ensure the ease of the subsystem maintenance.



NOTE:

*On receiving and unpacking your subsystem, please check the package contents against the included **Unpacking Checklist**. If any modules are missing, please contact your vendor immediately.*

1.1.2 Enclosure Chassis

1.1.2.1 Chassis Overview

The SecurStor 16I RAID storage is housed in a 3U metal chassis that is divided into front and rear sections. Key components are respectively accessed through the front (see [Figure 1-3](#)) and rear (see [Figure 1-4](#)) panels. The enclosure chassis can be mounted into a standard 19-inch rack or enclosure cabinet using support brackets that are separately-purchased.



NOTE:

*Components accessed through the front panel are referred to as “**Front Panel Components**” and components accessed through the rear panel are referred to as “**Rear Panel Components**.”*

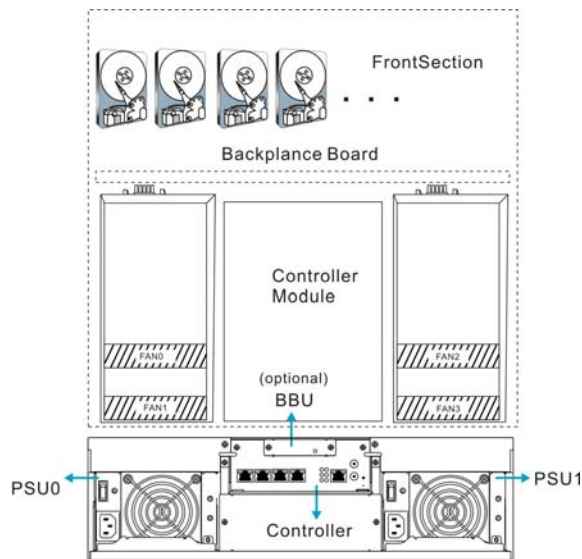


Figure 1-2: Locations of Key Components

1.1.2.2 Physical Dimensions

The SecurStor 16I comes in a 3U chassis with the following dimensions:

- With handles: 483mm (W) x 131mm (H) x 504.3mm (L) (19 x 5.2 x 21 inches)
- Without handles: 445mm x 130mm x 487mm (17.5 x 5.1 x 19.2 inches)

1.1.2.3 Front Panel Overview

The front section of the subsystem features a 4x3 layout for twelve (12) 3.5-inch drives. The two (2) handles on the front of the subsystem enable you to easily insert/extract the chassis into/from a rack or cabinet. The front panel of the SecurStor 16I RAID subsystem described in this manual is shown in *Figure 1-3*. A description of each front panel component is given below:

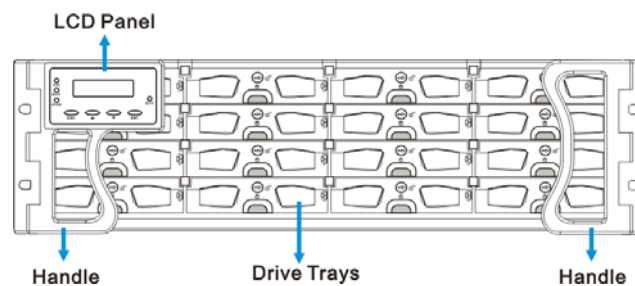


Figure 1-3: SecurStor 16I Front View

The front panel shown in *Figure 1-3* accommodates the following components:

- **Drive bays with drive tray canisters:** The drive bays house the SecurStor 16I hard drives.
- **Forearm handles:** The subsystem has right and left handles for easier rackmounting and handling.

1.1.2.4 Hard Drive Numbering

The front section of the SecurStor 16I enclosure houses sixteen (16) hard drives in a 4x4 configuration. When viewed from the front, the drive bays (slots) are numbered 1 to 16 from left to right and then from top to bottom.

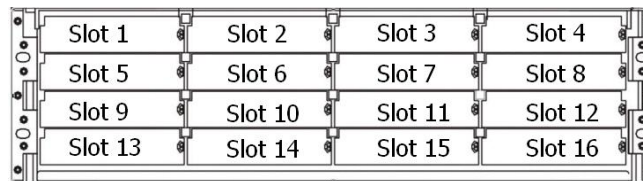


Figure 1-4: Hard Drive Numbering

1.1.2.5 Rear Panel Overview

The rear section of the SecurStor 16I subsystem is accessed through the rear panel and is reserved for a single RAID controller module, one (1) optional BBU, two (2) power supply units (PSUs), and two (2) cooling modules.

A rear view of the subsystem is shown below. Descriptions of each rear panel component are given below:

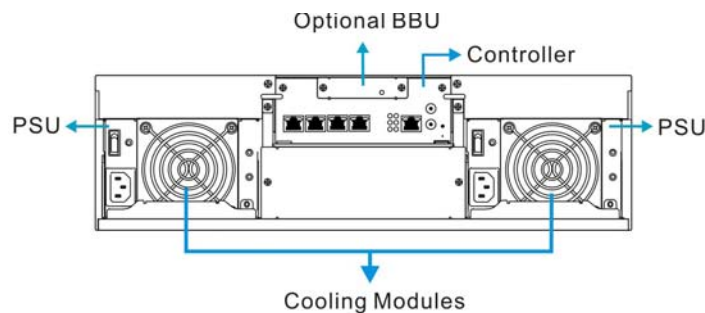


Figure 1-5: SecurStor 16I-2 Rear View

The rear panel shown in *Figure 1-5* accommodates the following components:

- **RAID controller module:** The RAID controller module manages all functionalities provided with the subsystem, and all interface connectors are on located on the controller’s faceplate. (See *Section 0*)

- **BBU module:** An optional BBU module sustains unfinished writes cached in memory during a power outage in order to prevent data loss. (See *Section 0*)
- **PSU modules:** The hot-swappable PSUs receive single-phase power and deliver +5V, +12V, and +3.3V power to the subsystem. A power switch is located on each PSU to turn the system on and off. (See *Section 0*)
- **Cooling modules:** The redundant cooling modules ventilate the subsystem to maintain a cooling airflow across the subsystem. (See *Section 0*)

1.1.2.6 Backplane Board

An internal backplane board separates the front and rear sections of the SecurStor 16I. The PCB board consists of traces for logic level signals and low voltage power paths. It contains no user-serviceable components.



WARNING!

*When inserting a removable module, **DO NOT USE EXCESSIVE FORCE!** Forcing or slamming a module can damage the pins on the module connectors either on the module itself or on the backplane. Gently push the module until it reaches the end of module slot. Feel the contact resistance and use slightly more pressure to ensure the module connectors are correctly mated. If the module comes with ejection levers or retention screws, use them to secure the module.*

1.2 Subsystem Components

The SecurStor 16I houses many active components and most of them can be accessed through either the front or rear panel. The modular design of the active components facilitates their easy installation and removal. Hot-swap mechanisms are incorporated to eliminate power surges and signal glitches that might occur while removing or installing these modules.

1.2.1 Drive Trays

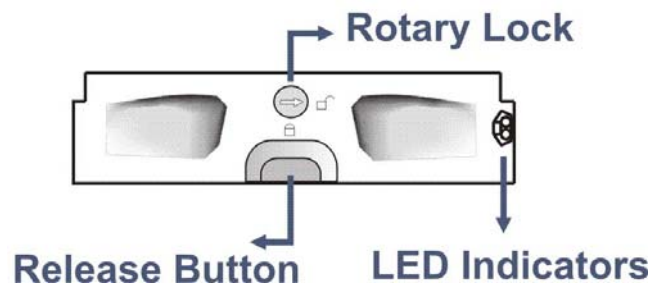


Figure 1-6: Drive Tray Front View

The SecurStor 16I subsystem comes with sixteen (16) drive trays (see *Figure 1-6*) designed to accommodate separately purchased, standard 1-inch pitch, 3.5-inch SATA-II disk drives. The drive bays are accessible from the enclosure front panel. Two (2) LEDs on the front bezel indicate the operating statuses. A key-lock on each drive tray secures the hard drive in place, while a release button enables fast retrieval of a hard drive.



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 of the subsystem. If the drive bay superstructure is deformed or altered, the drive trays may not fit into the drive bays.

1.2.2 The RAID Controller Module

The default size for the DDR RAID controller module is 512MB. RAID controller module contains a main circuit board, a preinstalled 512MB capacity or above DDR RAM DIMM module, and the controller module interfaces. The controller module contains no user-serviceable components and should never be removed or opened, except when installing/upgrading the cache memory inside.



WARNING!

Although the RAID controller can be removed, the only time you should touch the controller itself is to install the memory modules. The RAID controller is built of sensitive components and unnecessary tampering can damage the controller.

The heart of the SecurStor 16I RAID controller subsystem is the iSCSI-to-SATA controller board. The controller comes with four (4) GbE Ethernet host ports. The subsystem connects to the host through RJ-45 connectors, while the connectors are also ready to connect to one or more network

switches, enabling access to your storage volumes in complex configurations such as data-sharing or network zoning.

The docking connector at the rear of the controller board connects the controller module to the backplane board. A DDR RAM DIMM socket is strategically placed in an easily accessible location on the controller board for easy insertion of the DDR RAM DIMM module.

1.2.3 Controller Module Interfaces

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

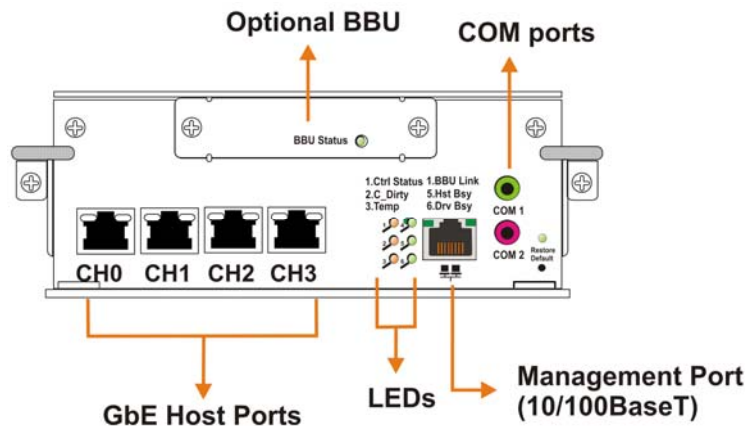


Figure 1-7: Controller Module Interfaces – 2-port version

- **Host ports:** Four (4) Gigabit Ethernet host ports (simulated and indicated as CH0 to CH3 in the diagram shown above) connect the SecurStor subsystem to the networked iSCSI initiators through RJ-45 connectors.
- **COM port:** The controller module comes with two (2) COM ports. The serial ports are used for local access to the firmware embedded configuration utility and the connection to a UPS device.
- **LED indicators:** Six (6) LED indicators illustrate the system statuses for system monitoring. Please see *Chapter 3* for more information.
- **Ejection Levers:** Two (2) ejection levers located on the sides of the controller ensure that the back-end connectors are properly seated in the module slot and properly mated with the backplane.
- **Management LAN Port:** Another 10/100BaseT Ethernet port connects the subsystem to a management computer. Available management interfaces include: telnet, Java-based RAIDWatch manager, or the web-based manager invoked by an http console.
- **Restore Default LED and button:** The push button and LED are used to restore firmware defaults in cases when upgrading

firmware or if an administrator forgets system password. For more details, please refer to *Chapter 3*.

1.2.4 DIMM Module

The controller module comes with a preinstalled 512MB capacity or above DDR RAM DIMM module and the allocable size can reach 2GB. The memory socket is located on the side of the controller board.

1.2.5 BBU

An optional, separately purchased Li-ION battery backup unit (BBU) module (see the diagram below) can sustain cache memory for days during the event of power outage. The battery module comes with an EEPROM that marks the installation date, and system administrators will be notified when the one-year left expectancy is reached. Please refer to *Section 2.6* for installation instructions.

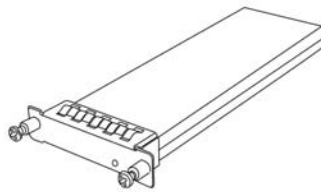


Figure 1-8: BBU Module

In accordance with international transportation regulations, the BBU module is only charged to between 35% and 45% of its total capacity when shipped. Therefore, when powering on the subsystem for the first time (see *Section 4.4*) the BBU will begin to charge its batteries to their full capacity. It normally requires approximately twelve (12) hours for the battery to be fully charged. If the battery is not fully charged after twelve (12) hours, there may be a problem with the BBU module. You may re-install the battery; and if the battery still shows problems with charging, contact your subsystem vendor for a replacement. While the battery is being charged, the LED on the BBU will start flashing. (See *Chapter 3.2.6* for details on the LED indicators.)

You can check battery's charge level using the RAIDWatch software or the embedded firmware utility.

1.2.6 Power Supply Units

The subsystem is equipped with two (2) redundant, hot-swappable, 530W PSUs, which are installed into the rear section of the chassis. The PSU is permanently mounted into a 2U (dual-level) bracket especially designed to house both the PSU and a cooling module, which is mounted at the end of the 2U bracket.

**NOTE:**

Hot-swapping the PSU also removes the cooling module at the lower slot.

As shown in **Figure 1-9**, each PSU comes with a power socket and a power switch to turn the subsystem on and off. Two (2) embedded cooling fans provide sufficient airflow. A single LED indicates the PSU status. When a power supply failure occurs, the red LED lights come on. A rejection handle at the rear of the PSU is especially designed to help properly install or remove the module.

A screw hole on the ejection handle helps secure the PSU to the chassis.

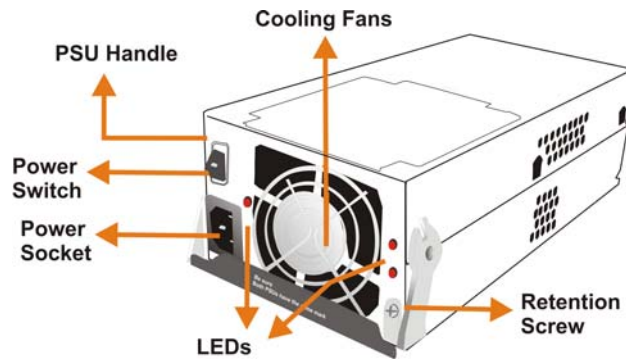


Figure 1-9: PSU Module

Please refer to **Appendix B** for the technical information of the PSUs.

