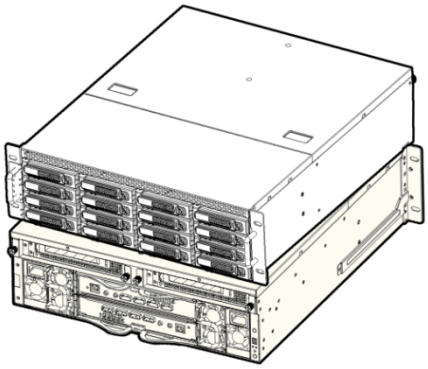
3U 16-Bay SBB RBOD



Hardware User's Manual

Model	Description
XB-RM11-3163S-SRxxxx-A1	StudioRAID 16Re, 3U 16-Bay SAS RBOD
SSG-SBRDSA1Sxx-3163-A2	Standard 3U 16-Bay SAS RBOD

Document	XM-UG-A-XSR-316
Date	4/14/10
Version	1.01

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Changes

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FCC Compliance Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference.
(2) This device must accept any interference received, including interference that may cause undesired operation.

Warning:

- A shielded-type power cord is required in order to meet FCC emission limits and also to prevent interference to the nearby radio and television reception. It is essential that only the supplied power cord be used.
- 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.

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SAFETY PRECAUTIONS

Before getting started, please read the following important cautions:

- All cautions and warnings on the equipment or in the manuals should be noted.
- Most electronic components are sensitive to electrical static discharge, therefore, be sure to ground yourself at all times when installing the internal components.
- Use a grounding wrist strap and place all electronic components in static-shielded devices. Grounding wrist straps can be purchased in any electronic supply store.
- Be sure to turn off the power and then disconnect the power cords from your system before performing any installation or servicing. A sudden surge of power could damage sensitive electronic components.
- Do not open the system's top cover. If opening the cover for maintenance is a must, only a trained technician should do so. Integrated circuits on computer boards are sensitive to static electricity. Before handling a board or integrated circuit, touch an unpainted portion of the system unit chassis for a few seconds. This will help to discharge any static electricity on your body.
- Place this equipment on a reliable surface when install. A drop or fall could cause injury.
- Please keep this equipment from away humidity.
- Carefully mount the equipment into the rack, in such manner, that it won't be hazardous due to uneven mechanical loading.
- Do not leave this equipment in an environment unconditioned, out of operation or storage temperature range may damage the equipment.
- This equipment is to be installed for operation in an environment with maximum ambient temperature below 35°C.
- The openings on the enclosure are for air convection to protect the equipment from overheating. DO NOT COVER THE OPENINGS.
- Never pour any liquid into ventilation openings. This could cause fire or electrical shock.
- Make sure the voltage of the power source is within the specification on the label when connecting the equipment to the power outlet. The current load and output power of loads shall be within the specification.
- This equipment must be connected to reliable grounding before using. Pay special attention to power supplied other than direct connections, e.g. using of power strips.
- Place the power cord out of the way of foot traffic. Do not place anything over the power cord. The power cord must be rated for the product, voltage and current marked on the product's electrical ratings label. The voltage and current rating of the cord should be greater than the voltage and current rating marked on the product.
- If the equipment is not used for a long time, disconnect the equipment from mains to avoid being damaged by transient over-voltage.
- Never open the equipment. For safety reasons, only qualified service personnel should open the equipment.
- If one of the following situations arise, the equipment should be checked by service personnel:

➢ The power cord or plug is damaged.
➢ Liquid has penetrated the equipment.
➢ The equipment has been exposed to moisture.
➢ The equipment does not work well or will not work according to its user manual.
➢ The equipment has been dropped and/or damaged.
➢ The equipment has obvious signs of breakage.
➢ Please disconnect this equipment from the AC outlet before cleaning. Do not use liquid or detergent for cleaning. The use of a moisture sheet or cloth is recommended for cleaning.

Product features and specifications are subject to change without notice.

DOCUMENT HISTORY

Author	Date	Action	Revision
ES	4/9/10	Initial release	1.00
ES	4/14/10	Graphics enhancements	1.01

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Using this Guide

Congratulations on your purchase of an Xtore™ StudioRAID™ 16Re / Serial Attached SCSI (SAS) SBB (Storage Bridge Bay) RBOD storage enclosure. Xtore is pleased to provide this high-performance StudioRAID 16Re / 3U16 SBB RBOD storage enclosure that has been designed to ensure maximum performance and provide a premium RAID storage appliance.

The StudioRAID™16Re can be used with Avid products for both Windows and Macintosh® operating systems.

Unless noted otherwise, the material in this document applies to the Windows XP and Mac OS® X operating systems. The majority of screen shots in this document were captured on a Windows XP system, but the information applies to both Windows and Mac OS X systems.

Note: The documentation describes the features and hardware of all models. Therefore, your system might not contain certain features and hardware that are covered in the documentation.

Symbols and Conventions

Xtore documentation uses the following symbols and conventions:

Symbol or Convention	Meaning or Action
	A StudioRAID symbol means that the information precedes that is a specific description for Xtore StudioRAID 16Re product.
	A Standard symbol mean that the information precedes that only applies for the standard model of 3U16 RBOD.
	A caution means that a specific action you take could cause harm to your computer or cause you to lose data.
	A note provides important related information, reminders, recommendations, and strong suggestions.

1. Introduction

The 3U 16-Bay SAS (Serial Attached SCSI) RBOD (RAID of Bunch Of Disks) is a high performance, high density, scalable SAS to SAS/SATA (Serial ATA) to SAS/SATA Disk in an SBB (Storage Bridge Bay) form factor.

The RBOD is made up of several modules including single or dual IO SBB modules with intelligent environmental monitoring, 16-port backplane board, power supply modules with integrated fans, LED indicators on the drive carriers and rear display panel, and hot-swappable hard drive canisters.

The unit can be cascaded from a SAS server, a SAS Switch, or SAS DAS (Direct Attached Storage) expansion unit through the integrated expander for maximum storage expansion. An optional FC mezzanine card is also available for applications that require connections to FC server, switch or any FC expansion storage.

Xtore StudioRAID 16Re version comes with the 16 drives configured with RAID5.

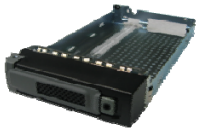
1.1. Key Features

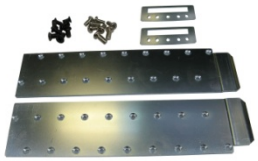
- 3U rack mount enclosure in 17 x 5.25 x 20 inches in dimension
- SBB 2.0 compliant controller canister for SAS/SATA RAID application:
- 16 High Density 3.5" Drive Trays
    - Lockable HDD Trays
    - **3Gb/s SATA II Drives with optional SATA interposer board for single-channel mode**
    - 3Gb/s SATA II Drives with optional SATA interposer board for dual-channel active-active mode
    - 3Gb/s SAS Drives
- Dual 500W Switching Power Supplies
    - Up to 85% Efficient Power Regulation and Utilization
    - Auto ranging 100-240 VAC
- Auxiliary bays for special functions specific to AIC 3U16 SBB Enclosures
    - Fan-out expander module
    - PCI-e x8 expansion card canister

1.2. System Components

Before removing the subsystem from the shipping box, visually inspect the physical condition of the shipping carton. Exterior damage to the shipping carton may indicate that the contents of the carton are damaged. If any damage is found, do not remove the components; contact the dealer where the subsystem was purchased for further instructions. Before continuing, first unpack the subsystem and verify that the contents of the shipping carton are all there and in good condition.

Your new 3U16 RBOD Enclosure includes:

Item#	Description	Image	Quantity
1	3U16 SBB Enclosure Chassis Consists of backplane, controller, PSU, and fan modules.		1
2	Lockable 3.5" SATA/SAS Drive Tray with SAS interposer		16
3	RAID controller SBB Module *Quantity depends on the SKU configuration		1*
4	Power Supply Unit		2
5	Fan Module (left and right)		2
6	Printed Quick Start Guide		1
7	Manual and Utility CD		1
8	Power Cable (US or EU)		2
9	Screw Set for Mounting Drives		1 set

10	Serial cable		1
11	Bracket set for Rack Mounting		1 set

For StudioRAID 16Re, there are additional items as follow:

Item#	Description	Image	Quantity
12	Bezel		1
13	Hard drives installed to the trays, preconfigured with RAID5 Drives capacity depends on the SKU configuration		16
14	Host Bus Adapter HBA model depends on the SKU configuration		1

If any items are missing, please contact your authorized reseller or sales representative.

1.2.1. Front Panel

Front panel of 3U16 RBOD enclosure consist of 16 3.5" drive bays, power button, and status LEDs.

Figure 1.1: 3U16 RBOD Front Side

1.2.2. Drive Carrier

The drive carrier supports:

- Drive presence detection
- 12 Volts to 5 Volts Regulator
- 12 Volts to 3.3Volts Regulation for the SATA Mux version.
- 1 x SAS disk with passive interface board in active-active mode, using the SAS interposer board
- **1 x SATA disk with passive interface board (single channel only) using the SAS interposer board**
- 1 x SATA disk with dual channel Active-Active SATA MUX, using the SATA interposer board.
- I2C bus to manage AAMUX
- 5Bit Slot ID to identify AAMUX device Address

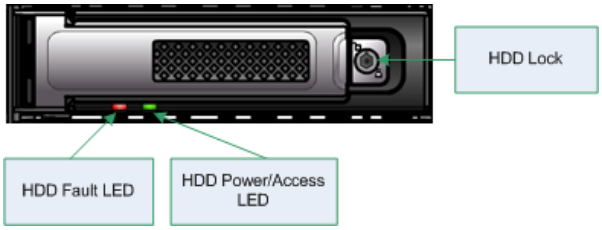


Figure 1.2: 3U16 SBB Drive Tray

1.2.3. Rear Panel

Rear panel of 3U16 SBB provides two SBB slots as well as two auxiliary bays for an optional expansion card slot available to meet the application's needs, (i.e. fan-out expander card, PCI-e expansion card). Fan and power supply can be seen from the rear panel. Display control panel is available for powering up the unit and displaying error codes.

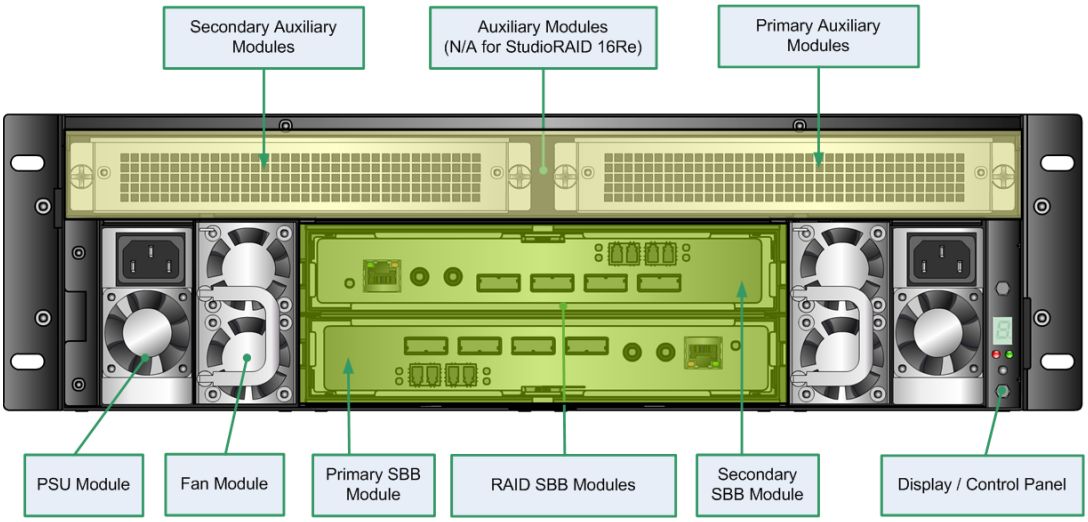


Figure 1.3: 3U16 SBB Rear Side

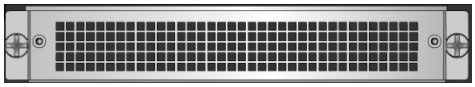
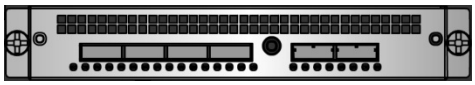
Xtore StudioRAID 16Re does not utilize the auxiliary slots.

STD

1.2.4. Auxiliary Module (if applicable)

3U 16-Bay SBB Enclosure offers two auxiliary bays specific for special functions of Application Server SBB. Xtore StudioRAID 16Re does not offer this option.

Below are the types of auxiliary canister which can be integrated into 3U16 SBB auxiliary slots enclosure.

Item	Auxiliary Configuration Options	Image
1	Dummy Auxiliary Canister This is a default auxiliary that comes with a system with a default configuration	
2	Fan-out SAS Expander Switch Canister This module converts one or two SBB module's SAS ports into 4 SAS expansion ports, externally. See Chapter 3.2 for connectivity.	
3	PCI-e Auxiliary Canister PCI-e x8 expansion card is made available for SBB's PCI-e lane expansion (i.e. FC card, graphic card, GbE Ethernet card). See Chapter 3.1 for connectivity.	

1.2.5. Front Display Panel

The front display panel provides a brief monitoring status such as System Status LED, SBB Controller Status LED, as well as a Mute button.

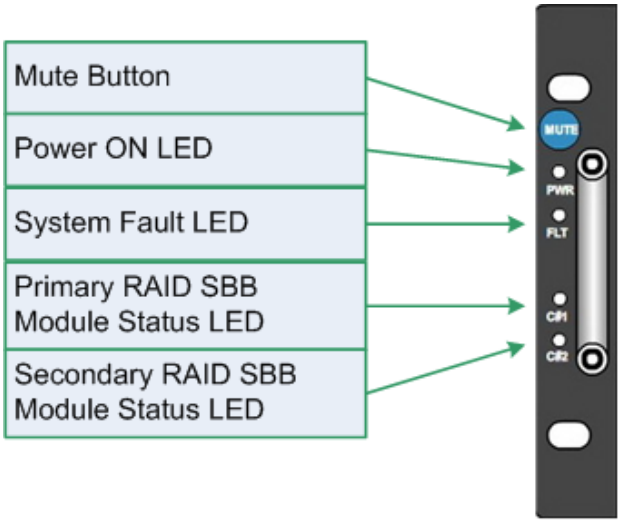


Figure 1.5: 3U16 SBB Front Display Panel

1.2.6. Rear Display Panel

The rear display panel provides complete monitoring and status as well as software controlled on-off capability. The following is the key features of the display panel:

- I2C Interface to Controller

- I2C optional EEPROM for factory data
- Push button for PSU ON-OFF support
- 7 Segment Display Error Code
- LED status display

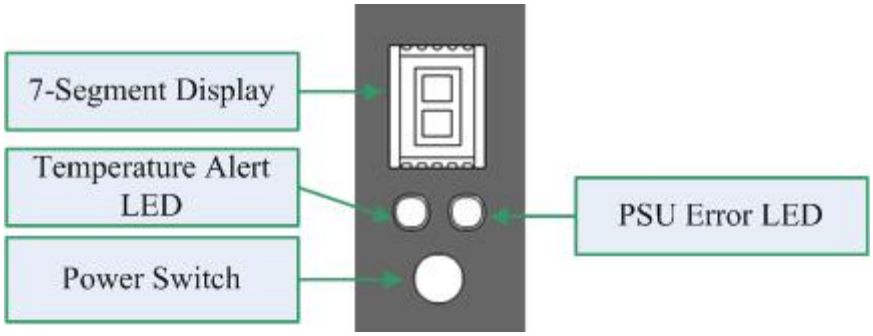


Figure 1.6: 3U16 SBB Rear Display Panel

1.2.7. Power Supply Unit

The system comes with two power supply units described below.

- AC input: 100-240V, 47-63Hz, 8-3A
- Output power: 500W
- DC output: 12V@40A, 5VSB@3.5A
- I2C power monitoring
- Active PFC, full range switching power supply
- Meets 80 Plus Certification for Efficiency
- Ball bearing fan
- RoHS compliant

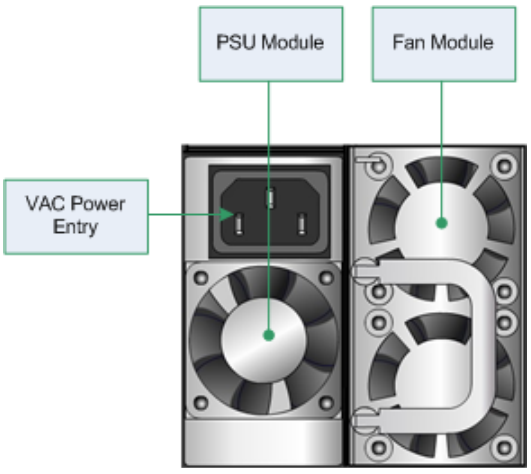


Figure 1.4: 3U16 SBB Power Supply

Moreover, each PSU is managed by the following I2C signals:

- Power On/Off (IN)
- Power Good Status Signal (OUT)
- Slot ID (IN)
- PSU Presence (OUT)
- I2C (OUT): 12V rail voltage level, 12V current level, Fan Speed, Exhaust Temperature, AC status
- I2C (IN): Fan Speed, Power On/Off

2. Hardware Installation

This chapter provides detailed instructions on hardware installation. Installation involves installing disk drives, SBB modules, power supply and fan units, and optionally connecting auxiliary canisters. Open and inspect all system components as listed in 1.2 before proceeding with installation. Installation into a rack enclosure should be performed prior to installing drive trays with disk drives. Open and inspect all system components as listed in 1.2 before proceeding with installation.

Note: Please read all instructions prior to attempting installation. Follow these instructions carefully to avoid damage or improper operation.

Warning: Electro-Static Discharge, ESD, can damage the hard drives and other electronic elements of the system without exhibiting physical signs of damage. Proper grounding and protective steps should be employed when handling any ESD sensitive materials or devices. Failure to follow proper ESD protective procedures may result in equipment damage or failure. Simple tests may be used to determine whether equipment damage is the result of ESD or other electrical short circuit. Damage sustained resulting from ESD is not covered under the warranty.

2.1. Handling and Safety Precautions

2.1.1. System Precautions

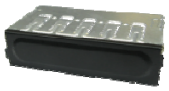
- ☑ The system can weigh in excess of 60 lbs without drives installed. It is recommended that 2 or 3 people be involved in lifting the enclosure and, if desired, installing it in a rack enclosure.
- ☑ Prior to operation make sure all drive trays are installed in the enclosure regardless of whether they contain disk drives. Drive trays must be present to insure proper airflow and cooling through the system
- ☑ The system requires open space front, minimum 3", and rear, 3", to allow airflow for cooling.
- ☑ The system requires reliable AC power, either 100-120 or 210-240 V_{AC}, for proper operation. Power supply should be connected to properly grounded AC power source.
- ☑ Secure all drive trays as described in the instructions. Loose or unsecured components can result in system damage or personal injury.
- ☑ Make sure to retain packing materials and cartons for possible re-packing prior to transporting or shipping the system. Do NOT ship system with drives installed.

2.1.2. Static Precautions

- ☑ Static Electricity can damage the system components and drives without physical sign of damage. Use proper ESD protection measures when handling any electronic components.
- ☑ Discharge static electricity by using an anti-static strap. If a strap is not available discharge but touching a grounded metal object like the enclosure chassis if the PSU is connected to a properly grounded power source.
- ☑ Avoid plastics unless they are anti-static material.
- ☑ Avoid carpets, vinyl, and Styrofoam in the work area or from coming in contact with the enclosure.
- ☑ Handle all modules by their handles or metal trays. Avoid touching components or printed circuit boards.

2.2. Removing a Drive Tray and Installing a Hard Drive

The 3U16-Bay SBB RBOD drive slots can be populated with the following:

Item	Drive Tray Configuration Options	Image
1	3.5" SAS/SATA Drive Carrier Drive tray accepts SAS/SATA II drives. StudioRAID model will only accept certain models qualified by Avid Certified process.	
2	3.5" Dummy Carrier A cover for unpopulated drive bay (sold separately)	

Warning: The system and drive trays are designed to accept 3.5 inch wide x 1 inch high SATA drives. No other drive sizes or types should be installed in the system.

The following describes the procedure to remove a drive carrier, install a hard drive, and replace the carriers in the enclosure.

Figure 2.1: Opening 3U16 SBB Drive Tray

Note: Use proper ESD protective measures when handling disk drives.

2.2.1. Removing a Disk Drive Tray

1) Unlock the key mechanism if the tray is locked
2) Release the handle mechanism by gently but firmly press Button 1. Handle lever 2 should pop out slightly indicating the locking mechanism has been released.
3) Pull Handle 2 outward to disengage the drive carrier. The handle acts as a cam to disengage the carrier from the backplane. If a drive(s) is present and the system is powered on, retract the carrier a few inches to disconnect from the backplane. Allow a minute for the drive(s) to spin down prior to removal from the system.
4) Fully retract and remove the carrier from the enclosure.
5) If a drive(s) is present the needs to be replaced, remove it by unscrewing the mounting screws, sliding the drive toward the front of the tray to disengage it from the interposer board, and gently lifting the drive out of the carrier.

2.2.2. Installing a Disk Drive

1) Unpack and remove any packing materials and interface covers from the replacement hard drive.
2) Place the drive in the carrier position and slide toward the rear firmly seating the drive to the interposer board.
3) Secure the drive using four (4) of the 6/32 flat head drive-mounting screws provided.

Figure 2.2: 3U16 SBB Drive Screw Locations (same applies to the other side)

Warning: Properly securing the drives is required for proper system operation. Unsecured drives may exhibit a variety of behaviors including sporadic or intermittent operation, shortened drive life, and outright failure.

4) Replace the drive tray in the enclosure slot. Slide into the system until the carrier engages the backplane.
5) Push latch 1 home to fully engage the drive. Handle 2 will rotate inward and engage with Latch 1 and a click sound indicates the latch is secured.
6) After a moment the LED indicator should light indicating the drive has power and is beginning initialization and spin up.
7) Allow a minute or two for the initialization process to complete. The LED should show constant blue indicating normal inactive status or flashing blue if activity is present. If the LED indicates red or does not illuminate:

a. Inspect the drive for proper installation. Reinsert the drive carrier to ensure proper connection.

b. If the symptom persists, follow the procedure in above step 1 to remove the drive tray, inspect for proper drive installation within the tray and mating with the interposer board, and if necessary, remove and test the drive to validate it independent of the tray and enclosure.

8) Lock tray if needed

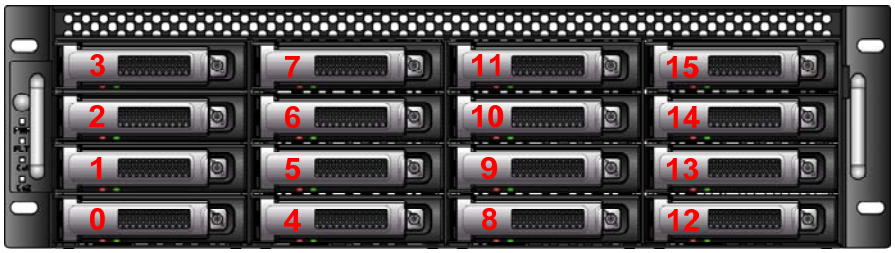
Warning: Electro-Static Discharge, ESD, can damage the hard drive and other electronic elements of the system without exhibiting physical signs of damage. Proper grounding and protective steps should be employed when handling any ESD sensitive materials or devices. Failure to follow proper ESD protective procedures may result in equipment damage or failure.

Warning: Handle hard drives with extreme care. Dropping the hard drive or touching the components on the circuit board may damage the hard drive without exhibiting physical signs of damage. Use only the mounting screws supplied with the system. Using larger screws may damage the drive.

Warning: All drive trays must be installed regardless of whether they contain drives prior to system operation. Drive trays in each of the drive tray slots insure proper air flow for cooling the system. Prolonged operation with empty slots may result in overheating and resultant damage to drives or system components.

2.2.3. Enclosure Drive Slot Mapping

The diagram below shows physical locations and slot order of the drives within the enclosure.



2.3. Removing and Installing an SBB Module

SBB Specification defines mechanical locking mechanism of the SBB canister. It is defined as such so that the two handles of the canister meet together by the latch in the center of the module.

Warning: When removing RAID SBB module from a system with RAID volume already configured, please make sure to back up the RAID configuration prior to do so. Failing to do the back-up procedure will destroy the existing RAID configuration. To back up, please refer to Section 4.1.6

2.3.1. Removing an SBB Module

To remove an SBB module, press on the Latch 1 downward while pulling two Handles 2 outwards. The module will slide away from the SBB slot.

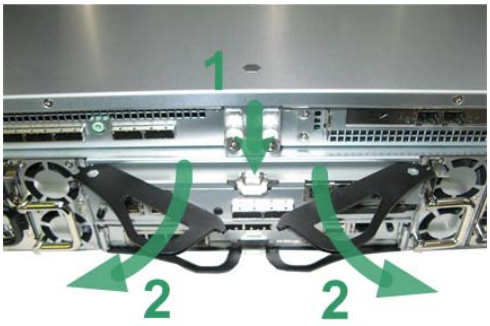


Figure 2.3: Removing a 3U16 SBB Module

2.3.2. Installing an SBB Module

Prior to inserting the module, arrange the Handles 2 into position as illustrated below. Push the module into the SBB slot, the Handles will start to turn inwards. Push the Handles 2 toward the Latch 1 until it clicks.

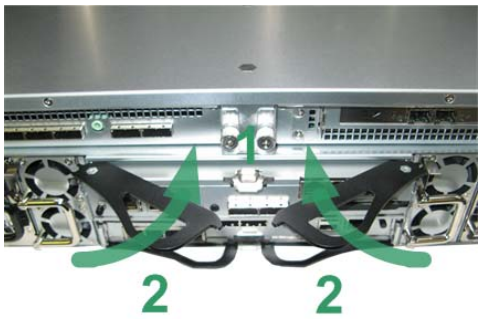


Figure 2.4: Inserting a 3U16 SBB Module

2.4. Removing and Installing a PSU Modules

This section describes removing and installing a PSU Module.