1.2.7 Cooling Modules

Two cooling modules are implemented within the rear sections of PSU modules. (see **Figure 1-10**.) The cooling fans operate at two (2) fan speed levels. When the subsystem operates normally, the cooling fans operate at the lower speed. If a major component fails or when one of the temperature thresholds is violated, the cooling fans automatically raise its rotation speed.

More technical information can be found in **Appendix B**.

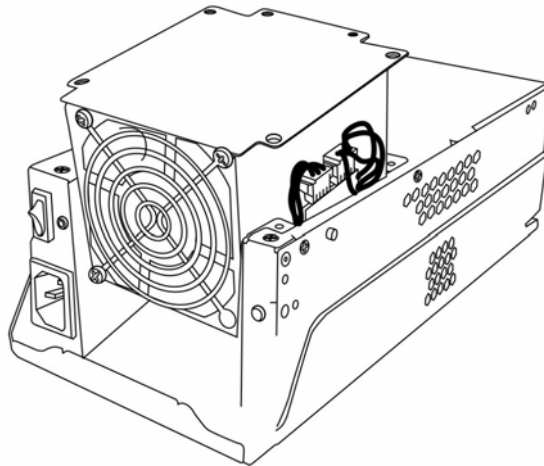


Figure 1-10: Cooling Module

1.3 Subsystem Monitoring

The iSCSI RAID subsystem comes with a number of different monitoring methods that provide you with continual updates on the operating statuses of the subsystem and individual components. The following monitoring features are included:

1.3.1 I²C bus

The following subsystem elements are interfaced to the RAID controller over a non-user-serviceable I²C bus:

- Cooling modules
- Module presence detection circuits
- Temperature sensors (for detecting the temperature of the backplane board and controller board)

1.3.2 LED Indicators

The following components come with LEDs to indicate the operating statuses of individual components:

- RAID controller
- BBU module
- Cooling modules (on PSU faceplates)
- PSU modules (1 LED on each module)
- Drive trays (2 LEDs on each tray)

1.3.3 Firmware (FW)

Firmware: The firmware is pre-installed software used to configure the subsystem. The latest firmware functionalities include Task Scheduler, Intelligent Drive Handling, and Media Scan. Media Scan handles low quality drives in both the degraded mode and during the rebuild process. Maintenance tasks will then be performed on an entire array or specific hard drives. Various options are user-configurable such as priority, start time, and execution intervals. For more information, please refer to the *Generic Operation Manual* in the product utility CD.

1.3.4 Audible Alarms

The subsystem comes with an audible alarm that is triggered when a component fails or when the pre-configured temperature or voltage thresholds are exceeded. Whenever you hear an audible alarm, it is imperative that you determine the cause and rectify the problem immediately.

Event notification messages indicate the completion or status of array configuration tasks and are always accompanied by two (2) or three (3) successive and prolonged beeps.



Failing to respond when an audible alarm is heard can lead to permanent damage to the 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 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 hot-swappable:

- Power supply units (PSUs)
- BBU module
- Hard disk drives

1.4.3 Normalized Airflow

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

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Chapter 2

Hardware Installation

2.1 Introduction

This chapter gives detailed instructions on how to install the subsystem. When installing the subsystem, it is necessary to mount the chassis into a rack cabinet and to install hard drives and drive trays. Installation into a rack or cabinet should occur *before* the hard drives or drive trays are installed into the subsystem.



CAUTION!

Please note that the installation instructions described in this manual should be carefully followed to prevent any difficulties and damage to your subsystem.

2.2 Safety Precautions

1. Disconnect the power cords if the need should arise for cleaning the chassis. Do not use liquid or sprayed detergent for cleaning. Use a lightly moistened clothe for cleaning.
2. Be sure the correct power range (100-120 or 220-240VAC) is supplied by your rack cabinet or power outlet. It is highly recommended to connect two different power supplies to separate power sources; e.g., one to a power outlet, and the other to a UPS system.
3. Thermal notice: All drive trays (even if they do not contain a hard drive) must be installed into the enclosure. Leaving a drive bay or module slot open will severely affect the airflow efficiency within the enclosure, and will consequently lead to system overheating. Keep a faulty module in place until you have a replacement unit and you are ready to replace it.
4. Rack-mounting: The subsystem is intended to be rack-mounted. Following concerns should be heeded when mounting the enclosure into a rack cabinet:
 - a. An enclosure without disk drives can weigh over 60 pounds. Two (2) people are required to install or relocate the subsystem. Drives should be removed from the enclosure before moving the subsystem.

- b. The subsystem is designed to operate in an environment where the ambient temperature around the chassis must not exceed 104°F.
 - c. The openings on the enclosure are for air circulation and hence the ventilation openings should never be obstructed.
 - d. Proper grounding, over-current protection, and stability features should be provided with the rack cabinet into which the subsystem is mounted.
5. Operate the subsystem in an environment with low humidity.
6. Make sure the voltage of the power source is within the rated values as indicated by the label attached to the power supplies before connecting the subsystem to the power source. You may also refer to the Appendix A of this manual for technical details.
7. Airflow considerations: The subsystem requires an airflow clearance especially on the front and the rear sides. For proper ventilation, a minimum of 1 inch is required between the front of the enclosure and rack cover; a minimum of 2 inches is required between the enclosure and end of the rack cabinet.
8. Handle the system modules by the retention screws, eject levers, or the modules' metal frames/faceplates only. Avoid touching the PCB boards and connector pins.
9. None of the covers or replaceable modules should be removed in order to maintain compliance with safety, emission, or thermal requirements.
10. If the subsystem is going to be left unused for a long time, disconnect the subsystem from mains to avoid damages by transient over-voltage.
11. Never open the subsystem top cover, unless directed to do so by EMD Support.
12. Always secure every enclosure module by its retaining screws or make sure it is held in place by its latches or hand screws.
13. Always make sure the subsystem has a safe electrical earth connection via power cords or chassis ground by the rack cabinet.
14. Be sure that the rack cabinet in which the subsystem chassis is to be installed provides sufficient ventilation channels and airflow circulation around the subsystem.
15. If it is necessary to transport the subsystem, repackage all disk drives separately.
16. If one of the following situations arises, get the enclosure checked by service personnel:
 - a. Any of the power cords or plugs is damaged.
 - b. Liquid has penetrated into the subsystem.
 - c. The enclosure has been exposed to moisture.

- d. The subsystem does not work well or you cannot get it work according to this manual.
- e. The subsystem has dropped and been damaged.
- f. The subsystem shows obvious signs of breakage.

2.3 General Installation Procedure

Following all the instructions provided below can save subsystem installation time. Detailed, illustrated instructions for each component are given in the following sections.



CAUTION!

To ensure that your system is correctly installed, please follow the steps outlined below. If you follow these steps, installation will be fast and efficient. If you do not follow these steps, you may accidentally install the hardware incorrectly.



Step 1. **Unpack:** Unpack the subsystem.



Step 2. **Install an optional BBU:** If an optional BBU has been separately purchased, it should be installed prior to operating the subsystem. (See *Section 0*)



Step 3. **Rack/Cabinet installation:** If the subsystem is going to be installed in a rack or cabinet, it should be installed prior to installing the hard drives. Installing the subsystem into a rack or cabinet requires at least two (2) people. (See *Section 0*)



Step 4. **Install drive trays:** After the hard drives have been installed into the drive trays, the drive trays must be installed into the enclosure itself.



Step 5. **Cable connection:** Use the power cords that came with the subsystem to connect the subsystem to the main power source. Use self-purchased RJ-45 cables (see *Chapter 4* for more details) to connect host ports to the network or external devices.



Step 6. **Power up:** Once the components have been properly installed and all cables are properly connected, you can power up the subsystem and configure the RAID array. (See *Section 4.4*)

2.3.1 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.

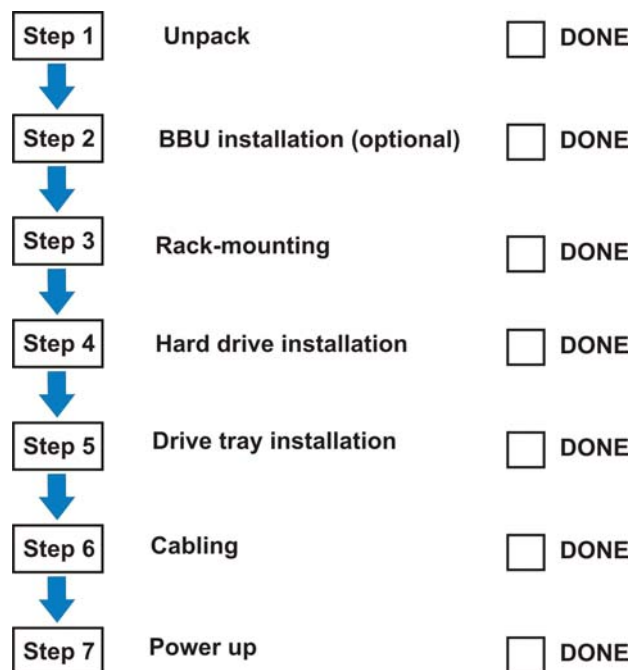


Figure 2-1: Installation Procedure Flowchart

2.4 Unpacking the Subsystem

Unpack the unit, drives, and accessories.

Accessory items include an RS-232C audio jack cable, power cords, a null modem, and a product utility CD containing the RAIDWatch program.

2.5 Installation Overview

You must install the following components:

- Hard drives (SATA-I or SATA-II disk drives)
- BBU module (if ordered)

2.6 BBU Installation

2.6.1 BBU Module Installation Overview

The BBU module is an optional item that can sustain cache memory in the event of a power failure or in the unlikely event of failing both PSUs. A BBU is highly recommended. The optional BBU provides additional data security and helps minimize the loss of data during power shutdowns.

The BBU module is inserted into a module slot on the controller module. The BBU module is secured with two (2) retention screws. When shipped, the BBU module slot is covered with a dummy plate that must first be removed.

2.6.2 BBU Warnings and Precautions

- Do not use nor leave the BBU near a heat source. Heat can melt the insulation and damage other safety features of battery cells, possibly leading it to acid leak and result in flames or explosion.
- Do not immerse the BBU in water nor allow it to get wet. Its protective features can be damaged. Abnormal chemical reactions may occur, possibly causing functional defects, acid leak, and other hazardous results.
- Do not disassemble or modify the BBU. If disassembled, the BBU could leak acid, overheat, emit smoke, burst and/or ignite.
- Do not pierce the BBU with a sharp object, strike it with a hammer, step on it, or throw it. These actions could damage or deform it, internal short-circuiting can occur, possibly causing functional defects, acid leak, and other hazardous results.
- If the BBU leaks, gives off a bad odor, generates heat, becomes discolored or deformed, or in any way appears abnormal during use, recharging or storage, immediately remove it from the subsystem and stop using it. If this is discovered when you first use the BBU, return it to Infortrend or your system vendor.

2.6.3 Installation Procedure

To install a BBU into the controller module, please follow these steps:



Step 1. Prior to installing the BBU module, power off the subsystem or restart the subsystem after installation. For power off procedures, please refer to *Section 4.4*.



Step 2. Use a screwdriver to *loosen the two (2) retention screws located on both sides of the dummy plate*. (See *Figure 2-2*)

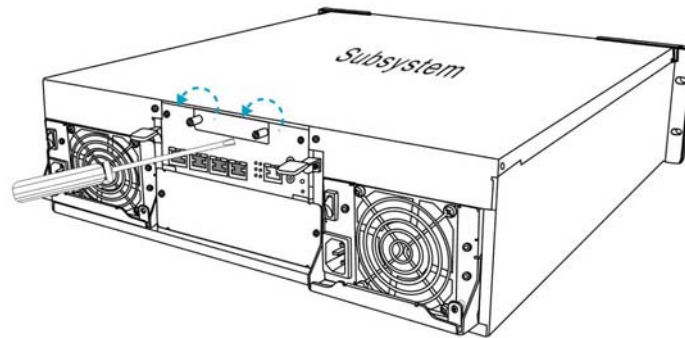


Figure 2-2: Loosening the BBU Retention Screws



Step 3. Once the retention screws are loosened, gently retrieve the dummy plate out of the enclosure. (See *Figure 2-3*)

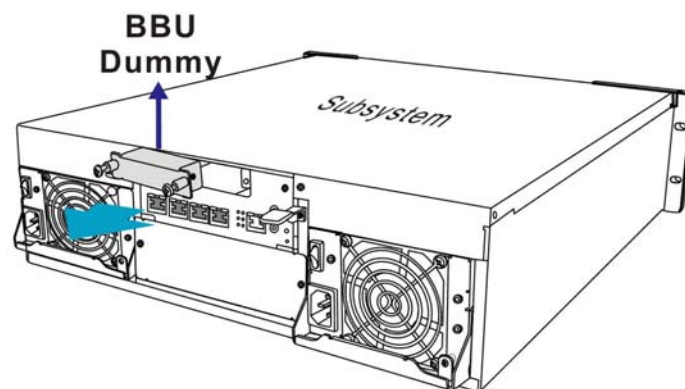


Figure 2-3: Removing the BBU Slot Dummy Plate



NOTE:

It may be difficult to remove the dummy plate as it is embedded in the subsystem chassis. If you are unable to dislodge the sheet, wedge the head of a flat-head screwdriver between the metal sheet and the chassis and then gently nudge the metal sheet out of the chassis.



Step 4. **Install the BBU module.** Align the BBU module with the BBU module slot and gently insert the BBU module until the back of the BBU module reaches the end of the slot. Use slightly more force so that the back-end connector can mate with the backplane.



Step 5. **Secure the BBU module to the chassis.** Fasten the two (2) retention screws on the BBU module to secure the BBU module to the chassis. (See *Figure 2-4*)

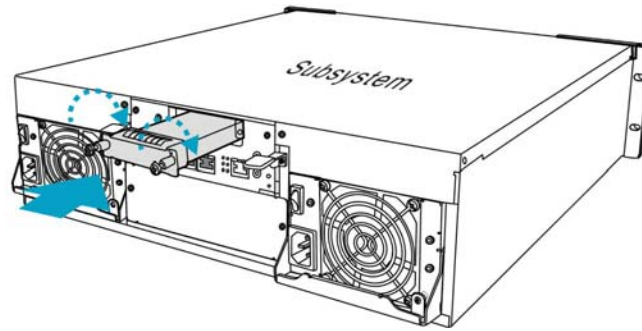


Figure 2-4: Installing the BBU Module

2.7 Hard Drive Installation

2.7.1 Hard Drive Installation Prerequisites



CAUTION!

The hard drives and drive trays should only be installed into the subsystem after the subsystem has been mounted into a rack cabinet. If the hard drives are installed first, the subsystem will be too heavy to handle and the possible impact during installation may damage your drives.



WARNING!

Handle hard drives with extreme care. Hard drives are very delicate. Dropping a drive against a hard surface (even from a short distance) and hitting or touching the circuits on the drives with your tools may cause damage to the drives.

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WARNING!

All drive trays must be installed into the enclosure even if they do not contain a hard drive. If the trays are not installed into the enclosure, the ventilation airflow will not be normalized and the subsystem will overheat.

2.7.2 Hard Drive/Drive Tray Installation



- Step 1. Make sure **the rotary bezel lock is in the unlocked position**, i.e., the groove on its face is in a horizontal orientation. If the groove is in a vertical position, as shown

in *Figure 2-5*, then the bezel lock is locked and the front flap on the drive tray cannot be opened.

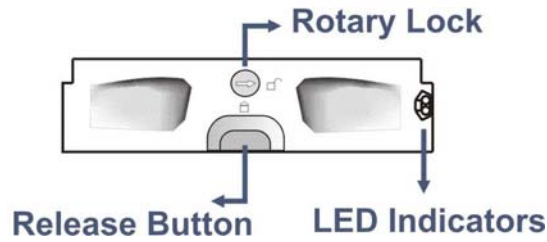


Figure 2-5: Front View of an Individual Drive Tray



Step 2. *Open the front flap on the drive tray.* (See *Figure 2-6*) Push the release button on the drive tray. The front flap will spring open.

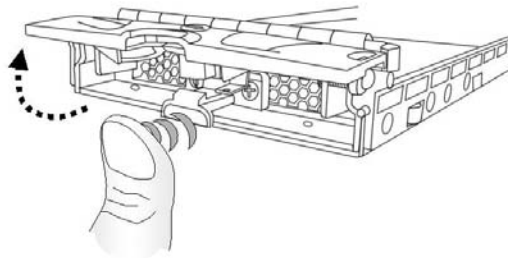


Figure 2-6: Drive Tray Release Button



Step 3. *Align the drive tray with the slot* in which you wish to insert it making sure that it is properly aligned within the drive bay. Gently slide it in until the drive tray reach the end of drive bay. This should be done smoothly and gently. (See *Figure 2-7*)

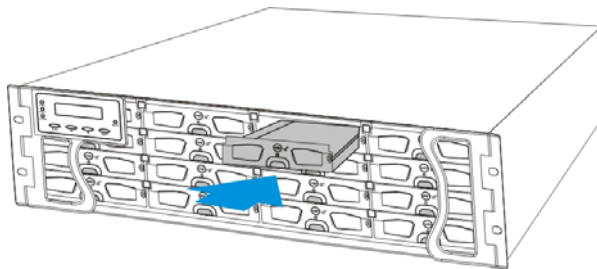


Figure 2-7: Installing a Drive Tray



Step 4. *Close the front flap on the drive tray.* Make sure the front flap is closed properly to ensure that the SATA connector at the back of the drive tray is properly mated with the

corresponding connector on the backplane board. If the front flap is not closed properly, the connection between the hard drive and the subsystem may come loose and mysterious drive signals may result.



- Step 5. **Lock the flap into place** by turning the key-lock until the groove on its face is pointing down (vertical orientation). (See *Figure 2-8*)

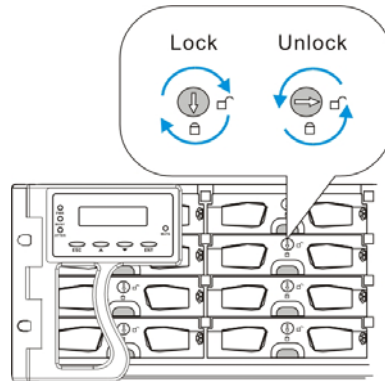


Figure 2-8: Drive Tray Key-lock Rotation



- Step 6. Once the drive bays are populated and the subsystem powered on, the RAID controller will automatically spin up the hard drives and recognize their presence.

2.8 Rack/Cabinet Installation

The subsystem is designed to fit into a variety of 19-inch rack cabinets or racks. Make sure you have an appropriate site location and cables prepared with adequate lengths to connect to mains and other devices.

The subsystem should be installed in the rack or cabinet *before* the hard drives and the drive trays are installed. If the drive trays with the associated hard drives are installed, the subsystem will be too heavy to mount into a rack or cabinet. When installing the subsystem into a rack or cabinet it is advisable that two (2) people assist in the mounting process.

For details on the use of the rackmount rails, please refer to the installation instructions that came with them.

Chapter 3

Subsystem Monitoring

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3.1 Subsystem Monitoring Overview

The SecurStor 16i subsystem is equipped with a variety of self-monitoring features that help to keep subsystem managers informed of the subsystem operational statuses. These monitoring features provide vital feedback to help you maintain the operational integrity of the subsystem. Prompt response to warnings and subsystem component failure notifications will ensure data integrity and help ensure the longevity of the subsystem.

Self-monitoring features include:

- **Firmware (FW):** The RAID controller in the subsystem is managed by preinstalled FW, which can be accessed using a PC hyper-terminal connected through the COM1 serial port. Device status information can be obtained from the FW-embedded configuration utility. The FW is fully described in the Manual that came with your system. Please refer to this manual for further information.
- **RAIDWatch:** RAIDWatch is a fully integrated, Graphical User Interface (GUI) installed with the firmware, which can be used to monitor and maintain the subsystem locally or remotely over TCP/IP network. Connection to RAIDWatch is made using the 10/100BaseT management port.

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The RAIDWatch Panel View can be customized to display a graphical representation of the subsystem components in the content panel of the RAIDWatch screen. Panel View allows you to quickly determine the operational status of critical components. Please refer to the *RAIDWatch User's Manual* for further details.



NOTE:

Detailed installation instructions for RAIDWatch Manager are given in the *RAIDWatch User's Manual*.

- **LEDs:** Device-status-indicating LEDs are located on all important modules. These LEDs inform you of the integrity of a given component or a host/management link. You should become familiar with the various LEDs and be aware of their functions. (See *Section 0*)
- **Audible alarm:** An audible alarm is present on the subsystem controller board and will be triggered if any of a number of threatening events occurred. These events usually jeopardize the functional and operational integrity of the controller board and must be heeded at all times. Events such as a breaching of the temperature threshold will trigger the alarm. If a subsystem manager is present, the manager should use the RS-232 terminal console to determine the cause of the alarm and take appropriate corrective measures. (See *Section 0*)

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- **Inter-Integrated Circuit (I²C):** The I²C serial bus is used to connect various temperature sensors and presence detection circuits within the chassis.

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

3.2 Status-indicating LEDs

3.2.1 Brief Overview of the LEDs

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The following devices all come with LEDs that inform subsystem managers about the operational status of the component.

Component	LEDs per Unit	Total LEDs	Definition
Drive Trays	2	32	See <i>Section 0</i>
Controller Module	7	7	See <i>Section 0</i>
Ethernet Ports	2	10 (5 ports)	
BBU Module (if BBU is installed)	1	1	See <i>Section 0</i>
PSU Module	1	2	See <i>Section 0</i>
Cooling Module	2	4	See <i>Section 0</i>

Table 3-1: LED Distribution

LED definitions are given in the following sections.

3.2.2 Drive Tray LEDs

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Two (2) LED indicators are located on the right side of each drive tray. (See *Figure 3-11*) Refer to *Table 3-2* for the LED definitions. When notified by a drive failure message, you should check the drive tray indicators to find the correct location of the failed drive. Replacing the wrong drive can fail two members of a logical array (RAID 3/5) and thus destroy data in the array.

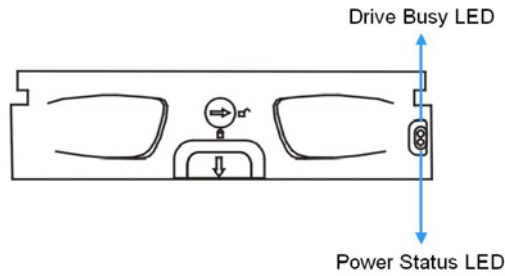


Figure 3-11: Drive Tray LEDs

Name	Color	Status
Drive Busy	Blue	FLASHING indicates data is being written to or read from the drive. The drive is busy. OFF indicates that there is no activity on the disk drive.
Power Status	Green/ Red	GREEN indicates that the drive bay is populated. RED indicates that the disk drive has failed.

Table 3-2: Drive Tray LED Definitions

3.2.3 Controller Module LEDs

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The LEDs on the rear-facing faceplate of the RAID controller are shown in *Figure 3-12*. The LEDs on the controller's faceplate that can be accessed from the rear of the enclosure are numbered from 1 to 6. The definitions are shown below.

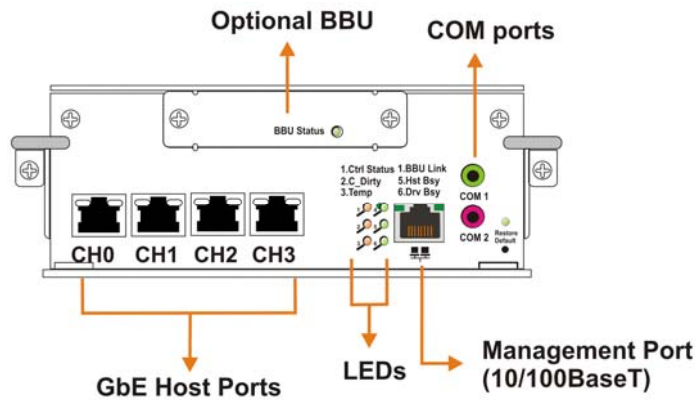


Figure 3-12: Controller Module LEDs

Name	Color	Status
Ctrl Status	Green/ Amber	Green indicates that the RAID subsystem is operating healthily.

		Amber indicates that a component failure has occurred, or inappropriate RAID configurations have caused system faults.
C_Dirty	Amber	ON indicates that there are certain amounts of cached data held in memory. OFF indicates that the cache is clean.
Temp.	Amber	ON indicates that the detected CPU/board/chassis temperature has exceeded the higher temperature threshold. OFF indicates that the detected temperature reading is within the preset safe range.
BBU Link	Green	ON indicates the presence of a BBU backup module.
Hst Bsy	Green	Rapidly Blinking to indicate traffic on the host bus.
Drv Bsy	Green	Rapidly Blinking to indicate traffic on the drive channels.
Restore Default	Green	Lit Green to indicate the RAID configuration default has been successfully restored. The LED state will be invalidated after a few seconds. Note that restoring default will not affect the existing RAID configurations of disk drives.

Table 3-3: Controller LED Definitions

Restore NVRAM Defaults – a Push Button



CAUTION!

The Restore NVRAM Default push button is a function that carries some risks. Firmware restoration will not destroy the existing logical drive configurations; however, if the existing logical drives cannot be adequately associated with host ID/LUNs after firmware default restoration, data loss or inconsistencies might occur.

There is a non-latch type push button accessed through a round opening underneath the Restore Default LED.

1. Before pressing this button to restore firmware defaults, it is highly advised to make a list of the existing ID/LUN mapping information. You will need the list for restoring ID/LUN mapping after restoring defaults. Default restoration will erase the ID/LUN mapping associations (e.g., which logical drive is associated with which host ID/LUN), and it is necessary to restore

the host ID/LUN mapping after firmware default restoration in order to access data on the previously configured arrays.

2. Some of the latest firmware updates may be incompatible with the firmware currently running on your subsystem. These updates may require restoring firmware defaults before firmware upgrade can actually take place. Before using the button, it is highly advised to practice the following:
 - Stop host I/Os,
 - Backup your data,
 - Make a list of host ID/LUN mapping information for future references.

You may also jot down the configured parameters such as the performance preferences, specific stripe sizes, etc.

3. The third condition that requires restoring defaults is when an administrator forgets the password configured to control the access to a RAID subsystem. Before pushing this button, also practice the steps listed above. You can access array information even without a password.

How to use the button?

After the subsystem is powered down, you can use a straighten paper-clip to press the button. Press and hold down the button, power on the subsystem, and wait for the LED to light up to indicate system defaults have already been restored.

3.2.4 Ethernet Port LEDs

4. GbE host ports, which provide different connection speeds, are located on the controller faceplate. Shielded or non-shielded, Cat5e straight-through Ethernet cables can be used to connect the RJ-45 ports to the network. Two (2) LEDs located on each Ethernet port indicate the Ethernet connection speed and link status. See the diagram below for the locations of the two (2) LED indicators. Refer to *Table 3-5* for the LED definitions.

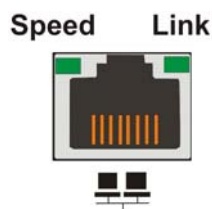


Figure 3-13: GbE LAN Indicators

Name	Color	Status
Speed	Green	ON indicates currently connected with GbE speed, OFF means connected with 10/100 speed.

LAN Activity	Green	ON for linked. BLINKING indicates active transmission.
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Table 3-4: GbE LAN Port LED Definitions

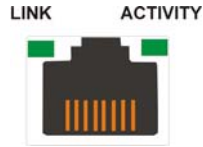


Figure 3-14: 10/100BaseT Management Port Indicators

Name	Color	Status
Link Status	Green	ON indicates currently connected to a LAN.
LAN Activity	Green	BLINKING indicates active transmission.