Figure 2.5: A 3U16 PSU Module removed

2.4.1. Removing a PSU Module

1) Remove any power cables connected to the PSU module.
2) Allow a minute for fan to spin down.
3) Loosen PSU module retaining screw.
4) Grab the handle and push down on the release tab under it, and gently pull the PSU module out of the slot until it clears the chassis.
5) Place in anti-static bag or container prior to storage or shipment.

2.4.2. Installing a PSU Module

1) Remove any packing material and cover.
2) Hold the PSU module and align it with the slot opening in the rear of the enclosure. Slide in until PSU is fully engaged.
3) Secure PSU module retaining screw.
4) Connect AC power cable to Module. If system is operational during installation, the PSU module will self test and fan will begin operation. LEDs will reflect status.

2.5. Removing and Installing a Fan Modules

This section describes removing and installing a Fan Module.

1. Push the latch downward
2. Pull the fan module out

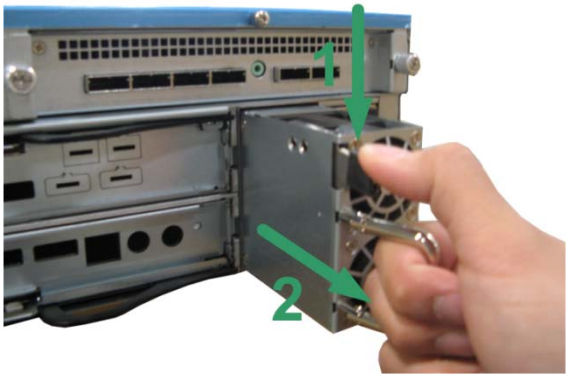


Figure 2.6: A 3U16 Fan Module removed

2.6. Installing the Enclosure to Rack Cabinet

3U16 RBOD comes with a set of slide rail. TBD.

3. Hardware Setup and Operation

This chapter provides detailed instructions on hardware setup and operation. Setup involves establishing connectivity between SBB modules and external enclosures. Please follow carefully the installation procedure listed in Chapter 2 before proceeding with setup.

3.1. Installing a Host Adapter and Driver

3.1.1. Installing the Host Adapter Board

The HBA needs to be installed in both Windows and MAC workstations to support RAID functionality. The RAID controller board ships with the Xtore StudioRAID 16Re and must be installed in a Windows or a Macintosh workstation in a PCIe slot. See the manufacturer's documentation that came with your workstation for instructions on installing additional boards and for the location of your PCIe slots.

Warning: Anti-static precautions, for example, the use of an anti-static mat, or an anti-static wrist or ankle strap, must be used when handling hardware components and boards. Never touch any exposed electrical connectors on the components as they can be damaged by electrostatic discharge (ESD).

The Windows and Macintosh workstations currently supported with the StudioRAID 16Re are listed on the Xtore web site. As more workstations are tested and qualified, and as different configurations meet approval, these configurations will be posted on the Xtore web site. For the latest information concerning workstations qualified with the StudioRAID 16Re, go to www.xtore.com.

Note: Each Windows or Macintosh workstation has its own particular slot configuration location. Refer to the documentation that came with your workstation for the location of the PCIe slots.

3.1.2. Installing Drivers

After the HBA has been installed in your workstation, the next step is to install the drivers for the enclosure and controller board. The driver for the HBA is located on the Xtore StudioRAID CD. The driver for the StudioRAID 16Re enclosure is also located on the Xtore StudioRAID CD that ships with the Xtore StudioRAID 16Re and are also available for download at the download center at www.xtore.com. Please follow the instruction included with the driver.

Depending on your operating system, choose one of the following drivers for your system and follow the installation procedure.

Windows XP, Vista, and 7

If you are using a Windows XP or a Vista workstation, you need to install the driver for the Windows operating system:

To install the drivers for Windows XP, Vista, and 7:

1. Turn on your workstation.
2. To access the drivers to install, follow the folder structure on the *Xtore StudioRAID* Installation CD to the Xtore StudioRAID 16Re folder.
3. Inside the StudioRAID 16Re folder, locate the RAID controller R380 driver for the version of Windows you are using.
4. Click on the R380 driver for the version of Windows you are using.

Follow the on-screen instructions to complete the driver installation.

Macintosh Operating Systems

If you are using a Macintosh workstation you will need to install the driver for the Macintosh operating system:

To install the drivers for the Macintosh operating systems:

1. Turn on your workstation.
2. To access the drivers to install, follow the folder structure on the *Xtore StudioRAID* Installation CD to the Xtore StudioRAID 16Re.
3. Inside the StudioRAID 16Re folder, locate the RAID controller R380 driver for the version of Macintosh you are using and click on the R380 driver.

Follow the on-screen instructions to complete the driver installation.

3.2. Connecting to the Enclosure

3U16 SBB RBOD enclosure is a robust and flexible system that can be linked to a number of external enclosures. Below is a diagram illustrating the connections that are supported by SBB enclosures.

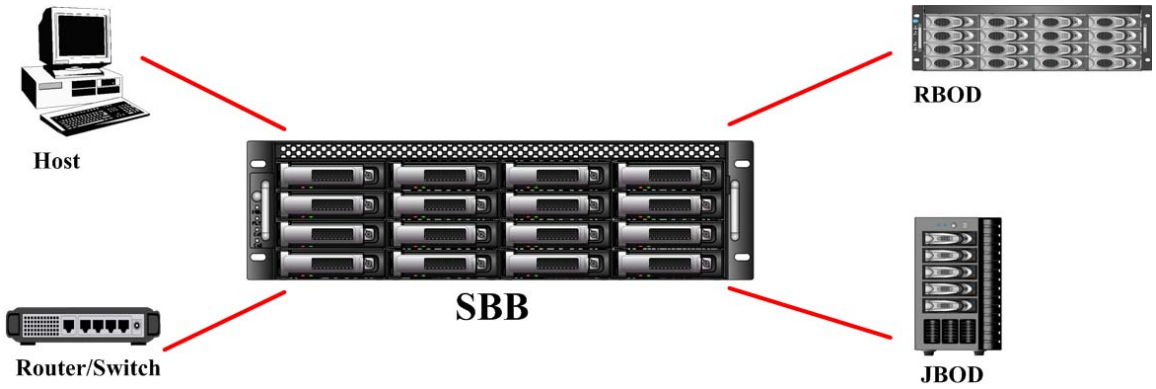


Figure 3.1: 3U16 SBB RBOD External Connections

The Windows and Macintosh workstations currently supported with the StudioRAID 16Re are listed on the Xtore web site. As more systems and third-party boards are tested and qualified; and as different configurations meet approval, they will be posted on the Xtore web site. For the latest information concerning workstations qualified with the StudioRAID 16Re, go to www.xtore.com.

To connect your 3U16 RBOD:

1. Turn off your workstation before connecting the 3U16 RBOD.
2. Plug one end of the miniSAS cable into the "UP" SAS connector on the rear of the 3U16 RBOD enclosure.
3. Plug the other end of the miniSAS cable into the host adapter board port
4. Plug one end of the power cord into the power connector on the 3U16 RBOD and the other end into a properly grounded power outlet.
5. Turn on your 3U16 RBOD and then turn on your workstation.

The blue LEDs on the disk drives flash as the drives boot up. On any workstation, when the blue LEDs remain solid, you are ready to configure your 3U16 RBOD.

There are 2 possible ways to expand a StudioRAID 16Re / 3U16 SBB RBOD to a workstation to expand the storage:

a. Expand by adding another StudioRAID 16Re / 3U16 SBB RBOD to the second port of the host adapter
b. Expand by daisy-chaining to a StudioSTOR 16Re / 3U16 JBOD expansion enclosure

3.2.1. Connecting the Second 3U16 RBOD to HBA

1. Back up all existing data to another location as upgrading to two enclosures overwrites all existing saved data on your existing drives.
2. Turn off your workstation before connecting the two 3U16 SBB RBODs.
3. Plug one end of the first miniSAS cable into the "UP" SAS connector on the rear of the first 3U16 SBB RBOD.
4. Plug the other end of the miniSAS cable into the first host adapter port in your workstation.
5. Plug the second miniSAS cable into the second host adapter port in your workstation.
6. Plug the other end of the second the miniSAS cable into the "UP" SAS connector on the rear of the second 3U16 SBB RBOD.
7. Plug one end of each of the power cords into the power connector on each of the enclosures and the other end of each power cord into a properly grounded power outlet.

The following figure is shown only as an example and shows two enclosures connected to a PC workstation.

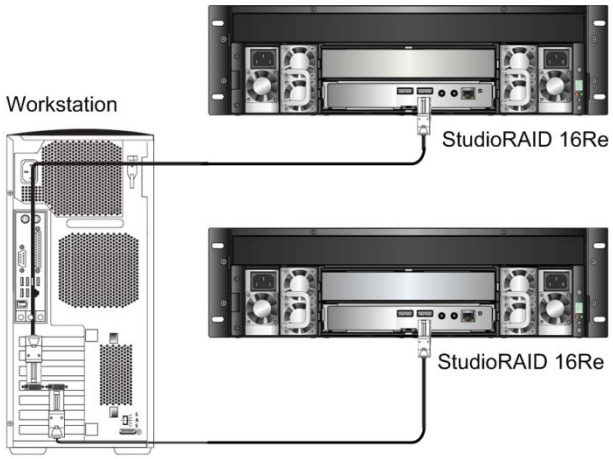


Figure 3.2: 3U16 SBB RBOD Expansion Connection

3.2.2. Daisy-chain 3U16 RBOD

3U16 SBB RBOD can be daisy-chained to a 3U16 JBOD / StudioSTOR 16R expansion unit (sold separately).

1. Back up all existing data to another location as upgrading to two enclosures overwrites all existing saved data on your existing drives.
2. Turn off your workstation before connecting the 3U16 JBOD expansion unit to 3U16 SBB RBOD
3. Plug one end of the first miniSAS cable into the "UP" SAS connector on the rear of the 3U16 SBB RBOD.
4. Plug the other end of the miniSAS cable into the host adapter port in your workstation.
5. Plug the second miniSAS cable into the "DOWN" SAS port on the rear of the 3U16 SBB RBOD.
6. Plug the other end of the second the miniSAS cable into the "UP" SAS connector on the rear of the second 3U16 JBOD.
7. Plug one end of each of the power cords into the power connector on each of the enclosures and the other end of each power cord into a properly grounded power outlet.

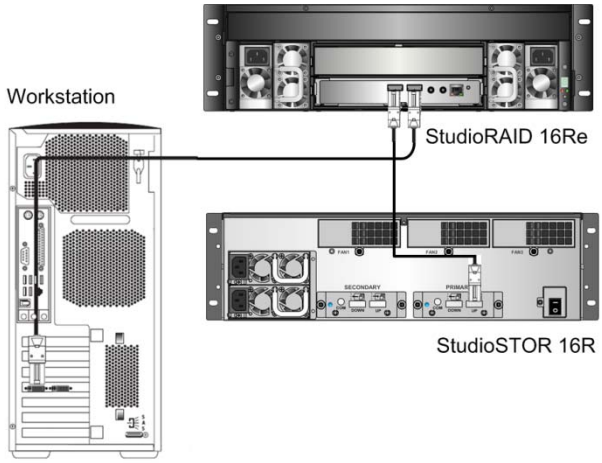


Figure 3.3: 3U16 SBB RBOD Daisy-Chain Connection

3.3. Hardware Operation

3.3.1. Preparing to Power On

Prior to powering on the system you will need to have completed the following:

- ☑ Hard drives are properly installed and secured.
- ☑ All drive trays are installed and secured.
- ☑ All external cables (e.g. Ethernet cable, SAS cables) are properly connected.
- ☑ Power cable is installed.
- ☑ Power from a suitable power source
- ☑ The system should have been in place long enough to adjust to ambient temperature.

Warning: The system requires adequate open space front and rear to allow for proper cooling.

Warning: The system power supply should be connected to suitable grounded 100-120V or 210-240V AC power sources.

3.3.2. Powering On the System

After the 3U16 SBB is prepared for power on, drive trays inserted, and external connections completed, the system may be powered on using the following steps.

1) If you have not already done so, using the power cords supplied connect the PSU modules to the power source.
2) Power on any network switches and hosts in the configuration.
3) Press and hold the power switch on the Rear Display panel until the system powers up (about 2-4 seconds). The fan should come on immediately after you release the button and the drives will begin to spin up and initialize.

Figure 3.2: 3U16 SBB Power Button

4) The RBOD system is powered up and ready to use.

Note: If system does not power up after 2-4 seconds of long press, the display board might enter the ID mode (as signified with a dot next to the digit). Please press the power button until the dot is gone, then you can do another long press to power up the unit.

Warning: Be sure to have the RBOD powered up and ready before attempting any host power up. Failure to do so will cause the host not to recognize the RBOD and its RAID volume(s).

Once the system has been powered on, the Display can be checked to verify proper operation. System monitoring and status information is collected via the internal I^2C bus and is made available via the LEDs and 7-Segment Display messages on the Display panel as well as to external controllers and management tools via SES.

- Drive LED status will be steady Blue indicating power on idle state or intermittent Blue indicating Drive activity.

3.3.4. Power Off the System

1) Power off all the servers accessing volumes on the system to be powered down, prior to powering down the unit.
2) Press the intelligent On/Off button on the Rear Display panel (about 1 second).
3) Allow a few minutes for the drives to spin down and the enclosure to shut down.

4. RAID and GUI Configuration

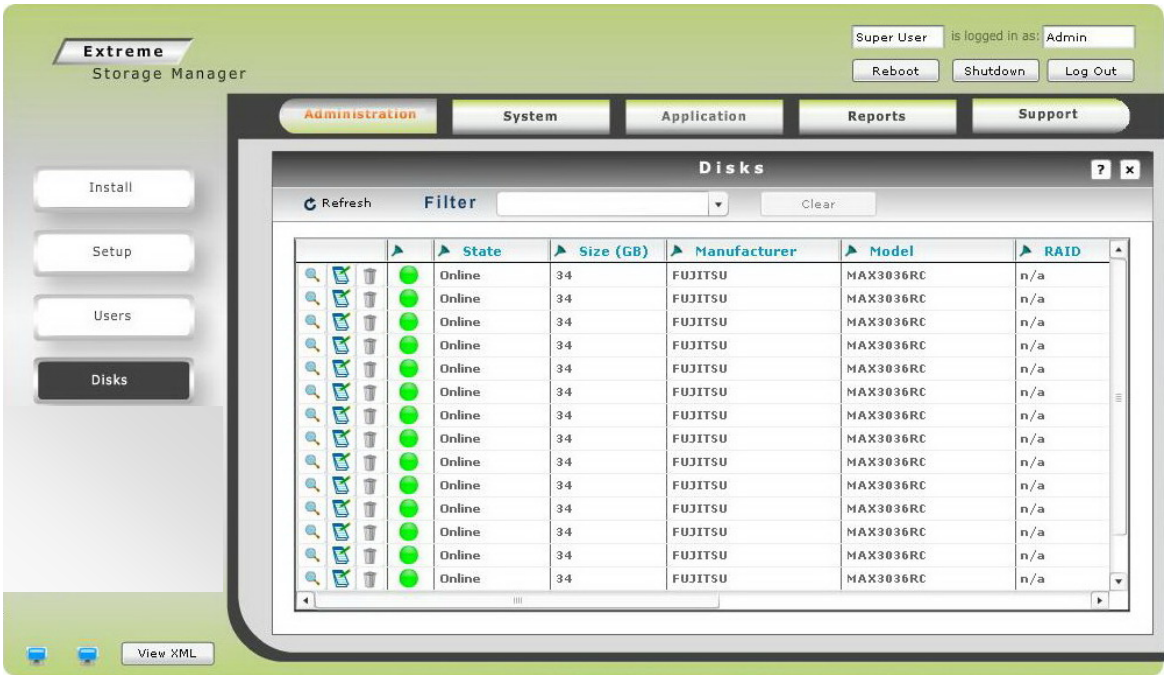
4.1. RAID Creation Guide

4.1.1. RAID Preparation

Connect an Ethernet cable from 3U16 SBB RBOD Ethernet port to Host. Open a web browser on the host and type in the RBOD's IP address. The default IP address of the RBOD is 192.168.1.100. To configure a custom IP address through serial console, please follow Section 6.1.2. A GUI will be shown as below.

Log in to the system using the default Super User username and password.

After login, the main screen of the GUI will be displayed.



To check the disk installed, go to "Administration" tab then choose "Disks" from the left column. All the disks will be defaulted to Mission Critical Quality of Service (QoS). There are 3 types of QoS:

- Mission Critical: a QoS setting that is used to categorized drives with high speed performance and high intensive purpose, i.e. SAS drives
- Business: Used by hard drives with medium level intensive purposes.

- Archives: QoS for low intensive resource disk drives, i.e. SATA drives

To change a Quality of Service of a hard drive, click the button of the selected drive and change the QoS from the drop down menu. For more details regarding QoS, refer to Section 4.3.

The user can optionally add a host name and a WWN to 3U16 SBB RAID. To add a host, go to "System" tab then choose "Host" from the left hand column; then create a host name and specify its WWN.

4.1.2. RAID Addition

3U16 SBB RBOD supports the following RAID level:

- RAID 0: Striped set without parity/Non-Redundant Array.
  It provides improved performance and additional storage but no fault tolerance. It requires a minimum of 2 disks. The capacity of RAID 0 will be roughly $c_1 + c_2 + c_3 + c_4$ …etc, where c_n is the size of each of the drives.

- RAID 1: 3U16 SBB RBOD defines RAID1 as mirrored sets in a striped set. With or without Spare drives. It provides fault tolerance and improved performance.
  It works with either an odd or even number of disks, with a minimum of two disks.
  The capacity of RAID 1 will be roughly (c x n)/2 where c is the size of the smallest drive and n is the number of disks.

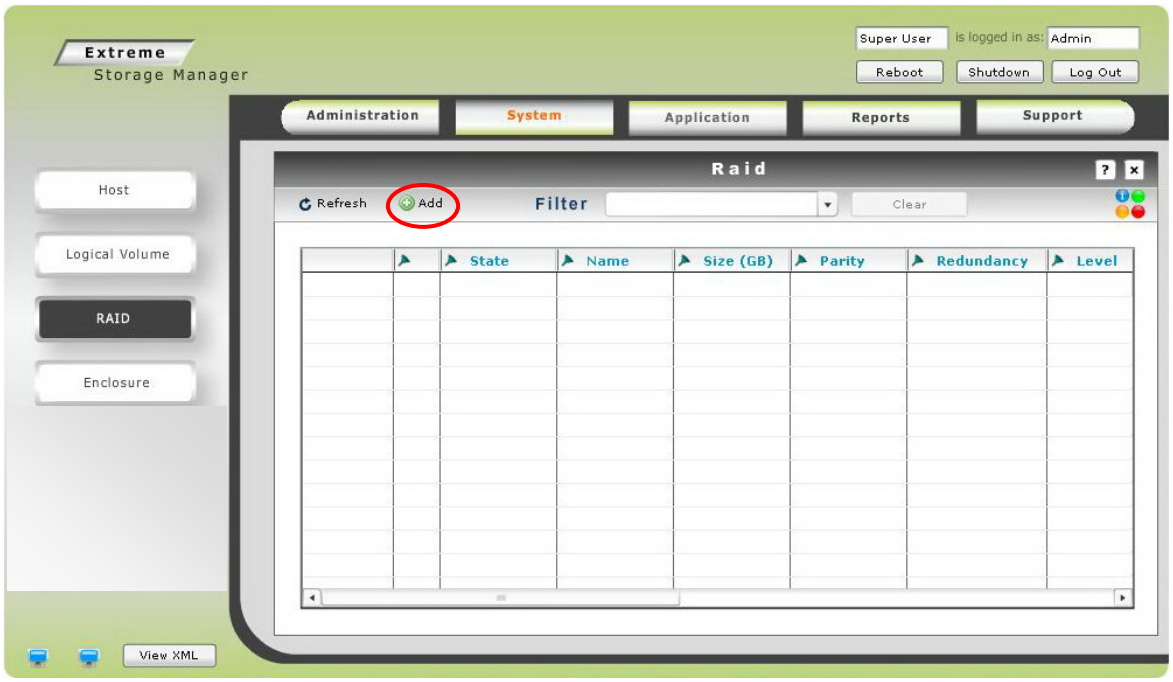
- RAID 5: Striped set with distributed parity. With or without Spare drives.

Distributed parity requires all drives but one to be present to operate; drive failure requires replacement, but the array is not destroyed by a single drive failure. It requires a minimum of 3 disks. The capacity of RAID 5 will be roughly (n-1) x c.

Note: c is the size of the smallest drive and n is the number of disks.

To create a RAID volume, refer to the steps as follow:

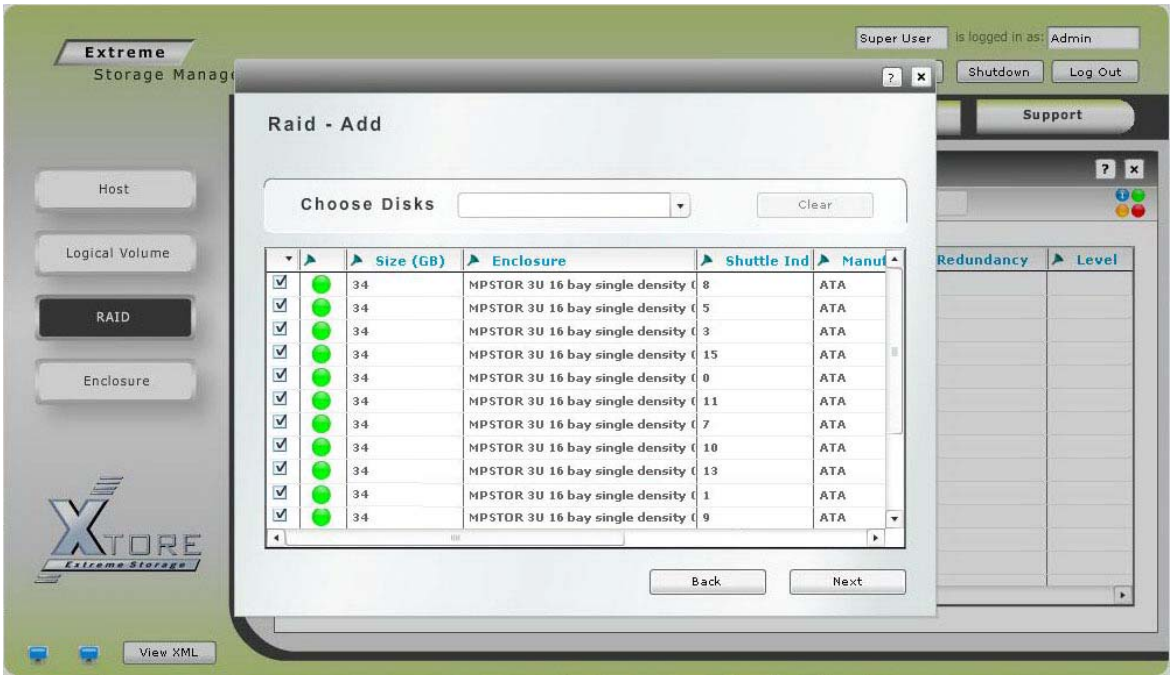
By choosing "System" from the menu bar along the top of the screen and then selecting "RAID" from the bar that appears on the left of the screen, RAID creation screen will be displayed as below.



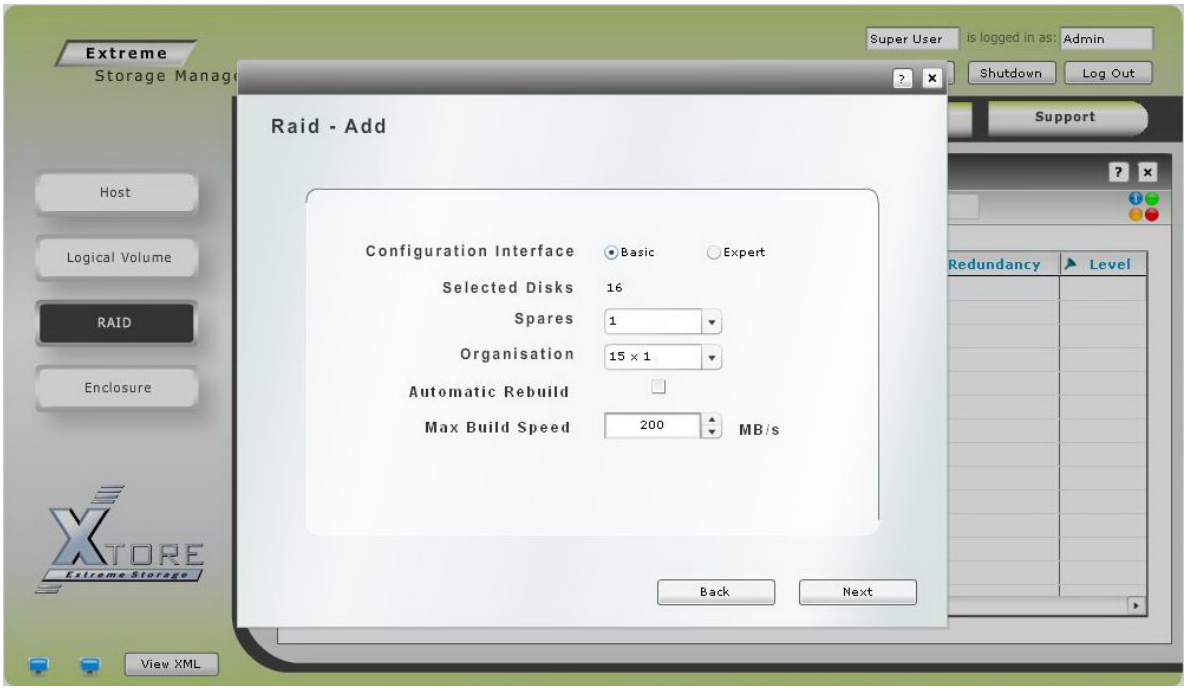
To add a new RAID, click on the "Add" button to the left of the data grid.