Table 3-5: 10/100BaseT Management Port LED Definitions

3.2.5 BBU Module LED

The BBU module has an LED on its faceplate. (See *Figure 3-15*) The function is the same as the similar LED on the controller module. The LED is off when the BBU is functioning normally and is able to sustain the cache memory. The LED flashes to indicate the BBU is charging. If the LED is illuminating amber, the BBU may have lost its ability to hold electrical charge. You should then contact your vendor to verify the problem.

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Figure 3-15: BBU Module LED

3.2.6 PSU LEDs

Each PSU comes with a single LED at the back (see *Figure 3-16*), located close to the power switch that turns on the subsystem. This LED indicates the operational status of the PSU module. Please refer to the PSU LED definitions shown in *Table 3-6*.

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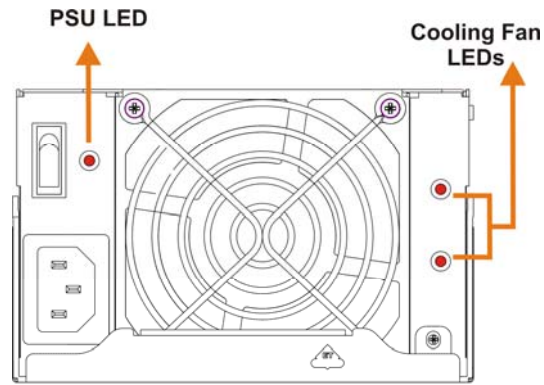


Figure 3-16: PSU Module LED

Color	Status
Steadily Blinking Green	The power supply has not been turned on. The PSU module LED will blink when the subsystem is connected to a power source but not yet turned on.
Static Green	The PSU is operating normally and experiencing no problem.
Static Red	The PSU has failed and is unable to provide power to the subsystem.
OFF	The PSU is not turned on and the power cord is disconnected.

Table 3-6: PSU Module LED Definitions

3.2.7 Cooling Module LEDs

Each individual cooling fan within the cooling module has one (1) red LED on the PSU module. The LED corresponds to the single fan in the cooling module. (See *Figure 3-17*) When the LED is on, it indicates the fan has failed. When the LED is off, it indicates the fan is functioning properly.

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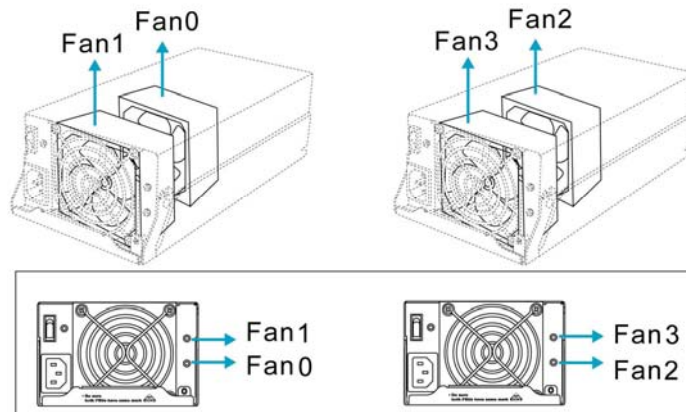


Figure 3-17: Cooling Module LEDs and Cooling Fan Locations

The subsystem has a novel approach to stabilizing the temperature within the subsystem: When the intelligent sensors on the backplane detect elevated temperature, such as high ambient temperature or the failure of any cooling or PSU module, the system will turn the cooling fans to high speed to extract more heat. Once the ambient temperature cools down to normal or the failed modules have been replaced, the cooling fans will return to low speed.

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3.3 Audible Alarm

Different controller environmental and operational parameters (like 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 on the subsystem fails. If the SecurStor 16i manager is onsite and hears an alarm, the manager must read the error message on the PC terminal or RAIDWatch screen to determine what has triggered the alarm. After determining what has occurred, the SecurStor 16i manager must take appropriate actions to rectify the problem.



WARNING!

If an alarm is triggered it is necessary for you to determine the problem. If the audible alarm is ignored and the problem is not rectified, unexpected damage may occur.

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3.3.1 Default Threshold Values

Table 3-7 shows the default threshold values for the EMD SecurStor 16i subsystem. If any of these values are surpassed, the alarm will sound:

	Upper Threshold	Lower Threshold
+3.3V	+3.6V	+2.9V
+5V	+5.5V	+4.5V
+12V	+13.2V	+10.8V
CPU Temperature	90°C	5°C
Controller Board Temperature	80°C	5°C
Enclosure Ambient Temperature	40°C	0°C

Table 3-7: Default Threshold Values

3.3.2 Failed Devices

If any of the following components fails, the audible alarm will be triggered:

- RAID controller module
- Cooling fan modules
- PSU modules
- BBU module
- Hard disk drives



NOTE:

When temperature exceeds a preset threshold, the controller's charger circuits will stop charging. You will then receive a message that says "Thermal Shutdown/Enter Sleep Mode." When the temperature falls back within normal range, the battery will resume charging.

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3.4 I²C Monitoring

The operating status of PSU and cooling fan modules are collected through an I²C serial bus. If either of these modules fails, the failure will be detected and you will be notified through the various methods described above.

Chapter 4

Subsystem Connection and Operation

4.1 Connection Overview

4.1.1 Cabling

Following are the requirements on the type of cables used to connect the subsystem's iSCSI host ports:

1. Gigabit Ethernet network cables.
2. Cat5e STP type cables or better performance types (important for meeting the requirements imposed by emission standards).
3. Straight-through Ethernet cables with RJ-45 plugs.
4. Use of cross-over cables can also automatically be detected and re-routed for a valid connection.

Connection:

1. Directly to iSCSI initiators or through Gigabit Ethernet switches.
2. To servers equipped with an iSCSI HBA, and then to client stations with an Ethernet NIC or iSCSI HBA.
3. The subsystem presents its logical capacity volumes through SCSI-like IDs and LUNs. These RAID volumes then appear as iSCSI targets through the network.



NOTE:

Even though iSCSI initiator software is a cost-effective way of building iSCSI SAN, software initiator adds additional workload to the server processor. It is recommended to apply iSCSI HBAs that come with TCP/IP offload engines in order to reduce overhead.

**WARNING!**

All cables must be handled with care. Make sure Ethernet cables do not run parallel with power cords. To prevent interference within a rack system, the cable routing path must be carefully planned and they must not be bent.

4.1.2 Network Topologies

The iSCSI host ports connect to Ethernet network devices and iSCSI initiators that comply with the IETF iSCSI standard (RFC 3720). Network connection of the EMD SS16i subsystem's iSCSI ports is flexible. The use of network connecting devices, subnet, Name Servers, or iSCSI management software can vary from case to case. In the following sections, configuration diagrams will be provided to illustrate the possible uses of the EMD SS16i subsystem in an iSCSI network.

Note that these configurations only recommend but do not intend to impose limitations on the use of subnet settings or networking paths to servers.

4.1.3 Points of Failure

The primary concern for configuring host-side topologies is that *points of failure* should be avoided. It is therefore preferred that the host side be connected to two (2) HBAs and better not the onboard Ethernet. Data flow and access management should therefore be implemented to avoid access contention. MPIO software can be implemented in order to discover a capacity volume through an alternate data link in the event of cabling failure.

4.2 Host Connection Topologies

4.2.1 Sample Topology – Direct-Attached, Dual-path Connection

In the configuration shown in *Figure 4-1*, one (1) EMD SecurStor16i subsystem is connected to two (2) servers. These servers are equipped with iSCSI HBAs and using the subsystem as the shared storage. Multiple arrays or logical partitions can be created and made available separately through different ID/LUNs on the host ports.

Note the following with the configuration as diagrammed below:

1. The RAIDWatch management software accesses a subsystem through its IP address. A management station running RAIDWatch can access the array through the 10/100BaseT management port.
2. Configuration of each port connection into a subnet isolates each iSCSI host link, decreases overheads, and eliminates the impact of link failure.

3. Different storage volumes are made available on host ports. Different volumes can be separately optimized for different I/O characteristics.

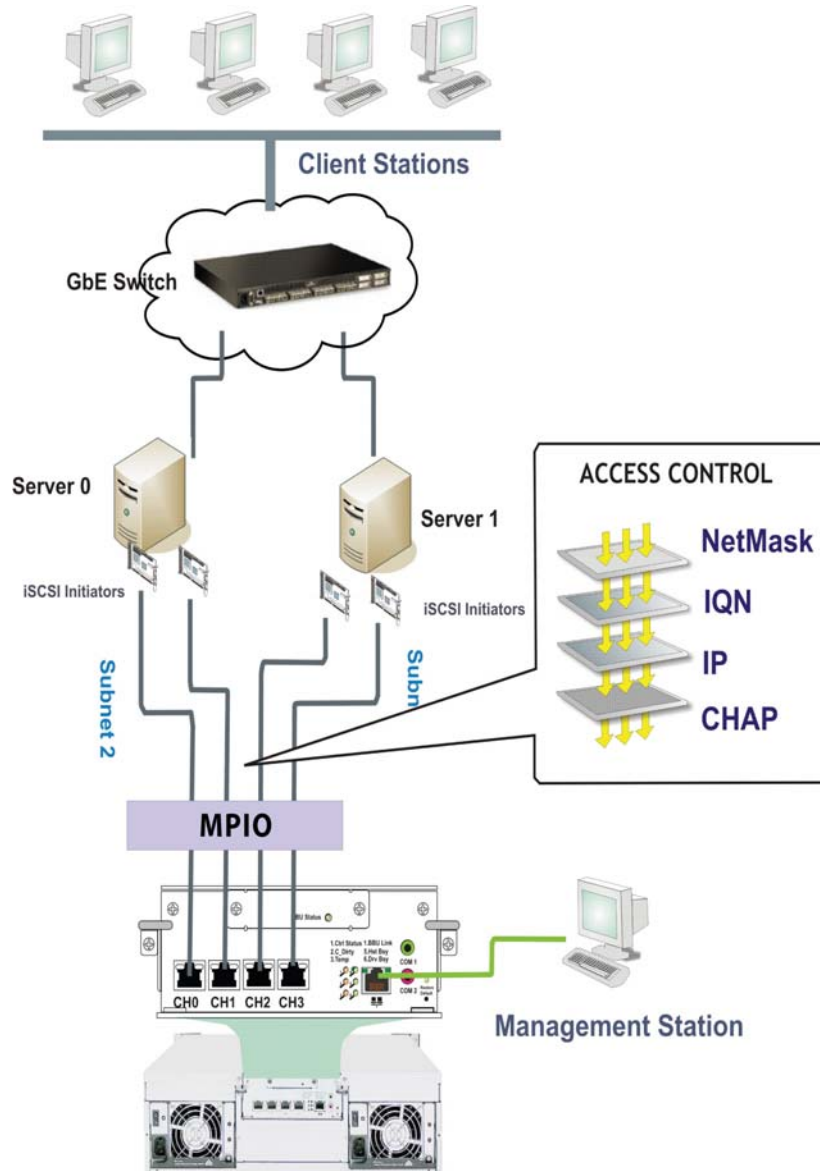


Figure 4-1: Sample Topology: Multiple Servers Each with Dual Connections

4.2.2 iSCSI Topology and Host LUN Mapping:

Configuration Details:

1. A logical drive can be associated with several SCSI IDs on separate channels making it a RAID volume accessed through different data paths. The default ID on every host channel is ID#0. More can be created if the need arises.
2. You can manually include or exclude specific iSCSI initiators from the access list to you iSCSI arrays. A number of access conditioning factors can be included: IQN, NetMask value, CHAP, and IP addresses can be associated with a RAID array (a logical drive). In this way, only the authorized host adapters can access your arrays.
3. In the sample below, 2 logical drives are created each out of 8 member drives. Depending on your demands for logical capacity volumes, specific array parameters such as optimization modes, spare drives, RAID level, and stripe size/width, can be specified when creating logical drives.
4. Subnet can be created to reduce overheads and provide access security. LAN configuration is beyond the scope of this hardware manual.
5. Multiple arrays or multiple partitions can be created and made available separately through different ID/LUNs on the host ports. The RAID volumes appear as shared storage over the Ethernet network.
6. To ensure the optimal performance, make sure you connect the iSCSI RAID to a high speed Gigabit Ethernet network.

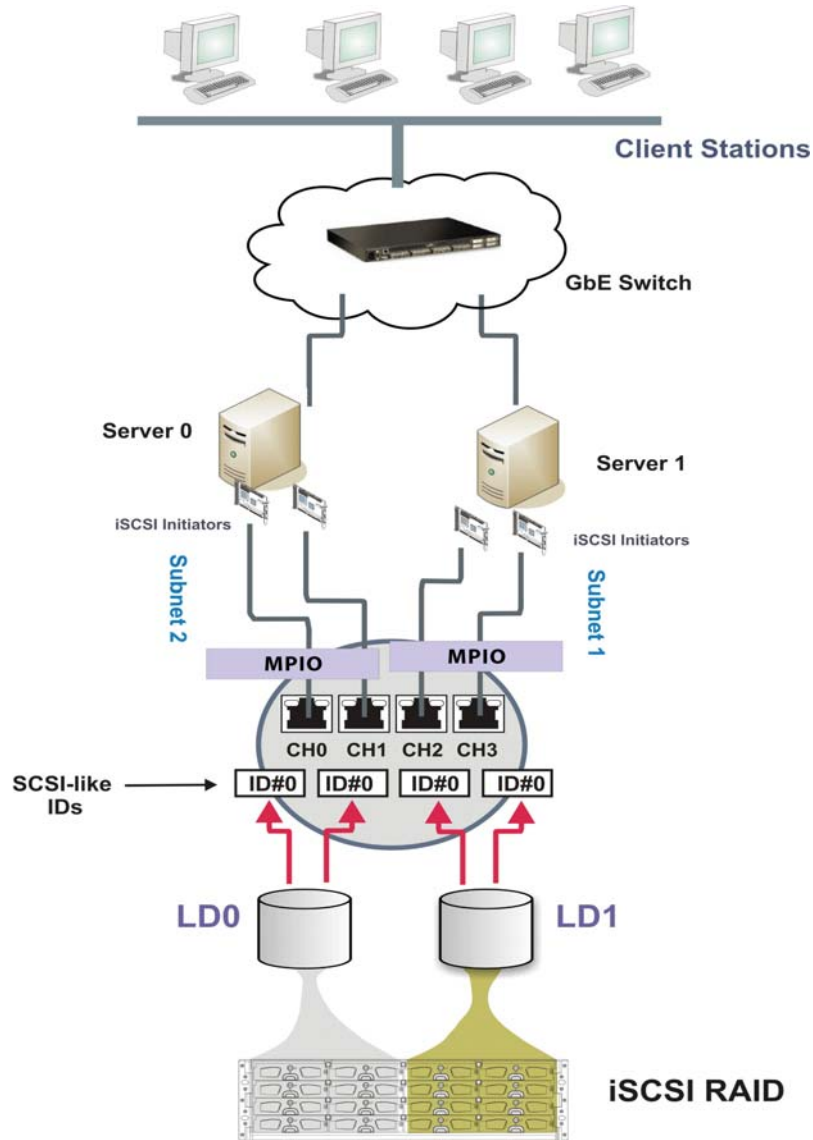


Figure 4 - 2: Sample Topology: Connection and Host LUN Mapping

4.3 Power On

Once all the components have been installed in the EMD subsystem, the iSCSI ports have been connected to the network, power on the network devices, the subsystem, and then power on the servers/iSCSI initiators.

4.3.1 Check List

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

- Memory Modules** – Memory modules have been correctly installed on the controller boards. You may skip this if you have not changed the pre-installed module.
- BBU Modules** – If used, that the BBU module has 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.
- Cable Connections** – The iSCSI ports on the subsystem have been correctly connected to the initiators or the Ethernet network.
- Power Cords** – The power cords 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.

4.3.2 Power On Procedure

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



Step 1. **Power on the network connection devices.**

These devices include the Ethernet switches, iSCSI HBAs, and any other such devices that have been connected to the EMD SS16i subsystem. Please refer to the documentation that came with your network device to see the power on procedure.



Step 2. **Power on the EMD subsystem.**

The EMD subsystem should only be powered on after all the network connection devices have been powered on. Consult your network administrators for proper network configurations. The power on procedure for the EMD subsystem is described below.



Step 3. **Power on the initiators.**

The servers or iSCSI initiators should be the last devices that are turned on. Please refer to the documentation that came with your application servers to see their own power on procedures.

4.3.3 Power On Enclosure

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. There is no limitation on which PSU should be powered on first.

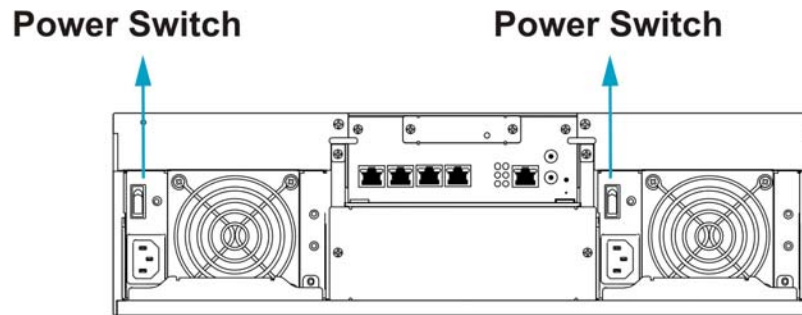


Figure 4-3: Power Switches



CAUTION!

Although the PSUs are redundant and a single PSU can provide sufficient power to the subsystem, it is advisable to turn both of the power switches on. If only one PSU is operating and fails, system operation will be terminated.

4.3.4 Power On Status Check

Once the 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* LED should flash green.
- Drive Tray LEDs** – The drive status LEDs (that contain hard drives) should all lights blue.
- Firmware and RAIDWatch** – The overall status of the system may be checked using the embedded firmware utility or the RAIDWatch GUI screen.
- 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 right after power-on, indicating the RAID control unit is attempting to access the hard drives.



NOTE:

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

4.4 Power Off Procedure

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



NOTE:

When powering down the EMD subsystem, please ensure that no time-consuming processes, like a “Logical Drive Parity Regeneration” or a “Media Scan,” are taking place.



Step 1.

Stop I/O access to the system.

Stop all I/O accesses to the SS16i subsystem. Please refer to the related documentation of your applications.



Step 2.

Flush the cache.

Locate the Cache_Dirty LED on the back of controller module to check if there is data cached in the memory. Use the Shutdown Controller function to flush all cached data. This prepares the RAID subsystem to be safely powered down.



Step 3.

Turn off the power.

Turn off the power. Once the RAID subsystem has been powered down, other devices connected to the subsystem can be powered down.

Chapter 5

Subsystem Maintenance and Upgrading

5.1 Overview

5.1.1 Maintenance

Constant monitoring and maintenance of your SS16i 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 module – *Section 0*
2. Memory module – *Section 0*
3. BBU module - *Section 0*
4. PSU modules – *Section 5.5*
5. Cooling fan modules (bundled with PSU modules, not separately available) – *Section 0*
6. Hard drives – *Section 5.7*

5.1.2 General Notes on Component Replacement

- With the exception of the RAID controller module, all of the components on the SS16i subsystem, including the PSU modules (along with the cooling modules within), and drive trays, are hot-swappable and can be replaced while the subsystem is still in operation.
- Qualified engineers who are familiar with the SS16i subsystem should be the only ones who make component replacements. If you are not familiar with the subsystem and/or with RAID subsystem maintenance in general, it is strongly advised that you refer subsystem maintenance to a suitably qualified maintenance engineer.
- Normalized airflow is directly dependent on 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. Rough or improper handling of components can lead to irreparable damage.
- When removing a RAID controller module from the subsystem, ensure that your applications running on servers have been properly closed, users notified of the down time, all cached writes conducted, etc. Ensure that 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.

**WARNING!**

*When inserting a removable module, take heed that **DO NOT USE EXCESSIVE FORCE!** Forcing or slamming a module can damage the connector pins either on the module itself or on the backplane. Gently push the module until it reaches the end of module slot. Feel the contact resistance and use slightly more force to ensure the module connectors are correctly mated. If the module comes with rejection levers or retention screws, use them to secure the module.*

5.2 Replacing Controller Module Components

5.2.1 Overview

The controller module consists of the following components:

- **DIMM Module** The DIMM module can be replaced when a DIMM module fails or if a larger capacity DIMM is required.
- **BBU** If the BBU has lost its ability to hold electric charge, replace it with a certified module. With the new BBU that comes with ASIC400 models, an EEPROM is implemented and that system administrators will be notified by system events when the approximate one-year life expectancy is reached.

**WARNING!**

1. *The BBU is hot-swappable and can be independently swapped from the controller. However, the BBU is installed into a metal bracket on the controller module. When the controller is removed, the BBU is also removed.*
 2. *It is recommended to remove the BBU from the chassis before handling the controller because the BBU needs to discharge the charge built up from supporting the cache memory. If you replace a DIMM module with supplied voltage, damage may occur.*
-

5.2.2 Notes on Controller Module Maintenance

- The controller module contains a DIMM module for cache buffer. When replacing the controller module, the DIMM module can be removed and used on the replacement controller if they are known to be good.
- When replacing the controller module, you must remember that the controller board is one of the most sensitive components in the EMD SS16I 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, 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. **Prepare a clean, static-free work pad or container** into which to place the controller that will be removed from the chassis.



Step 2. **Make sure there is no data access to the subsystem to avoid losing data.** Stop all I/O accesses to the subsystem and make sure all cached writes have been distributed to disk drives.



Step 3. **Power off the subsystem.** If possible, **power off** the subsystem in the way described in *Chapter 4*. Be sure to flush all cached data before powering off the subsystem. If it is not possible to do this **turn off** both PSU modules and disconnect the power cords.



Step 4. **Disconnect all cables** that are connected to the controller module you wish to replace. These include the Ethernet cables connected to the network, and any cable connected to the RS-232C audio jack connector.



Step 5. **Remove the BBU module if one has been installed.** Loosen the BBU module's retention screws and then retrieve it from the chassis.

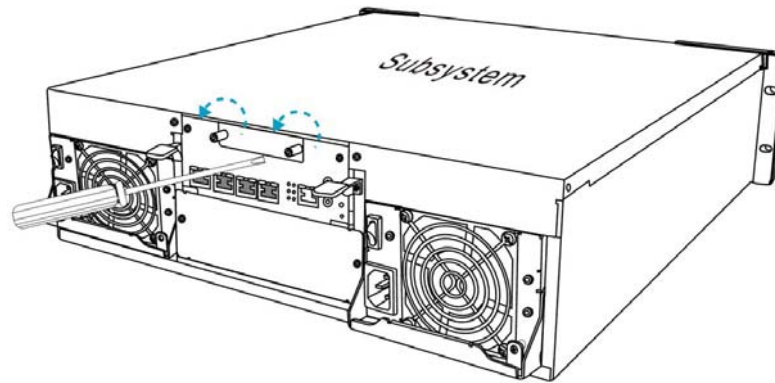


Figure 5-1: Loosening the Retention Screws from the BBU Module



Step 6. **Loosen the retention screws from controller.** Use a medium-size Phillips screwdriver to remove the screws underneath each of the ejection levers. Keep the screws for future use.

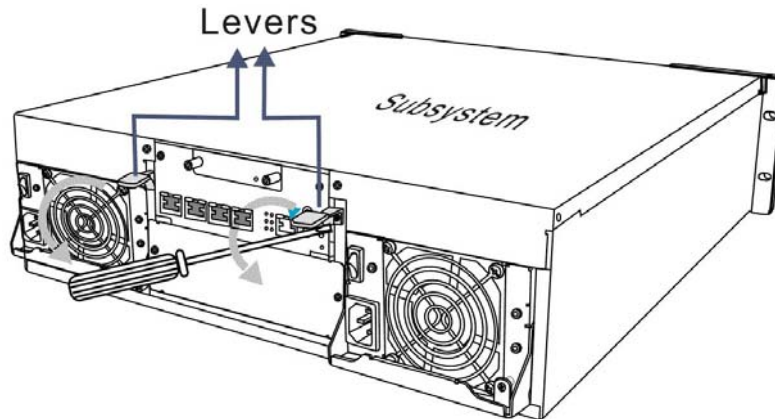


Figure 5-2: Loosening the Retention Screws from the Controller Module



Step 7. Disconnect all cables from the controller module. These include the cables connecting to host or cascaded subsystems, and any cables connecting the COM ports.



Step 8. **Remove the controller module** by pressing down the two ejection levers. The controller will automatically be eased out of the module bay. Gently pull the controller module out of the subsystem with one hand underneath to support the weight of the module.

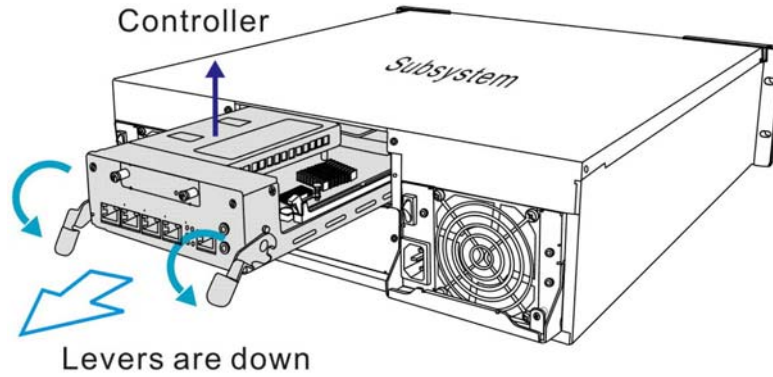








Figure 5-3: Removing the Controller Module from Chassis

5.2.4 Replacing the Controller Module

If the controller module has failed, replace a failed controller with a replacement from your vendor:

- 
 Step 1. **Remove the failed controller.** (See Section 0) If the DIMM module is undamaged it can be removed (See Section 0) and reused on the new controller module.
- 
 Step 2. **Install a DIMM module on the new controller module.** (See Section 0)
- 
 Step 3. **Insert the controller module.** Align the controller module with the controller module bay at the rear of the subsystem, making sure that the levers are down. Gently slide the controller module in.
- 
 Step 4. **Secure the connection.** Once the controller reaches the end and you feel the contact resistance, you can lift up the levers on the sides. The levers will ensure that the back-end connectors are properly mated.
- 
 Step 5. **Fasten the hand screws.** Once fully inserted secure the controller module to the chassis by fastening the retention screws through the holes underneath the ejection lever.
- 
 Step 6. **Re-attach all the cables** that you previously removed. These include the cables that connect to the local network or iSCSI initiators that were previously attached to the iSCSI ports, and any cable that was attached to the RS-232C audio jack connector.



Step 7. **Power up** the subsystem.

5.3 Replacing or Upgrading Memory Modules

5.3.1 Memory Module Installation Overview

- The subsystem comes with a pre-installed 512MB (or above) DDR RAM DIMM module. The controller supports a memory module up to 2GB in size. If DDR RAM DIMM modules with a different size need to be used or the original memory module is damaged in some way, the pre-installed module can be removed and a replacement installed. Replacement and installation instructions are described fully below.
- A DIMM socket is located on the controller main circuit board. The controller board is a sensitive component and must be treated with care.



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.

5.3.2 Selecting the Memory Modules

If the memory module on the SS16i controller module is going to be replaced, the following factors must be considered when purchasing replacement DIMM modules:

- **Purchasing a DIMM module:** To avoid the compatibility issues, it is recommended to contact EMD for an updated list of compatible DIMM modules. We provide tested modules from reliable vendors with reliable chips.
- **DDR RAM DIMM modules supported:** The subsystem supports 184-pin, registered, ECC-capable DDR RAM DIMM modules with memory capacities ranging from 512MB to 2GB.
- **Installation considerations:** When installing the DIMM module, it is necessary to remove the controller module. The controller board is more susceptible to damage than 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.