Input the desired RAID name, RAID level, and other parameters. A Fast RAID checkmark is available to the user for a quicker RAID5 creation process. That option will cut the RAID5 building time for about 1 to 2 hours. This feature is only available for RAID5 configuration. After everything has been setup, click "Next".

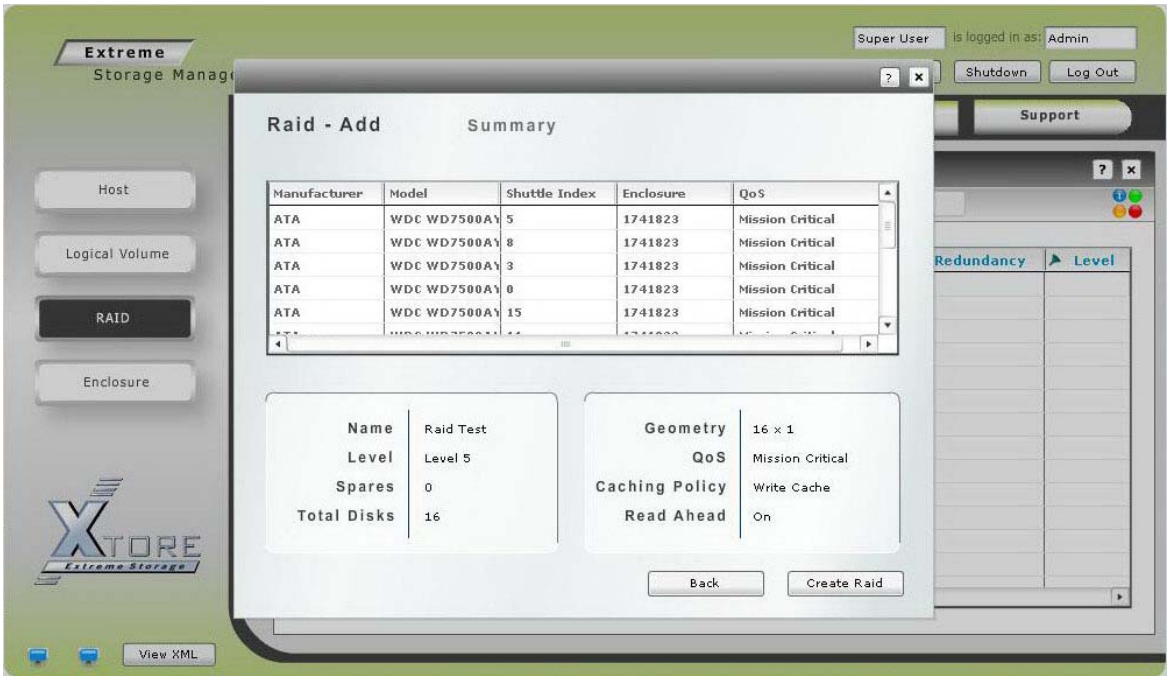
Note: RAID will only be able to select drives with the same QoS setting.



Select the required amount of disks for the RAID. Disks can be of different size but only the size of the smallest disk selected will be used on each of the other bigger disks. Click "Next".

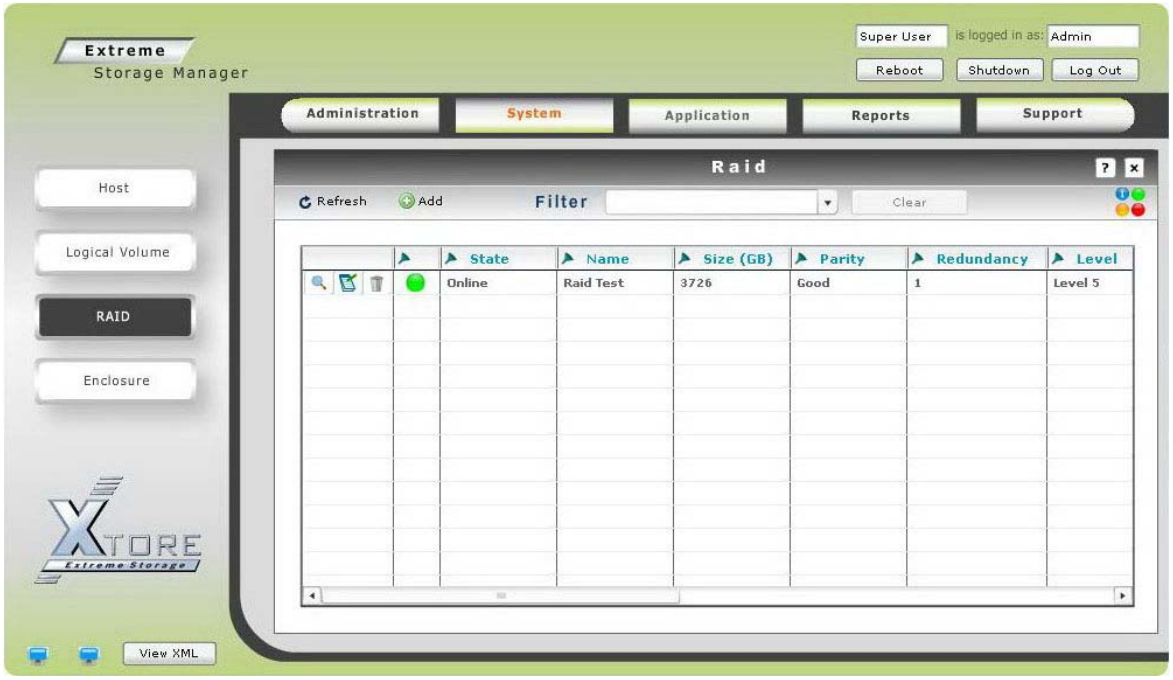


If you want to create a spare disk, put aside a number of spare disks taken out from the selected disks and the RAID geometry. Refer to Section 4.1.4 for details about adding spares.
An expert configuration interface can be chosen to open up additional options such as chunk size.



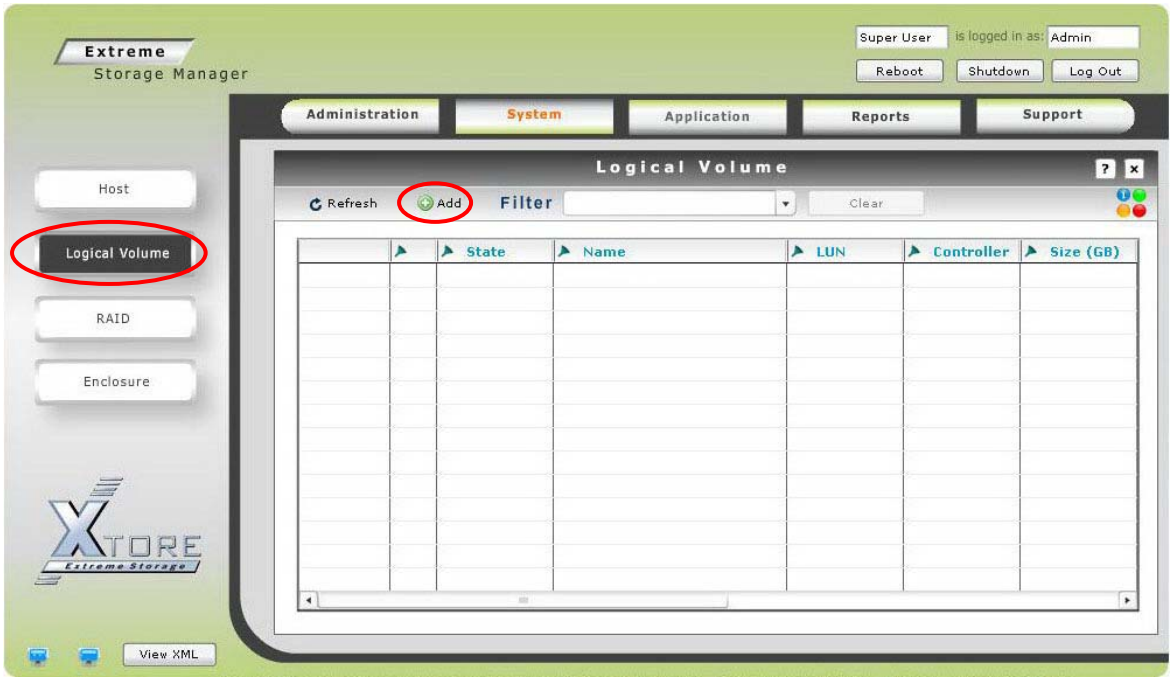
The above screen is displayed, detailing the disks chosen and all other relevant details of the RAID to be made. Clicking on "Create RAID" will initialize the RAID creation process.

The above screen appears to indicate that the RAID has been created successfully. This also gives the details of the new RAID as well as showing the build progress.



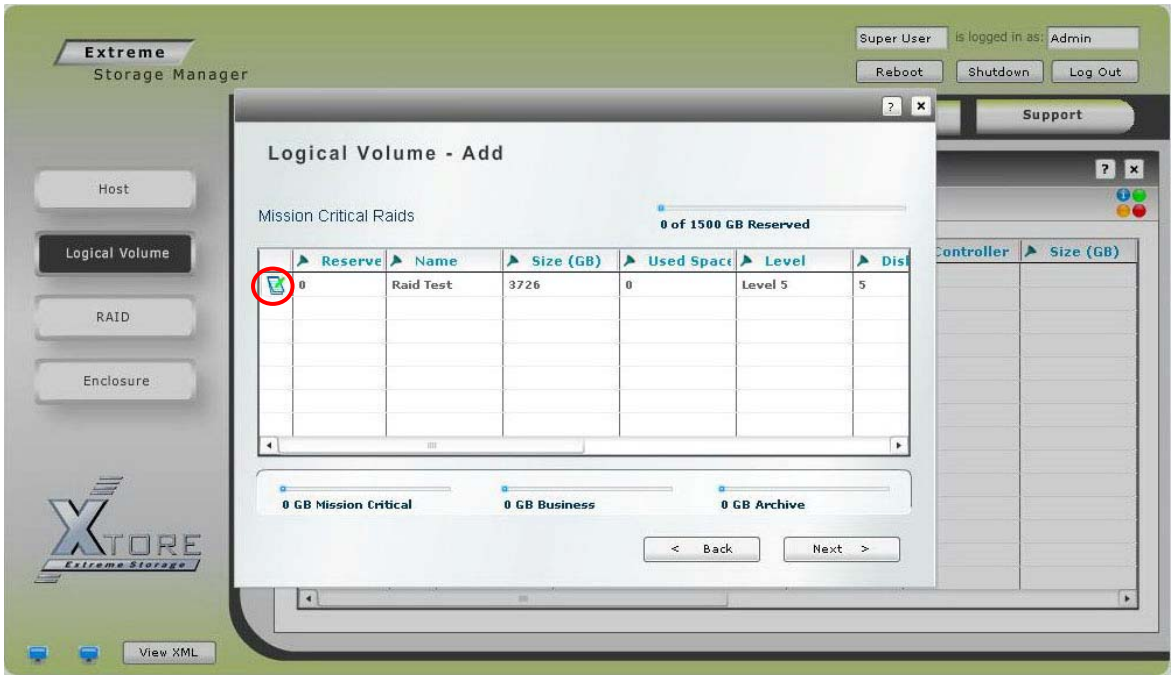
The above screen shows Level 5 RAID is online with 5 drives and 3.726 TB in size.

4.1.3. Add Logical Volumes

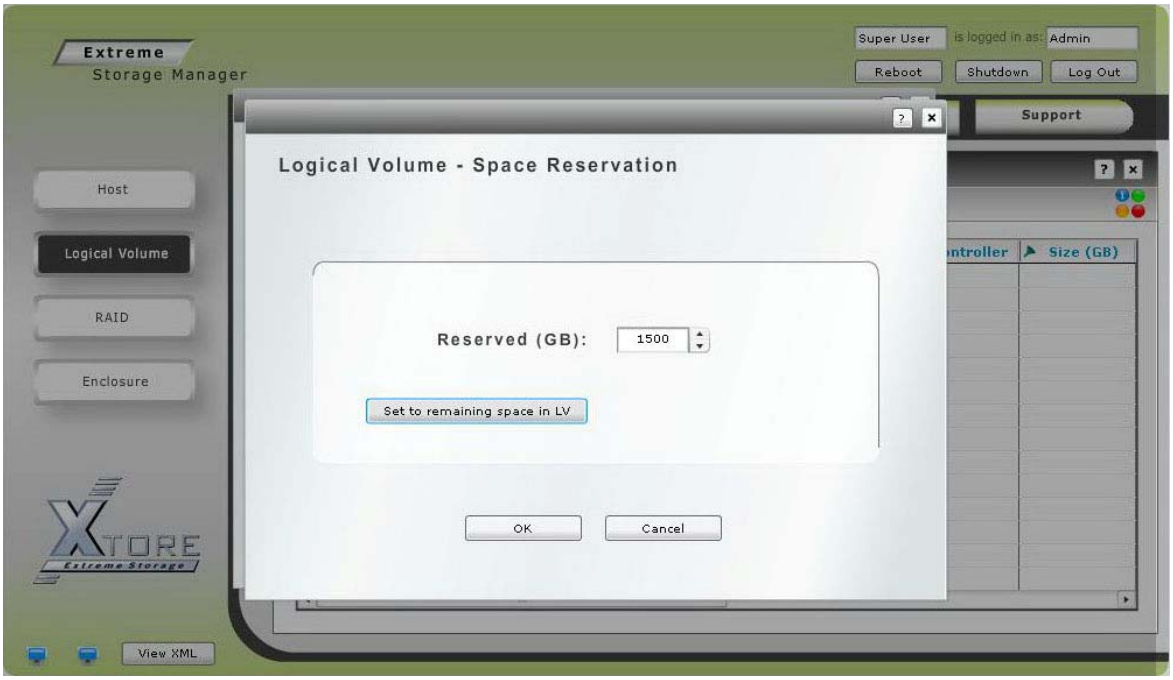


To add a Logical Volume to the system, click on the "Logical Volume" tab on the left of the screen and then on "Add" when the data grid appears.

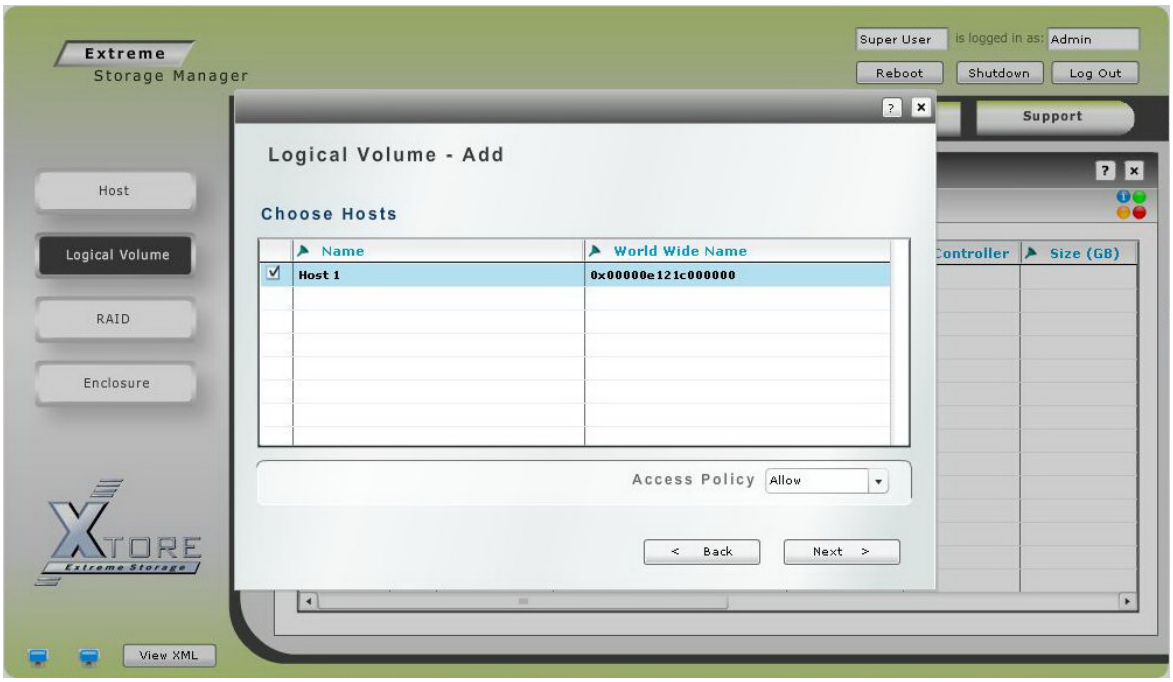
Set the name for the Logical Volume, Size of the logical volume (it should be the same or less than the size of RAID), QoS type (logical volume will only recognize the created RAID array with the same QoS type).



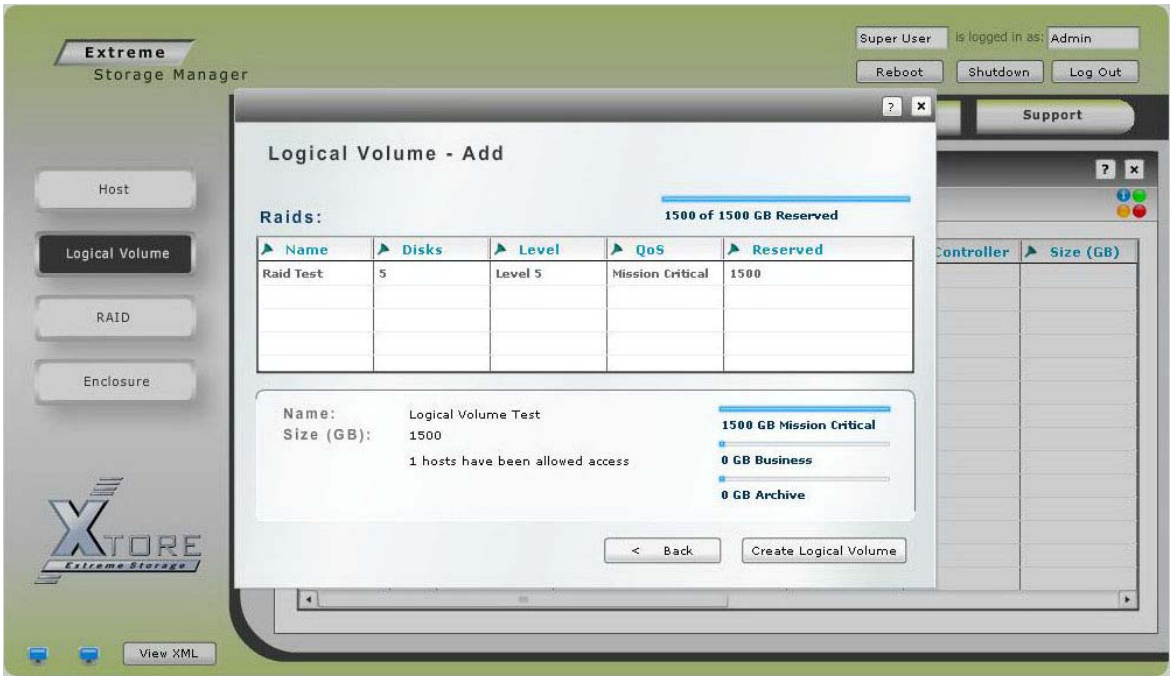
To reserve space on a RAID, click on the icon to the left of the data grid entry for that RAID.



When the space reservation screen appears, select the amount of space one wish to reserve on this RAID. Choose "Set to remaining space in LV" if user want to use all the available space.

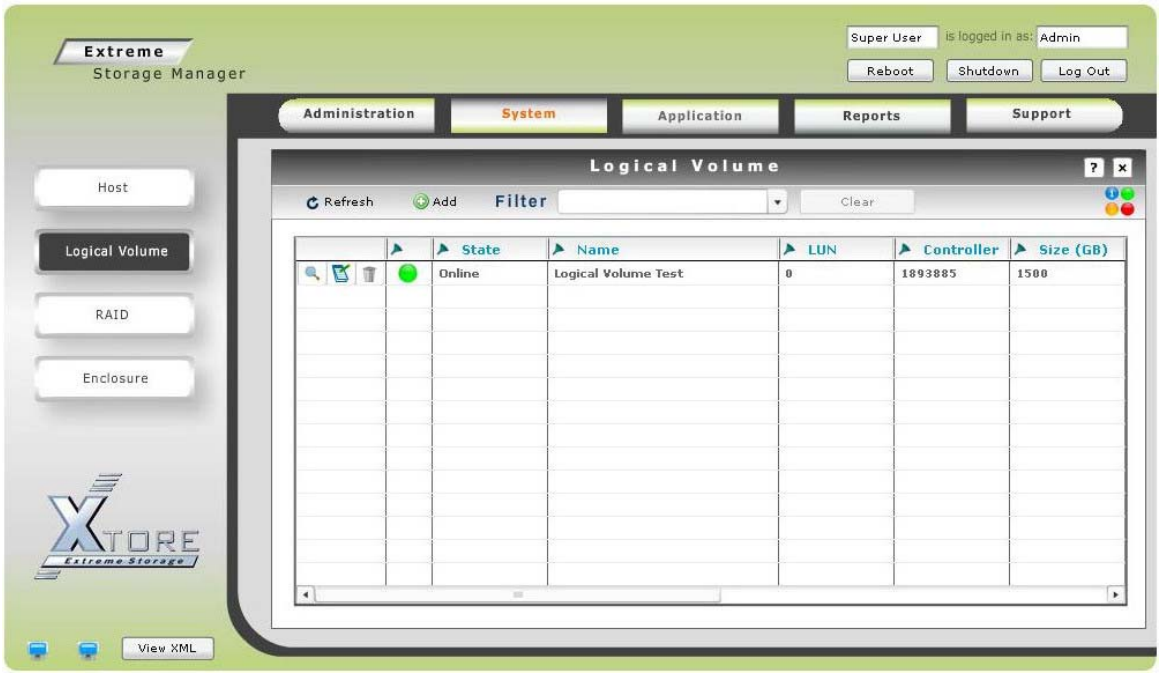


Choose a host (that has been created from Section 4.1.1.) to be allowed to access the logical volume.



This screen displays all details on the Logical Volume about to be created.

This screen is displayed when the Logical Volume has been created.

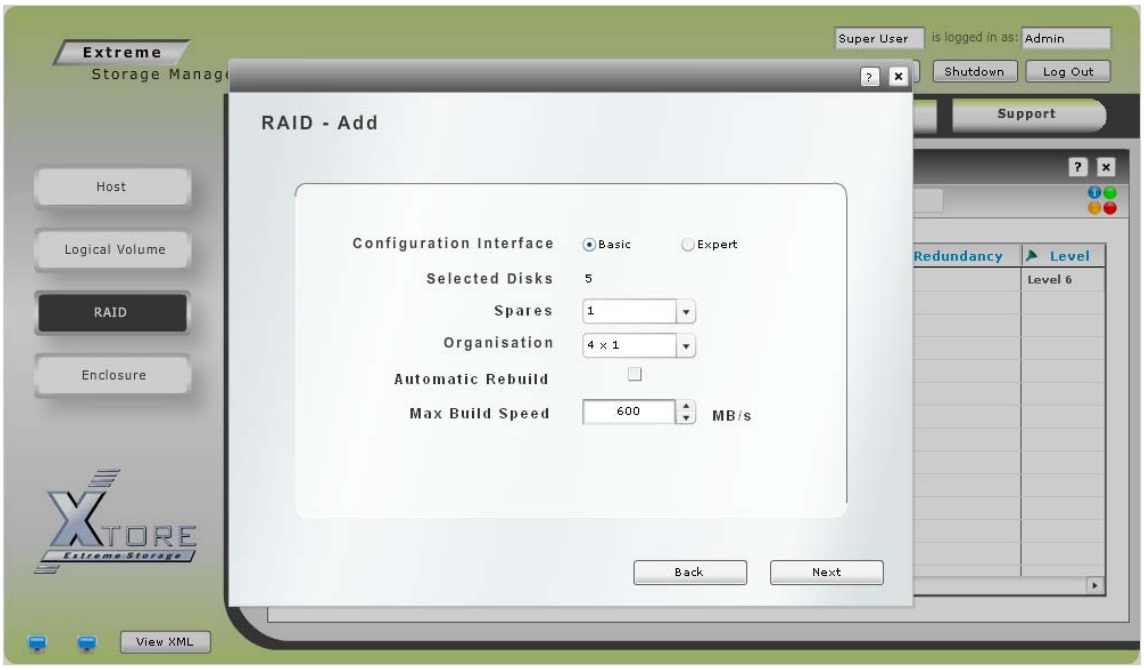


The above screen shows one logical volume created. To add more logical volume with the remaining available RAID space, click on Add button.

4.1.4. Add Spare Drives

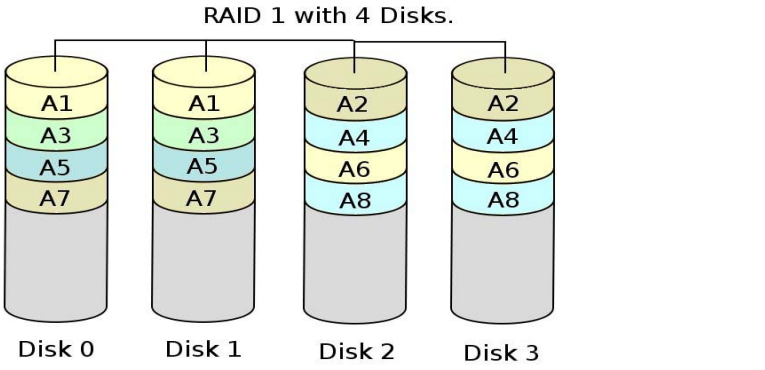
In the RAID creation step, users are given a chance to allocate one or more disks to be spare drives. Note that the spare disks will be taken from the assigned RAID drives. In the example below, 1 disk out of 5 selected RAID 1 disks will be allocated as a dedicated spare disk. The end result will be a RAID 1 volume with the capacity of 2 disks ((number of drives x smallest size of disk)/2), and 1 spare disk.