5.3.3 DIMM Module Installation



WARNING!

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



Step 1. Prepare an anti-static work pad or container for placing a removed module. Use of an ESD grounding strap is highly recommended.



Step 2. Remove the BBU module, if installed. Carefully place the module for it contains Li-ion batteries. Do not drop it to the floor or place it near any heat source or fire.



Step 3. **Remove the controller module.** See Section 0.



Step 4. **Remove the previously installed DIMM module from the DIMM socket.** To do this, push the white module clips on either side of the DIMM socket down. By doing this, the previously installed modules will be ejected from the DIMM socket. (See Figure 5-4)

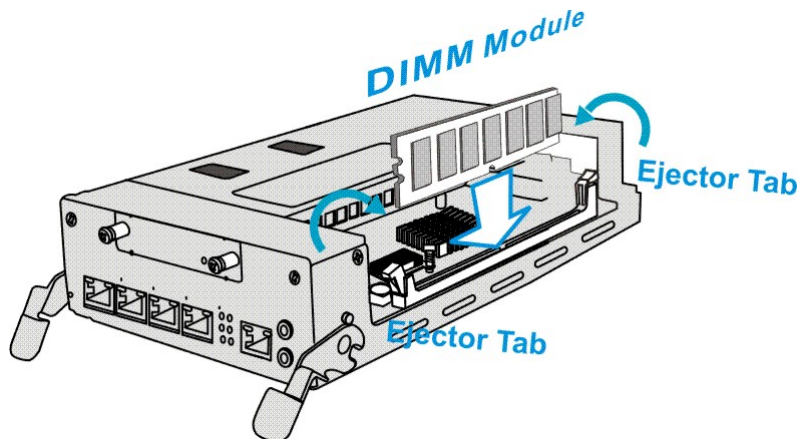


Figure 5-4: Removing a DIMM Module



Step 5. **Gently pull the DIMM module out of the DIMM socket.**



Step 6. **Insert the replacement module into the DIMM socket.** Make sure the white clips of the DIMM socket are in the open positions. Align the DIMM module with the DIMM socket by checking its “keyed”

position. Once aligned, gently and firmly 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.



Step 7. *Reinstall the controller module.* After the DIMM module has been properly installed, install the RAID controller. To do this, align the controller module with the controller module bay. Then gently push the controller module in the controller bay. Carefully push the controller until you feel the contact when the board edge connectors are being mated to the backplane. Do not use force. If unusual contact resistance is felt, try it again. Use the ejection levers on the sides of the controller to secure it into the chassis.

When the controller is inserted with the lever at its the lowest position, notches on the levers should properly clinch to the round metal protrusions on the interior walls of module bay. You may then pull the lever upward to secure the controller into module bay.



Step 8. Next secure the controller module into the subsystem by fastening the screws through holes underneath each ejection lever.

5.4 Replacing a Faulty BBU

The BBU is an optional item for the subsystem that can sustain cache memory in the event of a power failure or in the unlikely event of failing both PSUs. The BBU provides additional data security and helps minimize the chance of losing data due to power outages.

A BBU consists of a metal bracket, battery cell pack, and a PCB board that connects to the controller module. Each BBU is secured to the subsystem using retention screws. Please read the BBU handling precautions below before proceeding with the replacement procedure.

Fault Conditions:

A BBU failure can result from the following:

1. A BBU has lost its ability to hold electrical charge. This may be the case after the battery cells have been recharged for many times regardless of how long the module has been used. Therefore, a stable power source is important for system operation.
2. The charger circuitry implemented with the controller has failed.

There are other conditions that might trigger the BBU fault events and trigger the BBU fault LED:

1. The temperature sensor embedded with the subsystem's charger circuit reports a temperature reading exceeding the preset threshold. The charger circuits will enter a low-power and self-protection state.
2. A BBU module has been charged for over twelve (12) hours. A timer is embedded with the charger. When this occurs, the charger will enter a timer fault state. The fault condition usually occurs with a brand new BBU or with a totally discharged

BBU. Charging will resume automatically if you remove and re-install the BBU module.

5.4.1 BBU Warnings and Precautions

- Install or replace the BBU with BBUs supplied by your EMD vendors only. Use of battery cells provided otherwise will void our warranty.
- Always dispose of a replaced battery in an ecologically responsible manner. Dispose of used BBUs at authorized battery disposal sites only.
- Do not use or leave the BBU near a heat source. Heat can melt the insulation and damage other safety features of battery cells, possibly will cause acid leak and result in flames or explosion.
- Do not immerse the BBU in water nor allow it to get wet. Its protective features can be damaged. Abnormal chemical reactions may occur, possibly cause functional defects, acid leak, and other hazardous results.
- Do not disassemble or modify the BBU. If disassembled, the BBU could leak acid, overheat, emit smoke, burst and/or ignite.
- Do not pierce the BBU with a sharp object, strike it with a hammer, step on it, or throw it. These actions could damage or deform it and internal short-circuiting can occur, possibly cause functional defects, acid leak, and other hazardous results.
- If a BBU leaks, gives off a bad odor, generates heat, becomes discolored or deformed, or in any way appears abnormal during use, recharging or storage, immediately remove it from the subsystem and stop using it. If this is discovered when you first use the BBU, return it to EMD.

5.4.2 Replacing a Faulty BBU

To replace the BBU, please follow these steps:



- Step 1. ***Remove the faulty BBU from the chassis.*** The BBU module is secured to the chassis with two (2) screws. Loosen the retention screws located at the sides of the BBU faceplate, then pull out the BBU. (See *Figure 5-5*)

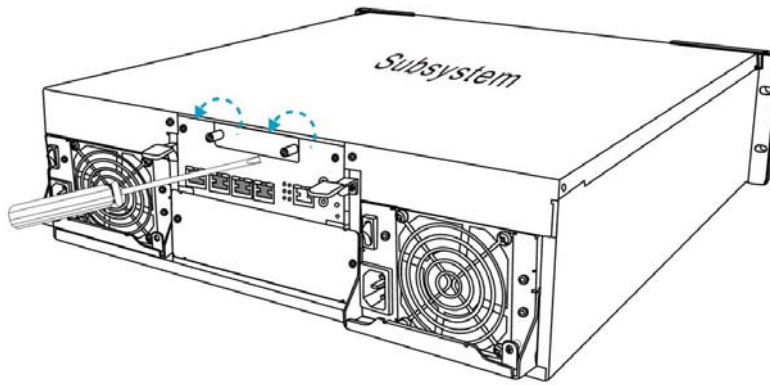


Figure 5-5: Remove the Retention Screws from BBU Faceplate

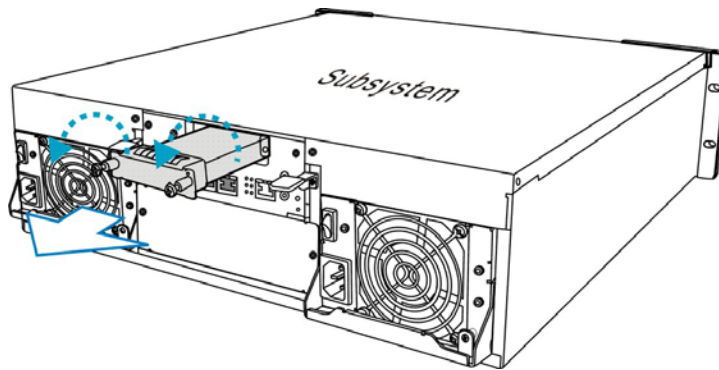


Figure 5-6: Remove the BBU Module



Step 2. **Install the replacement BBU.** After the faulty BBU has been removed, the new BBU module can be installed. To do this, align the BBU module with the empty slot, and then gently push the BBU module into the slot. (See *Figure 5-7*)

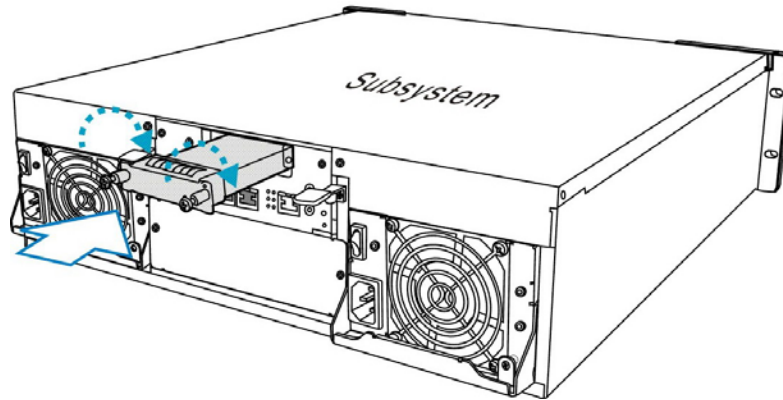


Figure 5-7: Install the BBU Module



Step 3. **Secure the BBU module to the enclosure.** Tighten the two (2) retention screws as shown above using a Phillips screwdriver.



Step 4. **Reset the subsystem.** Find appropriate time to reset the subsystem for the subsystem firmware to recognize the replacement module. After reset, the BBU LED will start flashing to indicate that the BBU is being charged. When the BBU is fully charged, the LED will be off.



NOTE:

1. A new or replacement BBU takes approximately seven (7) hours to charge to its full capacity. Reset the subsystem whenever a BBU is replaced or added in order for the replacement module to take effect.
2. The life expectancy of a BBU is more than one year. However, it is considered a safe procedure to replace the BBU every year. Follow the procedures above to replace a used BBU with a replacement in order to maintain the fault tolerance feature.
3. The chance of BBU charger failure is comparatively low. If the cause of a failure cannot be determined even after a BBU module is replaced, contact your system vendor for a replacement controller and return the controller module through EMD's standard RMA procedure.

5.5 Replacing a Failed PSU Module

5.5.1 Notes on PSU Module Maintenance

- **Two (1+1) redundant PSU modules:** The subsystem comes with two fully redundant, hot-swappable PSU modules. These modules are located at the rear section of the subsystem.
- **PSU canister:** Each PSU module is housed in a robust steel canister, with the power supply converter unit in the front and two serial-aligned cooling fans in the rear section. When the PSU is removed from the chassis, the cooling module is also removed.
- **Printed text on PSU handle:** Before you insert a new PSU, make sure that the printed text on the PSU handle matches the printed text on a partner PSU. Double-check to avoid using a PSU of a different EMD series.

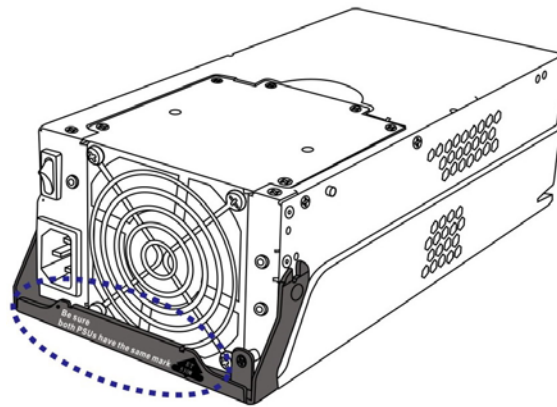


Figure 5-8: Printed Text on PSU Handle

- **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 subsystem can operate using a single PSU module, it is not advisable to run the EMD subsystem with a single PSU module for an extended period of time.

5.5.2 Replacing the PSU Module



WARNING!

Before you insert a new PSU, be sure that it has the same warning label on its extraction handle as that shown on the lever of a remaining PSU. Double-check to avoid mixing a similar yet different PSU of another EMD series.

To replace a PSU, please follow these steps:



Step 1. **Power off the PSU.** The power switch is located on each PSU's rear-facing panel. (See *Figure 5-9*)



Step 2. **Disconnect the power cord** that connects the PSU to the main power source.



Step 3. **Remove the retention screw** that secures the rejection handle to the chassis. (See *Figure 5-10: Removing the PSU Retention Screw.*)

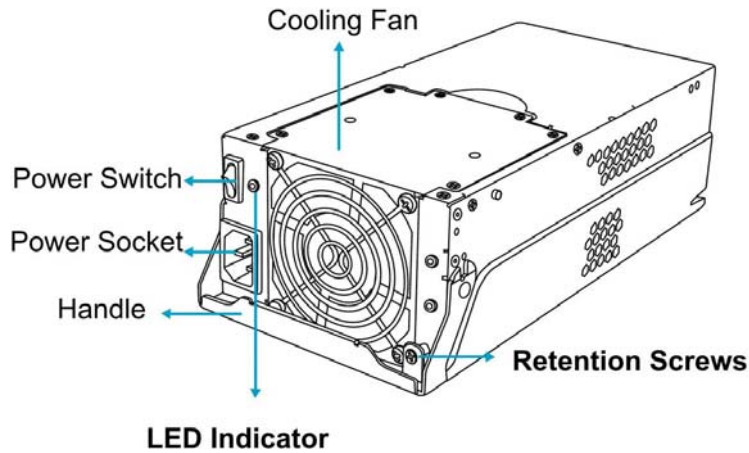


Figure 5-9: PSU Parts Identification

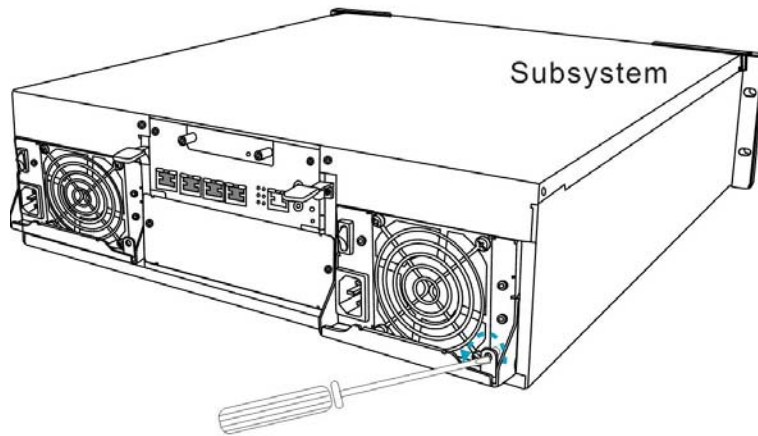


Figure 5-10: Removing the PSU Retention Screw



Step 4. **Remove the PSU module** by grabbing the rejection handle and pulling the handle upwards. The rejection handle should gracefully disconnect the PSU from the backplane connectors. Once dislodged, gently pull the PSU module out of the subsystem. If the subsystem is mounted in a rackmount rack, use another hand to support its weight while removing the module. (See *Figure 5-11*)