The following is the steps of creating spare drives:



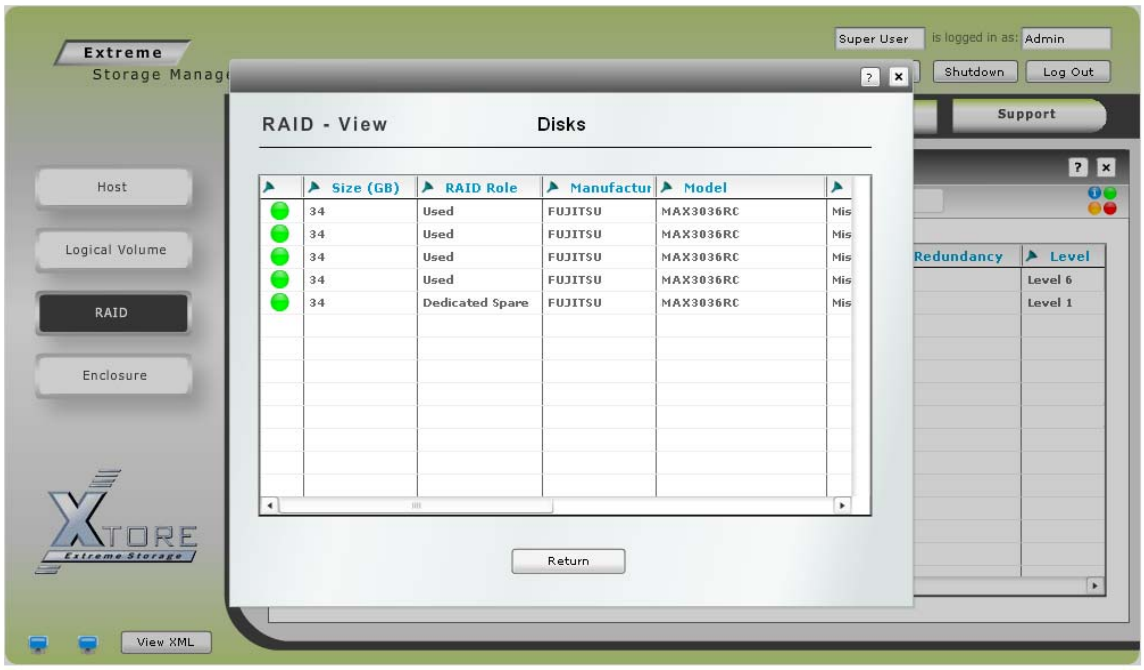
With 5 disks selected, set 4x1 organization and 1 spare.

Below is a diagram explaining how 3U16 SBB RBOD RAID 1 works:

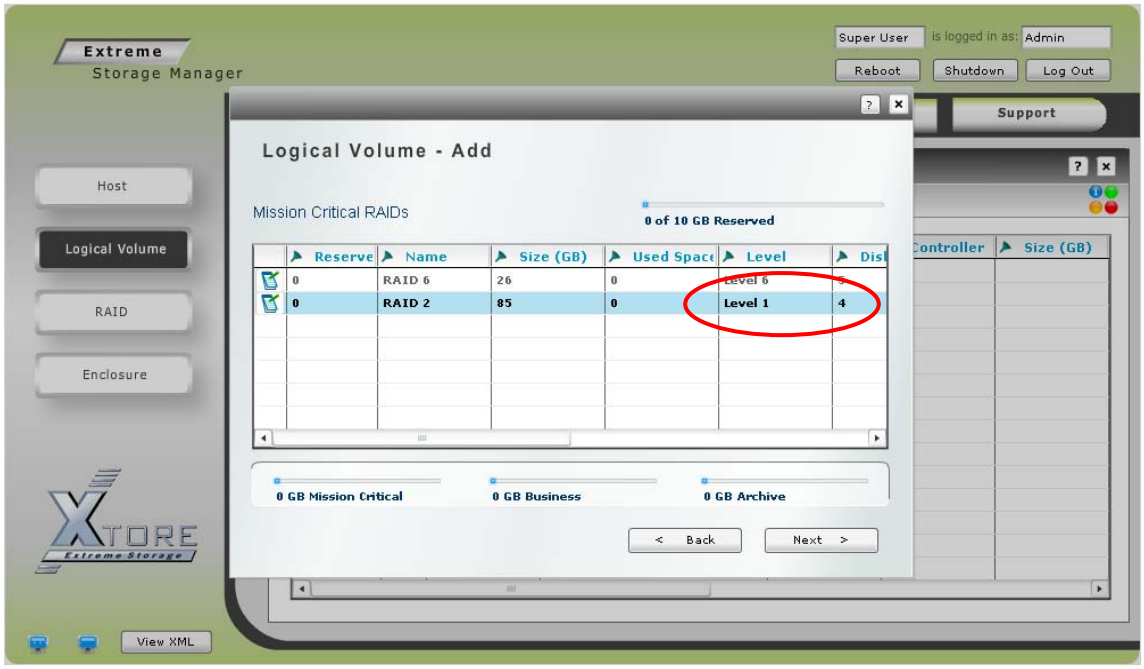


A(x) = One copy of a block of data.

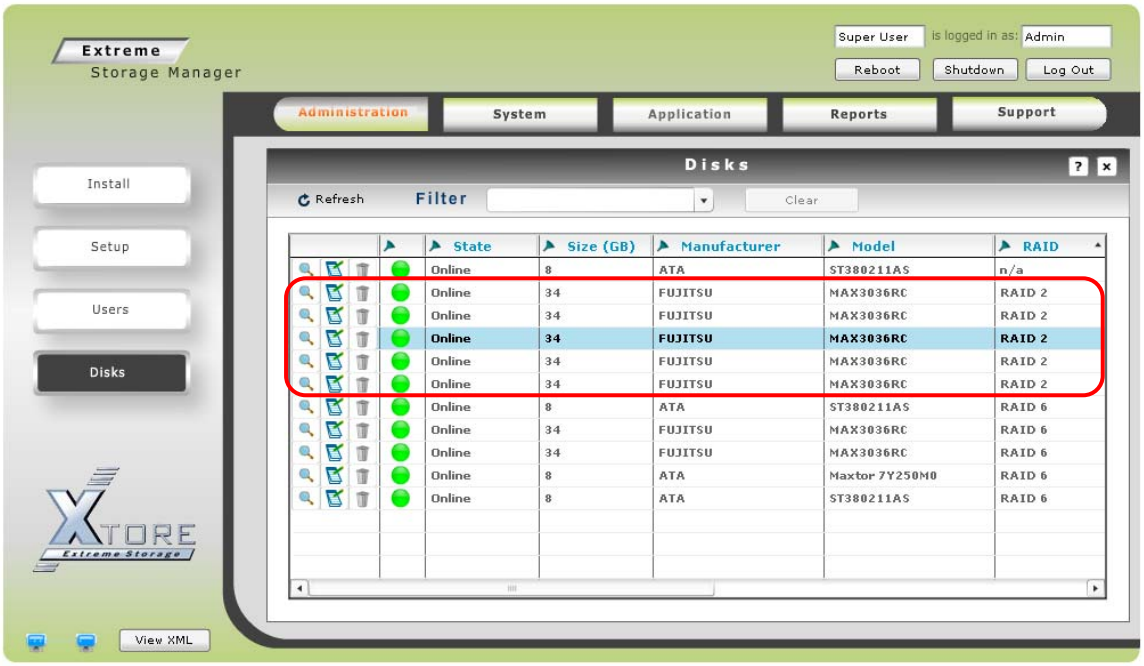
The A1 block is identical to the A1 block on the second disk.

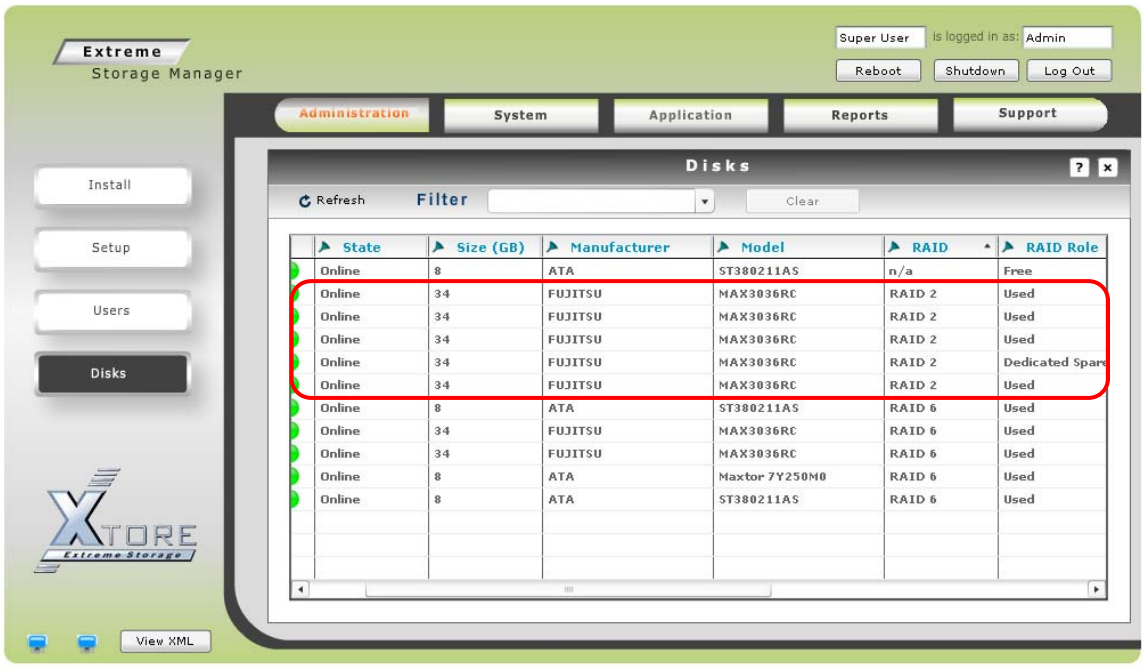


The RAID is shown as 4 disks and 1 spare in the RAID VIEW-DISKS field.



Looking at the logical volume, we have 4 disks used in the RAID1 and 1 dedicated spare.

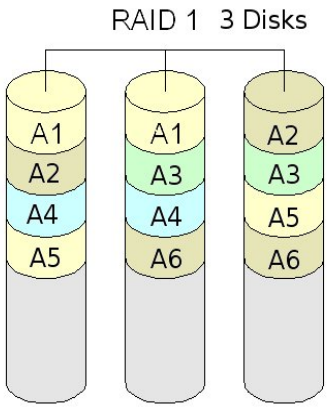




Note: The controller's RAID 1 level also allows the creation of a RAID 1 on odd (or non even) number of disks.

This means that the creation of any RAID with at least two disks is possible, like the creation of a RAID with 3 disks, 5 disks, 6 disks, 7 disks or 8 disks.

Please see below the diagram explaining the logic behind such a RAID (a RAID 1 with an odd number of disks):



A(x) = One copy of a block of data.

The A1 block is identical to the A1 block on the second disk.

4.1.6. Backup a RAID Configuration

Backing up a RAID configuration is essential in cases where RAID SBB Module has to be removed for a replacement. In order to retain the RAID configuration, a backup function is available to use. Please refer to the figure below to backup your RAID configuration.

Once the new RAID SBB module is installed, 3U16 SBB RAID will automatically restore the saved RAID configuration for you.

4.2. AIC GUI Overview

Extreme Storage Manager (ESM) is a Graphical User Interface (GUI) embedded inside the 3U16 SBB RAID system. This easy-to-use utility enables RAID management, monitoring and configuration remotely.

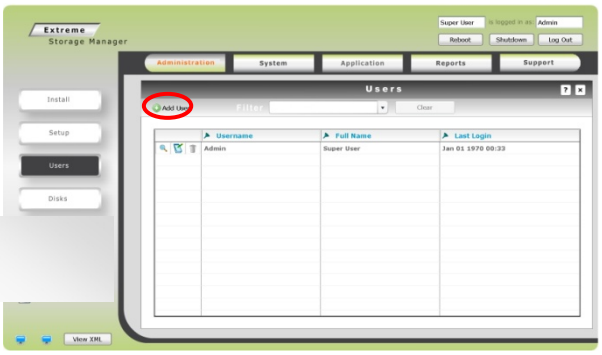
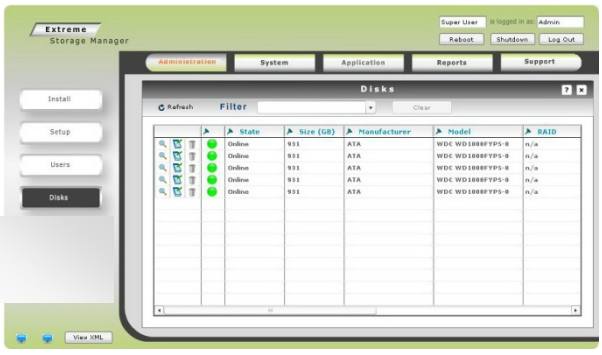
With ESM tool, a system can concurrently support multiple RAID levels (0, 1, 10, 5, 6), a variety of volume group sizes. This flexibility enables ESM to best match user's experience in terms of performance, capacity, and data protection requirements.

ESM does not require installation; its web based interface ensures the low usage of resources thus provides a better experience for the user. To connect to ESM, enter the IP address of the system from any browser.

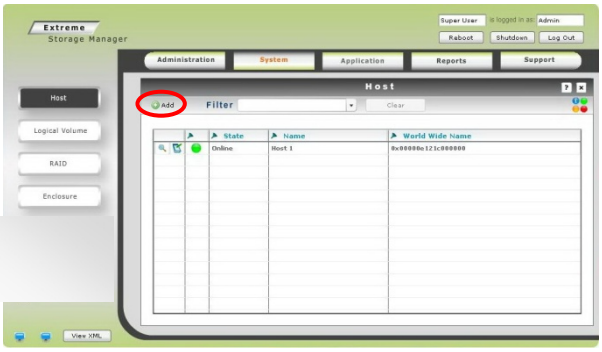
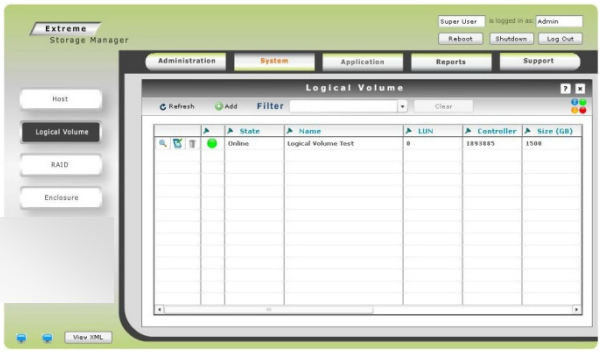
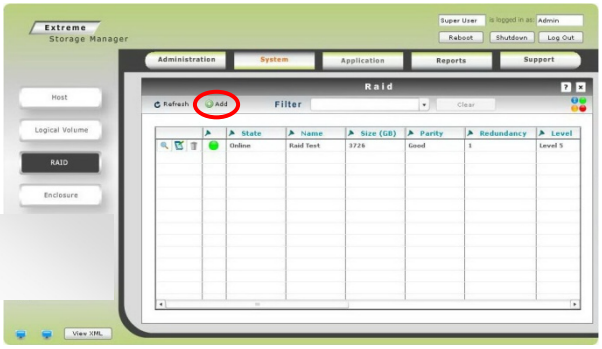
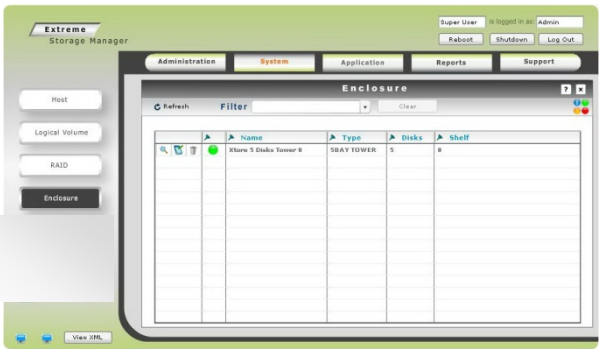
The ESM interface is categorized into five menus:

1. Administration: where user can view and manage installed packages, system setup, IP and SMTP setup, users, and disks.
2. System: where user can manages hosts, RAID, Logical Volumes and Enclosure.
3. Application: Snapshot, Replication, and Commissioning are discussed here.
4. Report: it deals with log, history and alert management
5. Support: where user can manage the firmware and look for support.

4.2.1. RAID Administration Menu

Administration Options	Description
Install 	List of installed packages in the system. Used to view the software component detailed information To install software component To uninstall software component
Setup 	An administrator setup that manages System Name, Current Date and Time, SMTP and IP Configuration. To setup SMTP, input SMTP address in the form of *smtp.company.org* (or refer to system administrator for the address) and SMTP port (default to 25). Check Authentication Required to "Yes" and set a username and password if SMTP server requires it. The GUI SMTP feature currently does not support secure connections (SSL/TSL).
Users 	This field handles the user creation, managing, and listing. To add a user, click on the Add button on left of data grid (shown in the picture). Used to view the user detailed description To edit the existing user's password and access privileges To remove an existing user name
Disks 	This field listed all the installed hard drives, their status, sizes, manufacturers, models. Used to view the disk detailed description as well as the RAID volume associated with it To edit disk's QoS (default is Mission Critical) and RAID role. Refer to Section 4.3 for details. To remove a hard drive from the list Green light is online, Red is fault or offline, Amber is "Expelled", click for disk log.

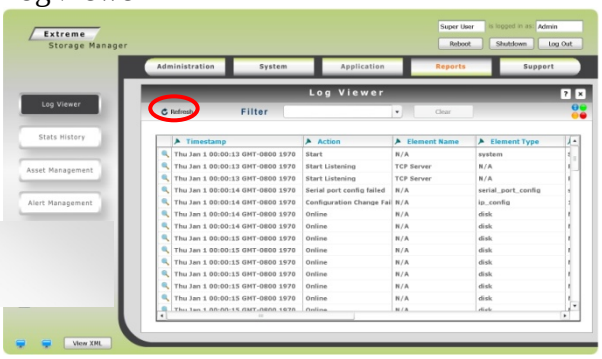
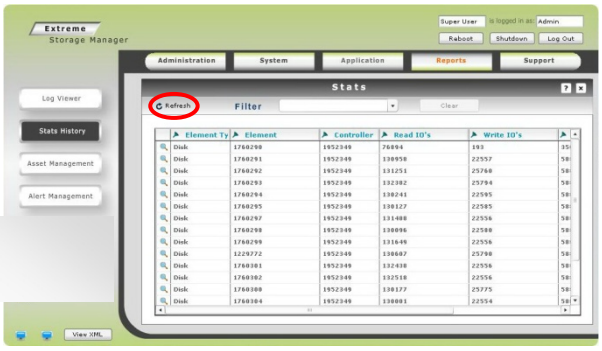
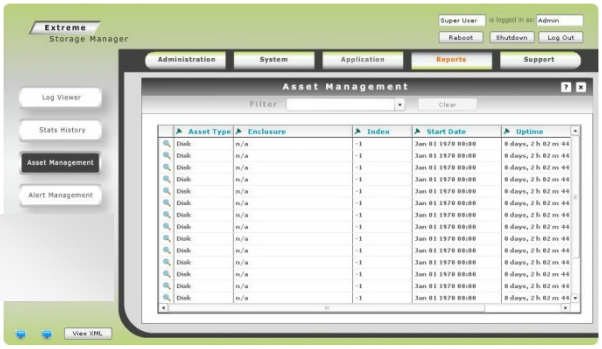
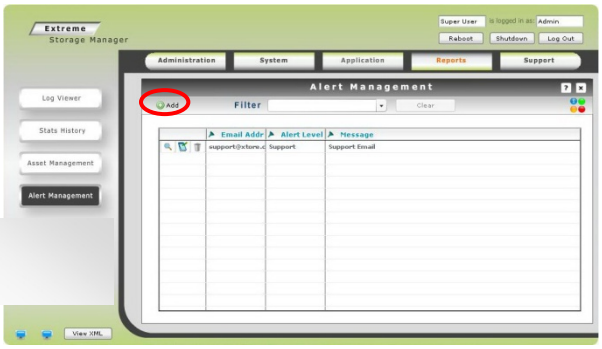
4.2.2. RAID System Menu

System Options	Description
Host 	This field lists and manage the hosts linked to the system. To add a host, click on the Add button on left of data grid (shown in the picture).
Logical Volume 	This field handles and managing logical volumes. Used to view the logical volume properties such as LV name, disks. To edit logical volume's name and stop LV To stop and delete logical volume Green light is online, Red is fault or offline, click for LV log.
RAID 	This field handles and managing RAID array. To add a RAID, click on the Add button on left of data grid (shown in the picture). Used to view the RAID properties including RAID build progress, logical volumes, disks To edit RAID volume's name, stop and rebuild a RAID. Go to Section 4.4 for details. To stop and delete RAID Green light is online, Red is fault or offline, Amber is building or degraded, click for RAID log.
Enclosure 	This field lists the RAID enclosure as well as the daisy-chained enclosure. Used to view the disk detailed description i.e. enclosure front, back view and disks details To edit enclosure's name To remove an enclosure from the list Green light is online, Red is offline, Amber is fault, click the button for enclosure log

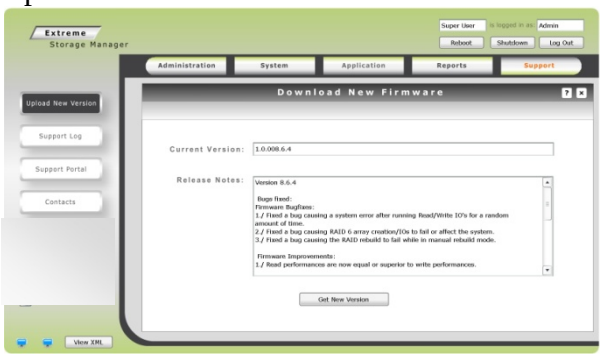
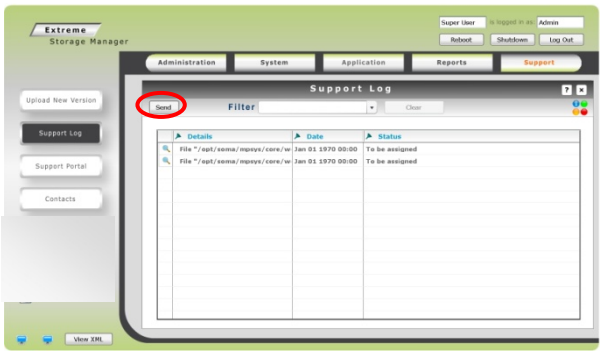
4.2.3. Application Menu

Application Options	Description
Snapshot 	In which some space is reserved for changes, snapshot is presenting a static point-in-time view of the file system
Replication 	This process is to ensure consistency between redundant drives to improve reliability, fault-tolerance, or accessibility.
Commissioning 	To give commission to the RAID management
Tools 	Provides tools that is useful for RAID management

4.2.4. Report Menu

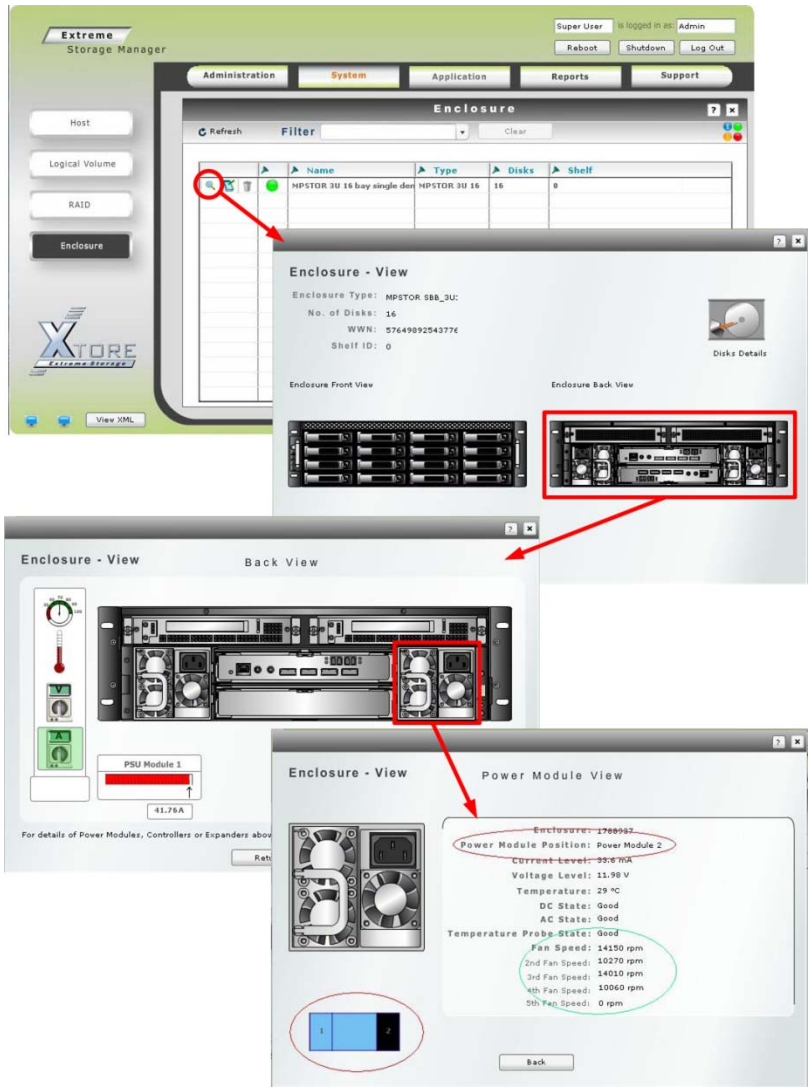
Report Options	Description
LogViewer 	This field lists the log of the system Press refresh (indicated by red circle on the picture) to check for a new log. To view the detailed log
Stats History 	This field lists the stat history of disks and RAID arrays Press refresh (indicated by red circle on the picture) to check for a new history. To view the item's detailed description
Asset Management 	This field manages the assets such as disk, power modules, and controllers To view the item's detailed description such as drive manufacturer, power module status and voltage level, controller's HW and FW version
Alert Management 	The RBOD can send out alert of any error and occurrence to a designated email address. To use this feature, SMTP configuration must be activated. To add an email address, click on the Add button Used to view the email detailed description To edit the existing email address and send test email To remove an email address

4.2.5. Support Menu

Support Options	Description
Upload New Version 	This option lists the current firmware version of the box, and to upload a new firmware version. To upload a new version, click on the "Get New Version" button. The firmware image will be available on AIC HTTP server. For a complete instruction, go to Chapter 4.6.
Support Log 	This field lists the debug files generated by the system Press send (indicated by red circle on the picture) to send the debug log to support@aicipc.com. To view the debug lines
Support Portal 	Support portal lists the technical support information.
Contacts 	AIC office, sales and technical support information can be found in Contacts screen.

4.3. Status Monitor

In addition to monitor the RAID volume status, ESM GUI also observes the fan and PSU module health. To go to the Enclosure Status View from your GU, go to System → Enclosure, then click on the button of the enclosure you want to observe. Follow the diagram below for details.



From that diagram you can see status like fans speed rpm, voltage and current level, temperature and so forth.

4.4. Quality of Service (QoS)

This section outlines the QoS selection for individual disks and the usage instructions to create QoS specific RAIDs.

The provided flash GUI allows you to manage the pool of online disk with a QoS (Quality of Service) setting. This setting allows you to easily "mark" drives with a specific QoS setting in accordance to the drive specs.

For instance, one would want to create different RAIDs on different disk quality or specs in order to match the production requirement of this RAID.

A RAID destined to archiving files, for instance, would require bigger but cost effective drives since the RAID will not be used for intensive IOs but rather for large storage. For that reason it might be a good idea to only use large SATA drives for this RAID.

On the other hand, RAID serving very fast and data demanding applications might require less storage space, but sturdier and faster drives, such as more expensive but more reliable SAS drives.

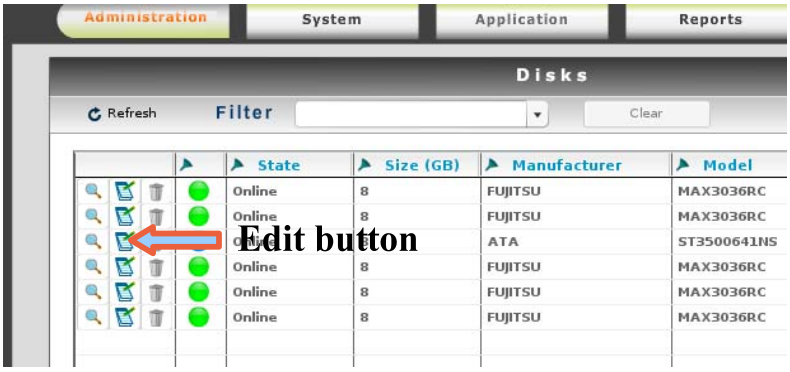
For that reason, the QoS setting was introduced, letting you marking your drives according to their final use, and to be able to create a specific QoS RAID using the matching User defined QoS drives.

4.4.1. Disk Management

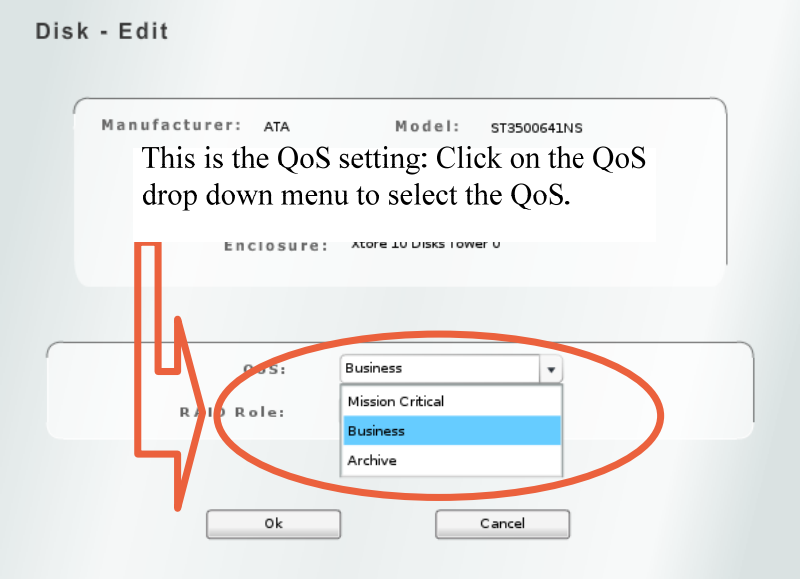
- The QoS setting must be defined for each drive separately.
- The QoS setting can be changed at any time, except if the drive is already part of an active RAID.
- There are currently 3 QoS level settings available on the system:
  - Mission Critical (default level).
  - Business
  - Archive

In order to select the QoS for a specific drive, you need to navigate to the following section within the GUI: Click on the Administration tab → Click on the Disks sidebar button.

Within this disk management view, you will then need to locate the drive for which the QoS setting needs to be changed by clicking on the "disk edit" button as shown below:



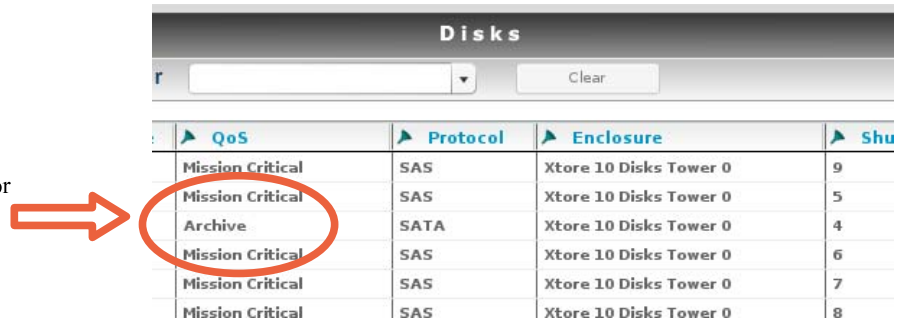
Clicking on this button will bring you to the individual "Disk Edit View":



Once you have selected the relevant QoS for this individual drive, click on the "OK" button to validate.

The QoS for this drive had been set. You can now observe the QoS level for this drive in the Disk View. It should have changed to the one you selected, as shown below:

The individual QoS level for this drive was changed successfully to "Archive".

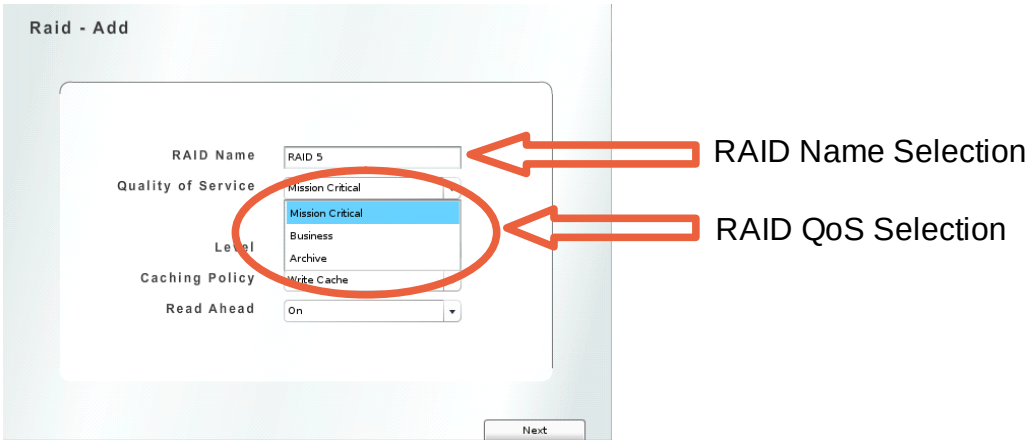


4.4.2. QoS Usage for RAID creation

Once all your drives have been setup with the relevant QoS level, you can then proceed to creating RAIDs.

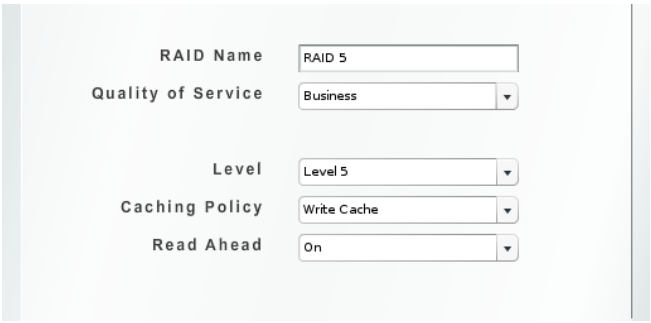
- Click on the "System Tab" to display the system leftside menu bar.
- Click on the "RAID" leftside button to access the RAID manager.

Click on the Add button. The RAID creation helper window will then pop up as follow:



- Pick a name for this RAID (the name cannot be longer than 15 characters).
- Choose a QoS for this RAID using the Quality of Service drop down menu, as shown above.
- Choose a RAID level for this RAID (0, 1, 5 or 6).
- Click on the "Next" button to proceed.

In the below example, we are choosing "Business". We previously setup 3 disks with the "Business" QoS setting:



Clicking on "Next" brings us to the Disk Selection. We can only see disks that have previously been setup with a "Business" QoS level since we are creating a "Business" QoS level RAID:

We can now click on the "Create RAID" button to complete the RAID creation process and start the RAID building process.

The built RAID will be a "Business" QoS level set RAID. Its level cannot be changed unless the RAID is taken apart.

To summarize:

- The QoS is a handy feature that can facilitate disk and RAID management in a system containing multiple enclosures with large amount of disks.

- One example of the feature is that it can be used in conjunction with User management, where a User could be setup with permissions to only "Add" items, but not delete nor modify them. The User in question would then have to create RAIDs using the pre-determined disks QoS.

- The Administrator of the system could then setup a specific QoS for each disk while setting up the system and let Users creating RAIDs only using the pre-determined disk QoS settings.

4.5. RAID Rebuilding

This section outlines the RAID rebuilding process, manual or automatic, as well as practical usage information on the RAID rebuilding feature.

Because of the nature of a RAID, a disk belonging to an array will fail at a certain point of time. The advantage of the RAID is to recover from this condition, without any data loss. To do so, a drive that has either been removed, or failed, will need to be replaced with a similar drive (size, type), to "rebuild" the RAID to a healthy status.

The disk used in an array to replace a failed/missing drive is called a "spare", or "Hot Spare".

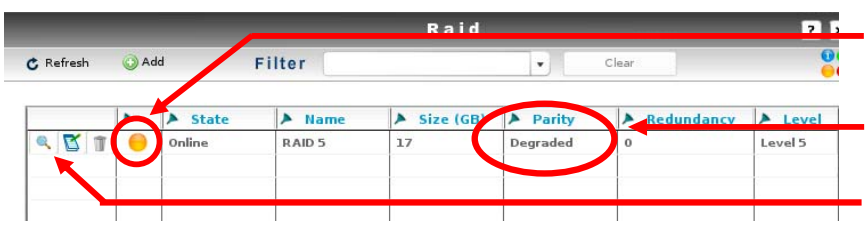
The fact that when a RAID 5, for example is running on a "degraded" mode (with one missing drive), is prone to corruption if any of the remaining drives fails, calls for an urgency to replace the drive.

Because of this high demanding availability of administration, some automatic measures have been put in place.

The Automatic rebuild feature is one of them. On a system with pre-defined "Hot Spares" or "spare" disks, the automatic rebuild feature will automatically rebuild a RAID array that got into a "degraded" state with one of the Hot spare drives, if it is of similar size specifications.

4.5.1. Manually Rebuilding a RAID Array

In the figure below, we can see that the existing RAID on the system is "degraded" (i.e. one of its drives is missing or failed). This is represented by an orange graphic button as well as the "status" mention: "Degraded".

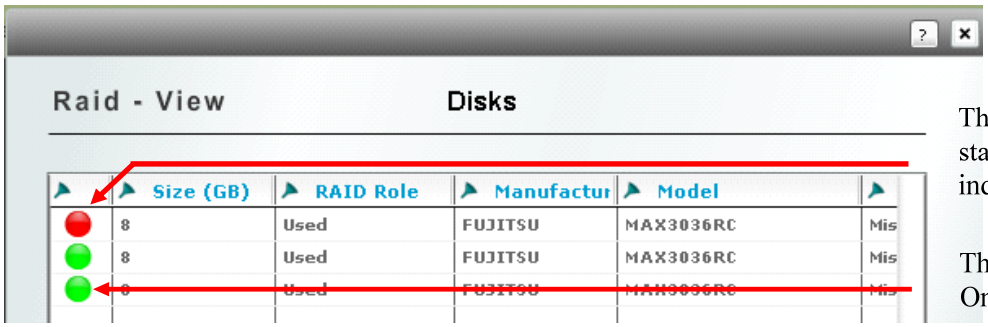


RAID Status color coded button.

RAID Parity status

RAID View button icon.

- Clicking on the magnifying glass left of this RAID allows us to access the RAID disk view, which gives us an overview of the disks belonging to this RAID



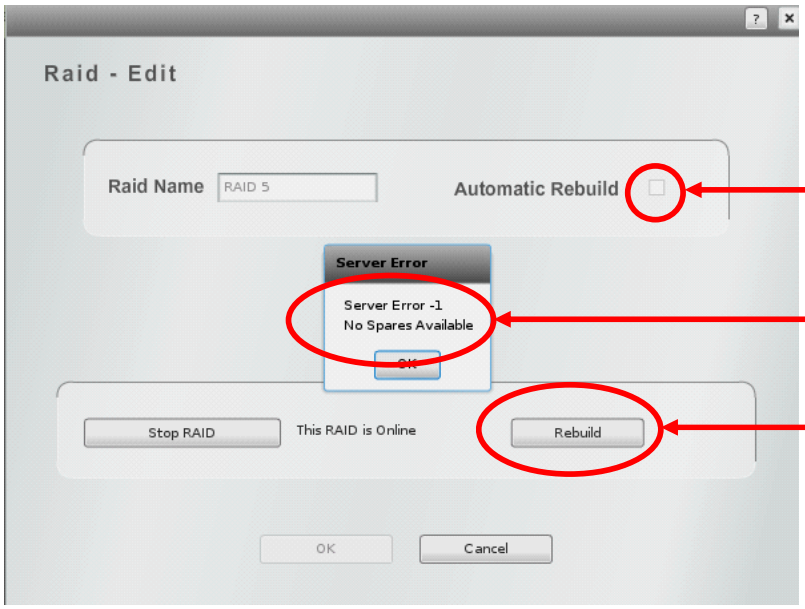
This disk's color coded status is RED and therefore indicates a failure.

This disk status is Online and green.

- On the picture above, we can see that one of these disks appears offline. That disk was removed from the bay. The offline/failed disk has got a Red status button, while the online disks have got a Green status button.

- Clicking on "Return" then "OK" brings us back to the general RAID view window.

- Clicking on the RAID "Edit" button (The small notepad icon in between of the "RAID View icon" (magnifying glass) and the "RAID delete icon" (bin icon), shows us whether this RAID is set to rebuild automatically or not



Automatic Rebuild Tickbox. This can be set when a RAID is offline.

Error message yielded by clicking on the Rebuild button when no spare disks are available

Rebuild button used to manually rebuild a RAID array.

- In the above example, we can observe that the "Automatic Rebuild" tickbox is not set.
  - The Automatic Rebuild feature is therefore not enabled.

Note: the Automatic Rebuild feature can only be enabled at the RAID creation stage or while a RAID is offline.

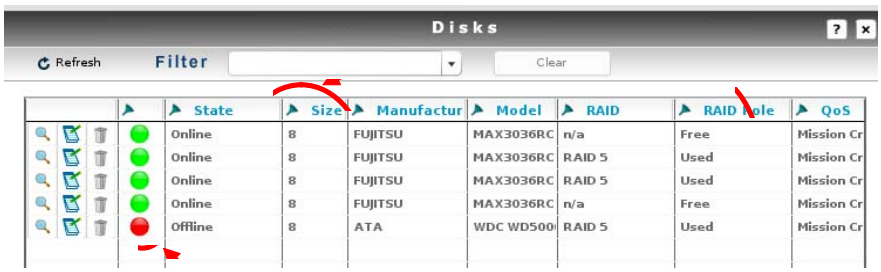
- We then tried to click on the "Rebuild" button from the RAID view, which immediately triggered the following error message: "No Spares Available".

This error message is due to the fact that we did not previously set any spare drives, or "Hot Spares". We now need to add such a drive to our "disk pool" in order to rebuild our "degraded" RAID array.

4.5.2. Managing Spare Drives

In order to add spare drives to the disk pool, you need to click on the "Administration" tab, and then click on the "Disks" left side-bar button icon.

This will bring you to the "Disk view" menu, as shown below:



A spare disk needs to be the same size as the size of the drives in the RAID it will be used in.

RAID Role summary. Can be "Free", "Used", "Dedicated Spare" or "Global Spare"

This Disk is Offline.

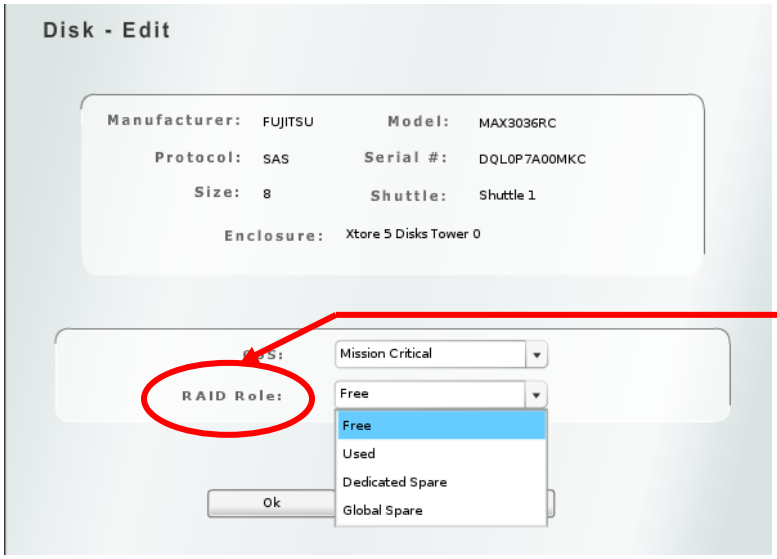
This view gives you a detailed list of all the disks connected to your system. Here we can see that one disk has become offline. It belongs to the array called "RAID 5" that we have used previously.

We can see that two of the RAID pool disks do not belong to any RAID (i.e. the RAID column shows them as "n/a" or Not Available.). Moreover, their "RAID Role" status is set to "Free", which means they have not been reserved for a later use, nor been set as "Dedicated Spare" or "Global Spare" disks.

We now need to pick one of these disks to replace the missing drive from the "RAID 5" array. We first make sure that this new drive is at least the same size as the smallest size drive used during the array creation by comparing the displayed size of the free disks with the ones from the RAID we are intending to rebuild.

In the above example, the free drives and the missing drive are all 8GB, which makes the two free drives ideal candidates to become "Hot Spares".

We then choose one of these two drives, and click on the drive's "Edit" button. The "Disk Edit" view is then displayed as shown below:



Click on the "RAID Role" drop down menu to display the list of available roles, and select the required role for this disk to set it. Click "OK" to validate your choice.

We can now change the "RAID Role" from "Free" to "Global Spare" by clicking on the "RAID Role" corresponding drop down menu.

Note: We cannot use "Dedicated Spare" in this case; dedicated spares need to be part of an active RAID to be used for rebuilding. They can only be used to rebuild the RAID they were created with.

Rebuilding a RAID is using an automatic priority system that decides which spare will be selected to rebuild a specific RAID. The disks will be picked in the following order:

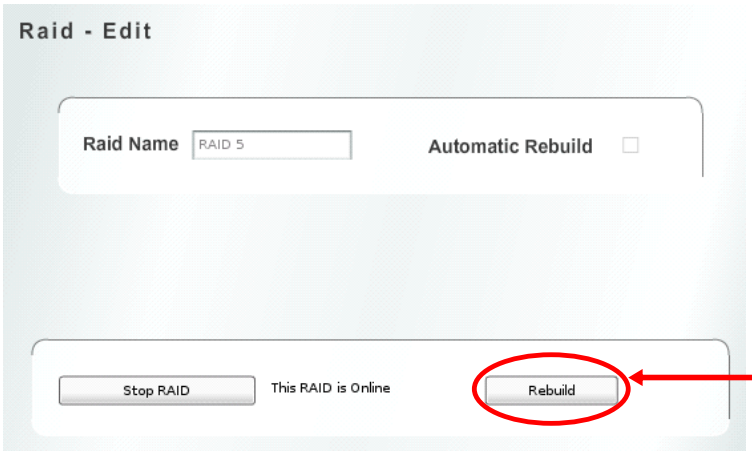
- A "Dedicated Spare" disk setup during the RAID creation process.
- If none available, a "Global Spare" from the disk pool matching the size of the smallest disk of the array.
- If none available, a "Global Spare" from the disk pool bigger than the smallest disk of the array.

Note: The QoS for the spare disks is not taken in account when rebuilding a RAID manually nor automatically. For instance, a RAID with a "Business" QoS can be rebuilt with an "Archive" QoS disk.

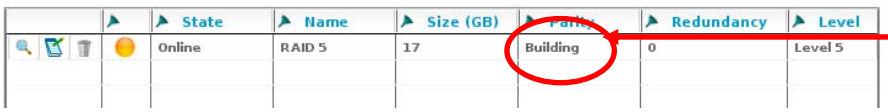
Once the "RAID Role" has been set, click on "OK" to validate.

We can now re-attempt to rebuild the array by clicking on the "System" tab, then clicking on the "RAID" left side-bar menu icon, followed by clicking on the "RAID Edit" button (the notepad icon).

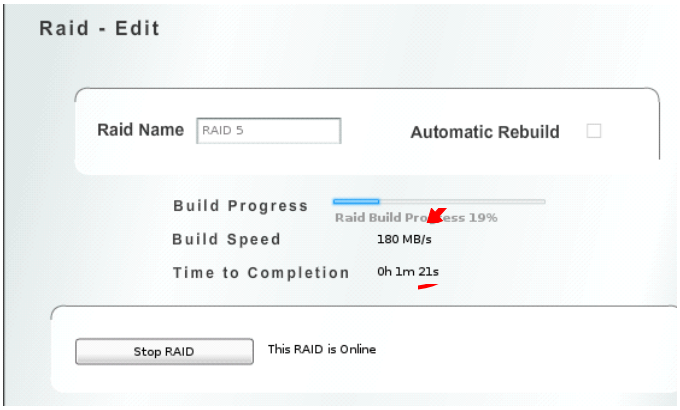
Clicking on the "Rebuild" button now closes the "RAID Edit" view and starts rebuilding the RAID. A click on the "Refresh" button will be required to observe the RAID new state:



This is the "Rebuild" button used to rebuild a RAID manually.



We can see here that the RAID is being rebuilt, after having clicked on the "Rebuild" button.



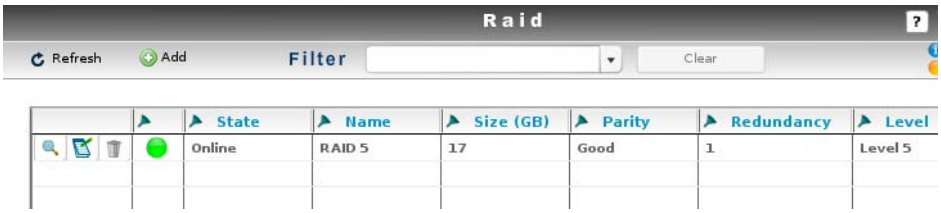
The build progress indicates the percentage of the RAID rebuild process done.

Overall speed at which the RAID is rebuilding.

Estimated time to completion, based on the build speed.

The picture above shows the RAID rebuild process. The progress bar indicates the overall process completion status, while the "Build Speed" field indicates at what speed in Mb per second the array is being rebuilt over all the disks. The "Time to Completion" field is an estimate of the remaining time needed to rebuild the array fully. This estimate is based on the overall Build Speed rate and may decrease or increase depending on what actions are being performed on potential other RAIDs Online the system.

Once the progress bar is full, the RAID rebuild status will go back to 0 percent: This means the RAID has finished rebuilding. The RAID View window can now be closed. The RAID status should now have changed from "Building" to "Online":



Your RAID is now rebuilt. However, this procedure needed the intervention of a person to complete. Because of the urgency of rebuilding a RAID as mentioned earlier, using the Automatic Rebuild feature would save a lot of time and effort in order to rebuild a RAID.