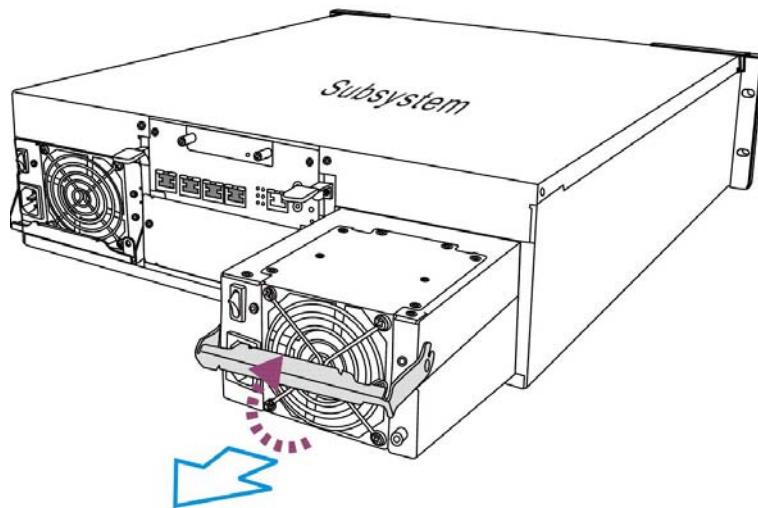


Figure 5-11: Removing the PSU Module

**WARNING!**

1. When a PSU is removed from the chassis, the cooling module is also removed from the chassis.
2. It is recommended that the replacement procedure is completed in less than five (5) minutes to prevent the subsystem from overheating.



Step 5. **Install the replacement module.** Make sure the ejection handle is at its up-most position so that the saddle notches on the sides of the handle can snap onto the metal protrusions along the interior walls of the PSU slot. Push the PSU into chassis, and when you feel the contact resistance, push the handle downward to secure the module.



Step 6. **Secure the PSU to the subsystem** by fastening the retention screw through the PSU ejection handle.



Step 7. **Replace and Connect the power cord** that connects the PSU module to the mains.



Step 8. **Power on the PSU module.**

5.6 Cooling Module Maintenance

5.6.1 Notes on Cooling Module Maintenance

- **Redundant cooling modules:** The subsystem is equipped with four (4) cooling fans, two (2) within each PSU module. These cooling modules control the internal operating temperature of the subsystem and therefore their working integrity should be maintained at all times.

Although the cooling modules are fully redundant, it is not advisable to run the EMD subsystem with fans in a single PSU module for an extended period of time. If the cooling fans in the only remaining PSU module fail, the subsystem will quickly overheat.

- **Detecting a failed cooling module:** If a cooling module fails, the LEDs located at the back of the PSU module, an audible alarm, the firmware, the RAIDWatch manager software, or the Configuration Client can notify you.
- **Replacing a cooling module:** Once 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 immediately available.

5.6.2 Replacing a Cooling Module

If one of the cooling modules fails, it must be replaced as soon as possible. The cooling module is secured to the PSU module with the six (6) screws from the top. To replace the cooling module, follow the steps below:



WARNING!

The fan replacement process should be completed within five (5) minutes. If the process takes too long, the accumulated heat can damage the subsystem.



Step 1. **To remove the cooling module**, remove the PSU module first. Please follow the PSU removal process listed in the previous discussion.



Step 2. **Use a medium-size Phillips screwdriver to remove the six screws from the top of the PSU module.** (See *Figure 5-12: Removing a Cooling Module*)

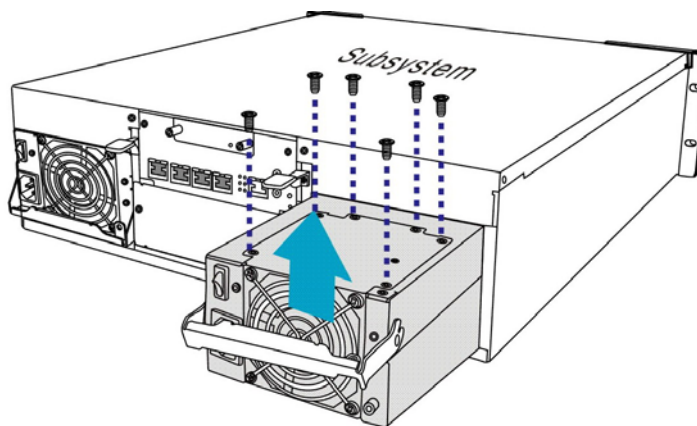


Figure 5-12: Removing a Cooling Module



Step 3. **Remove the cooling fan assembly by the following steps:**

Step 3-1. Make sure the PSU handle is in the down position so that you can grab the edge of the cooling fan assembly.

Step 3-2. Use your thumb and middle fingers to seize the cooling assembly, your thumb by the upper edge of the fan guard and your middle finger at the hemispheric indent.

Step 3-3 Tilt the fan a little bit and remove the fan assembly with a precisely vertical motion.

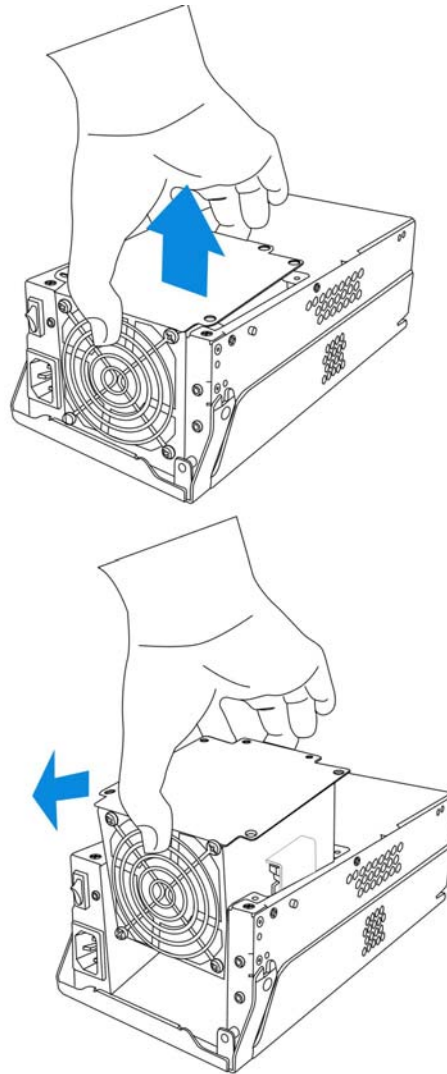


Figure 5-13: Removing a Cooling Module



Step 4.

Install the replacement module by aligning it with the module bay on the PSU module and gently lowering it into. The fan outlet should be aligned with the PSU faceplate and that the side with screw holes should be facing up. Do this with a precisely vertical motion so that the cooling module's connector can correctly mate with the connector in the module bay.



Step 5. **Secure the module** by fastening the screws you previously removed.



Step 6. **Reinstall the PSU module into chassis.** When powered on, check if the cooling fan LEDs are lit. If not, that means your cooling fans are operating properly.

5.7 Replacing a Failed Hard Drive

5.7.1 Hard Drive Maintenance Overview

- **Hot-swappable drive trays:** The drive trays are all hot-swappable. A disk drive failure can be corrected online.
- **Handles:** If the failed hard drive is behind either the left or right front handle, unfold the handles to open the front access to the drive trays.

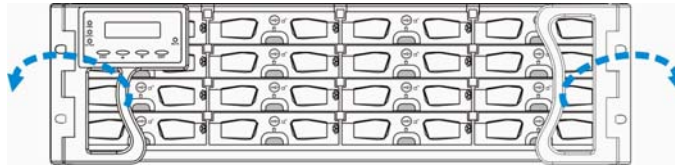


Figure 5-14: Open the Front Handles



Step 1. **Open flap:** Once the front 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 front flap has been opened may cause data errors.



Step 2. **Slowly remove a faulty drive:** When removing a drive tray from the subsystem, **pull the drive tray out only about one inch and then wait for at least 30 seconds for the hard drive motor to spin down before taking it out completely.** Any impact to the hard drive while the drive motor is spinning can damage the hard drive.

There are situations that healthy drives can be removed. In operations such as Copying & Replacing member drives with drives of larger capacity, you may need the replaced disk drives in other installations.



- Step 3. **Keep a replacement on hand:** If a hard drive has failed, make sure you have a replacement drive readily available before removing the failed drive from the subsystem. Do not leave the drive tray slot open for an extended period of time or the normalized airflow will be disrupted and subsystem components will overheat and may become permanently damaged.

5.7.2 Replacing a Hard Drive

To replace a hard drive, please follow these steps:



WARNING!

Hard drives are fragile; therefore, always handle them with extreme care.

- *Do not drop the hard drive.*
- *Always be slow, gentle, and careful when handling a hard drive.*
- *Handle a hard drive only by the edges of its metal cover, and avoid touching its circuits part and interface connectors.*



- Step 1. **Identify the location of the drive tray** that contains a hard drive indicated as faulty. You may use firmware utility or RAIDWatch software to locate a faulty drive. The drive tray LED should also light red.



- Step 2. Make sure **the rotary bezel lock is in the unlocked position**, i.e., the groove on its face is in a horizontal orientation. If the groove is in a vertical position, as shown below, then the bezel lock is locked and the front flap on the drive tray cannot be opened.

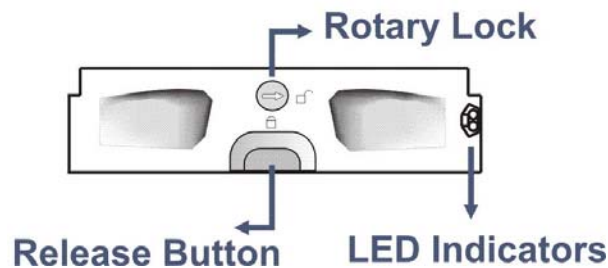


Figure 5-15: Front View of an Individual Drive Tray



Step 3. **Open the front flap on the drive tray.** Push the release button on the front of the drive tray. The front flap will automatically swing up into position.

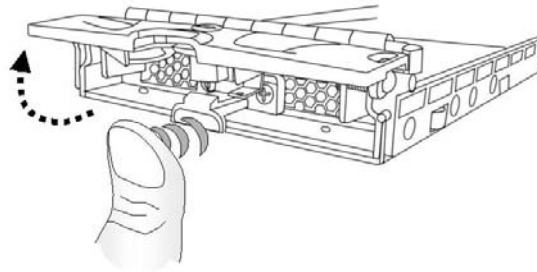


Figure 5-16: Opening the Drive Tray Front Flap



Step 4. **Remove the drive tray by pulling it one inch away from the drive bay.** Wait for at least 30 seconds for the disk drive to spin down (if the disk drive is removed for a different purpose, e.g., cloning the members of a logical drive or Copy & Replace), and then gently and carefully withdraw the drive tray from the chassis.

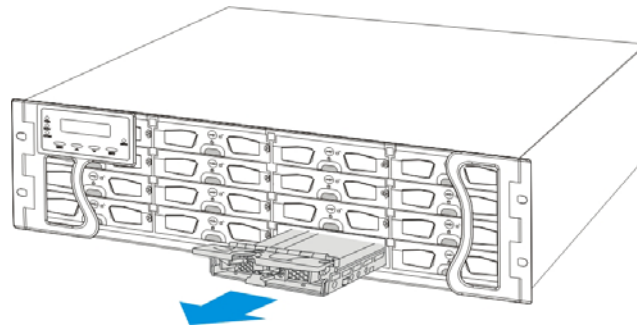


Figure 5-17: Removing a Drive Tray



Step 5. **Remove the four (4) retention screws** that secure the hard drive from the sides of the drive tray (two on each side.)