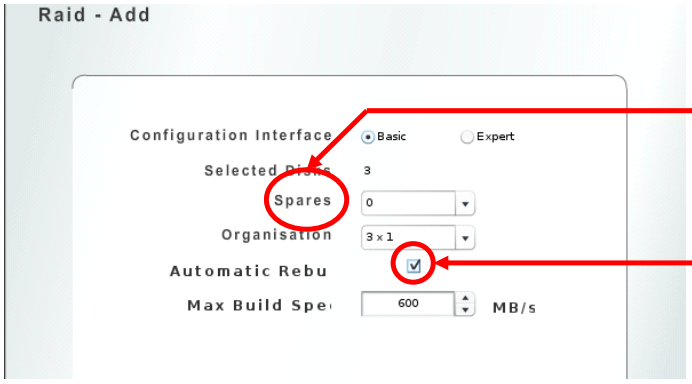
4.5.3. Using the Automatic rebuild feature

The previous sections of this documentation module already covered how to add a Spare to the disk pool, manually rebuild a RAID, monitor the progression of the RAID rebuild as well as the completion of the procedure. This section will explain how to setup an automatic RAID rebuild procedure to reduce human presence to admin the system.

Setting up the "Automatic Rebuild" feature at RAID creation time:

- Create a new RAID by clicking on the "Add" icon from the "RAID View" general view.
- Select the QoS, the RAID level required for this RAID.
- Click on "Next" and select the disks required for this RAID.

- The next view lets you customize the RAID geometry as well as the number of spares required.



Number of Spare disks required to create the array with. The Spare disks will be shared with other RAID arrays using disks of a similar size.

"Automatic Rebuild" feature tickbox, used to enable or not the Automatic rebuild feature for this specific RAID.

Tick the "Automatic Rebuild" box as shown above to enable the Automatic rebuild feature for this RAID. If this RAID loses a drive, the Automatic Rebuild feature will start rebuilding it straight away, but only if a spare is available for it.

Note: It is a good idea to select one more disk than required for the RAID to set it up as spare before the RAID creation. It avoids having to do so later on and makes sure at least a number of spare disks of the right specifications will be available when needed for this RAID.

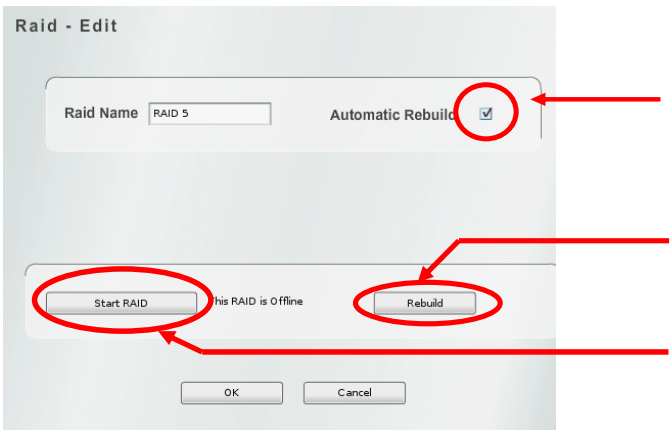
Click on "Next" and then on "Create RAID" to finish the RAID creation process.
Your RAID should now be building.

Once your RAID is built, if one of your RAID drive is pulled, or fails, your RAID array will start rebuilding automatically and immediately, should any spare disk be available.

Setting up the "Automatic Rebuild" after RAID creation time

It could happen that a RAID that was created without the "Automatic Rebuild" feature needs to be set as so.

To change the Automatic Rebuild setting on a specific RAID, click on the "RAID edit" button (notepad icon) from the "RAID View" general menu.



The Automatic Rebuild feature has been ticked, which enables the feature for this RAID once the choice is registered by clicking on the "OK" button.

RAID status indicator. A RAID can be either Online or Offline.

RAID Stop/Start button. A RAID needs to be stopped to be able to enable the Automatic Rebuild feature

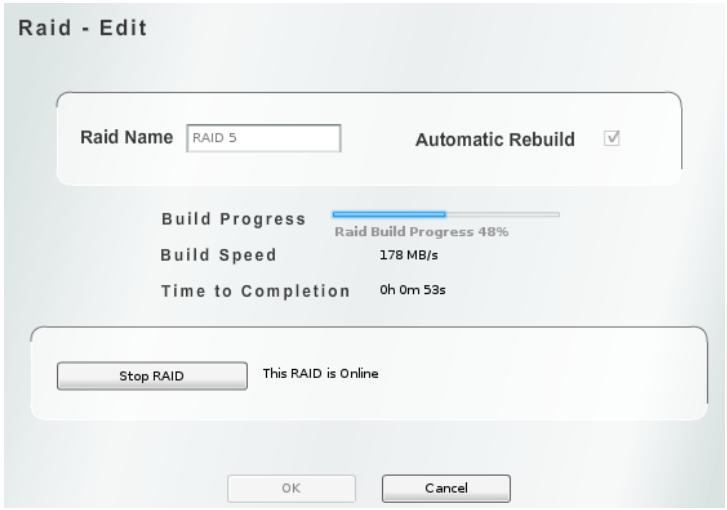
The Automatic Rebuild box can only be activated while a RAID is offline.
For that reason, the RAID needs to be stopped (if no activity is currently performed on it), by clicking on the "Stop RAID" button.

Once stopped, the Automatic Rebuild tick box, previously grayed out, becomes active.

In order to activate it, tick the box corresponding to the Automatic Rebuild field, but do not directly click on the "Start RAID" button. This would cause the feature to be reset to the state it was in before stopping the RAID and would cause the RAID to restart without the feature being activated. Instead, once the box is ticked or unticked, click on the "OK" button to validate and save this option onto the RAID. Once done, the RAID – Edit view form should close and you will need to reopen it, and click on "Start RAID" to restart the RAID. You should observe that the Automatic Rebuild tick box displays your setting and will get grayed out once the RAID has restarted.

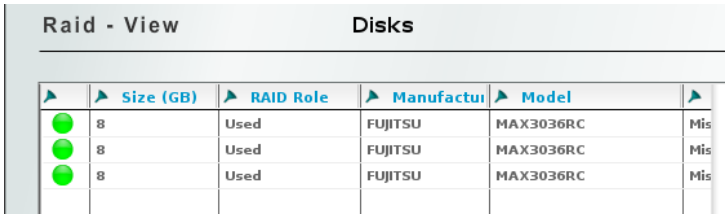
Automatic Rebuild Behavior

With the Automatic Rebuild feature enabled, and your disk pool containing at least one spare disk of the similar specifications (similar size), pulling an active RAID disk from its bay will automatically start rebuilding the array in which the disk is contained, even if the RAID is being used at the same time, in total transparency. In the picture below, one of the RAID disk was pulled, which kicked in the RAID rebuild process automatically:

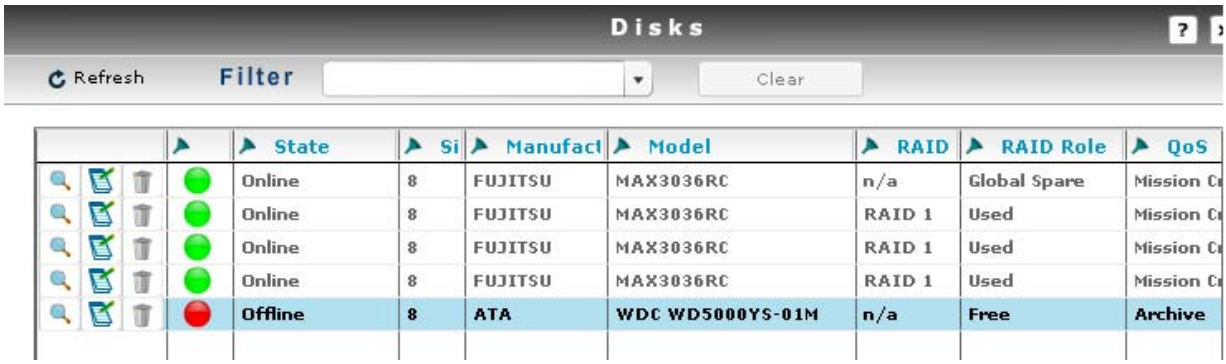


Clicking on the "Edit RAID" button (notepad icon), will show you that this Automatic Rebuild RAID is being rebuilt, and will show you the RAID rebuild progress bar, the RAID building speed in Mb/sec as well as an estimated time to completion.

Clicking on the "Cancel" button and clicking on the "RAID View" button (magnifying glass), then clicking on the "View Disks" button icon will show you that the Offline disk, the disk that was pulled, has been "kicked out" of the array and replaced by a good disk, which was taken from the "global" or "dedicated" spare disk pool.



The disk that was pulled was automatically put back in the disk pool, with the "Offline" mention, and we can clearly see that it's RAID Role has changed from "Used" to "Free", and that it does not belong to the RAID named "RAID 1" anymore.



		State	Si	Manufact	Model	RAID	RAID Role	QoS
		Online	8	FUJITSU	MAX3036RC	n/a	Global Spare	Mission C
		Online	8	FUJITSU	MAX3036RC	RAID 1	Used	Mission C
		Online	8	FUJITSU	MAX3036RC	RAID 1	Used	Mission C
		Online	8	FUJITSU	MAX3036RC	RAID 1	Used	Mission C
		Offline	8	ATA	WDC WD5000YS-01M	n/a	Free	Archive

We can see also that one of the "ex" spare disk, that had a "Dedicated Spare" RAID Role, is now part of this array.

The Automatic Rebuild Process has now successfully completed. A good idea would be to replace the failed/pulled disk by a healthy disk of the same size and mark it as a "Global Spare", to organize a spare replacement for the spare disk we just used to be ready for the next potential disk failure.

Usage examples:

RAID Rebuilding is an essential part of the RAID technology. Without it, an array would only accept one and only failure, after which the data would not be considered as safe. This is for this reason that enabling an Automatic RAID Rebuild feature greatly reduces the time window at which an array is considered at risk, i.e, when one of its components, or disk, has failed or has been removed.

However, this feature requires a sacrifice of one or more disk per array in order to work automatically. But peace of mind can sometimes balance the lost storage space.

The RAID rebuild feature can be used in conjunction with the Alert manager, which will alert the system administrator in case of a disk failure. Activating the Automatic Rebuild feature will then rebuild the degraded RAID automatically and immediately, together with alerting the system administrator that a RAID had gone in a degraded state and is now being rebuilt.

4.6. Using Filters in the GUI

This section outlines the usage of filters for administration purposes and ease of use within the "ESM" GUI.

This system is a complex system, which can gather and accumulate a lot of assets and information that can cause confusion if not presented properly.

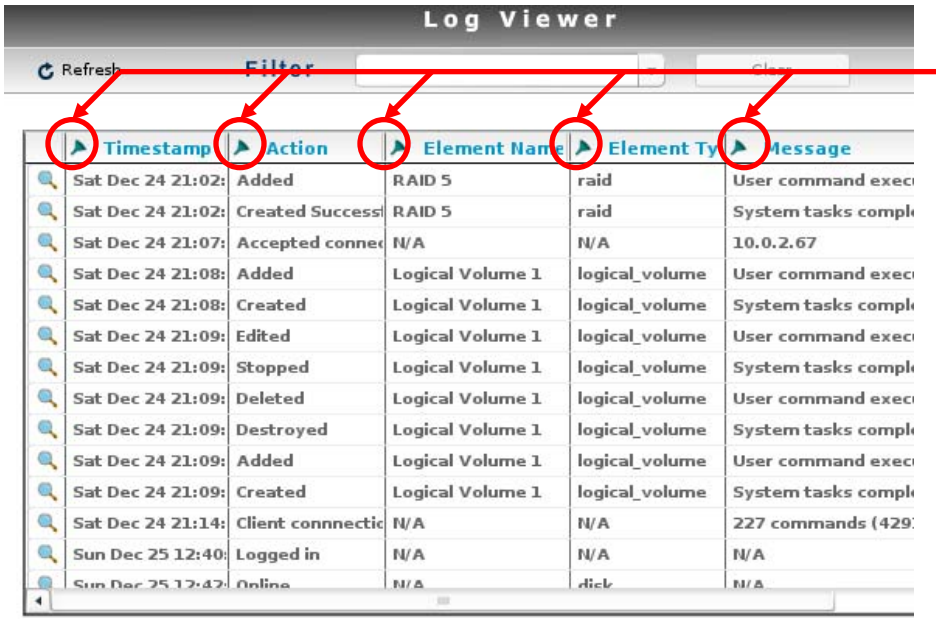
For this reason, a set of data and asset "filters" were implemented to facilitate the usage and the information finding on this system.

The filters can be used within the GUI with any item that is listed in a data list, i.e., an item present in a table with columns and rows, and can be combined between elements for a narrower search.

4.5.1. How to use the filters within the GUI

For documentary purposes, we will use the filters within the Log Viewer only, although it is good to note that they can be used in many of the GUI's sections.

Locating the "Filter" button:
Although the filter feature is very intuitive, one has to know where to find the feature first. The filter menu is located at the top of a data sheet's column, represented by a small pin icon.

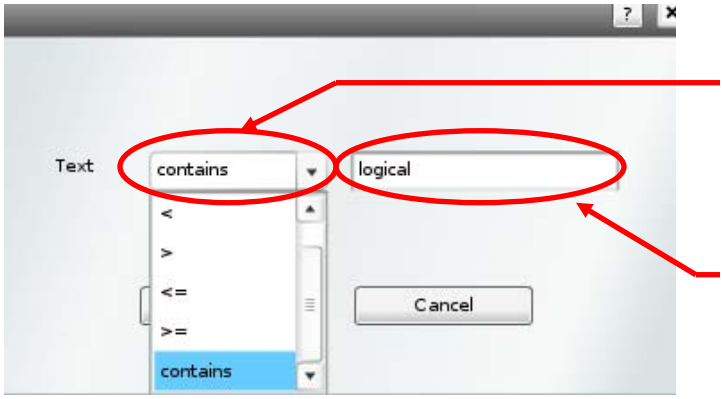


These pins are all corresponding to different possible filters for each data type represented in each column. The filter type will vary depending on the data type being filtered. For a date, a date filter will be displayed, for a field containing text; a general filter will be displayed.

The picture above shows all the different filters available for this "Log Viewer" view. There is one "Filter" pin available for each column, allowing to select which column or element is to be filtered.

In the following example, we will be filtering the "Element Types" in order to display the log entries only regarding the "logical_volume" elements types.

You will first need to click on the corresponding column's "Filter" pin that you need to setup the filter for. Therefore in our example we click on the "Element Type" Pin icon.



This drop down menu allows you to pick from the available "operands" or modifier for your filter.

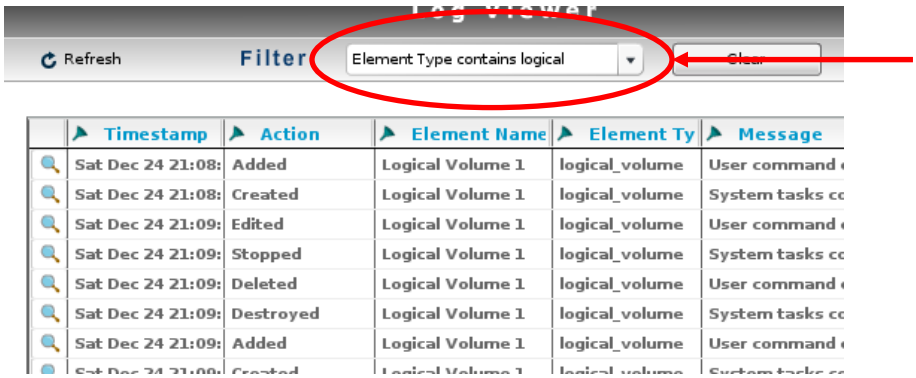
This box allows you to input the text used by the filter to display the relevant entries you are looking for.

The "Filter" setup window will open as shown above. Depending on the data type contained in this column, this window will vary to match the best search options with the data type. For instance, a column containing text and numbers will allow you to search with the following operands:

- < - to search for a value under the specified value.
- > - to search for a value over the specified value.
- <= - to search for a value under or equal to the specified value
- >= - to search for a value over or equal to the specified value.
- Contains – This is a text and number search features, searches for a value containing the same string of text or number as specified.

There are more filters setup window types for different data type. They will be reviewed later on.

In the above example, we need to select the filter operand to "contains" and input the search query required, "logical". Once our filter is set, we then need to click on the "OK" button to activate the filter.



This is the filter summary drop down menu. It displays the most recent active filter. Clicking on it will display the full list of active filters.

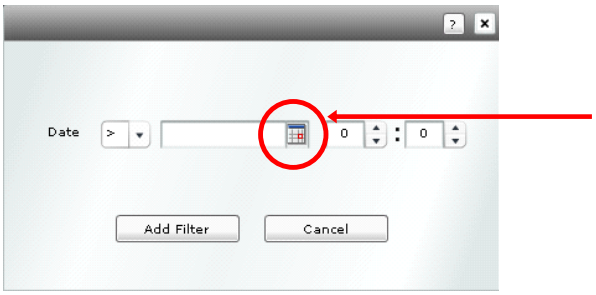
The filter has been activated, and only the "Element Types" containing the word "logical" are being displayed.

This facilitates browsing of all the events relating to the Logical Volumes.

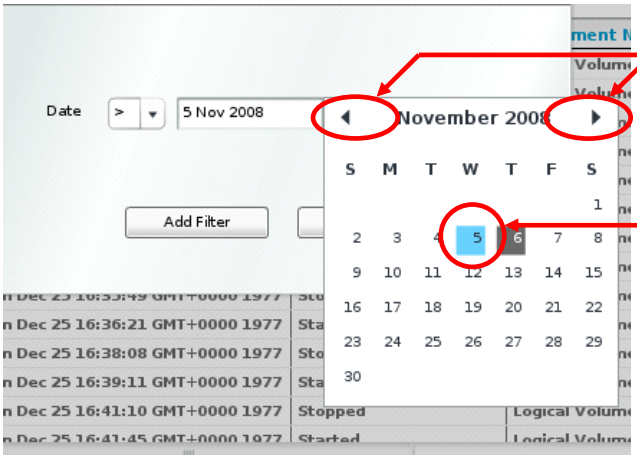
However, there could be too many Logical Volume events while we only want to display the Logical Volume events that occurred after the 5th of November 2008. We will then need to combine the existing filter with a second "Timestamp" or date filter.

4.5.2. Combining filters

Combining filters is very straight forward. Once a filter is active and is being displayed in the "Filter" drop down menu at the top of the active page, a new filter can be combined to the existing one by simply creating a new filter.
In the below example, we will add a "Timestamp" filter to the existing "element_type" one.



The calendar icon needs to be clicked in order to display the Date picker helper.



The arrows allow to skip one month back or forth.

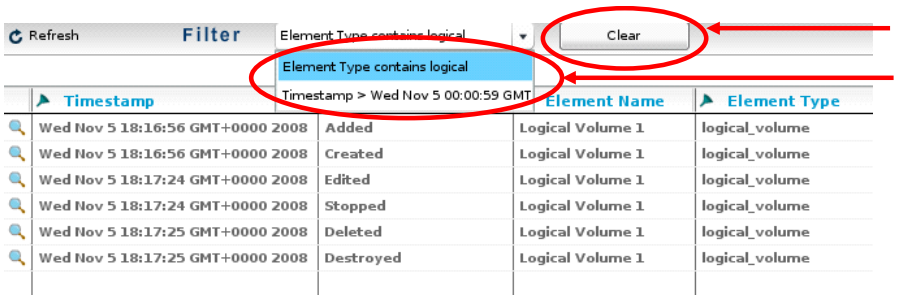
The day selection allows to pick the required day to search for.

We first need to click on the "Timestamp" Pin icon to bring the Timestamp filter menu up.
We can observe that the filter selection has changed slightly for this "Date" filter data type.

A calendar date picker allows us to pick the specific we want to filter the events from.

We choose the date as higher than the 5th of November 2008 and validate by clicking on "Add Filter".

The Log Viewer now only shows the events concerning the Logical Volumes that occurred after the 5th of November, as requested:



This deleted all the existing active filters.

Clicking on the "Clear" button will clear all the active filters listed in this drop down menu.

Once we have finished using the filters, they can be cleared to resume the display of a full "Events" page by clicking on the "Clear" button.

Filter usages and conclusion:

The Filters are a great feature that can seriously reduce the time involved in browsing through over populated event logs, or when dealing with multiple enclosures daisy-chained to a single, central controller. They can be combined for perfect tuning of the queries and can be cleared very easily. The filters are automatically changing regarding of the data type you are filtering, and the following filter types are available on the system:

- Text filtering with < > = contains operands.
- Date filtering with a calendar date picker helper as well as minutes and seconds.
- Value picking, used to pre-set standard values, used for a status for instance.
    - Value picking allows you to pick a filter attribute from all the possible values for this item, for example: "State: Start, Online, Offline".

In order to use a filter, simply click on the column's Pin icon and follow the instructions.

4.7. RAID Firmware Upgrade

3U16 SBB RAID provides a firmware upgrade through HTTP server only. Firmware image will be stored in AIC HTTP server to make the firmware upgrade process effortless.

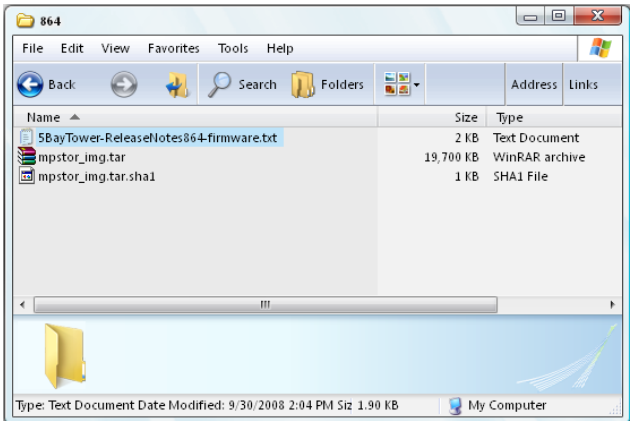
The unit's firmware is stored on an inboard flash memory chip that can be flashed to apply updates, or fix the system.

The system can be flashed from the GUI, in the "Support" section. A tab called "Upload New Version" allows you to flash the controller using fresh firmware images.

In order to transfer these images onto the controller's flash, a HTTP connection will be used from the controller to an AIC HTTP server sharing the required upgrade firmwares.

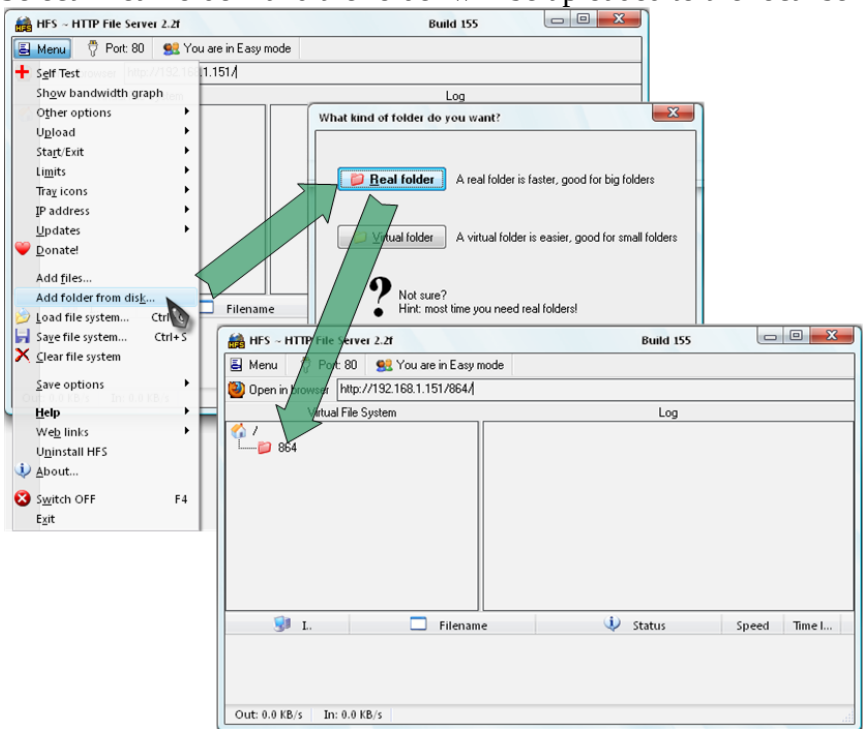
Should the AIC HTTP server become unavailable, another way to upgrade the firmware is through local download. The following details how to install a free, very simple and small HTTP server for the Flash upgrading purpose:

1. Foremost, download the latest firmware from AIC website and extract it to reveal the firmware files inside a folder as follow:

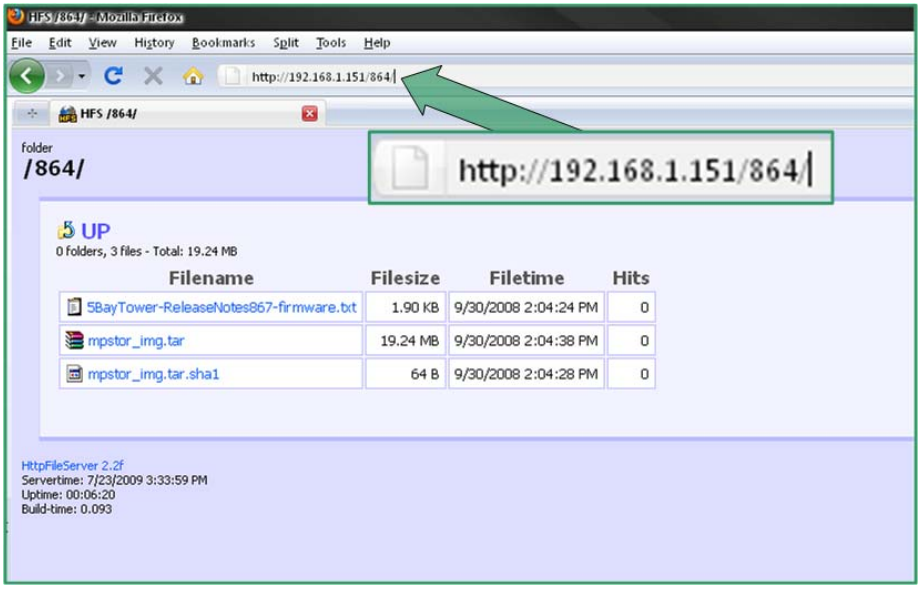


2. Download and open a simple HTTP server program from http://www.rejetto.com/hfs/ called *hfs* (HTTP File Server).

3. Please follow the diagram below to upload the firmware file into the HTTP file server. Make sure that you are using port 80.
   a. Select Menu → Add folder from disk
   b. Choose the folder extracted from the downloaded firmware file
   c. Select "Real folder" and the folder will be uploaded to the local server

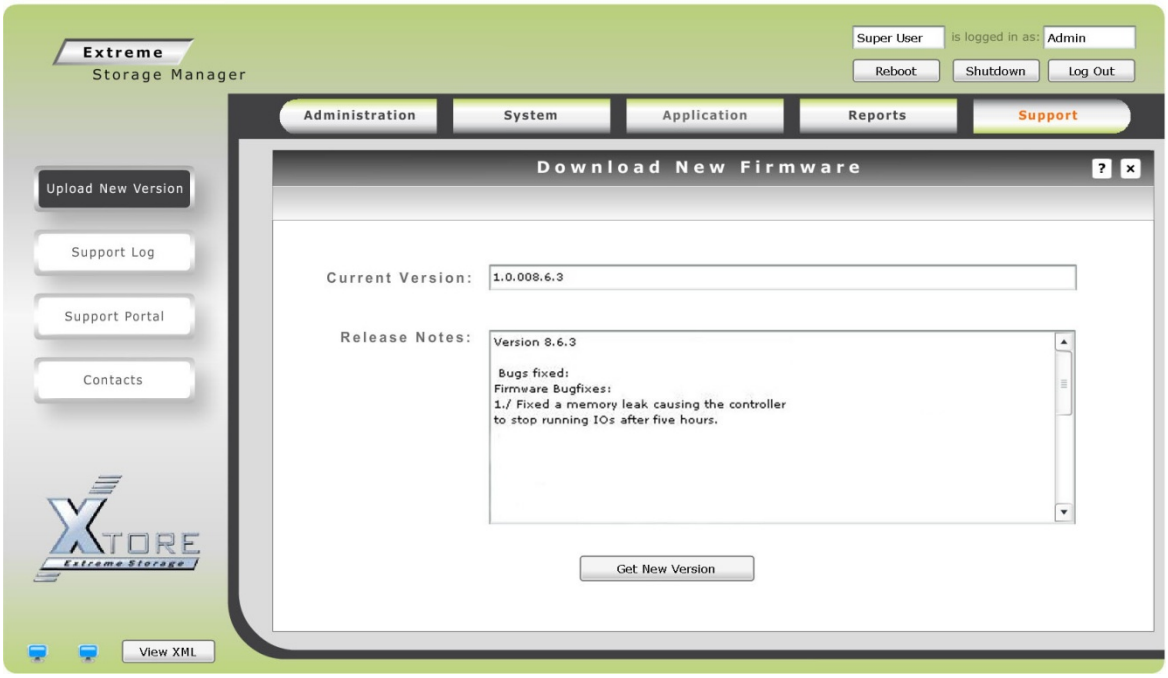


4. Once the firmware files are up on the HTTP file server, make sure that the files are accessible by using a browser and entering the host IP address followed by the firmware folder name.