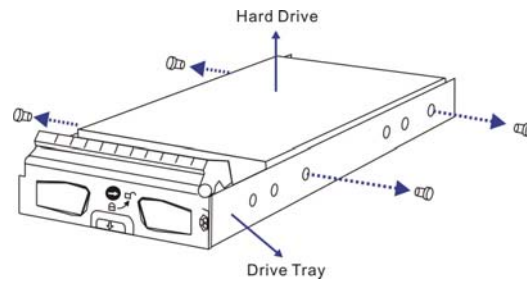


Figure 5-18: Loosening the Hard Drive Screws



Step 6. ***Install the replacement hard drive.*** Please refer to the complete hard drive installation procedures in ***Section 2.6.***

Appendix A

Specifications

A.1 Technical Specifications

Environmental Specifications	
Humidity	5 to 95% (non condensing – operating and non-operating)
Temperature	<i>Operating:</i> 0° to 40°C (35°C if BBU is applied) <i>Non-operating:</i> -40° to 60°C
Altitude	<i>Operating:</i> Sea level to 12,000ft <i>Packaged:</i> Sea level to 40,000ft

Power Requirements	
Input Voltage	100VAC @ 9A 240VAC @ 4.5A with PFC (auto-switching)
Frequency	47 to 63Hz
Power Consumption	530W

Dimensions		
	With Forearm Handles (Not including rear-end protrusions)	Without Forearm Handles
Height	131mm (5.2 inches)	130mm (5.1 inches)
Width	482.6mm (19 inches)	445mm (17.5 inches)
Length	504.3mm (19.8 inches)	488.2mm (19.2 inches)

System Weight	
Net Weight	28kg (61.7 pounds)
Gross Weight	31kg (68.3 pounds)

Certifications	
<ul style="list-style-type: none"> • FCC Class-B • CE • CB • UL60959 / IEC 60950 • BSMI 	

Shock	
Half-sine	<i>Operating: 5G peak, 11ms duration</i> <i>Non-operating: 15G, 11ms duration</i>

Vibration	
Operating	5 to 500Hz, 0.2G, X/Y/Z
Non-operating	5 to 500Hz, 1.0G, X/Y/Z

Warning Alarms	
<ul style="list-style-type: none"> • Audible alarms • System LEDs • Event notification via the RAIDWatch Manager (LAN broadcast, email, fax, MSN, SMS, and SNMP traps) and RS-232C terminal screen 	

A.2 Controller Specifications

Configuration

Specification	
RAID Levels	0, 1(0 + 1), 3, 5, 6, 10, 30, 50, 60, JBOD, and non-RAID disk spanning
Host O/S Compatibility	Host O/S independent; also dependent on iSCSI offload utilities and hardware
Host Interface	RJ-45 Gigabit Ethernet
Host Channels	4 pre-configured host channels
Drive Interface	Supports up to 16 channels of 3Gbps SATA-II; SATA-I backward compatible
Drive Channels	All drive channels are pre-configured and cannot be changed
Cache Mode	Write-through, write-back, and adaptive write policy
Cache Memory	Pre-installed 512MB (or above) DDR RAM DIMM with/without ECC, registered; in one DIMM socket
Number of LUN's	Up to 32 per host ID
Multiple Target IDs/Host Channel	Yes
Firmware on Flash Memory	Yes

Architecture

Specification	
CPU	933MHz PowerPC 750GL
Gigabit Ethernet Chip Controllers	Intel 82546 x 2
DIMM Slot	One 184-pin DDR DIMM module
ASIC	Excel-Meridian Data 64-bit chipset (ASIC400)
Flash ROM	64Mbit (8MB)
NVRAM	128Mbit with RTC (with Embedded RAIDWatch utility)
Hardware XOR	Yes
Real-time Clock	For event messages with time record and task scheduling

A.3 Drive Tray Specifications

Specification	
Height	28mm
Width	110mm
Depth	218.92mm
Key Lock	Yes

A.4 Power Supply Specifications

Specification	
Nominal Power	530W with active PFC
DC Output	12.0V: 32A (Max.) 5.0V: 32A (Max.) 3.3V: 30A (Max.)
Input Frequency	47 to 63Hz
AC Input	100VAC @ 9A or 240VAC @ 4.5A with PFC
Power Factor Correction	Yes
Hold-up Time	At least 20ms at 115/230VAC full load after a loss of AC input
Over-temperature Protection	Auto shutdown when lost cooling or exceeded ambient temperature; over-voltage protection is also available.
Cooling Fans	No fans specific for PSU; heated air is drawn by the cooling fan module fixed in the rear section of PSU.

A.5 Cooling Module Specifications

Specification	
Speed	High or low rotation speed controlled by firmware proactive mechanisms
Max. Air Flow (each module)	High speed: 90 CFM Low speed: 70.7 CFM
Input Power	13.2W max.
Input Current	1.1A max.
Rated Voltage	DC 12V
Temperature	Operating: -10 to +70°C Storage: -30 to +70°C
Acoustic Noise	High speed: 51dB Max. Low speed: 46dB Max.

A.6 RAID Management

Specification	
Configuration	<ul style="list-style-type: none"> • Text-based firmware-embedded utility over RS-232C through the included audio jack-to-DB-9 serial cable • LCD keypad panel • The RAIDWatch Manager program using the management port (10/100BaseT)
Performance Monitoring	Yes
Remote Control and Monitoring	Yes
Event Broadcast/Alert	Yes (via RAIDWatch sub-modules, the Configuration Client utility, NPC, or Embedded, browser-based RAIDWatch)
Event Notification	Yes (via RAIDWatch sub-modules, Configuration Client, NPC, or Embedded, browser-based RAIDWatch)
Hardware Connection	over Ethernet or RS-232C
Configuration on Disk	Configuration data stored on disks for logical drive assemblies to exist after controller replacement; basic settings, e.g., channel mode settings, are stored on NVRAM
Failure Indicator	Via audible alarm, LCD panel, RAIDWatch Manager session, or terminal emulation

A.7 Fault Tolerance Management

Specification	
Drive S.M.A.R.T. support	Yes, with user-configurable detect-only, clone-and-replace, and perpetual-clone options.
Battery Back-up Option	Yes
Sensors and Module Presence detection through an I ² C serial bus.	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) or RAID6 Logical Drive	Yes
Salvage the 2 nd Temporarily Failed Drive in a RAID 1, 3 5, or	Yes

6 Logical Drive	
Salvage the 1 st Temporarily Failed Drive in a RAID 0 Logical Drive	Yes

Appendix B

Pinouts

B.1. D-SUB 9 and Audio Jack Pinouts

B.1.1. COM1 Serial Port Cable

COM1 Cable: This cable connects the COM1 serial port on the controller module to the serial port of a management computer. The serial port's defaults and requirements are:

1. Set at 38400 baud, 8 bit, 1 stop bit, and no parity.
2. In most cases, connecting RD, TD, and SG is enough to establish communications with a terminal.



Figure C-19: Adapter Cable for COM1 - Connector Pinouts

CN1 Pin Number	Pin Name
1	Ground
2	TXD
3	RXD

CN2 Pin Number	Pin Name
1	NC
2	RXD
3	TXD
4	DTR (Shorted)
5	GND
6	DSR (Shorted)
7	RTS (Shorted)
8	CTS (Shorted)
9	NC

Table B-1: COM1 Adapter Cable CN1 and CN2 Pin Out Definitions

B.1.2. COM2 Serial Port Cable to UPS

COM2 Cable: Use this cable to connect the COM2 port to a UPS.



Figure C-20: Connector Pinouts - Adapter Cable for COM2

CN1 Pin Number	Pin Name
1	Ground
2	TXD
3	RXD

CN2 Pin Number	Pin Name
1	TXD
2	RXD
3	NA
4	NA
5	NA
6	NA
7	NA
8	NA
9	Ground

Table B-2: COM2 Adapter Cable CN1 and CN2 Pin Out Definitions

B.2. Null Modem

A null modem has its wires swapped and is necessary for connecting COM1 CN2 to the serial port of a management computer.

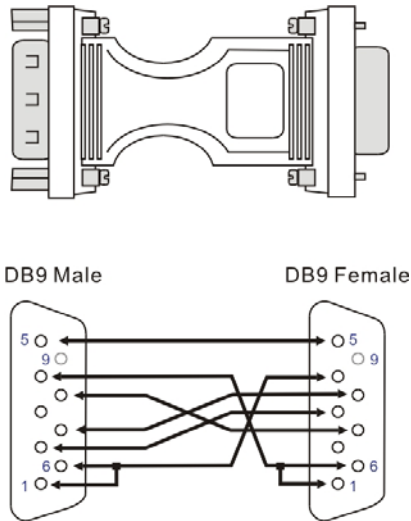


Figure B-21: Null Modem Pinouts

Swap pin 2 and pin 3
Swap pin 4 and pin 6
Swap pin 7 and pin 8

Table B-3: Null Modem Pinouts

B.3. Ethernet Port Pinouts

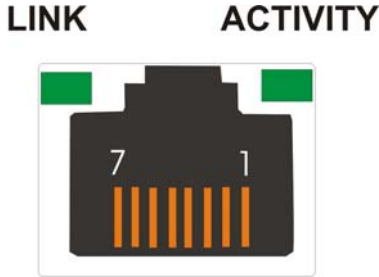


Figure B-22: Ethernet Port Pinouts

Pin	Pin Name	Pin	Pin Name
1	LAN_TXP	5	N2
2	LAN_TXN	6	LAN_RXN
3	LAN_RXP	7	N1
4	N2	8	N1

Table B-4: Ethernet Port Pinouts

B.4. STP LAN Cable

This shielded twisted pair cable is an optional accessory item. More details are shown below:

- Description: SFTP CAT5E Ethernet cable.
- Color: black.
- Connector: 8P8C plug (covered by metal shield)
- Cable type: round cable, #24AWG*4P braided wire OD: 6.2mm

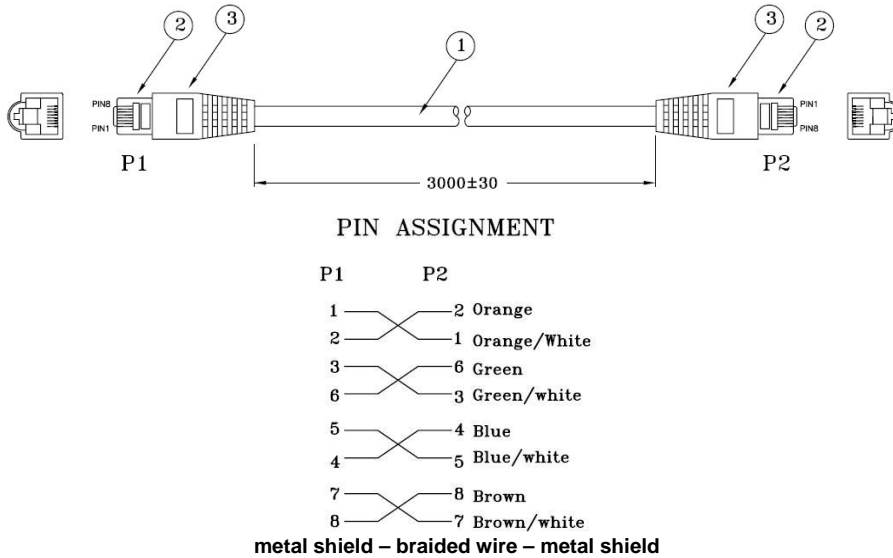


Figure B-23: STP Ethernet Cable Pinouts

B.5. Main Power

IEC-type receptacle. Unless specified otherwise, cable type will be determined by the shipped-to area.

Uninterruptible Power Supply

C.1 Uninterruptible Power Supply Overview

An uninterruptible power supply (UPS) is a separately purchased battery backup unit that is connected to an [EMD Storage](#) subsystem. If the UPS is sufficiently large, it [should allow](#) the whole subsystem [to safely finish the ongoing I/Os](#) in the event of an AC power failure.

C.2 Compatible UPS Supplies

The APC SMART_UPS [700VA](#) is compatible with the [SecurStor](#) subsystem.

C.3 Serial Communication Cable

The [subsystem](#) is shipped with a customized audio-jack_to_DB9 serial communication cable. The cable is used to connect the controller module on a subsystem to a PC hyperterminal for subsystem management. If you wish to use a UPS with your subsystem, an additional [audio-jack to DB9](#) serial communication cable (see [Figure C-24](#)) must be purchased.

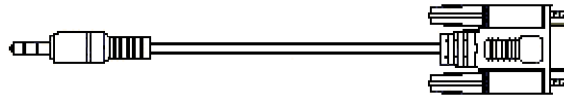


Figure C-24: Audio-Jack to DB9 Serial Communication Cable



CAUTION!

The pinouts on the COM2 audio-jack to DB9 serial cable used to connect to the UPS are different from the pinouts on the serial cable that was shipped with the subsystem. When connecting the UPS device, please [make sure you use the correct cable type](#). The cable pinouts are listed in [Appendix B](#).

C.4 Connecting the UPS to the Subsystem

C.4.1 Connect the PSU Module Power Cords

The two (2) power [cables](#) 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 C-25*) Please refer to the UPS manual to determine the location of these sockets. The UPS must then be connected to main power.

C.4.2 Set the Baud Rate

The default baud rate for the COM 2 serial port is 38400 and must be changed to 2400. [For instructions on changing the baud rate, please refer to the *SCSI to SATA RAID Subsystem's Operation Manual* that came with the subsystem.](#)

C.4.3 Connect COM2

The separately purchased audio-jack-to-DB9 serial cable connects the COM2 port on the controller module to the UPS directly. (See *Figure C-25*) The cable transmits UPS status updates to the controller module 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.

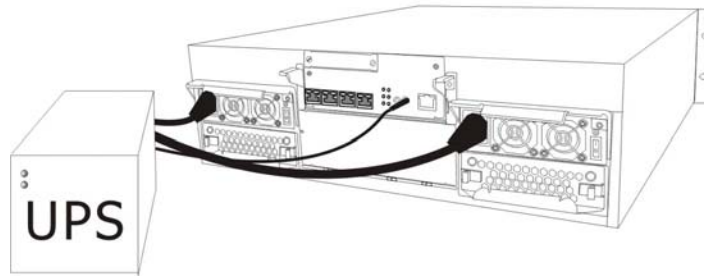






Figure C-25: Connecting the UPS to the Subsystem

C.5 Power On

When powering on the subsystem, the UPS must be powered on before the subsystem. [For instruction on 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 SCSI channel connection devices (including hubs and switches).
-  **Step 2.** Power on the UPS.
-  **Step 3.** Power on the subsystem.
-  **Step 4.** Power on the host computers.



Step 5. 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.
- If you are daisy chaining systems together, be sure to make all the cable connections and then power on the *SecurStor 16i* subsystem that is not directly connected to host computer before powering on the first subsystem.

C.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.

C.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.

C.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.

C.6.3 UPS Message Summary

Table C-1 below 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
<i>UPS connection is absent</i>	N/A	N/A	Write back
<i>UPS connection detected</i>	N/A	N/A	Write back
<i>Warning: UPS AC Power-Loss detected</i>	Disconnected	BPL > 50%	Write through
<i>Warning: UPS Battery Low 50%. Please shut down to protect data loss</i>	Disconnected	BPL < 50%	Write through
<i>Warning: UPS Battery Low 50%.</i>	Connected	BPL < 50%	Write through
<i>UPS AC Power Restored</i>	Reconnected	BPL > 50%	Write back
<i>UPS AC Power Restored</i>	Reconnected	BPL < 50%	Write through
<i>UPS Battery restored to safe level</i>	Reconnected	BPL > 50%	Write back

Table C-1: UPS Status Messages

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