5. Upgrade the firmware:

   - Under Support → Upload New Version, click on "Get New Version" button to start. This screen also shows the current version of the firmware



   - Input the address of the computer where hfs is running followed by a slash ("/").

- Click on "Next". The firmware download will start, followed by the firmware install.

- The procedure takes about 15 minutes to complete. Once completed, you will be prompted to restart your controller. The screen will appear showing the new firmware version as well as its release notes.

- Reboot the controller using the top right corner GUI "Reboot" button.

4.8. GUI Session Management

The power maintenance functions are located on the top right corner of the GUI.

*4.8.1. **Reboot***

To restart the RAID controller, press "Reboot" button. Allow a couple of minutes for the RAID controller to log out and restart itself.

4.8.2. Log Out

Press "Log Out" button to end the GUI session or login in as a different user.

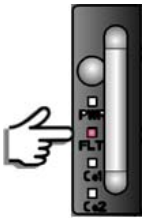
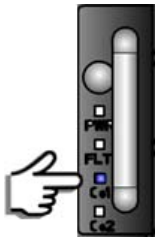
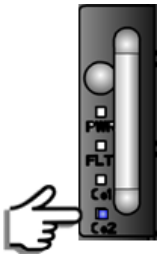
4.8.3. Shutdown

The "Shutdown" button is available to turn off the RAID controller. Note that the enclosure power will not turn off by using this function. To shut down the system entirely, press the Power button of the enclosure as described in Chapter 3.2.4.

5. System LED and 7-Segment Display Status

5.1. System LED Status

The following table describes the LED status information and alerts.

Item	Description of Operation
Power LED 	The power button lights up blue when system is successfully powered up. [PWR] Power/UID (Power On/Beacon) • BLUE = Unit powered up, • Flashing BLUE = Unit is being beaconed
Faulty LED 	Red LED indicates that there is a faulty in the system [FLT] General Status LED • OFF = OK • RED = Failure occured
Controller 1 Status LED 	This LED indicates the status of the RAID controller in the Secondary SBB Slot [C#1] Secondary RAID Controller Status • BLUE = OK • RED = Failure • Blank = canister not inserted
Controller 2 Status LED 	This LED indicates the status of the RAID controller in the Primary SBB Slot [C#2] Primary RAID Controller Status • BLUE = OK • RED = Failure • Blank = canister not inserted
Drive Tray LEDs 	Each Drive Tray has 2 LEDs, Blue LED on the right and Red LED on the left hand side Off – Drive not present or not powered on

Item	Description of Operation
	Solid Blue – Drive is present and powered on, no activity Flashing Blue – Drive powered on, activity Red – Fault: check GUI for detail
Ethernet LAN Port LED 	Speed: Off – 10Mbps, Amber – 100Mbps, Green – 1Gbps connection. Act/Link: Off – No link, Solid Green – Linked, Blinking Green – Data activity.
SAS Channel LED 	Red solid dim – standby power mode Green solid – PHY connection established
Fibre Channel LED (Optional) 	Red solid dim – standby power mode Green solid – FC connection established
7-Segment Display 	The Display Panel's 7-Segment Display provides subsystem component status and alert information. In normal mode the display shows the Enclosure Shelf ID, in Error mode it shows the error condition. The table in section 5.1.2 defines the codes and related condition descriptions.
Temperature Alert LED 	Red LED shows if there is a Display Board Temperature problem. Green LED indicates a normal temperature condition.
PSU Error LED 	Red LED shows if there is a 12V (out of range) problem, otherwise Green LED shows.

Table 4.1: LED Status

5.2. 7-Segment Display, Display Codes & Messages

See Table 4.2 for a full list of Error codes.

7-Segment Display

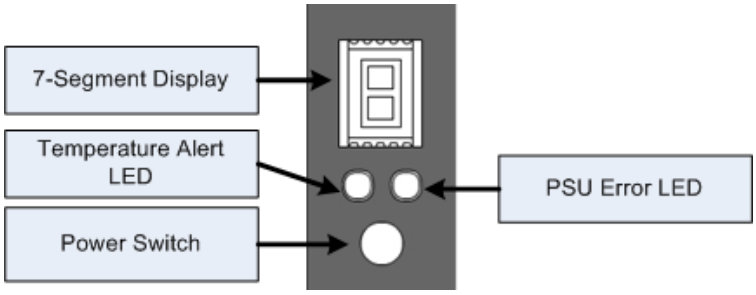


Figure 4.1: 3U16 SBB 7-Segment Display

The Display Board allows the User to

- Power On-Off the System
- See System Status and Alarm
- Set Enclosure ID

Power On
When AC is first applied to the system the Display board will be powered by the 5V standby power and remain in the "Standby Mode".
The Display board in the Standby mode will cycle through all the LEDs to indicate it is in this mode and BLANK the Display Digit.

In "Standby Mode" the PSU 12V power is turned off.

Pressing the ON-OFF button momentarily will cause the Display Board to exit standby mode and power up the system. The Display board will go to "Operational Mode".

Power Off
When the system is in "Operational Mode" pressing the ON-OFF button momentarily will cause the display board to go on Standby Mode and shut off the 12V supply.

ID Mode
A quick press on the power button will bring the unit into an ID Mode. ID Mode is where user can assign an ID to the unit to differentiate one unit to another in case of multiple systems configuration.
Once in ID mode, a dot on the lower right hand corner of the 7-segment display will show to indicate such state. In this mode, system cannot be turned on or off with a long press.
To quit this mode, do a long press to exit the ID mode state. When the dot disappears, system is at normal mode again.

Status LED

When an Error occurs in the system the Status LEDs are activated. The Status LEDS use the following protocol to display the Error:

- Full Green LED: There is no Error
- Flashing Red-Green LED: There is an Error occurring for the element, the Error Code is displayed for that Element on the Display Digit.

Display LED
A 7-segment display LED is used to show Enclosure/Shelf ID and an Error code.
Error codes are displayed as a cycle of sequence of 3 digit numbers with x.xx format. The following is an example of an error message. Refer to the meaning of the error code on the table below.

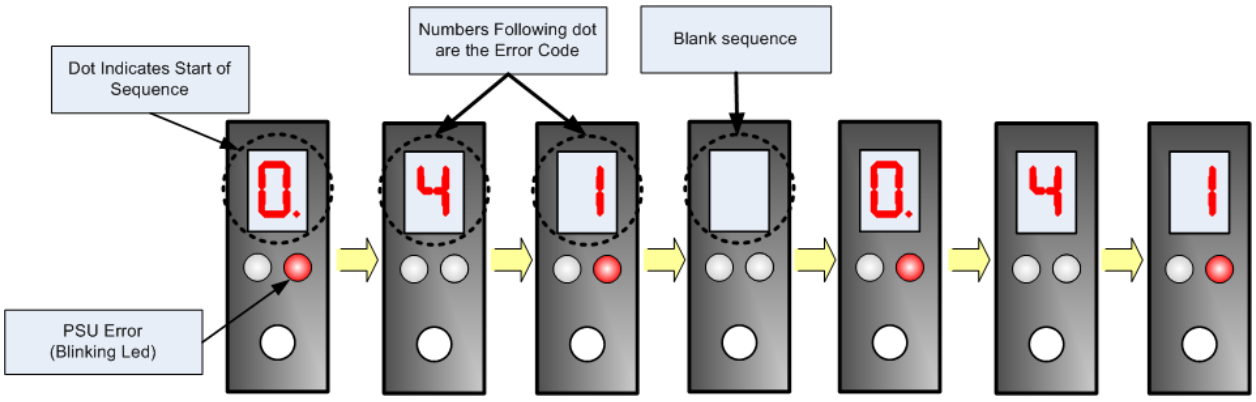


Figure 4.2: 3U16 SBB Display during a PSU Error on PSU#0 with Error Code 41

ALARM ACKNOWLEDGE
The Sequence below shows a PSU/Module0 with Error code 41 followed by an Alarm Acknowledge (the Mute button on the front display panel), the next Error is then displayed which is a PSU/Module1 Temperature Error of 52 degrees Centigrade.

PLEASE NOTE that the error condition on PSU/Module0 is still present so the LED will stay FULL RED. In addition, the PSU Module Number0 will show a Module RED LED ERROR.

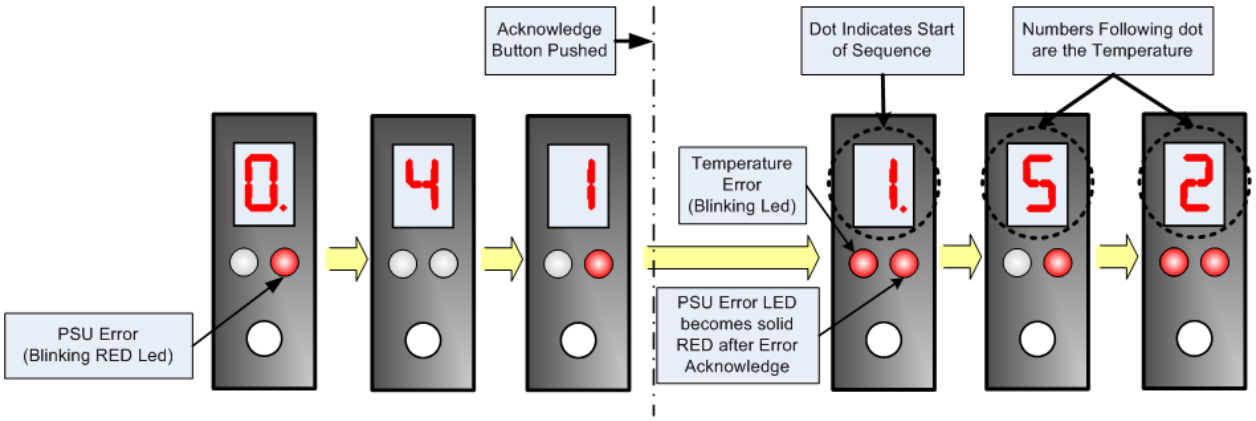


Figure 4.3: 3U16 SBB Display Error Code with Acknowledge Button Pushed

FULL RED LED
If the Display LED is full RED than an error condition exists for that Element.
If the Error has already been acknowledged than the ERROR code will no longer be displayed for that LED

The table describes the codes and message definitions available on the rear 7-Segment Display Panel.

Error Code	Module	Error description	Action
0.01	Module0	The I2C Bus is Faulty	
0.02	Module0	The AC cable is faulty or missing	
0.03	Module0	The PSU voltage is too Low	
0.04	Module0	The PSU current is too High	
0.05	Module0	The PSU voltage is too High	
0.21	Module0	The I2C Bus is Faulty	
0.22	Module0	The Temperature is too High	
0.41	Module0	The I2C Bus is Faulty	
0.42	Module0	The Fan speed is too Low	
0.43	Module0	The Fan speed is too High	
1.01	Module1	The I2C Bus is Faulty	
1.02	Module1	The AC cable is faulty or missing	
1.03	Module1	The PSU voltage is too Low	
1.04	Module1	The PSU current is too High	
1.05	Module1	The PSU voltage is too High	
1.21	Module1	The I2C Bus is Faulty	
1.22	Module1	The Temperature is too High	
1.41	Module1	The I2C Bus is Faulty	
1.42	Module1	The Fan speed is too Low	
1.43	Module1	The Fan speed is too High	

Table 4.2: Error Codes

STD

6. Auxiliary Module

This chapter is applicable to 3U 16-Bay SBB RBOD only. Xtore StudioRAID 16Re does not have this option. 3U16 SBB RBOD offers two auxiliary bays specific for special functions of an SBB unit. An auxiliary canister is an optional module that can be purchased separately. Some of the types of auxiliary canisters are listed below:

6.1. Connecting an Auxiliary Module

6.1.1. PCI-e Expansion Auxiliary Module Connection

The PCI-e expansion module can be populated with any off-the-shelves card or controller. Such cards include: Fiber Channel controller, SAS controller, GbE Ethernet card, graphic cards, etc.

Below is the description of the PCI-e Expansion Module front side.

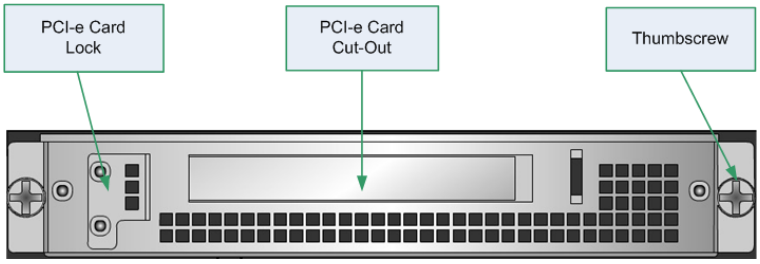


Figure 5.1: PCI-e Expansion Auxiliary Module

Below is one of the connections PCI-e expansion module can be utilized for.

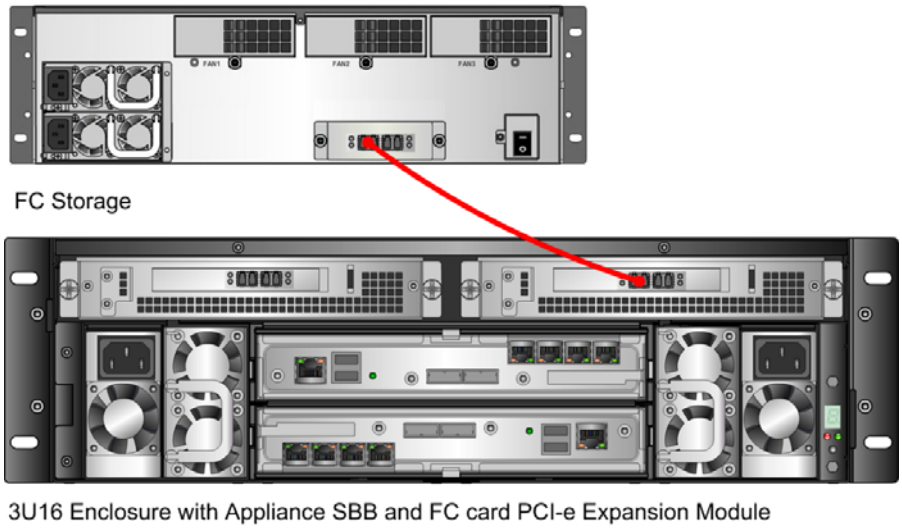


Figure 5.2: PCI-e Expansion Connection Diagram

6.1.2. Fan-Out Expander Auxiliary Module Connections

Below is the description of the ports of a Fan-Out Expander auxiliary module.

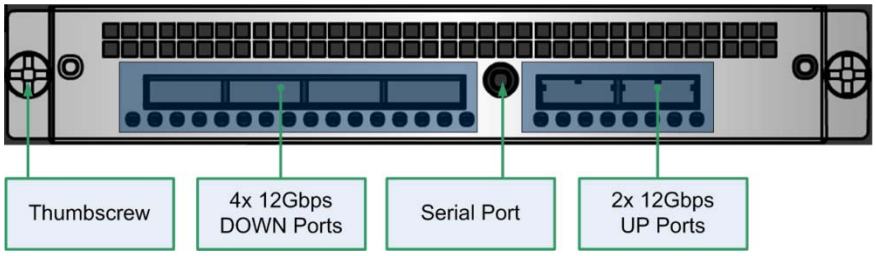


Figure 5.3: 3U16 Fan-Out Expander Auxiliary Module

As mentioned before, a Fan-out Expander is used for providing extra expansion port (4 DOWN ports) to an SBB enclosure for additional storage.
To do so, first establish a connection by joining the SBB module (Appliance module used in this example) to one of the UP port of the Fan-Out Expander Auxiliary module using a SAS cable. From the Fan-Out Expander module, you can connect to up to 4 storage systems (AIC 3U16 JBODs used here).

Other SBB modules can be used to initiate the link, such as JBOD SBB module, RAID SBB module. Refer to respective module user's manual for a complete detail.

A redundancy path can also be established for fail-over circumstances. See below diagram for redundancy connection.

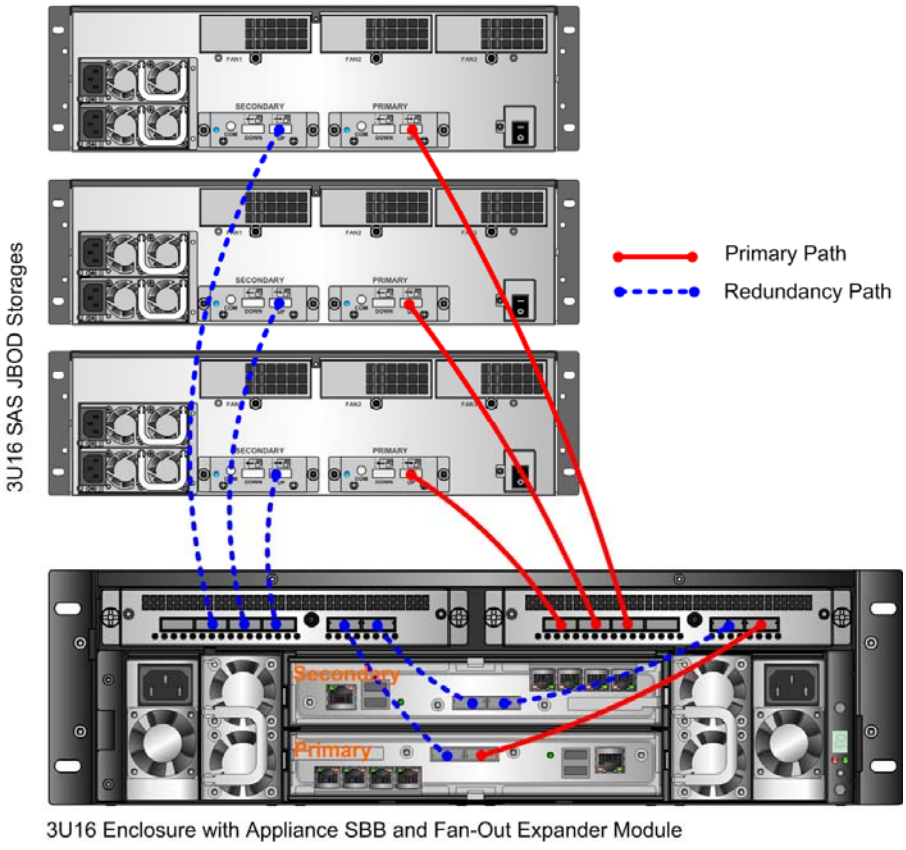


Figure 5.4: Fan-Out Connection Diagram

6.2. Using an Auxiliary Module

6.2.1. Removing and Installing an Auxiliary Module

The auxiliary module uses thumbscrews to lock itself onto the enclosure. Simply undo the thumbscrews and pull the module out of the slot to remove the canister. Conversely, push the canister towards the opening on the enclosure and lock the thumbscrews to insert the auxiliary module.

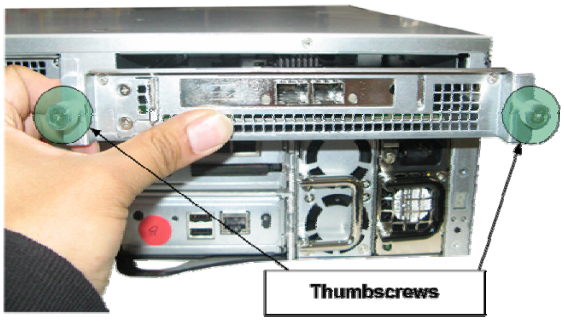


Figure 5.5: Removing/Inserting a 3U16 Auxiliary Module

6.2.2. Installing Adapter Card into PCI-e Auxiliary Module

While most of the auxiliary modules have a plug-and-play feature, some of the auxiliary modules need a little bit of assembly effort in order to function. Such module is the PCI-e Auxiliary Module which essentially is a PCI-e expansion board in a canister that sports one PCI-e x16 slot. A host bust adapter or RAID card then can be installed into the PCI-e auxiliary board to provide expandability. Below are the steps of installing an adapter board:

1) Before you install the adapter board, undo the screws securing the brace (shown at number 4) and remove the brace.

   Then hold the adapter board and insert the lower edge of the adapter bracket into the slit on the auxiliary module bracket cut-out

2) Align and carefully place in the golden finger of the adapter board to the PCI-e slot of the PCI-e auxiliary board

3) Align the upper adapter bracket into the opening of the module bracket cut-out

4) Place back the brace into the opening on step number 3 and secure it with screws.

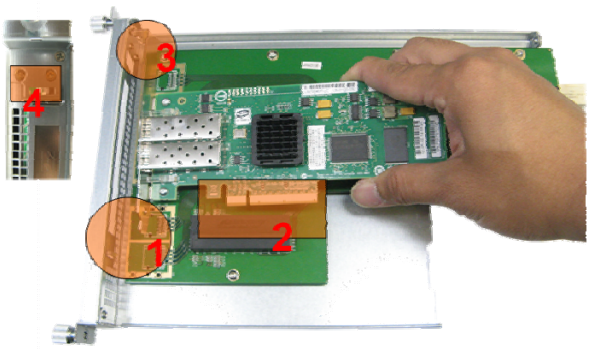


Figure 5.6: Installing an Adapter to 3U16 Auxiliary Module

7. Appendix A - Serial Port Interface

The serial Port Interface allows user to visualize the 3U16 Status using a standard serial port.

Most terminal types will work correctly.

The serial connection should be set to

- 115200 Baud
- 8 Bits
- 1 Stop bits
- No H/W handshaking

To display the menu hit the <ESC> key at any time.

The menu shown in Figure 6.1 will be displayed.

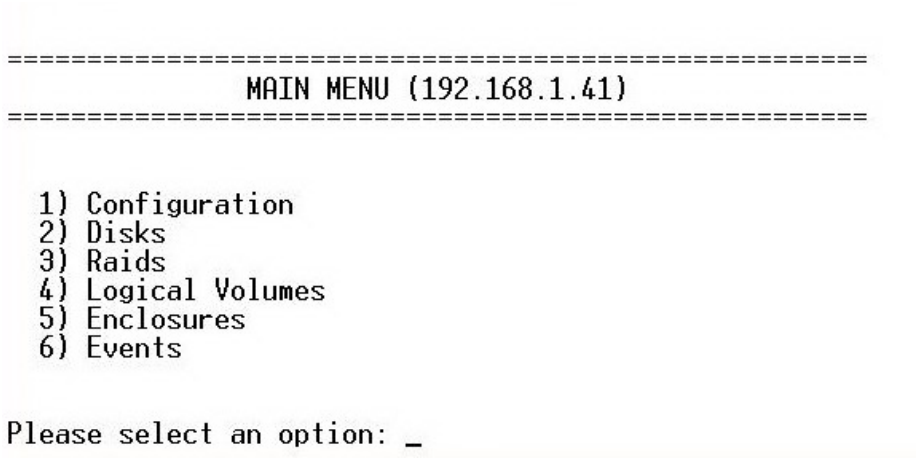


Figure 6. Main Menu

7.1. Configuration

By choosing option number 1 from the main menu, the option displays the following selections (Figure 6.1):

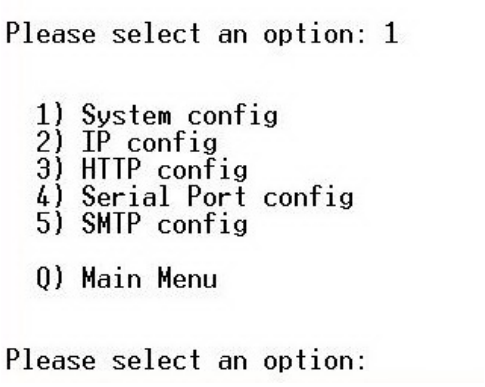


Figure 6.1. Configuration Submenu

7.1.1. *System Configuration*

This option number 1 of the submenu displays the following information:

- Uptime: the time duration the system has been up
- The name of the system
- Date setting
- Current state of the system
- System ID
- An option to edit the configuration (edit name and action)

7.1.2. IP Configuration

Option number 2 displays the following information:

- DNS server
- Default gateway
- Subnet mask
- DHCP setting
- IP address
- A selection to edit IP address, subnet mask and default gateway

7.1.3. HTTP Configuration

Option number 3 lists the following information:

- Username
- Proxy setting
- Host name

- Port number
- Password
- Choices to edit proxy setting, hostname, username, password and port

7.1.4. Serial Port Configuration

This configuration displays the current baud rate and a selection to edit the baud rate.

7.1.5. SMTP Configuration

This configuration option number 5 displays:

- SMTP username
- Authentication setting
- SMTP port
- Hostname and password
- The option to change host name, port, username, password and authentication setting

7.2. Disks

Choosing this second option from the main menu will present the user a list of all disks installed by selecting "View all disks" option from the submenu.

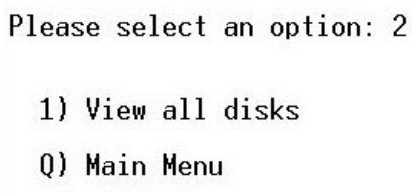


Figure 6.2.1. Disks Submenu

Furthermore, selecting "View disk details" will show the detail of the drive selected as exampled below.

```
Please select the disk number you wish to view: 1

  1) View disk details

  B) Back to disk list

Please select an option: 1

              Disk 1316224 (1 of 1)
              ---------------------
         enclosure_name : MPSTOR 3U 16 bay single density 0
        shuttle_position : Front
              raid_name : Raid 1
                   raid : 1053178
                ejected : 0
                   size : 698 GB
              raid_role : Used
               protocol : SATA
              enclosure : 1357576
                shuttle : 1052895
                  state : Online
           shuttle_index : 5
          status_summary : Good
           serial_number : WD-WCAPT0303094
                    qos : Mission Critical
                  model : WDC WD7500AYYS-0
                    wwn : 5766302626367115908
                     id : 1316224
           manufacturer : ATA
```

Figure 6.2.2. Disk Detailed View

7.3. RAIDs

Choosing the third option from the main menu will present the user a list of RAID built by selecting "View all raids" option from the submenu.

```
Please select an option: 3

  1) View all raids
  2) Add raid

  Q) Main Menu

Please select an option: _
```

Figure 6.3.1. RAID Submenu

Below is the detailed view of the selected RAID. See Figure 6.3.2. for example.

```
Please select an option: 1


              Raid 1053178 (1 of 1)
              ---------------------
                  parity : Good
                     qos : Mission Critical
                      id : 1053178
                    size : 1397 GB
              num_spares : 0
                    rows : 3
           caching_policy : Write Through
estimated_build_completion : 26432115.0000
                   state : Online
                 columns : 1
         max_build_speed : 200
              controller : 1357494
              redundancy : 1
          build_progress : 0.0000
               num_disks : 3
              chunk_size : 64
              read_ahead : False
              used_space : 0
                    name : Raid 1
                   level : 2
             build_speed : 0.0000
          status_summary : Good
        parity_algorithm : Left Symmetric
       automatic_rebuild : False
```

Figure 6.3.2. RAID Detailed View

7.4. Logical Volume

The fourth option of the terminal console main menu manages logical volumes.

```
Please select an option: 4


  1) View all Logical Volumes
  2) Add Logical Volume

  Q) Main Menu
```

Figure 6.4.1. Logical Volumes Submenu

```
Please select an option: 1

     id       size   name             status_summary  access_policy  write_prot
ection  state

  1) 1817073  20 GB  Logical Volume 1  Good            Allow          False
       Online

  B) Back to Logical Volumes menu
```

```
Please select the logical volume number you wish to view: 1

  1) View logical volume details
  2) Start logical volume
  3) Stop logical volume
  4) Delete logical volume

  B) Back to logical volume list

Please select an option: _
```

Figure 6.4.2. Logical Volumes View

The above figure displays the logical volume created in Section 4.1.4. Selecting the logical volume will provide options to view the details, start, stop, and delete the logical volume. Below is the result of option number 1.

```
Please select an option: 1

         Logical Volume 1817073 (1 of 1)
         -------------------------------
                     name : Logical Volume 1
          write_protection : False
             access_policy : Allow
                controller : 1562127
               io_throttle : 0.5000
        bandwidth_throttle : 0.4000
                     state : Online
            status_summary : Good
        primary_controller : 1562127
                        id : 1817073
                       lun : 0
                      size : 20 GB
```

Figure 6.4.3. Logical Volumes Detailed View

7.5. Enclosure

The fifth option is to manage the enclosure.

```
Please select an option: 5

  1) Enclosure 1

  Q) Main Menu

Please select the enclosure number you wish to view: 1

  1) View Enclosure Map
  2) View Enclosure General Data
  3) View Enclosure Disk Data
  4) View Enclosure Power Module Data

  B) Back to enclosures list

  Q) Main Menu
```

Figure 6.5. Enclosure Submenu and Its Branches

7.5.1. Enclosure Map

By pressing key '1', this option displays the following information:

```
Please select an option: 1

+---------------+ +---------------+ +---------------+ +---------------+
|               | |               | |               | |               |
|  3) Y/F/-/-   | |  7) Y/F/-/-   | | 11) Y/F/-/-   | | 15) Y/F/-/-   |
|               | |               | |               | |               |
+---------------+ +---------------+ +---------------+ +---------------+
|               | |               | |               | |               |
|  2) Y/F/-/-   | |  6) Y/F/-/-   | | 10) Y/F/-/-   | | 14) Y/U/-/-   |
|               | |               | |               | |               |
+---------------+ +---------------+ +---------------+ +---------------+
|               | |               | |               | |               |
|  1) Y/F/-/-   | |  5) Y/U/-/-   | |  9) Y/F/-/-   | | 13) Y/F/-/-   |
|               | |               | |               | |               |
+---------------+ +---------------+ +---------------+ +---------------+
|               | |               | |               | |               |
|  0) Y/F/-/-   | |  4) Y/F/-/-   | |  8) Y/U/-/-   | | 12) Y/F/-/-   |
|               | |               | |               | |               |
+---------------+ +---------------+ +---------------+ +---------------+

Code format: [front_disk_state]/[front_disk_raid_role]/[back_disk_state]/[back_d
isk_raid_role]

Code key:

  Y - Disk online
  N - Disk offline
  U - Disk in use on raid
  D - Disk is dedicated spare
  G - Disk is global spare
  F - Disk free
```

Figure 6.5.1. Enclosure Map and Disk Status

7.5.2. Enclosure General Data

Pressing key '2', the option displays the enclosure information such as temperature status, PSU status, fan status, number of disk present. More information is attached below.

```
Please select an option: 2


            Enclosure 1357576 (1 of 1)
            --------------------------
      temperature_status : Fault
              psu_status : Fault
                shelf_id : 0
          enclosure_type : MPSTOR 3u 16
            drive_status : Fault
   interface_board_0_type : Controller
              fan_status : Fault
           system_status : Fault
               num_disks : 16
   interface_board_1_type : Not Present
                     wwn : None
                      id : 1357576
                    name : MPSTOR 3U 16 bay single density 0
```

Figure 6.5.2. Enclosure General Data

This option allows the user to view what devices are installed in the system.

7.5.3. Enclosure Disk Data

This option will list all the installed disks in succession.

```
Please select an option: 3


              Disk 1316224 (1 of 16)
              ----------------------
         enclosure_name : MPSTOR 3U 16 bay single density 0
        shuttle_position : Front
               raid_name : Raid 1
                    raid : 1053178
                 ejected : 0
                    size : 698 GB
               raid_role : Used
                protocol : SATA
               enclosure : 1357576
                 shuttle : 1052895
                   state : Online
          shuttle_index : 5
         status_summary : Good
          serial_number : WD-WCAPT0303094
                    qos : Mission Critical
                  model : WDC WD7500AYYS-0
                    wwn : 5766302626367115908
                     id : 1316224
           manufacturer : ATA


              Disk 1208518 (2 of 16)
              ----------------------
         enclosure_name : MPSTOR 3U 16 bay single density 0
        shuttle_position : Front
               raid_name : Raid 1
                    raid : 1053178
                 ejected : 0
                    size : 698 GB
               raid_role : Used
```

Figure 6.5.3. Enclosure Disk Data

7.5.4. Enclosure Power Module Data

This option displays the following information about the corresponding PSU.

```
Please select an option: 4


          Power Module 1052888 (1 of 2)
          -----------------------------
                dc_state : Good
                ac_state : Good
             temperature : -20
               fan_state : Faulty
           current_level : 10.6400
  temperature_probe_state : Faulty
               fan_speed : 0
                      id : 1052888
                   state : Not Present
           voltage_level : 12.1000
          status_summary : Warning
          location_index : 0
               enclosure : 1357576


          Power Module 1052889 (2 of 2)
          -----------------------------
                dc_state : Good
                ac_state : Good
             temperature : -20
               fan_state : Faulty
           current_level : 10.7600
  temperature_probe_state : Faulty
               fan_speed : 0
                      id : 1052889
                   state : Not Present
           voltage_level : 12.1000
          status_summary : Warning
          location_index : 1
               enclosure : 1357576
```

Figure 6.5.4. Enclosure Power Module Data

7.6. Events

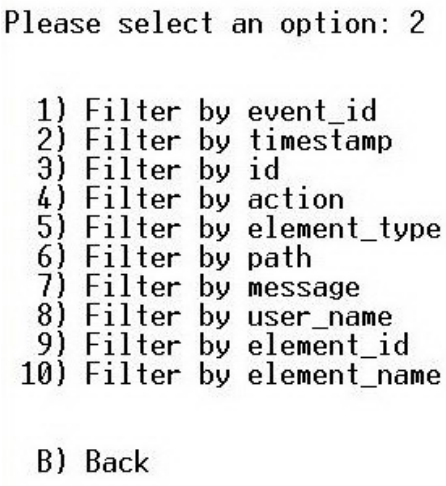
Choose option 1 to view all events, option 2 to filter events (shown in Figure 6.6.2.)

```
Please select an option: 6


  1) View all events
  2) Filter events

  Q) Main Menu
```

6.6.1. Events Submenu



6.6.2. Filter Events Menu

8. Appendix B - Display Management API

This document is a reference specification for the 3U16 Display Management Board API. The interface used to communicate with the board is I2C.

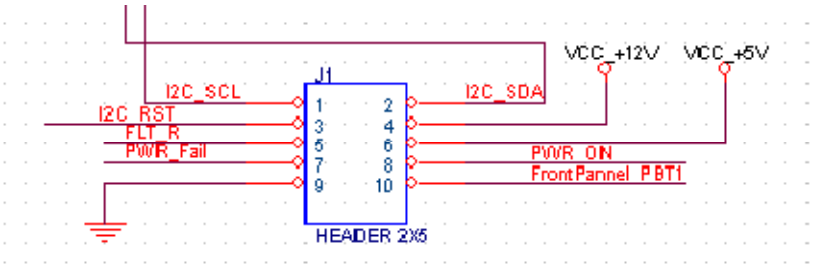


Figure 7.1: Display board connector

- I2C address: 0xC0
- The Display Board uses full I2C Read/Write method.
- Read is a buffer of 7Bytes.
- You have to write 11 bytes to the board.
- Single register access is no possible.

8.1. Read Display Board Data

8.1.1. Buffer Received from the Display Board

Register Name (8bits)	Address	Description
ID_Byte_Reg	0x00	Display Board Identity
PBT_Reg_Status	0x01	Push Button Status register
Temperature_Reg	0x02	Temperature value
12V_Reg	0x03	12V value
HW_Revision_Reg	0x04	Hardware revision of the board
SW_Revision_Reg	0x05	Software revision of the board
LRC_Reg	0x06	Checksum

8.1.2. ID_Byte_Reg

Offset: 0x00

By default ID_Byte is '0x03'. This number is saved in EEPROM. For ID setup options see section 3.2.

8.1.3. PBT_Reg_Status

Offset: 0x01

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
PBT_RST_ MEM	PBT_FP_ MEM	NC	BUZ_ STATE	NC	PBT_ RST	PBT_FP	PWR_ STATUS

Used for Push Button functions.

(B7) PBT_RST_MEM:

- 0: On-Board Push button was not pressed
- 1: On-Board Push button was pressed

This bit is used for internal use.

(B6) PBT_FP_MEM:

- 0: Front Panel Push Button was not pressed
- 1: Front Panel Push Button was pressed

This bit is used for internal use.

(B4) BUZ_STATE:

- 0: Buzzer is OFF
- 1: Buzzer is ON
-

(B2) PBT_RST:

- 0: On-Board Push button not pressed
- 1: On-Board Push button pressed

(B1) PBT_FP:

- 0: Front Panel Push Button not pressed
- 1: Front Panel Push Button pressed

(B0) PWR_STATUS:

- 1: System Power is ON (PWR_ON signal is 5 volts)
- 0: System Power is OFF (PWR_ON signal is 0 volts)

8.1.4. Temperature_Reg

Address: 0x02

This is the onboard Temperature sensor readings. See Table B1 for conversion between temperatures and numeric values.

Fahrenheit	Celsius	Decimal	Hexadecimal
113.90	45.5	92	5C
113.70	45.39	95	5F
113.50	45.28	96	60
113.20	45.11	97	61
113.00	45	98	62
112.60	44.78	99	63
111.90	44.39	100	63
111.60	44.22	101	63
111.40	44.11	102	64
110.80	43.78	103	65
110.30	43.5	104	66
109.90	43.28	105	67
109.20	42.89	106	68
108.90	42.72	107	69
108.50	42.5	108	6A
107.80	42.11	109	6B
107.40	41.89	110	6C
107.00	41.67	111	6D
106.70	41.5	112	6E
106.30	41.28	113	6F
105.80	41	113	6F
104.60	40.33	114	70
104.50	40.28	115	71
104.20	40.11	116	72
103.10	39.5	117	73
103.10	39.5	118	74
103.10	39.5	119	75
102.40	39.11	120	76
101.70	38.72	121	77
101.50	38.61	122	77
100.90	38.28	123	78
100.40	38	124	79
100.20	37.89	125	7A
99.70	37.61	126	7B
99.50	37.5	127	7C
99.10	37.28	128	7D
98.60	37	129	7E
98.10	36.72	130	7F
97.70	36.5	131	80
97.30	36.28	132	81
97.00	36.11	133	82
96.30	35.72	134	83
95.90	35.5	135	84
95.20	35.11	136	85
94.80	34.89	137	85
94.50	34.72	138	86
94.10	34.5	139	87
93.40	34.11	140	88
92.10	33.39	141	89

Fahrenheit	Celsius	Decimal	Hexadecimal
91.90	33.28	142	8A
91.60	33.11	143	8B
91.20	32.89	144	8C
91.00	32.78	145	8D
90.90	32.72	146	8E
90.30	32.39	147	8F
90.10	32.28	148	90
89.80	32.11	149	91
89.10	31.72	150	92
88.70	31.5	151	93
88.30	31.28	152	94
88.00	31.11	153	95
87.80	31	154	96
87.40	30.78	155	97
86.50	30.28	156	98
86.40	30.22	157	99
85.80	29.89	158	9A
85.80	29.89	159	9B
85.60	29.78	160	9C
84.70	29.28	161	9D
83.80	28.78	162	9E
83.50	28.61	163	9F
82.90	28.28	164	A0
82.80	28.22	165	A1
82.40	28	166	A2
82.40	28	167	A3
81.50	27.5	168	A4
81.30	27.39	169	A5
81.50	27.5	170	A6
80.10	26.72	171	A7
79.70	26.5	172	A8
76.80	24.89	177	AD
75.90	24.39	178	AE
75.70	24.28	179	AF
73.00	22.78	180	B3

Table B1: register value VS temperature

8.1.5. 12V_Reg

Address: 0x03

The value read from this register is a measure of the 12V voltage, to compute the 12V voltage, the following formula is used:
V = 12V_Reg_Value * 0.0613267

Example:

Register	Value	Decimal Value	Value
0x03	0xC4	196	12.02V

8.1.6. HW_Revision_Reg

Address: 0x04

This register stores the hardware revision of the board in hexadecimal:

Example:

Register	Value	Decimal Value	Version
0x04	0x64	100	1.00

8.1.7. SW_Revision_Reg

Address: 0x05

This register stores the software revision of the board in hexadecimal:

Example:

Register	Value	Decimal Value	Version
0x05	0x64	100	1.00

8.1.8. LRC_Reg

Address: 0x06

This byte is A buffer transfer checksum. It's an XOR operation between all the bytes transferred.

Example:

Register	Value	Decimal Value	Description
0x00	0x03	3	ID 3
0x01	0x01	1	Power is ON
0x02	0x7E	126	37Deg Celsius
0x03	0xC4	196	12.02V
0x04	0x64	100	Hardware Revision 1.00
0x05	0x64	100	Software Revision 1.00
0x06	0xB8		LRC

8.2. Write Data

8.2.1. Buffer Sent to Display Board

Register Name (8bits)	Address	Description
Set_ID_Reg	0x00	Change ID
Led_Buz_Reg	0x01	LEDs and buzzer management
Blink_Led_Reg	0x02	LEDs and buzzer Blinking management
Digit_1_Reg	0x03	Roll over Digit 1
Digit_2_Reg	0x04	Roll over Digit 2
Digit_3_Reg	0x05	Roll over Digit 3
Digit_4_Reg	0x06	Roll over Digit 4
Threshold _12V_L_Reg	0x07	12V lower band threshold
Threshold_12V_H_Reg	0x08	12V higher band threshold
Threshold_Temp_Reg	0x09	Temperature Threshold
LRC_Reg	0x0A	Checksum

8.2.2. Set_ID_Reg

Address: 0x00

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
DOT	BURN_ID	NC	ID4	ID3	ID2	ID1	ID0

This register is used to change and save the board ID, the IS is then printed on the 7 Segment display. The number must be between 0x00 and 0x19. To add the dot, add 0x80 at the current value. See Table B2 below for values.

(B7) DOT:

- 0: Dot segment is turn off for the ID
- 1: Dot segment is turn on for the ID

(B6) BURN_ID:

- 0: The ID will not be stored in the Eeprom
- 1: The ID will be stored in the Eeprom, this bit will auto-clear.

(B4-B0) ID_x:

These bits are used to set the Board ID which is displayed on the 7 Segment display, the table below lists the hexadecimal values and the corresponding digit displayed.

Value	ON/OFF Segment	Value Print on the Display segment
0x00	b'00000011'	0
0x01	b'10011111'	1
0x02	b'00100101'	2
0x03	b'00001101'	3

Value	ON/OFF Segment	Value Print on the Display segment
0x04	b'10011001'	4
0x05	b'01001001'	5
0x06	b'01000001'	6
0x07	b'00011111'	7
0x08	b'00000001'	8
0x09	b'00001001'	9
0x0A	b'00010001'	A
0x0B	b'11000001'	B
0x0C	b'01100011'	C
0x0D	b'10000101'	D
0x0E	b'01100001'	E
0x0F	b'01110001'	F
0x10	b'00000000'	8. (all segments on)
0x11	b'11111110'	.
0x12	b'11111101'	-
0x13	b'11111011'	1 segment on
0x14	b'11110111'	1 segment on
0x15	b'11101111	1 segment on
0x16	b'11011111'	1 segment on
0x17	b'10111111'	1 segment on
0x18	b'01111111'	1 segment on
0x19	b'11111111'	all segments off

Table B2: Hexadecimal to Digit values conversion

Segment Operation

- 0: Segment is ON
- 1: Segment is OFF

8.2.3. LED_Buz_Reg

Address: 0x01

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
BUZZER	VAL_MUTE _FUNC	MUTE_FUNC _STATE	NC	FLT_R	PWR_FAIL	NC	NC

(B7) BUZZER:

- 0: Turn off buzzer.
- 1: Turn on buzzer.

(B6) VAL_MUTE_FUNC:

- 0: Change MUTE STATE Not Allowed
- 1: Change MUTE STATE Allowed (mute function is controlled by BIT 5).

(B5) MUTE_FUNC_STATE:
- 0: Mute function is OFF
- 1: Mute function is ON

(B3) FLT_R:
- 0: FLT_R signal is 0 Volt
- 1: FLT_R signal is 5 Volt

(B2) PWR_FAIL:
- 0: PWR_FAIL signal is 0 volt
- 1: PWR_FAIL signal is 5 volts

8.2.4. Blink_LED_Reg

Address: 0x02

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
BUZZER	DIGIT_0_3	SYSTEM_OFF	NC	FLT_R	PWR_FAIL	NC	NC

(B7) BUZZER:
- 0: The buzzer beeps continuously (if Led_Buz_Reg, Bit7 is '1').
- 1: The buzzer beeps at 2Hz (if Led_Buz_Reg, Bit7 is '1').

(B6) DIGIT_0_3
- 0: Default, display Board ID
- 1: The 4 digits (Digit_1, Digit_2, Digit_3, Digit_4) are sent to the Display in rotation at a rate of 2Hz

(B5) SYSTEM_OFF
- 0: Default, the system is ON
- 1: System OFF request. When set the system will turn off immediately

(B3) FLT_R
- 0: FLT_R signal set to 1, (if Led_Buz_Reg, Bit3 is '1').
- 1: FLT_R will toggle at a rate of 2 Hz (if Led_Buz_Reg, Bit3 is '1'). PWR_FAIL

(B2) PWR_FAIL
- 0: PWR_FAIL signal set to 1, (if Led_Buz_Reg, Bit3 is '1').
- 1: PWR_FAIL will toggle at a rate of 2 Hz (if Led_Buz_Reg, Bit3 is '1').

8.2.5. Digit_1_Reg, Digit_2_Reg, Digit_3_Reg, Digit_4_Reg

Address: 0x03 – 0x06

These registers are used to display an error code onto the 7Segment display, and can also be used for any messaging through the 7 Segment display, See Table B2 the conversion table.

Example:

Register	Value	Display	Description
0x03	0x82	**.2**	Digit 1
0x04	0x03	**3**	Digit 2
0x05	0x01	**1**	Digit 3
0x06	0x04	**4**	Digit 4

8.2.6. Threshold_12V_L_Reg, Threshold_12V_H_Reg

Address: 0x07 – 0x08

The 12V threshold is set using the following formula:

Threshold_12V_x = V / 0.0613267

Default values:

- Threshold_12V_L 0xB0 10.8V
- Threshold_12V_H 0xD8 13.2V

LED_PWR: is Set to RED when
Measured value > Threshold_12V_H
Or Measured value < Threshold_12V_L
LED_PWR: Set to GREEN when
Threshold _12V_L < measured Value < Threshold _12V_H

8.2.7. Threshold_Temp_Reg

Address: 0x09

Default value:

- Threshold_Temp 0x5C 49°C

LED_TEMP: Is set to RED when the measured value > Threshold_Temp
LED_TEMP: Is set to GREEN when the measured value =< Threshold_Temp

8.2.8. LRC_Reg

Address: 0x0A

This byte is a buffer transfer checksum. It's an XOR operation between all the bytes transferred.

Example:

Register	Value	Value	Description
0x00	0x07	7	Change ID
0x01	0x00	0	LEDs and buzzer management
0x02	0x00	0	LEDs and buzzer Blinking management
0x03	0x01	1	Roll over Digit 1
0x04	0x02	2	Roll over Digit 2
0x05	0x03	3	Roll over Digit 3
0x06	0x04	4	Roll over Digit 4
0x07	0xB0	10.8V	12V lower band threshold
0x08	0xD8	13.2V	12V higher band threshold
0x09	0x5C	49°C	Temperature Threshold
0x0A	0x37	55	Checksum

9. Glossary

Mezzanine Card
A circuit board meant to be an extension or "daughter" of a motherboard or main board.

1U/2U
"U", Rack Unit, is equal to 1.75" in height. One rack unit is commonly designated as "1U"; similarly, 2 rack units are "2U" and so on.

HDD
A hard disk drive (HDD) commonly referred to as a hard drive or hard disk.

Hot Swap
The ability to pull out a component from a system and plug in a new one while the power is still on and the unit is still operating. Redundant systems can be designed to swap drives, circuit boards, power supplies and virtually anything that is duplicated within the system.

Redundant
It is used to guard the primary system from failure by acting as a backup system.

Host Bus Adapter (HBA)
An I/O adapter that sits between the host computer's bus and the storage device and manages the transfer of information between the two devices

SBB
Stands for Storage Bridge Bay, is an industry standard created by a nonprofit corporation "The Storage Bridge Bay Working Group, Inc." formed by industry members to develop and distribute specifications standardizing portions of storage enclosures.
SBB Specification defines mechanical, electrical and internal interfaces between a storage enclosure and the electronics cards that give the subsystem its personality or function.

If you have any technical questions, please contact your authorized dealer before contacting us.

For more information, visit our website at www.aicipc.com or www.xtore.com.